

Blue Beaches

Lead
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1927

WHITE LEAD

INTERNATIONAL LABO

STUDIES AND RE
Series F (Industrial Hygiene)

WHITE LEAD

DATA COLLECTED
INTERNATIONAL LABO
IN REGARD TO THE USE
LEAD IN THE PAINTING

GENEVA
1927

PREFACE

The present volume embodies the report drawn up by the International Labour Commission on White Lead was discussed, and by the Third Session of the International Labour Conference at Geneva in 1921. The original report has been considerably expanded in the light of the data collected by the International Labour Office.

The present time is opportune for the publication of a survey of the facts, devoid of any conclusions, although the question is still the subject of discussion in some countries, the success of the efforts to reach an agreement shows that agreement is gradually being reached, which was the source of so much controversy.

At the beginning of 1927 the White Lead Convention was ratified by 13 countries: Austria, Czechoslovakia, Estonia, France, Greece, Hungary, Poland, Rumania, Spain, and Sweden. Ratification was recommended in three countries — Hungary, Italy, and the Netherlands — and in five — Argentina, Cuba, Germany, and Uruguay. In such circumstances a survey of the facts cannot but be useful to countries which are not yet inclined to ratify, the Convention, and it may assist towards the creation of a common body of opinion.

The first subject dealt with in the report is the use of white lead and the question of the danger to health it involves. This is discussed on the basis of the statistical data assembled by the Office, with a view to showing whether the use of white lead is or is not justified.

Next the technical aspect of the problem is considered in the light of information elicited by committees of experts.

associations, and experts who have taken up the problem of white lead. Its object is to discover if it is true that other materials can be substituted for white lead or if, on the contrary, as is sometimes asserted, neither zinc white nor any other substitute can fully take the place, technically and economically, of white lead. Reference is made in this part of the report to the results of practical experience in the painting of coaches and carriages, ships, bridges, etc.

The third subject discussed is the efficacy of restrictive regulation in the painting trades; regulations of this kind have been in force for a long time in some countries, and they are sometimes thought and said to be preferable to complete prohibition of the use of white lead. The object of this section is to ascertain whether more or less severe regulation can take the place of total prohibition.

The last section of the report is devoted to certain special points which were laid before the Governments by the questionnaire of the International Labour Office in 1921. It includes the replies given by the Medical Sub-Committee¹ of the White Lead Committee of the Conference to the questions put to it, while in the Appendices will be found a full report of the discussion which took place in plenary session at the International Labour Conference in 1921².

¹ The Medical Sub-Committee consisted of experts nominated by Governments and employers: Dr. Curschmann, Dr. Frey, Dr. Gilbert, Sir Kenneth Goadby, Dr. Gonzales y Castro, Sir Thomas Legge, Dr. Loriga, and Prof. Lehmann.

² *Daily Intelligence*, Vol. IV, No. 28, pp. 500-508; No. 27, pp. 515-522; No. 28, pp. 532-534.

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PART I

HISTORICAL SKETCH OF THE MOVEMENT AGAINST THE USE OF WHITE LEAD IN PAINTING

I. — ITS ORIGINS

The risks to the painter's health involved in the use of certain products, particularly white lead, have caused disquietude for centuries ; popular imagination has long been stirred by some of the effects of these products, above all the notorious "lead colic". Yet the campaign against lead poisoning did not enter the sphere of technical discussion until 1779, when Courtois placed before the Academy of Dijon a zinc white which retained its tone remarkably when lead white turned yellow. Four years later, also in France, Guyton de Morveau asserted that zinc white could be substituted for white lead.

The problem of legislative action against the use of white lead was bound logically to arise once legal protection for the worker became an accepted principle. It is needless to go back to Robert Owen or to Le Grand, the Alsatian, or again to the Congress of the Workers' International Association of 1867, which demanded protection for workers in unhealthy industries ; the principle was definitely laid down at the International Workers' Conference convened by the Paris trade unions in 1896. The demands of this Conference included compulsory equipment of workshops with the necessary safeguards for the health of the workers and prohibition of certain trades or methods of production which were particularly injurious to the workers' health.

In the following year, on the instructions of the Swiss Workers' Congress, the Central Committee of the Swiss Workers' Federation convened an International Congress on the Protection of the Workers. A report on work in industries dangerous to health, presented by Dr. Erismann, of Zurich, and L. Héritier, of Lausanne, reached the following conclusions :

Industries dangerous to health, as defined in the report, must in each country be specified in a list drawn up by Administrative Order. Children, young persons under 18, and women must not be employed in industries dangerous to health. In such industries there must be regular and official medical inspection of the workers. The employers are entirely responsible for any injury to the health or life of workers employed in industries dangerous to health. *In industries of a nature dangerous to health where no technical means of diminishing this danger have been found, the use of the noxious material must be absolutely prohibited.*

In the reports and resolutions of the Congress occurs a sentence specifically mentioning white lead: "In many cases substances injurious to health have been replaced by harmless substances, as for example white lead by zinc white (Sulzer engineering works at Winterthur)."

From that time onwards there was a succession of reports, discussions, and enquiries dealing with either the technical or with the health and economic aspects of the problem, while the advent of the twentieth century marked the beginning of definite and sustained action.

II. — THE INTERNATIONAL MOVEMENT

In 1901 the constituent assembly of the International Association for Labour Legislation adopted a resolution advocating research into the relative unhealthiness of different industries and into the state of legislation on unhealthy industries, more particularly those which manufactured or employed lead paints.

At the second meeting in 1902 the reports of the National Sections showed that the use of lead and lead derivatives could be considerably restricted, and that white lead was admittedly not absolutely indispensable for house and coach painting. Several members drew attention to the possibility of replacing white lead by lithopone, zinc whites, etc. The meeting adopted the following resolution:

The dangers to the workers' health involved in the handling and use of white phosphorus and lead being particularly grave, it is urgently necessary to set up a Committee to seek ways and means of removing these dangers, to secure general prohibition, by international agreement, of the use of white phosphorus, and to abolish as far as possible the use of white lead.

The Committee shall at once approach Governments and local authorities, through the Bureau (Officers), to secure that the use of white lead shall be prohibited in all Government, local, and municipal works.

¹ *Rapports et propositions*, p. 118.

² Reports of the meetings of the International Labour Office (Bale). Cf. also: *L'Association internationale pour la protection légale des travailleurs et l'Office international du Travail, 1901-1910*; Brussels, 1910.

The resolution was supported by the delegates of the Austro-Hungarian, Belgian, Dutch, French, German, Italian, Luxemburg, Norwegian, Swedish, and Swiss Governments. From this time forward the international movement in favour of substitutes for white lead was merged in the work of the International Association for Labour Legislation. In 1903 the Committee appointed by the general meeting stated that:

It is unnecessary to seek international agreement on the use of white lead in painting. In the Committee's opinion this matter raises no serious difficulties in international competition, and the general question of regulation in connection with lead and lead compounds could more usefully be considered by an international conference. It considers that vigorous steps should be taken in each country to secure prohibition of the use of white lead in painting work for public authorities and individuals.

The Governments of the various countries must be approached with a view to securing that investigations, which are clearly necessary, are carried out to ascertain fully the present state of affairs. If scientific research for harmless substitutes fails to render prohibition of the use of lead possible, the dangers to the health of the workers should be eliminated, or at least mitigated, as far as possible by strict enforcement of existing special regulations or the issue of new protective regulations for each class of industry which manufactures or uses lead and lead compounds.

In 1904 the general meeting stated that:

As regards the use of white lead in painting, the Association should confirm without modification its previous resolution advocating prohibition in all work where lead can be replaced by substitutes. The meeting further considers that strict regulations should be issued immediately wherever prohibition has not yet been adopted.

In 1905 the officers of the Association proposed that the National Sections should ask specialists in their respective countries to investigate and report on the best means of preventing lead poisoning in the manufacture and use of lead paints, etc. The reports were to give full information on existing legislation prohibiting the use of lead paints in the painting trade and on the results of any experiments with leadless paints.

In 1908 delegates' meeting held at Lucerne confirmed the resolutions previously adopted in favour of abolishing the use of lead paints. In the opinion of the meeting experience had shown that the use of white lead for interior work was unnecessary and could be suppressed. The meeting recommended that Governments should institute experiments to test the possibility of entirely prohibiting the use of lead paints for all other work, and especially white lead for exterior work:

Until a general prohibition of lead paints and colours is introduced, all vessels and cases in which substances containing lead are distributed for purposes of trade or use should be marked in an unmistakable manner so as to show that their contents contain lead and are poisonous. Workmen employed in preparing or manipulating paints and colours containing lead should always have their attention drawn to the danger of poisoning.

It was added that these measures were not intended to take the place of the complete prohibition of lead paints advocated in 1908; the meeting desired, however, to emphasise the necessity of enforcing existing legislation, especially partial prohibition, which it considered the only effective measure so long as complete prohibition had not been enacted¹.

The health experts of the Association became increasingly active, encouraged by the offer of prizes for the best work in industrial hygiene for the prevention of lead poisoning, the creation of a Permanent Council of Hygiene in 1908, and the petition signed by the President, Mr. H. Scherrer, on 15 December 1909, on the organisation of the campaign against lead poisoning among workers engaged in painting, plastering, and decorating².

According to this petition, many experiments had shown that lead paints could be replaced by non-poisonous ones; the investigations of the Austrian Ministry had proved that interior painting was particularly injurious to the health of the workers, while even the employers had declared themselves in favour of prohibition up to this point. The petition recalled that the Association's policy had been to demand only such measures as were urgently necessary for the protection of health and at the same time technically and economically feasible; it had been proved by numerous experiments that non-poisonous paints could be substituted for lead paints even in exterior work. In conclusion the petition repeated, on behalf of the officers and Sections of the International Association for Labour Legislation, the twofold demand of the resolution adopted at the general meeting held at Lucerne in 1908: (1) that the use of lead-containing materials should be prohibited, particularly for interior painting and decorating; (2) in so far as the trade in lead paints was not entirely prohibited, all containers should be clearly marked: "containing lead and poisonous".

In 1910, at the Lugano meeting, the following resolution was passed:

The Delegates' Meeting is of opinion that the time has come to prohibit the use of lead paints and colours for interior work and to require that all receptacles containing such colours should be marked to that effect. The Bureau is instructed to approach the National Sections on the matter, being guided by the principles set forth in the petition submitted to the meeting. The Sections are requested to give the petition their active support in its presentation to their Governments.

¹ Petition of the International Labour Office (Bale), 15 Dec. 1909.
² See Appendix I.

Again, at its last meeting before the war, in 1912, at Zurich, the Association adopted the following resolution:

Painters and decorators. — The Delegates' Meeting, noting with satisfaction that the use of colours containing lead in the painting of the interior of buildings has been prohibited in several countries, requests the National Sections to present reports on investigations which have been undertaken in their countries, and in particular on enquiries and experience relating to the use of colours not containing lead in the painting of metal in engineering workshops and similar works.

III. — THE LABOUR MOVEMENT

The agitation against white lead carried on by the workers' organisations was, to begin with, merely part of the general movement for the protection of the workers, which was at first limited to protecting the health of women and children. But once the Labour movement was disciplined and organised in large and powerful trade unions, the campaign against white lead became more definite and widespread. This appeared as early as 1902; in that year the *Austrian* Union of Painters, Plasterers, etc., petitioned the Government to issue Orders for the protection of painters. In Belgium, too, the Brussels Federation of Painters' Unions petitioned the Mayor and Aldermen of Molenbeek-Saint-Jean to prohibit by Order the use of white lead in municipal work; this request was supported by the Brussels Chamber of Painters. The Governor of Brabant transmitted the petition to the Minister of Agriculture, together with a declaration of the municipal council that a single municipal prohibition, while injuring local contractors, would be ineffective, and that the matter should be regulated by an Order applicable to the whole country, to be submitted first to the Council of Public Health. The Minister sent these documents to the Council for consideration on 5 April 1902. On 2 June the Council received a telegram from the Mayor and Aldermen of Schaerbeek stating that the municipal council had decided that zinc white must be substituted for lead white in all paints used on municipal buildings; before adding this clause to the specifications for tenders they wished to have the opinion of the Council on the measure, which had been proposed for humanitarian reasons and the protection of health.

In *Switzerland* the Central Association of Painters, Plasterers, etc., presented a petition to the Federal Council on 1 October 1902 asking that prohibition of the use of white lead should be added to the specifications for tenders in work for the Federal

Government; this petition was granted, but only as an experiment for four years from 1 January 1904. (See Appendix.) The French painters in 1902 went on strike in support of their demand for the prohibition of white lead, and in 1908 the fourteenth Congress of Railwaymen protested against the delay in legislating for prohibition.

In Germany the painters had protested against the use of white lead as early as 1900, at the ninth meeting of their unions at Würzburg. In 1903 Sommerfeld presented to the meeting of the Berlin painters' union the modest proposals which are given later; but in December of that year the general meeting of the Union of German Painters and the German Congress for the Protection of Building Workers both demanded that the use of white lead in painting should be absolutely prohibited. In a petition to the Imperial Chancellor the painters' unions advocated "prohibition of the use of all paints with a lead base in the trades of painter, decorator, varnisher, and plasterer". They expressed the hope that the State and communal authorities would set an example by forbidding the use of white lead in any painting or decorating done under their orders and by inducing representatives of the benefit societies to take an interest in prohibition. The meeting had declared that there was no technical or economic obstacle to total prohibition of white lead in the painting trade, and that the statements of certain employers denying the dangerous nature of white lead and the efficiency of substitutes were in contradiction with the opinion of other employers'. The petition was discussed by the Reichstag Committee on Petitions on 24 February 1904 and in full session on 6 May, and then sent to the Chancellor. As a result the Order of 27 June 1905 was issued laying down measures for the protection of painters.

This Order was bitterly criticised by the employers. The workers, appealing to section 120 of the Industrial Code, presented another petition stating that only complete and statutory prohibition of the use of lead paints — a step which was technically feasible — could put a stop to lead poisoning as an occupational disease of painters. One edition of this petition, under the title *Ein offenes Wort*, ran into 50,000 copies, a second, entitled *Wohlan denn*, into 32,000. The petition drew attention to the grave danger of lead poisoning among painters, the long illnesses and premature deaths, and the inadequacy, especially in Germany, of

¹ Cf. the opinion of F. Hansen, of Hamburg, given later.

mere regulation of the building industry. It pointed out that satisfactory substitutes for white lead did exist, and that the statements made by opponents of prohibition were often at variance with the practice of competent technical men. At the same time the Painters' Guild of Hamburg presented an exhaustive petition to the Federal Council requesting it not to approve the Bill prescribing protective measures for painters but instead to issue an absolute prohibition of the use of lead paints and colours.

In Belgium the fifth Congress of Trade Unions, meeting in Brussels on 25 and 26 December 1904, requested all Socialist municipal authorities to forbid the use of white lead in painting on municipal works.

In 1906 the German Union of Painters, Decorators, etc., set on foot an agitation in favour of legal protection for workers employed on the interior of ships and exposed to the poisonous effects of the solvents and quick driers contained in the paints they used. While on the one hand the Prussian railways stated in 1907 that they could not dispense with white lead, on the other the Painters' Guild of Ratibor and those of other Silesian towns decided to discontinue its use.

In Austria the sick benefit society of the Vienna house and coach painters and decorators requested the Provincial Government on 1 June 1906 to add prohibition of the use of white lead and white lead paints to the specifications for tenders. The Provincial Government granted this petition, and issued an Order on 27 August 1906 prescribing that leadless paints must in future be used on all State contracts.

The Governor of the Province of Vienna suggested to the Minister of the Interior that the use of lead paints and colours should be generally prohibited, but the Minister replied that the results of the enquiry being carried out by the Office of Labour Statistics would provide a basis for later regulation¹.

In Great Britain the forty-second Trades Union Congress (8-11 September 1909, at Ipswich) demanded the most severe restrictions on the use of poisonous substances. The American Federation of Labour also took part in the movement. At its thirtieth annual convention, held at St. Louis from 14 to 28 November 1910, the following resolution on industrial poisons and occupational diseases was adopted:

¹ See below, under "Statistics".

The Federation calls urgently for an enquiry into working conditions, a system of industrial legislation and of inspection of factories and mines, protection of welfare of workers and the application of laws for the regulation of labour which will bring America up to the standard of the more advanced nations; it extends its encouragement and support to the American Section for the Legal Protection of Workers in all that it has so far effected in this connection.

The agitation now became increasingly vigorous. In 1911 the German Federation of Painters, Decorators, etc., at its congress at Munich from 8 to 13 May, reiterated its demand for legal prohibition of the use of lead paints. In 1912 the eighth congress of the German Transport Workers' Federation (Breslau, 9-16 June) demanded that steps be taken to prevent or mitigate occupational diseases of all kinds. The third Congress of Building Workers (Leipzig, 11 and 12 August 1912) demanded the prohibition of lead paints in all painting and decorating work, the provision free of charge of cloakrooms, lavatories, dining rooms, drinking water, dormitories with beds (in the case of work done in foreign countries), and protection against draughts for workers employed on interior work.

In 1913 the appeared in *Belgium* a popular pamphlet by the secretary of the Liège branch of the Central Painters' Union, entitled "Painters' Lead Poisoning", describing the steps necessary to enforce regulations on the use of white lead.

In 1914 the fourteenth annual Congress of the British Labour Party (Glasgow, 27-30 January) advocated the provision of lavatories, working clothes, etc., in all dusty industries, while in the same year the fourth Congress of Trade Unions of *British Columbia*, held at New Westminster, passed a resolution in favour of stricter protective measures for building workers.

IV. — THE EMPLOYERS' MOVEMENT

No sooner had the agitation for the replacement of white lead by harmless substances begun than the manufacturers of lead paints and the master painters set on foot an organised resistance to prohibition of the use of white lead and even to the adoption of protective measures in the painting trades. For some time this resistance brought to nothing all efforts on behalf of the working painters, but during the last few years before the war the opposition of manufacturers and employers was confined to the total prohibition of white lead in every kind of painting; a

minority even supported prohibition of lead paints for interior work, considering that the use of substitutes was not merely possible but desirable. Just before the war the resistance weakened still further, and protective regulations were seriously considered.

In 1903 the Association of Swiss Master Painters, in a memorandum to the Department of Industry, stated that it had no objection to a possible prohibition of the use of lead compounds in Government contracts, particularly those of the Federal Government. The Association nevertheless felt bound to give the opinion of its members, which was as follows:

For interior work and generally for work not exposed to the weather, zinc white, lithopone, and other substitutes can very well be used in place of white lead. As regards the quality and permanence of the paints, the Association considers that there are no complete substitutes for white lead but merely imitations. Since lead compounds are undoubtedly dangerous to the workers' health and substitutes can in certain cases be used in place of white lead, the executive of the Association of Master Painters recommends its members to restrict the use of lead compounds to the minimum.

In *Belgium* Dr. Delbastée's Bill prohibiting the use of white lead in building work, introduced in the Chamber of Representatives on 26 November 1903, gave rise to protests from a number of master painters; at a meeting held at Ghent on 25 July 1904 they admitted that the risk of lead poisoning existed and was serious, but were nevertheless in favour of the use of white lead because there was no substitute for it. The restrictions imposed by the Royal Order of 13 May 1905, which came into force on 15 August 1906, caused vigorous protests from the General Federation of Master Painters. At the Liège Congress in 1905 the following resolution was adopted and forwarded to the Minister of Industry and Labour:

Whereas the Royal Order of 13 May 1905 imposes restrictions on us by prescribing precautionary measures in the use of white lead; and whereas the meeting has formally declared that in certain respects lead white is irreplaceable: the members of the Federation of Master Painters, meeting in congress at Liège, declare that they would prefer complete prohibition of the use, manufacture, and import of white lead to restrictive regulations, which they are unanimous in considering impossible of enforcement in their undertakings.

On 19 May 1907 the Brussels trade association of master painters stated that according to all medical reports no painter escaped the effects of lead, whether more or less noticeable, after a few years at his trade; it would be quite impossible for any employer to undertake a contract with the assurance of carrying it through successfully if some of his workers were to be eliminated after medical examination. Regulations which were as irksome

as they were ineffective could only be avoided by prohibiting the use of lead paints. For those reasons the association, repeating previous resolutions, recommended that the said Order should be replaced by an Act forbidding the use of white lead in painting. However, five years later, on 6 December 1912, a group of Belgian white lead manufacturers presented a petition to the Minister of Labour objecting to the proposed total prohibition and asking for the maintenance of the *status quo*.

In *Austria* a very large number of employers admitted that lead paints could easily be dispensed with in exterior work and that for interior work their replacement was not merely possible but desirable; the use of white lead was rather a habit than a necessity.

In *Germany* a memorandum issued by manufacturers of rolling stock, shipbuilders, etc., describing the advantages of white and red lead and throwing doubt on the danger of lead poisoning, elicited an exhaustive reply from the painters' trade unions. Nevertheless some employers' associations were in favour of prohibition; a petition from the Hamburg Employers' Association pointed out that its members frequently used substitutes for white lead. The manager of the Painters' and Decorators' Association of Hamburg, Mr. K. F. Hausen, stated that even if zinc white and lithopone were inferior to white lead in covering power and density they should be used for the sake of the workers' health. In any case, he added, it had long been proved that zinc white was better than white lead for interior work, and there was no apparent reason why it should not be equally durable when exposed to the open air. In his opinion prohibition was preferable to detailed regulation.

The Painters' Guild (*Malerinnung*) of Hamburg also asked the Federal Council to refuse its consent to the Bill prescribing protective measures and to approve complete prohibition of white lead¹. The reasons given were: that it was impossible to improve conditions of hygiene because the painters and other workers objected to the sanitary regulations; that a law of this nature would lead to informing and interference; that it could be carried into effect only by force; that it would be injurious to employers; and that the possibility of using substitutes for white lead had been demonstrated, while not only were there substitutes for

¹ WÄCHTER: *Die gewerbliche Bleibergiftung*, pp. 91 et seq. 1908.

² *Ibid.*, p. 96.

other lead paints, such as red lead and chrome yellow, but they were more satisfactory. The Guild therefore declared in favour of zinc white paints, all the more strongly, it stated, because diseases due to lead did not arise simply from lack of cleanliness, and their consequences were more serious than was generally admitted. While concluding that painters could dispense with lead paints, the Guild considered that any law enacted should not be more rigorous than existing labour legislation.

For *Great Britain* the National Federation of Master Painters and Decorators of England and Wales has kindly supplied information showing that only a very small number of firms use exclusively substitutes for white lead. The members of the Federation were unanimously of opinion that substitutes were satisfactory in certain cases, notably for interior work and jobs requiring a coat of varnish or enamel. They considered, however, that substitutes were inferior to white lead for interior washable paints and for all exterior work, especially in damp districts. There were no substitutes comparable to white lead in resisting power.

The British master painters were less categorical at the meeting of their Federation in October 1910 at Newcastle and at the exhibition of building paints, where experiments to compare zinc whites and zinc sulphide with white lead gave results in favour of the former in 50 per cent. of the cases¹. After a long examination and comparison of the properties of the various pigments and paints the members of the Association came to the conclusion that each pigment (white lead, oxide of zinc, sulphate of zinc, lithopone) had its own qualities and defects, and that no one of them could be recommended to the exclusion of the others; each had its own sphere of use in which it was the best. Although the majority were in favour of employing white lead in painting, it was decided to appoint a committee for experiment and research.

In the following year at Derby the Association voted against prohibition of the use of white lead, but the British Committee on the Use of Lead in Painting remarked that the members of the Association who supported this resolution were not in possession of all the evidence laid before Committee². Competent

¹ OLIVER: *Industrial Lead Poisoning in Europe*. U.S. Bureau of Labour. Bulletin No. 96. Washington, 1911.

² GREAT BRITAIN: *Report of the Departmental Committee Appointed to Investigate the Danger of the Use of Paints containing Lead in the Painting of Buildings*, p. 89. Cd. 7882. 1915.

witnesses, such as Mr. McHugh, chairman of the Liverpool Contractors' Association, and the representatives of the National Federation of Master Painters, stated before the Committee that in the opinion of the majority white lead was not necessary for interior work and that prohibition of its use was desirable, although no other product was, they considered, absolutely equal to it. Mr. McHugh even stated that if the use of white lead were prohibited the National Federation of Master Painters would raise no objection.

In *Italy*, when an enquiry into the risk of lead poisoning in painting was carried out at Genoa in 1912, Mr. Bevilacqua presented to the Mayor of the city a memorandum on the use of white lead¹; the chief points of this memorandum were included in the reply sent in by the Italian Association of White Lead Makers to the questionnaire of the International Labour Office in 1921. Mr. Bevilacqua considered that the problem had never been fairly stated; no attention had been paid to other poisonous products, including solvents such as benzine and paraffin and other substances such as compounds of zinc, copper, mercury, arsenic, and even chromic acid and hydrocyanic acid. He insisted that, although it is easy to protect the worker against paint dusts, it is impossible to protect him against the fumes of the solvents; in his opinion, however, the worker grows accustomed to these fumes without suffering thereby.

V. — VIEWS OF TECHNICAL MEN

While the views of humanitarians and of those whose interests were directly involved have been described, the opinion of technical men — architects, engineers, and chemists — must not be neglected.

In *France* the Architects' Society of the Aisne Department in 1901 adopted a resolution forbidding the use of white lead. In the same year the General Council of Civil Construction recommended prohibition of the use of white lead in interior work; the Advisory Committee on Public Health recommended prohibition in "the vast majority of painting operations", and the

¹ *Ibid.*

² *Memoria della Ditta Andrea Bevilacqua al sindaco di Genova*, 30 March 1912.

Committee on Industrial Hygiene prohibition in house painting. In February 1902 the Society of Public Medicine and Sanitary Engineering declared itself (with only two dissentients) in favour of all administrative measures taken to restrict or abolish the use of paints with a lead base.

In *Belgium* Mr. Stas, the chemist, presented a memorandum dated 1885, which will be dealt with later. In 1902 the Chemists' Association, and a report by Mr. van Langendock¹, pointed out that the time for research was over and that the use of white lead in contracts for the Government, the provinces, and the municipalities must be prohibited until such time as a law should be passed prohibiting it altogether. Mr. van Langendock described the objections to prohibiting the use of white lead in exterior work as biased or short-sighted.

In *Austria* the majority of experts in 1906 declared that the use of white lead paints, even of the best quality, in interior work was responsible for discoloration, particularly for a certain yellowish tinge, and that this defect could be overcome by the use of substitutes. In 1906 and again in 1912 Rambousek, who opposed prohibition of the use of white lead in painting, noted that in various quarters there were proposals for the abolition of lead paints at any rate in interior painting, and stated that they were worth discussing.

In the *Netherlands* a technical report drawn up in 1907 by an association of engineers and architects, the "Sociaal-technische Vereeniging van democratische Ingenieurs en Architecten", concluded with the following recommendations²:

The use of white lead for any interior work should be prohibited by law. The use of red lead should be prohibited by law, except for the first coat on iron which is to be permanently submerged in water.

The specifications of painting contracts for Government departments should be altered so as to prohibit entirely the use of white lead (except in certain specified cases).

Specifications for provincial and municipal contracts should be similarly altered.

Lead poisoning should be a compulsorily notifiable disease.

The workers should be medically examined.

Sanitary measures should be taken in painting workshops.

The Committee should continue its experiments with leadless paints in industries where it has not yet been proved technically possible to use substitutes for white lead.

All lead paints should be prohibited.

¹ *La substitution du blanc de zinc au blanc de plomb (céruse)*, 1902.

² No. 4. Amsterdam, 1907.

In *Great Britain*, Sir Thomas Oliver¹, referring to the conclusions reached by the Commission of 1898, of which he was a member, stated that while expert opinion was divided on the subject², it was subsequently found that white lead could be replaced in interior work and a number of experiments had even cast doubt on the alleged superiority of white lead for exterior work.

In *Germany* Fischer³ frequently drew attention to the good results obtained with substitutes for white lead, especially in interior work. In his opinion prohibition of the use of lead paints, particularly white lead, for interior work, would be a good start towards complete prohibition, should this prove practically feasible. Experiments up to that time had shown that, with few exceptions, white lead and lead paints could be dispensed with, not merely in interior work but in other operations also. He concludes that more radical measures should be taken and the use of lead compounds prohibited for all work where experience had shown that they were not essential.

In the *United States* Mr. E. F. Ladd⁴, Dean of the chemical and pharmaceutical laboratory in the North Dakota College of Agriculture, and a recognised expert on the technique of painting, gave his opinion as follows:

I would limit the use of white lead paint, not permitting its use in general for interior painting, although I do not know that I would say that white lead should be excluded from all classes of interior painting. I would not at this time exclude the use of white lead from exterior painting. Restrictions in the use of white lead should not be confined to that alone, but should apply to all classes of lead paint that are possessed of toxic properties. I would, unless information that I do not now possess can be furnished, prohibit the dry rubbing down of white lead, but permit the use of pumice and water or sandpaper and some drying oil. I would restrict the use of dry white lead to be handled by painters; it is not necessary, for the work can be done better in the factory. I would have every paint of this kind labelled to show its true composition in such a way that every-

¹ OLIVER : *op. cit.*, pp. 28 and 32, note 2.

² The conclusion of the Commission was as follows: "With regard to all these so-called substitutes the Committee have invariably found that on closer enquiry of persons competent to judge and unprejudiced on either side, the substance in question was in some particulars inferior; and they have come to the conclusion that there is at present no substitute that can take the place of carbonate of lead made by the old Dutch process."

³ *Mitteilungen des Instituts für Gewerbe-Hygiene*, 1912. Frankfurt-on-Main.

⁴ Dr. Alice HAMILTON : *Hygiene of the Painters' Trade*. Bulletin of the U.S. Bureau of Labour Statistics, 1913. No. 120. (Cf. also reports presented to the Congress on Industrial Diseases, Brussels, 1910, and the International Health Congress, Washington, 1913.)

one can understand its essential features. I would also have an educational campaign carried on warning painters of some of the dangers of carelessness and telling them of remedial methods to prevent lead poisoning.

In *Switzerland* the report of a technical committee which met at Geneva in 1907 was more unqualified in opposing prohibition:

The vast majority of trade experts reply that zinc cannot replace lead in all painting work. That is our conclusion. We cannot attach authority to the interested statements of a minority of contractors to the effect that they can dispense entirely with lead; we congratulate them on depriving a majority of contractors, mainly working employers, and the workers themselves of a material which they demand as essential, simply because it is admitted that a man handling a brush cannot keep clean¹.

VI. — THE WAR

As was noted earlier, the International Association for Labour Legislation at its last meeting before the war had declared prohibition of the use of all lead-containing paints, even for exterior painting, to be possible and urgently necessary for health reasons. The war brought a sudden interruption to a movement which seemed destined for success, but it also brought important new facts to light.

During the war very little lead was available for the manufacture of white lead, which almost came to an end. As a result the painting trade was obliged to use other materials, notably zinc white and lithopone. It should be noted that the vehicles and solvents available were not such as to produce paints of the finest quality; in most countries linseed oil, which is essential for a good paint, was mainly absorbed by war industries and the food supply. Turpentine was replaced by heavy oils, petroleum, etc. There was also a shortage of skilled labour. In any impartial estimate of the value of substitutes for white lead allowance must be made for the unfavourable conditions in which they were first employed on a large scale.

It should also be noted, however, that the restriction and often compulsory cessation of the use of white lead was followed by so obvious an improvement in the health of working painters that the Chemnitz factory inspector immediately attributed it to the decreased use of white lead, while the Leipzig inspector remarked

¹ *La cruse. Rapports et enquêtes de la Commission sur le projet de loi visant l'emploi des composés au plomb dans les travaux de peinture en bâtiment*, p. 86. Geneva, 1907.

that it was an ill wind which blew nobody any good. This point will be examined in greater detail in connection with statistics of lead poisoning among painters.

At the close of the war came the declaration in Part XIII of the Treaty of Versailles that :

Conditions of labour exist involving such injustice, hardship and privation to large numbers of people as to produce unrest so great that the peace and harmony of the world are imperilled; and an improvement of these conditions is urgently required: as, for example, by... the protection of the worker against sickness, disease and injury arising out of his employment.

At about the same time the International Federation of Trade Unions adopted a resolution to the following effect :

(a) The contracting Governments have undertaken to develop their national legislation for protecting the health of the workers. In particular they will endeavour to introduce uniform health regulations for the various industries, to secure permanent joint action against industrial poisons and action to prohibit methods of production which are especially prejudicial to health.

(b) The list of poisons drawn up by the International Association for Labour Legislation should be considered as part of the joint action in matters of occupational hygiene mentioned under (a); poisons which can be replaced by less dangerous materials should not be used in industrial undertakings or workshops.

VII. — AFTER THE WAR : THE THIRD INTERNATIONAL LABOUR CONFERENCE IN 1921

For the first time the fundamental principles of the movement for industrial hygiene were given official sanction at the International Labour Conference at Washington in 1919. As a result of the suggestions then put forward, the Governing Body of the International Labour Office decided to include on the agenda of the 1921 Conference the prohibition of the use of white lead in painting.

The questionnaire on the subject¹ gave a brief survey of the chief points relating to technique, hygiene, pathology, and practical experience which had appeared up to that time. It was confined to the problem as it arises in the building industry alone, but on 12 April 1921 the Governing Body decided that the whole question of prohibiting the use of white lead in any kind of painting should

¹ INTERNATIONAL LABOUR OFFICE, International Labour Conference, Third Session, Geneva, October 1921 : *Prohibition of the Use of White Lead in Painting*. Item III (b) of the Agenda. Geneva, 1921. 83 pp.

be laid before the Conference. For this reason the information given subsequently covers also the use of substitutes in painting coaches, furniture, bridges, etc.

It is remarkable that this questionnaire issued by the International Labour Office revived discussions and arguments which had appeared obsolete long before the war. It almost seemed as though the cataclysm of the war had swallowed up all the efforts, experiments, and results achieved by scientists and technical men in the sphere of social medicine before the war — as though positive or negative results, checked by science and experiment, were not of the same value as when they were first obtained.

The International Labour Office not merely asked Governments for information, but sent its questionnaire to employers' associations and trade unions in the painting industry. It was thus able to ascertain the views of the organisations most concerned and complete its review of the subject. The replies received were summarised in *Daily Intelligence*; they are briefly recalled in the present report in order to bring up to date the historical survey of the movement¹.

LABOUR VIEWS

The International Congress of Painters' Trade Unions meeting at Stuttgart on 10 September 1920, decided on vigorous action to secure that the use of white lead should be absolutely prohibited. The various sections of the International were to present to their respective Governments a resolution on the demands approved by the Congress. This petition was presented in 1921 by the German painters' unions², both the "free" and the Christian unions, and by the Swiss Union of Building Workers. The resolution was as follows :

The undersigned, being the officers of the Building Workers' Union, are constrained by the bad social and occupational conditions from which painters suffer to make an urgent demand for effective protection by law which shall prescribe general hygienic precautions. These protective measures are rendered all the more necessary by the disastrous effects of the war on public health, especially among workers, whose power of resistance was always low.

¹ The views of the Governments are given in the report by the Office to the Conference : *Report on the Prohibition of the Use of White Lead in Painting*. Item VI of the Agenda. Geneva, 1921. 66 pp.

² *Verbot der Bleiweißverarbeitung im Malergewerbe; Material zu den Verhandlungen der Internationalen Arbeitskonferenz, 3. Tagung, Genf, 1921.* Hamburg, Verlag O. Streine, 1921. English and French translations of this memorandum appeared as Series F, No. 5, of Studies and Reports, published by the INTERNATIONAL LABOUR OFFICE.

We presume that the Government is in general aware of the facts on which we base our claims, facts established by data which are easily accessible, by published statistics, and by works published in this country and abroad. Here, therefore, we will merely recall certain facts which are conclusive.

The painter's workplace is constantly shifting. Painters work in the open air or in draughty, unheated rooms which are often also damp. In addition to the chills which they may thus contract, painters run the risk of lesions caused by the inhalation of toxic or noxious dusts, of intestinal complaints, and poisoning caused by preparing various chemical materials such as paints, varnishes, vehicles, and solvents. They also suffer from irregularity of meals, since the employer's premises or the workers' homes are often a long way from the place of work. The workplace, being purely temporary, is often provided with no sanitary conveniences whatever. The house painter, again, is in grave danger of falls and other accidents.

These dangers to the life and health of the worker may, it is true, be mitigated to some extent by legislation requiring, for example, that buildings shall be weatherproof throughout the year, that scaffolding and ladders shall be of the best quality, that the use and preparation of lead paints shall be restricted, and that sanitary conveniences shall be provided. But such preventive measures could not entirely do away with the present state of affairs, since they cannot be fully adapted to the special nature of the trade. The most effective protection will always be the personal immunity of each worker. It is well known that, other things being equal, the effects of accidents and diseases are grave and lasting in proportion as the general health of the worker is poor — in other words, as his social condition is bad.

In general, conditions among painters are bad, as is proved by the unemployment statistics for the trade which we have collected since the beginning of the war. The average period of unemployment per worker per year was 7.5 weeks in 1916, 5.1 in 1917, 3.1 in 1918, and 4 weeks in 1919. By the end of 1920 there had been a still greater increase, so that the average unemployment per year for the five years covered is 6 weeks, i.e. about 250 hours per year — a figure which corresponds with the independent estimate made by the fiscal authorities.

The effect of all these bad conditions is to increase very considerably the dangers of working in badly-equipped premises arising from draughts, dust, and, above all, poisonous and injurious substances such as lead and certain gases. It must not be forgotten that those whose physique is weakened by bad and irregular food or other bad living conditions are much more liable to occupational diseases, especially lead poisoning, than healthy and vigorous men.

It should further be noted that scientific observation has confirmed the existence among house painters of many cases of disease directly or indirectly attributable to the risks of the trade (even apart from direct lead poisoning), among others articular rheumatism, bronchial catarrh, inflammation of the lungs, inflammation of the tissues (abscesses), tonsillitis, gastric and intestinal complaints, infectious diseases, diseases of the teeth, nerves, kidneys, and eyes, varicose veins, and tuberculosis.

The foregoing remarks refer primarily to the special conditions of house painters, but they apply also to the work of those who, though not strictly painters by trade, are employed in varnishing works or on varnishing in various industrial undertakings. Although in such cases the work is more regular and involves less travelling, the risk incurred in the preparation of lead paints and poisonous vehicles and solvents is just as great. Frequently this work is done in closed workshops at a high temperature.

We consider that, in order to reduce all these occupational risks to a minimum, the following measures are essential in the painting trade, including varnishing:

- (1) Prohibition of the use of white lead in any kind of painting, whether interior or exterior.
- (2) Until this prohibition shall have taken effect, the following regulations are required to prevent lead poisoning and other diseases:
 - (a) compulsory declaration of all paints, vehicles, or solvents containing salts of lead or any other substance directly or indirectly injurious to health;
 - (b) provision of towels (at least one per man weekly), soap ("black soap" or "akremin" soap), nail brushes for cleaning hands and nails, also a clean basin so that the workers can wash;
 - (c) instruction of young people in the symptoms and effects of occupational diseases and in methods of prevention;
 - (d) regular medical inspection of all persons belonging to the trade;
 - (e) an effective system of supervising undertakings on lines which would give the workers an adequate share in it through worker-inspectors nominated by their trade unions;
 - (f) issue of a poster with the order to display it in all undertakings and present a copy to each worker especially exposed to the risk.
- (3) An Order requiring all undertakings to fit effective appliances for ventilation and for the removal of dust and poisonous fumes, to keep all buildings closed during the autumn and winter months, and to provide suitable workshops and good working clothes.

In Italy the Painters', Decorators', Varnishers', etc., Union of Milan in 1920 convened a meeting of the workers concerned with a view to taking action on both the economic and the sanitary aspects of the question. It asked the painters' unions of other towns for assistance and support in organising a national movement against the use of white and red lead. At its meeting at Bologna on 27 and 28 February 1920 the Federal Congress on Social Insurance unanimously adopted a resolution moved by the secretary of the Milan Painters' Union in the following terms:

Whereas prohibition of the use of poisonous products which can be replaced by harmless substances is a means of preventing the risk of lead poisoning and occupational diseases, the Congress demands that the use of the said poisonous substances be prohibited.

This resolution was also approved at the Trieste Congress on Social Insurance, held in October and November 1921.

In Germany the following resolutions were adopted at the seventeenth general meeting of the Union of Painters, Decorators, etc., held at Frankfurt-on-Main on 13 June 1921:

The seventeenth general meeting of the Union of Painters, Varnishers, Decorators, Whitewashers, and Plasterers considers that the use of poisonous paints with a lead base presents a grave danger to the health of the workers represented by the said meeting and to that of their families. These dangers are very greatly aggravated:

- (1) by the difficulty of detecting the origin of diseases due to lead;
- (2) by the acute nature of their development;
- (3) by the unsatisfactory social conditions of working painters, both economically and professionally;

(3) by the impossibility of enforcing effective measures of protection, due to the fact that painting is a small-scale industry and that, outside the actual workshop, the places of work are equipped in very rudimentary fashion owing to the constant shifting.

In consideration, however, of the small quantities of mixed lead-containing paints (*bleihaltige Mischfarben*) used, the working painters and decorators confine their demands for the present to legal prohibition, in both indoor and outdoor work, of the use of white and red lead, which are used in large quantities and are extremely dangerous to health owing to their high content of poison.

The general meeting has every reason to hope that this prohibition will be carried into effect in all countries, following on the decision of the Third Session of the International Labour Conference, in the interests not merely of the class of workers endangered but also of the welfare of society as a whole.

In the *United States* the Brotherhood of Painters, Decorators, and Paperhangers of America, which had a membership of 125,000, mainly house painters, stated that the use of white lead is a grave menace to the health and lives of painters and should be forbidden. According to the Brotherhood, statistics were misleading and gave a very inadequate idea of the effects of white lead on the health and mortality of painters. It dismissed as fallacious and contrary to experience the view that no satisfactory substitute has yet been produced and that if suitable precautions are taken white lead can be used with relative impunity.

In *Great Britain* the National Amalgamated Society of Operative House and Ship Painters and Decorators, with a membership of 73,656 in 1920, also stated, in the light of experience, that many of the substitutes for white lead are both economical and effective; their covering power was equal to that of lead paints, while substitutes with a zinc base remained white longer than white lead. For indoor work the Society was wholeheartedly in favour of substitutes, since dry rubbing down, which was essential for good work, was dangerous when white lead was used. Regulations which might be effective in a factory are impossible in house painting, and the Society declared that nothing short of absolute prohibition could remove the dangers attendant on the use of white lead.

In *Australia* the Operative Painters' Union appointed a committee in 1918 to investigate the use of white lead in painting,

INTERNATIONAL LABOUR OFFICE : *Daily Intelligence*, Vol. II, No. 27,

pp. 345-348.

Ibid., No. 42, pp. 526-527.

and the committee reported in favour of prohibition. A detailed memorandum was presented to the New South Wales Board of Trade on the occasion of its enquiry in 1921.

In the *Netherlands* the "Nederlandsche Schilderergesellenbond", pointing out that in that country the use of white lead had practically ceased in interior work and was steadily decreasing in exterior work, stated that the results obtained with substitutes, especially zinc white, were entirely satisfactory. The use of white lead had been abandoned solely under the pressure of public opinion, and the same force would render its prohibition possible.

In *Austria* the Union of Painters, Decorators, etc., emphasised that painting done during the war without white lead had been satisfactory so long as good vehicles and solvents had been available. Work spoiled rapidly when nothing but bad material was available. When the war was over, with the return to white lead there was immediately a recrudescence of lead poisoning; the cases occurred mainly in outdoor work, the prohibition of white lead applying in Austria only to indoor work. The union was of opinion that lead poisoning could not be prevented except by total prohibition of the use of all lead paints.

In *Spain*, during the debate on the question in the Institute of Social Reform, the workers' representatives stated that they were in favour of prohibiting the use of white lead in painting.

In *France* the trade unions and their congresses have always taken an interest in the question. At the congress of the Building and Contracting Workers' Union, held at Dijon in 1921, there was a further protest against the failure to enforce the Act of 1909 prohibiting the use of white lead and plumbous linseed oil in both indoor and outdoor work.

In *Argentina* an agitation for prohibition of the use of white lead started in Buenos Ayres in 1920.

In *Switzerland* the Building Workers' Union informed the International Labour Office that, pending the results of the petition

NEW SOUTH WALES BOARD OF TRADE : *Report on White Lead as Used in the Painting Industry ; its Dangers and Their Prevention*, pp. 606 et seq. Sydney, 1921.

Daily Intelligence, Vol. II, No. 58, p. 722.

Ibid., No. 59, p. 734.

Ibid., No. 31, p. 392.

Ibid., No. 68, p. 781.

presented to the Federal Council on 12 January 1921 asking for prohibition of the use of white lead, the Union was in favour of very strict regulations in the painting trade.

The trade unions of *Czechoslovakia*, too, were in favour of prohibiting the use of white lead in painting; they also considered that the factory inspectors should be empowered to secure the enforcement of this prohibition in the undertakings, and that doctors and sick funds should be compelled to notify cases of lead poisoning, the sick funds to inform the factory inspectors¹.

EMPLOYERS' VIEWS

Employers' organisations, both of white lead corrodors and of master painters, conducted a vigorous agitation against the insertion of the white lead problem on the agenda of the International Labour Conference. The *German* white lead makers published the following statement on 15 October 1920:

(1) For many years commercial white lead has been ground only in oil, and the danger of lead poisoning is thus completely removed. The contract of employment already lays down that there shall be breaks for dinner and tea. By the workshop rules every worker is obliged to wash his hands before eating. As a result there has been no case of lead poisoning for years. The cases noted in the past and those which may arise from time to time are due to the use of white lead in powder form; handling dry powders might be a cause of poisoning through inhalation of the dust.

(2) There is no substitute for white lead in exterior work. No other white pigment can be even remotely compared with it for durability. All other white pigments rapidly perish and lose their tone.

(3) Customers would run the risk of very serious loss if house painting, etc., were done with inferior substitutes for white lead. Only the best materials should be used.

(4) If the use of white lead were prohibited, painting contractors would no longer be able to guarantee their customers perfectly executed work.

(5) Every means should be adopted to prevent the issue of absurd regulations which might injure the whole painting trade.

The Hanover and Stollberg Chambers of Commerce on 24 August sent a protest to the Ministries of Economy and of Labour against the proposal to forbid the use of white lead, stating that prohibition would be useless, since in their opinion there was no substitute².

¹ *Ibid.*

² *Ibid.*, Vol. IV, No. 6, p. 194.

In *Argentina* the president of the Master Painters' Association, in reply to a question from the Labour Association (an employers' organisation), pointed out the great drawbacks of using white lead, stating that it was the duty of employers to seek a remedy for this evil. He concluded in favour of prohibiting the use of white lead in painting¹.

In *Spain*, on the occasion of the discussion in the Institute of Social Reform on the questionnaires for the International Labour Conference, the architects' expert spoke against prohibition of paints with a white lead base. He said that the dangers of using white lead had been exaggerated, and that preventive regulation would be sufficient, whereas prohibition would do a grave injury to the lead-mining industry, most of the ore being sent to white lead works.

The *Finnish* Employers' Association stated that to prohibit the use of white lead would deprive the public of the most durable pigment for certain kinds of work. The Association considered that white lead could no longer be regarded as dangerous to health, thanks to the improvements in its manufacture, and that prohibition was unnecessary².

In *France* the Paints and Varnish Trade Chamber objected that no attention had been paid in the Act to its reiterated protests, which still held good, against the infringement of liberty involved in abolishing an industry without compensation. The risk of lead poisoning had been exaggerated and there was no substitute with the same technical qualities to replace white lead. The Chamber consequently recommended that each State be left free to legislate or not, as it saw fit on the question of white lead, and that new enquiries should be carried out in all countries, not into the harmful nature of white lead, which was not questioned, but into the actual risks of lead poisoning occasioned by its use in painting.

In *Italy* the factory inspectors' reports stated that employers and workers in paint and varnish factories were in favour of prohibiting the use of white lead, but that the white lead corrodors preferred regulation of the painting trade³.

¹ *Ibid.*, No. 5, p. 159.

² *Ibid.*, Vol. III, No. 19, pp. 579-580.

³ Information supplied by the Italian Government.

The Painting Trade Material Committee of Great Britain and Ireland stated that in its opinion prohibition was too radical a step and that white lead was unique as a protective material in paint. The Committee considered that wide regulations which were thoroughly understood would effectively eliminate all danger to the health of painters¹.

In Switzerland the manufacturers of white lead declared that to prohibit its use in painting would be not merely to strike a mortal blow at a Swiss industry but, even worse, to make Swiss industries entirely dependent on foreign countries. Since experiment had failed to discover any complete substitute for white lead, they were decidedly against the whole principle of prohibition. Employers' organisations when interrogated replied that the prohibition of white lead and the use of substitutes for it were matters not yet sufficiently elucidated to justify at this early stage so radical a measure as prohibition². On 3 March 1921 the Association of Master Painters and Plasterers presented to the Federal Economic Department a petition in reply to that sent in by the trade union (see above, page 31); the Association proposed to combat the dangers involved in the use of white lead by quite simple measures without going so far as prohibiting it³. The petition included the following passage:

The Association considers that to describe painting as a dangerous trade is merely an arbitrary statement; on the contrary, when the trade is carried on in the open air it is perfectly healthy. Work in new buildings is generally done in summer, and if in exceptional circumstances it is occasionally done during the winter it is to the employer's own advantage to provide heating, without which no good work can be done. The employers stand to gain by removing or limiting as far possible the risk of occupational disease, but the danger of lead poisoning in painting is grossly exaggerated. Nowadays lead poisoning among painters is very rare, and the employers are prepared to support this statement by statistics.

Whereas in the past white lead was frequently used in powder form, today throughout the painting trade it is used solely ground in oil and is sold in this form. The steady reduction in accident insurance premiums (from 3.2 to 2.4 and later to 2 per cent.) shows that the risk of lead poisoning is now reduced to a minimum.

Practical experience shows that white lead is indispensable for outside painting.

The risk of lead poisoning can be entirely removed if the workers will observe scrupulous personal cleanliness. If this were done, any cases which did arise would be due solely to the worker's own carelessness.

The employers present the following comments on the proposals made by the working painters:

¹ Communication to the International Labour Office.
² Information supplied by the Swiss Government.
³ *Baurbätter*, 2 April 1921, Zurich.

It is impracticable to prohibit the handling of lead paints for outside work because no effective substitute for white lead has yet been found, especially in resistance to the weather. For certain interior work, too, there is no substitute for white lead.

There would be no objection to compulsory labelling if this measure could be enforced. Since white lead alone is in question, it should be noted that vessels containing this substance already have a label indicating the contents which is well known to every painter.

The supply to the workers of towels, nailbrushes, etc., has given no practical results. The Order issued by the town of Zurich to require these measures remained a dead letter owing to the attitude of the workers.

There is nothing to object to in the proposal that apprentices should be instructed in the danger of lead poisoning, but medical examination appears unnecessary in view of the extremely slight risk in the painting trade. If this point of view were adopted the State would be obliged to have all the inhabitants of the country alike medically examined at intervals.

There are no objections to the distribution and posting of a notice on lead poisoning.

An Order requiring the installation of sanitary conveniences, efficient ventilation, the removal of dust and poisonous fumes, the closing of buildings during the autumn and winter, the provision of cloakrooms and working clothes would be too detailed. If regulations are necessary, recourse could be had to the Labour Act.

For the *United States* the general secretary of the International Association of Master House Painters and Decorators of the United States and Canada transmitted to the International Labour Office, by a letter dated 4 June 1921, the following resolution, which was unanimously adopted at the thirty-seventh annual convention of the Association, held at Louisville from 1 to 4 February 1921:

Whereas it is reported that at an International Labour Conference to be held shortly at Geneva a proposition will be considered involving a recommendation that the use of white lead in painting be prohibited, and

Whereas it is understood that, in support of this proposition, it will be claimed that there is to-day no question as to the practicability of replacing white lead in the painting industry, and

Whereas, without expressing any opinion as to the relative merits of various pigments used by us, we know that this claim is untrue. Therefore be it

Resolved, that we, the International Association of Master House Painters and Decorators of the United States and Canada in convention assembled, hereby declare that any general prohibition of the use of white lead in painting would result in less permanent and satisfactory work being done, and be it further

Resolved, that the secretary of the Association be directed to send a copy of this resolution to the Secretary of the said International Labour Conference and to each of the representatives of the United States and Canada to such Conference, should such representative be appointed.

The resolution unanimously adopted by the Master Painters' and Decorators' Association of Pennsylvania, at its conference at Harrisburg on 26 July 1921 was transmitted to the Office by the president of the Association under date 19 August 1921; the resolution is similar to that of the Canadian Association quoted in full below. On 1 November the president of the International Labour Conference received a telegram from the annual meeting

of the National Paint, Oil and Varnish Association protesting strongly against the proposal to prohibit the use of white lead in painting¹.

The secretary of the Canadian Association of Master House Painters and Decorators sent, by letter of 20 July 1921, the following resolution, which was unanimously adopted at the convention of the Association held at Ottawa from 12 to 14 July :

Whereas it has come to our knowledge that a proposal will be made at the International Labour Conference to be held in the City of Geneva, Switzerland, about October 1921, to prohibit the use of white lead in painting, and

Whereas this proposal, it is said, will be advocated for the alleged reason that it is entirely practicable to replace white lead for painting purposes,

Whereas in our opinion, as progressive and practical painters of many years' experience in the application of our art, we have no hesitancy in branding this claim as false :

Therefore be it resolved that the Canadian Association of Master House Painters and Decorators in annual convention assembled hereby goes on record and declares that any prohibition of the use of white lead in the painting industry would practically mean a calamity for the consumers of paint, as the result would be less permanent and satisfactory work, for the reason that white lead, when used either alone or as a constituent of prepared paints, meets requirements that in the present state of the art cannot be practically met by the substitution in substantial amount of any other pigment for it; and be it further

Resolved that the Secretary of this Association be directed to send a copy of this resolution to the Honourable Oideon Robertson, Minister of Labour, Ottawa, and also a copy to the secretary of the International Labour Conference, Geneva, Switzerland².

LITERATURE RECEIVED

The delegates to the Third International Labour Conference had before them a large number of documents submitted by organisations of employers and workers in the painting trade and by technical men. The more important of these are noted here.

Germany

HANDELSKAMMER ZU DÜSSELDORF : *Die Verwendung von Bleiweiß im Maler- und Anstreicherhandwerk*. April 1921. Printed by A. Bagel. 22 pp. *Verbot der Verwendung von Bleiweiß im Malerhandwerk. Antwort des Vereins Deutscher Bleifarbenfabrikanten, e. V. Köln*. Düsseldorf, 1921 28 pp. (This pamphlet was also presented in French.)

VERBAND DER MALER, LACIERER, ANSTREICHER, TÜNCHER UND WEISSBINDER DEUTSCHLANDS : *Verbot der Bleiweißverarbeitung im Malerhandwerk. Material zu den Verhandlungen der Internationalen Arbeitskonferenz*. Hamburg, Verlag O. Streine, 1921. 28 pp. (An English translation of this publication appeared in the "Studies and Reports" of the International Labour Office, Series F, No. 5.)

¹ *Daily Intelligence*, Vol. III, No. 23, p. 721, and Vol. IV, No. 14, p. 326.
² *Ibid.*, Vol. III, No. 16, pp. 458-459.

— Die Bleischädigungen im Maler- und Lackervergewerbe unter dem Gesichtswinkel des Arztes und des Gesetzgebers. Vortrag des Bayerischen Landesgewerbebezugs Ministerialrat Dr. F. Kölsch. Hamburg, Verlag O. Streine, 1921. 37 pp.

Great Britain

HOME OFFICE, FACTORY DEPARTMENT : *Memorandum on Industrial Lead Poisoning*. Form 324. January 1921.

The Prohibition of the Use of White Lead in Painting. Case against Prohibition. Issued by the London Chamber of Commerce on behalf of the White Lead Corroders' Trade Section. London, 1921. xxxiv + 28 pp.

The Prohibition of the Use of White Lead in Painting. Case against Prohibition. Stated by the White Lead Makers of Europe in answer to Questionnaire and Memorandum issued by the International Labour Office. London, 1921. xvi + 64 pp. (This pamphlet has also appeared in French.)

White Lead — Its Suppression Necessary for the Protection of the Lives and Health of the Workers, as indicated by the Official Reports of Departmental Committee appointed by H.M. Governments. Edited by Arthur Seymour JENNINGS. London, Trade Papers Publishing Co., Ltd., 1921. x + 77 pp.

Italy

"I verniciatori, decoratori e affini per l'assoluta abolizione della biacca." Special Number of *Il pennello*, journal of the Union of Painters, Decorators, etc., May-July 1921. Milan.

During the Conference there also appeared the following work :

F. L. CANTINEAU : *Une grave question d'hygiène professionnelle et sociale : La céruse*. Paris and Liège, Héranger. 480 pp. The same author also issued a complete French translation of the report of the British Departmental Committee of Enquiry into the Use of Lead in Painting (Cd. 7882, 1915) and in Coach Painting (Cmd. 630, 1920).

THE THIRD SESSION OF THE INTERNATIONAL LABOUR CONFERENCE

This was the position when, in October 1921, the Third Session of the International Labour Conference assembled at Geneva, with an agenda including the item : "Prohibition of the Use of White Lead in Painting".

The report accompanying the questionnaire on this subject had been the subject of criticism which, coming as it did from individuals and bodies opposed in principle to prohibition, was sometimes rather vehement. It can hardly be said, however, that it contributed anything new to the discussion. The same is true of the prolonged debates in the White Lead Committee and its Medical Sub-Committee at the Conference. Nevertheless, since the opponents of prohibition, reverting to certain facts or experiments, have tried to show that under some conditions working

painters could agree to the use of white lead, and since some scientific doubts might legitimately be entertained, the International Labour Office considered it a duty to re-examine the whole question, to assemble and collate all the medical and technical evidence at its disposal. The results of this work are embodied in the present report, which is as complete and accurate as careful revision in the light of the facts collected since 1921 can make it¹.

ATTITUDE OF THE STATES TO THE DRAFT CONVENTION OF 1921

When the Draft Convention had been adopted² the States Members of the International Labour Organisation had to submit it to the Parliaments of their respective countries for ratification. This afforded a further opportunity for resistance and objections from the supporters of white lead, but the arguments advanced were the same.

Between 1921 and 1925 there appeared the final reports of a number of committees of enquiry which had been appointed some years before to examine the white lead question; these were the report of the British Committee on Industrial Paints (issued in February 1923), the report of the New South Wales Board of Trade, and the report of the Belgian Committee of Enquiry³.

It may be of interest to give here some account of the movements for or against white lead which appeared in the countries which presented the Draft Convention to Parliament for ratification. The story will then be complete up to September 1926.

Mention should first be made of two demonstrations, originating with the Draft Convention, which took place in France and Belgium. The League of Red Cross Societies organised a demonstration in Paris on 3 March 1923 to further universal adoption of the resolutions passed by the 1921 Conference, with a view to protecting working painters against the dangers inherent in the

¹ Since the Office already possessed all the technical and practical information elicited by public and private enquiries, it was not thought necessary to convene the Hygiene Committee set up by the Washington Conference. In addition, the studies carried out by the Office in pursuance of the Washington Resolution had been hampered from the first by practical obstacles. The Committee was therefore unable to meet until the time of the Third Session of the International Labour Conference.

² See Appendix V.

³ See Appendix II.

use of white lead; a further object, applying to France alone, was to demand strict enforcement of the Act of 20 July 1909 prohibiting the use of lead paints in all interior house painting and its extension to coach painting and the use of red lead, without technical justification, for the protection of iron against oxidation⁴. The chair at this demonstration was taken by Mr. Albert Peyronnet, then Minister of Labour. A similar demonstration was organised in Brussels on 26 April by the General Council of the Belgian Red Cross.

In May 1924 representatives of the Belgian and British painters' trade unions met in London to discuss the Draft Convention. Reports were presented by Mr. J. A. Gibson, general secretary of the British union, and by Mr. W. Pickles, a member of the executive council (see below). The Swiss Trade Union Committee, again, meeting at Olten on 9 July 1925, unanimously adopted a resolution on the subject moved by the secretary of the Trade Union Federation (see below).

Argentina

The International Congress on Social Economy, meeting at Buenos Ayres in October 1924, discussed a report by Mr. Angel M. Jimenez on poisoning due to the use of white lead in painting. On 9 December the official journal of the Federation of British Industries published a note to the effect that paint manufacturers were much perturbed by the ban on the import of white lead into Argentina; the Federation made representations both in Argentina and through the President of the British Board of Trade⁵.

On 18 May 1925 the Argentine Government sent a Message to the National Congress asking for authorisation to ratify the Convention⁶. The Municipal Council of Buenos Ayres drafted an Order prohibiting the use of white lead in painting, but this was vetoed by the municipal inspector and did not come into force. The National Department of Hygiene has suggested to the Government that a Bill prohibiting the use of white lead should be prepared, but nothing has yet been decided. Some public departments, such as the Ministry of Marine and the General Directorate of Navigation and Ports, have decided of their own accord to forbid the use of paints with a white lead base in any work done under their authority⁷.

The International Labour Office was recently informed that a special session of Congress had been summoned to deal, among other things, with the ratification of Conventions, and that a committee had been appointed to prepare a draft Labour Code in harmony with the Conventions adopted by the Conference since 1919⁸.

¹ INTERNATIONAL LABOUR OFFICE: *Industrial and Labour Information*, Vol. VI, No. 7, pp. 325-326.

² *Ibid.*, Vol. XIII, No. 11, p. 479.

³ INTERNATIONAL LABOUR OFFICE: *International Labour Conference: Report of the Director*, 1926, p. 341.

⁴ *Boletín de servicios de la Asociación del Trabajo*, 20 June 1925. Cf. *Industrial and Labour Information*, Vol. XV, No. 12, p. 520.

⁵ *Report of the Director*, 1926, p. 341.

Australia

In the Commonwealth House of Representatives on 21 May 1924, Mr. Coleman, speaking on behalf of the Operative Painters' Union of Australia, pressed for adoption of the Convention. Sir Littleton Groom, the Attorney-General, pointed out in reply that the position of the Commonwealth was complicated by the fact that it was under a federal constitution; the duty of the Federal Executive was to forward the decisions of the International Labour Conference to the competent authority. Referring to the White Lead Convention, he said that, while the Commonwealth had certain powers with regard to public health, it had no power to impose by legislation prescribed duties on persons carrying on industries within a State; this Convention would therefore be forwarded with others to the State authorities.

In *Western Australia* regulations have been issued under the Factories and Workshops Act (Amendment) Act, 1923, which itself provides for regulation of the use of white lead. An award delivered in the Arbitration Court of Western Australia on 5 August 1924 is interesting, since in some respects it corresponds exactly with the Convention and in others goes even further. In addition to fixing maximum daily and weekly hours of work, minimum hourly and weekly wage scales, etc., the award prescribes that the workers must be allowed a period of five minutes prior to breaks for meals and prior to leaving the workplace for washing their hands; the employer must provide soap and hot water for this purpose. Inside spraying with paint containing white lead and dry rubbing down and scraping of lead-painted surfaces are prohibited. Higher rates of wages are fixed for outside spraying with paint containing lead, for dangerous work on suspended scaffolding, etc.

The *New South Wales* Minister for Labour and Industry stated in 1925 that enquiries were being made to enable him to come to a decision on the question of prohibiting the use of white lead in painting.

In *Queensland* an amendment to the Health Act concerning the use of white lead was adopted in 1922. One section is as follows:

No paint containing more than 5 per cent. of soluble lead shall be used or put within four feet from the ground or floor of any residence, hall, school, or other building to which children under the age of 14 years have access, or any verandah, railing, gate, or fence. No surface of paint which contains more than 5 per cent. of soluble lead shall be rubbed down in a dry condition.

Austria

A Government Bill for the ratification of the White Lead Convention was passed by the National Assembly on 20 February 1924 and by the Federal Council on 29 February 1924. Ratification was registered on 12 June 1924, and the Convention came into force on 20 July. The first annual report reached the Office on 13 March 1925, while the second refers to the year ending 31 December 1925.

The use of white lead in interior painting is prohibited in Austria under the Order of 8 March 1923, promulgated on 6 April 1923, and amending, in order to meet the terms of the Convention, the Order of 15 April 1906 on the protection of persons employed in the painting, varnishing, and decorating trades. The one provision of the Convention which is not

¹ *Industrial and Labour Information*, Vol. XI, No. 8, pp. 312-313.

² *Report of the Director*, 1925, p. 276.

³ *Industrial and Labour Information*, Vol. XII, No. 6, p. 276.

⁴ *Ibid.*, Vol. XVI, No. 8, p. 355.

⁵ *Ibid.*, Vol. V, No. 2, p. 70.

included in this Order is Article 7, on the compilation of statistics. With a view to giving effect to this Article also, the Austrian Government is at present considering the possibility of issuing a special Order creating a system of statistics in the form required by the Convention.

White lead may be used in exterior painting only when it is necessary as a protection against weather or water. The employment of young persons under 18 and of women in any work involving the use of white lead is also prohibited. A series of provisions corresponding closely to those of the Convention lays down the precautions to be observed when white lead or other lead paints are, as an exception, used. The annual report points out that the use of white lead in interior painting was already prohibited by the Order of 1906, which had led to a fall of two-thirds in the number of cases of lead poisoning reported in recent years. (See Appendices for legislation.)

Belgium

On 5 December 1918 Mr. Bertrand and five doctors who were members of the House of Representatives introduced a Bill abolishing the use of white lead in all house painting, whether interior or exterior. The Government considered this too far-reaching a measure, and therefore set up a technical commission by Royal Order of 10 April 1914. The war interrupted the work of this commission, but on 18 February 1922 it submitted its report to the Minister, proposing as a compromise that the use of white lead should be prohibited for interior work and regulated for exterior painting. By Decree of 20 June 1922 a committee was appointed to consider the modifications in the existing regulations required to bring them into conformity with the Draft Convention. This committee went so far in its desire for restriction as to propose that the sale to private individuals of any paint containing white lead should be prohibited. Following on these investigations, on 31 July 1924 the Government introduced in the Senate a Bill on the use of white lead and other white lead-containing pigments. The Bill, which was also introduced in the House of Representatives on 4 August, was discussed in the Senate on 24 and 25 November 1925, when the technical, economic, and medical aspects of the problem were all minutely examined. The Bill was passed by 95 votes, with one abstention.

The Works Committee and the Municipal Council of the town of Liège decided in December 1922 to prohibit the use of white lead in all indoor and outdoor painting on municipal contracts. The same step was taken on 13 August 1925 by the town of Antwerp. In April 1923 the College of Aldermen of the town of Brussels decided to prohibit also the use of lead sulphate and all lead compounds in indoor and outdoor painting on municipal works; the prohibition did not apply to zinc white containing not more than 4 per cent. of lead.

On 31 May 1923 the town of Verviers also prohibited the use of white lead in painting, whether indoor or outdoor, on municipal works.

Brazil

The Convention was laid before the Chamber of Deputies and referred to the Diplomatic Commission.

¹ *Report of the Director*, 1925, p. 275.

² *Industrial and Labour Information*, Vol. XVI, No. 13, pp. 589-591. *Compte rendu du Sénat belge*, 1925.

³ *Report of the Director*, 1924, p. 265.

Bulgaria

The Sobranje ratified the Convention on 6 June 1924. In its report for 1925 the Bulgarian Government states that the provisions of the Convention are enforced within the compass of the Act of 1917 on the health and safety of the workers, but that as the provisions of this Act do not entirely correspond with those of the Convention the Ministry of Trade, Industry, and Labour is preparing a Bill to give full effect to the Convention. This Bill will be passed before the expiry of the period allowed by Article 4 of the Convention, i.e. before 20 November 1927.

Canada

The Canadian Government has considered the Draft Convention in relation to the jurisdiction of the Federal and Provincial authorities, and has decided that the subject falls within the jurisdiction of the latter.

The Interprovincial Conference held in September 1923 adopted a resolution to the effect that the Provinces should take steps to investigate the use of white lead in painting; it was agreed that the Federal Department of Labour should also make enquiries and secure co-operation among the Provinces in their enquiries.

Chile

On 7 August 1924 the Government recommended the National Congress to ratify the Convention.

China

The Convention was transmitted to the Ministry of the Interior, which is to take the necessary steps to put it into force.

Cuba

The Senate was recommended, by a Message dated 7 November 1924, to examine the Convention.

Czechoslovakia

Ratification was registered on 31 August 1923. An Act embodying in detail the provisions of the Convention was passed on 12 June 1924, and came into force on 28 September 1924, including the clauses prohibiting the use of white lead in interior painting with the exceptions allowed by Article 1, paragraph 1, of the Convention. To these exceptions the Czechoslovak Act adds: "owing to its practical necessity and to the analogy with exterior painting, the application of paint in premises where it is frequently exposed to the action of steam or other fumes".

Denmark

The Government requested the opinion of the Labour Council on the Convention. On 8 December 1924 the Minister of Social Affairs intervened in the Folketing one Bill to ratify the Convention and another dealing with the use of white lead in certain painting operations.

Ibid., 1925, p. 277 and 1926, p. 692.

Ibid., 1924, p. 266.

Ibid., 1925, p. 271.

Ibid., 1926, p. 341.

Ibid., 1926, p. 276.

Estonia

Ratification was registered on 8 September 1922. The first report, received on 26 January 1925, stated that a Bill to give effect to the provisions of the Convention had been laid before the Council of Ministers but had not yet been passed by the State Assembly.

Finland

The Government proposed to Parliament that the question of ratifying the Convention should be adjourned until the necessary legislation to give effect to it could be introduced, if, after detailed consideration, this was found to be desirable.

France

On 25 August 1924 there were introduced in the Chamber of Deputies two Bills, one for the ratification of the Convention, the other to amend Book II, Part II, Chapter IV, of the Labour Code (special provisions on the use of white lead in painting). This second Bill extends the prohibition to sulphate of lead and plumbous linseed oil already in force under French law to all persons using white lead and lead sulphate, including employers, the prohibition previously applying to working painters only. Painting done by the owner or occupier himself, however, is excepted. The two Bills were passed by the Chamber on 23 February 1925.

A report on these Bills as adopted by the Chamber was laid on the table of the Senate by Mr. Pottier, on behalf of the Committee on Public Health and Assistance, Social Insurance and Welfare, on 24 December 1925. The two Bills were adopted without discussion by the Senate on 26 January 1926 and came into force on 31 January.

Germany

In 1923 the German Government drafted a Bill for the approval of the Reichstag, authorising ratification of the Convention, and this was approved by the Provisional Economic Council. In the accompanying memorandum the Government explained that the essential provisions of the Convention were already satisfactorily enforced by the Order of 27 June 1923, issued under section 120 (e) of the Industrial Code. A Bill was then prepared dealing with compulsory notification of cases of lead poisoning. It was stated, ratification would necessitate only a slight amendment of the Order of 1923 on the protection against lead poisoning of persons employed in painting, plastering, whitewashing, decorating, and varnishing.

Greece

In 1922 representatives of employers' and workers' organisations were associated with the Hygiene Office authorities in their attempt to give effect to the Convention on the use of white lead in painting. The aim was to effect a friendly collaboration between Government representatives and the workers and employers' Industrial Joint Council, which represents employers and workers in England, Scotland, and Wales, resulted in the preparation of draft regulations. The draft was completed in June, and the Council passed the following resolution: "The Council

Ibid., 1925, p. 691; 1926, p. 692.

Ibid., 1924, p. 266.

Ibid., 1925, p. 271.

Ibid., 1926, p. 341.

Ibid., 1926, p. 276.

agrees that these regulations shall apply to both internal and external painting"; this expressed the decision of the parties to enforce the regulations with regard to indoor work also, pending abolition of the use of white lead on such work, in the terms of the Convention.

Voluntary observance of the regulations prior to ratification was considered, but it was agreed that this would have the effect of binding the organised trade while leaving the unorganised free. The following resolution was therefore passed: "These regulations having been approved by the Painters' and Decorators' Industrial Joint Council of Great Britain, representing etc., etc. . . . this Council urges the Government to give legal effect to these regulations at the earliest possible moment."

At the beginning of 1923 appeared the report of the Departmental Committee appointed by the Home Office in August 1921 "to re-examine . . . the question of the danger from the use of lead paints to workers in the painting trades, and the comparative efficiency and cost, and the effect on the health of the workers of paints containing lead and leadless paints respectively". The Committee consisted of Sir Henry Norman (chairman), Mr. G. Bellhouse, Dr. O. J. Kauffmann, Dr. Legge, Mr. A. Munby, Dr. A. Scott, and Mr. H. O. Weller. After hearing 26 witnesses, the Committee presented a very detailed report, which is summarised in Appendix II of the present volume.

The demonstrations in Paris and Brussels referred to earlier gave rise to a considerable amount of comment and correspondence in the English press, which was summarised at the time in *Industrial and Labour Information* ².

Speaking in the debate on the Draft Conventions which took place in the House of Commons on 9 May 1923, the then Minister of Labour, Sir Montague Barlow said that difficulties had arisen with regard to the wording of the White Lead Convention, notably in Article 3^a. He explained how, as British Government representative at the Conference, although he had voted in favour of the compromise Draft Convention, he had at the time explained that the vote was given, and given solely, on the basis of the compromise being a satisfactory one, acceptable to all. As difficulties had arisen with regard to the interpretation of the text of the Draft Convention, and in view of the fact that the report of the Departmental Committee on the subject seemed to indicate that, as a result of recent discoveries, some of the restrictions embodied in the Draft Convention were no longer of such vital importance as in 1921, the matter clearly called for further consideration; the Government proposed to communicate with the authorities at Geneva, while the Home Secretary would take the matter up in conference with the interests affected ³.

On 25 April the International Painting Trade Materials Committee, representing the Master Painters' Federation or England and Scotland and the Association of Ireland, met at York to discuss the situation. All sides of the problem were thoroughly examined, and the Committee unanimously adopted a resolution indicating the attitude of the bodies constituting it. This motion points out (1) that the code of regulations governing the use of white lead had been drafted by the Painters' and Decorators' Industrial Joint Council in collaboration with the Home Office; (2) that these regulations were part of an implied understanding between operatives and employers in the painting trade to give effect to the Geneva Convention; (3) that as a result of the compromise embodied in the Geneva Draft Convention the agitation for total prohibition in Great Britain had ceased. The Committee therefore found itself unable to accept the invitation to form

¹ *Industrial and Labour Information*, Vol. III, No. 11, pp. 523-524.

² *Ibid.*, Vol. VI, No. 7, pp. 328-336. Among others, the views of Lord Asquith, Mr. Armstrong, and Mr. Gibson are given.

³ Cf. INTERNATIONAL LABOUR OFFICE: *Official Bulletin*, Vol. VI, Nos. 8-9, p. 327.

⁴ *Industrial and Labour Information*, Vol. VI, No. 8, pp. 349.

part of a deputation to the Home Office for the purpose of urging the Government not to ratify the prohibition clauses of the Convention; it would not, however, oppose an extension of the exceptions provided in the Convention ¹.

On 3 April 1924 the then Home Secretary, Mr. Arthur Henderson, presented the Lead Paint (Protection against Poisoning) Bill, with a view to bringing the Convention into force. With certain minor exceptions, it prohibited the use of lead paint in painting the interior of buildings and the employment of women and young persons in painting any part of a building with lead paint. It empowered the Home Secretary to make regulations for the use of lead paint in painting buildings, particularly as regards the use of lead compounds, the prevention of danger from lead paint in the form of spray, the prevention of danger from dust caused by dry rubbing down, and the procuring of facilities for washing during and on cessation of work and for the use of protective clothing ².

Meanwhile representatives of the Society of Operative House and Ship Painters and Decorators met representatives of the Belgian building workers in London to discuss the Convention, and heard reports by Mr. J. A. Gibson, general secretary of the Society, and Mr. W. Pickles, a member of the Executive Council.

The National Society of Painters also published a pamphlet, entitled *White Lead and its Suppression for Interior Painting*, in support of its demand for ratification. The pamphlet seeks to refute what it describes as "misrepresentations" by opponents of prohibition for interior painting, and states that:

The trade itself (employers' and operatives' organisations) desires the Geneva Convention ratified, and we look to the British Government to take into full account the beneficial effect that ratification will have in assisting to remove, as no other measure would, an industrial disease from the lives of house painters, a body of men whose chief function it is to create healthy and sanitary surroundings for their fellow-creatures ³.

On the other side the London Chamber of Commerce, on behalf of the White Lead Corroders' Trade Section, issued a pamphlet ⁴ opposing the provisions of the Government's Bill. The objections were confined to the prohibition contained in clause 1 and the provisions consequential thereon: "the regulative clauses of the Bill are ample to protect house painters from the dangers of lead poisoning." After preliminary reference to the British Departmental Committees of 1911 and 1921, the pamphlet recalls the proceedings of the Geneva Conference of 1921 and repeats the allegation of partisanship against the questionnaire issued by the International Labour Office. Statistics are quoted to support the statement that the danger of lead poisoning among house painters has been grossly exaggerated. Referring to the unanimous adoption by the Conference of the compromise embodied in the Draft Convention, the pamphlet says:

In agreeing to this compromise those who had been in favour of the policy of regulation were influenced by the statements of the British Government representatives (1) that only about 10 per cent. of the total use of white lead paint was used on interiors; (2) that the compromise would for ever put an end to the agitation of zinc white interests for total prohibition; (3) that the practicability of moist rubbing down had not been proved. None of these statements and reasons (although given in good faith) has, in the event, been justified ⁵.

¹ *Ibid.*, Vol. VI, No. 11, pp. 522-523.

² *Ibid.*, Vol. X, No. 8, pp. 276-277.

³ *Ibid.*, pp. 293-296.

⁴ *The Prohibition of the Use of White Lead in Painting. Case against Prohibition*. London, 1921. xxiv + 28 pp.

⁵ *Industrial and Labour Information*, Vol. X, No. 13, pp. 502-503.

The Government Bill passed its second reading in the House of Commons on 20 June 1924, but its further progress was checked by the dissolution of Parliament in November 1924. When the new Government came into office it did not at first announce its intentions with regard to the principle of prohibition, but appeared to be inclined to favour an increasingly extensive regulation of the use of white lead; in fact, it stated that it would introduce a Bill to give it the necessary power to deal by means of regulation with the principal dangers arising out of the use of white lead.¹

On 7 January 1925 the War Office issued an Army Council Instruction prohibiting the use of lead paint containing more than 2 per cent. of white lead or sulphate of lead (expressed as metallic lead) in painting buildings internally, except in so far as it was necessary to use up existing stocks of paint. The use of lead paint for external work was to continue, subject to any regulations which might be issued by the Home Office.² The Federation of British Industries, in conjunction with those directly interested, protested, pointing out that the Bill on lead paints had met with very great opposition in the House of Commons, and the War Office thereupon cancelled its instructions.³

In a debate on the International Labour Organisation which took place in the House of Commons on 9 April 1925, Mr. H. Fisher expressed regret that the Home Office could not frame legislation more closely on the lines of the White Lead Convention. The Home Secretary replied that there were great difficulties in getting through a Bill for prohibition of the use of white lead in painting. The best thing to do was to proceed as far as possible by regulation and then, if this did not reduce morbidity and mortality rates very considerably, to ask for further powers. He hoped therefore to introduce directly after Easter a Bill to enable him to make regulations dealing with the use of white lead paint. Arrangements, amounting almost to an agreement, had been made between the users and manufacturers of white lead, and he hoped to get general agreement for his Bill. He admitted that this would not enable the Convention to be ratified, but contended that, in spite of appeals for international agreement, the Government must put the interests of British trade first.⁴

On 1 May 1925 a Bill "to make better provision for the protection against lead poisoning of persons engaged in painting buildings" was introduced by the Home Secretary in the House of Commons. It contained no direct reference to the Geneva Convention. It was to come into operation on 1 January 1926 and did not extend to Northern Ireland.⁵

The Law and Parliamentary Committee of the National Federation of Building Trades Employers of Great Britain and Ireland considered this Bill during the summer of 1925. The President of the Federation, pointing out that the Bill did not include ships and yachts, stated that in a district where there was a lot of yacht building done the men frequently had to work in very cramped quarters and must inhale dust. After discussion it was agreed to support the inclusion of all paints in the regulations and to draw attention to the fact that no mention was made in the Bill of painting in the yacht-building and coach-building trades.⁶

The question of ratifying the Geneva Convention was again raised at the Trades Union Congress in September 1925 at Scarborough. Mr. Gibson outlined the historical development of the matter, and moved the following resolution, which was carried unanimously:

That this Congress deplores the action of the British Government in failing to ratify the International Labour Convention dealing with the prohibition of white lead in interior painting.

¹ *Report of the Director*, 1925, p. 277.

² *Industrial and Labour Information*, Vol. XIII, No. 11, pp. 478-479.

³ *Ibid.*, Vol. XIV, No. 4, pp. 102-103.

⁴ *Ibid.*, Vol. XIV, No. 4, pp. 106-106.

⁵ *Ibid.*, No. 7, pp. 254-255.

⁶ *Ibid.*, Vol. XV, No. 12, p. 519.

Further, that this Congress enters an emphatic protest against the Lead Paints (Protection Against Poisoning) Bill introduced by the Home Secretary, Sir W. Joynson-Hicks, as such Bill in no way embodies the Convention agreed to by way of a compromise of all the parties concerned at the Third Session of the International Labour Conference held at Geneva, 1921.

Further, that the said Bill is expressed in vague terms and provides for the application of regulations only, and in view of the proved danger to human life there is no valid reason why the partial prohibition embodied in the Convention should not be ratified by the British Government.

The Lead Paints (Protection Against Poisoning) Bill came before the House of Commons on 15 March 1926.¹ On 4 June it passed its second reading by 181 votes to 56. In the course of the debate Mr. Rhys Davies, Lord Henry Cavendish-Bentinck, and others urged that the Government should have introduced a Bill which would give effect to all the provisions of the White Lead Convention instead of one confined to regulation of the use of white lead. They contended that the Bill as it stood would serve only to postpone indefinitely the prohibition of the use of lead paint in interior painting.

On the report stage of the Bill, on 3 August 1926 Mr. Rhys Davies moved a new clause prohibiting the use of lead paint in the interior painting of buildings; he stated that the object of the amendment was to render possible the ratification of the Geneva Convention. The Under-Secretary of State for the Home Department replied that in his opinion regulation would be easier to enforce than prohibition. He repeated the pledge given by the Home Secretary that if the regulations did not succeed in very largely reducing the death rate from lead poisoning the Government would bring in another and far more drastic Bill which would have prohibition as its essence. The amendment was rejected by 188 votes to 74. Another amendment to omit the exclusion of women from employment in painting buildings with lead paint was also rejected. The Bill was then read a third time and sent to the House of Lords.²

Regulations for the protection of coach painters against lead poisoning have recently been issued.

Greece

A Bill for ratification was passed by the National Assembly.³

Hungary

On 28 May 1924 the Government laid before Parliament a Bill to incorporate in Hungarian legislation the provisions of the Convention. One clause in the Bill makes the entry into force of the Convention conditional upon ratification by France, Germany, and Great Britain. The Bill, which also provides for ratification, was passed by the National Assembly on 4 March 1925.⁴

India

The Standing Committee of the Legislative Assembly, to which the Convention was referred in January 1923, decided against ratification.⁵ The Government of Bombay, however, in 1924 issued a series of recommendations on the use of white lead, which are summarised later⁶ (see Appendix).

¹ *Ibid.*, Vol. XVII, No. 13, p. 414.

² *Ibid.*, Vol. XIX, No. 12, p. 423.

³ *Report of the Director*, 1924, p. 264.

⁴ *Ibid.*, 1925, p. 277.

⁵ *Ibid.*

⁶ *Industrial and Labour Information*, Vol. XI, No. 8, pp. 320-322.

Irish Free State

An investigation has been undertaken to ascertain how far prohibition of the use of white lead can be enforced, but the work of the committee of enquiry is not as yet sufficiently advanced to permit of the Government taking a decision in the matter. The Minister of Industry and Commerce, however, stated in the Dail that it would seem, from preliminary consideration of the question, that prohibition should be recommended¹.

Italy

The Council of Ministers agreed to ratify the Convention, and the Government is authorised by Legislative Decree to give full effect to it².

Japan

The Privy Council decided not to ratify the Convention for the present. Although there is in general no objection to the principles contained therein, the Government feels that it cannot, in view of the physical development of the Japanese, adopt immediately the age of 18 as the minimum for employment in painting. It is further stated that if it were proposed to stop the use of white lead its manufacture would have to be restricted, and legislation for this purpose would take some time to draft³.

Latvia

Ratification was registered on 9 September 1924. Legislation on the subject has been drafted but not yet passed⁴.

Netherlands

Certain legislative changes would be required to give effect to the Convention, especially to cover male workers over 18 years of age outside factories or workshops, and to put into force Article 5, paragraph III (b), of the Convention. In the Bill authorising formal ratification, presented in the Second Chamber, the Government has therefore reserved to the Crown authority to ratify at a later date⁵.

New Zealand

According to the annual report of the Department of Labour for 1923-1924, experiments have been conducted in the use of certain substitutes for white lead⁶.

Norway

The Department of Social Affairs proposed that ratification should be postponed until the legislation necessary to give effect to the Convention had been introduced in the Storting. This attitude was approved by the Storting Committee on Social Affairs⁷.

In June 1925 the Minister of Social Affairs transmitted to the International Labour Office a copy of his statement to the Council of State to the effect that examination of the Convention had reached an advanced stage and that measures could be taken in the near future. The report was

¹ Report of the Director, 1923, p. 341.

² Ibid., 1923, p. 341.

³ Ibid., 1924, p. 266.

⁴ Ibid., 1925, p. 275.

⁵ Ibid., 1924, p. 284.

⁶ Industrial and Labour Information, Vol. XIV, No. 5, p. 53.

⁷ Report of the Director, 1924, p. 265.

subsequently submitted to the Storting and adopted on 27 June 1925. In this report the Minister stated that there should be a re-examination of the Convention of which ratification had been postponed on their first presentation. The White Lead Convention is among these¹.

Poland

Ratification was registered on 21 June 1924. The Government has drawn up legislation to render uniform the existing law on white lead, which is contained in the various Acts and Orders in force in the former Austrian, German, and Russian provinces and in the Polish Order of 30 September 1920. In the former Russian provinces the last-named Order appears to be the most important. It lays down that cases of lead poisoning are to be reported within twenty-four hours, and requires the communal authorities to hold an enquiry and report to the district health office; the latter must in turn notify the competent factory inspector in order that existing precautionary measures may be enforced or new ones taken. In the former Austrian provinces, in addition to the above Order, that of 15 April 1908 is still in force; it forbids the use of paints with a lead base in interior painting and the employment of women and young persons, except apprentices, in painting, varnishing, and decoration which involves the use of white lead. It also lays down a series of regulations for the use of white lead in special cases which largely correspond to the terms of the Convention. In the former German provinces the Order of 27 June 1905 remains in force; it contains provisions regulating the use of white lead, etc., in painting and similar work².

Rumania

Parliament has passed an Act to ratify the Convention³.

Siam

The Government considers it impossible to apply the Convention owing to the special conditions of the country. The only means of preventing the use of white lead would be to prohibit its import, and the Government states that such a step would require the consent of the Treaty Powers⁴.

South Africa

The Government recommended that the Convention should not be adopted for the present; it considers that the adoption of measures of cleanliness, coupled with precautions in the handling of white lead and its substitutes, is sufficient to achieve the object underlying the Convention. In the Government's opinion the Union Factory Act, 1918, satisfies the provisions of Article 2, paragraph (a), of the Convention. The attention of the Department of Public Health has been drawn to the Convention, particularly the provisions for statistics of morbidity and mortality. It is intended, moreover, when the amendment to the Public Health Act is being considered by Parliament, to provide for powers to make regulations requiring the notification of lead or other metallic poisoning. This would provide data for further consideration of the terms of the Convention in South Africa. Apart from the provision mentioned above, Union legislation is not considered to be in conformity with the Convention and, desirous as the Government is of protecting the workers against all avoidable evil, it does not clearly see its way to amending the legislation in force to bring it into conformity with the clauses of the Convention⁵.

¹ Ibid., 1923, pp. 341-342.

² Ibid., 1925, pp. 275-276.

³ Ibid., p. 277.

⁴ Ibid., 1924, pp. 263-267.

⁵ Ibid., 1924, p. 916; 1925, p. 340.

Spain

Ratification was registered on 20 June 1924. In its report for 1925 the Government announces that a Royal Decree applying the principles of the Convention to Spanish industry was issued on 19 February 1923. Under section 9 of this Decree the Minister of Commerce, Labour and Industry, after consultation with the Labour Council, will issue the necessary regulations to give effect to the Decree within six months from its promulgation¹.

Sweden

Ratification was registered on 27 November 1923. The report of the Swedish Government states that, so far as it is possible to ascertain, the paints covered by the Convention are not used in interior painting; instructions were given to the factory inspectors towards the end of 1923 to see that the provisions of the Convention were thoroughly observed². An Act prohibiting the employment of workers in certain cases on work involving contact with white lead was promulgated on 19 February 1923.

Switzerland

On 4 May 1923 the Federal Council sent to the Federal Assembly a message concerning the Draft Conventions and Recommendations. It states that the White Lead Convention in its present form is the result of a compromise which was supported by the Swiss delegates. The Federal Council considered that, so far as it could judge immediately of the question, Switzerland could adopt the Convention³.

The Swiss Trade Union Federation drew up a petition, dated 26 November 1923, in the form of a reply to the questionnaire sent out by the Federal Labour Office. There was strong opposition to ratification of the Convention. The Trade Union Committee unanimously adopted a resolution on a report made by the secretary of the Trade Union Federation at a meeting held at Olten on 9 July 1923. The resolution enumerates the factors in favour of prohibiting the use of white lead and those which render enquiry made by the Federation of Wood and Building Workers which showed that in May 1925 only 133 painting undertakings out of 600 still used white lead, and of these only 87 used it for interior work. Recalling finally that the use of substitutes was growing daily more widespread, the Trade Union Committee requested the Federal Council to ratify the Geneva Convention immediately⁴.

In November 1925 the Federal Labour Office issued its provisional report on the question of white lead; this is summarised in Appendix II of the present report, with the full text of the conclusions.

Tunisia

A Decree issued by the Bey of Tunis on 10 April 1922 forbids the use of white lead, plumbous oils, and all specialties containing white lead in both indoor and outdoor painting after the expiry of one year from the date of promulgation⁵.

¹ *Ibid.*, 1925, p. 275; 1926, p. 692.

² *Ibid.*, 1925, p. 275; 1926, p. 693.

³ *Industrial and Labour Information*, Vol. VI, No. 11, p. 524.

⁴ *Ibid.*, Vol. XV, No. 2, pp. 85-86.

⁵ *Report of the Director*, 1922, p. 192.

Union of Soviet Republics

Although this Union is not a Member of the International Labour Organisation, it is desirable to note that the Commissariat of Labour, Foreign Trade, and Home Trade and the Supreme Economic Council have agreed on the text of an Order concerning the preparation, sale, and use of white lead.

According to *Trood* of 18 January 1926, the state of Russian industry, even in the present circumstances, is such as to render the enforcement of this Order perfectly feasible. In the interests of the workers it is essential to prohibit the use of white lead, as the danger of poisoning is nowhere so great as in industries using lead. Prohibition is equally essential if output and the efficiency of labour are to be increased. It has been demonstrated that in undertakings where white lead is prepared the period of actual work does not exceed two hours per day; the worker spends the rest of his time in changing his clothes, washing, etc., since scrupulous personal cleanliness is necessary owing to the poisonous nature of the product.

The Order issued by the People's Commissar of Labour practically forbids the establishment of new white lead works and the export of the product. All white lead works already in existence must register with the Commissariat within two months. As from 1 January 1926 the sale of white lead in powder form is prohibited; it may be sold only in the form of paste. Undertakings which cannot dispense with white lead are allowed to use it up to 1 January 1930. As from 1 January 1928 the use of white lead in interior painting is an offence punishable by fine. From 1 January 1930 onwards the sale, preparation, or use of white lead in any form whatever will be prohibited.

United States

Although the United States also is not a Member of the International Labour Organisation, it is worthy of note that work in the painting trade has been the subject of study and regulation in several States of the Union. Here it need merely be mentioned that in 1924 an agreement was signed by the Association of Master Painters and Decorators of the City of New York, the Society of Interior Decorators, and the Cabinet Makers Employers' Association on the one hand, and the local branch of the Brotherhood of Painters, Decorators, and Paperhangers on the other, prescribing healthy conditions of work for painters: ventilation of workplaces, prohibition and regulation of the use of benzol and wood alcohol, elimination of paint materials injurious to health, labelling of paints, prohibition of dry rubbing down, provision of washing facilities, etc.¹

Uruguay

The National Labour Office of Uruguay has informed the International Labour Office that a Bill prohibiting the use of white lead has been submitted to Parliament, while another Bill, which has the approval of the State Insurance Bank, aims at securing the same end by amending the existing Act on industrial accidents, which include occupational diseases².

Venezuela

On 11 July 1925 the Senate passed a resolution adjourning consideration of "the drafts emanating from the International Labour Office" until the parliamentary sessions of the following year³.

¹ *Industrial and Labour Information*, Vol. XII, No. 6, pp. 274-275. See also Appendix II.

² *Report of the Director*, 1925, p. 342.

³ *Ibid.*

VIII. — PROGRESS OF RATIFICATION

On 30 September 1926 the position as regards ratification and application of the Convention of 1921 concerning the use of white lead in painting was as shown below.

A. RATIFICATIONS

(a) Ratification Registered

- Austria : Ratification registered 12 June 1924.
Provisions came into force 20 July 1924.
Reports received 13 March 1925 and 4 January 1926.
- Belgium : Ratification registered 19 July 1926.
- Bulgaria : Ratification registered 6 March 1925.
Report received 6 April 1926.
- Chile : Ratification registered 15 September 1925.
- Czechoslovakia : Ratification registered 31 August 1923.
Provisions came into force 30 April 1924.
Reports received 18 February 1925 and 11 March 1926.
- Estonia : Ratification registered 8 September 1922.
Reports received 26 January 1925 and 15 February 1926.
- France : Ratification registered 19 February 1926.
- Latvia : Ratification registered 9 September 1924.
Reports received 1 April 1925 and 16 February 1926.
- Poland : Ratification registered 21 June 1924.
Provisions came into force 21 June 1924.
Reports received 2 April 1925 and 3 March 1926.
- Rumania : Ratification registered 4 December 1925.
- Spain : Ratification registered 20 June 1924.
Report received 16 March 1926.
- Sweden : Ratification registered 27 November 1923.
Provisions came into force 27 November 1923.
Reports received 9 March and 22 February 1926.

(b) Ratification Approved

Greece, Hungary (conditional ratification), Italy, Netherlands.

(c) Ratification Recommended

Argentina, Cuba, Denmark, Germany, Uruguay.

B. APPLICATION

(a) Legislation Adopted

Belgium, France, Hungary.

(b) Laws in Process of Adoption or Preparation

Bulgaria, Denmark, Estonia, Germany, Italy, Latvia, Switzerland, Uruguay.

C. LEGISLATION SUBSEQUENT TO ADOPTION OF THE CONVENTION

Austria, Czechoslovakia, Poland, Spain, Sweden.

D. STATES HAVING REFUSED TO RATIFY

India, Japan, Siam, South Africa.

E. STATES HAVING TAKEN NO DECISION

Australia, Bolivia, Brazil, Canada, China, Finland, Great Britain, Irish Free State, Lithuania, Luxembourg, Norway, Portugal, Serb-Croat-Slovene Kingdom.

F. STATES HAVING SUPPLIED NO INFORMATION TO THE INTERNATIONAL LABOUR OFFICE

Albania, Columbia, Costa Rica, Dominican Republic, Ethiopia, Guatemala, Haiti, Honduras, Liberia, New Zealand, Nicaragua, Panama, Paraguay, Persia, Peru, Salvador, Venezuela.

Formerly pigments were placed on the market in form of powder, granules, or small blocks; now they are sometimes still in powdered form, but more often in the form of pastes or prepared or semi-prepared paints. The result of this is a considerable reduction of the work of kneading formerly effected by the workers in their homes when out of work during winter days. There is, however, no general rule, and for certain delicate work the pigment is still ground by hand.

Besides white lead and minium many lead colours are found on the market with fancy names¹. In this connection it should be noted that the substitutes also are too often known under fancy names².

The use of substitutes has made fairly good progress everywhere³, though where bricks, cement, and stone have replaced wood for outside construction, a reduction in the use of white lead is noted; on the other hand, for interior work, especially when delicate work is in question, increase in its use is sometimes recorded. In the mechanical construction industry (motor cars, agricultural machinery, metal boxes, etc.) the use of mechanical means (painting by dipping, spraying, etc.) is becoming more and

¹ These are "Silver White", "Clichy White", "Mulhouse White", "Naples Yellow", "Turner Yellow", etc.

In Germany and Austria white lead is known in commerce under the names "Krems White", "Venetian White", "Hamburg White", "Cologne White", "Magdeburg White", "Lithographic White", "Slate White", and "Patison White".

Minium is known as "Paris Red" or "Satur Vermillion". The following colours have also a lead content: "Chrome Vermillion", "Chrome Red", "Chrome Yellow", "Patentgelb" (patent yellow), "Turner Yellow", "Montpellier Yellow", "Verona Yellow", "Alpine Yellow", "Paris Yellow", "Cologne Yellow", "Leipzig Yellow", "Cassel Yellow", "Royal Green", "Lemon Yellow", "Green Vermillion", "Leaf Green", "Oil Green", "Patent Cinnabar Green" (Patentzinnober), "Carminette", and "Lacquer Red".

The following colours similarly contain white lead: "Platinfarbe", "Glimmerfarben" in other words the "Schuppenpanzerfarben" of Graf, the "Rostini" of Weber, the "Bessmerfarbe" of Lutz, the "Rubigonit" of Jelinek, and the "Krokodilschuppenfarbe" of Lambrecht (*Bebergsitzungen in hütten Mäntischen und gewerblichen Betrieben*) (see Part V, K. K. Labour Statistics Department, Ministry of Commerce Office, Vienna, 1918). See also Note.

² An enquiry instituted by the German Federation of Working Painters, Lacquerers, and Whitewashers has called attention to the existence, besides lithopone and zinc white, of twenty-seven other substances used in the painting industry to replace colours with a lead content. Amongst these may be mentioned: "Metal White", "Dresden White", "Royal White", "Mineral White", "Edelweiss", "Victoria White", etc.

³ Enquiries in England, Austria, Holland, the Netherlands, Italy, etc. Reports of the factory inspectors: Switzerland, Germany, Austria, etc. See: KOELESCH, ROTH, LEHMANN, etc.

PART II

MEDICAL DATA

I. — THE PAINTING TRADE AND WORKING CONDITIONS

PAINTS

The term "paint" is used to designate all substances prepared with a view to their application to a surface in order to protect it from external factors of deterioration and for the purpose of decoration. Paint necessitates the presence of a solid constituent or pigment and a more or less liquid constituent—the medium. The present description will be confined to paints properly so called or oil paints. The word "pigment" henceforth introduced into the technical terminology with the English meaning designates a colour in its solid form (powder) free from all binding, diluting, or drying mediums.

The pigments which come under consideration here are those having a lead basis, the most important of which are white lead and mixtures of lead compounds, sulphates, oxides, or anhydrides — hydrated or non-hydrated — lead sulphide and chromate, etc. It may be said that all colours and especially whites have a white lead basis. Commercial white lead is a lead hydrocarbonate of varying composition. Its formula is generally $2\text{CO}_2\text{Pb} \cdot \text{Pb}(\text{OH})_2$ or something near that. Its composition varies, however, according to the process of manufacture. Certain characteristics of commercial white lead will be considered later (see Part V: "Technical Data").

Binding and diluting mediums comprise oils, spirits of all kinds, varnish, turpentine, benzene, petrol, spirit, etc. The most important property of linseed oil is eminently its drying capacity, in other words, its capacity for changing, in contact with air, a viscous substance into a dry and solid and finally a hard substance; this property renders it very valuable in the preparation of varnishes. To obtain a product of even greater drying capacity and more efficacious the oil is boiled with litharge or other lead compounds.

more general. Though, however, an increased use of white lead¹ is reported in some countries, in the majority of the inspectors' reports it is stated that substitutes are used for the most part (Canada², Great Britain³, etc.).

WORKERS IN THE PAINTING TRADE

Workers in the painting trade comprise painters and varnishers (on the Continent, three categories), but even this distinction is not always possible in small enterprises where one worker is found, for instance, applying himself indifferently to all operations.

Painters of buildings (engaged on coating and white washing) paint wooden or metal walls. These workers, who are not, properly speaking, skilled workers and who have not infrequently followed other callings previously, have as a rule served no apprenticeship as painters: after merely a period of some months as painters' assistants they commence to wield the painter's brush themselves. In certain places, however, a short apprenticeship is demanded.

Decorators follow an apprenticeship of three to four years to learn, besides painting buildings, decorative painting and painting of signs. An apprenticeship of four years is likewise demanded for varnishers, who must learn the most artistic kinds of brush work and the special technique of smooth varnishing. Unskilled workers are, however, met with, more particularly in metal varnishing, where work was formerly often done by women.

OPERATIONS IN PAINTING

The surfaces to be coated with paint require to be prepared, that is to say, to be rendered perfectly smooth: roughness is removed with a scraping tool, and hollows are filled out with paste mostly of the same colour as the paint to be applied and almost always with a lead basis. In large establishments paste for this purpose was formerly kneaded by hand by special workers employed for this purpose. Now the putty is machine made or bought ready for usage; it could be prepared from non-toxic substitutes.

¹ HAMILTON.

² See below, Part III: "statistics".

³ Report of the Chief Medical Inspector of Factories for 1925, p. 68.

Old layers of paint are scraped or burned, polished, and washed down. This work gives rise to production of dangerous lead dust, arsenic dust, and chrome dust. Benzine is principally used for removing resin and tar.

Having rendered the surface smooth the basic coat is applied: this first coat and each succeeding coat are polished either by the dry method or the damp method. The first of these methods consists in polishing each coat with pumice stone, glasspaper, or sandpaper with a view to rendering the superimposed coats as smooth as possible. In the second method the surface to be polished is rubbed with a piece of felt or a cloth dipped in a mixture of pumice stone and water. For carriage painting 12 to 15 coats are sometimes necessary (for details, see page 248).

WORKING CONDITIONS

Painters' work is generally seasonal, resulting in alternating spells of overwork and long continued unemployment. This is the case with constructional painters who work now for one employer, now for another, their working conditions varying in accordance with the builder, the importance, and the cost of the construction.

Hygienic conditions are as a rule defective in small workshops: they are often found to present a lack of cleanliness, to be wanting in washing facilities, and without messrooms or cloakrooms, etc. Doubtless city workers work under more favourable conditions, being under the protection of highly organised unions. Factory painters are still better off, for their work is steady and is effected in better hygienic conditions. Even amongst these, however, the turnover is very considerable¹.

Year	Work units (full time workers or workers working 300 days or working periods)	Workers working at the year round	Casual workers
1902	628	194	1,764
1903	719	241	2,120
1904	790	237	2,249
1905	885	261	2,527

¹ "Turnover of Workers in 25 Viennese Workshops": *Bleivergtlungen*, loc. cit. Vienna, 1918.

II. — THE DANGER

Though doubt might exist as regards the absolute accuracy of Sickness Fund data, it would nevertheless be difficult to use that argument to contest the social gravity of lead poisoning since these statistics, considered from the point of view of their relative value, show that the sum of all other occupational poisoning does not amount to a twentieth of the cases of lead poisoning.

The worker is mostly totally ignorant of the danger to which he is exposed in the course of his work. The employer likewise may not be aware of the exact extent of the danger; thus thirty-five Dutch employers not only denied the existence of the lead hazard to the inspector, but affirmed that cases of poisoning were due solely to the use of adulterated white lead¹. Other employers attribute the whole origin of the trouble to lack of cleanliness and precaution on the part of the workers.

DIFFICULTY IN EDUCATING WORKERS IN REGARD TO ADEQUATE HEALTH PRECAUTIONS

The education of painters in regard to adequate health precautions is very difficult to effect: working in isolation they escape too often the vigilance of technical and medical inspection. The difficulty here originates in the multiplicity of small workshops.

¹ See the works of LEWIN, KOELSCH, STERNBERG, TELEKY, BROUARD, OULIAC, etc. For the Netherlands see: *Report of the Medical Inspector of Factories*: "Enquiry on Lead Poisoning in the Province of Overijssel, 1910". For Bavaria and Germany, F. KOELSCH: "*Berufsschädigungen im Maler- und Lackierergewerbe 1921*", Hamburg.

It has been objected that the use of fancy names involves no inconvenience for the worker. The contrary opinion is held to be true. In Austria, for example, where the name "Kremawhite" (*Kremservweiß*) is currently used to designate white lead, employers have been known to make the following reply: "As I use exclusively 'Kremawhite' in my workshop, I do not think there can be any question of danger for any workers." (*Inspectors' Report*, 1913, Vienna-Neustadt). And, again, in the *Factory Inspectors' Report for Leipzig* (1913) it is stated that the "carpenters were ignorant of the fact that 'Kremawhite' is a lead colour". E. ROTH, in a treatise on occupational diseases (second edition, 1909, p. 79), emphasises the frequency of lead poisoning due to the ignorance of the workers in question: ULLMANN (see *Wiener Arb.* by TELEKY, 1910, p. 37) draws attention to the same point; GRAHAM RODGERS, in his report on lead poisoning in New York (see p. 1137 of the *Report of the Commissioner of Labour*, 1913), states that in many instances the employees themselves are unaware of the presence of lead in the materials used or the danger resulting therefrom. Mr. SPÖHN has emphasised again recently the danger involved in the application of fancy names and the ignorance of workers ("*Die Entwicklung der Listen neben gewerbl. 'Gifte'*", 1921, p. 10 et seq., Zurich).

In Germany in 1895 the painting trade covered 40,197 workshops in 18,175 of which no assistants were employed, while 17,911 had 1 to 5 workers, 2,720 had 6 to 10 workers, and only 1,391 had more than 10 workers; among 80,443 members of the trade, workers, apart from masters and apprentices, numbered 19,399¹.

In the Netherlands of 247 workshops, 191, or 77.3 per cent., have less than 5 apprentices; 43, or 17.4 per cent., have 5-10 apprentices, and 13, or 5.3 per cent., only have over 10 apprentices². The majority of these workshops therefore escape inspection.

In Bavaria³ in 1907 investigation revealed the fact that 2,150 workshops employed one single worker; 2,646 from 1 to 5 workers, 500 from 6 to 50, while 5 workshops employed 51-100 workers.

In Vienna⁴ an enquiry has likewise established that, in 1905, of 445 workshops 152 had less than one full-time woman worker, 195 from 1 to 5, 42 from 6 to 10, 17 from 11 to 15, 15 from 16 to 20, 12 from 21 to 30, 4 from 31 to 40, and 7 had 50 or over.

Even if, as has been asserted, the question of lead poisoning were merely a question of cleanliness, the obstacles to be encountered by isolated workers in obtaining the necessary means for the application of adequate hygienic precautions may be imagined.

THE AGE OF THE WORKERS

As a rule, in the branch of the painters' trade for painting buildings young apprentices are seldom, if ever, employed. Workers take up this work at an age when the task of educating and instructing them in proper precautions has been so long delayed as to be difficult, if not impossible. The painting industry does not usually demand skilled workers. How can it be expected that workers from a variety of other industries, often old, sometimes even weak and already damaged in health, should offer the necessary resistance to the action of lead and to other causes of disease?

¹ FLECK: *Handbuch der Arbeiter Krankheiten*. Jena, 1908.

² Dutch Report, 1910, loc. cit.

³ KOELSCH: *Erhebungen d. Kgl. Bay. Gewerbeaufsicht. über das Malergewerbe, 1910-1911*. Munich.

⁴ Loc. cit., Part V.

In *Great Britain* in 1912, of 29,308 workers in the industries involving contact with lead 2,709 only, or 9.20 per cent., were under 18 years of age.

In *Genoa*, of 305 workers 21 only were under twenty. Of 305, 98 had started work at 15, 72 at 20, 66 at 30, 64 at 50, and 5 at 60 years of age. Therefore 44.25 per cent., or almost one-half, had started work at ages above 20.

In *Bravaria*, of 10,840 persons employed in 1910 in 2,972 workshops 85.4 per cent. were adults, 12.9 young persons from 14-16 years, and 1.6 children under 14. The distribution by age groups expressed in percentages for 5,000 painters in this state who were made the subject of an enquiry by Koelsch is as follows :

Master painters	Working painters	Age
—	10.9	15
3.9	23.0	16-20
11.1	17.2	21-25
37.2	14.4	26-30
25.3	20.4	31-40
15.4	9.6	41-50
6.7	3.0	51-60
0.4	0.9	61 and over
	0.6	Unknown

BRANCHES OF THE PAINTING TRADE OTHER THAN THAT OF OUTSIDE WORK

Lead poisoning due to painting of carriages, wagons, and motor-cars originates in the same manner as that contracted during painting of buildings. In fact, the seams in coach painting are filled out with a paste having a white lead basis and, as in the painting of buildings, the coats of paint are rubbed over with pumice stone and glasspaper. Thus, as the English committee has stated, the danger here is greater since more coats of paints are necessary.

Of all branches of the painting trade, however, that which constitutes the greatest source of danger for the workers is the painting of ships, since it demands the greatest number of coats

¹ *Report of the Departmental Committee on the Use of Lead Compounds in the Painting, Enamelling, and Varnishing of Coaches and Carriages.* 1920. Cmd. 680.

² RUBINO, loc. cit.

³ KOELSCH, loc. cit.

of white lead and is executed in a confined space, where dust raised by dry rubbing down combines with turpentine fumes, or those of other more toxic diluting mediums, in creating a grave menace to the life of the painters. In certain parts of ships the worker is often obliged to work doubled up in a very trying position, especially when in the act of removing the old coat of minium, often with the pneumatic hammer. Finally, reference should be made to the risk to which workers are exposed when engaged in breaking up old ships. During the war, but chiefly after the armistice, the work of ship breaking, and especially that of burning or cutting with the oxyhydrogen flame metallic surfaces painted with products having a lead basis (minium, white lead), caused a great number of cases of lead poisoning of a very serious and even fatal character¹.

DILUTING MEDIUMS : TURPENTINE

During the discussion raised by the placing on the agenda of the International Labour Conference held in 1921 of the question of prohibition of the use of white lead, it was repeatedly stated that painters suffer rather from the action of diluting mediums, and in particular from that of turpentine, than from the action of white lead itself².

Before examining the arguments for and against the damage due to turpentine attention should be drawn to the frequent use of products from the fractional distillation of crude petroleum or white spirit. These products are none other than a very poisonous mixture of hydrocarbons, with such a disagreeable smell that at times it is found necessary to counteract it by adding to these spirits strong smelling substances (nitro-benzene). Tetraline has also been adduced as the cause of the injury.

The action of turpentine will now be examined in detail. When paints and varnishes were prepared with turpentine of a superior quality, cases of poisoning caused by this substance did not exceed 2 per cent. of the total cases of sickness among painters,

¹ See for example the Report of the English Factory Department, HOME OFFICE: Form 1795, April 1925, London.

² Minority report of the English committee, loc. cit., and the polemic printed in the *Daily Bulletin* during the month of May 1921 and following. See the statements of Mr. ARMSTRONG made before the English committee (Vol. IV, Blue Book, Cmd. 632: statements of 14 Dec. 1911 and 12 Oct. 1912).

and they most frequently appeared as forms of dermatitis'. Though Lehmann¹, referring to the noxious action of turpentine amongst painters, does not enter into precise details, the gravity of the injury depends indeed, according to research undertaken by Poincaré², on the quality of the turpentine used. Cases of immunity reported in regard to the noxious action of emanations of spirit of turpentine are of no absolute value; such immunity may cease under the influence of unduly prolonged occupation or of work in a badly-ventilated place. A kind of hereditary acclimatization of a remarkable character has been noticed amongst the children of painters who follow their fathers' occupation. The therapeutic application of turpentine, apart from slight gastric troubles, has never given rise to symptoms approaching those derived from lead.

What are the symptoms of cases attributed to turpentine? The most frequently ascribed symptom is headache. Another effect of turpentine referred to by the workers is a certain disturbance of equilibrium which they describe as similar to alcoholic intoxication: a kind of giddiness, which passes off readily in the fresh air after working hours. It must be confessed that at times alcoholic beverages play their part in the production of this affection; it is, however, certain that, even that being so, the use of a substance with a turpentine base in the course of occupation increases and renders more definite the effect of alcohol. Ocular troubles follow closely after headaches in the order of frequency of noxious effects. Or 282 workers questioned by Poincaré, 136 complained of such symptoms. Painters in side buildings, who are often obliged, in order to avoid raising of dust, to keep the places in which they work closed, therefore suffer intoxication from fumes, which give rise to general nutritional disturbances due to turpentine, sometimes in addition to troubles arising from lead poisoning, but which may also exist without being complicated by the presence of the latter.

¹ KOELSCH, loc. cit.

² LEHMANN: *Arbeits-u. Gewerbehyg.* Leipzig, 1919.

³ POINCARÉ: "Recherches sur les effets des vapeurs d'essence de térébenthine". *Revue d'Hygiène*, 1879, p. 435.

Devoto: *Il Lavoro*, 31 Aug. 1921: "We doctors have in fact been accused of ascribing to lead the toxic and fatal action which may be the result of other substances mixed in various forms with lead. This view is obviously not that of medical men nor of the workers. Not that of the medical men for they are very well aware that no substance exists capable of producing the characteristic clinical picture offered by lead poisoning, etc." L. FERRANNINI: "Anche la biacca è ribaltita?" *Rass. Previd. Sociale*, Oct. 1921. Rome.

It is comprehensible that the troubles ascribed to turpentine are more frequent amongst ship painters (Hamilton, Rubino, etc.). In his treatise on occupational diseases (1906), Pieraccini recalls the affections caused by turpentine amongst painters: irritation of the conjunctiva and the respiratory passages, headaches, vertigo nausea. Roth¹ quotes the cases of Schuler, Eulenberg, Liersch, Drescher, and a case observed by himself in which the workers, victims of acute turpentine poisoning, presented various symptoms which, as Sir Thomas Oliver² says, "constitute a series of symptoms *sui generis*". He states further that a painter poisoned by benzine, turpentine, etc., "is in the same state as a man who has been drunk the previous evening".

In France, J. Rebau and A. Bouchardat³ had already noted that exposure to turpentine fumes causes slight cephalalgia, followed by a state of fatigue and faintness, incapacity for work, and general prostration amounting to complete exhaustion of the muscles.

Nicholl, Flinn and Hayhurst⁴, after examining 62 painters-varnishers of Chicago have reported the effects of turpentine on certain workers, bringing to light the local action of this product on the eyes, the skin, and the respiratory apparatus. Though these authors are of the opinion that the action of turpentine on the urinary system may cause acute or chronic lesions they admit (page 87) that 14 workers only, out of 44 subjected to examination of the urine in this connection, showed evident symptoms of chronic kidney disease. Amongst the 14 painters affected 11 were over 40 years of age, and the authors stress the point that the workers in question were the oldest and had spent all their lives on this work (15-50 years). They add that it is impossible to estimate exactly the action exerted by turpentine fumes in the pathogenesis of these urinary lesions. As 3 workers only out of 44 examined had in the past shown symptoms of lead poisoning, the remaining number of cases (11) is too small to form a basis for reliable conclusions, and it is difficult to agree with the authors when they state that turpentine fumes may justly be suspected of a capacity for producing in large measure chronic diseases of the urinary system.

¹ *Kompendium der Gewerbe Krankh.*, 1909, p. 272.

² *Lead Poisoning*, 1914, p. 50.

³ WUNTZ: *Dictionnaire de chimie*, Vol. III, p. 980.

⁴ *Report of the Commission on Occupational Diseases*, p. 84. Illinois, Jan. 1911.

Fischer¹ speaking of turpentine, recalls its well-known action on the skin, the external mucous membranes, and the respiratory passages, and refers to the effects of its fumes on the urinary system, but in the latter case only when the action is long and continuous.

In all the literature examined, nowhere was any reference found to any symptom whatsoever due to turpentine with a resemblance, even faint, to the lead colic of painters.

Similarly, the suggestion recently advanced that turpentine fills the rôle of catalyser in favouring the outbreak of poisoning among painters cannot be accepted, for were this the case it would be necessary to enquire what is the substance which fills the same rôle in the other lead industries where turpentine is not used.

Heim de Balsec, Agasse-Lafont, and Feil have conducted, at the Institut d'Hygiène of the Faculty of Medicine (Paris), comparative enquiries dealing with the numerous and varied categories of working painters, all of whom handle spirit of turpentine — some in conjunction with salts of lead, others with zinc white. They found amongst the former frequent rates of hypertension and kidney lesions, and amongst the latter rarely hypertension (which was, when present, moreover due to non-occupational causes) and absence of kidney lesions. They decided, in conclusion therefrom, that it is indeed lead and its compounds and not spirit of turpentine which injures the kidneys, the heart, and the blood vessels².

Still more conclusive evidence in the same connection is furnished by the Norman report in Great Britain. Basing their conclusions on British experimental data, those who ascribed the toxic action to turpentine argue as follows: Acute kidney troubles are common amongst painters, whilst uncommon amongst workers in white lead factories who manipulate similarly white lead. Since experimental research proves that turpentine exerts an action on the kidneys it is therefore probable that painters derive this special form of disease from the action of turpentine rather than that of white lead³.

¹ *Weyls Handbuch von Hygiene*, Vol. VII, p. 1069. Leipzig, 1921.

² *ACADÉMIE DES SCIENCES*, Paris: Sitting of 22 January 1923.

³ *LONDON CHAMBER OF COMMERCE: Case against Prohibition*, loc. cit.

Now, the Norman report contains a paragraph, in regard to the effects of turpentine, in which the statements of doctors, experts, and employers are summarised, and which may be given briefly as follows¹:

The Committee, in view of the statements made in various quarters as to the serious nature of the physiological effects produced by inhalation of turpentine fumes, has examined carefully the nature of the evidence adduced in support of these statements. It has, in addition, received evidence from Sir Kenneth Goadby, who during a number of years has effected laboratory research into the nature of the effects of thinners by animal experiment. The deductions from his researches are cited in his statement made before former Committees and in Appendix XXI, Cmd. 681. Amongst his conclusions the following may be recalled:

- (i) That the different paint thinners in use — turpentine, white spirit, benzol, and others — are all dangerous, some even more so than turpentine.
- (ii) That the use of these bodies constitutes a very serious risk to painters.
- (iii) That the symptoms produced by them are abdominal pain, colic, anaemia, and headache. The anaemia affects both the number of red cells and their haemoglobin.
- (iv) That such symptoms, bearing much resemblance to those produced by acute lead-poisoning, may result from the inhalation of turpentine vapour when in considerable concentration, and in surroundings precluding free ventilation.
- (v) That the definite attribution of such symptoms to lead on the one hand, to turpentine on the other, was a difficult matter, and could not as yet be made with certainty.
- (vi) That the witness had met with cases presenting such symptoms among painters who are using a paint free from lead, and had not been using lead paint for some time previously.
- (vii) That even anaemia which, when due to lead, arises only when considerable quantities of lead have entered the system, may occur as a result of turpentine, and in the absence of lead.
- (viii) That animal experiments with inhalations of turpentine in considerable concentration had given clear proof of kidney-changes produced by the turpentine, and that these changes might progress to the degree of chronic Bright's disease. But he allowed that in the case of animals which had not died of acute turpentine poisoning, but which had been subsequently killed, he had no evidence to offer as to disease of the kidneys or changes in the urine.
- (ix) That he had no clinical evidence of chronic turpentine poisoning in man. His observations included only acute cases. There was no evidence to show that these sufferings had continued for any length of time or that they had led to permanent structural disease.
- (x) That investigations upon which he was still engaged indicated that for the same age groups the blood pressure of a painter tended to be high, whereas that of workers in another lead industry where turpentine was not used, i.e. white lead manufacture, it tended to be low. This was the case where the painters were employed on leadless paints and had been so for

¹ DEPARTMENTAL COMMITTEE ON INDUSTRIAL PAINTS (appointed 1921): Report, 1923 (Norman report).

1890-1892 to more than 15 to 1 in the period 1910-1912. It is evidently impossible to draw any conclusions from ratios founded on the very small numbers of deaths compared in these cases, and therefore the whole argument appears to fail. The 8 : 1 ratio for painters may quite as fairly be compared with that of 15 : 1 for file makers, who are not exposed to turpentine risk, as with the 15 : 10 ratio quoted for lead manufacturers.

To put the matter in another way : the deaths in the standard population from lead poisoning and from Bright's disease in 1900-1902 and 1910-1912 compare as follows for lead manufacturers (table 3¹) and file makers (table 5¹) respectively :

	Lead manufacturers		File makers	
	Lead poisoning	Bright's disease	Lead poisoning	Bright's disease
1900-1902 ¹	102	160	56	134
1910-1912	123	56	10	154

¹ The figures given here are based on returns of deaths and populations inclusive of the figures for persons recorded as retired from the occupations, a method first introduced for the period 1901-1902. The figures used by Sir Kenneth Goadby for lead manufacturers for this period, viz. 103 for lead poisoning and 149 for Bright's disease, are for occupied workers only.

For lead manufacturers the proportion of mortality ascribed to lead poisoning per cent. of that ascribed to Bright's disease increased from 64 per cent. (102/160) to 220 per cent. (123/56), while in the same periods the same proportion for file makers decreased from 42 per cent. (56/134) to 7 per cent. (10/154). No conclusions can legitimately be drawn from ratios so fluctuating as these.

Further, Dr. Stevenson also pointed out that the comparison between two industries in the way made by Sir Kenneth Goadby should only be made with the figures which are in excess over those for the entire population. The Bright's disease rate for the whole population for the 1900-1902 return was 32. It is only the excess over this which can fairly be ascribed to the industrial conditions. Viewed in this light the comparison of the figures used by Sir Kenneth Goadby stands as follows :

	Lead poisoning	Bright's disease (excess)
Painters, plumbers, and glaziers	23	37
Lead manufacturers	103	117

It is clear, therefore, that the mortality statistics do not warrant the suggestion that turpentine is the cause of a large proportion of the excess of Bright's disease among painters.

Dr. Stevenson has failed to find in the returns of the last ten years a single certificate in which the cause of death was assigned to turpentine poisoning.

In support of their theory on the harmfulness of turpentine and other paint thinners, the witnesses have called attention to the toxic vapours liberated in coating aeroplane wings with tetrachlorethane. This very poisonous substance, however, sets up in human beings very definite symptoms, having no resemblance whatsoever to those attributed to turpentine and other diluting agents.

Similarly, cases of poisoning caused by the use of paint with rapid drying properties are all acute cases and seem to be due to a concentration of fumes liberated by some very volatile body, such as benzol or an organic chlorine compound, rather than to turpentine.

¹ Dr. Stevenson's tables.

some time. The witness had discussed this matter in a paper¹ to which he referred. (It is to be remarked that, up to the present, the number of painters examined for this purpose is too small to enable reliable deductions to be drawn.)

As regards chronic effects in man due to the thinners, Sir Kenneth Goadby sought to show, from the occupational mortality statistics compiled by the Registrar-General for the years 1910-1912 and 1900-1902, that the painter suffers in a remarkable degree from incidence of Bright's disease as compared with the lead manufacturer². In this argument he claimed to find confirmation of his laboratory experiments on animals, viz. that inhalation of turpentine was a factor in the production of Bright's disease. He alluded to the difficulty he had found in regard to the comparability of the Registrar-General's figures from decade to decade.

Finally, he expressed himself as satisfied that the clinical, practical, experimental, and statistical evidence all converged to throw suspicion upon the paint thinners as an active cause of Bright's disease in painters. He stated that in his opinion the matter needed further investigation, and that if this corroborated his views the question of paint thinners ought to be made a subject of regulation or warning, or perhaps legislation.

Subsequently, the Committee had the advantage of the evidence of Dr. T. H. C. Stevenson, of the Registrar-General's Office, who corrected misunderstandings of the occupational mortality statistics into which Sir Kenneth Goadby had fallen, doubtless as a result of using unpublished statistics unaccompanied by explanatory comment³. Dr. Stevenson explained that, although the standard population, to which the are group death rates for the various occupations dealt with are referred for purposes of comparison, formerly varied from decade to decade, the returns for 1890-1892 and for 1910-1912 have been recalculated on the basis of the standard population for 1901 ; so that now three sets of mortality rates, all based upon the same standard population, are available for comparison at intervals of ten years, viz. those for 1890-1892, 1900-1902, and 1910-1912.

Dr. Stevenson has furnished tables of the deaths in the standard population and the comparative mortality figures for (1) occupied males ; (2) painter, plumber, glazier ; (3) lead manufacturer, leaden goods maker ; (4) potters ; (5) file makers — the most important lead risk occupations. His main objection to Sir Kenneth Goadby's argument was that, in consequence of their small numbers, the mortality ratio of Bright's disease to lead poisoning for lead manufacturers is so unstable as to be worthless. For painters and plumbers, whose numbers are large, table 2⁴ shows that this ratio has been fairly stable ; but for lead manufacturers, who are under 2,000 in number, it has fluctuated to such an extent that quite different conclusions would be reached according to the period selected for comparison. In the two periods, 1890-1892 and 1910-1912, the mortality for these workers ascribed to Bright's disease was much less than half that ascribed to lead poisoning, whereas in the period 1900-1902 it was 50 per cent. greater (table 3⁵). But though if either of these periods had been chosen instead of 1900-1902 the argument as stated would have been much more striking, it loses its force in view of the instability of one of the two ratios compared and of the experience recorded for other occupations exposed to lead risk. The number of file makers (table 5⁶) is much larger than that of lead manufacturers, yet their mortality ratio of Bright's disease to lead poisoning has increased from just over equality in the period

¹ "Immunity and Industrial Disease," *Journal of the Royal Society of Arts*, 1 July 1921, Vol. LXIX, No. 3,580.

² Lead manufacturer, i.e. worker in the group "lead manufacturer : leaden goods maker" of the Registrar-General's returns, *passim*.

³ Although the figures are available in the Registrar-General's Office the decennial supplement on occupational mortality statistics for the years 1910-1912 has not been published.

⁴ Dr. Stevenson's tables.

The Committee therefore concluded this part of the paragraph by stating that the statistical data at their disposal "tended to show that turpentine as a serious agent in the production of chronic painter's illness was not to be compared with white lead and the other lead compounds used in paint".

Realising the advantage also of data furnished from industrial sources, the Committee organised investigations in factories using turpentine without using lead. An absence register very carefully kept by the director of a factory making railway carriages showed no proof of serious effects amongst its workers as a result of the use of turpentine.

Investigations made by the secretary to the Committee likewise gave no proof that workers exposed to the fumes of thinners used in such great quantity in painting and varnishing suffer from chronic effects as a result thereof.

With a view to studying the effects of turpentine apart from the possible effects of lead, the Committee confined its investigations chiefly to establishments which were believed to have been using for some time past leadless paints and to firms engaged in making products used for polishing and cleaning, etc. In a large depot for tramway repairs under the management of the London County Council, giving employment to 135 painters and using exclusively leadless paint, except for a very small quantity of lead chromate, the director-general of the service, who had been a member of the Committee on Carriage Painting appointed in 1911 and was therefore fully cognisant of the statements relative to the noxious effects of thinners, had not since that date heard any complaint to the effect that cases of poisoning by turpentine had been caused as a result of conditions under which carriage painting is effected.

Another factory manager of a works engaged in constructing carriages for the Midland Railway Company, Derby, employing over 350 painters, placed before the Committee comparative tables showing time lost during three consecutive years in three services managed by him. These factories employed only leadless paint and the time lost in the painting department is almost identical with that lost in workshops for constructing and repairing the railway wagons.

After a careful examination of witnesses, the Committee was led to the conclusion that "there was not sufficient grounds to warrant them in accepting the view that turpentine poisoning is

the cause of the leading symptoms commonly attributed to either acute or chronic lead poisoning, nor in attributing to the inhalation of the fumes of turpentine and other thinners the occurrence of chronic Bright's Disease".

DUSTS

Among the agents which exert an influence on the origin of lead poisoning in the painting industry, the principal is, without doubt, dust. In fact, white lead dust, thanks to its fine subdivision and despite its weight, is easily disseminated throughout the atmosphere and deposited on the body and on clothes.

It is important to note that the air in coach-painting shops, during operations of sand-paperying, was found to contain so much lead dust in comparison with the amount previously registered by Mr. Duckering in the atmosphere of workplaces where tinning operations and those of glazing pottery were being carried on, that it proved to him to be necessary to modify his system of estimation. In rooms where dangerous pottery processes are conducted, the quantity of lead in the atmosphere varied from 1.1 to 13.3 milligrams per 10 cubic metres of air, and in connection with one highly dangerous tinning process it rose to as much as 124.3 milligrams. In a coach-painting shop Mr. Duckering, found over 1,000 milligrams (a gramme) of lead per 10 cubic metres of air; this result was obtained in a workplace in which a wheel was being dusted after sand-paperying over quick-drying lead paint; the corresponding test taken during the sand-paperying of the same wheel, without dusting off, gave 83 milligrams — an amount which seems moderate by comparison with 1,000, but which is nevertheless many times, say 40 times, greater than could be allowed to exist in an atmosphere to be breathed with reasonable safety.

The following table indicates the results obtained from determinations made in other workplaces during the processes of sand-paperying and dusting off:

39.6 mg. of lead per 10 cu.m. of air (coach body).
99.7 mg. of lead per 10 cu.m. of air (coach wheel).
133.3 to 278.3 mg. of lead per cu.m. air (motor bodies).
38.7 to 143.8 mg. of lead per cu.m. air (van wheels).

According to Mr. Klein¹, the dust content of the atmosphere near the mouths of workers engaged in dry rubbing down as

¹ Norman report.

well as the lead content of this dust would be : for dry rubbing down, 45.3 milligrams of dust per cubic metre, containing 5.7 milligrams of lead, and for moist rubbing down, 2.0 milligrams of dust, with 0.1 milligrams of lead.

The English Committee¹ judged it of use to draw up an estimation of the quantity of lead collected on overall jackets and other garments of painters. The research carried out by the Government laboratory has given the following results : for 24 overalls worn during a week of normal employment the dust removed by beating gave in 21 cases an average quantity of lead (in the form of monoxide) of 31.484 milligrams, in one case traces, in another case a maximum of 145.80, and finally a negative case. An estimation of lead in the fine dust lodged in pockets was negative in 21 cases, and in three others an average of 23.13 milligrams was found, with a maximum of 456.84 milligrams. A chemical examination of the garments in question after removal of the dust by beating resulted in the following returns :

	Milligrams
Average quantity	8,009.36
Maximum quantity	10,128.24
Minimum quantity	51.84
Minimum quantity	278.64

(negative case as revealed by beating).
(case showing traces as revealed by beating).

In a lead foundry Tichler found 2.5 to 9 milligrams per 100 litres of air, and Müller in the same industry found 236.8 milligrams of lead per 100 litres of air, while the quantity of lead dust fell to 0.29 to 0.56 after a dust extractor was installed².

During the Austrian enquiry³ research carried out by Kaup showed the presence of 1.25 milligrams of lead per 1,000 litres of air, that is to say, 10,250 milligrams per 10 cubic metres.

Lehmann informed the White Lead Committee at the Third Session of the International Labour Conference (Geneva, 1921) that the atmosphere of white lead factories which he had visited contained from one-tenth of a milligram to four-tenths of a milligram of lead per cubic metre. This amount was only noted when protective exhaust apparatus was not working normally : under these circumstances the workers might inhale 2.3 milligrams

¹ Report published in Part III (Appendix XXXII) of the English report, 1915 : "The full result of the experiments shows that the average quantity of lead in dust collected from a garment after a week's work does not amount to less than 92.7 milligrams."

² OLIVER, *loc. cit.*, p. 167.

³ *Loc. cit.*

of lead per day. Now, inhalation of a quantity of lead in excess of 4 milligrams per day during a prolonged period exposes the workers to serious risk of lead poisoning. The faecal matter of nine workers contained an average of 9 to 10 milligrams of lead per day¹.

In his treatise *Industrial Hygiene* (page 200) the same expert gives results of experiments carried out by Chyzer, Herbert and Heim, Duckering, etc., in regard to the quantity of lead present in the surrounding atmosphere. It might, however, be opportune to ask, like Gerbis, whether this question is not rather of scientific interest than of practical interest for protection of the workers.

It must finally be recalled that dust raised during scraping of old paint with a white lead basis would be (according to Stueler and Kaup) still more poisonous since it contains chiefly oleate of lead, which is more easily assimilated by the organism than the other lead products.

DROPS OF PAINT OR PAINT SPRAY

Without entering into a discussion relative to the liberation of lead fumes from a newly-painted surface², the elements of risk arising from small drops of paint or paint spray projected into the atmosphere will here be dealt with in some detail.

Without doubt there is already a certain amount of risk in the splashings from the painter's brush. Similarly, it has been proved by experiment that the operation of mottling executed above the worker's head presents a real danger for him ; though, according to certain authorities, this risk cannot be compared to that presented by dust. The attention of experts is at present, however, chiefly directed to those devices which permit of vaporising paint not only in the coach-building industry but also in the building industry, in that of naval construction, or, briefly, in all painting of surfaces of large dimension.

¹ Sitting of 4 November 1921. See the Committee's report.

² From the pathogenic point of view of lead poisoning, the question of emanations from freshly-painted surfaces (whether it is a question of lead or other products) is only of secondary importance. This problem is still in course of investigation, but it is not considered necessary to take account of it here.

For small objects paint can be applied by vaporisation with local projection and local exhaust device in such a way that the worker is effectively protected. But such a state of things is impossible in the building industry. Thus, the Norman Committee holds that vaporisation of lead paint should be prohibited for inside work, except where a system of local exhaust ventilation — an effective system, it should be added — can be installed. It holds further that whatever the process adopted for the application of lead paints, the most effective precautionary measures should be applied on account of the danger presented by splashings which dry on the body and on the clothes of the worker.

It seems important to emphasise the question of the liberation of microscopic lead-bearing spray during the operation of painting. The experiences of Messrs. Armstrong and Klein (see communication made to the Royal Society of Arts, London, 26 July 1921) would appear to prove that such spray constituting a "mist of paint" could not remain long suspended in the atmosphere, it being a question of relatively large drops (the production of very minute droplets with oil paint is not possible), so that the inhalation of these would be highly improbable. However, in reviewing the text of the lecture of Messrs. Armstrong and Klein (*Journal of the Royal Society of Arts*, No. 3,538 p. 669), the following words are encountered: "...a painter must be regarded as being in a shower of falling drops and any surface presented to this shower as liable to be splashed"; and seven lines further on: "...only the front of the cap is exposed to the falling splashes, as the head is bent back during the operation and is largely out of the splash zone". But eight lines further on, however (p. 670), one reads: "...the mask showed that a considerable amount of the splash falls on the face... the higher concentration in the vicinity of the mouth being due to its closer proximity to the stippling tool and its position relatively to the falling particles... we feel that this is an operation in which a suitable light respirator or filter might, with advantage, be worn over the mouth". At the end of the section occur the words: "It is, therefore, apparent that the mouth of the painter is in such a position relatively to the falling spray as to be practically out of the danger zone."

A later communication made by Mr. Herman, whose statements are contested by the authors quoted above, deals with the later investigations in regard to this problem and is even based on data verified by a doctor. Mr. Herman expresses his opinion in the following terms: "During painting with white lead colours there are produced microscopic lead-bearing droplets sufficiently minute to remain in suspension long enough to permit of their penetrating the respiratory passages (the mouth and nose) of the painters. For some time back technical application of spray painting has been effected. Without entering into a technical discussion, it is sufficient to state that this method offers, in the author's opinion, great risk for workers who are obliged to vaporise paint with a lead basis. In fact, if the worker is not quite effectively protected, he is exposed to the inhalation of the poison in suspension in the surrounding air in the form of particles of extremely fine subdivision."

(In the request of the Industrial Hygiene Division of Ontario and of the Committee on Industrial Fatigue, Sharpe, of the Institute of Pharmacology of Toronto University, undertook an enquiry with a view to estimating the risk to which painters who apply paint by means of the spray method are exposed (*Journal of Industrial Hygiene*, April 1922, No. 12, pages 378-386). The enquiry was confined to interior painting, in which the

The Medical Sub-Committee of the White Lead Committee at the Third International Labour Conference (see *Report of the 8th Sitting*, 8 November 1921) has drawn attention to the danger of methods of painting implying the use of spraying. It also refers to the indirect risk offered under certain circumstances by projection of the spray.

use of an existing device for extracting dust and spray is not practical. It was reported that in all the cases (enquiry made in 30 establishments in the town), save one in which paint containing 3 per cent. of lead was used, the workers declared that, as far as they knew, the use of lead paint was extremely rare. It was therefore decided that experiments should be made with paints having a white lead basis (60 per cent.) prepared according to the formula required for the use of spraying machines. Sharpe discovered without difficulty that the paint spray was not present on the floor but that a mist was quite visible at three metres from the work; that the mask, especially at the level of the nose and the mouth, the hands, and the arms, was contaminated with a fine coating of paint; and that a sensation of suffocation was experienced which persisted even for some time after a cessation of work. It is interesting to quote the results of the enquiry as regards the different types of masks used for protection of the workers. The following table gives a summary of the data in question. Experience has, however, proved the impossibility of wearing a really effective mask without inconvenience to the worker. The enquiry established also that the use of the spraying machine for interior painting with lead paint always gives rise to the absorption of lead, and that with the exception of sodium sulphide no other substance can be suggested to counteract by means of masks the action of the lead present in the atmosphere. The author was not able to assemble data in relation to the danger of poisoning by fumes of volatile products contained in the paint, but he expresses in his report his intention of undertaking a study of this question.

EFFICIENCY OF VARIOUS TYPES OF MASKS AS SHOWN DURING SPRAY PAINTING OF AN INTERIOR WALL (N. C. SHARPE)

Samples of air taken at the level of the nose and mouth of the operator	Milligrams of lead	
	per 300 l. of air	per 10 cu. m. of air
A. Mask of metallic material No. 20 Control: without mask	6.25 6.25	208.00 208.00
B. Gauze, cotton, wool, and animal charcoal mask: minimum thickness which can be worn Control: without mask	0.31 2.75	10.42 90.00
C. Gauze, cotton, wool, and animal black mask: prepared by Bauer and Block Control: without mask	0.1 3.12	3.33 104.2
D. Gauze and cotton wool mask of the minimum thickness which can be worn, damped with a 5 per cent. solution of sodium sulphide Control: without mask	0.37 6.98	12.4 232.2
E. As in D and below Control: the same mask without sodium sulphide	0.17 0.34	5.853 11.706

THE MEANS OF ENTRY OF LEAD INTO THE SYSTEM

The penetration of the poison into the body of the painter may occur in the form of dust traversing the respiratory passages, by inhalation, by way of the digestive tract, and by deglutition.

It may also take place — here again the gravity of the risk would be diminished by the worker observing scrupulous cleanliness — by way of the mucous membrane and the skin, for scientific experiment has shown that healthy skin offers a means of absorption even of volatile substances and gases. Cutaneous absorption among painters is further favoured by chaffing of the skin, which may be produced by manipulating dirty tools, and alteration of the epidermis may even be produced by the poison — a very slight alteration, it is true, but one sufficing to render the epidermis more permeable. It would not be possible to deny the occurrence of poisoning by way of the skin in citing experiments made on animals (guinea pigs, dogs, cats, and rabbits) because of the difference in the histological constitution of the skin of animals as compared to the human skin. Further, recent observations, such as those of Anderson in the Brooklyn Navy Yard¹, leave no doubt on the subject.

Oliver (Manchester, 1902), Manouvriez, Proust, Brezina (1912), Sternberg (1906), and Eichhorst (in his *Treatise of Medical Pathology and Treatise on Toxicology*) all insist on very serious and even fatal affections resulting from the external application of the lead.

This fact once established, it is, however, evident that the skin may not be considered as a normal means of entry of lead into the system. Several scientists (Devoto, etc.) whose theories have received unanimous recognition have shown that it is chiefly as an indirect factor of poisoning that the skin plays its part, viz. applied as a coat to the skin of the hand, lead dusts deposited on the skin, the moustache, the beard, the clothes, etc., transmission of these dusts to the mouth contaminated by dirty hands (through cigarette smoking, tobacco chewing, and eating). Müller (quoted by Oliver²) found 0.7 to 11.28 milligrams of lead on the hands of lead-foundry workers after their day's work. In one case he even found 643 milligrams. It is true that Süßmann has recently denied the absorption of lead by way of the skin as

¹ UNITED STATES ASSOCIATION FOR LABOUR LEGISLATION : *Bulletin*, 1921, p. 284.

² *Loc. cit.*, p. 168.

occurring amongst workers, and Smith¹, though he admits that lead can be absorbed by the skin, considers it impossible that white lead can transverse the skin even facilitated by the presence of scratches.

The Medical Sub-Committee of the White Lead Committee at the Third International Labour Conference has, however, formulated the following conclusions in reply to the questions which the White Lead Committee put to it (see *Report of the Eighth Sitting*, 8 November 1921) :

By far the most important danger is from dust which enters through the nose and mouth. Penetration of lead directly through the skin is without any practical importance, but in many ways lead can be deposited on the skin and be carried thence to the mouth.

THE RÔLE OF THE RESPIRATORY PASSAGES

Credit is due to the English and Italian medical schools for having first drawn attention to the rôle played by the respiratory system in occupational pathology. Goadby and Legge² attribute to it as the means of entry of lead into the organism, a rôle much more important than that of the digestive tract. It must, however, be recalled that much experimental research has been effected on cats, animals who possess only nasal respiration. Now the German research³ would appear to lead to the conclusion that half the dust inhaled is arrested in the nose and upper respiratory passages in the course of nasal respiration, thence ejected either by sneezing (when the dust causes irritation of the mucus) or by blowing the nose, or by deglutition of mucous secretion, charged with dust when sniffing, with nasal catarrh.

The experiments of Lehmann, Saito, and Gfroerer on animals would appear to prove that two-thirds or nine-tenths of the dust inhaled are always found at the autopsy in the stomach and intestine, whilst a third or one-tenth only is found in the respiratory system⁴.

¹ *Enquiry in New South Wales*, p. 166. See also the important work of Schmidt (of Halle) : *Ztrbl. f. Gewerbhyg.*, July 1924, No. 1.

² *Lead Poisoning and Lead Absorption*, London.

³ LEHMANN, *loc. cit.* and *Arch. für Hyg.*, Vol. LXXV, pp. 195-198.

⁴ "We can, of course, never be quite sure of the quantity of lead which reaches the lungs and is retained there in men who are working in, and breathing, an atmosphere laden with lead dust, for much of the dust is caught in the nasal pharynx and is swallowed, or it is trapped in the upper respiratory passages and does not reach the lungs at all" (OLIVER : *Lead Poisoning*, 1914, p. 37). "It is very doubtful, or at least not so far

Though under certain conditions, such as alcoholism or addiction to smoking, the mucus membrane loses its sensibility, the natural reaction which the respiratory passages offer to the passage of foreign bodies is reduced and the entry of dust into the furthest ramifications of the organ is facilitated. Even then dust, having arrived in the smaller bronchial tubes and the alveoli, can set up a process of phagocytosis and be expelled to a great extent in spitting. If, however, it advances into the pulmonary tissue it overcomes the feeble obstacle presented by the alveoli, penetrates into the tissue of the lungs, reaches the sub-pleura or the hilum of the lungs, whence by way of lymphatic circulation and the circulation of the blood it is carried into the various organs of the body¹.

Such is the process of poisoning by way of the respiratory passages.

Data relating to 4,000 workers in the lead mines of Brokenhill, provided by the Committee of enquiry of New South Wales, have led to the conclusion that pneumoconiosis was only present amongst 2 per cent. of the miners who had been working for 10 years and amongst 11 per cent. of those working for 20 years in the mines. The Committee found also amongst a certain number of workers symptoms of lead poisoning. Without doubt the natural protection offered by the nasal passage is removed or reduced by changes in it oftener than might seem probable. Without doubt also the fact that painters often sing during their work favours inhalation of dust and lead spray in suspension in the atmosphere. In this way there can be no possible doubt that dust can penetrate into the lungs. It might even be supposed that the quantity of lead absorbed due to dirty hands is often not so great as the quantity inhaled in the dusty trades. It is none the less true, as Lehmann² says, that as a general rule the quantity which

proved, whether dusts inhaled be absorbed by the respiratory passage and carried into the blood stream. The dust inhaled mostly reaches the digestive system. A series of experiments which I have carried out prove that an enormous quantity of dust reaches the intestines of an animal when it breathes an atmosphere rich in dust" (Biondi : *Le Malattie dei Minatori*, 1920). See, on the other hand, the very recent experiments (Kuss : *Acad. de Médecine*, Paris, 4 April 1922), according to which the quantity of dust present in the lungs is in very strict proportion to the dust content of the atmosphere. A part of the dust reaches the pulmonary alveoli with a regularity almost equal to that shown when gas is inhaled.

¹ See the works of Devoto's School (Milan), and especially the report presented to the NATIONAL CONGRESS OF OCCUPATIONAL DISEASES, Turin, 1901 : *La Pneumoconiose*, by CESABIANCHI and DEVOTO.

² *Op. cit.*, p. 200.

arrives in the lungs is not considerable. Dust inhaled is immediately transformed into moist matter and deposited on the lining of the upper respiratory passages. Where poisoning takes place, it is due to lead localised in the mouth, the throat, etc., rather than that which arrives in the lungs. The opinion of Lehmann is supported by Oliver¹, Pieraccini, Laborde, Meillère, etc. Even as regards drops in suspension in the atmosphere Lehmann, Saito, and Majima² have stated that the quantity which can be inhaled does not in general exceed 12 per cent. Lehmann thinks that this figure is even somewhat high.

Weighing well all the possibilities, it must be admitted that the very extensive surface of the respiratory tract and its exceedingly active circulation represent two important factors in absorption of the poison deposited on the mucus membrane of the upper respiratory passages.

THE RÔLE OF THE DIGESTIVE SYSTEM

The majority of authorities hold that the digestive passages play a still greater part than the respiratory passages in the pathogenic action of lead poisoning³. This rôle has recently been brought into evidence in the United States by the Committee of enquiry into the danger of lead poisoning in the pottery industry.

¹ *Op. cit.*, p. 37.

² *Arch. für Hyg.*, 1912, Vol., LXXV, pp. 185-183.

³ *Oliver*, *loc. cit.*, p. 117, states : "Admitting that the lungs and the respiratory passages are frequent channels of entrance of lead into the system, I am of opinion that it is by the alimentary canal, even when lead has primarily reached the upper part of the respiratory passages, that most of the poison enters the body." COADY and LEGGE write : "Gastro intestinal absorption can take place, and is by no means negligible, in ordinary industrial conditions" (*loc. cit.*, p. 12). The importance of the respiratory passages is made evident by these authors as demonstrated by a series of animal experiments. They say : "That a certain amount finds its way into the stomach direct is not denied, but from experimental evidence we consider the lung rather than the stomach to be the chief channel through which absorption takes place" (p. 9). It must, however, be recalled that the animals were placed in an atmosphere very rich in dust and tracheotomised.

In the New South Wales report (p. xxv) it is stated that the absorption of lead by the respiratory passages involves a minimum quantity. This opinion would appear to gain support by the negative results of a series of animal experiments. In fact the animals fed for three years with one grain of white lead per day showed no symptoms of lead poisoning. The results in question caused no surprise to those effecting the experiments, as they had long been able to provide a very satisfactory explanation of these negative results.

White lead arrives in the stomach by deglutition of dust with the saliva, with rhynopharyngeal catarrh, but chiefly by deglutition of substances contaminated by dirty hands. Further, too often the workers hold the brush between their lips and keep tobacco and even food in their pockets. Without entering into detail as to the transformation to which lead is subjected during its passage through the digestive tract — which can be read in the masterly article by Schmidt already quoted — it is useful to note that in the anterior part of the intestine a new absorption of the lead, absorbed in the gastric juices, takes place. A series of experiments of digestion carried out by Oliver and Bedson have demonstrated that the gastric juices possess the property of dissolving white lead and transforming it into chloride of lead (which is extremely soluble and dialysable), and that the bile dissolves three times more lead than the gastric juices. Carlson, using human gastric juices, has discovered that the basic sulphate of lead does not possess greater solubility than the white lead in gastric juices. For him the greater solubility of the sulphate is a chemical impossibility¹.

The chemical analysis carried out in course of post-mortem examination of victims of lead poisoning have shown that the liver and digestive passages, the nervous system, the bones, and the hair of the body are in general the parts most impregnated with lead. The respiratory passages, on the other hand, show relatively small localisation of lead. The following figures may serve to illustrate this :

Organs	Bedson in millionths	Oliver in millionths	Langen- beck (p. 100)	Blyth gram.	Thomson and Miles gram.	Payson and Miles	Muller mm.
	Case						
	I	II	III				
Hair	149.7-58.36-30.19	—	—	—	—	—	700 to 6200
Nervous system	49.7-37.8-41.6	37	0.005	0.016 to 0.081	0.0437	0.039	19 to 71
Liver	—	—	0.215	—	0.0036	—	18 to 90
Intestine	23.8-37.70	—	traces	—	—	0.015	—
Digestive organs	15.5-10-13.30	12	traces	—	—	—	6 to 35
Kidneys	14.7-12-39	10	—	—	—	—	11 to 22
Spleen	—	—	—	—	—	—	—
Heart and vessels	—	—	—	—	—	—	—
Respiratory passages	2.1- 7.60	—	traces	—	0.0126	—	5 to 12

¹ OLIVER, *loc. cit.*, p. 100.

III. — THE ACTION OF LEAD ON

The action of lead on the system has been in course of study and discussion. With the details of the pathology of lead poisoning that formerly lead was held to be an irritant of the protoplasm. Later it was thought that it exerted on the smooth muscular fibre of the arteries this hypothesis served to explain arteriosclerosis arising from lead poisoning. Now it is maintained that a condition of diathesis under the action of lead prepares the way for vascular alteration which, of other factors, leads to a complicated and severe poisoning (Devoto, Preti, etc.).

According to the researches of Tschernak chronic lead poisoning caused by small doses begins with an increase in the excretion of lead, a spell of loss of weight with a slowing down of the liver. Stimulation by these small doses of lead bring about diminution of the activity of the process of oxidation with retarded nutrition.

Lead therefore exercises an action which is harmful on the metabolism. It enters into combination with the noids of the live cells and forms albuminates of lead which are eliminated with difficulty, leading to the destruction of the cell where they have been deposited.

It is not yet known in what form lead enters the serum but it has been proved that it can always be found in the serum.

According to Schmidt, lead is not only a general irritant of the cellular nucleus, a specific irritant of the bone marrow (of the bone marrow in particular), but also causes the destruction of the elements of the blood in the stream and the chief cause of the various complications in different organs and tissues.

Scremin in 1924 was induced by his experiments that lead introduced into the organism is in the form of phosphates which, as such, are yielded by the elements. These phosphates being very

¹ Arch. f. exp. Pathol. u. Pharm., Vol. CX, p.

quantity of soluble lead products is certainly small. This fact would explain the very slow appearance of the toxic phenomena in lead poisoning.

Schmidt¹ has made a profound study of the problem of absorption and poisoning by white lead. According to him, impregnation of the intestinal mucous membrane is the first phenomenon of the toxic process. It follows the hepatic passage with elimination, accompanied by bile, of a part of the poison by way of the intestines and with possibility of reabsorption, of, however, very small quantities, the intestines not possessing the acid and solvent action of the stomach.

All the lead which is filtered through the liver, with the exception of that which passes into the intestine with the bile, reaches directly by way of the portal blood or the lymph the pulmonary circulation through the right heart. An unknown percentage of the poison introduced into the organism is filtered in the lungs, and while one part is eliminated by way of the bronchial tubes, another reaches the lymphatics and returns to the lungs. The latter become therefore a second means of circulation and elimination. The circulatory passages of the large organs; intestines, skin, kidneys, etc., constitute at the same time means of circulation and of elimination of the poison.

Schmidt holds that the action of lead is exerted by impregnation of the inner layer of the blood vessels (arteries) and in particular of the capillaries. It is probable that the endothelium of the pre-capillaries and of the capillaries is most affected. By these means the toxic action of lead is exerted on the organs affected. The digestive canal, the organ of absorption and elimination is the first to be affected, and this explains the early appearance of digestive troubles and of colic.

Schmidt does not favour generalisation of the suggestion made by Goadby and Legge, according to which saturnism breaks out when the absorption and elimination of lead are no longer in equilibrium. This hypothesis may be true of certain cases but not of others. The human organism is a very delicate machine, with extreme variation from one individual to another. The distribution and biological action of the toxic thus differ in accordance with the particular case. The poison may originate under certain

¹ *Ztbl. f. Gewerbehyg.*, 1924, No. 1. See also the recent contribution of AUB. FAIRHALL, MINOT and REZNIKOFF, 1926, in *Médecine Monographs*, Vol. VII, 264 pp., Baltimore; and of BEHRENS, of Königsberg in *Arch. f. exp. Pathol. u. Pharm.*, Vol. CIX, Nos. 5-6.

conditions from a deposit existing in a latent state in the organism and be suddenly projected into the blood stream. Too many multiple connections between the organs and the nervous system and between organs, functions, and the endocrine system are not yet clearly understood to enable the microevolutions which agitate the human organism to be definitely determined.

It has, however, been proved that the lead cannot circulate throughout the system without giving rise to lesions in all the tissues and organs, and especially in the emunctories (liver, kidneys), but, as will be seen later, it is on the kidneys that the lead has its most injurious effect. Another important factor brought into evidence by Teleky is that a worker, having once suffered from lead paralysis, and again exposed to the absorption of lead, may become the victim of a new attack of paralysis without other symptoms of poisoning becoming manifest.

It is difficult to determine the period of exposure to the poison necessary to induce poisoning. Though experience proves that at times a very short period suffices, there are found in medical literature cases of lead poisoning which only arise after 10, and even 30, years of contact with lead (Biondi). The characteristic fact is that small quantities of lead introduced daily into the system during months provoke poisoning more easily than two or three large doses taken at short intervals, and, moreover, in the first instance the poisoning is more serious than in the second. The English Committee of 1911 held that for painters on constructional work the presence of 1.025 to 3 milligrams of lead per 10 cubic metres of air represents a quantity which more than suffices to induce poisoning, since the absorption of two milligrams per day may, at the end of a certain time, give rise to chronic lead poisoning.

Brouardel was of the opinion that doses of one milligram of lead administered to a man would suffice to cause chronic poisoning, and, according to Meillère, some milligrams of lead localised in the nerve centres can cause affections similar to those produced by alcoholism and syphilis.

Smith and Rubner consider as the limit for rendering drinking water poisonous a lead content of .36 milligram per litre, and Oliver has reported symptoms of poisoning with .5 milligram per litre. Medical literature contains reference to 13 cases of poisoning which occurred to a group of 38 persons said to have drunk during a period of nine months water containing .2 to 1.5 milligrams of lead per litre.

Lehmann (1924), as the result of long experience, has declared that the toxic action of lead exerted itself as soon as animals had received 10 milligrams per day and per kilogram during a period of two to three months¹.

Nehring (1923) is inclined to the opinion that minimum doses of lead — 9 milligrams per kilogram, and less — suffice to cause poisoning when inhaled during a sufficiently long period. He thinks that for research of this kind rabbits are preferable to cats, for the latter often offer resistance to lead, and amongst them the appearance of punctate basophilia of the red corpuscles is of slower occurrence².

INJURIOUS ACTION OF LEAD COLOURS AND COMPOUNDS

From a health point of view, all the lead salts and pigments, as well as metallic lead, are poisonous. Laboratory work has demonstrated that amongst the lead compounds the oxides and white lead are the most poisonous³.

A few grammes of white lead, or even less, suffice to cause rapid mortality amongst animals. This experiment does not, however, permit of the same results being applied in regard to human pathology. Lewin wrote in 1902⁴: "Toxicology is not a science which it can be hoped to conquer by feeding an animal with a toxic product and giving it subcutaneous injections at repeated intervals during a year." This criticism applies likewise to all the problems of pathogenesis which it is desired to solve by experiment.

Without doubt the method of grinding colours in oil in the factory has reduced the work formerly done by hand by painters themselves, and which exposed them to great quantities of injurious dust. A reduction in the risk of poisoning has therefore taken place. It is not, however, possible to agree with Professor Bard

¹ *Arch. f. Hygiene*, Vol. XCIV, Nos. 1-2, 1924.

² *Ibid.*, Vol. XCIV, Nos. 7-8.

³ LEHMANN, *loc. cit.* See all the authors quoted. FLECK: *Dissert. Befähigungskriterien der Maler, Anstreicher u. Lackierer*, Leipzig 1915: "The lead compounds responsible for occupational poisoning are chiefly white lead and the oxides of lead." GOADBY and LEGGE: *Lead Poisoning and Lead Absorption*, p. 7. London.

⁴ *Obergesundachten über Unfallverhütung*, p. 3.

that white lead ground in oil is practically harmless¹, even though this statement has found a certain amount of support. In its reply to the questionnaire, the Government of Western Australia wrote: "Since there is no lead dust when paint ready for use is employed, painters are less affected than pottery workers and lead foundry workers." Now, as far back as 1903, Sommerfeld² stated: "The various reports of employers and of different organisations, and the pamphlets issued by naval construction works and railway companies try to prove that cases of lead poisoning are almost unknown since ground white lead has been used for painting. These reports, however, are confined to a small number of personal opinions, and are completely lacking in statistical data." Further, grinding is not the only source of danger. The principal danger is represented by the operation of painting itself, by contact with the colouring matter. It is chiefly scraping or burning of old paint and rubbing down of fresh coats which give rise to the production of toxic dust. Work of this kind is frequent in interior painting, but rare in outside painting. Moreover, the action of dust is more injurious in a confined space. Suppression — as will be seen later — of this disadvantage by wet rubbing down of the coats of paint encounters, according to the statements of skilled workers, various technical objections. Besides, wet rubbing down and scraping also involve³ for the worker a certain danger⁴; since, to accelerate the drying of the oil used in mixing the colour, there is added 2 to 3 per cent. of a drying medium which is usually litharge (oxide of lead).

The painter is thus threatened on all sides by the poison which penetrates his system: dust and spray may reach his bronchial tubes, and certainly his stomach; splashing, absolutely impossible of avoidance, fall on his hands and face; and his tools, more or less covered with paint, contaminate his hands and his clothes. It would be necessary for the painter to take the most minute care of his person, and chiefly of his hands, in order to avoid contamination of his food, which becomes a very powerful factor in

¹ See Geneva enquiry, *loc. cit.*: "The use of lead pigments is, without any doubt, the cause of the increasing risk to the health of workers in the painting and varnishing industries." See also KOEHLER: Conference held at Frankfurt-on-the-Main, June 1921.

² Quoted by LEWMANN: *Die Bekämpfung der Bleigefahr in der Industrie*, p. 192. Jena, 1908.

³ Reply, amongst others, of the Federation of Painters, etc., of Great Britain (1921).

⁴ Data furnished by the German Government.

poisoning. The painter often carries the poison into his home, and becomes the unconscious cause of poisoning in his family. This risk is so great that the English insurance scheme, after three years of experience, has raised its insurance premium from 20 to 30 shillings per cent.¹ It is certainly true that technical improvements and health insurance have diminished the number of cases of lead poisoning in large scale industry, that is to say, in the white lead factories, lead compounds factories, etc. The reports of factory inspectors, however, prove that even at the present time cases of poisoning are fairly frequent. On the other hand, in the painting industry, the reduction in the frequency of cases does not appear to have assumed the proportions which might have been hoped for.² Without doubt, lead poisoning has diminished from 1914 onwards. This fact is concomitant with the limitation and even, in certain countries, suppression of the production of white lead, the use to an increasing extent of substitutes for it, and the limitation or complete suppression of building. From the commencement of the first years after the war, however, when it was possible to resume activity in the building industry, and when, in consequence, the use of paints with a lead basis was again resorted to, an immediate increase of the incidence of lead poisoning amongst painters appeared (see later statistics for Great Britain).³ The lead danger is not a modern invention.⁴ Lead and its compounds — or, at least, certain of them — have been known since historic time, and their toxicity has never at any period been called in question. Already, before our time,⁵ colic was considered as the most characteristic form of lead poisoning. Despite this there are people who affirm to-day that certain lead compounds, particularly lead sulphate, are not as poisonous as they are said to be, and ought not to be included in suppression applied to white lead.

¹ English report, 1911. According, however, to the statements of employers, it would appear, nevertheless, that in Great Britain and Switzerland the premiums have recently been diminished (1923-1924).

² RAMBOUSEK, J.: *Ueber die Verhütung der Bleigefahr*; Vienna 1908. "Painters are most affected by lead poisoning: it is always the same story" (*American Bulletin of Labour*, 1912). See also later statistics for Great Britain.

³ See factory inspectors' reports in Germany for 1914-1918-1919, etc.; Switzerland, 1916-1917, 1918-1919. See also L. Davoro in *Il Lavoro*, 1921.

⁴ Letter from Mr. BEVILACQUA in *Il Sole*, Milan, 21 April 1921.
⁵ The toxic properties of white lead, minium, and litharge were known to Pliny, Dioscorides, Hippocrates, etc.

It is worth while stopping to consider the case of lead sulphate. When lead sulphate, said to be insoluble, was placed on the market under the name of "harmless white lead", Lehmann stated, after examination, that this lead compound could not be regarded as a harmless product. It is possible that poisoning by the sulphate occurs more slowly than that, for example, due to the carbonate. This fact, however, if proved, is only of interest from a scientific point of view. Practically, its use runs the risk of being even more dangerous than that of white lead, by very reason of its so-called harmlessness or slighter toxicity.

All the experts who have studied this compound have arrived at a similar conclusion.

Goadby¹, it is true, had concluded from his experiments that the solubility of lead sulphate in the human gastric juice is greater than that of white lead and of litharge. Carlson and Woelfel², however, after a long series of researches, have determined that it is the basic carbonate of lead which is most highly soluble in the human gastric juice. The carbonate dissolves in the proportion of 59.8 to 77.9 per cent., and the sulphate in the proportion of 24.7 to 30. Gibson and Apfelbach arrived at the same conclusion.³ Finally, Hamilton⁴, basing her conclusions on examination of the morbidity rates of workers in sulphate of lead factories, has been able to confirm that this product is dangerous, and calls for the same precautionary measures as white lead. The Norman report reads, in regard to this question, as follows:

Basic lead sulphate is manufactured in this country (Great Britain) for use as a white base. As such it is used both here and to a still greater extent in America. In many quarters it is assumed to be non-poisonous. The manufacturers of this substance object to its being classed along with ordinary white lead (basic lead carbonate) and claim for it that it is much less poisonous and therefore should not be subject to the same restrictions. Whilst there is some justification for this contention it is, nevertheless, a very poisonous substance. If we represent the average composition of commercial basic lead sulphate as $PbSO_4 \cdot PbO$, it is evident that half of its lead content is in the form of lead oxide, which would be soluble in dilute hydrochloric acid of the strength specified in the Home Office test for pottery glazes. The results of a series of careful tests made in the prescribed

¹ *Journal of Hygiene*, 1909, Vol. IX, p. 122.

² *Bulletin of the U. S. Bureau of Labour*, No. 141, p. 82.

³ STATE OF ILLINOIS, BOARD OF HEALTH INSPECTORATE: *Bulletin*, No. 1, 1913, pp. 25-32.

⁴ *Journal of Industrial Hygiene*, No. 1, Vol. I, and *loc. cit.*: "The sulphate of lead ($PbSO_4$) or metallic white, etc., is of little importance for the painting industry. The sulphate of lead, $2 PbSO_4 \cdot Pb(OH)_2$, which, by its chemical constitution, approaches white lead, is of greater interest for the said industry, and is also found on the market under various names (white leads of Bardiets, Lewis, etc.)."

manner, which were brought as evidence before us, showed that the House Painting Committee¹ underestimated the amount of soluble lead in basic lead sulphate paint, so that instead of 20 per cent. of this substance being allowable on a basis of 5 per cent. soluble lead, as they reported, not more than 8 to 9 per cent. could in fact be allowed. This agrees well with what theory indicates as a maximum, namely, 10 per cent.

On the other hand, normal lead sulphate, $PbSO_4$, is relatively non-poisonous, as it is so sparingly soluble both in water and in dilute hydrochloric acid containing 0.25 per cent. HCL (the strength specified in the Home Office test), that it may be regarded as an insoluble and a non-poisonous compound².

Even admitted that the toxicity of certain lead compounds, of normal sulphate of lead in particular, is relative, it would not be possible to label these products as absolutely harmless, a designation which they by no means deserve.

From the scientific point of view this question is bound up with the relation between the toxic action and the solubility of the product — which, however, does not mean that toxicity depends on solubility in water. White lead, for example, insoluble in water, dissolves in the gastric juice. Sulphate (of lead), insoluble in water, soluble with difficulty in dilute hydrochloric acid, cannot be considered as absolutely insoluble in the juices of the body. According to Rambousek³ only the sulphide is insoluble and would be incapable of setting up poisoning. Even this opinion, however, is not held by all experts and meets with proof to the contrary in practice. All scientific studies of the toxicity of white lead are effected in relation to products which are chemically pure. Happily (that is to say, from a health point of view) in practice the product in question is usually white lead mixed with baryta⁴ which renders it less dangerous. The white lead factories place on the market quantities of white pigments containing 80, 60, 40, etc., and even 10 per cent of white lead. In a general study, however, it is not possible to take into consideration this circumstance, which is only of importance when the painter or small employer grinds the white lead himself.

¹ See Cmd. 7882, p. 102.

² Norman report, 1923, *loc. cit.*, p. 23.

³ The discussion raised by Rambousek in regard to the harmlessness of lead sulphide is very well known to experts in industrial medicine. In the report of the German inspectors for 1913 very interesting data in relation to the use of white lead in insulating work show that continued inhalation of small quantities of lead, though soluble with difficulty, may give rise to lead poisoning.

⁴ KOELESCH, *loc. cit.* See also ASSOCIATION OF ITALIAN MANUFACTURERS OF WHITE LEAD, which states that "by reason of the great covering property of white lead it is possible to mix it with an inert pigment (baryta), a fact which permits of the preparation of relatively good and very inexpensive painting media", *Daily Information*, Vol. III, No. 6, pp. 169-171.

The functions of the human body still involve too many processes, unknown or but slightly known, to permit of use without restriction of products which experimental research proves to be poisonous. It is further known that the same dose of these toxic products is not equally dangerous for each individual. That does not, however, mean that certain people possess immunity, but infers rather a certain habitual nature to lead, habituation, moreover, which is of a very exceptional nature so that, according to Lewin, it ought rather to be considered as a kind of deferred poisoning. This point, however, will be discussed later.

Lead is all the more dangerous by reason of the fact that its action is accompanied by no kind of warning — "it is a dog which bites without barking". The destruction of the system takes place very gradually without the possibility of any violent crisis acting as a warning to the worker. How many workers consider themselves as healthy and believe that they have escaped the risk of contact with white lead, and at the same time show numerous punctate basophilia in the red corpuscles or even fall victims to colic shortly thereafter?

The questionnaire issued by the International Labour Office (which has been reproached with this fact!) stated that "every person exposed to lead poisoning ought to be regarded as in imminent danger of poisoning". Doubtless cases such as those cited at Geneva, for instance, where facts seemed to prove the contrary, could be raised in opposition to this statement¹. Is it not a fundamental principle of prophylaxis, however, that every person who has been in contact with a source of infection should be regarded as sick throughout the period of incubation peculiar to each disease in question? Does not the presence of the lead line referred to by the doctor serve as an indication to him that the worker examined, as well as his companions, is exposed to lead dust? Is not periodical medical examination of workers in the toxic industries demanded in order to reveal, at an early stage, symptoms of impregnation and poisoning, and are there not to-day many experts in favour of basing diagnosis entirely on the results of blood tests? Further, do not the statistics quoted later prove that the lead risk is the most serious risk to which the worker in the painting industry is exposed?

¹ *White Lead*, p. 29. Geneva.

Under these circumstances can it be an exaggeration to admit theoretically the principle of the imminence of danger from lead for workers in the lead industries?

THE SYMPTOMS

There exist in the symptomatology of lead poisoning¹ facts which give rise to divergency of opinion, if not in regard to themselves, at least in regard to their interpretation.

The individual reactions (of the endocrine system?) intervene with the effect of creating varying morbid forms of the disease and serve to explain the variable degree of resistance to the poison shown by each worker. It is, despite this fact, of vital interest to follow the broad outlines of the course of the poisoning. Certain workers "apparently" escape the toxic effect. In general, however, brief contact with lead suffices to introduce symptoms of lead poisoning². Tanquerel quotes cases of encephalopathy 8 or 10 days after contact with white lead. Cases more recently observed occurred after a period varying from one to four weeks (4 cases in 7), from one to three months (58 cases amongst 68 workers³), from one to two weeks (37 cases).

Can it be deduced from the study of such symptoms that there are individuals more or less immune to the action of lead or more or less susceptible to its action? Even if this be so, the admission of lead first category to work involving the manipulation of lead and prohibition for those belonging to the second category to engage in work of this kind would only affect a small number of particular cases.

A reference has just been made to workers with "apparent" immunity. Cases in fact are known⁴ where a lapse of months and the action of special circumstances has been required to induce

¹ See the literature of lead poisoning, especially the treatises of occupational pathology, and the very numerous reports on the special subject of lead poisoning.

² See the typical cases referred to by Scott, of Glasgow (*British Medical Journal*, 1902), Devoto, Thoinot, etc.

³ A. FLECK: *Weyls Handb. der Arbeiterkrankh.*, p. 545.

⁴ Enquiry carried out by Koelech, Hamilton and Carozzi, who have reported cases of lead poisoning amongst white lead workers after three days' work.

⁵ Cases quoted by Lehmann, Devoto, etc. Shufflebotham, an English factory inspector, reports 14 cases of lead poisoning amongst soldiers. The symptoms appeared five to seven weeks after mobilisation and may very probably be explained by the complete change in their mode of living or by fatigue phenomena experienced among the recruits during the first days

in workers, who had been in contact with lead, colic due probably to alteration in the excretion of lead still present in their system — what Leymann would call "mobilisation of lead" (*Mobilisierung von Blei*).

Many authorities incline to ascribe greater susceptibility to lead to women and young persons. Collis⁵, on the contrary, does not admit that women, in the exercise of industrial tasks, prove more susceptible to lead than men, finding that eventually both sexes and people of all ages prove susceptible to the action of lead which appears among all categories alike after a more or less extensive lapse of time.

There are certainly poisons to which the system becomes habituated, but there are, on the other hand also, those to which the system "appears" to become habituated, whilst in reality it becomes the subject of chronic poisoning. In this case there is only a pseudo-habitation — the subject is not really habituated to the poison, the more he consumes the further his disease progresses. He may arrive at a point at which he can stand a remarkable amount of the poison without experiencing any immediate toxic effects, but if chronic poisoning ceases immunity ceases at the same time. Poisons belonging to this group cannot be classed with those such as tobacco, or, better still, with the group known as venoms in regard to which the system can acquire veritable immunity, the mechanism of which is to-day well understood.

An immunity of this latter order has recently been mentioned in regard to the lead compounds, but Lehmann⁶ denies its existence. Doubtless certain persons appear to possess partial immunity against attack by these substances. Their organs may contain appreciable quantities of lead without the presence of clearly characterised symptoms of lead poisoning being observed. It is perhaps a case of persons "mithradatised" (rendered proof against the poison by gradually increasing doses) in regard to lead. There is, however, nothing to prove that they do not suffer

of their military service. "The lead is slowly eliminated. Some years ago I examined the urine of painters and found traces of lead poison, though these men had entered the Institution 17 years previously and had certainly not been in contact with the poison during this period" (Biondi, *loc. cit.*).

⁵ *Health of Industrial Workers*, 1921, p. 293.

⁶ *Loc. cit.*, p. 203.

indirectly, as a result of the poisoning, a certain weakening of the system which may predispose them to attack by various diseases¹.

There is not a single poison known to chemistry up to the present which, introduced over a long period into the system of animals, is capable of producing in their blood a counter-poison able to attenuate or suppress the toxic action of the said poison. Practice weakens the hypothesis of immunity, and hypothesis which might lead to dangerous solutions since certain authorities might go so far as to permit workers who have been cured, or are in progress of being cured, to resume work involving the manipulation of lead. As for the question of excluding definitively workers susceptible to lead — who represent in accordance with blood tests recently carried out in Germany a proportion of at least 30 per cent. of employed workers — it presents a very serious problem in industrial, national and social economy², and one which calls for very thorough and detailed study.

The factors of accumulation and elimination of the poison play a rôle in the pathogenesis of the disease. The poison accumulates more or less rapidly in certain organs and its elimination, favoured by special conditions in certain individuals, takes place by way of the urine, the bile, the faeces, the saliva, the skin, etc., in a slow, irregular fashion, and even intermittently.

It is admitted that where elimination proceeds at the same rate as absorption the danger of poisoning is limited. Should, however, the elimination become, for one reason or another, difficult or irregular, the equilibrium is disturbed and a case of poisoning with more or less grave symptoms according to the susceptibility of the patient occurs.

It may even happen that no specific crisis occurs, but that lead, by generally weakening the system, becomes the indirect cause—very often an unknown cause—of various diseases³.

¹ BRETON, p. 152.

² According to GOADBY and LEGGE (*loc. cit.*, p. 35), the clinical data collected by industrial medical inspectors in relation to workers in white lead works would appear to prove that the susceptibility of young persons is at least double that of adults, and that sufficient proof exists to support the hypothesis that the tissues of an adult are less adapted to absorption and elimination of the poison than those of young persons. In the *Proletariat*, Hanover, 16 July 1921, it is stated: "Workers suffering from lead poisoning ought not to be employed in the painting industry."

³ ORLIAC and CALMETTE: *Le Saturnisme*. Paris, 1912.

ANALYSIS OF DIFFERENT SYMPTOMS

Like all diseases plumbism is characterised at the outset by very varied symptoms. In its initial stage there is no sign peculiar to the poisoning justifying certain diagnosis. Clinical and laboratory resources, however, now offer the possibility of diagnosing most doubtful cases.

The opinion expressed by those who state that lead and each of its compounds possesses an action peculiar to itself, which varies in relation to the particular constitution of each individual, appears to be correct. This view serves to explain the varying clinical features presented by cases originating in different causes of poisoning, such as metallic lead or its compounds, white lead, minium, etc. It explains also the more frequent presence of punctate basophilia in the latter cases than in the former. There is, therefore, in the varying forms of poisoning by lead compounds a greater rôle to be attributed to the factor quality than that of quantity¹.

In the majority of cases there is found a general symptomatology and a special symptomatology peculiar to certain organs or to certain systems setting up their reactions against the poisoning, which vary in accordance with the endocrine system of the patient. This accounts for the variety in the initial symptoms and the lack of agreement at first sight observed in the works of different authors².

General Health

The symptomatology of lead poisoning presents itself, as has been noted, at a very early stage of the disease. The general health is very rapidly affected. Amongst the characteristic symptoms may be quoted loss of appetite and of energy, loss of weight³, and anaemia.

¹ A very interesting discussion on the early diagnosis of lead poisoning is given in the pamphlet by TELEKY, GERIS and SCHMIDT, published by the Institut für Gewerbhygiene of Frankfurt (Fischer, Berlin, 1919). See also the work of AUB, FAIRHALL, MINOT, etc., and the article "Lead (Poisoning by)" in the encyclopaedia, *Occupation and Health*, and the *Bibliography of Industrial Hygiene*, both published by the INTERNATIONAL LABOUR OFFICE.

² Difficulty of diagnosis, however, is exclusively confined to the initial stages of poisoning.

³ Present to a very remarkable degree in experimental poisoning.

The patient complains of feeling a peculiar sweetish, metallic taste and often suffers from nausea and vomiting. A fetid breath connected with a bad state of the mouth (stomatitis and pyorrhoea) is often noted.

The Lead Line

In the early stage of lead poisoning a line on the gums¹, which can be differentiated by known means (touching the gums with a 10 per cent. solution of monosulphate of soda), is often noted.

Cases well known in medical literature do not permit of the conclusion that a local infection is necessary to the development of the lead line. Koelsch, Lane, and others have often reported amongst painters very marked pyorrhoea, attributed by Koelsch

¹ According to numerous authors (Oliver, Ruge, Schmidt, etc.), the line which cannot be removed by brushing is a sign of the presence of lead in the system. Teleky even regards it as a sign of absorption when it develops very rapidly. Difference of opinion is more marked in regard to the line formed by a deposit (Hins, Teleky, etc.) which is only of value in detecting the disease in the case of persons exposed to the inhalation of lead dust. In any case prevention of the formation of this line (oral hygiene) has nothing to do with that of lead poisoning. It is evident that where the state of the teeth is good, the line in question is always a sign of poisoning (Böttlich), that is to say, a line marking elimination.

The appearance of this line among young persons during the first weeks at work or among persons with but slight exposure to poisoning signifies a very grave symptom. Its incidence is very variable. Of 151 workers examined by Koelsch, 118 showed this line, 44 to a marked extent and 69 slightly. Gerbis met with it 97 times to a marked degree, 52 times slightly present, and 17 times in a very marked degree among a total of 190 workers. Weber noted it in 16 to 20 per cent. of the workers exposed to lead (see *Frühdiagn. d. Bleivergift.*, loc. cit. pp. 35 et seq.). Glue (*Journal of the American Medical Association*, March 1921), on the other hand, found it in 90 per cent. of his cases.

Even by itself the line on the gums is "a sign of warning of lead poisoning" (Oliver), or "important as regards early diagnosis" (Schenk-Wilmerdorf, Walker); "a sign which should raise the presumption of lead poisoning" (Schmidt); "to be regarded as an early sign" (Tanquerel de Planches, Naegeli, Knierrien, Ruge, Schmidt, Oliver, Teleky, etc.).

C. K. Lane, chief medical officer of the Accident Insurance Office in Queensland, noted its presence in 60 per cent. of the cases examined by him, even when the workers' teeth were in a good condition (1925). The line on the gums may not be present in serious cases (Graham Rodgers), though this is of rare occurrence (Schmidt). Naturally, its importance as regards diagnosis is very much greater when it is accompanied by basophilia and hematurorrhynuria. Schmidt has noted this to be the case especially when the line on the gums is very marked.

According to Feil and Heim de Balsac (*Paris Med.*, No. 21, 1923), its incidence is very frequent but not constant. It may be lacking among individuals certainly suffering from lead poisoning. For this reason it is preferable not to attach an absolute value to its presence, nor to demand its presence in order to diagnose as lead poisoning symptoms noted.

In conclusion, the absence of the line on the gums does not exclude the possibility of lead poisoning; it is rarely absent in cases of actual poisoning; there is almost complete agreement of opinion as to its value as a sign of warning.

to the action of albuminate of lead on the gums, favoured by anaemia and nutritional disturbances of the gums themselves. A bad breath has only been noted in very serious cases of lead poisoning (Teleky, Weber, Koelsch) and fairly rarely, while Weidemer considers it as a serious warning, and Schenk-Wilmerdorf as an important symptom¹.

It is natural that lead dust becomes deposited on the buccal mucous membrane, especially of the gums, forming "the line of deposition" which must be distinguished from "the line of elimination", which alone is a sign of the presence of lead in the system. Like all the symptoms it is only one factor of diagnosis. Though very frequent, it is not present in all cases of lead poisoning. It would, however, be difficult to subscribe to the opinion that the lead line is not now accepted as a sign of lead poisoning².

The Lead Complexion

Many authors regard "the lead complexion" as an important symptom of early diagnosis (Teleky, Weber, Gerbis, Dreschke, Curschmann, Schultze, Glibert, Lane, etc.). Oliver speaks of the "pallor of the pre-saturnine stage", and others (Koelsch, Böttlich, Kranenburg, Frey, Schönfeld, etc.) look upon it as a symptom of relative importance. Schmidt states that it is possible to suffer from the action of lead without necessarily developing the lead complexion, and that it is difficult to distinguish the real lead complexion from a lead-like colour indicative of a momentary morbid condition³.

The Digestive System

Buccal lesions, pharyngitis, and even parotitis are symptoms sometimes noted in victims of lead poisoning.

According to a certain number of authorities digestive derangements are equally early symptoms. The American manufacturer, V. Hammer, recognises such affections as being of very frequent occurrence⁴. In chronic forms the liver is fairly rapidly affected,

¹ *Frühdiagnose d. Bleivergift.*, p. 24.

² New South Wales report, Vol. XVIII.

³ *Frühdiagnose d. Bleivergift.*, p. 24.

⁴ *Bulletin of the American Association for Labour Legislation*, 1912. See also Feil and Heim de BALSAC: *Paris Med.*, 1923, No. 21, p. 406.

involving in certain cases cirrhosis, hyperplastic chronic angiocholitis of the small and large bile ducts. In acute forms, or forms induced experimentally by massive doses, hepatic lesions are not frequent. As a result of changes caused by lead in regard to the nitrogen exchange, the increase of uric acid in the blood favours the outbreak of gout in persons predisposed to it. The classic work of Garrod has brought into prominence gout accompanying lead poisoning — very frequent in Great Britain — as a special morbid form confirmed by Charcot in 1863. It has been, on the other hand, rarely met with in Germany. This difference may be fairly well explained by the fact that each country has general conditions of life and of feeding, etc., peculiar to itself. According to Devoto and his school, lead favours a state of uricaemia by retention : the increase of uric acid in the blood of the victim of lead poisoning proves the existence of a morbid condition due to alteration of the nitrogen exchange. Arteriosclerosis, nephritis, etc., are satisfactorily explained by this theory. The problem is certainly deserving of detailed research, but numerous authors insist on the frequent existence of gout in cases of lead poisoning (see below, "Statistics"). Hübner considers that the two lesions are interdependent, especially in the case of old workers suffering from arteriosclerosis and albuminuria. Dreschke favours the theory of predisposition to gout amongst victims of lead poisoning, and according to Böttlich gouty subjects should be excluded from industries with a lead risk¹.

Colic constitutes the epiphenomena of chronic lead poisoning. It is sufficient to recall here its great frequency as compared with the other symptoms of lead poisoning, its duration, and consequently its importance from the point of view of individual or social economy. The data to be quoted later confirm this statement. The action of lead on the intestine occurs in two ways : directly, by way of the smooth fibres of the intestinal muscular system, and indirectly by mesenteric innervation itself. This theory is of capital importance in the accurate interpretation of the pathology of colic.

Already in 1839 Tanquerel de Planches found that colic occurred in 1,493 cases of lead poisoning 1,217 times, arthralgia 751 times, paralysis 127 times, and cerebral symptoms 73 times.

¹ See also observations made during the course of eight autopsies carried out on victims of chronic lead poisoning and in regard to six cases of gout, by BROUSSIER and WODARZ (*Deut. Arch. f. Klin. Med.*, Vol. CXXXIX, No. 3-4).

Lead poisoning is often manifested by other symptoms, such as arthralgia, myalgia (accompanied or not by colic), general muscular weakness, paresis, and paralysis. Teleky¹ is of opinion that weakness of the extensors of the hand, which has also been studied for a long time by Gilbert, is an early and frequent symptom of lead absorption and poisoning.

The Nervous System

Motor derangement (the classic type : paralysis of the forearm, partial or complete, uni- or bi-lateral) may be met with in the peripheral nervous system, in addition to derangement of sensation (myalgia, arthralgia) sensory troubles (amaurosis, headache, retinitis, optic neuritis).

Statistics prepared by Legge in relation to a period of 15 years (1900-1914) have brought to light very interesting facts. The varieties of paralysis reported during this period cover 606 cases, of which 352 were cases of actual paralysis and 253 of muscular weakness, affecting especially the two forearms, 72 the right forearm, 50 the arm and leg, etc. In the Norman report, it is stated that paralysis of the radius amounted to 17.6 per cent. among painters engaged in constructional work, while it only formed 13.6 per cent, among other workers suffering from lead poisoning. Headache may represent an important early or late symptom of lead poisoning for persons in contact with lead², even in the absence of albumina in the urine and without modification of the base of the eye. It may also be an early sign of a more complicated clinical picture such as encephalopathy.

Encephalopathy, with its complicated symptomatology : convulsions, hallucinations, trembling, delirium, coma, amaurosis, blindness (the very clinical picture of meningitis), and pseudotabes (less frequent), still occurs, though more rarely. The experimental research of Goadby proved that the first and earliest effects of lead are microscopic hemorrhages³ in the meninges, the

¹ *Klin. Woch.*, 7 May 1923.

² OLIVER, *loc. cit.*, p. 141.

³ *Munch. Mediz. Wochenschrift*, 1921. In a note by Teleky in his translation of the treatise by Legge and Goadby (p. 97 of the German text), he expresses his surprise that recent German literature, excepting the works of Rambousek, neglects to mention the small hemorrhages due to lead poisoning, but quotes the opinions of various authors and draws attention to the fact that changes of the vessels due to lead resemble those caused by chloride of barium, hydrastine, and hydrastinine, which are agents of vasoconstriction and cause contraction of the vessels with increase of arterial pressure.

liver, spleen, and intestine, but chiefly in the nerves of the paralysed muscles. Encephalopathy, however, frequently revealed by diagnosis in Great Britain, is less general in France, Italy, and Germany; though recently mental forms have been reported as occurring after two or three months only of contact with lead colours.

The data furnished by one of the most important hospitals in New South Wales show that out of 1,000 deaths occurring each year amongst painters, about 1.2 are due to mental derangement following on lead poisoning, while for other male workers the proportion is 0.8.

It has already been stated that encephalopathy comprises a very complicated symptomatology: a simple irritation of the nervous system manifested by headache, nervousness, neurasthenia with vertigo, incoercible, etc., but without very definite manifestations, and sometimes presenting a clinical picture which recalls epilepsy or other more complicated forms with fatal termination (Dreeschke, Hübner, Koelsch, Oliver, etc.). "I have not the slightest doubt", writes Oliver, "that there are many cases of illness attended by obscure nervous symptoms of which no explanation can be given and which are illustrations of atypical plumbism."

The Respiratory Passages

Lead poisoning also affects the respiratory system². The pulmonary tissue, already impaired by the specific action of lead on its vessels, presents a series of phenomena (asthma, etc.) which invariably leads to sclerosis.

It is probable that this sclerosis, which in certain individuals may evolve into an atubercular form of disease, is succeeded by a specific form conditioned by special surroundings and ways of living peculiar to the individual. It is universally admitted that the average age of painters is more considerably reduced by tubercular infection than by plumbism itself. It has long been noted that amongst 38 occupational groups that of painters occupied the second place as regards mortality due to tuberculosis³.

¹ Loc. cit. (p. 108). See also article by WELLER and ALLEN Dean CHRISTENSEN: "Encephalopathy due to Lead Poisoning (Analysis of 300 Cases Published up till the Present)". *Arch. of Neurol. and Psychiatry* (Chicago), 1925, No. 3. An account of this form of the disease has been compiled in France by DUVOIR and SAINT-LAURENT (*Congrès de Neurol.*, 1925).

² See works by DEVOTO and CEBABIANCHI, loc. cit.
³ SOMMERFELD.

It is evident that lead poisoning, aggravated by bad general health, poor nourishment, and exhaustion, prepares the way for phthisis or accelerates its development.

Arterial Pressure: The Blood

Alterations of the blood vessels, hypertension, arteriosclerosis, etc., have even been noted as early symptoms of lead poisoning. It would, however, be dangerous in this domain of clinical medicine to attempt to draw formal conclusions from observations made in regard to arterial pressure amongst workers in contact or not in contact with lead products¹. At the present time opinion is still very varied in regard to the value of blood pressure and arterial tension.

Gerbis holds that blood pressure is not of great value, and Curschmann considers it as too variable an element on which to base conclusions. The kind and the duration of employment, objective living conditions outside the factory, former disease history, but especially the technique followed by the doctor (apparatus, method of application, etc.) represent factors liable to exert an effect on the research and give rise to unstable results. The value of blood pressure is very important when plumbism is already present (Gerbis), for it may lead to recognition of the imminence of nephritis due to lead poisoning (Böttirich).

Amongst the alterations of the blood, hypoglobulia and certain lesions of the red cells already noted in 1875 have been confirmed later. Without insisting on the alterations of the leucocytic formula (mononucleosis with inversion of the formula or leucocytosis with polynucleosis) it may be said that polychromatophilia and punctate basophilia met with in victims of saturnism as early as 1899-1900 are regarded by the great majority of authorities² as the earliest symptoms of lead absorption.

¹ ROYAL SOCIETY OF ARTS, London, 1921. The problem of hypertension is so complicated that when a doctor tries to form deductions having a certain degree of accuracy from some figures obtained with an apparatus it is hardly necessary to state that he must consider them in conjunction with the data furnished by a clinical examination. G. B. PAGE in *Journal of State Med.*, Vol. VI, 1921, found amongst painters values superior to those noted amongst workers not exposed to the action of lead.
² See *Frühdiagnose d. Bleivergift.*, loc. cit., and especially the works of Schmidt, Gilbert, Biondi, Schwarz, etc.

SELLERS in *Journal of Industrial Hygiene* 1921, had already stated that he had only very rarely met with punctate basophilia in the blood of healthy persons not in contact with lead and only to a very limited extent in positive cases. He had even said that apart from symptoms of confirmed cases of plumbism it is fairly easy to recognise the blood smear of a

It is now admitted by all that punctate basophilia is not the result of the action of lead on the erythrocytes, but the indication of the reaction to the poison of the hematopoietic organs which pour into the blood stream a more or less extensive quantity of immature red cells.

In relation to the practical side to this question, it may be permitted to point out that the objections raised and the negative opinion advanced on this subject depend very often on defective technique and especially, as has been said, on the fact the action of metallic lead is compared with the very different action of its soluble or less soluble compounds.

worker exposed to the lead risk. C. K. Lane, of Queensland, found punctate basophilia amongst 20 per cent. of workers suffering from lead poisoning, but with greater experience in the use of the microscope this proportion would certainly be exceeded (1925).

According to Sellers (quoted by LEUCKE: *Annual Report of the Chief Medical Inspector of Factories*, 1924, p. 70), the number of workers exposed to plumbism who show punctate basophilia of the red cells is greater than the number generally expected, and the number of basophilic erythrocytes per million is greater than that stated by authorities on the subject. It is not, in fact, rare to find 10,000 and even 20,000 basophilic erythrocytes per million.

The methods of examination are simple and such that they can be applied on a large scale. It must, however, be admitted that enumeration is at times rendered erroneous by faults which even trained persons are not able to avoid completely.

According to Sellers, this method permits of detection of lead absorption even in those cases which do not present the usual symptoms of lead poisoning. It is opportune to recall at this point that Teleky wished to suggest a standard method to be used by all experts. By this means it would be possible to obtain comparable data.

Though Lehmann (see later) found punctate basophilia in half of the workers examined (66 in all), Schwartz, on the other hand, amongst 87 painters in Hamburg only found 5 to 6 per cent. with "a slight, almost insignificant, increase".

According to BLAIR BELL, WILLIAMS, and CUNNINGHAM (*Lancet*, 17 October 1925), intravenous introduction of lead into the system alters the constitution of the red corpuscles, which show punctate basophilia even a few hours after administration of the first dose. Anemia, polychromatophilia, anisocytosis, and poikilocytosis only appear later. Leucocytosis, on the contrary, frequent, and leucopenia very rare. According to these authorities, punctate basophilia is the earliest symptom, and they do not share the view that this condition is frequently to be met with in normal blood. It is, however, true that it may be encountered in certain pathological cases and especially amongst anemic persons. Polychromatophilia is very frequent. These authorities found amongst 117 patients punctate basophilia 76 times, punctate basophilia in conjunction with nucleated red cells 24 times, polychromatophilia 14 times, punctate basophilia nucleated red cells and poikilocytosis once, and punctate basophilia nucleated red cells and polychromatophilia twice. The author is indebted to Professor Kruse, director of the Institute of Hygiene of Leipzig, for the following data:

The blood tests referred almost exclusively to painters "suspected" of plumbism.

Schwartz, Biondi, Carozzi, Teleki, Schmidt, etc., insist on the importance of good preparation of the blood platelets. Schmidt affirms that "an examination carried out in accordance with the requisite technique will reveal in chronic cases with very rare exception the presence of punctate basophilia". He feels it necessary to recall that the reservations made by the district doctor of Kattowitz in regard to the value of this research were merely the result of faulty technique.

Long practice has proved that punctate basophilia constitutes a very useful symptom for early diagnosis, even if it be admitted that it is found with other pathological conditions. Its incidence is such that in the absence of other symptoms it must be considered as a signal of warning, raising the presumption of latent plumbism. The experiments carried out on animals can only be accepted with certain reservations as indicative of the effect on human beings. It would further be useful to take into account the minimum number of basophilic erythrocytes which Schmidt (Halle), for example, fixes at 100 for a million red cells. The value however of this index is absolute as confirmation of a diagnosis based on other symptoms.

In 1917, of 100 persons, 29 showed 100 or more basophilic erythrocytes per million, and 18 under 100; 29 per cent. of positive cases were found. In 1919 for both groups the figures are 7 and 9 and percentage of positive cases 17.9; in 1910, 12.8 and 24.5; in 1918, 11.4 and 31.4; in 1914, 5.1 and 29.4. In 1919 two negative cases, and in 1920 six cases of which only two were positive, 33.3 per cent. In summarizing, 58.1 per cent. of the cases examined were found to be negative, 16.1 per cent. with punctate basophilia under 100 per million, 26 per cent. exceeding this limit, that is to say, 4.4 per cent. with a value of 100, 10.1 per cent. between 100 and 800, 9.8 per cent. between 800 and 1,000, and 2.8 per cent. above that figure.

It is interesting also to note that the researches of Kruse confirmed once more the results observed in the past in regard to the greater incidence of punctate basophilia amongst painters than amongst workers in other occupations exposed to the lead risk. In fact, the average of these positive cases during the period 1907-1920 affecting 2,288 workers examined gave 13.2 per cent. for printers, 17.8 per cent. for workers engaged on colour blowing (pottery industry), 21.9 per cent. for tinmiths and 32.5 per cent. for painters and varnishers.

According to HAYHURST and GLUE (*Journal of the American Medical Association*, 28 March 1921), mononucleosis is almost invariably present in chronic cases.

See article "Blood" by SCHMIDT and that of BIONDI: "Lead (Poisoning by)" in the encyclopaedia *Health and Occupation*. See also article by SCHWARTZ in *Deut. Med. Woch.*, 16 Feb. 1923, p. 212, and his report made to the meeting at Essen (1925) of the DEUT. GESELL. FÜR LEI- und HYGIENE; that of LEHMANN in *Arch. f. Hyg.*, 1924, Vol. XCIV, Nos. 1-2; of MACCORD in *Journal of the American Medical Association*, May 1924; and of CRAIK in *British Medical Journal*, 20 Jan. 1923, etc.

The basophilic red cells were discovered by Ehrlich in 1885, and subsequently confirmed by other scientists. They are very rare in the normal blood of men: Schmidt and Trautmann found them in 1.8 per cent. of the cases in the proportion of one basophilic red corpuscle per 10,000 normal cells¹.

Though it is true that they may be found in many cases of anaemia, especially secondary anaemia and pernicious anaemia and leucemia, in jaundice, and in malaria, it is now, however, admitted that in lead poisoning alone basophilic red cells are present in such great numbers that many authors attribute to their presence importance, from the point of view of diagnosis, greater even than that of the lead line (Grawitz, Hamel, Schmidt, Moritz, Büsing, Frey, etc.).

Thanks to vital staining Pappenheim and especially the Italian scientists have been able to demonstrate the presence of basophilia in erythrocytes examined in fresh preparation. Their number is remarkable in forms of anaemia and poisoning². Later it was found possible to distinguish two substances in the cells; a thread-like ortho- and a meta-chromatic substance, or the substances A, B of Cesaris Demel. Ehrlich has similarly proved the existence of a polychromatophilia which he interprets as a sign of degeneration of the red corpuscles. However, the polychromatophilia was subsequently regarded as a sign of immaturity of the red corpuscles, said to be more immature than the red cells, with punctate basophilia. As regards the relation between polychromatophilia and punctate basophilia, the majority of experts admit a genetic relation between these two varieties of structure. Askanazy regards them as two morphological expressions of the same order of phenomena; others incline to the view that polychromatophilia is the result of dissolution of the nucleus, and that punctate basophilia is the result of its separation into fragments. Though Pappenheim holds that the first has no relation to the second, Naegeli considers, on the other hand, that polychromatophilia should have in regard to diagnosis of plumbism the same importance as punctate basophilia.

The relation between the threadlike substance and the basophilic red cells has been very much discussed, for certain authorities assert that the two are identical, while others deny this. Cesaris

¹ See note, p. 99.

² See the works of Grawitz, Pappenheim, Jolly, Frey, Blondi, Ferrata, Cesaris Demel, etc.

Demel, who for a long time has been studying this question, admits that the two are substantially identical, but different from the morphological point of view. Punctate basophilia of the fixed platelets would correspond to the B or metachromatic substance, and there would appear to be a quantitative relation between them. On the other hand, as regards polychromatophilia and its relation to the threadlike substance, there is much greater concurrence of opinion between authorities. However it may be, the presence of basophilia in the blood depends on a pathological or embryonic function of the bone marrow. It is the expression of a pathological reaction of regeneration.

It has, on the other hand, been shown that where there are no symptoms of plumbism, also amongst painters, the number of basophilic red cells is very low, and notably inferior to that observed during the acute stage (colic).

It has been stated that this sign may be rendered doubtful in subjects suffering from serious anaemia or malaria. Examination of the blood, carried out by a trained medical man, allows of distinguishing the two morbid forms, for the data relevant to anaemia — especially pernicious anaemia — and to malaria are such that they lead to diagnosis, taking into consideration, of course, the whole clinical picture offered and all data relevant to the case history. As regards malaria, the examination of fresh blood brings into evidence not only the presence of the parasite, but also granules in the blood pigment, granules which an inexperienced person may, it is true, confound with impurities or precipitations.

In forms of chronic malaria, which alone may give rise to doubt, the clinical examination, the evolution of the disease, analysis of the blood with Manson staining, will reveal in the one case the nature of the malaria and in the other the remaining symptoms of lead poisoning, and collateral clinical research (research for lead in the urine) will permit of correct diagnosis.

Frey¹ found punctate basophilia in 87 per cent. of 687 zinc foundry workers examined, 42 of whom showed the Burton line.

Böttlich, together with cases free from punctate basophilia, notes this positive sign in two-thirds of the cases having also the lead complexion and (or) the lead line.

¹ *Deutsche med. Woch.*, 1907, No. 6.

Curschmann found a remarkable increase of basophilic cells in 20 per cent. of a number of workers exposed to lead and still healthy and free from special affections, though anaemic. Koelsch noted it in the majority of workers suspected of plumbism but still fit for work. John Russell¹ reported basophilia in 26 per cent. of a number of workers in receipt of compensation for lead poisoning. Lutoslawsky² found only 17 persons in 107 affected with chronic lead poisoning who did not show basophilia. A recent contribution by Engel³ on welding with lead provides data as to the incidence of lead poisoning among certain categories of workers in this occupation.

Oliver states⁴ that this sign is not of such great importance in regard to the diagnosis of plumbism as certain authors attribute to it, but he admits⁵ that basophilia is most often found in the early stage of poisoning, and this fact is of capital practical importance.

Schmidt, Lutoslawsky, Curschmann, Koelsch, Hamel, Moritz, Grawitz, Behrend, Gilbert, van Embden, etc., are all of opinion that basophilia is one of the initial signs permitting of diagnosis of the poisoning, even before the worker has complained of feeling any affection connected with lead poisoning. Schönfeld⁶ has said that examination of the blood alone allows of detection of lead poisoning. Clinical study teaches the folly of assuming a diagnosis based on any single fact, especially when the latter is the result of a simple method of research. It also teaches, however, that where such a method presents a negative result it does not on that account justify exclusion at the outset of the diagnosis sought for. On the contrary, it must be admitted that Nägeli thought "a definitely positive result, even when it forms the only sign found, is of great value from the point of view of diagnosis".

It has been stated that diminution of the plasticity of the red cells in relation to the variation in superficial tension is also an early symptom (Gilbert, Biondi).

¹ *British Medical Journal*, 1914.

² Quoted by OLIVER, *loc. cit.*, p. 127.

³ *Schrift. aus dem Gesamtgeb. der Gewerbehygiene*, 1925, No. 13, Neue Folge. Springer, Berlin.

⁴ *Loc. cit.*, p. 123.

⁵ *Ibid.*, p. 129.

⁶ *Mediz. Klinik*, 1913.

Syphilis and Lead Poisoning

Dreyer proposed in 1911 to apply the Wassermann reaction to detect lead poisoning during the latent stage. Later research, however, carried out in accordance with the technique suggested by Stern, did not confirm the importance of this reaction. Though there is in fact ground for hoping for the discovery of a specific antigen capable of combining with the specific antibodies believed to be peculiar to the blood of victims of lead poisoning, and so disposing of a means of research of capital importance, it is nevertheless true that up to the present control researches in the clinic and in the laboratory have yielded entirely negative results¹.

Nothing final or completed can be admitted in the field of science. New research is always of advantage, yet in the problem in question it is necessary to adopt the utmost precaution before stating that poisoning has any relation to syphilitic infection merely because the Wassermann reaction is positive. Dreyer found four positive reactions in 35 cases of lead poisoning, Schnitter four cases out of 14 workers in contact with lead, whilst Oliver only found a positive reaction in one case suspected of syphilitic infection. Meantime it is held that a positive Wassermann reaction in the case of a victim of lead poisoning is only a coincidence, and that perhaps a more minute examination and a more careful analysis of the case history would lead to a different diagnosis (development of general paralysis: Sicard and Bloch, etc.).

Uro-Genital System

The elimination of lead by the kidneys² is not without danger for these organs, so important in the economy of the system, and

¹ F. PERUSSIA: *Il Lavoro*, 1911, p. 243, and *Deutsche med. Woch.*, 1912, p. 1559.

² F. PERUSSIA: "La Nefrite Saturnina". *Il Lavoro*, 1911.

"When there are no other factors capable of altering the kidney, lead causes a chronic lesion of the kidney, 'the small atrophic, kidney peculiar to lead poisoning'; which is to be distinguished from the 'small atrophic kidney as ordinarily met with' (ASCHOFF).

OLIVER, *loc. cit.*, p. 201, also holds that in the absence of other causes it is likely that the troubles may be due to lead when chemical analysis reveals the presence of this product in the organs. He does not, on the other hand, admit that the presence of lead constitutes absolute proof, though he adds that neither does the absence of lead exclude the possibility of a form of lead poisoning.

BERTILLON has shown that working painters run approximately five times the risk of dying of chronic nephritis incurred by other men. The

the harmful action of the poison reveals itself already in the early stage of poisoning, affecting the secretory epithelium. At a later period lesions of the connective tissue and the vessels may even be observed. The slow and almost continuous action of the poison is capable of producing in the organ alterations, the final evolution of which is represented by interstitial atrophic sclerosis, resulting in the small atrophic kidney. It is therefore essential to regard the histogenesis of lead nephritis as a process of epithelial

clinical researches of Oliver, Abelsdorf, and Jacob may be quoted, or the laboratory experiments of Jores, etc. (see LEHMANN, *loc. cit.*, p. 212). Peyrot in the French Senate (see *Journal Officiel*, 30 Nov. 1906, p. 1049), stated that "lead passes through the kidney like hail through a window, by destroying it, and at the end of a certain time there is nothing left of the kidney through which the lead has passed".

In 1899, in his *Monographie sur la Néphrite saturnine*, LAVRAND, of Lille, stated that this lesion was rarely found in white lead workers in the towns, but he holds that the kidneys are affected by lead, and that it would be impossible to deny the existence of lead nephritis. The trouble in question is essentially slow of development, very prolonged, and requiring for its development, according to him, a certain predisposition on the part of the patient in addition to the effects of the poison.

According to GOADBY and LEGGE, *loc. cit.*, pp. 72 et seq., a large number of observers have shown the serious damage inflicted on the kidney in the excretion of lead. In practice all medical men are agreed that the kidney is gravely affected in chronic poisoning, and the majority hold that the vessels themselves form the initial seat of alteration. The same authors, on p. 58, draw attention to the really striking proportion of deaths from nephritis amongst the workers in the lead industries. In fact the figure 160, compared with the figure 35 for all other adults, would provide very evident confirmation — if this were necessary — of the fact that chronic nephritis is an almost fatal sequel of lead poisoning. (LIVEN, *loc. cit.*, pp. 3 and 173, also draws attention to the fact that nephritis should be considered as a typical kidney lesion in lead poisoning amongst white lead workers. Goadby and Legge give the following statistics for cases of lead poisoning amongst workers in certain industries (*loc. cit.*, p. 55):

	1910	Probable number of persons employed	Number of examinations	Probable number of reported cases	Affect rate per thousand
White lead			77,752	1,495	34
Paints and colours			19,081	1,590	17
Earthenware and china			78,560	6,547	77

In a total of 204 deaths studied, nervous symptoms were found in 38 cases (10.6 per cent.), nephritis, cerebral haemorrhage, paralysis or chronic plumbism alone or in combination with other symptoms, were found in 188 cases (71.2 per cent.). See also "Statistics" (Part III).

The incidence of nephritis amongst victims of lead poisoning is also referred to by C. A. THILANDER (British Medical Association, Queensland section, Oct. 1925).

The gravity of the action of lead on the kidney has been brought into evidence by Blair Bell, Williams, and Cunningham in the course of research on the action of this metal as introduced into the system for the treatment of cancer (see *The Lancet*, 17 Oct. 1925). This action is so serious that it calls for great precautions in the administration of lead, especially in the case of large doses.

For data furnished in relation to this point by the Norman report, see p. 66, where the so-called action of turpentine on the kidneys is discussed.

degeneration, which evolves slowly into atrophy of the parenchyma, and subsequently into sclerosis of the tissue. The lead acting at the same time on the small vessels, provokes atrophy and sclerosis in the majority of the glomerules. Later, vascular alterations may be observed which, in turn, exert a detrimental action in the evolution of renal cirrhosis for, by preventing the healing process commencing with the epithelium, they thus favour destruction of the tissue.

Examination of the urine often reveals albumin, and in the early stage hematoporphyrin, the expression, according to some authors, of alteration of the normal exchange of the haemoglobin or, according to others, of troubles of the gastric and intestinal function.

It is not necessary to insist on the damage caused to the genital organs and functions both of men and of women, for they are well known and now generally recognised. Of the glands with internal secretion it is the suprarenal capsules which are the most affected by the action of lead. The whole highly important function of the endocrine system is consequently interfered with, and it is easy to deduct therefrom the effects on the clinical picture presented by the patient.

Summary and Conclusion

It follows from what has been rapidly reviewed that the essential symptoms of lead poisoning are: the Burton line, the lead complexion, punctate basophilia, the presence of lead in the urine, and the faeces, hematoporphyrinuria, and digestive troubles. Opinion in regard to the importance of these symptoms is, as has been seen, fairly varied.

Lehmann placed before the Committee of the Geneva Conference the results of an enquiry conducted by him in 1920 dealing with 100 workers occupied in a lead colours factory. He found the following percentages:

Van Embelen, Goetzl, and Neubauer, etc. According to Stokvis, Derokl, and Lecompt, hematoporphyrin is a normal constituent present in very small quantity in the urine (about 1.7 mg. per litre, and in larger quantity during lead poisoning). Chronic, in acute cases momentary, augmentation of the destruction of the red cells, which has, as a counter effect in the bone marrow, an active regeneration of the red cells themselves, provides, according to certain authorities, an explanation of the parallel development of punctate basophilia and hematoporphyrinuria. The former is said to be an early symptom of plumbism (Schmidt), a frequent symptom (Curechmann, Teloky, etc.), a constant symptom (Stokvis); but it is preferable to regard hematoporphyrinuria as a sign of plumbism which should not exclude a thorough clinical examination.

<i>Barton line</i>	Negative 53	Slight 25	Marked up to very pronounced 22
<i>Basophilia</i>	Normal; almost normal 22 96	Evident 98	Highly increased 24
	48		
<i>Hæmoglobin</i>	Normal (80-100) 64	Diminished (75-70) 25	Heavily reduced (65 and less) 11
<i>Albumin (urine)</i>	Normal 90	Traces 6	Evident 4
	96		
<i>Hæmatoporphyrin (urine)</i>	Normal 80	—	Increased 20
<i>Arterial pressure</i>	Normal (up to 135) 75	Slightly increased (140-145) 46	Highly increased (150 and upwards) 9
<i>Energy</i>	Increase (above the average) 31	Normal (average) 58	Diminished 21
	79		
<i>General appearance and complexion</i>	Above average 22	Normal (average) 46	Diminished 33
	68		

To summarise, a quarter of the workers showed a marked lead line, a half evident, up to increased basophilia, a third diminution of the hæmoglobin, a fifth increase of the hæmatoporphyrin, a quarter increased arterial pressure, and a fifth diminished energy. Several of these facts, of course, apply to the same individual.

"It is only when none of these symptoms exist", says Sternberg, "and when the administration of iodide does not reveal lead in the urine, that the existence of lead poisoning can be denied." The absence of some of the symptoms enumerated above, however, does not permit of such a conclusion. An important practical question is to discover if, in default of symptoms, it is right to classify a patient as suspected of malingering, or to designate him as suffering from hysteria or lead phobia. "When all the symptoms enumerated are lacking, and when even the test consisting of administration of iodide of potassium does not cause

¹ *Ztbl. f. Gew. Hyg.*, Feb. 1922, No. 11, p. 49. *Schriften aus des Gesamtgeb. der Gewerbehyg.*, Springer, Berlin.

elimination of lead in the urine, then the existence of lead poisoning may be excluded. The sole lack of red cells with punctate basophilia, or even lack of elimination of lead in the urine, whatever certain authorities may aver, still precludes absolutely the conclusion that lead poisoning is not present."

EARLY DIAGNOSIS¹

Consideration has been given to the problem as to whether it would not be useful to distinguish, in regard to plumbism, between absorption, impregnation, and poisoning. It appears, however, impossible to draw definite distinction between these three stages of the disease, and to determine the point where symptoms of absorption yield to symptoms of impregnation, and later to those of poisoning — an impossibility which deprives of all practical value the attempt proposed by a minority of doctors to interpret the early signs of plumbism simply as indicating a deposit of the toxic product in the system (impregnation), and not as actual poisoning which has not so far declared itself. The advantage of early diagnosis² lies in the possibility of its facilitating timely treatment likely to render a cure possible.

When a doctor with a very sound knowledge of the subject fails to arrive at diagnosis, medical science cannot be held responsible. The intense work of analysis and synthesis which the medical man is obliged to engage in require that he should subject the patient to a comprehensive and minute examination without limiting his observation to probable symptoms of poisoning³. As regards occupational pathology, Ramazzini, and with him all the great clinicians, have insisted on the capital importance of the case history, and require that the doctor should always be acquainted with the occupation of his patient⁴. Rapid conception and a capacity for exact diagnosis, the results of a thorough know-

¹ *Die Frühdiag. der Bleivergiftung*, loc. cit.

² *Ibid.*

³ The Norman report reads as follows on the subject: "It has been alleged that cases among house painters are not verified. It must be remembered in this connection that in lead poisoning diagnosis offers difficulties for the practitioner which he does not meet with in the notification of infectious diseases. There is no standard as to what constitutes lead poisoning, and every medical practitioner must form his own criterion. Appendix III shows that of the cases of house painters reported on by the certifying surgeon only 4.2 per cent were excluded as 'wrong diagnosis', and 3.1 per cent included although doubtful, as compared with 14.1 and 8.0 per cent. respectively for the factory cases."

⁴ *Medici minus plebes curantis est interrogare quas artes exerceant.*

ledge of general, and special pathology, can only be the possession of specially trained physician. He must, however, possess in addition a gift for observation, the clinical sense, and a capacity for co-ordinating the symptoms found. These qualities are sometimes instinctive, but in addition, they demand careful and accurate study (Leube).

To know how to attribute to each symptom found the value peculiar to it, is the essential condition of good diagnosis. Medicine can never be practised by resort to a kind of *va de mecum*, attributing certain groups of symptoms to each disease. The clinical picture is rarely so typical that it permits of ready diagnosis without meticulous cogitation. Even in the simplest cases differential diagnosis is unconsciously effected. The error which results in regarding poisoning as a spontaneous disease is a more serious one than the inverse error. It has often been committed. It is attended by attenuating circumstances in the case of criminal poisonings where the requisite knowledge is always lacking, but not in the case of occupational poisonings, since there the medical man possesses data to aid him, once his suspicion is aroused, to arrive at a fairly accurate diagnosis.

In regard to lead poisoning, clinicians are of opinion that a minute examination of the patient by a trained doctor, even without the assistance of methods of research, suffices for diagnosis in the majority of cases. Jacob even says that doubtful cases are the exception when once it is known that the worker is in contact with lead compounds.

The French Decree of 4 May 1921, relative to the assimilation of lead poisoning to industrial accidents in regard to compensation, cites as follows the symptoms by which poisoning may be manifested: "colic, rheumatism, anaemia, paralysis, encephalopathy, nephritis, gout, amaurosis, arteriosclerosis, cirrhosis of the liver, trembling, cachexy".

Poisoning may be manifested in the most varied forms, which require to be studied from the etiological point of view. The symptoms by which such forms are revealed must not be considered in isolation. According to certain authorities, the diagnosis of plumbism cannot be made without at least taking into consideration four symptoms: the lead complexion, the lead line, punctate basophilia, and hematoporphyrinuria. An attempt has been made above to show the value of each of these symptoms, more especially in regard to early diagnosis. Other signs may, however, be of use from the point of view of diagnosis. Like

every other disease, plumbism is liable to be easy or difficult of diagnosis. In fact the worker occasionally, without any warning signs, presents morbid conditions leading to the diagnosis of kidney disease or disease of the blood vessels, which are but signs of lead poisoning. Cases are known of workers who, having shown the presence of lead in the urine without suffering from lead affections, have become the victims of poisoning several months after leaving the factory.

There are occupations in regard to which a diagnosis of plumbism has been wrongly made, but it may be admitted with Tekey that those in which the presence of the disease is overlooked in diagnosis are by far the most numerous. According to the experiments of Elmann, who examined 30,000 patients in ten years, errors of diagnosis may occur frequently in regard to plumbism where the worker neglects to provide the medical man with accurate information as to the case history, or where the medical examination is a superficial one. Errors in diagnosis (dilatation of the kidneys, intestinal carcinoma, tetany, appendicitis, etc.) which he met with would not have occurred if the patient had been carefully examined. Moreover, Oliver similarly insists on errors of this kind, and quotes instances of surgical intervention in cases of uraemia or colic due to lead poisoning.

Clinical practice cannot be established in accordance with rigid formulae. Diagnosis may not be based on a single symptom and still less on a single laboratory finding. The individual reaction is so strong that it defies all research confined merely to laboratory experiment. The negative results of the Wassermann reaction in victims of lead poisoning suffice to prove that accurate understanding of the factors assembled by a careful examination of the patient can alone lead to correct diagnosis.

It is for this reason that the medical sub-committee on white lead, at the Third Session of the International Labour Conference (1921), unanimously adopted the following Resolution:

Medical science has been able for a long time to diagnose satisfactorily typical and severe cases of saturnism.

Modern methods of diagnosis, in the hands of specially trained medical men, enable them:

- (1) to recognise saturnism in most doubtful cases;
- (2) to exclude cases of alleged saturnism;
- (3) to recognise lead absorption and lead intoxication at an earlier stage than heretofore.

¹ OLIVER, *loc. cit.*, p. 109.

² See also L. STIEFEL: "During the last few years there were sent to the surgical clinic 32 cases of lead poisoning, 19 for the purpose of operation" (*Deutsche med. Woch.*, No. 44, 1923, p. 1502).

EXTERNAL AGENTS

It is evident that dampness, cold, and bad posture represent so many causes of disease amongst painters.

Alcoholism also accelerates poisoning, yet if it be admitted that digestive troubles are an early manifestation of lead poisoning, the temptation which urges the workers to improve their digestion by drinking may well be understood. It may therefore be asked whether alcoholism is not a result rather than a cause of poisoning, in which case there should not be attributed to alcohol a detrimental effect which in reality derives from lead alone. Those cases are very rare, moreover, which provide positive data in support of the opinion that alcoholism is more prevalent amongst painters than amongst other categories of workers¹.

THE CONSEQUENCES OF POISONING

Statistics of all countries demonstrate early sickness and mortality rates amongst painters and varnishers, involving heavy economic loss for the nations affected. It is not necessary to insist here on the danger which lead poisoning represents for the race. Mortality and the frequent incidence of miscarriages amongst women in contact with lead, or amongst the wives of workers manipulating lead, constitute irrefutable proof of the pernicious action of lead and its compounds, an action which it is impossible to deny, even allowing for the fact that the statistics relative thereto are to some extent rendered unreliable by the intervention of other factors such as venereal disease, alcoholism, unduly large families, and difficult conditions of existence.

Goadby has further shown that work involving manipulation of lead reduces the birth rate. Whilst the general birth rate in Great Britain is 162, it is only 155 for painters². This fact is perhaps fundamentally of graver consequence than lead poisoning itself.

¹ See Koelsch, Oliver, and the reports already quoted. It is not without advantage to insist on the danger which alcoholism presents for workers in the toxic industries. All authorities are agreed in stating that alcoholic subjects should be removed from work involving manipulation of lead. SCHMIDT (*Die Frühdiagn. der Bleivergiftung*, loc. cit., p. 45) says: "It remains, however, to be determined whether such workers are more exposed to risk than others, by reason of the fact that they offer reduced resistance, or because they are more negligent, or for both reasons together."

² *The Nation's Health*, 15 March 1922, p. 171.

THE EFFICACY OF MEASURES OF CLEANLINESS

It would be simplifying the question excessively to say that lead poisoning can be avoided by measures of cleanliness³; or, again, that plumbism does not occur amongst workers instructed as to the danger and possessing a sense of responsibility in regard to cleanliness⁴.

It is true that cleanliness should constitute a fundamental principle of modern life and that educating people in matters of hygiene is the duty of all Governments. Unfortunately, however, it is not sufficient to issue theoretical regulations in order to enforce their adoption as recognised custom⁵. As regards white lead, the importance of cleanliness of the hands and of the mouth has always been insisted on by health authorities. Certain experts have suggested the use of soaps and solutions which facilitate the elimination of lead by altering it into an insoluble sulphate. In practice, however, the application of such methods is not feasible by reason of the fact that the workers have a certain repugnance for the use of the specially prepared soaps, which blacken the hands and that, moreover, despite the most careful washing, traces of lead are still left on the skin. No one, however, has entertained any doubt as to the difficulties met with in practice in regard to the installation of washing accommodation in workrooms, and still more so in regard to every effort made with a view to obtaining separate washing facilities for isolated workers. It has recently been proposed⁶ to distribute to workers toilet necessities, which it would be found difficult to provide in the workshops: aluminium boxes containing soap, nail brush, towel, aluminium tumbler, tooth brush, and tooth powder.

THE EFFICACY OF WRITTEN INSTRUCTIONS

Instructions drawn up in popular form have always been widely employed for warning workers of the danger to which they are exposed. In most countries organisation and inspection ser-

³ KOELSCH, SCHÖNFELD, the Geneva report, etc.

⁴ SCHÖNFELD: *Zitbl. f. Gew. Hygiene*, 1921.

⁵ *White Lead*, p. 69. Geneva.

⁶ KOELSCH, loc. cit.

voices distribute these instruction sheets by the thousand'. This work of propaganda has not fully achieved the object in view. Experience has proved that though a certain degree of education and instruction limits the danger from poisoning it cannot suppress it. Without casting any reflection on the occupational dignity of the worker it may be said that prohibition of the use of white lead is necessary in order to protect him from the poison even allowing that he is clearly and intelligent. Rambousek¹ mentions aged, experienced, and instructed workers who were no more fortunate than others in escaping lead poisoning. Can the law be said to exceed its legitimate function in demanding prohibition of a product which only a few workers either by luck on their part or by special carefulness are able to handle without danger?

OPINIONS AND RECOMMENDATIONS OF MEDICAL MEN

At this point in the Report it is of advantage to quote the opinions (sometimes contradictory it is true) of scientists, doctors, and health authorities who have followed very closely the discussions for and against the use of white lead in painting and in industry in general.

It may be readily understood that doctors, usually considering in the abstract the economic problem, should be favourable to the use of a substitute for white lead in painting. It is also true, however, that certain of them have gone very thoroughly into the study of the problem, being led to do so by reason of their official position (doctors of sickness funds, industrial medical inspectors, factory doctors, experts in industrial health, etc.).

In France, at the sitting of 4 March 1901, the Advisory Committee of Public Health adopted the conclusions of Ogier's report.² In Germany at the beginning of the year 1903 Sommerfeld submitted the following conclusions to a public meeting of the Berlin painters' organisation:

¹ Care must, however, be taken to avoid every inaccurate statement, such, as those, for example, made by a lead colours factory, where it was stated that work with ground colours and colours in the form of paste is more dangerous than that involved in the handling of dried colours, and subsequently that careful observation of the regulations would prevent anyone from developing lead poisoning (see TELEKY: *International Hygiene Congress*, Berlin, 1907).

² *White Lead*, p. 73. Geneva.

³ *Loc. cit.*

⁴ See Appendices.

(1) Experience of doctors and the statistics of sickness funds prove that the use of lead colours is responsible for cases of lead poisoning, often resulting in very serious cases and involving incapacity and sometimes death.

(2) Various reports of employers and industrial organisations, the pamphlets issued by dockyards for naval construction and by railway companies, seek to prove that lead poisoning is almost unknown since white lead ground in oil has been used for painting. These reports, however, are confined to a small number of personal opinions totally unsupported by statistical data.

(3) The health of painters and varnishers demands a serious campaign against the lead risk.

(4) If in spite of measures of hygiene adopted cases of poisoning still occur it will be necessary to prohibit the use of lead colours and especially of white lead, by passing a law to that effect.

These principles were again expounded by Sommerfeld at the International Health Congress of Berlin in 1907. On this occasion, he stated that the possibility of substituting harmless colours for white lead had been proved both by his experiments with paint at the Permanent Welfare Exhibition of Charlottenburg and by the success obtained by the firm of Siemens and Halske in the exclusive use of substitutes for lead colours for interior as well as exterior painting. At the same Congress, Mosny and Laubry presented a report on occupational lead poisoning, the conclusions of which were as follows:

When regulation is recognised as efficacious legislative measures should be passed providing for prohibition of the use of dangerous products. For these products there may be substituted harmless products equally satisfactory from the economic and industrial point of view.

As early as the first International Congress for Occupational Diseases, which took place in Milan in 1906, scientists had called for legislative provisions calculated to provide for substitution of lead products wherever this might be found possible and for entrusting to a trained medical man the supervision and protection of workers in those industries in which the worker is brought into contact with lead products. These scientists on the other hand expressed their desire to see progress made in the manufacture of improved substitutes and the hope that new substitutes might be found.

These opinions, which were more particularly based on experiments made in Austria, France, and Holland, have received confirmation from the favourable effects noted on the state of the health of painters. Thus, Teleky, for instance, holds that the remarkable reduction in the incidence of lead poisoning noted

¹ The other proposals of Sommerfeld will be quoted later.

by him in Vienna was rather to be ascribed to prohibition of lead colours for interior work than to precautionary measures adopted¹. Similarly, in 1908 Rambousek stated that the precautionary measures so far adopted could not be considered to have given entire satisfaction, and Koelsch² was obliged in his turn to admit that the measures adopted in Bavaria have not given the desired results.

The fourth Italian Congress on Occupational Diseases (Rome, 1913) also approved proposals tending to prohibit the use of white lead in the form of powder or to limit its consumption by favouring the use of white lead in paste form. It approved likewise the proposal to prohibit the use of white lead in public works or at least on interior work and to replace minium by sesquioxide of iron.

The Queensland Section of the British Medical Association has conducted a vigorous campaign in favour of prohibition of the use of white lead in painting, resulting in the passing of a law partially prohibiting the use of white lead in painting (see Appendices). The Director-General of Public Health at Melbourne, in his reply to the Commonwealth Government, writes in this connection :

No other State appears to have attached importance to the question of lead poisoning (except Queensland), where attention has been directed to the problem in consequence of the attacks made by Drs. Turner and Gibson on the use of white lead for interior painting or for exterior painting in the case of wooden buildings. These two doctors have been conducting a campaign for the last twenty years with a view to proving that lead poisoning among children is much more frequent than is generally admitted and with a view to gaining recognition for the pathogenic theory advanced by Dr. Gibson.

As a result of the report of these two doctors, the Queensland Section of the British Medical Association requested the Minister for the Interior on 12 July 1918 to introduce into a Bill to amend the Health Law a clause concerning the use of lead for painting surfaces within the reach of children.

It was decided that a conference should be held between the Council of the Queensland Section of the British Medical Association and the representatives of the Association of Employers in the Painting and Decorating Industry. This Conference, which met on 25 July 1918, adopted the following resolutions :

¹ Zentralblatt f. Gewerbehygiene and appendices to reports of the English Committee.

² Enquiry into Lead Poisoning, loc. cit.

(1) In order to prevent lead poisoning among children, to prevent crumbling or scraping of paint within their reach.

(2) As such crumbling principally occurs on doors and windows, on railings and lattice work essential that a pigment which does not readily crumble should be used.

(3) The paint used should contain a maximum of lead and a minimum of 40 per cent. of oil. It should be ground in the factory and put on in the form of paste or liquid. They ought to bear a guarantee that they have been prepared in conformity with the above conditions.

(4) The diluting agent used should be a mixture of oil and pure crude linseed oil.

(5) The painted surfaces in question which are accessible to children should be repainted every three years. Yearly washing of such surfaces is recommended.

(6) Absolute prohibition of the use of white lead.

It should be noted that this latter resolution was adopted by representatives of both associations.

A very detailed scientific study has been made by Dr. Young and Dr. Young at the Tropical Institute of Melbourne. The urine and faeces of a certain number of children suspected of lead poisoning were chemically analysed and it was discovered that lead poisoning is not rare among children. In fact, lead was discovered in the faeces of 18 children out of 20 examined.

The spirit which has always animated the Queensland mate health experts in regard to prophylaxis of occupational lead poisoning has been expressed in the report presented to the municipality of Melbourne. In regard to hygiene should be entrusted to the municipality with a view to satisfying the just demands of the public that they may be able to amplify and extend the work undone by private enterprise, too often inefficient.

PART III

STATISTICAL DATA

I. — THE AVAILABLE STATISTICAL SOURCES AND THEIR RELATIVE VALUE

It has been said above that lead poisoning is the "painters' disease" and that attacks of colic are its most characteristic phenomenon. The literature which it is now the intention to analyse proves that this form of poisoning is still at the present time the gravest occupational risk encountered by workers in the painting industry. Cases of plumbism among painters are even said to be, according to Lehmann, of more frequent incidence than formerly: statistics of increasing accuracy do not permit of the conclusion that a reduction¹ has occurred in any country. nor lend support to the view that doctors suffer from a sort of obsession which causes them to see lead poisoning among all those whose work involves contact with lead².

As regards mortality from lead poisoning, Oliver³ states that in *Great Britain* it has not diminished but increased.

In relation to morbidity, Schnitter in *Germany* wrote in 1915⁴ that the incidence of lead poisoning amongst hospital patients might be estimated as on an average from 50 to 100 cases per annum, and he draws attention to the heavy economic loss involved for the individual and community since the hospital could not discharge these patients as cured in the clinical sense of the word, that is to say, fit to resume work. It is unanimously agreed that plumbism constitutes the greatest occupational risk of

¹ *Arbeits- u. Gewerbehygiene*, p. 414.

² *SOMMERFELD*, loc. cit. See also TELEKY: "No case of similar poisoning (lead poisoning) having occurred in the other factories in this industry, the employer was strongly inclined to consider the cases of lead poisoning in his establishment as a pure fiction on the part of the doctors." "War and Industrial Diseases," *International Labour Review*, Vol. III, Nos. 1-2, July-Aug. 1921, pp. 51-77.

³ *The Lancet*, 13 Aug. 1913.

⁴ *Therapeut. Monatschr.*, No. 5.

painters; in *France*, from the time of Layet to that of Laborde, Gautier, Mosny, Letulle, Meillère, Brouardel, Langlois, etc.; in *Germany* Sommerfeld, Koelsch, Teleky, etc.; in *Italy* Pieraccini, Devoto, Giglioli, etc.; in *America* Hamilton, Hayhurst, etc. In *Great Britain* the committees of enquiry into lead poisoning in 1915 stated that "the number of deaths due to lead poisoning amongst painters and constructional workers exceeds by itself alone the total of all the deaths due to lead poisoning amongst workshop and factory workers"; and in 1920 that "each painting causes yearly a greater number of cases of lead poisoning than any other industry coming within the scope of the various legislative provisions relating to factories and workshops".

Statistical analysis reveals numerous cases of plumbism in countries where certain enquiries had led to the belief that the disease did not exist, and shows that the German Sickness Funds have always had their budget heavily taxed in connection with lead poisoning.

It is of course recognised that statistics must be very prudently dealt with when used as the basis of formal conclusions. Morbidity statistics — like any other statistics — are concerned with the enumeration of concrete objects limited in time and space and referring to definite units.

Such statistics are based on multiple and repeated data, and, in the present instance, well-defined occupational categories with reference to age, occupation, and causes of sickness or death for each individual enumerated form the objects of the study.

In reference to statistics, the Medical Sub-Committee of the White Lead Committee of the International Labour Conference of 1921 expressed the following opinion:

In so far as concerns painters using white lead or other lead compound, saturnism is the chief professional risk, but that the statistics are vitiated:

(1) *As to mortality:*

(a) Primarily, by the exclusion of cases of death due to saturnism which are grouped under other headings.

(b) Secondly, by the inclusion under saturnism of cases of death due to other causes.

(2) *As to morbidity:*

By defects in notification and certification, and by other imperfections.

The Sub-Committee adds:

That obligatory notification by a medical practitioner of suspected cases of saturnism, and the certification of these cases by an independent medical man appointed by the State, would give (as is the case in certain countries) satisfactory statistics.

It may be stated that up to the present, statistics relative to occupational poisoning have been vitiated rather by the exclusion of cases of death due to lead poisoning than by the inclusion of cases of death due to other causes. In a single Austrian factory, while the official statistics showed 19 cases of phosphoric neurosis, Teleky found 46; and in the town of Milan, while the official statistics mentioned only one death as due to lead poisoning in 1910, 9 cases of death had been reported during the year to the industrial clinic. To take another example, while from 1910 to 1917 no cases of lead poisoning had been reported among the lead foundry workers of Port Pirie (South Australia), despite the fact that compensation for such poisoning had been legalised since 1912, the hospital of Port Pirie registered 10 cases of plumbism in 1910, 9 in 1911, 21 in 1912, 58 in 1913, 30 in 1914, 22 in 1915, 48 in 1916, and 31 in 1917¹—a total of 229 hospital cases as opposed to nil in the factories.

Notification of the occupational diseases of painters not being compulsory everywhere, all sources will be utilised here, even though certain of them demand cautious treatment.

What are the statistical sources available and what is their value?

Hospital records are very defective and only provide partial information, since the causes of lead poisoning treated in hospitals can hardly represent a quarter of the total number of cases².

Sickness records of factories and workshops submitted to the medical inspectorate can only be utilised with difficulty³.

¹ *Report of the South Australian Royal Commission on Lead Poisoning, 1925.*

² Kasp for Berlin; Oliver for Newcastle; Teleky for Vienna (see statistics for the different countries).

³ This raises a very delicate and serious problem. Many experts have for a long time insisted on the poor value attaching to health records. Thus, for example, whilst the reports of German inspectors for 1913 state that in Hess no cases of lead poisoning occurred in the two white lead works, the local Sickness Fund (of Offenbach) paid compensation in 115 cases, covering 3,006 days of sickness, amongst workers from these factories. The same Sickness Fund had compensated 26 cases of illness (with 466 days of absence) amongst workers from the same works, the form of illness contracted being probably due to the occupation in question.

LEHMANN, *loc. cit.*, p. 214, recalls that there is no doubt that in certain factories the doctor only partially reports cases of plumbism, since many cases of this disease are diagnosed otherwise, and that very often this occurs without any lack of good intention on the part of the doctor.

The relatively brief space of time devoted to consultations, the lack of collateral clinical research, the absence of characteristic symptoms of lead poisoning, the fear of unduly alarming the patient, the silence required with a view to refraining from attracting the attention of the

At the 1912 meeting of the American Association for Labour Legislation¹, the manager of a white lead factory stated that he had not had cases in his factory for many years. He admitted, however, at the same time that he had dismissed every worker presenting incipient symptoms of poisoning.

Even the data of factory inspection services constitute an incomplete source of information, for they only refer to a small part of the existing cases. The 1911 report of the Belgian Medical Service, after recalling the difficulties encountered in the application of the Order obliging working painters to present themselves for periodical medical examination, states that "in these conditions it is not possible to establish any adequate statistical account of the number of symptoms of poisoning found in the course of the medical examinations effected". Had the medical enquiry been extended to include all the members of different local organisations of painters, the results would have been still more striking². Only one further element would be wanting to render such statistics accurate: the record of the workers absent on account of sickness. The following incident given by Francke, offers a proof of the importance of the latter element. In 1910 Prussian factory inspectors reported 619 cases of lead poisoning, in 1911 798, and in 1912 1,119. The sudden increase revealed by the last figure is due to the fact that in 1912 the Sickness Funds had been requested to inform the factory inspectors of all cases of lead poisoning which might be regarded as occupational³.

The statistics of Sickness Funds, however, are not themselves wholly free from criticism. The basis on which they are prepared is neither uniform nor complete. At the twelfth Congress of the Central Federation of German Local Sickness Funds, it had to be admitted that the report on plumbism could not be drawn up

factory inspector and so giving rise to regulations, sometimes also cases of malingerers, especially during a slack period, are all causes, the importance of which must be recognised when passing judgment on the data found in factory health records relative to the incidence of plumbism.

¹ See report, p. 279.

² Enquiries by Koelach, Carrozzi, Helm de Balseac, Agrasse-Lafont, and Feil in the coachbuilding industry, etc.

³ The same increase was observed in Saxony after the regulation providing for compulsory notification of occupational diseases had come into effect on 28 Feb. 1913. Similarly, when the State of New York made the notification of lead poisoning compulsory (1913), the majority of cases notified were found to affect painters; following in order of importance came workers in electric battery factories, and thereafter a very limited number of cases of lead poisoning among white lead workers.

because out of 230 Funds 63 had furnished incomplete data¹. Doubtless the Fund of a trade organisation would be in a better position to furnish an exact account of the morbidity of a category of workers than the local Fund or the factory Fund, but even in such a case it is recognised that the statistical data may be modified according to the manner in which the diagnosis is presented by the doctor².

Thus it is seen that the relative character of existing statistics cannot be denied. It is consequently natural that the desire has been expressed to see statistics established in future in accordance with more rigorous methods. Appended to the majority report of the White Lead Committee of the Third Session of the International Labour Conference 1921 is a report drawn up by the Medical Sub-Committee which, in relation to statistics of lead poisoning amongst painters, approved the following text:

(1) *Morbidity*: The Governments should be invited to take measures necessary to obtain the notification and scientific control of all cases of saturnism amongst painters.

(2) *Mortality*: The Sub-Committees can only suggest that each Government request the assistance of its Registrar-General in devising a method of determining which of the most important diseases of painters exceeded those of the general standard population.

Nevertheless, it would seem probable that even were very accurate statistics established difficulties would always be encountered, the most serious of which are enumerated below.

First of all comes the question of occupation. In small communities the same person may engage in several occupations: the carpenter is at the same time painter, glazier, and even paper-hanger. Even in larger and more important centres there is no true division of labour as regards the operations of whitewashing, coating, and painting. Those who carry out such work are not always classed as painters. Certain workers, even young workers, after having been subjected to the influence of lead or its compounds, quit the trade, but too late to escape its effects. Should they become ill and die of a disease due to lead, their deaths are registered under the name of the industry in which they are working at the moment when the disease occurs. As regards old

¹ BUSCHOLD: *International Congress of Occupational Disease*. Brussels, 1910.

² It suffices to recall on this point the question of complicated diagnosis, the disease being too often classified under the first item of such diagnosis and the second item being entirely left out of account. See also INTERNATIONAL LABOUR OFFICE: *Occupational and Health, "Occupational Diseases"* (under Statistics), by HOFFMANN and PRINZING.

workers, those incapacitated for work have become the inmates of homes or infirmaries, and statistically they would be classed in the category of "individuals without occupation, or hospital patients".

Attention must also be drawn to the varying conditions of work, and consequently of risk, under which workers are employed according as to whether they engage in work as isolated painters or as painters in a large factory.

A second difficulty, not this time concerned with assembling of statistics and their verification but rather with their interpretation, refers to cases of mortality due to plumbism. Appeal has sometimes been made to statistical data in order to prove that cases of mortality from lead poisoning are rare amongst painters above 35 to 40 years of age. Now, it may be imagined that the cause of this phenomena, at first glance rather reassuring, is connected with the excessively small number of working painters above the age in question. For instance, statistics relative to painters and varnishers for 1910 drawn up by the local Sickness Fund of Liepzig, and relating to 18,549 persons, only refer to 4,164 between the ages of 35 and 54, or 22.44 per cent., and 449 between the ages of 55 and 74, or 2.42 per cent. Similarly, according to the enquiry conducted by Kroeckh in Bavaria, painters and apprentices above 40 years of age only represented a percentage of 21.6, and above 50 years of age a percentage of 7.8. Among masters painters 3.9 per cent. were aged from 21 to 25 years, 11.1 from 26 to 30 years, 51.1 from 31 to 45, 11.4 from 46 to 50, and 22.1 from 51 to 65. Is not the very fact that such a limited number of painters reach an advanced age an indication that the trade is an unhealthy one?

A final difficulty of interpretation occurs in regard to the diagnosis which the doctor inserts on the sickness or death certificate. Here the information and experience of the doctor must be taken into account. The knowledge that the doctor possesses in regard to the occupation of the patient and to the dangers to which he has been exposed permit of his effecting more easily an exact diagnosis. On the other hand, a skilled physician able to make an exact diagnosis of poisoning is in a position to detect the existence of a toxic agent, till then unknown or misunderstood, in a certain industry or occupation.

¹ See also later the data for New South Wales, Italy, etc.

II. — THE INTERPRETATION OF STATISTICS

Many nervous, digestive, vascular, and renal forms of disease are none other than the result of latent lead poisoning, and thus receive statistical classification without any mention of plumbism. It may certainly happen that the doctor arrives at the diagnosis of plumbism by reason of the sole fact that the patient has been in contact with lead; yet the experience of industrial doctors proves that the contrary occurrence is more frequent. In the report of a meeting of the American Association for Labour Legislation¹ the statement may be read that there were actually doctors who asked if the operation of scraping minium involved risk for the worker engaged thereon. Would such doctors be capable of a correct interpretation of the statistics in question? It has, moreover, already been seen, in regard to the question of turpentine, what great difficulty is encountered in reading and interpreting statistics accurately.

¹ The Sicknes Fund of Cologne shows for 1920 a single case of lead poisoning amongst painters in Cologne. But, on the other hand, it shows numerous cases of gastro-intestinal troubles. Similarly, as regards disease of the nervous system, the cases reported amongst painters are as numerous as those for metal workers despite the fact that the number of painters is very much smaller. (See *Zitrl. d. christl. Gewerkschaften Deutschlands*, No. 23, 7 Nov. 1921.)

It cannot be denied that many cases of occupational poisoning, more especially in their early stages, escape the observance of a doctor untrained in regard to this work. This is so true that competent authorities have always raised the question of special training for doctors who desire to engage in industrial hygiene and pathology. They have always demanded the institution of special courses during the university career or of post-graduate courses, and numerous countries have now, officially or otherwise, created chairs or clinics for occupational disease. There may be mentioned in this connection the German Association of Lead Colour Manufacturers, which recently gave at the University of Halle a special course devoted to the instruction of factory doctors on the subject of early diagnosis indispensable to satisfactory prophylaxis and on the organisation of research into lead poisoning. There may again be mentioned the courses organised by the *Deutsche Gesellschaft für Gewerbehygiene* (Germany) and those organised, for example, in Italy at several universities (Milan, Genoa, Sienna, Rome, etc.). See, in this connection, the criticisms of TELEKY: "Die Bleifarbenverwendung in Österreich", in *Veröff. aus. d. Geb. d. Medizin*, Vol. XIII, No. 9, 1921.

² Year 1912, p. 278.

³ The technical German reviews of industrial medicine for the year 1921 contain a proposal made by doctors to create lead poisoning statistics based exclusively on the results of blood tests (punctate basophilias). In regard thereto the statement made previously as to individual reaction may not be recalled, namely, that the pathological picture may not necessarily show the reaction by the blood in question. The fact is all the more striking since it is admitted that it is impossible to base diagnosis of plumbism on the positive result of a single symptom. On the other hand, many authorities who have studied the problem of plumbism quote cases clinically proved but which do not present punctate basophilias.

WHAT STATISTICS DO NOT TELL US

Cases of sickness amongst painters examined in private consultation or otherwise by doctors not directly interested in social medicine entirely escape statistical classification. The same is very often true for cases which may be grouped in the category of "sequels of lead poisoning".

"It does not happen, or at least it rarely happens", says Brouardel, "that a person dies of lead colic or lead paralysis, and yet mortality statistics for lead poisoning are confined to deaths due to lead paralysis or lead colic. Very often, however, a patient dies of cardio-vascular degeneration, lesions of the kidneys, or other organs five years after he has left the trade. No indication is thus given that he died of lead poisoning, but the troubles assuredly due to plumbism are imputed to albuminuria, cerebral apoplexy, or heart or kidney disease, etc."

For Mosny, as for Brouardel, and for the same reason, statistics of plumbism fatally omit to take account of a great number of lead victims, and the lead peril is far superior to the indications provided by the best established statistics.

Sommerfeld has shown on several occasions that a fairly large number of lead diseases are not classed as such in statistical returns, but rather under the heading of some other disease, which is often nothing other than a form or manifestation of lead poisoning, which latter remains unmentioned: gastric catarrh, nervous disease, rheumatism, etc. It would doubtless be very difficult to say how many cases under each heading should in reality be attributed to lead, but it is none the less true that, on account of the above, the figure for cases of lead poisoning is in reality superior to that revealed by the statistical returns of the Sicknes Funds. On this point Sommerfeld is in agreement with Neisser and Abele, two specialists who hold that many lead diseases figure in statistical returns under a false flag: what reads as rheumatism, nervous disease, gastro-intestinal catarrh, should very often read lead poisoning, for these diseases are but different forms under which the same morbid cause is manifested.

For Kaup, similarly, statistics provide an unfaithful picture of the extent of the damage, a picture which is rendered still more inaccurate by reason of the fact that workers only apply to hospitals for treatment as a last resort. According to him, the hospital figures ought to be multiplied by four or five. By reason of the fact that manifestations of lead poisoning are so varied and so slightly characteristic, leading to hesitation on the part of the doctor to pronounce the diagnosis of this poisoning, and by reason of the fact that many cases of illness escape statistical classification

because the consequences of poisoning only appear when the worker is engaged in another occupation, the opinion of Bertillon that it is difficult to draw up mortality tables by occupation appears well founded, at least in relation to lead poisoning. Bertillon himself, held, moreover, that painters die of disease due to lead poisoning and especially to Bright's disease, which was of incomparably more frequent incidence in Paris amongst painters than amongst workers not in contact with lead. This opinion is confirmed by English statistics.

The suggestion that diagnosis inscribed on death certificates should be checked by post-mortem examination has long been considered by scientific medical authorities. Without doubt the compulsory application of such a principle would in many cases lead to appreciable progress in medicine; but in regard to the problem which forms the subject of this study, authorities are generally agreed in recognising that autopsy would with difficulty yield decisive indications in regard to the decision as to whether death was due to plumbism or rather to other causes.

CAN LEAD POISONING BE SAID TO BE DIMINISHING AMONG PAINTERS ?

From the fact the gravity of certain forms of the disease has become very much attenuated, certain authorities have arrived at the conclusion that plumbism amongst painters is practically non-existent without at all taking account of the extent and important of the form henceforth known by the name of "mild plumbism".

It is true that reduction of the serious cases, formerly so frequent, cannot be denied. This success is to be attributed to general hygiene, and especially to a more restricted use of white lead. The introduction of mechanical work, wet rubbing down, and good systems of local ventilation—in one word, the campaign against dust—have reduced serious cases of lead poisoning in white lead factories, but they have not completely eliminated them. The placing on the market of white lead in the form of paste has modified the risk for isolated painters, even though this advantage only favours those workers who formerly ground the white-lead themselves. Still it remains true that the number of cases is stationary — if, in fact, it has not increased — and that

the statistics of Sickness Funds reveal the growing importance assumed by diseases of the heart, vessels, kidneys, digestive tract, and nervous system¹.

The most frequent and serious forms, on the other hand, continue to be met with amongst skilled painters and foremen, the reason being that they are engaged on the most delicate and costly interior work demanding the use of pure white lead and rubbing down effected in the dry state².

STATISTICS OF THE WAR AND POST-WAR PERIODS

A factor of first-rate importance occurred to modify the statistical data — the war.

The reports for inspection services in the different countries mention that during the war the majority of white lead factories were closed. They were completely closed in Great Britain during six months in 1917, and in 1918 they only produced 60 per cent. of the quantity annually manufactured in pre-war times. The white lead industry was likewise at a standstill in Hesse, where, for example, for 125 cases of saturnism reported in 1913 in the white lead factories no case was reported from 1916 to 1918. This cessation of the white lead industry during the war must not be lost sight of in interpreting the statistics of this period. The Leipzig Sickness Fund, for instance, in statistical returns relating to cases of plumbism before and during the war³ indicates a remarkable decrease of such cases in 1919. Is it not

¹ It may be added that what Sommerfeld wrote as early as in 1908 is still perfectly true: "When faced with similar declarations drawn from the experience of the master painters of the Rhine Province who, in their reports published by the Federation of Lead Colour Manufacturers in Germany, insist that amongst them and their fellow employers lead diseases have hardly been noticeable, it may be said to be obviously a question of defective observation. In questions of health it is not fitting to confront, as regards supreme and final argument, the declarations of doctors with mere opinions expressed by trade employers". (*Industries Insalubres*, p. 60. Fischer, Jena, 1908.)

² Reply of the National Amalgamated Society of Operative House and Ship Decorators of Great Britain to the questionnaire issued by the International Labour Office.

³ The statistics referred to are as follows:

Year	Cases	Days of sickness	Payment (in marks)
1910-1913 (average)	230	7,950	133,430
1919	20	468	7,210
1910 (1 Jan.-1 Oct.)	6	135	2,300

necessary to interpret such a decrease as proof of the immediate effects of the absence of white lead in paints resulting from the closing of the white lead factories?

It can with truth be alleged that the transformation of factories for the purposes of war industry, though it frequently involved stricter supervision of methods of protection for the workers, also inflicted on the reduced number of medical inspectors an augmentation of work which often obliged them to overlook the notification of cases of poisoning. This fact would not, however, in itself suffice to explain the very impressive reduction of cases of poisoning during the war years.¹

In contesting the reduction in question attacks were made on the accuracy of the pre-war statistics. It was stated that certain means of diagnosis provided for, that is to say, blood tests, permitted of a reduction in the statistical returns and even caused the entire disappearance of cases of lead poisoning amongst painters. It was further alleged against the pre-war statistics that they had included frequent cases of lead hysteria.

The objection may, however, be made to this argument that examination of the statistics of the last few years prove that cases of plumbism are again on the increase. In certain professions with a lead risk this increase is even remarkable and has attracted, and rightly so, the attention of the competent authorities in Great Britain.

It is expedient to emphasise this tendency towards an increase of cases in post-war statistics.² It seems incontestable.

In order to prove that cases of plumbism are not again on the increase, the following facts have been alleged. The report of the Sickness Fund of the painters' trade organisation of Düsseldorf reports a single case of lead poisoning in the course of the last four years. The Sickness Fund of Essen likewise only reports a single case. That of Dortmund, with an annual average of 1,000 members, had six cases in 1911, seven in 1912, ten in 1913, and none in 1919. For Leipzig there has been quoted the analogous data prepared by Schoenfeld, who compares the figures

¹ The large reduction noted in cases of saturnism in Great Britain in 1918 is probably due to suppression of work in 1917. Since workers for many years in contact with lead had time to recover during this period of enforced rest, and as the manufacture was not resumed by the same workers, the new workers engaged on it did not begin to feel any effects till after they had spent a certain time on the work in question.

² *Handelskammer zu Düsseldorf: Die Verwendung von Bleiweiß im Maler- u. Anstreicher gewerbe, April 1921.*

for the period 1910-1913 and the years 1919 (October) to 1920. It has likewise been stated that the local Sickness Fund of Munich had in 1919, with a total of 217,777 members, a single case of saturnism, the Magdeburg Fund a single case amongst 40,325 members, whilst that of Dresden, with 157,000 members, did not report one case.¹ Before, however, drawing a single conclusion from these facts, it would be expedient to consider, together with the cases of poisoning enumerated, the quantities of lead products and of their substitutes used during the period in the question, and in the localities affected.²

III. — THE LEAD RISK AMONGT PAINTERS IN 17 COUNTRIES

The following statistical data have been extracted from the medical literature of those countries which possess statistical returns in regard to lead poisoning, or from information furnished by Governments in their reply to the questionnaire issued by the International Labour Office.

The statistical data in question, being of varied form and applying to different periods, are not in consequence comparable. It has been judged most expedient to quote the statistics for each country in chronological order, without interrupting this order and without contrasting data referring to very distant periods except where the most recent data were found to modify the earliest data.

Australian Commonwealth

At the seventh Session of the White Lead Committee, Mr. Cookson, the Australian employers' delegate, produced statistics based on enquiries effected by the Governments of the various

¹ *Loc. cit.*, p. 88. It is, however, possible to read in the inspectors' reports for 1920 that in Prussia, at Königsberg, for example, no case of lead poisoning occurred because the high cost of lead colours had greatly limited their application in the painting trade. At Cassel the cases reported were due to the use of an olive green and yellow Japanese lacquer containing 15 per cent. of metallic lead, and, in another factory, to the use of "Glaucrite" with a lead content of 1.7 per cent., etc.

² In fact the following extract quoted from the report may raise some doubt as to the impartiality of its editors: "No danger threatens workers in the lead industry if only they observe, like the general population, the ordinary rules of industrial hygiene. The lead industry and lead colour industry of Germany would suffer a calamity with incalculably far-reaching effects if the manufacture of white lead and lead colours were to be prohibited." (SCHOENFELD in *Zitbl. f. Gen. Hyg.*, 1921.)

States of the Australian Commonwealth in which lead poisoning is regarded as an industrial accident. These statistics showed lead poisoning to be of relatively rare occurrence. The morbidity rate is shown to be much the same for painters as for other occupations. At the twelfth sitting Mr. Merry, speaking in the name of the Australian workers, stated that, as a white lead member of the board of directors of the Adelaide Hospital, he had undertaken enquiries in conjunction with the medical man in charge of this service, who had stated to him that the number of cases of poisoning was so restricted that they had ceased to take any account of them. Further, he stated that he could not remember any death from lead poisoning amongst the members of the union of which he was secretary.

The Director-General of Public Health at Melbourne had placed before the Commonwealth Government in 1921 a memorandum which stated :

The question of lead poisoning was made the object of as detailed and careful a study as circumstances permitted. That data assembled, despite their disparity, are useful in throwing light on the proposal submitted to the International Labour Conference in regard to the prohibition of the use of white lead in painting.

In the first place, the table given below shows, in accordance with information provided by the Australian Statistics Bureau, the number of deaths due to lead poisoning, (men and women) in the different States of the Commonwealth :

Years	Total	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania
1908	13	7	1	4	1	—	—
1909	9	2	2	2	2	—	—
1910	15	5	5	3	1	1	—
1911	7	3	1	3	—	—	—
1912	6	3	1	1	1	—	—
1913	10	3	1	6	—	—	—
1914	6	3	—	3	—	—	1
1915	11	3	3	2	2	—	—
1916	18	5	3	8	2	—	—
1917	18	7	1	6	4	1	—
1918	10	6	—	3	—	—	—
1919	18	—	—	—	—	—	—
1920	13	—	—	—	—	—	—
1921 ¹	20	11	—	—	—	—	—
1922 ¹	25	6	2	7	4	1	—
1923 ¹	22	8	5	8	8	—	—
1924 ¹	26	—	—	9	4	—	—

¹ Complete according to the annual statistical reports of the Commonwealth.

This table shows that in the course of 11 years a total of 123 deaths ascribed to lead poisoning has been registered in the various-

Australian States. This figure would represent a very feeble proportion were it required to support the argument that cases of chronic lead poisoning are frequent. However, in the course of the following six years the number of deaths by lead poisoning reached 124.

NEW SOUTH WALES

At the beginning of the year 1922 the Office received the report of the enquiry conducted by the Department of Commerce of New South Wales in regard to the use of white lead in the painting industry.

This enquiry¹ provided information as to the mortality amongst painters and carpenters (in accordance with age groups) during the period 1909-1915 for the Australia Commonwealth, compared with that of the active male population and expressed as a proportion of the number of painters, etc., distributed by age groups on the basis of the figures furnished by the 1911 census.

Number of painters, glaziers, sign painters, paper-hangers, classified in age groups.		Mortality during the period 1909-1915 classified in age groups			
		Painters	Carpenters	Active male population	
Ages	Number	Per cent	Per cent	Per cent	
From 15-19	1,482	2.1	5.5	2.2	
" 20	2,283	3.2	2.6	4.3	
" 25	2,085	4.7	4.1	4.6	
" 30	1,637	6.0	2.8	4.6	
" 35	1,503	5.3	3.0	5.3	
" 40	1,452	8.4	4.8	6.3	
" 45	1,353	10.7	7.6	7.9	
" 50	1,050	12.5	8.5	8.7	
" 55	658	11.0	8.8	8.6	
" 60	429	10.0	9.6	8.4	
" 65	238	8.8	10.3	9.1	
" 70	112	7.0	10.5	9.5	
" 75	73	5.6	10.4	9.2	
" 80	16	2.8	9.1	6.9	
" 85	8	1.4	4.6	3.3	
And 85 and over	—	0.5	1.2	0.9	
Groups of 5 and over	—	26.1	46.5	36.1	
Total	14,309	100.0	100.0	100.0	

¹ See Appendices Nos. 13 and 14, p. 7, of the report.

The particular conditions created by the war being likely to interfere with the accuracy of statistical returns, the figures relating to a period not affected by the effects of the war, namely, the period terminating in 1915, have been chosen in order to avoid the possibility of faulty conclusions.

During the period 1909-1915 the painters and glaziers who died in Australia numbered 1,309, 27 of whom were aged from 15-19, 104 from 20-29, 147 from 30-39, 250 from 40-49, 308 from 50-59, 131 from 60-64, and 342 above that age.

The highest mortality rate for the painters occurs between 45-54 years of age, whilst for carpenters, who may be taken to represent a standard, it was between 60 and 64.

For painters the average age at death is 53.5, for carpenters 60.9, for all workers 57.1. These averages have been calculated for all workers starting at 15 years of age; if 20 years of age were taken as the starting point the averages would be, for painters 54.2, for carpenters 61.6, and for all workers 57.8.

The number of painters on constructional work and of painters in general in New South Wales who died during the periods 1909 and 1913 was 374 (86 in 1920). 48 deaths were due to tuberculosis (11 in 1920), 27 to other diseases of the respiratory passages (6 in 1920), 45 to diseases of the nervous system (11 in 1920), 23 to diseases of the digestive tract (8 in 1920), 57 to chronic nephritis (9 in 1920), and 6 to lead poisoning (2 in 1920).

During the period 1909-1920 the cases of death registered as due to lead poisoning in New South Wales numbered 76 (23 of which occurred between 1909 and 1913). Among these 76 cases, painters on constructional work numbered 22, painters on coach-work 1, and sign painters 1. Of the 23 cases from 1909 to 1913 6 affected painters on constructional work and one case a painter on coach-painting.

The mortality rate for painters and workers in all occupations based on the mortality during the period 1909-1915 is as follows (on the hypothesis that the distribution in age groups and occupations is the same as that of the 1911 census¹):

¹ See pp. 729-731 of the report.

Ages	Painters
	Per thousand
All ages from 15 years onwards	12.9
15-19	2.8
20-24	2.5
25-29	4.1
30-34	6.6
35-39	6.9
40-44	11.1
45-49	14.6
50-54	21.5
55-59	30.8
60-64	43.2
65-69	68.7
70-74	118.0
75-79	143.0
80-84	352.0
85 and over	430.0

Were the mortality rate for painters by groups, states the report, applied to the population, the resulting mortality rate would be 12 per thousand. This rate may be taken as mortality index compared to 12 per thousand for all occupations.

For 1,000 men living at the age of 20 at subsequent ages would be represented

Age	Painters
20	1,000
30	965
40	905
50	795
60	610
70	350
80	90
90	10
100	—
Life expectation at the age of 20	About 42 years

The table below, relative to different causes, indicates excessive mortality rates among painters from certain diseases (page 736, exhibit 16):

Categories (1)	Causes of death expressed as proportion of total number of deaths				Lead poisoning, chronic nephritis and tuberculosis (all forms) (Total of columns 3 to 5)
	All causes of death (2)	Lead poisoning (3)	Chronic nephritis (4)	Tubercu- losis (all forms) (5)	
All occupations (Commonwealth), men of 15 years and over	1,000	0.4	55.2	90.4	146
Painters (New South Wales), 15 years and over	1,000	16.0	152.0	128.0	296

For 1,000 cases of death the cases of mortality attributable to the influence of lead is therefore 150.

The mortality index for different cases of death would be as follows (per thousand) :

	All causes	Lead poisoning	Chronic nephritis	Tuberculosis	Diseases of the circulatory system
Painters	15.7	0.25	2.38	2.01	2.23
Active male population	12.0	0.00	0.66	1.08	1.95

The medical enquiry effected in 1909 by Drs. Chapman and Smith, in collaboration with other doctors, at Broken Hill related to 3,968 workers, 1,697 of whom were miners exposed during a short period, but very considerably, to the action of lead bearing dust (sulphide of lead and blende) and in a lesser degree to that of small quantities of carbonate of lead. Post-mortem examination always revealed the presence of lead in the pulmonary tissues.

16 per cent. of the miners (277 out of 1,697) showed symptoms of diseases which might be attributed to lead, and 1,420 showed no signs of poisoning.

Of 741 workers exposed to the action of lead-bearing dust during less than 10 years, 70 showed signs of poisoning. Of 544 exposed to this dust for over 10 years and less than 20 only 68 revealed symptoms of lead poisoning. Of 289 exposed for more than 10 and less than 30 years 97 showed these symptoms, and

32 out of 123 exposed for over 30 symptoms were noted as affecting 15. 2,271 exposed to a varying degree to

The enquiry conducted at Port Pirie to workers engaged in lead foundries.

During the period 1909-1913 4 families were reported as affecting children of Hill (2 were children aged 12 months and one aged seven years) and were attributed to containing lead.

At the request of the department of statistical returns addressed an enquiry to the Hospitals for Mental Diseases, requesting information on the incidence of lead poisoning as a factor in mental derangement. Whilst the data available on this point it would appear from the information obtained from the most important hospitals of the State that each year amongst painters 1.2 approx. per cent. of the population suffer from derangement following on lead poisoning, whilst amongst other workers of the male sex being 0.3 per cent.

These figures must, however, be accepted with caution, in this computation no account was taken of occupational work, and also because from the definition of lead poisoning exists. They are merely indicated here without any detailed interpretation given them by the investigator.

Badham, the medical official entrusted with the enquiry in the Public Health Department of New South Wales, in 1924 100 painters on coachbuilding were examined on this work in Sydney¹.

According to his conclusions 14 per cent. of the painters had plumbism and 6 of them had recently developed this disease. 12 suffered from a slight form of the disease, 17 might be regarded as suspected cases, but not sufficing to justify a positive diagnosis.

¹ Report of the Director-General of Public Health, 31 December 1924, Section (1), (c), p. 90: "Investigation concerning the Incidence of Lead Poisoning."

QUEENSLAND

The Government of the State of Queensland sent to the International Labour Office the following observations :

At the moment there exists in Queensland no legislation bearing directly on lead poisoning. A Bill is, however, at present in the course of preparation containing the following provision : "From a date to be fixed later no pigment containing more than 5 per cent. of soluble lead compounds shall be employed for painting walls, etc., up to a height of 5 feet from the floor in interior painting and above the floor on exterior work."

There are in Queensland about 3,479 individuals handling lead or lead compounds, of which 1,452 are painters and decorators, 1,320 tinmiths, 292 workers engaged in the manufacture of lead, and others tinmiths, zinc workers, and galvanizers.

No information is available as to the number of cases of lead poisoning amongst painters on constructional work, apart from 7 cases for which compensation was requested under the Workmen's Compensation Act. This number was reported in the course of the three years 1917-1920. During this same period 15 cases of lead poisoning were reported amongst the remainder of the population.

There are in Queensland only two establishments engaged in manipulating lead ore, and production last year amounted to 1,708½ tons. There are no establishments engaged in the production of zinc.

The statistics for Queensland only mention, for a period of several years, 8 deaths due to lead poisoning, 4 of which affected children, 2 young persons between the age of 20-25 years of age, 1 a young man of 19, and 1 a man of 68. In each case death was ascribed to lead poisoning.

Austria

In Austria cases of lead poisoning are often disguised under the names of ordinary complaints, and statistics present a very incorrect picture of the health of painters¹.

With the exception of those of Vienna, painters belong to several different Sickness Funds, but the official enquiry of 1907, the numerous works of various experts, and in particular that of Teleky, for long advisory medical expert to the local Occupational Diseases Fund of Vienna, provide a good idea of the situation.

In 1906 Teleky wrote that in Vienna the use of white lead, especially for interior painting, had declined to a remarkable extent, a statement confirmed by the direction of the Painters' Association.

¹ *Blutergiftungen im Hütten u. gewerbli. Betriebe, Vienne, 1907, loc. cit.* L. TELEKY: *Report on Plumbism presented to the International Health Congress, Berlin, 1907*. See numbers of *Wiener Arbeiter aus dem Gebiete der sozialen Medizin*. The report of TELEKY in the *Ztbl. für Gewerbekygiene*, 1913, and in the *Appendices of the English Committees Report, 1911*. Factory Inspectors' Reports: "Die Bleifarbenverwendung im Anstrichergewerbe," Vienna, 1907 (*Volksschrift über Gesundheitsw. u. Sozialpolitik*, Vol. IX). I. VERKAUF: "Die Arbeiter u. die Bleierkrankungen" (*Volksschrift über Gesundheitsw. u. Sozialpolitik*, Vol. II).

See also TELEKY: *Die Bleifarbenverwendung zu Anstreicherarbeiten*. Berlin, 1921.

Teleky was in a better position than anyone to report the remarkable reduction of cases of lead poisoning amongst Viennese painters, and to confirm the fact that this diminution was due to prohibition of white lead for interior painting, even though this prohibition was still not absolute. The following figures afford proof of this fact :

Years	Number of members in general	Cases of sickness	Duration for each disease in days	Morbidity	Lead poisoning				Diseases of the digestive system			
					Number of cases	Days of sickness	Duration of each case	Mortality	Number of cases	Days of sickness	Duration of each case	Mortality
1901	3,314	1,217	30,429	22.8	33,88	130,3,053	15.0	3.43	—	—	—	—
1903	3,205	1,285	28,542	22.2	33,76	163,3,387	20.0	3.55	—	—	—	—
1905	3,704	1,690	38,186	24.1	40.51	198,3,763	16.9	3.95	100	1,505	11.1	2.06
1907	3,765	1,649	37,659	22.0	39.44	204,4,939	24.4	4.30	103	1,485	10.2	2.51
1909	3,589	1,617	33,297	19.3	41.67	143,2,973	22.9	2.99	122	1,661	12.5	3.53
1911	4,272	1,811	40,218	21.4	40.63	109,2,712	22.6	2.29	117	2,248	16.3	2.50

For the period 1896-1900 statistics show amongst 1,724 painters members of a Viennese Fund an average of 11.9 cases of lead poisoning per hundred cases of disease, and for the period 1901-1905 11.4 per cent. of 3,978 members. The absolute morbidity figure for lead poisoning had been 185 for the first period and 163 for the second.

According to Teleky, cases of lead poisoning amongst Viennese painters subsequent to 1905 were distributed as follows (the figures in parenthesis indicate cases treated personally by Teleky) :

	1906	1907	1908	1909	1910	1911
	229	187	152	129	128	95
	(103)	(98)	(79)	(71)	(73)	(80)

In a workshop where white lead and minium had been used chiefly for the exterior work, the cases of lead poisoning for the same period were as follows :

	1906	1907	1908	1909	1910	1911
Average number of workers	94	75	109	113	114	—
Cases of lead poisoning:						
Absolute number	15	7	28	46	56	36
Percentage	15.96	9.33	25.69	40.71	49.12	—

The number of cases of lead poisoning is very much higher among workers engaged on coating and varnishing than amongst decorative painters (Teleky). In 1906 such cases attained their maximum with 10.68 per cent. amongst workers engaged on coating. In 1911 the percentage fell to 3.68. This reduction is to be attributed without doubt to prohibition of the use of lead colours and mastics for interior painting which came into force on 1 April 1909. Proof of this is furnished by the following table, which furnishes the total number of cases of poisoning among painters, varnishers, and lacquerers, etc., in Vienna.

Years	Yearly average membership			Cases of lead poisoning		
	Men	Women	Total	Morbidity	Days of sickness	Mortality
1910	3,910	7	3,917	138	3,155	—
1911	4,266	6	4,272	110	2,715	—
1912	4,712	6	4,718	116	2,976	1
1913	4,734	7	4,741	86	1,998	—
1914	3,477	7	3,484	53	1,546	—
1915	1,717	8	1,725	10	234	—
1916	1,236	6	1,242	8	258	—
1917	935	7	942	1	5	—
1918	832	25	857	—	—	—
1919	1,702	15	1,717	3	17	—
1920	1,918	32	1,950	1	1	—

* Communication of the Association of Painters, etc., of Vienna, to the International Labour Office. During the period 1910 to 1914, according to the reports of factory inspectors, cases and duration of symptoms of plumbism amongst Viennese painters showed a remarkable reduction. This reduction became still more marked later on, with the result that no further notification of lead poisoning is met with in 1918. This fact cannot be explained as in the case of other countries, such as Germany and Great Britain, save in the following manner: the first period bore the influence of the Order of 15 April 1908 relating to the prohibition of the use of white lead and lead colours for interior work; during the second period the use of white lead had ceased completely as a result of the requisition during the war of metals and consequently of lead. From the moment, however, when industrial activity was resumed, there was immediately, dating from 1919, a reappearance of cases of poisoning, which became still more marked in 1920. The factory inspectors' reports for 1917 (page xxxix) state that no case of lead poisoning was notified amongst painters; the reports for 1918 recall that the limitation of the production of white lead (of the two existing factories one only was working, and merely part time), and the similar limitation of the use of lead colours on the one hand and the lack of these products on the other, explains the very reduced number of cases, none of which affected painters. The reports for 1920 (p. lix) point to the same causes and cite two cases of lead poisoning, one of which affected a painter on constructional work (Vienna).

The strict relation existing between the use of white lead and the incidence of lead poisoning is again confirmed by the following table accompanying the report of the Austrian committee of enquiry:

LEAD POISONING AMONGST WORKERS ENGAGED ON COATING IN RELATION TO THE USE OF WHITE LEAD FOR THE PERIOD 1903-1905

Diseases due to lead poisoning, etc. (Number of cases per establishment)	Total number of establishments		Establishments using white lead			Number of establishments not reporting the use of white lead	
	Establishments	Cases	Number of Establishments	Cases	Amount of white lead used Kg.	Kg. of white lead for each case of poisoning	Cases
1	76	76	35	35	40,076	1,145	41
2	29	58	18	18	16,690	486	11
3	9	27	4	4	3,920	377	5
4	4	16	3	3	6,850	571	1
5	9	45	6	6	12,605	420	4
6	4	24	4	4	18,162	757	3
7	3	21	2	2	11,000	786	1
8	2	16	2	2	32,011	2,001	—
9	1	9	1	1	1,100	122	—
10	1	10	1	1	1,800	180	—
11	—	—	—	—	—	—	—
12	1	13	1	1	3,000	231	—
13	1	14	1	1	9,700	683	—
14	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—
17	1	17	1	1	2,550	150	—
18	1	18	1	1	5,300	204	—
19	1	19	1	1	901	47	—
20	1	29	1	1	8,200	283	—
31	1	31	1	1	20,550	663	—
65	1	65	1	1	220,000	3,385	—
Total	146	508	84	404	413,414	12,491	104

There may again be quoted, according to Teleky, the incidence of lead poisoning amongst the workers in a workshop where white lead was not prohibited and where red lead was abundantly employed for constructional iron.

Years	Average number of workers employed	Number of cases of lead poisoning	Percentage of cases of lead poisoning
1906	94	15	15.96
1907	75	7	9.33
1908	109	28	25.69
1909	113	46	40.71
1910	114	56	49.12
1911	—	36	—

It is equally interesting to note the incidence more or less frequent of lead poisoning in the different workshops, an incidence which may well be said to be in relation to the hygienic conditions and the more or less rational use of lead colours.

Years	Number of establishments in which cases of lead poisoning were reported	Number of workshops with cases of incapacity due to lead poisoning						Total number of cases
		1	2	3	4-6	7-10	and over	
1903	77	49	12	6	5	2	3	163
1904	90	65	13	4	2	4	2	197
1905	94	59	13	9	9	2	2	198
1906	99	56	22	6	6	5	4	202
1907	92	51	17	9	11	3	1	177
1908	73	49	11	5	5	1	2	140
1909	61	40	9	4	5	1	2	116
1910	56	39	10	2	4	—	1	108
1911	49	32	8	6	2	—	1	91

The Parliamentary enquiry has revealed the relation of lead poisoning to the labour turnover. It is certain that temporary workers without instruction and often in very delicate health show little resistance to lead poisoning; in fact, the data for the period 1902-1905 relating to 25 painting workshops in Vienna are as follows:

Years	Number of full time workers	Number of		Cases of sickness reported				Cases of lead poisoning in the middle of the period 1902-1905 (Other diseases in parenthesis)			
		Permanent workers	Temporary workers	Cases	Percentage	Days of sickness	Mortality	Cases	Percentage	Days of sickness	Mortality
1902	628	194	1,764	232	36.9	4,091	7.8	—	—	—	—
1903	719	241	2,120	260	36.2	5,799	8.1	76	10.1	1,679	2.2
1904	790	237	2,249	358	45.3	7,544	9.2	(234)	31	5,040	6.7
1905	884	261	2,527	396	43.9	8,842	10.0	—	—	—	—

For the same period the incidence of forms of plumbism affecting the same individuals (relapses) has been reported by the committee as showing the following values:

Once affecting	263	painters	Five times affecting	6	painters
Twice	85	"	Six	"	4
3 times	25	"	Eight	"	1 painter
4 "	10	"	Nine	"	1 "

The factor "disease incidence" is a factor not only in regard to its relation to instruction but also in regard to its relation to instruction. It is also in relation to his social state, his age, and his occupation. These different relations are shown in the following table:

LEAD POISONING AMONGST PAINTERS

Years	Number of		Workers who fell victims to lead poisoning					Workers		
	Cases of lead poisoning	Signs of lead poisoning	Once	Twice	Three times	Four times	Five times	Instructed	Uninstructed	Backsliders
1902	125	105	90	11	3	1	—	93	12	36
1903	163	124	94	23	5	2	—	100	14	58
1904	197	159	129	27	—	1	2	135	24	81
1905	198	152	115	29	7	1	—	129	23	74

Lead poisoning occurs sometimes in contact with lead. In this connection the following figures:

CASES OF LEAD POISONING

Years	At work		Out of work
	Cases	Days	
1902	84	1,644	27
1903	124	2,647	25
1904	141	2,953	43
1905	138	2,610	37

As regards the incidence of different diseases, that of tuberculosis, the Austrian statistics for the period 1896-1900 and 1901-1905, the figures show that amongst painters, lacquerers and workers

AVERAGE FIGURES FOR THE PERIODS 1896-1900 AND 1901-1905

	Workers engaged in coating only (Andriecher) (Andriecher)		Varnishers		Painters	
	1896-1900	1901-1905	1901-1905	1896-1900	1901-1905	1901-1905
Number of members	1,179	1,888	267	545	1,223	
Plumbism:						
Number of cases	130	146	8	5	9	
Days of sickness	2,812	3,807	140	112	121	
Cases per 100 members	11.0	7.7	3.0	0.9	0.7	
Morbidity figure	2.4	1.6	0.5	8.2	0.1	
Tuberculosis:						
Number of cases per 100 members	4.7	4.3	2.6	4.0	3.4	
Morbidity figure	2.7	2.7	1.7	2.5	2.0	
General morbidity:						
Cases per 100 members	61.5	47.4	33.7	43.7	31.2	
Morbidity figure	14.3	11.1	7.4	11.4	7.0	
General morbidity due to lead symptoms:						
Cases per 100 members	30.5	30.7	30.7	42.8	30.5	
Morbidity figure	11.9	9.5	6.9	11.2	6.9	

After examination of 208 painters, the committee reported the presence of the characteristic lead line in 112 (54 per cent.) cases. 65 showed normal lead line, and 17 a very marked lead line: 50 painters engaged on coating who had the lead line (45 per cent.) had for the most part suffered from several attacks of sickness, 26 subsequent to the year 1902 and 24 previously.

Amongst 50 individuals, 23 (46 per cent.) stated that their first attack of poisoning was to be ascribed to dry rubbing down of coats of white lead and mastics with pumice-stone. Twelve of them fell ill subsequently to 1902 and 2 before that date. These workers complained especially of work effected with closed windows and of dry rubbing down of articles of furniture and of the ceilings. They stated to the committee that they had carefully observed the hygienic precautions and had washed their hands regularly, but added that the strictest regard for cleanliness was of no effect on such very dusty work.

Belgium

The industrial census¹ for the year 1910 furnished the following statistical data relative to the number of working painters engaged on constructional work:

¹ Information furnished by the Belgian Government.

Number of establishments working 6,535.
Heads of establishments (employers, directors, agents, etc.): men 6,510, women 46, total 6,556.

Members of the families of heads of establishments employed as assistants, men 1,981, women 17, total 1,998.

Employees: men 86, women 6, total 92.

Workers: men 6,617, women 16, total 6,633.

Total number employed: men 15,194, women 85, total 15,279.

On the other hand, data relating to workers engaged on different branches of painting are very vague. The classification in the census covers at the same time painters on constructional work, decorative painters, painters and paper hangers, and painters and glaziers. On the other hand, the notification of occupational diseases not being compulsory in Belgium, this country does not possess satisfactory statistics in regard to lead poisoning. It is shown by the data assembled that in 1921 four white lead factories, occupying 215 workers, were in action. Further statistical returns for the year 1919 prepared by the Ministry of Mines provides the following data:

(a) As regards zinc foundries, the number in 1919, as in 1913, was 13. The number of zinc-rolling mills, which was 14 in 1913, was reduced to 12 in 1919. The number of workers in these factories was:

Zinc foundries	1913	1919
Zinc rolling mills	8,529	3,714
	805	776

(b) Four factories for lead and silver, comprising 804 workers, were working in 1919. In execution of the decision of the Minister of Industry, Labour, and Social Insurance, who had undertaken to engage in certain enquiries with a view to finding out the actual situation (1923) in regard to lead poisoning amongst painters, an examination of the working painters of the towns of Malines and Alost was undertaken. 122 working painters were examined in the course of this very limited inquiry. 105 individuals were recorded as enjoying good general health at the time of the examination, 17 were in a medium state of health, 15 showed the lead line, 11 punctate basophilica, four of whom had a lead line, and 11 others with the lead line showed no basophilica.

Without entering into detail in regard to this report¹, it is sufficient to quote the conclusion thereof. Lead poisoning is on the decline to a marked extent amongst painters in Belgium, but nevertheless this redoubtable poison still causes much harm amongst them.

¹ Report of Dr. GLIBERT. See *Bulletin de l'inspection médicale du travail*, 1923, Nos 3-4.

Canada

Sharpe, of Toronto, in the course of an enquiry affected in 1923 examined 132 painters not at that time suffering from lead poisoning, but 13 of whom had suffered from it in the past. He found 40 acute forms of poisoning due to turpentine or benzol used for "flattening" in painting, five cases of poisoning by methyl alcohol, and four by benzine or acetone in the operation of scraping old paint. A medical examination of these painters conducted by Sharpe revealed evident signs of chronic lead poisoning: trembling, myalgia, constipation, digestive disturbances, increased blood pressure, headaches, etc.

The statistical returns of the Division of Industrial Hygiene of the Health Department of Ontario reports 223 cases of lead poisoning in a total of 472 cases of occupational disease, notified with a view to compensation in the course of the period January 1921-July 1923. No distribution of these cases of poisoning according to the occupations concerned is available.

Finland

This country does not produce white lead but has imported it according to the reply sent by the Government to the International Labour Office questionnaire — to the extent of 504,985 kg. in 1913 and 195,393 in 1920. In the same year Finland imported:

	1913	1920
	Kg.	Kg.
Zinc white	1,028,798	787,620
Lithopone and baryta	—	191,270
Metallic lead	859,829	1,044,501
Metallic zinc	300,007	17,280

The use of white lead in painting has considerably diminished. It is no longer employed except for exterior painting.

No accurate statistics are available in relation to cases of lead poisoning amongst painters, notification of cases of poisoning not being compulsory. The majority of cases, however, have received notice in the medical literature of the country by reason of their rare occurrence. Over a period of several years only a few cases occurred.

In 1913 there were 98 workshops in the painter's trade employing 6 children under 15, 27 workers from 15 to 18, and 121 adults, or a total of 154 workers. Two varnish and colour factories in 1917 gave employment to 26 workers from 15 to 18, 44 women, and 49 adults.

The Federation of Finnish Painters reports that for interior work white lead is not at all used and only in small quantity for exterior work. The members of the Federation are compulsory members of a Sickness Fund. The activity of this Fund only dates from two years back. During these two years no case of lead poisoning had been reported. Titaniferous whites are very much used in Finland as substitutes for white lead.

France

According to Treille, 196 painters suffering from lead poisoning were registered in 1864 in the hospitals of Paris.

In 1888 there were in Paris 30,000 painters, and 600 cases of lead poisoning had been treated in the hospitals of the town. Cases treated in the workers' homes are not taken account of in this number.

A report on cases of lead poisoning in the Department of the Seine during the years 1884, 1885, and 1886, presented in 1887 by Gautier to the Public Health Council, showed that during this period the annual average cases of poisoning had been 239 instead of 421 during the preceding triennial period. This diminution was partly attributable to health measures adopted by employers and especially to suppression of the white lead factory at Clichy. The workers chiefly affected were painters, grinders of colour, and whitewashers, among whom 19 deaths were recorded in three years for 481 cases of sickness.

According to the same author, who resumed his enquiry in 1902, it is necessary to distinguish between two periods in the history of lead poisoning in France:

- (1) The initial period from 1876 to 1881 (preceding the regulations of 1881);
- (2) The period from 1882 to 1901 following the vote and the posting up of the regulations referred to.

The results obtained are summarised in the following table:

	1876-1881	1882-1901
Annual number of lead diseases treated in hospital	567	275
Average number of days passed in hospital by each patient	12.6	16.6
Number of deaths per annum	5	16
	(hospital only)	(hospital and towns)

¹ ORLIAC and CALMETTES: *La lutte contre le saturnisme*, Paris, 1912. OFFICE DU TRAVAIL: *Poisons industriels*, 1901. The reports of Mr. BIERON in the *Chambre des députés*, etc. The statistics of cases of lead poisoning compensated in accordance with the law of 1919, in *Bulletin de l'inspection du travail*, 1920, 1921, etc. Enquiry into cases of lead poisoning reported in the hospitals of Paris during the last three quarters of 1911, in *Bulletin de l'inspection du travail*, 1912, p. 483, and 1913, p. 380.

Though in the last few years lead poisoning has considerably diminished in France, painters and colour grinders always suffer most amongst workers exposed to this disease, since painting of constructional work, which brings the worker into direct contact with the poison, is responsible alone for half the cases of lead poisoning. Grinders of colours and painters excepted, the workers the most affected by lead poisoning are those whose trade involves the greatest exposure to lead-bearing dusts.

Amongst recent data relative to the incidence of lead poisoning in France must be quoted that furnished by the enquiry undertaken by the "Administration de l'Assistance Publique" of Paris at the request of the Minister of Labour. The cases of lead poisoning reported in the hospitals of Paris from 1 April 1911 have been subjected to methodical and detailed observation by the hospital services, with the result that the inclusive statistical returns seem more reliable as regards numbers and accuracy of information relative to each case than the statistics so far published in France on the same subject.

The data assembled by this periodical enquiry refer to the last three quarters of 1911 and to the year 1912¹. As regards the years 1913 and 1914-1920, the data provided by the Government in reply to the questionnaire issued by the International Labour Office are given. However, the data relative to the last three quarters of 1917 and to the years 1918 to 1920 only furnish the number of cases without any other indications. These statistical returns refer to 1315 lead victims, but the detailed information only affects 1,285 individuals, 17 of whom are women. As regards age, these 1,285 patients were distributed as follows: 7 under 18 (0.5 per cent.), 34 from 19 to 30 (26.5 per cent.), 373 from 31 to 40 (29 per cent.), 319 from 41 to 50 (24.8 per cent.), 198 from 51 to 60 (15.4 per cent.), 43 to over 60 (3.5 per cent.), and 4 without any age indicated (0.3 per cent.).

According to information provided by the hospitals, the distribution relative to occupation shows that of 1,315 patients 681, or 53.07 per cent., are painters. Further, amongst the remaining cases are to be found occupations which might well be classed in the painting trade (colour grinders, decorators, etc.).

566 of the patients constantly used white lead, 392 red lead, and 114 white lead and red lead.

¹ Statistics of the town of Paris. Report of the deliberations of the Health Council, *Bulletin du Ministère du Travail*, Paris.

Thanks, then, to the regulations of the Health Council, despite the fact that the number of workers exposed to lead poisoning had certainly increased, the annual number of lead victims fell from 557 for the period 1876 to 1881 to 275 for that from 1882 to 1901, in other words to one half.

The average number of days under hospital treatment increased from 12.6 to 16.6, and the number of deaths due to lead poisoning from 5 to 16. Doubtless alcoholism, tuberculosis, and bad general living conditions contributed to increase the morbidity rate. It must not, however, be forgotten, on the other hand, that sickness in workers' homes escapes all statistical record and that amongst the deaths which it causes, those due to lead poisoning are not recorded under their true designation. Thus it may be said that the figures obtained are mostly inferior to the actual number of cases.

As regards incidence of the disease, amongst 1,000 workers 104 cases appeared to be due to the grinding of colours, while 18 should be ascribed to painting of constructional work.

The "Office du Travail", in the publication mentioned, gives for the years 1894-1898, 1,552 cases of lead poisoning treated in hospital with 86 deaths. Half of the patients were painters and varnishers and the remainder workers employed in colour factories.

Painters engaged on coating also show a heavy proportion of lead victims. Their trade organisation has prepared statistical returns showing 18 deaths amongst 200 members during the years 1898 and 1899.

In regard to mortality amongst painters, the following table by Bertillon shows clearly that this category of worker is more exposed to the risk in question than other workers.

TABLE OF MORTALITY IN FRANCE (1883-1889) FOR 1,000 WORKERS

	20 to 29 years			30 to 39 years			40 to 49 years			50 to 59 years		
	11.0	6.6	14.8	14.9	7.0	23.0	21.2	8.7	28.8	31.0	11.4	42.0
Total of the male population of Paris												
Workers												
Painters, glaziers, decorators												

In 1906 Bertillon wrote in this connection :

Of 100,000 Parisians between 40 and 60 years of age there are each year: 97 who die of albuminuria (painters of the same age: 355); 873 of tuberculosis (1,372); 63 of cirrhosis of the liver (94); 360 of respiratory diseases, tuberculosis excepted (537); 181 organic diseases of the heart (260).

As regards diagnosis, the medical observations and the degree of severity of the cases, the replies furnished do not always offer facilities of comparison. 213 patients are designated as affected by general lead poisoning (without any indication as to the nature of the manifestation), 816 are referred to as suffering from colic, 114 as affected by paralysis, and 27 by nephritis. Many of these cases, however, are classified under a double diagnosis: colic and paralysis, colic and nephritis, nephritis and paralysis, and nephritis and gout, etc. The fatal cases appear to amount to 13.

The returns prepared during the war prove that in the hospital of Paris cases of lead poisoning had perceptibly diminished, but that at the same time the average age of the patients undergoing hospital treatment had increased and that a fairly large proportion of cases affected women.

A Medical Study of the State of the Lead Poisoning Question in 1921, edited by Dr. Audistère, of Paris, and submitted (type-written) to the White Lead Committee of the International Labour Conference (Geneva, 1921) by the employers' group, shows (page 23) the following figures:

Cases of lead poisoning reported by:

The town of Paris	1911	1912	1913	1914
The Minister of Labour	391	426	427	298
Hospitals of Paris (number of painters received in clinics)	298	361	342	186
	162	198	186	103

The author is of the opinion — shared by all — that these figures prove how difficult it is to obtain accurate statistical returns. He is, however, led to state that, "taking the lowest figures, painters only account for 50 per cent. of the total cases of lead poisoning".

The French authorities are certainly not ignorant of the enquiry made by Koelsch for instance, nor of the English factory inspection reports prepared impartially on the basis of accurate figures referring to vast numbers. These reports would not permit of confirmation of Dr. Audistère's opinion, that is to say, that "long before the legal prohibition of the use of white lead a campaign against white lead had succeeded in bringing about a considerable and evident diminution in the case of lead poisoning".¹ The article often quoted by Carnot² would not appear to be based on sufficiently positive data, leading as it does to the conviction that lead poisoning had—at this period—almost disappeared.

¹ Loc. cit., p. 24.

² *Progrès médical*, 11 Sept. 1909. Paris.

The report of Dr. Audistère¹ presents statistical returns covering white lead and minium factories, but the figures refer chiefly to Spain for they have also been found in a report² by Dr. José de Elzégui (see under Spain). Apart from this detail, the statistical returns do not state the average annual number of workers employed, which would be essential in order to impart the requisite accuracy to the calculations.

The cases of lead poisoning treated in the hospitals of Paris and the quantities of white lead used (see also Appendices: France) are said to be, according to Dr. Audistère³, as follows for the years 1901 to 1921:

CASES OF LEAD POISONING TREATED IN HOSPITALS OF PARIS

Years	Numbers of cases ¹		Number of painters	Number of deaths ²	Quantity of white lead (paste) in tons
1901	521	148	—	14	19,000
1902	395	149	87	15	
1903	391	108	48	12	
1904	479	132	72	12	
1905	486	286	183	12	16,000-18,000
1906	547	—	—	14	
1907	424	—	—	23	
1908	445	—	—	16	
1909	412	—	—	24	11,000
1910	427	—	—	15	
1911	391	288	162	14	
1912	428	361	198	22	
1913	427	342	186	23	
1914	298	186	103	14	

¹ Verbatim reports of the deliberations of the Health Council.

² Bulletin du Ministère du Travail.

³ Annual statistics, Town of Paris (assistance publique).

For the year 1915 a consumption of 2,000 tons of white lead and 48 cases are reported, for the period 1916-1918 (war period) a consumption of about 5,000 tons and 42 cases in 1916, 8 in 1917, and 7 in 1918. The consumption rose to 9,900 tons in 1919 and the cases to 12, to 13,000 in 1920 and the cases to 16.

In the report presented in the name of the "Commission de l'hygiène de l'assistance", etc., by Senator Pottevin in relation to the Draft Convention on the use of white lead in painting⁴, the patients treated for lead affections in the Paris hospitals numbered as follows:

¹ Loc. cit., p. 18.

² Page 42.

³ Loc. cit., p. 11.

⁴ Senate Order, 1925, No. 616, Extraordinary Session, p. 11.

Year	Patients discharged	Deaths	Total
1911	377	14	391
1912	406	22	428
1913	404	23	427
1915	76	5	81
1916	103	10	113
1917	40	4	53
1918	27	2	29
1919	59	1	90

The situation—says the Reporter—has therefore been incon- testably improved. It remains, nevertheless, still sufficiently serious to call for stronger measures of protection.

To provide an estimate of the incidence of lead affections, there are now available the lists of cases notified in execution of the law of 25 October 1919, which came into force on 27 January 1921, and extends to occupational diseases the benefits of the law of 9 April 1898 relating to industrial accidents.

The record of cases notified for the years 1921-1924 is as follows :

Years	Total number of cases notified	Number of notifications relating to painters
1921	144	13
1921	797	54
1923	1025	76
1924	1343	56

It must here be remarked that the increase in the number of cases notified year by year expresses not a natural increase in the number of cases but a stricter application of the law year by year.

An enquiry relating to painters in the coach-building industry effected by Heim de Balsac, Agasse-Lafont, and Heim in 1921¹ affecting 83 workers belonging to two factories, the majority of whom (about two-thirds) had been employed in the trade for relatively long periods, has given the following results. The lead line was found very marked amongst 25 per cent., and present to a slight extent amongst 40, therefore positive for 65 per cent. of the workers. Punctate basophilia occurred to a marked extent or fairly marked extent in 21 per cent., was rare in 35, being present in a total of 56 per cent. of the workers. Its presence was doubtful in 11 per cent. The presence of lead in the urine was negative for 19 per cent. It was present to a slight degree in 19, traces were clearly present in 49, and marked traces in 19, there- fore positive in 81 per cent.

¹ *Bulletin de l'inspection du travail*, 1921, pp. 223 et seq. Paris.

A past history of colic was given as affecting 6 per cent. of the workers, and arterial hypertension was found in 27 per cent.

The enquiry dealt with workers present in the factory. It showed that polishers and rubbers-down, though engaged on wet surfaces and not directly manipulating toxic products, still repre- sented as regards the lead line and the presence of punctate baso- philia a percentage as high as that shown for finishers and painters, and distinctly higher as regards the presence of lead in the urine and arterial hypertension. This fact is due — according to the authorities — to incrustation in the tegument macerated by the damp, and under the nails of deposits of lead, and to the penetra- tion of lead by way of the skin or the digestive tract.

Germany.

A reduction in the average age of painters is reported for Ger- many in the middle of the nineteenth century. At Frankfurt it was 47 years and 5 months for the period 1820-1852. For 1889-1893 it was not more than 38 years and 8 months. For painters who died of pulmonary tuberculosis during the years 1900-1905 the average age was 36 years and 4 months.

According to Volgelsanger², an enquiry dating from 1896 to 1897 into the state of health of painters in Berlin proved that, according to the local Sickness Fund for painters, 25 per cent. of cases of illness were due to lead, certain of them being extremely serious. In 1896 7.9 per cent. of the deaths recorded were attri- buted to lead poisoning. About half of the fatal cases were due to tuberculosis and a considerable proportion (about 10 per cent.) of the deaths were caused by kidney disease.

The local Sickness Fund of Berlin registered yearly amongst those of its members who were in contact with lead and its com- pounds about 400 cases of plumbism.

¹ Sources : WEYL, loc. cit. LEHMANN, loc. cit. KAUP (*Concordia*) 1907 (*Soziale Hyg.*, 1910). SOMMERFELD (LEYMANN, loc. cit.), GNEHM (*Über die gesetzl. Schutzmassen gegen gew. Bleivergiftung*, Zurich, 1912). WÄCHTER : *Die gewerb. Bleivergiftung*, Jena, 1908. BUSCHOLD (*Congrès Int. Mal. Prof.*, Brussels, 1910). SCHÖNFELD (*Zitbl. f. Gewerbehyg.*, 1921). KLEIN (quoted by the *Zitbl. Gewerbehyg.*, 1916), and again KOELSCH, TELEKY, etc., in the treat- tises on industrial pathology. See *Verbot der Bleiverarbeitung im Maler- gewerbe*, edited by the Association of Painters, Varnishers, etc., of Germany (Hamburg, 1921), reports of the factory inspectors, 1913-1914 to 1918-1919-1920-1922, etc. (During the Conference the employers' group on the White Lead Committee were requested to furnish statistical data quoted in speeches made by their technical experts, but the data in question were never received.)

² See report of the INTERNATIONAL ASSOCIATION FOR THE LEGAL PROTECTION OF WORKERS, Schaffhausen Section, 1903.

For the period 1903-1912 the same Fund recorded amongst its members a total of 22,899 cases with 701,574 days of sickness, i.e. 45.7 cases and 1,401.8 days' absence per hundred members. Colic and plumbism showed 7.1 cases and 268.2 days per hundred members.

These figures have been compared with those presented by the Painter's Fund (at Hamburg), and it is a matter for regret that the annual reports cease at the year 1911 in the one case and 1912 in the other¹.

This comparison is not, however, feasible because the two Funds comprise two groups of workers of totally different composition, and the figures in question refer to a form notoriously difficult to identify (plumbism). It may be added that the Berlin Fund was amalgamated on 1 June 1914 with the General Sickness Fund of Berlin and that of the painters located in Hamburg was dissolved about the same time.

Certain figures furnished by the Central Fund of Berlin offer a proof of the precautions which it is necessary to take before basing conclusions on the figures provided. The statistics of this Fund for 1904-1905 indicated that in 1904 for 5,010 members there were 2,684 cases of sickness, 450 only of which were caused by lead, and that in 1905 for 5,613 members there were 2,805 cases of sickness, 420 only being due to lead. Now a very minute and critical examination furnishes the conclusion that in reality the cases due to lead poisoning number 1,451 in 1904 and 1,195 in 1905².

Thus the official figures of the Sickness Fund were far below the actual number of cases.

Another instance in support of the contention that too much caution cannot be used in the interpretation of the statistics is as follows: the Düsseldorf Chamber of Commerce, reporting a reduction in the number of cases of plumbism in Hamburg, concludes that

¹ MEMORANDUM OF THE DÜSSELDORF CHAMBER OF COMMERCE, 1921

	Number of cases of sickness per 100 workers	Average number of days of sickness per case of sickness	Average number of days of sickness per hundred workers
Berlin: Painters' Sickness Fund	45.7	30.6	1,401.8
Central Sickness Fund for Painters (Hamburg)	30.1	24.6	932.3

² See WÄCHTER, *loc. cit.*, p. 45. See also the reports of the German Inspectors.

the reduction is a result of precautionary measures taken, whilst the use of substitutes for long resorted to on a wide scale among the painters of Hamburg is the true cause of the improvement demonstrated by the statistics.

Further, no account is taken of the fact that this improvement lasted only a certain time: for though the percentage of cases of colic and lead poisoning dropped from 2.4 for 1903 and 2.4 for 1904 to 2.1 for 1905 and 1.5 for 1906, it increased to 1.8 in 1907 and 1908, and 1.9 in 1909, and has remained almost invariable in 1910 (1.8) and 1911 (1.7).

The Central Sickness Fund for painters in Germany has furnished the following figures for 1900-1903:

Year	Members	Lead colic		
		Cases	Days of Sickness	Deaths
1900	6,134	170	5,041	2
1901	6,570	170	5,341	1
1902	7,245	169	6,315	1
1903	7,365	177	—	—

The Painters' Organisation of Leipzig registered, for the first six months of 1902, 558 workers in contact with lead, of which 422 were painters, 115 varnishers, and 21 (*Anstreicher*) workers engaged on coating; 92 cases of sickness were reported, 13 to 14 per cent. of which were due to lead poisoning.

The Painters' Organisation of Dresden numbered 885 members in 1901. In 40 per cent. of the cases of plumbism the average duration of sickness was 47 days.

Mr. Buschold, formerly accountant of the Painters' Sickness Fund in Berlin, and at present director of the Statistical Section of the General Sickness Fund of Berlin, prepared the following statistical reports taken from the pamphlet of the Painters' Union in Germany¹:

¹ INTERNATIONAL LABOUR OFFICE: *Prohibition of the Use of White Lead in Painting*. Issued by the "Verband der Maler, Lackierer, Anstreicher, Tüncher und Weissbinder Deutschlands", Hamburg, 1921. *Studies and Reports*, Series F, No. 5, 1921.

CASES OF LEAD POISONING FROM 1906 TO 1920 (MEN)

Local Insurance Fund for Painting and Lead Trades

Year	All diseases		Lead poisoning		
	Number of members	Number of cases	Total number		Per 100 members
			Cases	Days of sickness	
1906	5,355	2,318	347	12,872	6.48
1907	5,173	2,369	379	13,451	7.33
1908	4,992	2,276	298	13,223	5.97
1909	4,781	2,065	285	11,769	5.96
1910	4,980	2,114	268	11,135	5.40
1911	4,981	2,285	302	12,139	6.06
1912	5,052	2,361	244	9,704	4.83
1913	4,898	2,504	468	19,423	9.35

General Insurance Fund of Berlin Trade Group No. 16 — Building Industries¹

1914	8,419	9,191	274,770	174	5,839	2.07	69.36
1915	3,045	3,967	118,435	40	1,544	1.31	50.71
1916	3,098	3,332	103,918	23	626	0.74	20.21
1917	1,719	1,362	43,168	16	716	0.93	45.14
1918	3,553	3,206	92,922	2	242	0.06	6.81
1919	8,233	3,154	96,602	6	169	0.07	2.05
1920	8,066	4,361	131,461	15	615	0.19	7.62

¹ This table includes masons, carpenters, decorative painters, slaters, well-sinkers, builders or repairers of chimneys, and sweeps.

It results from the above figures that the number of cases of lead poisoning, fairly low in 1918 — 0.06 per cent. for a total of 3,553 workers in the building industry — rose in 1920 to 0.19 per cent. Had the figures for painters been kept separately since 1914, as was formerly done, the increase among the latter would have been much more marked, the number of cases having increased 7½ times.

Painting with white lead having been now resumed, and the painters working without interruption, the sickness statistics will without doubt show a new and considerable increase.

For all the trades together, the General Local Fund for the town of Berlin gives the following figures per 100 members :

Year	Number of cases	Days of sickness	Year	Number of cases	Days of sickness
1914	0.12	4.11	1918	0.01	0.44
1915	0.04	1.28	1919	0.01	0.21
1916	0.03	1.29	1920	0.01	0.47
1917	0.02	0.86			

It will be noted that the percentages given in the preceding table for the building industry are considerably higher, this being most certainly due to the occurrence of lead poisoning amongst painters¹.

The incidence of the various disease forms amongst painters is shown to be as follows :

	Per cent.
Lead poisoning	8.1
Nervous diseases	3.9
Diseases of the heart	1.9
Gastric diseases	2.4
Muscular rheumatism and arthritis	7.3

The total number of days of sickness per member and per year was 13.82. Whilst for the last decade hardly any fluctuations in the number of cases of lead poisoning occur, the percentage of nervous diseases and kidney diseases exceeds very greatly that for cases of lead poisoning.

Cases of sickness with incapacity for work noted in 1925 amongst painters, lacquerers, and whitewashers, entered as members in the General Local Sickness Fund of Dresden, are distributed as follows² :

Diseases	Number of		Average duration per case (days)
	Cases of sickness	Days of sickness	
Exhaustion, anaemia, chlorosis	11	897	81.5
Tuberculosis and suspected cases	32	1,624	50.8
Syphilis	1	20	20
Gonorrhoea and soft chancre	1	57	57
Influenza	40	965	24.1
Other infectious diseases	2	68	34
Tumours, malignant and non-malignant	1	83	83
Diseases of the nervous system	61	2,009	32.9
Diseases of the respiratory passages	57	1,806	31.7
Diseases of the heart and the vessels	30	2,392	79.7
Affections of the digestive tract	49	1,739	35.5
Diseases of the uro-genital system	12	768	64
Diseases of the skin	29	1,205	41.6
Diseases of the locomotor system, gout	85	2,072	24.4
Other diseases of the locomotor system	8	303	37.9
Diseases of the ear	4	92	23
Diseases of the eye	7	187	26.7
External lesions	82	1,803	22
Occupational poisonings	7	141	20.1
Other diseases and cases of uncertain diagnosis	23	569	24.7
Totals	542	18,800	34.7
Figures for 1911	418	8,627	19.2

¹ Prohibition of the Use of White Lead in Painting, loc. cit., pp. 19-20.
² Statistics kindly supplied by Mr. Streine, of Berlin.

The statistical reports of the Local Sickness Fund of Leipzig show interesting morbidity and mortality figures both for the total number of insured workers and for painters. These statistics cover an observation period of ten years¹.

The group comprising painters, lacquerers, varnishers, and gilders represented, during this period, an average of 18,549 members, of whom 13,936 belonged to the age group 15-34 years, 4,164 to the age group 35-55 years, and 449 to the age group 56-74 years². It will be noted in passing that the first group comprised 74.5 per cent. of all the workers belonging to this category.

The cases of sickness for the three age groups in question, as well as the duration in days of the periods of sickness, are distributed as follows (annual average for ten years):

Years	Cases of sickness	Number per 1,000	Cases of sickness	Number per 1,000	Average duration per case
15-34	5,616	402.6	115,667	4.31	20.6
35-54	2,042	490.4	50,130	13.69	29.0
55-74	372	828.5	14,614	40.09	39.4

¹ *Leipziger Ortskrankenkasse-Statistik*, 1910, Vol. I, pp. 131-135; Vol. III, pp. 106 et seq.

² According to the statistics supplied by the German Government, the number of painters, lacquerers, etc., working in the factories or workshops was as follows: 1910, 26,959; 1911, 32,658; 1912, 34,354; 1913, 32,973; 1919, 18,347.

If the different causes of sickness be taken into account, the following values are found for a thousand

Disease forms	15-34
<i>Infectious and parasitic diseases:</i>	
Morbidity	45.3
Mortality	2.15
<i>Other general diseases:</i>	
Morbidity	61.5
Mortality	0.36
<i>Local diseases, nervous system:</i>	
Morbidity	10.3
Mortality	0.14
<i>Respiratory passages:</i>	
Morbidity	53.2
Mortality	0.57
<i>Circulatory system:</i>	
Morbidity	12.1
Mortality	0.22
<i>Digestive tract:</i>	
Morbidity	72
Mortality	0.14
<i>Urinary system:</i>	
Morbidity	5.4
Mortality	0.07
<i>External diseases:</i>	
Morbidity	28.7
Mortality	—
<i>Diseases of the locomotor system:</i>	
Morbidity	30.8
Mortality	—
<i>Diseases of the ears:</i>	
Morbidity	2.0
Mortality	—
<i>Diseases of the eyes:</i>	
Morbidity	7.7
Mortality	—
<i>Other diseases:</i>	
Morbidity	2.5
Mortality	0.22
<i>Tuberculosis (all forms):</i>	
Morbidity	7.8
Mortality	1.87
<i>Poisoning:</i>	
Morbidity	56.3
Mortality	0.29

The Leipzig statistics¹ affecting 25 showing the most common forms of morbidity

¹ *Op. cit.*, Vol. I, p. 131.

number of days of sickness, give per thousand members the following rates of days of sickness :

Diseases	Age group	All occupations	Painters, lacquerers, and varnishers
Tuberculosis	15-34	529	613*
	35-54	858	1,260
Diseases of the heart	55-74	824	1,118*
	15-34	172	288*
Rheumatism	35-54	250	195
	55-74	733	465
Poisoning	15-34	466	620*
	35-54	1,327	1,660
	55-74	2,679	3,383
	15-34	102	1,414*
	35-54	185	2,689*
	55-74	257	5,334*

The figures marked with an asterisk represent the highest number of days of sickness designated by the fund as *Systematische ubertretung*. The painters occupy this unfavourable position in regard to tuberculosis (all forms), rheumatism (muscular, arthralgic, chronic), poisoning, diseases of the nervous system, diseases of the respiratory passages (catarrh, bronchitis, pneumonia), diseases of the stomach and intestines, and eczema. The cases of disease compensated in the course of 1925 amongst painters, lacquerers and whitewashers belonging to the general Local Sickness Fund of Leipzig are classified as follows :

Diseases	Number of cases	Days of sickness	Age	Cases of accidents			
				Up to 4 weeks		More than 4 weeks	
				Number	Days	Number	Days
Affections: anaemia, chlorosis, etc.	59	1,710	—	1	14	—	—
Diseases of the nervous system	49	1,516	70-80	—	—	—	—
Diseases of the respiratory system	134	5,161	35-40	—	—	—	—
Diseases of the circulatory system	27	1,513	40-50	—	—	—	—
Diseases of the digestive system	93	3,127	50-60	—	—	—	—
Hernia, catarrh of the bladder, haemorrhoids, etc.	15	1,034	—	—	—	—	—
Nephritis	7	1,152	—	—	—	—	—
Diseases of the locomotor system	95	2,969	—	—	—	—	—
Diseases of the skin	47	937	—	—	—	—	—
Infectious and venereal diseases	68	1,253	—	—	—	—	—
Diseases of the eyes	9	305	—	—	—	—	—
Diseases of the ears	6	438	—	—	—	—	—
External lesions	88	2,473	—	12	194	5	295
Other diseases	49	1,441	—	1	9	—	—
Total	750	23,349	4	14	217	5	295
		1 case = 31 days		1 case = 14.5 days		1 case = 59 days	

In regard to mortality the local Leipzig Sickness Fund shows for 1,000 insured members and 1,000 painters, etc. (each category being distributed according to three age groups), the following figures :

	1-34 years	35-54 years	55-74 years
Mortality for all occupations	4.41	11.98	35.31
Painters	4.31	13.69	40.09
Mortality from all causes and for total male members insured	2.90	16.04	45.41
Mortality from tuberculosis, all forms:			
Total members	1.90	8.32	9.92
Painters	1.87	8.12	6.68
Mortality from lead poisoning:			
Total members	0.01	0.05	0.20
Painters	0.29	0.72	2.23
Mortality from respiratory diseases (forms of catarrh):			
Total members	0.02	0.09	0.33
Painters	0.14	—	2.23
Mortality from acute and chronic bronchitis:			
Total members	0.08	0.30	1.27
Painters	0.14	0.24	—
Mortality from nephritis:			
Total members	0.05	0.22	0.46
Painters	0.07	0.48	—

The Leipzig returns afford proof of the incidence of kidney troubles (per thousand members of the Fund) amongst painters :

Occupations	From 15 to 34 years	From 35 to 54 years	From 55 to 74 years
	Per 1,000	Per 1,000	Per 1,000
Days of sickness:			
All occupations	33	63	106
Painters	33	111	—
Deaths:			
All occupations	0.05	0.22	0.46
Painters	0.07	0.48	—

Reference has already been made to the statement in the defence of white lead that spirit of turpentine is the cause of cases of gout reported amongst painters. The statistical returns of the Leipzig Fund contain a detailed chapter devoted to this question.

The information contained in this chapter is strictly in accordance with the opinion held by Devoto and his pupils, namely, that lead poisoning favours a uricæmic condition. This morbid form is found to occur 9 times as frequently amongst typefounders,

7 times as frequently amongst lead and zinc foundry workers, and 2.7 times as frequently amongst painters as amongst the other members of the Leipzig Insurance Fund¹.

Koelsch writes that in this connection the difficulty of differential diagnosis renders compulsory reference to cases of gout (2.6 per cent.). Returns for gout show without doubt increased frequency. Data relative to the repetition of former attacks are extremely numerous. The relation between gout and work involving manipulation of lead has long been recognised and proved in an evident and convincing manner by the Leipzig statistics, which offer a comparison of the number of days of sickness caused by gout amongst workers in the various lead industries and amongst workers in other industries.

Age	Number of workers in industries involving manipulation of lead	Days of sickness caused by :		Figures theoretically probable, showing days of sickness caused by gout calculated in accordance with returns for workers in industries other than lead industries	Proportion of the real figure for days of sickness due to gout to the theoretical figure
		Plumbism	Gout		
15-34	13,936	19,508	63	56	Percentage 112
35-54	4,164	9,621	881	250	352
55-74	449	2,404	46	57	81
Total	18,549	31,533	990	363	273

A six degree scale has similarly been established showing the degrees of risk of poisoning and constituted in accordance with the number of days of sickness per annum for 100 workers in each occupation : painters, varnishers, workers engaged in coating (Anstreicher) are found to correspond to the 5th and 6th degrees, and the highest figures for days of sickness affect them².

Amongst all the cases of lead poisoning observed in the Prussian hospitals, about one-third affected painters. In 1889 the number of cases rose to 1,624, whilst in 1902 only 1,225 cases were

¹ Leipzig, *loc. cit.*, Vol. I, p. 96.

² Lead poisoning is so frequent amongst painters that the morbidity rate experienced by them is not even attained by respiratory disease. Amongst varnishers the figures, though lower than amongst painters, are still astonishingly high (*Petition of the Society for Social Reform*, 1923). SCHÖNFELD (*Frühdiagnose d. Bleivergift.*, p. 32) ranks painters as fourth in order of workers exposed to lead poisoning.

reported, which led to the belief that the regulations enforced at that time. For the figures are according to Kaup :

Year	Prussia		Berlin	
	Cases	Days of sickness	Cases	Days of sickness
1904	391	12,246	109	2,246
1905	390	10,183	109	2,246
1906	286	7,709	91	1,709
1907	283	6,629	88	1,709
1908	259	6,211	69	1,709

The opinion of Schnitter as to the incidence of lead poisoning amongst hospital patients in Germany has been referred to. For the year 1913 the following statistics :

Prussia. — According to the factory inspectors, lead poisoning from lead colours still fails very often to be recognised ; of lead poisoning are rare ; the Sickness Fund reports that amongst painters.

Saxony. — According to the differential diagnosis, 10 cases of lead poisoning, of which 8 cases, of which 54 applied to painters ; 88 cases, of which 54 applied to painters ; 74 cases, of which 3 cases, of which 24 cases of lead poisoning amongst workers constituting the staff of a colour factory.

Württemberg. — 66 cases of lead poisoning, of which 47 occurred among white lead workers. The clinical forms reported were 47 times colic, and once paralysis and gout.

Baden. — 53 cases, 29 of which occurred amongst painters, and 3 amongst workers manipulating lead.

Hesse. — The local Sickness Fund received 10 cases of lead poisoning from 9 workshops, 6 of which were amongst painters.

Mainz. — The local Fund received 10 cases of lead poisoning, 14 of which occurred amongst painters.

¹ The inspectors' reports are very eloquent in *Prussia* : "The toxicity of lead colours is even now overlooked". *Württemberg* : "The remarkable incidence of lead poisoning amongst painters is notorious".

In the district of *Chemnitz* 88 cases of lead poisoning were recorded in 1913. Now in the same district only 66 were reported for the whole duration of the war, 3 covering the last two years of the War. Similarly, while 861 cases had been reported at Leipzig during the last five years of the pre-war period, the total for the period 1914-1916 only amounted to 161. In reviewing the reports of factory inspectors for the year 1919 it is noted, for instance, that in Hesse the resumption of work in the white lead factories immediately caused cases of lead poisoning. The workers least affected were those engaged on work in the open air. At Cologne, in 5 white lead factories, 7 cases of colic and 10 cases of disease of the digestive system were notified.

The report of the inspector for 1920 contains the following data, which are characteristic.

At Kreutzberg cases of lead poisoning amongst painters are very rare since lead colours are little used on account of their high cost.

The medical examination of painters engaged in painting ships at Stade shows that of 77 workers 11 had a slight lead line, 5 suffered from slight trembling of the hands, and 2 from muscular pains of occupational origin.

At Cassel the use of an olive green lacquer with a lead basis caused cases of lead poisoning amongst painters in a workshop.

In Saxony 48 cases of poisoning were observed in 1920 as against 19 in 1919; at Chemnitz the situation is favourable because of the restriction of the use of lead pigments; at Dresden out of 20 cases of lead poisoning 5 affected painters, and at Leipzig 2 in 18 cases. The report reveals serious conditions found by the medical inspectorate amongst the workers of a lead colours factory. A blood test conducted at the Health Institute of Dresden gave only 5 negative cases; 6 positive cases were met with amongst workers who had only been working for a very short time. An examination of urine in the case of an elderly worker showed the presence of lead.

Details of the inspectors' reports for the following years, an analysis of which has been made by Brezina and published by the International Labour Office, will not be given here¹.

¹ "Industrial Disease-Analysis of Factory Inspectors' Reports, 1920-1922", *International Labour Review*, Vol. XIII, No. 3, March 1926 and following numbers.

Mention will be confined to certain data taken from these reports. In 1920, cases of lead poisoning were met with among 5 cases in Bavaria, 7 in Saxony, and 4 in 1921 cases were reported from Potsdam, Münster; 11 cases in Bavaria, 14 in Saxony; 15 in the dockyards amongst shipbuilders (to minium); in 1922 several further cases were notified and in Breslau, 6 cases in Bavaria, and 3 in 1923 6 cases occurred amongst 26 painters, 6 cases in the naval dockyards. In 1923 many cases were met with amongst painters in Cassel at Dussekendorf in a white lead factory, and in a painter. At Erfurt 2 cases occurred affecting 6 painters in Thuringia amongst 13 cases of lead poisoning, 6 affected painters on constructional work, and 1 affecting a painter was notified. In 1924 Cassel reported 23 cases of plumbism, 9 cases amongst painters with a fairly short period of incidence. In the year 1923-1924 3 cases were reported from Saxony the increase of cases of lead poisoning is very remarkable, for 171 cases were notified which affected painters. The Health Institute in Hamburg has devoted special attention to lead poisoning in industry and in relation to each test is effected by the Institute. In the year 1923-1924 23.6 per cent. of the cases related to painters in workshops engaged in painting failed to meet the conditions of the Order of 27 June 1905 of the Reichstag were lacking in any hygienic accommodation.

The regulations therefore were not as strict as had been hoped amongst painters, while Kaup has brought into evidence the good results obtained in prohibiting the use of lead colours for interior painting.

Amongst all the disease forms reported lead poisoning shows the most frequent incidence. A report relating to 283 workers engaged on different occupations shows the incidence of colic in relation to the age

Forms	Absolute number of cases	Workers of 15-20 years of age : 16 per cent.	Workers of 20-30 years of age : 41 per cent.	Workers of 30-50 years of age : 37 per cent.	Workers of 50-70 years of age : 7 per cent.
Colic	105	15	39	46	5
Lead poisoning	108	5	25	69	9
Various symptoms	70	3	15	42	10
Total	283	23	79	157	24

Tietz¹ in his thesis (somewhat out of date) relates that amongst 142 cases of plumbism treated in the medical clinics, colic was noted 122 times, arthralgia 55 times, paralysis 19 times, and nervous troubles 15 times.

Even when all the symptoms cannot be attributed to lead, the majority of them are, in the case of victims of lead poisoning, incontestably caused by this metal. Returns of the Sickness Funds give almost invariably about 160 cases per annum of poisoning involving 4,500 days of sickness, which might appear of relatively small importance were it not for the fact that chronic poisoning is often disguised under other disease forms² and when those are taken into consideration different figures are obviously the result : about 1,500 cases of poisoning per annum with 37 to 38,000 days of sickness, figures which endow the action of lead with an importance which would not attach to it in accordance with the preceding data.

The figure of the local Sickness Fund of Berlin (1912) provides proof of what has just been stated :

	Number of members	Case of poisoning	Nervous diseases	Diseases of the heart and kidneys	Digestive diseases	Rheumatism	Total
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Painters, etc.	1,884	3.10	2.5	0.9	2.60	3.90	13.00
Total number of members	68,831	0.18	2.28	0.89	2.54	3.22	9.07

¹ Leipzig, 1892.

² "All the numerical data constitute minima, remaining well under the actual rates of morbidity since a certain number of clearly-defined lead diseases are not classed as such but rather under the designation of some symptomatic affection of lead poisoning such as gastritis, rheumatism, etc." (*Petition of the Society for Social Reform*, 1903).

It is obvious that subjects whose symptoms are weakened by other disease forms become more readily the victims of lead poisoning, and that similarly those who are affected by plumbism offer less resistance to infectious diseases. Thus it is easy to explain the incidence of fatal cases of tuberculosis, typhoid fever, etc., amongst painters.

As regards other diseases, the statistics of the Leipzig Sickness Fund prove that the number of days of sickness due to articular, muscular, or chronic rheumatism is higher for painters at all ages than for all other occupations.

Cases of articular rheumatism	From 15 to 34 years	From 35 to 54 years	From 55 to 74 years
All occupations	485 139	1,327 65	2,679 94
Painters	620 181	1,650 116	3,383 —

Similarly, the figure relative to deaths per 1,000 members provided by the Sickness Funds (men) are also higher amongst painters.

Disease	Occupation	15 to 34 years	35 to 54 years	55 to 74 years
Acute articular rheumatism	All occupations Painters	0.04 0.14	0.02 0.24	0.03 —
Chronic articular rheumatism	All occupations Painters	0.01 —	0.08 0.72	0.28 —
Muscular rheumatism	All occupations Painters	0.01 —	0.05 —	0.46 2.23

Alongside of the general reduction in industrial activity, one of the essential factors of the diminished rate of lead poisoning in Germany has been the reduced production and use of lead compounds.

The production of white lead, which was for the period 1910-1913 about 32,000 tons, fell subsequently to the following rates :

Tons	1918	1919	1920
1914	21,534	102	
1915	4,933	6,815	
1916	2,482	8,762	
1917	410		

The Sickness Funds were obliged at times to pay over a period of several years of sickness premiums for certain cases of plumbism which reached the amounts of 1,078, 1,460, 1,489, 1,723, and 2,609 marks. When the sum expended on a patient does not exceed a total of 1,000 marks it may be concluded that benefit has only been paid during a limited period¹.

The total amount expended in compensation and benefits covering hospital treatment reached the following amounts²:

Disease	1903	1905	1907	1909
Attacks of colic and lead poisoning	Marks 27,177.95	Marks 32,281.50	Marks 26,691.25	Marks 25,354.50
Nervous diseases and kidney diseases	11,957.65	19,573.50	29,367.75	27,043.75
Articular and muscular rheumatism	13,291.00	16,715.50	18,573.25	17,175.00

The total sums for the above diseases amount to 197,607.95 marks for lead poisoning, 160,619.90 for nervous and kidney diseases, 122,221.40 for articular and muscular rheumatism, 39,097.30 for diseases of the stomach, and 510,546.55 for all other diseases.

The total sum expended during the same period from 1903 to 1909 for affections of the respiratory system, that is to say, all diseases of the lungs, including tuberculosis, only amounts to 219,092.10 marks.

The statistical returns prepared by German employers in the lead colours industry show for 1905 to 1910 an annual average of 221 cases of plumbism, with 3,926 days of sickness; the general local Sickness Fund of the town of Leipzig gives the following figures for incapacity for work caused by lead poisoning:

Year	Men	Women	Medical benefits
1910	298	26	Marks 9,465
1911	190	21	7,138
1912	170	24	5,070
1913	211	45	9,126
Total	838	116	31,399
Annual average	210	29	7,850

¹ BOSCHOLD, *loc. cit.*

² SCHÖNVELD, *loc. cit.*

Bavaria. — The data assembled by Koelekh in the course of an enquiry¹ instituted by the Minister of the Interior of Bavaria (10 April 1910, No. 8698, II) deals with 5,000 working painters and varnishers. The enquiry was carried out during the year 1910 and a part of 1911, that is to say, 5 years after regulations of the work of painters came into force, with the object of reducing the lead risk and instructing the workers as to the danger by which they were threatened. No decided improvement² could, however, be observed. The conclusion to be derived therefrom is that the sole means of arriving at a radical solution would be the substitution of other products for white lead. This conclusion is all the more interesting since Koelekh, like the majority of German scientists, was chiefly interested in the effect which any radical measure would have on the general national economy, and since as early as this date the use of lead colours, and particularly of white lead, was very restricted, and the use of substitutes had attained considerable developments.

The examination was restricted to workers fit for work or absent on account of slight sickness, but did not take into account those who were really ill. Further, a certain number of workers examined had not been in contact with lead compounds. Despite all this, the enquiry led to the establishment of figures permitting of the conclusion that painters occupy the third place amongst workers exposed to lead poisoning.

Incidence of the Disease. — Better conditions of life cause master painters and foremen to enjoy a better state of health than apprentices. This, however, did not prevent the following state of affairs occurring during the period 1907-10, viz. 26.1 per cent., that is to say, one quarter of all the members of the Painters' Organisation becoming victims of the disease, the rates being distributed as follows: 21.3 per cent. of the foremen and 27.2 per cent. of the apprentices.

¹ *Loc. cit.*

² In the report of 1913 it is stated that cases of lead poisoning exceed 50 per cent. of the cases notified. The local Sickness Fund of Munich received 215 notifications of occupational diseases, 208 cases of which were lead poisoning; 135 of these cases affected painters. The Reporter states: "Lead poisoning among painters will never be reduced except to a very slight extent unless absolute prohibition of the use of white lead and lead colours is introduced." The report for Northern Bavaria contains the statement that the cases notified only constitute a part of those which really occur.

The number of painters of Southern Bavaria treated in the Munich hospitals is as follows for the years 1896-1910 :

1896 . . . 47	1900 . . . 54	1903 . . . 38	1906 . . . 21	1909 . . . 19
1897 . . . 41	1901 . . . 34	1904 . . . 24	1907 . . . 26	1910 . . . 26
1898 . . . 51	1902 . . . 33	1905 . . . 28	1908 . . . 22	

The percentage of diseases among painters (foremen and apprentices) is as follows : diseases of the respiratory passage, 3.74 ; pulmonary tuberculosis, 6.8 ; diseases of the digestive tract, 3.3 ; nephritis, 0.3 ; gout, 0.7 ; skin diseases, 0.84 ; anaemia, 0.1 ; turpentine poisoning, 0.04 ; articular rheumatism, 1.9 ; rheumatism, 2.8. All the above percentages were higher for painters than for other occupations. Owing to lack of statistical data it is necessary to refer to the statistical returns of the Leipzig Fund for confirmation of this.

In fact, in respect of 1,000 workers rendered incapable of work, days of sickness were distributed in regard to age groups as follows :

Occupations	15-34 years	35-54 years	55-74 years
For all occupations	6,980	11,107	20,568
For painters	8,300	14,200	32,615

Thus the occupational morbidity of painters exceeds the average for all age groups. Amongst the most frequent disease forms the enquiry notes : rheumatism, 10.8 per cent.; pulmonary tuberculosis, 6.8 per cent.; digestive affections, 10.3 per cent.; respiratory diseases, 10.9 per cent.; and infectious diseases, 8.5 per cent.

Amongst the rheumatismal forms of very frequent occurrence, the majority of those not due to lead are ascribed to chills. The diseases in question reappear annually and partly explain the relatively high mortality from respiratory diseases, attaining a mortality rate of 41.6 per cent. and even 47.4 per cent.¹

According to Koelsch diseases of the lungs may not be attributed to the action of dust in an unduly large proportion, since rubbing down and scraping are for the most part done wet. Yet despite this improved process the high morbidity rate among painters still continues. For tuberculosis the statistical returns of Leipzig quote the rates of 7.28 per 1,000 as against 3.07 for all males in 1908.

¹ Central Fund of German Painters, 1905. Local Painters' Fund of Strasburg, 1902.

Diseases of the digestive tract are very frequent amongst painters (10.3 per cent.) and particularly stomatitis, as well as a bad condition of the teeth attributed by certain authorities to the local action of lead. The use of substitutes for turpentine (heavy oils, hydro-carbons, etc.) causes cases of poisoning in addition to the poisoning due to lead pigments.

In order to obtain a more exact knowledge of the health conditions of all workers, Koelsch undertook an enquiry into the living conditions of each individual. The data assembled in this connection may be accepted with all confidence as they have been collected by trained medical men.

Of 5,000 workers examined, 691 (13.82 per cent.) had suffered once at least from a symptom of lead poisoning. Roughly a quarter were foremen and three-quarters apprentices. Lead poisoning figured in 50 per cent. of the cases of sickness. Further, in a district where holiday centres were found and white was very much the fashion, giving rise to the use of pure white lead, the morbidity rates were considerably higher.

For two-thirds of the workers the disease was limited to one attack (66.6 per cent. one attack, 16.8 per cent. two attacks, 6.2 per cent. three attacks, 10.7 per cent. over three attacks).

It is hard to say which manifestation of lead poisoning occurred most frequently, since the same individual often presented several different symptoms of poisoning. Colic in general appeared alone (85.7 per cent.) and more rarely in conjunction with other symptoms. Paralysis was present in 3.5 per cent. of the cases, nephritis in 1.4 per cent., and arthralgia in 2.7 per cent. of the cases.

According to Koelsch, the 1,454 workers interrogated in the dockyards (20 per cent. of the total number dealt with in the enquiry) and affected by lead poisoning, presented or stated that they suffered from 2,298 symptoms or subjective troubles, that is to say, 158 symptoms per 100 individuals.

In the first place, he found the Burton line amongst 590 workers (40.6 per cent. of the 1,454 examined, and 11.8 per cent. of the total number affected by the enquiry) ; diseases of the vascular system—pulse tension, hardness and sinuosity of the arteries, and that at times amongst very young patients, and apparent only to a slight extent (23.4 per cent. of the workers examined and 6.5 per cent. of the total number affected by the enquiry). Anaemia and pallor were found to be very common, and are similarly characteristic symptoms of lead poisoning (22.5 per cent. of the 1,454 workers examined and 6.5 per cent. of the total) ; headaches

(18.6 per cent. of those examined, 5.4 per cent. of the total). Still greater importance attaches to the relatively frequent complaints in regard to digestive troubles (12.5 per cent.), such as lack of appetite, gastralgia, slight abdominal pain, irregularity of the bowels (11.6 per cent.), and constipation alternating with diarrhoea, etc.

Despite the fact that it must be recognised that a great number of cases of sickness are to be ascribed to all possible causes, and that consequently very rigid conclusions must be avoided, Koelsch holds that it is precisely the presence of these indefinite symptoms which characterises the early phases of chronic lead poisoning. The 169 cases of chronic constipation, sometimes accompanied by slight spasmodic pain, must certainly, according to him, be attributed to the effects of lead.

The above remarks impart a significant importance to the frequent headaches, more particularly those affecting the back of the neck, which were found in 270 cases — 18.6 per cent. of the cases examined, and 5.4 per cent. of the total number of workers affected. 6.5 per cent. only of the cases examined presented symptoms of neurasthenia. The following nervous symptoms (with the exception of headache and vertigo) strictly connected with chronic plumbism, have been reported :

Disease	Number of cases	Percentage of cases among 1,454 workers examined	Percentage of workers forming the subject of the enquiry (5,000)
Nervousness and neurasthenia	95	6.5	1.9
Epilepsy	1	0.1	0.02
Weakness of the forearms	5	0.2	0.1
Trembling of the hands	175	12.0	3.5
Visual derangement and atrophy of the optic nerve	6	0.4	0.1

The enquiry provides no data in regard to cerebral forms, but Koelsch, in a single hospital in Munich during the period 1904-1910, reported 5 cases due to lead poisoning. The enquiry records three fatal cases affecting middle-aged foremen.

The effect of plumbism on social economy is proved by the duration of cases, which exceeds that for diseases affecting other classes of workers¹.

¹ For a high percentage the duration of sickness exceeds 5 weeks, 19.2 per cent. had a duration of one week or less, 18.7 two weeks, 16.7 three weeks, 16.2 four weeks, 30.2 over four weeks.

According to a computation made by Koelsch, 691 workers, victims of diseases due to lead poisoning, lost about 3,208 weeks, or 61 years of work. It would not be difficult to calculate the loss in wages and the social loss, especially taking account of the fact that lead poisoning favours the origin of infectious diseases and thus contributes to racial degeneration.

The enquiry proves also that five years in contact with lead suffices for inducing poisoning in any worker. In fact early symptoms appeared amongst 9.1 per cent. of the workers aged under 15 years, 23 between 16 and 20 years, 18.6 between 21 and 25 years, 17.5 between 26 and 30, 13 between 31 and 35, 8.5 between 36 and 40, 8.5 between 41.50, and 1.8 between 51 and 60. A quarter of the cases were found amongst workers aged between 16 and 20.

In considering the different branches of the painting industry covered by the enquiry in question as possible causes of lead poisoning, Koelsch found that 43.4 per cent. of the cases were due to actual painting, 24.8 to grinding and mixing of colours, 6.8 to rubbing down, and 24.4 to lack of cleanliness.

The inspection service has drawn attention to the lack of cleanliness, bad hygienic conditions of small workshops and dirty conditions of tools, and the pernicious influence of backward and prejudiced ideas of certain employers in regard to the education of their apprentices, etc.

In regard to the effect on painters of the regulations of 1905, Koelsch has noted a remarkable reduction of cases immediately following the application of the Order; but since then the situation has remained unchanged and there is no appreciable improvement. If cases of colic be compared for the two periods of 4½ years preceding and following the date of the Order, it will be found that in the second period cases of colic exceeded those in the first period by 125. In explanation of this paradoxical result it must be admitted that conditions had changed in the course of the second period. There were in fact in the second period a larger number of workers employed, hence the higher absolute figure for cases of colic. Morbidity figures increased further on account of the fact that apprentices were more numerous. On the other hand, diagnosis had been more rigorously executed by the doctors. At all events, even though it may not be said that conditions grew worse, subsequent to the application of the Order, neither can it be said that the Order was followed by considerable improvement in the state of health of painters.

In conclusion, it may be stated that 29.1 per cent. of the workers asserted they had suffered from or presented symptoms (19.9 foremen, 80.1 apprentices). No account was taken of cases involving slight or temporary affections. 11.8 only of the total, but 40.6 per cent. of those reported sick showed the lead line.

Great Britain

In Great Britain¹ attention has for long been called to the danger of lead poisoning, and regulation of the lead trades (pottery industry, white lead industry), house painting, and coach and wagon painting on the other hand, prove the existence of a real danger. A certain number of employers stated before the 1911 committee of enquiry, which had confirmed the incidence of lead poisoning amongst painters, that they were not aware of the seriousness of the ravages caused by this disease in the painting industry.

The terms of the Act of 1895 relating to Factories (section 73 of the Factory and Workshops Act, 1901) demand notification of cases of lead poisoning by doctors who meet with such cases. They do not, however, apply to painters engaged on house painting. Each year, however, doctors have notified voluntarily a large number of cases affecting this trade, though for certain of them it would be difficult to determine whether they come within the terms of the Factory Act or not. For such doubtful cases, fairly frequent amongst painters engaged in house painting, the inspector of factories is powerless to reduce the risk of poisoning, for since the law does not cover cases belonging to this category, notification of these has no effective result.

The census of 1891 included 160,201 painters and varnishers : that of 1911 181,613 painters only. The factory inspectorate estimates that for the period 1901 to 1911 the number of painters amounted to about 150,000.

¹ See reports of the year 1915 and 1920 of the English Committee on Lead Poisoning in the Painting Industry, appointed 1911. Oliver : *Dangerous Trades*, London, 1902. *Diseases of Occupation*, London, 1908. *Lead Poisoning*, London, 1914. Goadway and Legee : *Lead Poisoning and Lead Absorption*, London, 1912. Legee : *Annual Reports of the Chief Inspector of Factories, 1910-1924*. See also the *Report presented to the International Congress of Occupational Diseases*, Brussels, 1910 : *Memorandum on Industrial Lead Poisoning* : HOME OFFICE, FACTORY DEPARTMENT, London, 1921, etc. : *Report presented in February 1923 by the Committee on Industrial Paints* (appointed in 1921) to the Home Office regarding the Use of White Lead in the Painting Trades.

It is very difficult to calculate cases of lead poisoning amongst painters¹ ; using as a basis the cases voluntarily notified by doctors during the fourteen years (1900-1913), an annual average of 720.5 cases, or about 4.8 per thousand, is found. This figure, relatively low, is worthy of attention. It must in fact be recalled in this connection that painters do not work more than 9 months per annum : that the quarter during which they remain idle allows of the system eliminating, at least to a partial extent, the lead assimilated, and also that an ever-increasing number of workers are manipulating paints without a lead content. The witnesses heard by the 1911 committee of enquiry deplored the number of cases of sickness and death caused by lead poisoning, and recorded officially, and urged the absolute necessity for undertaking action with a view to improving the situation.

The number of cases of lead poisoning amongst painters engaged in house painting notified to the Factory Department reached its maximum in 1913. This figure has commenced to diminish since the beginning of the war (1914) as the lead market became controlled by the Government, and there resulted a great decline in the production of paints with a lead content. Cases diminished rapidly during the years 1914-1918. Though lead paints were again used in great quantity, the total number of cases is not very high perhaps by reason of the fact that the quantity of lead accumulated in the system of painters in the building trade had not yet reached, since the war, a sufficient amount to cause poisoning. Nevertheless (as indicated by the figure in parentheses in the table on page 173) the number of deaths which occur amongst these workers has not diminished in proportion to the number of cases. This fact is not surprising in view of the fact that deaths are due to chronic poisoning amongst painters who have abandoned their trade, or who, failing to find work in the painting industry, have gone into other trades.

The figures given for the other industries studied, and especially for carriage building, show a similar trend. In the case of naval construction, however, decrease of cases only became marked towards the end of the war. The lower figure, corresponding to the year 1921, is due without doubt to the crisis which at that time affected this industry.

¹ See *Reports of the Chief Factory Inspector*, and especially the *Memorandum* quoted in the preceding note and published by the HOME OFFICE, FACTORY DEPARTMENT, in 1921.

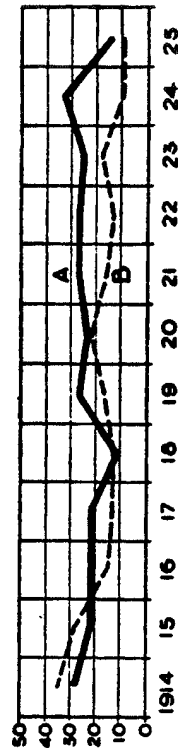
CASES OF LEAD POISONING IN GREAT BRITAIN (1914-1925) *



* A Cases of lead poisoning compulsorily notifiable.
B Cases of lead poisoning amongst painters not subject to compulsory notification.

It may be noted also that in the statistical returns in question the naval construction industry is taken as a whole, with the result that possibly the cases reported do not refer exclusively to painters.

FATAL CASES OF LEAD POISONING IN GREAT BRITAIN (1914-19-25) *



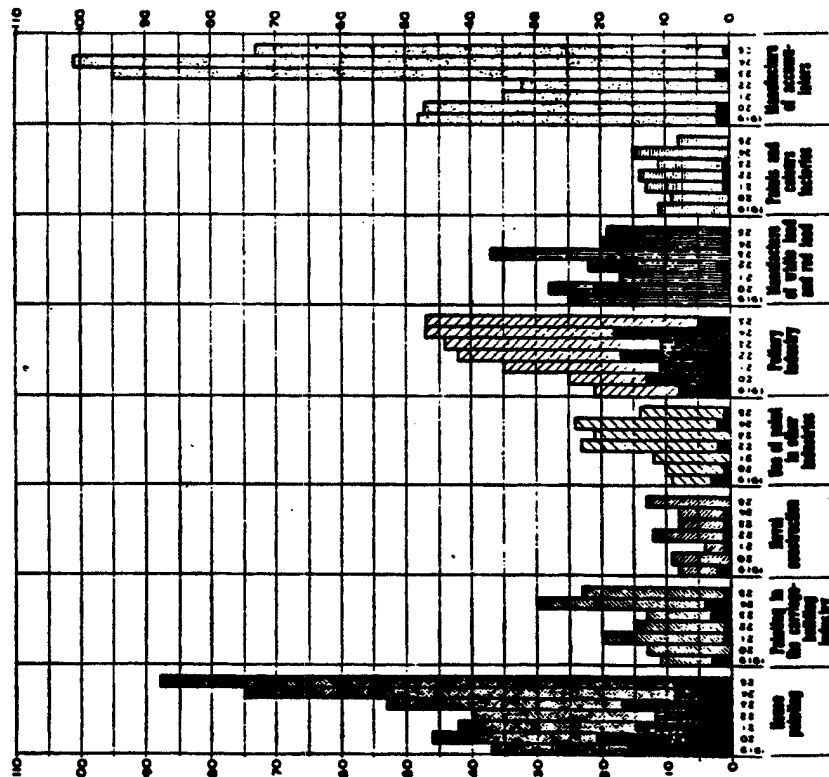
* A. Cases of lead poisoning compulsorily notifiable.
B. Cases of lead poisoning amongst painters not subject to notification.

CASES OF LEAD POISONING AMONGST PAINTERS NOTIFIED DURING THE YEARS 1910-1925 *

Years	House Painting	Carriage building	Naval Construction	Use of Paint in other industries
1910	195 (31)	70	21	51 (3)
1911	212 (35)	104	36	56 (1)
1912	217 (37)	84	34	48 (3)
1913	248 (31)	71	31	49 (3)
1914	207 (35)	57	31	38 (—)
1915	108 (29)	39	18	16 (2)
1916	52 (15)	33	25	20 (—)
1917	43 (13)	21	19	20 (1)
1918	25 (13)	12	9	15 (—)
1919	37 (16)	11	8	9 (3)
1920	46 (21)	13	9	10 (1)
1921	42 (15)	20	4	12 (—)
1922	40 (12)	15	11	23 (2)
1923	53 (17)	13	8	21 (2)
1924	75 (9)	30	8	24 (2)
1925	88 (9)	23	13	14 (1)

* Figures in parentheses indicate in each case the number of deaths.

CASES OF LEAD POISONING NOTIFIED IN GREAT BRITAIN DISTRIBUTED
BY INDUSTRIES AND BY YEARS



For certain of the lead industries, the proportion of the workers attacked can be estimated approximately. It is obvious, however, that such estimate offers the greatest difficulty as regards painters in the building industry. The following figures relating to this industry are given below and should be accepted with all reserve. The number of painters (150,000) comprised in this statistical return is that which the Committee on the use of lead in the painting and building trades gave as an average for the period between the 1901 and 1911 census (Cmd. 7,882, page 77). The number of workers indicated as exposed to poisoning in the carriage-building industry is that given for the year 1912 in the reports of the Committee on the use of lead compounds in the painting, enamelling, and varnishing of coaches and carriages (Cmd. 630, page 27).

COMPARISON OF THE INCIDENCE OF LEAD POISONING AMONG LEAD WORKERS
IN CERTAIN LEAD INDUSTRIES

Industries	Approximate number of persons occupied on processes involving a manipulation of lead					Cases						
	1911	1912	1913	1914	1915	Number		Number per 1000 workers				
White lead	1,405	1,382	1,201	1,119	41	23	29	29	17	24	26	
Storage batteries	1,149	1,254	1,475	1,543	24	38	44	41	21	30	27	
Pottery	6,710	6,142	7,085	4,661	92	80	62	15	13	9	6	
Metal foundries	2,820	2,404	2,678	2,827	48	56	26	36	17	23	13	
Printing	58,810	56,800	58,800	58,800	32	37	21	23	0.5	0.6	0.4	
Carriage painting	29,308	29,308	29,308	29,308	104	84	71	57	4	3	2	
Housepainting ^(a)	150,000	150,000	150,000	150,000	212	217	248	207	1.4	1.7	1.4	
" "	(b)	150,000	150,000	150,000	682	721	602	682	4.5	4.8	4.0	

^a For house painting, the rates have been calculated in two ways :
(a) On the basis of cases of lead poisoning notified and death certificates received in the course of the year. These numbers, however, do not correspond to the total incidence since notification is not compulsory with regard to house painters.
(b) By assuming that the ratio of the number of "deaths due to lead poisoning" to the number of "cases of lead poisoning" is the same for painters in the building trade as for workers manipulating lead in the combined factory. This ratio is known as regards workers handling lead in all industries carried out in factories, and the number of "deaths due to lead poisoning" amongst house painters is obtained from copies of death certificates furnished by the local registrars.

In this connection it is perhaps advisable to quote certain observations contained in the report of the 1911 committee, which reads as follows ¹ :

The number of serious cases of plumbism in certain industries (naval dockyards, and painting in other industries) exceeds the average, and the chronic forms and very serious forms such as paralysis are well above the average (Legge and Goadby). In industries such as the painting industry, where technique does not permit of the application of localised ventilation, cases of lead poisoning tend to increase. The same authors assert that the incidence of lead poisoning amongst painters is extremely high, a statement which can be easily confirmed by reference to statistics, and they add :

Despite the limited extent to which the Act applies to lead poisoning of house painters and plumbers, cases being notified voluntarily, the number of these every year exceeds considerably the total number of cases from any other lead industry in the country ¹.

¹ The morbidity and mortality figures relating to lead poisoning amongst painters engaged on house painting are relatively small, but they are not, however, as insignificant as might at first sight be imagined.

The total number of cases of poisoning for the period 1900-1909, all other industries coming within the law, amounts to 6,762, 275 of which were fatal, and for the same period the number of cases among painters amounted to 1,973, of which 293 were fatal. The proportion of fatal cases is therefore 4.06 per cent. as compared with 14.9 for painters.

² LEGGE and GOADBY : *Lead Poisoning*, p. 291.

Sir Thomas Oliver also stated that lead poisoning is of more frequent occurrence amongst painters than should be the case, and that the unfavourable position occupied in the lead industries by painters in the building and carriage-building trades is not peculiar to Great Britain.

In a report presented to the meeting of the British Medical Association¹ Sir Kenneth Goadby quotes the statistical returns prepared on the basis of the medical records of the Heartes of Oak Mutual Assurance Association, comprising 34,682 members, 2,013 of whom are described as painters. A comparison of the average figure of applications for sickness benefits made by the "painters" group with that of the general group of workers shows a lower figure for the painters. The figures for the year 1919 are as follows :

Categories	16 to 20 years	21 to 25 years	26 to 30 years	31 to 35 years	36 to 40 years	41 to 45 years	46 to 50 years	51 to 55 years
Painters belonging to other industries	16 18.3	12.3 15.4	9.8 16.2	8.4 18.7	11.6 18.5	9.0 18.6	13.8 18.5	13.7 18.7

These cases are distributed in accordance with age groups as follows :

Diseases	16 to 20 years	21 to 25 years	26 to 30 years	31 to 35 years	36 to 40 years	41 to 45 years	46 to 50 years	51 to 55 years
Respiratory system	25	21.7	25.0	25.9	38.8	25.0	28.6	33.3
Digestive "	12.5	4.3	15.5	7.4	2.8	6.0	7.5	6.0
Muscular "	6.2	11.5	12.5	22.6	16.9	12.5	20.0	11.8
Nervous "	6.2	4.6	3.1	0.0	0.0	0.0	1.5	5.6
All causes of disease	16	23	32	27	36	24	30	18
Exposed to risk	60	167	325	328	312	266	218	131

The years to which the statistics refer (1919-1920), the limited number of workers in question (2,013), and the fact that the mutual assurance association in question only accepts members subject to certain conditions of health are factors which might be regarded as likely to vitiate the value of the conclusions to be drawn from these statistics. Further, even the official reports draw attention

¹ Newcastle, 1921 : see *The Lancet*, 3 Sept. 1921.

to the definite rôle played in the reduction of cases of occupational lead poisoning by the general slackening of industrial activity and by the diminution in the use of lead colours.

The above graph (page 172) proves that though the year 1918 represents a minimum, the curve rose during the following years, in course of which the use of lead colours increased. Though the influence of the war exercised a remarkable effect on the curve for certain industries, on that of others the effect was hardly felt. Sir Kenneth Goadby himself is forced to admit the frequent incidence of lead poisoning amongst painters. He states that this phenomenon seems to him very difficult to understand. An effort to explain the chronic colic of painters by the theory of inhalation of turpentine fumes leaves unsolved the question raised by this expert, namely, the remarkable effect of the war on the curve of lead poisoning amongst painters and white lead workers. On the other hand, if, as is generally admitted, the altogether entire suppression of lead colours during the war had brought about perceptible improvement in the situation of painters, and if it be further admitted that this improvement rapidly declined with the resumption of the use of these colours, the solution of the problem no longer presents any difficulty.

The remarkable statistical returns carefully prepared by the English medical inspectorate during the ten years 1900-1909 permit of a greater importance being attached to lead poisoning in Great Britain. In fact, in 5,637 cases, serious symptoms were present on an average in the proportion of 28.2 per cent. (white lead workers 27.2, and painters in the different industries 31.4), slight symptoms were present in the proportion of 44.7 per cent. (white lead workers 50.8, and painters 43) ; indefinite symptoms occurred in the proportion of 2.4 per cent. (white lead workers and painters). Amongst the most important symptoms the total is fairly constant : gastric troubles in 80 per cent. of the cases with similar proportions for white lead workers and industrial painters, anaemia in 26.1 per cent. of the cases (2.5 only for white lead workers), paresia in 21.1 per cent. (10.3 for white lead workers), rheumatism in 10.3, headaches in 9.6, trembling in 33, and encephalopathy in 3.5 per cent. of the cases (5.1 for white lead workers and 2.5 for painters).

From 1 January 1910 to 31 December 1914 the factory doctors notified 1,079 cases of lead poisoning contracted by house painters¹. From the records received the medical inspectorate has been able to prepare the following tables :

¹ Report of the Norman committee.

GRAVITY OF THE SYMPTOMS

Cases	House painters		Other lead industries	
	Number of cases	Percentage	Number of cases	Percentage
Severe	76	29.0	450	18.4
Moderate	101	38.6	790	32.2
Slight	85	32.4	1,184	48.2
Not stated	—	—	27	1.1

NUMBER OF ATTACKS

Attacks	House painters		Other lead industries	
	Number of cases	Percentage	Number of cases	Percentage
First attack	140	53.4	1,863	73.0
Second attack	31	11.8	305	12.5
Third attack or chronic	89	34.0	251	10.2
Not stated	3	0.8	32	1.3

MAIN SYMPTOMS

Symptoms	House painters		Other lead industries	
	Number of cases	Percentage	Number of cases	Percentage
Gastric troubles	202	77.1	1,853	75.7
Anæmia	82	31.3	825	33.7
Headache	28	10.7	303	12.4
Peretic	46	17.6	333	13.6
Encephalopathic	3	1.1	53	2.2
Rheumatic	34	13.0	293	12.0
Other	27	10.3	186	7.6
Not stated	1	0.4	76	3.1

All these figures, however, ought not to be regarded other than as a fraction of the cases actually existing. During the 10 years (1900-1909) inclusive, the total number of deaths from lead poisoning amongst house painters and plumbers had been 387 (293 for painters and 94 for plumbers). During the period 1910-1913 the fatal cases notified were for the four years 134 plus 35 for plumbers, giving a total for the period 1900 to 1913 of 427 painters and 129 plumbers, altogether 556, the total figure for painters, namely, 427, exceeding the total number of deaths from lead poisoning amongst all factory workers (421) ¹.

¹ See report of the English committee, 1911, *loc. cit.*

In the absence of complete statistics regarding lead poisoning, Sir Thomas Legge considered it fairly reasonable to suppose that the proportion of non-fatal cases is practically the same for the house painters as for the combined factory industries. Based on the total attack rate for lead poisoning amongst factory workers and house plumbers would amount to 1,000 cases, an approximate estimate, which could hardly be regarded as an accurate computation.

For the years 1900 to 1909 in 6,762 cases amongst factory workers the number of fatal cases was 275: during the same period the number of deaths from lead poisoning amongst house painters rose to 293. Taking this figure as a basis, the number of cases of lead poisoning amongst painters would be computed to amount to 7,200 for the years 1900 to 1909, or an annual average of 720.5, for lead poisoning of about 4.8 per thousand of the population (the number of painters at 150,000). This rate is higher than that estimated for other industries presiding over lead poisoning but it is not, as Sir Thomas Legge says, as might at first sight be imagined, and would not justify the adoption of thorough precautionary measures in other branches of industry ¹.

Sir Thomas Legge placed before the White Paper of the Third Session of the International Labour Conference (1921) some graphic tables illustrating the extent of plumbism in the various British industries during the twenty-one years. With the help of these tables it is seen that in white lead factories and pottery factories the number of cases of lead poisoning had increased to a considerable extent, whilst in the industries in regard to which no had been introduced — plumbing and painting — the disease did not exist. In his opinion the fact that the disease of lead poisoning was due to lead dust had made it possible to take effective measures in regard to dust control. However, no method of eliminating such dust from the industry had been discovered. A detailed examination of the relative, on the one hand, to 278 cases affecting plumbers (about a fifth of the cases).

¹ *Ibid.*

² See report of Fifth Sitting.

the other hand, to those affecting the workers in British white lead factories, as well as those in other lead industries, leads to the conclusion that painters' and plumbers (not subject to regulations) are more frequently affected than the other factory workers by serious poisoning, by chronic disease, and by paralysis of the wrist.

The question was resumed in the Norman report, which referring to 1,079 cases of lead poisoning reported amongst house painters from 1910-1914, contains the following statement:

In regard to the 262 cases (24.3 per cent.) the report of the certifying surgeon happily contains data as to symptoms, duration of employment, severity, age, and so on, in precisely the same way as in factory cases. This circumstance arose from the fact that the section does not require the medical practitioner to say in what factory the patient was employed, and it was only by referring individual cases for enquiry by the certifying surgeon that information as to the house-painting occupation was obtained. These 262 cases are, therefore, strictly comparable with the 2,742 cases which occurred in factories and workshops during the same five years.

An analysis of these reports has enabled a comparative table to be drawn up relative to the gravity of the symptoms, the number of cases, the main symptoms, the number of cases excluded on account of "faulty diagnosis", and the number of doubtful cases. The data contained in this table show that lead poisoning constitutes the most serious occupational risk to which painters are exposed, and that the symptoms of cases affecting them are proved after study to have been more serious than those contracted in factories and workshops. In fact the proportion of serious cases reaches 29 per cent. for house-painters, whilst it is only 18.4 per cent. for male workers employed in factories. The number of cases of chronic lead poisoning notified as affecting house-painters amounts to 34 per cent., but falls to 10.2 per cent. for male workers employed in factories. It is, nevertheless, perhaps the number of cases of paralysis which constitutes the most striking proof of the gravity of lead poisoning among house painters. Radial paralysis (paralysis of the extensor muscles of the wrist) is the most classic symptom of lead poisoning. The proportion of cases in which this symptom was noted amounted to 17.6 per cent. amongst house-painters, whilst it was 13.6 per cent. for male workers employed in factories. Were it the case that poisoning among painters was due not to the effects of lead compounds but to those of turpentine, the figures would not correspond in this manner. No case of radial paralysis should in fact in such circumstances be observed amongst painters.

The appendices to the reports on former Committees contain a similar table, relating to cases of lead poisoning contracted in factories and workshops in the course of the ten-year period 1900 to 1909 (Appendix 2, Cmd. 631). If the two tables be compared it will be seen that the number of serious cases contracted by male workers employed in the factories and workshops fell from 28.2 to 18.4 per cent. of the total number of cases. Further, the proportion of cases of radial paralysis contracted by these same workers fell from 21.1 to 13.6 per cent. This progress has to be attributed to the fact that several industries carried on in factories and workshops have been subject to regulation, whilst house-painting is not so regulated.

An examination of the figures in the table given on page 173 confirms this opinion even in regard to present circumstances (Dec. 1925). In fact the number of cases of lead poisoning is on the increase, especially in the house-painting industry, where the campaign against dust is rendered more difficult on account of the technique in these industries.

It has been alleged, on the other hand, that cases of lead poisoning reported amongst house-painters are not verified. It should, at this point, be recalled that the diagnosis of lead poisoning involves difficulties not encountered by the general practitioner in notifying infectious diseases. There is no standard in regard to the symptoms of lead poisoning, and each medical practitioner is obliged to form a personal criterion. As a general rule the notification of a case signifies that a worker has consulted his doctor because of symptoms due to lead poisoning and necessitating interruption of his work. Appendix 3 shows that 4.2 per cent. only of cases contracted by house painters and reported by the certifying surgeon have been excluded from the table owing to "faulty diagnosis" and that 3.1 per cent. have been included of those designated as doubtful. For factory workers the number of the cases wrongly diagnosed amounted to 14.1 per cent. and that of doubtful cases to 8 per cent. of the total number of cases. One of the reasons for which the proportion of doubtful and wrongly diagnosed cases is higher for factory workers is as follows: the article of the law relative to the notification demands that in addition to the notification made by the medical practitioner, the employer should notify each case to the district inspector and the certifying surgeon. Not being a medical man, the employer often errs in regard to such declarations. The decorating firms, which are not subject to the factory law, have never furnished notifications of this kind. Certain representatives of decorating firms, who gave evidence before the committee, declared that they had never known cases of lead poisoning amongst their employees: some of them had knowledge of one case, very few reported more than one. The explanation of this fact is believed to be as follows: the 1,079 cases notified in the course of the five-year period 1910-1914 affected not less than 976 builders' and decorators' establishments situated throughout the country. For fifty-five of these establishments only the cases notified amounted to more than one. The total number of cases was distributed as follows:

South-eastern counties . . .	477
South-western counties . . .	144
Midland counties	166
North-eastern counties . . .	89
North-western counties . . .	171
Scotland and Ireland	92

Account must be taken of the fact that each notification signifies that other workers also suffered to a less degree from the harmful effects of lead. The average age of the painters affected was 39 and the average duration of their employment 18 years.

Similarly, as regards the factories, the 782 cases attributed to painting in the carriage-building industry, the shipbuilding industry, and to paint used in other industries during the five-year period 1910-1914, which were notified by the certifying surgeon, confirm in every respect what has been said in relation to the cases contracted by the house painters, that is to say, that lead poisoning constitutes the gravest occupational risk for workers in the painting trade. For nine of the 384 cases which occurred in the carriage-painting industry it has not been possible to determine whether the disease was not rather due to the effects of turpentine than those of lead; the same is true of 10 of the 153 cases contracted in the shipbuilding industry. Not infrequently reports relating to cases which occur during the painting of ships mention that fumes have given rise to syncope in the unventilated double-bottoms in which a great part of the work has to be executed. An interesting case notified in 1912 has been proved to be due to the effects of turpentine. In this particular case the ship's painter presented symptoms necessitating hospital treatment for haematuria but showed no symptom of lead poisoning.

However, one of them had 14 cases, another 9, a third 7, a fourth 6, and a fifth 5. Three of them had 4 cases, eleven had 3, and thirty-six had 2.

Very interesting data relating to cases of sickness reported amongst painters have been furnished by the National Amalgamated Society of Operative House and Ship Painters and Decorators. This association, which in 1920 comprised about 73,000 members, paid, for the period 1905-1910, the sum of £4,900 for fifty-two cases of total incapacity represented by blindness due to lead poisoning (13 cases), lead paralysis (37 cases), hemiplegia (1 case), and lead gout (1 case).

For the period 1910-1920, this association has drawn up the following table :

Year	Total number of members of society	Number of members insured in the Sickness Fund	Total amount paid in compensation
1910	15,351	13,627	£ 6,187 16 1
1911	16,208	13,785	5,516 7 1
1912	21,679	16,500	5,719 7 1
1913	30,200	19,635	8,763 19 11
1914	29,809	28,592	10,592 10 4
1915	28,416	19,340	10,075 16 8
1916	28,604	18,951	9,196 16 5
1917			
1918	37,649	18,266	7,065 7 6
1919	62,325	25,013	7,147 13 8
1920	73,656	26,243	7,862 8 10

The same association, which from 1921-1923 comprised about 54,000 members per annum, reported 120 cases of lead poisoning : in 1924 34 cases were reported as affecting 45,113 members, and in 1925 45 cases for about 45,000 members.

Cases in respect of which indemnities were paid were distributed as follows :

Incapacity due to	1921-1923	1924	1925
Blindness	3	4	2
Paralysis	22	7	2
Lead poisoning	-	6	2

The annual indemnity paid amounted to £400 in 1924, for the cases of blindness (£140 in 1925) ; £390 for cases of lead poisoning (£200 in 1925), to £640 for cases of paralysis (£200 in 1925) ; of a total of £2,025 in 1924 as against £1,285 in 1925.

The annual proportion of deaths due to lead poisoning among painters and plumbers in the course of the period 1900 to 1909 was on an average 195 per thousand. In order to show the

variations of the mortality figure in the various lead industries, the following values are given for the purpose of comparison. Too great importance must not, however, be attributed to their relative values by reason of the fact that the number of workers employed in these industries is really very limited : White lead workers 2,141 per thousand ; workers in the manufacture of storage batteries .387 ; workers in paint and colour factories .459 ; in the pottery industry .998 per thousand ; foundry workers .893 per thousand.

As early as the seventh International Health Conference in 1891 Ogle presented the following mortality table for Great Britain :

MORTALITY FOR 1,000 MALES AGE 25 TO 65

Occupations	Mortality rate	Excess of mortality
Liberal occupations	8.6	100
Farmers	9.76	114
Agricultural workers	10.84	126
White lead workers and painters	18.60	216

The National Society of Painters already referred to presents a very detailed report of fatal cases ascribed to lead poisoning amongst its members during the periods 1910 to 1919 and 1920 to 1925. In 3,278 fatal cases, forms of lead poisoning numbered 560 and were distributed as follows for the period 1910 to 1919 :

Disease	Absolute number	For 100 deaths
Lead poisoning	36	6.43
Chronic nephritis	175	31.25
Heart diseases	94	16.78
Diseases of the central nervous system	210	37.5
Diseases of the digestive system	45	8.4
Total	560	100

For the period 1920 to 1925 fatal cases are classed as follows :

Disease	1920-1923	1924	1925
Lead poisoning	30	11	3
Arteriosclerosis	24	6	11
Chronic nephritis	123	28	24
Paralysis	39	4	6
Total	216	49	44

DISEASES DUE IN PART TO LEAD

Diseases of the central nervous system	203	25	42
Diseases of the heart	440	86	71
Diseases of the digestive system	11	9	11

In the report above referred to presented by Sir Kenneth Goadby to the meeting of the British Medical Association (Newcastle, 1921)¹, the causes of death amongst painters (according to the *75th Annual Statistical Report*) expressed as a percentage of the relative mortality rate are as follows:

Causes of death	1901	1911
Diseases of the respiratory system	35.69	28.64
Diseases of the urinary system	8.69	11.62
Diseases of the circulatory system	14.74	22.72

Amongst the causes which most frequently cause a fatal issue may be mentioned, saturnine nephritis, respiratory, and circulatory disease, cerebral hæmorrhage, etc. The average age shows a minimum of 32 for the encephalopathic form, of 31-41 for tuberculosis, a general average of 46 years for painters, and 41 years for factory workers in the painting industry.

At the Sixth Sitting of the White Lead Committee Sir Kenneth Goadby, after quoting certain figures relative to the indemnities paid to white lead victims, remarked that in a given profession when a morbidity rate exceeding the normal is encountered, it is necessary to enquire as to whether the distribution of mortality by age groups in the occupation is similar to that for the whole population with which comparison has been made. As regards comparative mortality for painters, plumbers, and glaziers (relative

¹ See note, page 242.

In the 284 certificates of death due to lead poisoning studied by Legge (Congress of Brussels, 1910), the causes of death in the industries of importance from the point of view of this report were as follows:

Diseases	White lead venom	Paint and other industries	Carriage building industry	Lead cast-iron industry	Lead in other indus- tries	Total cases	Average age
Encephalopathy	13	4	1	1	—	39	32
Nephritis	2	—	6	4	3	79	42
Cerebral hæmorrhage	2	—	5	1	1	26	47
Paralysis	4	6	—	4	—	27	43
Lead poisoning	6	2	3	1	1	56	44
Tuberculosis	1	1	3	1	1	13	36
Other diseases	3	3	4	2	2	25	40

to the whole population), Sir Kenneth Goadby says that it amounts to 1,041 as against 1,000 for all males, for lead workers is 1,385, whilst the comparative mortality figure for butchers for instance is 1,062 (see above, *New South Wales*).

Taking as basis statistics relative to mortality established in accordance with the age of the individuals affected, he holds that it would be possible to arrive at the conclusion that workers in the painting industry are in general healthier than those in other occupations and that their occupation is more unhealthy. In fact, in the painting industry, up to the age of 35, the mortality would appear to be lower than in other occupations and higher from this age onwards. He adds, however, that the statistics drawn up in 1901 do not show a higher mortality percentage among painters than in other occupations.

The following mortality figures, according to age groups, are given by the National Amalgamated Society of Operative House and Ship Painters and Decorators for the years 1905-1910 and by the Scottish Society of House and Ship Painters for the years 1901-1910:

Number of cases	Age	Number of cases	Age
1	15	330	45
48	20	240	55
148	25	152	65 and over.
252	35	74	Not given.

Or a total of 1240 cases for workers of 15 years and over. Of 100 fatal cases 58.86 affected workers aged from 25-55 (11.93 per cent. 25-35 years of age, 20.32 per cent. 35-45, and 26.61 per cent 45-55 years).

Of the 1,240 fatal cases, excepting 39 cases due to lead poisoning and certain other cases of less direct interest, the following distribution is shown according to age groups.

Diseases	15 years	20 years	25 years	35 years	45 years	55 years	65 years	Not given	Total number of cases
Tuberculosis	—	11	55	60	36	18	3	1	184
Heart diseases	—	3	11	27	50	32	20	—	143
Bronchitis	—	—	1	4	9	27	25	1	68
Pneumonia	—	5	14	27	27	20	10	4	107
Nephritis	1	1	6	24	35	22	8	1	98
Diseases of the cir- culatory system	—	—	2	11	29	32	23	2	99

Another table is given below which shows :

- (1) The excess mortality percentage due to certain diseases amongst painters.
- (2) The average age at death for different categories.

Category	Importance of each cause of death in relation to the total possible causes				Average age at death due to		
	All causes	Lead poisoning	Inter-cats	All other causes	All lead poisoning	Ne-phritis	Inter-cats
For all males (England and Wales for 1900-02)	100.00	0.06	3.01	11.11	85.82	14.18	0.00
Painters, painters and var-nishers	100.00	1.89	5.94	18.36	73.41	28.19	12.01
Painters	100.00	3.33	8.34	15.72	72.57	27.43	13.25

¹ Supplement to the 65th Annual Report of the Registrar-General for Births, Deaths and Marriages.
² Mortality statistics of the Amalgamated Society of Operative House and Ship Painters and Decorators for 1905-1910 and of the Scottish Society of House and Ship Painters.

These tables are reproduced from the report of the English Departmental Committee of 1911, appointed to enquire into the painting industry.

The English medical inspectorate provides similarly interesting data in regard to the incidence of lead poisoning amongst painters in the carriage and wagon-building industry. Cases occurring in these two industries must also be notified, according to section 73 of the Factory Act.

In 1903 the reports of the inspectorate contained the figures 9,608 for workers employed in the 603 most important factories. From 1900 onwards the statistics have been more carefully prepared and indicate for the inclusive period 1900-1913 1,026 cases, of which 6 per cent. were fatal and 965 not fatal, or an annual average of 73.

¹ See the report of the English Departmental Committee on the Lead Danger in the Painting, Enamelling, and Varnishing of Coaches, Carriages, etc., 1920.

Among an average of 10 workers employed during the first six months of 1921 in the Marmet Baby Carriage Works, Letchworth, 5 workers in the painting department were attacked by lead poisoning. In 1920, on the other hand, no case was reported in the same factory. (*Parliamentary Debates*, Vol. 144, No. 192, Col. 2220-2221 and 2231-2232, July 1921.)

Cases of poisoning which occurred during the period 1901-13 in the different branches of this industry may be summarised as follows :

Year	Locomotives and Rolling Stock	Tramways	Motor-cars	Baby carriages	Other carriages and vehicles	Total
1901-1913	429	68	109	56	317	979

In 1912 the number of persons employed in the carriage- and wagon-painting industry was as follows :

Process	Males and females	Under 16	Over 16	Total
(1) Involving contact with lead. (a) Mixing and preparing paints (b) Rubbing down and painting Other operations	Males Males Females Males	400 1,440 889 2,729	3,571 13,454 9,553 26,579	3,971 14,894 10,442 29,308
(2) Not involving contact with lead	Total	20,385	170,196	190,581
Grand total		23,114	196,775	219,889

Thus 29,308 persons only were in contact with white lead and lead colours. The annual average of cases which occurred during 14 years is 2.50 per 10,000 and the average annual of mortality from lead poisoning .149 per 10,000.

The table drawn up by the United Kingdom Society of Coach-makers showing the average age at death in the branches of the carriage-building industry is given below :

Category	Actual number of deaths	Total years of life	Average age at death
Painters	496	26,319	53.1
Body-makers	437	23,920	54.7
Smiths	222	12,766	57.5
Coach-fitters	122	7,034	57.7
Wheelers	125	7,246	58.0
Trimmers	206	12,357	60.0
Carriage makers	71	4,384	61.7

¹ Trimmers, wheelers, smiths, and fitters do not use lead at any time.

According to Legge and Goadby, lead poisoning is of particularly frequent incidence in the carriage-building industry, and in 1912 no reduction had yet been observed in the number of cases notified annually. Sir Kenneth Goadby had to admit that this number was still very high in 1920.

The advantages of legal regulation where technique admits of it are clearly proved by the following table, which indicates the cases of lead poisoning in the following industries:

Industries	1900-1906	1907-1913	Regulation	Increase percentage (+) reduction percentage (-)
Carriage manufacture, including baby carriages	486	564	No	+ 16
White lead factories	1,113	309	Yes	- 72%
Pottery trade	787	589	Yes	- 25

Finally, the English statistics permit of the conclusion that, though the incidence of lead poisoning taken as a whole shows since the war a marked increase (230 cases in 1921, 246 in 1922, 338 in 1923, 486 in 1924, 326 in 1925, 243 in 1926), this increase affects particularly those industries in which means of prevention successfully applied elsewhere are not practicable, and the mortality rate in general shows a slight advance except amongst painters, for whom it must, however, be remembered the absence of compulsory notification prevents definite conclusions being arrived at.

India (Bartlett)

Under the stimulation of the Minister of Munitions for India¹ the production of white lead by the damp process was introduced in 1919 by utilising lead from Burma in a factory constructed at Hebbal. Between the years 1919 and 1920 a considerable quantity of white lead had been produced and put on the market. According to the statement now being summarised, no cases of lead poisoning occurred amongst the employees in this factory. No statistics are available regarding painters. In a letter dated 4 April 1926 the Labour Office of Bombay informed the International Labour Office that the regulations issued in 1924 by the Bombay Government in relation to the use of white lead in painting had been drawn up after detailed study of the administrative and technical problems raised by the Draft Convention.

The Bombay Office added that according to information from the Indian Government the use of white lead is fairly limited for interior painting, and that on the other hand the hospital doctors had not reported any cases of lead poisoning for about five years².

¹ *Journal of Indian Industries and Labour*, May 1921, No. 2, p. 2417.
² *Industrial and Labour Information*, Vol. XVIII, No. 9, p. 462.

Italy

In order to determine as accurately as possible the lead risk amongst painters, Italian experts¹ have always tried to ascertain the number of workers in daily contact with toxic pigments in order to compare this number with that of the workers suffering from or having suffered from diseases due to lead.

In the manufacture of lead colours, the number of workers exposed to risk is about 160. The number of workers in paint and varnish factories and laboratories, though difficult to estimate, is certainly higher².

The statistical data relating to the extension of the lead risk in Italy have been furnished chiefly by the scientific activity of the Industrial Clinic of Milan, and by the enquiry into risk in the painting industry organised by Dr. Carozzi and undertaken in Milan by Dr. Carozzi himself, at Genoa by Deputy Chiesa and Drs. Rubino and Porriani, and at Rome by Dr. Ranelletti. The observations of Carozzi were made during a strike of house painters in Milan (1908) and during an enquiry into the morbidity of painters treated in the principal hospital of the town during the years 1901 to 1905. They are, on the other hand, the result of experience which he acquired as chief of the consulting department in the Industrial Clinic of Milan, where he had the opportunity of examining several hundred painters. The results of these examinations are as follows:

614 cases observed are distributed as follows in accordance with age:

Age	Number of cases	Per cent.	Age	Number of cases	Per cent.
10-15	8	1.3	31-40	131	21.4
16-20	71	11.5	41-50	102	16.6
21-30	235	38.3	over 50	67	10.9

The injurious effects of lead poisoning — even in a latent state — in regard to fatherhood on the product of conception have long been known. Carozzi, in his report on births and

¹ Sources: The publications of: DEVOTO, CAROZZI, RANELLETTI, RUBINO, PIERACCINI, GIULIOLA, MONTI (*Il Lavoro Il Ramazzini*). *Primo Congresso Internaz. Mal. Lavoro*, Milan, 1906. *Congressi nazionali*. 1907 (Palermo), 1909 (Florence), 1911 (Turin), 1913 (Rome), 1922 (Florence), 1925 (Venice). Publications of the Italian Section of the International Association for the Legal Protection of Workers, Roman enquiry (RANELLETTI), *Indagine nell'industria della coloritura in Genova* (RUBINO, PORRIANI and CHIESA), 1912, etc. *Indagine sul pericolo saturnino nell'industria della coloritura in Italia*, (CHIESA, DEVOTO, CAROZZI), Milan, 1914.

² The General Confederation of Labour estimates that the white lead question affects about 20,000 working painters. See *Battaglie sindacali*, No. 33, 1921.

deaths among the working classes¹, states that, in accordance with the data assembled as a result of consultations in the Milan Clinic, in 1,474 confinements among wives of painters there were 209 miscarriages and 1,265 full time births; 725 only were alive at the time when the records of the enquiry were made. There was, therefore, a loss of 749 lives (50.81 per cent. of the conceptions and 42.6 per cent. of the births).

In a group of 273 painters, the time spent in the trade was under a year for 7, up to 5 years for 48, up to 10 years for 62, up to 20 years for 34, to 30 years for 45, and over 30 years for 30.

As regards the morbidity of painters, the data assembled at Milan by Carozzi, either in the hospitals of the town or at the Industrial Clinic, during the period 1901-1910, affect a total of 1,328 cases, which are distributed as follows:

Diseases	Cases	Percentage
Chronic lead poisoning and colic	638	48.0
Chronic nephritis	96	7.2
Radial paralysis	12	0.9
Cerebral hæmorrhage	11	0.8
Disease of the digestive system	73	5.4
" " respiratory "	147	11.0
" " circulatory "	47	3.5
Pulmonary tuberculosis	126	10.6
Typhoid fever	30	2.9
Other infectious diseases	25	1.8
Articular rheumatism	47	3.5
Diseases of the nervous system	36	2.7
Various	22	1.6

The clinical examination of 373 painters shows, according to age groups, the following results:

Diseases	Up to the age of :						Over 60 years	Totals
	15 years	20 years	30 years	40 years	50 years	60 years		
Lead colic	1	5	14	17	9	7	2	55
Chronic lead poisoning	5	8	28	20	21	5	2	89
Chronic nephritis	—	—	3	9	16	10	6	44
Radial paralysis	—	1	6	7	5	—	—	19
Diseases of the digestive system	—	1	19	11	8	2	—	41
Diseases of the respiratory system	—	1	4	3	1	1	—	10
Diseases of the circulatory system	—	1	4	3	4	6	1	19
Diseases of the nervous system	—	1	10	4	5	4	1	25
Pulmonary tuberculosis	2	3	18	7	5	1	—	36
Gout	—	—	1	1	4	—	—	6
Various	3	3	9	8	6	—	—	29
Totals	11	24	116	90	84	36	12	373

¹ National Congress of Industrial Diseases, Rome, 1913.

The most frequently noted clinical colic. In fact, this cause of incapacity for "chronic lead poisoning" in the records of 418 times out of 853 during the period 1901-1910, 13 times out of 475 cases observed by Carozzi.

As regards the proportion of relapses, relapse was recorded in the case of 128 of 53, three in that of 17, and four in that of 12, had nine to twelve attacks of colic, one duration of each attack is, however, very variable, attaining two to four days in 20 cases, 5 to 13 in 38, 16 to 20 in 34, 21 to 30 in 17.

There have, moreover, been recorded 100, 150, and even 400 days, a prolongation due to complications.

In a very detailed report covering 1901-1910, Devoto¹ presents observations made in the Milan Clinic. He records that of 136 cases of chronic lead poisoning, 9 (fatal), 71 affected painters. Furthermore, the wives of these painters had 147 children, of which 10 were born dead, 1 miscarriage (representing a loss of human life). He notes also that the mortality rate was 44.2 per cent.

Colic, the sign of saturation of the system, was the only morbidity form in 23 cases, as the only morbidity form in 23 cases, had been attacked by colic under the age of 15, one at 18, one at 22 years, three at 25, and 50. A worker aged 56 had had 40 attacks.

Though 23 painters showed no other morbidity than colic, 32 presented besides colic other disorders: chronic lead nephritis, 12 (fatal); chronic lead nephritis and tuberculosis, one (fatal); chronic lead nephritis and diabetes, one (fatal); chronic diseases of the heart and lungs, one (fatal); diseases of the heart and lungs, three; lead anaemia, three; lead anaemia and neuralgia, one.

Sixteen other painters who had been attacked by colic presented other disorders of a more or less chronic nature, such as lead paralysis, three; digestive disorders, three; skin diseases, three; lead anaemia, three.

¹ *Il Lavoro*, No. 23, 1911. Milan.

one. Of 71 painters, 13 only confessed to being heavy drinkers.

In the course of 232 visits made during the eighteen months June 1910 to December 1911, 20 cases of tuberculosis were met with, and one case of a worker who, having worked for twelve years, had a paralysed hand.

In 1909-1910, the statistical returns for the town of Milan recorded the deaths of 82 painters, 19 of which were due to tuberculosis, 9 to respiratory troubles, 14 to kidney trouble, and 10 to typhoid. Whilst the official statistics only record one death due to lead poisoning for the year 1910, the clinic has registered 9.

The enquiry undertaken at Milan, Rome, and Genoa has shown 351 cases of death amongst painters distributed as follows: 206 at Milan, 124 at Genoa between 1906 and 1910, and 21 at Rome between 1905 and 1909.

These 351 cases are distributed as follows in relation to the cause of death:

Diseases	Cases	Percentage
Atrophy	5	1.4
Diseases of the respiratory system	70	19.9
Apoplexy	18	5.1
Diseases of the digestive system	16	4.1
Diseases of the circulatory system	54	15.1
Infectious diseases	21	5.9
Pulmonary tuberculosis	64	19.1
Chronic lead poisoning	17	4.7
Chronic nephritis	40	11.3
Diseases of the nervous system	11	3.1
Various diseases	9	2.6
Accidents; lesions of a violent nature	24	6.8
Not diagnosed	3	0.8

Distribution according to age groups is also given for the 206 cases recorded for Milan:

Age	Number of cases	Per cent
Under 25	25	12.1
" 25 35	29	14.1
" 35 50	65	31.5
" 50 60	46	22.2
" 60 70	28	13.6
Over 70	13	6.3

In one of his reports¹, Devoto, relating his observations during the period 1906 to 1920, states that he met with a fairly remarkable and satisfactory diminution of lead poisoning in Milan. In fact

¹ See *Il Lavoratore*, 31 Aug. 1921. Referring to this study, the Federation of Working Painters recalls that during 1920 the Industrial Clinic had only treated 15 of the 50 painters who died during the year (40 of whom were members of the Federation).

there were treated at the clinic in 1912 114 cases of lead poisoning, in 1913 86, in 1914 75, and during the first six months of 1915 31. In 1920 the cases fell to a total of 30. Serious forms half disappeared; paralysis has passed from percentages of 16, 13, and 10 to 3; colic, which had shown an incidence percentage of 42, fell successively to 40, 29, 26, and 13 per cent. The later victims are adults rather than young persons. Devoto, however, is led to enquire what rôle is played in this improvement by the ever-increasing use of substitutes for white lead¹.

The Ranelletti enquiry in Rome comprised house painters, furniture and sign painters, painters of iron bedsteads, etc. It affected 50 employers and 200 workers. In accordance with his research and the examinations which he was able to make, Ranelletti draws the following conclusions:

Diseases and disorders of digestion were present in 44.44 per cent. of the workers examined, and such troubles very often form a prelude to colic. Colic and the lead line as symptoms of chronic poisoning were noted in 37.5 of the cases, especially amongst house painters. Respiratory diseases are represented by bronchitis (6.91 per cent.); diseases of the circulatory system (26.38 per cent.) are noted principally among young workers from 21 to 29 years of age who have not formerly suffered from infectious diseases. The nervous forms are represented by headache and vertigo (35 per cent.); those of the locomotory system by myalgia, arthralgia (15.28 per cent.). Nutritional diseases are represented chiefly by gout (4.16 per cent.); urinary diseases show a percentage of 9.72.

The painters treated in the hospitals of Rome during the period 1905 to 1909 reached a total of 329, 21 cases (6.3 per cent.) of which were fatal. The causes of disease as entered in the hospital records are as follows:

Diseases	Cases	Fatal cases
Infectious diseases	9	1
Veneral diseases	17	—
Diseases of the respiratory passages	31 (9.4 per cent.)	3
Tuberculosis	45 (13.6 "	8 (38 per cent.)
Malaria	22	—
Tumours	6	1
Diseases of the nervous system	11	1
Diseases of the circulatory system	31 (9.4 per cent.)	3
Diseases of the digestive system	35 (10.6 "	1
Diseases of the urinary and genital system	11	1
Diseases of the skin	3	—
Diseases of the bones and articulations	6	—
Articular rheumatism	20 (6 per cent.)	1
Various	12	—
Accidents	57	1
Unknown	12	—

¹ Working painters asked rather what part is played in this improvement by the restricted use of lead colours which occurred everywhere during the war.

The statistical returns of the hospitals do not comprise "lead poisoning", but they comprise "occupational poisonings" which are chiefly represented by the lead form, and which for the same period 1906-1909, involved 65 cases, 13 of which are indicated as cured, 37 improved, 11 without improvement, and 4 fatal.

Ranelletti is not able to provide mortality figures, but the hospital statistics give a proportion of 6 per cent. for all causes of death, among which pulmonary tuberculosis is the most frequent (38.09). The mortality rate due to lead poisoning appears to be 7 per cent.

A. Agrippa conducted at Rome, in 1922, an enquiry into the lead risk among painters and varnishers. He was able to examine 65 working house painters, carriage painters, and painters of ironwork in the course of their occupation. Like Devoto at Milan, he was able to conclude that lead poisoning was undergoing a diminution in intensity rather than in extent; and that for several reasons. Among these may be noted the use of zinc whites containing fraudulently up to 25 per cent. of lead compounds, the use of pigments in powder rather than in paste form, the use of lead-bearing linseed oils (up to 8 per cent.), the use of minium and other lead compounds, and the risk attaching to scraping and dry rubbing down, etc.

He found again very frequent incidence of digestive troubles (30 per cent. amongst varnishers and 53.3 per cent. amongst painters), respiratory diseases (35 per cent. for varnishers and 42.2 per cent. for painters), particularly of tuberculosis (15 and 17 per cent. respectively) and circulatory diseases (35 and 17.7), particularly arteriosclerosis. Diseases of the locomotory system show values of 20 and 17.7 per cent., of the urinary system, 10 and 11.1 per cent., of the nervous system 30 and 15.5 per cent., nutritional diseases 2.2 and 5 per cent.; chronic lead poisoning only shows values of 5 and 15.5 per cent., while in the preceding enquiry by Ranelletti, it was found to amount to 37.5 per cent. In the course of the year 1920-1921 18 deaths were reported for varnishers and 67 for painters.

A very detailed enquiry was conducted at Genoa by Drs. Rubino and Porrini and Deputy Chiesa, with special reference to the painting of ships.

The Genoa enquiry comprised 1,500 working painters, of whom approximately 125 had been white lead workers. The enquiry made in regard to hospitals in the town for the period 1906-1910

revealed 144 cases of lead poisoning, of which 86 (59.7 per cent.) affected painters.

The 305 workers questioned and examined in course of the enquiry may be grouped as follows:

According to age: Under 15 years, 3; from 15 to 20 years, 18; from 20-30 years, 60; from 30 to 50 years, 152; from 50 to 60 years, 47; over 60 years, 25.

According to length of apprenticeship: Up to 15 years, 98; to 20 years, 72; to 30 years, 66; to 50 years, 64; to 60 years, 5.

According to the length of time spent in the trade: Over 5 years, 28; over 10 years, 40; over 15 years, 63; over 20 years, 66; over 30 years, 72; over 40 years, 27; over 50 years, 9.

As regard the children of 189 married workers, the following facts were established. In 40 families children were still living or had died after reaching adult age. In 47 families children were still living or had died at an early age. In 36 families children were still alive or had been born prematurely, or had died at an early age. In 2 families children were still living or had died at an early age. 28 workers were childless, 6 had only had stillborn children. One case of syphilis and 119 cases of alcoholism were reported, affecting chiefly unmarried workers.

The diseases recorded as encountered amongst the 305 workers examined, and the hospital cards for 391 patients showed the following distribution: colic 116, digestive diseases 111, vertigo 269, polyuria 310, heart diseases 225, hypertension 406, and trembling 112; the lead line was noted 231 times.

Mortality returns for painters in Genoa show for the period 1906-1910 a total of 124 cases amongst males from 16 to 60 years of age.

Comparing the mortality of painters with general mortality in the town (in regard to the latter, the inclusion of infant mortality constitutes a vitiating factor) the report brings into evidence the fact that painters showed a higher mortality, though the difference was not really very great. It becomes, however, more marked if account is taken only of that category of painters which may be said to be the most representative of the occupational group, for here is found a percentage of 24.54 per 1,000 as against 18.3 for the town. The most frequent causes of death were diseases of the heart and blood vessels, respiratory, and kidney, and nervous diseases. The report states, in conclusion, that the lead trades in Italy retain the sad distinction of occupations which kill those engaged in them.

Netherlands

According to the census of 31 December 1920, the number of working house painters in Holland was 19,785. The employees of four white lead factories in the country numbered 385 in 1913, 462 in 1914, 272 in 1915, 256 in 1916, 169 in 1917, 110 in 1918, and 58 in 1919. The workers in question were aged 17 and over. From 24 October 1920 onwards no male workers under 18 were engaged. Metallurgical lead works do not exist in this country. The number of workers employed in 128 colour mills amounted to 878 about 1912. In the majority of these mills raw material with a lead content was used. The figures, however, relate also to lime kilns and varnish factories where white lead is not used. As regards the zinc industry, there is in Holland one zinc factory, one zinc white factory and one factory for producing zinc white and lithopone, the two latter belonging to the same company. In 1910 the zinc factory employed 820 workers, in 1914 869, in 1916 651; the zinc white and lithopone factory employed 398 workers in 1913, 413 in 1914, and 394 in 1920. Entry to this factory had, for many years, been forbidden to women and young persons.

In 1912, by virtue of Article 8 of the law on Prevention of Industrial Accidents and on Industrial Hygiene, a regulation was issued. At the outset of the same year regular medical supervision of the employees was instituted with the result that from 1912 onwards all workers in white lead factories had to undergo a monthly medical examination. The cases of lead poisoning notified during the period 1913 to 1919 have been as follows :

Years	Number of cases	Number of workers	Percentage
1913	31	385	8.0
1914	30	462	6.4
1915	14	272	5.1
1916	7	256	2.7
1917	4	169	2.3
1918	1	110	0.9
1919	1	58	1.7

Despite the fact that, in consequence of conditions brought about by the war, the staff of the four factories had greatly diminished during the latter years, the proportional figures nevertheless indicate a reduction in the cases of lead poisoning. No

information is available in relation to cases of lead poisoning, unless these are notified by the doctor in charge of the case, in virtue of Article 82 of the law of 1919 (Article 21 of the law of 1911). This notification is generally far from complete, with the result that it may be stated that the number of cases occurring is in reality much greater than might appear from the following figures. The number of cases of poisoning noted amongst painters from 1912 onwards is as follows¹ :

Years	House painters	Carriage painters	Painters and other workers in constructional or shipbuilding yards	Workers in colour factories
1912	26	1	4	—
1913	11	1	—	—
1914	9	—	1	—
1915	6	—	2	1
1916	6	—	4	—
1917	2	1	—	—
1918	—	—	—	1
1919	—	—	—	—

There should be added 3 workers who were engaged on scraping old layers of painting from sluice gates and a painter employed in a mechanical construction factory.

The Netherlands does not possess morbidity statistics, and it is therefore impossible to supply data relating to occupational diseases amongst painters.

As regards mortality, data relating to occupations involving contact with lead have been used, since no separate returns relating to the painting trade are available.

MORTALITY AMONGST WORKERS ACCORDING TO OCCUPATIONS
FROM 1886 TO 1900

Occupations	Workers who died at the age of		
	18-22 years	23-35 years	36-50 years
	per 1,000	per 1,000	per 1,000
Painters, etc. (glaziers)	6.46	6.19	9.30
Workers in domestic industry (including carpenters)	4.67	6.09	7.84
Masons	3.62	4.52	6.80

Tuberculosis is represented for the same period by the following figures :

¹ Data furnished by the Dutch Government (table included).

MORTALITY DUE TO PULMONARY TUBERCULOSIS

Occupations	Workers who died at the age of		
	18-22 years	23-35 years	36-50 years
Painters	per 1,000	per 1,000	per 1,000
Workers in domestic industry	2.97	3.11	3.18
Masons	2.62	3.03	2.49
	1.44	1.75	1.75

For the two statistical returns the proportions for all males employed in any occupation were :

	Workers who died at the age of		
	18-22 years	23-35 years	36-50 years
Mortality	Per 1,000	Per 1,000	Per 1,000
Mortality from tuberculosis	4.84	5.24	8.23
	2.39	2.41	2.25

The importance of the lead risk and its consequences for workers belonging to the trade affected, is proved by the medical inspectorate in a very detailed report¹, dealing with lead poisoning amongst painters in the Province of Overijssel. Referring to the census of 1899 there is found a comparative table of mortality amongst painters and amongst workers in trades considered as healthy, which takes account of age.

Age groups	Painters throughout the country	Painters in the Province of Overijssel	Gardeners	All trades
12-17	14.21	15.6	11.61	20.51
18-22	16.42	18.2	13.62	13.46
23-35	30.57	31.15	26.94	29.88
36-50	23.73	23.85	22.83	24.86
51-60	8.76	7.3	12.50	11.60
61-65	2.90	2.5	4.35	4.35
66-70	1.82	0.9	3.88	2.81
Over 71	1.50	0.5	3.30	2.53

The following table is even more striking since it classes deaths for 100 house painters and for all trades according to age and forms of diseases affecting the workers (or others concerned) :

¹ De invloed van het loodwit op den Gezondheidstoestand der Schilders. Centraal Verslag der Arbeidsinspectie over 1909.

Age groups	Tuberculosis	Apoplexy and meningitis	Diseases of the heart and blood vessels, etc.	Dropsy and diseases of the urinary system	Chronic diseases of the respiratory passages	Deaths due to all causes	Mortality amongst painters becomes abnormal.											
							House painters	All trades	House painters	All trades	House painters	All trades	House painters	All trades	House painters	All trades	House painters	All trades
From 12 to 17	3.87	14.82	1.42	0.92	0.48	0.31	7.72	32.23	24.20	26.20	41.15	87.80	144.85	236.95	481.20	—	—	—
" 18 " 22	11.96	12.40	1.54	1.08	0.64	0.45	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
" 23 " 35	15.54	15.87	1.69	1.08	2.12	1.57	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
" 36 " 50	15.87	12.16	2.81	2.78	2.30	1.32	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
" 51 " 60	16.64	12.07	6.81	7.91	6.07	1.56	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
" 61 " 65	14.86	12.07	12.07	14.70	10.30	17.56	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
" 66 " 70	19.35	11.00	23.09	26.90	17.80	43.19	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
Over 70	4.92	6.80	51.64	44.32	31.00	83.72	0.05	0.31	0.45	1.57	6.70	16.01	34.29	66.18	—	—	—	—
Total	13.85	10.45	5.95	4.65	4.32	3.50	4.70	6.35	4.32	4.70	6.35	4.32	4.70	6.35	4.32	4.70	6.35	4.32

In any case, however, the medical inspectorate drew attention to the fact that lead poisoning is represented in official mortality statistics by figures of such negligible value that the only possible explanation is that doctors often notify it under another diagnosis.

Up to the age of 35 the average duration of life for painters is only very slightly lower than that in other trades, but the difference becomes much more marked after 50 years of age.

The replies to the questionnaires issued in this connection have given the following results. The Dutch Painters' Union notifies 71 cases and the labour exchanges 27 cases; the report admits that in general but little importance is attached to an accurate knowledge of the occupational forms, and it may be added that even in Holland the returns only indicate partially the conditions. An oral enquiry, conducted in 9 districts, revealed a total of 122 certain cases of lead poisoning, 479 suspected cases, and 42 fatal cases. 82 district painters were in ignorance of the risk attached to their occupation.

For 1,000 workers examined in the Province of Overijssel the following figures have been obtained: 45 cases of lead poisoning, 323 cases which might be regarded as lead poisoning in a latent state (digestive troubles, anaemia, rheumatism, nephritis), and 632 healthy workers.

Of these 1,000 workers, 392 were carefully examined by Dr. Wintgens, van Emden, and Kleerekoper. The medical enquiry comprised an examination of each worker with regard to complexion, pulse, heart, presence of the lead line, blood test (haemoglobin, punctate basophilia), and analyses of urine (albumina, hematuria, hemoglobinuria). 302 examinations of the haemoglobin were made on this occasion, 118 blood films in the test for punctate basophilia, and 361 analyses of urine. The importance of hematuria was estimated by control examination of 500 workers who had not been in contact with lead. Among 45 per cent. of the apprentices objective lesions arising from lead poisoning were remarked after a short period of work. The proportion diminished subsequently, only to increase again among workers who had been in the trade from 10 years onwards. The inspectors had drawn attention to the fact that lead absorption is much more active in the first years than in the tenth year. Elderly workers often give up their trade on account of attacks of vertigo. Taking into consideration the results of the enquiry, the report presents the following conclusions:

- (1) It is not possible to obtain in the Netherlands morbidity and mortality statistics relative to painters using white lead.
- (2) Various data prove that lead poisoning exists among painters, though it is impossible to state definitely to what extent it occurs.
- (3) Examination of painters in the Province of Overijssel has shown that the injurious effect of white lead is influenced in the first place by more or less dangerous methods in handling it, and secondly by duration of time spent in the trade.
- (4) The harmful influence of this product is specially to be feared for adults during the first years of work.
- (5) Hygienic conditions in the painting trade leave much to be desired in the Province of Overijssel.
- (6) If the various industries be compared, the danger of lead poisoning is found to be less important for painters than for workers employed in white lead factories or for those engaged in glazing porcelain with a lead content. The danger, however, is slightly greater for painters than for printers and very much greater than for workers in the diamond trade.
- (7) In order to estimate the harmful effect of the use of white lead on the number of births and on mortality amongst painters' children, it would be necessary to examine the objective conditions under which painters live and to make a more extensive enquiry than that at present undertaken.

The Labour Department received, between 1 January 1912 and 31 December 1923, notification of 1,967 cases of occupational diseases, 328 of these being lead poisoning. Amongst these 328 cases, 78 affected painters, 223 white lead workers, 8 workers in red lead factories and 17 workers in naval dockyards.

Norway

The data furnished by the Norwegian Government lay stress on the facts that: (1) white lead is without doubt extremely injurious to the health; and (2) that requisite measures of precaution for attenuating the harmful effects of this product are hardly capable of realisation to any effective extent in the painting trade.

The Painters' Union has given the following figures indicative of the number of unskilled and journeyman painters during the period 1910-1920:

1910 . . .	2,850	1914 . . .	2,700	1918 . . .	2,000
1911 . . .	2,800	1915 . . .	2,450	1919 . . .	2,400
1912 . . .	2,900	1916 . . .	2,400	1920 . . .	2,400
1913 . . .	2,900	1917 . . .	2,300		

Norway hardly possesses actual lead industries in the strictly literal sense of the word.

As regards the zinc industry, it counted in 1921 four foundries employing 304 workers. One of these, which belonged to the State, employed 269 workers, but at that time was not working to its full capacity.

Data as to the incidence of lead poisoning in Norway are to be found in the monograph published in the yearly report of the factory inspectorate relative to the years 1912 to 1916¹.

This monograph only contains an account of 8 cases of lead poisoning and they do not affect painters.

South Africa

The Government of South Africa in its reply to the questionnaire stated that no statistics were available capable of providing complete information in regard to the question. According to the representatives of the painting industry, no case of lead poisoning or colic had been met with. According to the Painters' Union of South Africa, which comprises about 2,500 painters, a very small number of cases of poisoning had been recorded.

Spain

Spain does not possess any statistics in regard to lead poisoning in the painting industry.

In a pamphlet published on the occasion of the Third Session of the International Labour Conference (1921) by Dr. José de Eleizegui the following figures (page 42) appeared. They do not provide much enlightenment, and were furnished by the Association for Mutual Assistance against Industrial Accidents "La Previsión", of Madrid, and relating to the painters' group.

Years	Number of workers assured	Number of cases paid in compensation	Of which	
			There were in re- spect of accidents	There were in re- spect of lead colic
1916	312	36	27	9
1917	272	49	41	8
1918	246	40	33	7
1919	280	20	22	7
1920	559	31	26	5

Sweden

In 1921 the number of painters in Sweden amounted to about 6,000. No statistical returns in regard to lead poisoning are available, but according to data received by the Government cases of lead poisoning, even in the past, have in any case been very restricted and have occurred chiefly amongst workers engaged in grinding white lead. The workers in question were almost always

apprentices. To-day cases of lead poisoning are almost unknown, either because the use of white lead has been reduced to a minimum or because the slight amount of white lead used is sold in a form that is ready for use.

The law of 7 December 1906 demands that each recipient containing white lead shall be provided with a label indicating the fact, and stating that this toxic product may not be used for interior work.

The production of lead and of zinc is exceedingly small, and Sweden does not possess white lead or zinc white factories.

Quite recently (1926) attention was drawn to the frequent incidence of skin diseases amongst painters obliged to use Swedish turpentine. This latter product is much used as it is cheaper than other qualities of turpentine, but it contains a certain quantity of impurities. An enquiry carried out in several painting establishments has placed in evidence the fact that, though during the war and the subsequent years of economic crisis a great number of cases of eczema of the hands were met with, more recently this disease has almost disappeared, probably as the result of improvement in the quality of Swedish turpentine. According to certain experts, the danger from this turpentine derives in part from the manner of its use in the painting trade. Another authority who has studied the question considers that the incidence of dermatitis is not greater amongst painters than amongst other workers using the same product¹.

Switzerland

In Switzerland, in 1903, the report of Vogelsanger, industrial inspector, relating to occupational lead poisoning, and presented to the Schaffhausen section of the International Association for the Protection of Workers, once more brought into evidence the fact that the statistics could not be regarded as accurate since a great number of cases escaped notification, and he insisted on the great importance of injuries caused by lead.

Vogelsanger recalls that the incidence of relapses due to lead led the Insurance Fund (Sickness) to exclude from membership painters who had been ill several times. As early as 1902 there had appeared a list of working painters known under the name of the "black list".

¹ Undersøkelser over blyforgiftning i Norge for 5 aars perioden 1912-1916.

¹ See *Industrial and Labour Information*, Vol. XXII, No. 2, p. 79.

The federal inspectors observe in their reports that the use of white lead has greatly diminished in Switzerland, and that it has practically disappeared for interior painting. Even in exterior painting there has been a great diminution in its use in the sense that pure white lead is no longer used but is replaced by certain products of which it is only a constituent.

The federal public health services of the federal factory inspectorate report that the statistics assembled for the period 1901-1921 reveal among painters, varnishers, and plasterers 168 deaths due to lead poisoning (63 of which were master painters), giving for the 10,790 painters a mortality rate of 0.8 per cent. The general annual average is exactly 8 deaths. Data relating to morbidity are too incomplete to merit mention.

On the basis of these statements, the Swiss Government, in its reply to the questionnaire of the International Labour Office, says that it would be in its opinion an exaggeration to refer to the "ravages" caused by lead in the ranks of the painters, and that lead poisoning due to the use of white lead does not play a very important rôle in Switzerland. It adds, nevertheless, that, however insignificant this rôle may be, lead poisoning involves, notwithstanding, the loss of some lives and causes some cases of invalidity, and that it is essential that sacrifices of this kind should be reduced to a minimum.

According to the Geneva report of 1907, there was some difficulty in discovering the victims, as two house painters only had been treated in the course of the year in question at the Geneva hospital. "One of the two confessed to having been guilty of grave carelessness in regard to hygiene. The man in question was Italian. The other in regard to whom no details were available was French."

The Geneva hospital had recorded (including cases reported by the Painters' Union) a total of 86 valid cases, generally of a benign nature affecting painters throughout a period covering 31 years (1 doubtful death in 1903). The "Polyclinique" recorded 11 benign cases between 1901 and 1906 and one benign case in 1907, or a total of 12 cases. Adding together the cases notified to the committee as a result of different consultations, a total of 117 cases for painters (an average of 3.65 cases per annum) is obtained for a period of about 32 years¹.

¹ Report of the Geneva enquiry, p. 48.

² *Ibid.*, p. 16.

In 1907 there were reported in the second district of the labour inspectorate 4 cases amongst painters involving 71 days of sickness, in 1908 9 cases with 88 days of sickness, and for the period 1909-1910 9 cases, 5 of which affected painters (Geneva). To this must be added 16 painters treated during two years at the Lausanne hospital. The workers in question, however, were for the most part foreigners who had been poisoned in other countries¹. It is interesting to read the few lines devoted to this subject by the inspector of the second district:

One single case of lead poisoning was regularly notified during the year 1907-1908. It affected a compositor. We were also concerned with another case which had been notified by the victim himself. It is not possible for us to believe that the two cases of lead poisoning were the only ones which occurred in the district. We addressed a request primarily to the heads of Cantonal departments asking them to be good enough to seek information among hospital doctors and in infirmaries as to whether occupational disease victims had been treated by them. The Cantons of Neuchâtel, Geneva, Tessin, Valais, and Fribourg issued questionnaires to the medical staff of their hospitals and even to doctors in private practice. The Canton of Berne replied that no case of occupational disease had come to its notice and the Canton of Vaud refused to undertake an enquiry, taking refuge in the excuse of professional secrecy. Beyond the 12 cases reported, 4 of which affected painters, 22 cases were notified by hospital doctors in Geneva and Lausanne without any data being given as to the duration of incapacity for work or the name of the employer. Of the 22 cases treated, 16 affected house painters. The symptoms in question were mild forms of colic, 2 cases of nephritis and one case of radial paralysis of long duration. The injurious influence of lead and its compounds makes itself felt "to an extent far beyond that foreseen by us". The most serious cases affected workers employed in factories, which seems extraordinary, since preventive measures are of easier application there than elsewhere. In this connection care must be taken not to fall asleep in a sense of false security, for all negligence of this order must be paid for.

An analysis of the factory inspectors' reports provides the following figures relative to lead poisoning in Switzerland:

Years	Cases	Fatal cases	Years	Cases	Fatal cases	Years	Cases	Fatal cases
1897-1898	44	—	1907	40	—	1912	38	1
1899-1900	46	—	1908	44	—	1913	44	—
1901-1902	50	—	1909	46	4	1914	22	1
1903-1904	62	4	1910	78	1	1915	5	1
1905-1906	46	—	1911	68	—	1916	5	2
						1917-1918	6	—

The symptoms in question were generally attacks of colic which, according to the inspectors' reports, caused absences of over 40 days, and which in 1917 to 1918 attained even 44 days. These figures, however, are quite valueless unless the accompanying observations be taken into account.

¹ Report of the labour inspectorate, 1908-1909, p. 111 et seq.

First, lead poisoning is responsible for the majority of cases of poisoning notified. Secondly, lead poisoning has been reported more frequently amongst painters than in other trades. Eighty-three per cent. of the cases reported affect painters, and this is no cause for wonder if it be recalled that in certain Cantons white lead is used even for painting the benches in the schools, an obvious proof of the wide extent to which this product is used. In 1911-1912 in the first district, out of 72 cases of lead poisoning 66 were noted amongst painters, and several victims were treated by the doctor in the Canton of Vaud, in addition to the 18 which were notified. In 1913-1914, again in the first district, out of 34 cases contracted, 24 affected painters, 3 of them being painters in factories. It is thus seen that the use of white lead continues. An increase in diseases due to lead is reported in the third district. Two-thirds of the cases affect painters, two-thirds of whom work not in factories but in isolated workshops, where the application of regulations would not be possible. Attention was drawn to the fact that the specifications for certain hospitals demand that the ward furniture should be painted with white lead paint. During the war a diminution in cases of lead poisoning among house-painters and in the mechanical construction industry took place, a diminution due to decreased activity, or even almost total suspension, in these industries (building). The heaviest toll is taken by the diseases in painting shops (1916-1917), whilst, on the contrary, no case has been reported during this period for colour factories.

More recent data are provided by the provisory report of the Federal Labour Office¹ on the white lead problem. An analysis of this report will be found in the Appendices.

It is stated in the report in question, in regard to statistics, that lead poisoning does not play an important rôle amongst painters, and that its incidence has greatly diminished, though no accurate figures are available in regard to poisoning amongst painters. The report is restricted in this connection to an account of the number of deaths furnished by the Federal Statistics Office and quoted above. As regards morbidity, it contains the figures of the National Accident Insurance Fund which, for the period 1920-1924, shows 81 requests for compensation for lead poisoning, 10 of which were refused. The 71 cases compensated caused a

¹ Berne, Nov. 1925.

total working incapacity of 4,768 days, and partial incapacity of 240 days. Twenty-seven cases necessitated hospital treatment extending over a duration of 1,156 days.

From 1901-1923, 164 painters and plasterers affected by lead poisoning were treated in the Swiss hospitals, the cases being distributed as follows: 27 in Zurich, 16 in Berne, 3 in Glarus, 4 at Zug, 31 in the town of Basle, 1 in the Basle district, 4 at Schaffhausen, 3 at Appenzell, 11 at St. Gall, 1 in the Grisons, 10 in Aargau, 3 in Thurgau, 9 in the Tessin, 8 in the Canton of Vaud, and 33 in Geneva. The average number of cases amounted to 10 per annum during the period 1911-1914, and to 6.6 during the following years.

The report sums up the question as follows:

Statistical returns in relation to lead poisoning are incomplete and do not provide an accurate account of the effects which the use of white lead in the painting trade has on the health of the workers or on the national economy. Enquiries undertaken by the National Accident Insurance Fund have invested the data available with a certain amount of importance, but it is questionable whether these enquiries were based on consideration of a sufficiently long period to justify accurate and definite conclusions.

Despite defective statistical data, it has been established, however, that lead poisoning involves annually loss of life for a certain number of painters (an average of 6.2). A striking fact is that it would appear to be almost exclusively individuals who are not subject to compulsory insurance against accidents who fall victims to lead poisoning. If it might possibly be deduced therefrom that compulsory insurance exerts in regard to lead poisoning a salutary influence on those establishments where it applies, the question arises whether a solution might not be found in applying compulsory insurance to all establishments using white lead. It must, however, be remembered that master painters and the members of their families would not come within such a scheme of extended insurance.

United States

The Brotherhood of Painters, Decorators and Paper Hangers of America counted in 1921 125,000 members, of which the majority were painters employed on constructional work¹. In the town of New York, according to Pratt², 75,000 workers were engaged in work under conditions not subject to State inspection and habitually neglected by employers. Of 5,286 deaths registered in the course of a period of six years and nine months, 55 were due to

¹ Information of the International Labour Office.

² Other sources for the United States: A. HAMILTON, *Industrial Poisons in the United States*, New York, 1925. The same author: *Hygiene of the Painter's Trade*, published by the DEPARTMENT OF LABOUR, BUREAU OF LABOUR STATISTICS, Bulletin No. 120, 1913. E. PRATT: *Occupational Diseases — Lead Poison in the State of New York*, Albany, 1912. HAYHURST: *Industrial Health Hazards and Occupational Diseases in Ohio*, 1915, etc.

the use of white lead, and this product figures as a secondary cause in 32 other cases of death. Of 868 cases of permanent and total incapacity, the use of white lead was regarded as the direct cause in 81 cases and the secondary cause in 37 cases.¹

According to Hamilton, it would be absolutely impossible to determine even approximately the proportion of painters poisoned in the United States by lead pigments.

Pratt has been able to ascertain that lead poisoning generally affects the more skilled classes of workers, whilst the less skilled classes of painters are affected to a smaller extent.² This fact would appear to be due first to the circumstance that the latter use cheap colours containing little lead, and subsequently to the circumstance that their work does not demand the same finish as that of first-class painting. The most expert decorators, those who do the most delicate work, are more exposed to lead poisoning, and the majority of cases have been reported among workers working in large hotels and houses with luxurious decoration. Several enquiries conducted by scientists or committees have dealt with the state of health of painters on constructional work.

E. R. Hayhurst³, examining in 1911 100 working painters of Chicago fit for work and belonging to the Brotherhood of Painters, Decorators, etc., found that 70 of them showed more or less marked signs of slight sickness, 27 with distinct early symptoms of lead poisoning, and 19 with neuro-motor affections, and he was able to assemble data proving that in the case of 59 painters at least signs of chronic lead poisoning were present.

In 578 cases of lead poisoning reported by the committee on occupational diseases of Illinois (1911) and bearing on the years 1908-1910, 157 (27 per cent.) affected painters.

According to the statistics of the Prudential Insurance Company for 1912⁴, in a total of 2,783 deaths among painters 23.8 per cent. were due to tuberculosis, 9.9 per cent. to other diseases of the respiratory system (totaling 33.7 per cent.); lead poisoning represented 1.5 per cent., nervous diseases 10.7 per cent., and circulatory diseases of the heart and of the kidneys 25.9 per cent.

¹ The report of the Brotherhood from which these figures are taken does not specify the dates within which the period of six years and nine months fall. There is, however, some ground for believing that this period was the one immediately preceding the date of the request for information made by the Office, namely, 1921.

² PRATT, *loc. cit.*

³ Report of Committee on Occupational Diseases. Illinois, 1911.

⁴ See KOBER and HANSON : *Diseases of Occupation*, p. 515.

The number of cases of lead poisoning registered by the hospitals is very great. The majority have been found to affect painters. Thus in the town of New York¹ there were in 1910 60 deaths from lead poisoning, of which 40 or two-thirds affected painters. For the period 1909-1911 376 cases of lead poisoning were reported, a detailed enquiry having been made in respect of 109 of these. Among these 109 serious cases of lead poisoning, 42 affected painters — 3 cases were reported amongst painters under 25 years of age, 10 amongst painters between 25 and 34, and 11 affected those between 35 and 44, 11 those between 45 and 54, and 7 those over 54. 10 workers had suffered from one attack of colic and 28 were subject to chronic attacks of colic. 10 cases of paralysis were noted, 5 of which took the form of claw-hand (*main en griffe*); there were 37 cases of colic, 4 of arthritis, 5 of derangement of vision, and 4 of nephritis.²

The mortality amongst painters in 1900 in the United States was, according to Kober³, for a thousand painters employed, 3.19 for tuberculosis, 2.14 for diseases of the nervous system, 1.70 for diseases of the heart, 1.54 for pneumonia, 1.83 for diseases of the uro-genital system, etc., and 16.2 for all other causes.

In the State of Ohio the committee of enquiry created in 1913 visited 127 factories for paints and varnishes employing a total of 2,382 workers. This enquiry also dealt with those industries which utilise paint. The statistics for the years 1910-1912 showed a total of 1,025 deaths amongst painters, varnishers, glaziers, and paper-hangers, of which 185 (18.05 per cent.) were due to pulmonary tuberculosis. This percentage in all occupations for the same year was 13.3 and was 7.13 amongst agricultural workers. Of the 2,382 workers coming within the enquiry, 55 were under 20 years, 1,957 between 20 and 40, 200 between 40 and 45, 88 between 45 and 50, and 82 over 50. The enquiry made it evident that the most important toxic agent was always lead, but that the latter was only used now and again in certain workshops and was never used in others. Out of 167 cases of occupational disease notified amongst these workers, 154 were due to lead; 90 were obvious cases of lead poisoning, 27 slight cases, 26 partially cured cases, and 10 authentic cases but reported verbally. There was found besides the case of an ocular

¹ G. B. ANDREWS, in *Bulletin of Labour Legislation*, No. 86. New York.

² PRATT : *New York Factory Investigation Committee, loc. cit.*

³ *Diseases of Occupation*, p. 473.

lesion originating from lead poisoning and 8 cases of poisoning due to turpentine or its substitutes (benzine, petrol, methyl, alcohol), etc. The lack of facilities to permit of washing before meal-times was frequently complained of.

In the same State during the period 1909-1913 the deaths due to lead poisoning according to the reports of the Government Statistical Office were as follows :

	1909	1910	1911	1912	1913	Totals
Workers in the lead industries	2	6	3	5	4	20
Painters	6	6	6	10	11	39
Totals	8	12	9	15	15	59

Finally, still in the State of Ohio during the five years 1 July 1920 to 30 June 1925 the cases of lead poisoning numbered 443, 12 of which affected women. These cases were distributed as follows : electric battery manufacture, 145 (32.7 per cent.) ; automobiles, 114 (25.7 per cent.) ; white lead factories, 54 (12.1 per cent.) ; manufacture of tetraethyl of lead, 24 (5.4 per cent.) ; painters, 20 (4.5 per cent.) ; welding of metals, 12 (2.7 per cent.) ; manufacture of indiarubber, 11 (2.4 per cent.) ; disinfection in agriculture, 10 (2.2 per cent.) ; enamelling, 14 (3.1 per cent.) ; glass works, 8 (1.8 per cent.) ; bronze and brass foundries, 7 (1.5 per cent.) ; printing works, 5 (1.1 per cent.) ; pottery manufacture, 4 (0.9 per cent.) ; lead foundries, 4 (0.9 per cent.) ; manufacture of paints and varnishes, 3 (0.6 per cent.) ; steel works, 2 (0.4 per cent.) ; and tin foundries, 1 (0.2 per cent.).

In 1915 Apfelbach and Gibson in the State of Illinois¹ examined 150 painters : 23 had had colic, 22 suffered from nephritis, 49 from hypertrophy of the heart, 9 from valvular cardiac troubles, 26 from open pulmonary tuberculosis, and 10 from latent tuberculosis.

In Chicago 185 painters out of 1,009 were victims of lead poisoning : 72 of them suffered from kidney trouble, 77 from rheumatism, and 24 from stomach affections.

Of the hundred painters² treated in hospitals for acute or chronic forms of lead poisoning, 56 worked in the building industry, 24 in the coachbuilding industry, 12 in that of wagons, 4 on painting constructional iron, 3 in signal painting, and one in painting of shops. The specialist who examined these

¹ Quoted by HAMILTON : *Industrial Poisons*, etc., p. 194.
² *Ibid.*, p. 195.

painters remarks that to leave such a highly-paid industry skilled workers must really be in a very bad state of health. Of these 100 workers 67 had worked for more than ten years, and of this number 35 had worked more than 20 years ; 50 had suffered more than once from lead colic. The diseases reported may be classified as follows : digestive diseases of an acute nature and without complications 38, with complications 49, diseases of the locomotor apparatus 7, of the nervous system 7, paralysis and arteriosclerosis 1, and arteriosclerosis 3. Nineteen painters suffered from lead poisoning in the course of the first year of their work and 6 only after having worked for more than 25 years. Thirty-nine had had paralysis which in 14 cases affected one limb, 6 suffered from transitory encephalopathy, and 3 from a form of this disease which developed seriously. Eleven cases of visual derangement were found, 8 cases of arteriosclerosis with chronic nephritis, and 24 with pain localised in the muscles and articulations.

During the first year of its activity the industrial clinic of the Massachusetts hospital received 148 cases of lead poisoning, 68 of which affected painters (56 in the building industry, 5 in the coachbuilding industry, etc.). These 68 patients belonged to a group of 217 workers exposed to the lead risk, 149 of whom showed no obvious symptom of lead poisoning.

The average age of the victims was between 36 and 58 years and the duration of their occupation was, on the average, from 14 to 17 years. The average duration of the cases of sickness had been 1 year and 4 months¹.

In 1918 L. I. Harris, of the Health Department² of New York, examined 402 painters, 163 of whom (40 per cent.) showed obvious symptoms of lead poisoning. He also examined the urine of 150 painters and found lead in 72 cases. Lead was also present in the urine of 35 painters who showed no symptom of lead poisoning. The lead line was only present in 22 cases. A test for punctate basophilia in the red cells of 103 painters obviously victims of lead poisoning was positive in 13 cases (12 per cent.). Among 27 cases suspected of lead poisoning it was positive for 14.8 per cent. ; in 19 cases of latent lead poisoning it was positive for 21 per cent. Among 60 individuals apparently normal the test was positive once.

¹ WADE WRIGHT, in *U.S. Monthly Labour Review*, No. 12, 1917, p. 189, Washington.
² *Archives of the Intern. Medic.*, 1918, pp. 22-29.

W. Gilman Thomson reports also 268 cases of lead poisoning sufficiently serious to demand hospital or dispensary treatment. These cases were encountered by Thomson in the course of his work in the Presbyterian and Bellevue hospitals. About 75 per cent. of the patients were painters.

In the report presented in September 1921 by J. A. Runnberg to the General Executive Board of the Brotherhood of Painters, Decorators, etc., there are morbidity statistics dealing with the members of the Chicago section and relating to a period of 11 years (1910 to 1920). The section comprises chiefly members of Scandinavian and Germano-American origin. The average annual number of members had been 1,400 and the number of cases of sickness 1,421, with 103,339 days of incapacity, making 283 years (years of 365 days) of lost time. It will be noted that only serious cases were included, the average duration of which had been 81 days.

According to the statistics presented in No. 7 of the *Bulletin* of the Metropolitan Life Insurance Company*, of 2,722 painters 2 per cent. died of chronic lead poisoning. During the same period health cards showed that for each death from lead poisoning in the hospitals there were 59 serious cases of lead poisoning. The average age of painters who died of this disease was 48.5. In comparing the probable age of other groups with those of painters it may be said that the latter sacrifice 16 years of their life to the conditions under which they work.

In 1921 Apfelbach published his observations regarding 934 cases of lead poisoning. He was able to detect in 55.4 per cent. of the cases the lead line, in 36.5 anaemia, in 35.87 constipation, in 31.58 colic, in 25.48 pallor, in 17.1 loss of muscular energy, in 14.45 trembling, in 7.9 hypertension of the blood, in 2.8 albuminuria, in 2.37 paralysis of the extensors of the hand, and in 1.0 other forms of paralysis. A more detailed examination covering 72 cases showed in 81.9 per cent. of the cases constipation, in 51.3 per cent. the presence of punctate basophilia, in 36.1 the lead line, in 31.9 colic, etc.

The Health Bureau for painters and associated groups of workers of the town of New York organised in July 1922 by

* HAMILTON, *loc. cit.*, p. 196.

* Metropolitan Life Insurance Company, New York, 1921, and United States Census Tables Life Expectancy.

* Analysis in the *Labour Gazette* (DEPARTMENT OF LABOUR, CANADA), Jan. 1924, pp. 31 and 32. Ottawa.

the section of the Brotherhood of Painters, Decorators, etc., of America published in 1923 a report affecting 267 painters examined by the doctors of the Bureau. Only two per cent. of those examined were over 55 years; 12 per cent. were between 45 and 54 years. The Bureau has classed the workers examined in three groups: the first comprises members with an average age of 30½ years who have been in the painting trade for seven years, and 90 per cent. of whom had worked in it over 15 years; the second group comprises members aged on an average 38½ years who had been working for 10 years, and 84 per cent. of whom had been employed for over 15 years; and the third group finally includes persons of an average age of 45 years, 85 per cent. of whom had been employed in the trade from 16 to 39 years and 9 per cent. of whom had worked in it for 40 years or over.

The workers' cards proved that 33 per cent. of the painters in the last group suffered from cardiac lesions. One had had an acute attack of plumbism, two were suspected of suffering from plumbism, and four had had in the past attacks caused by lead poisoning. Out of 267 painters, 165 (61.8 per cent.) had suffered from occupational diseases of which 5 (1.9 per cent.) were serious and 24 (9.0 per cent.) were fairly serious, and 34 (12.7 per cent.) chronic. The 102 others (38.2 per cent.) had suffered from ordinary disease forms, among which 35 per cent. only were not of occupational origin. Individuals enjoying a normal state of health only numbered 14 (5.2 per cent.).

The percentage of persons affected by different diseases at the three age groups showed the following distribution:

Disease	Average age		
	30½ years	38½ years	45 years
	Per cent.	Per cent.	Per cent.
Loss of weight	40	49	46
Headaches	13	12	—
Muscular rheumatism	23	31	35
Constipation	43	47	41
General weakness	10	—	—
Gastric troubles	26	31	20
Anaemia	57	60	—
Arteriosclerosis	34	30	60 ¹

¹ 5 per cent. represented by very marked arteriosclerosis.

The conclusions drawn by the report of the Painters' Health Bureau of New York after one year's activity are as follows: the painter is exposed to constant danger by the use of toxic products. The painting trade is equally dangerous from the point

of view of accidents, a risk which for painters is double that incurred by the remainder of the population. The occupational risks threaten the health of young workers to an alarming degree. Exposure to several kinds of risk, such as dust, fumes and accidents, shortens the average duration of the painter's life by at least 16 years.

PART IV

TECHNICAL DATA

INTRODUCTION

The technical possibility of using substitutes for white lead is not a recent discovery. As early as 1783 Guyton de Morveau proved that a zinc white evolved by Courtois in 1779 could be used instead of white lead; eight years later Atkinson of Liverpool began to push the new material. Both men advocated the use of zinc white on grounds either of hygiene or of its chemical properties.

Despite favourable reports by the most eminent men of the time — such as Fourcroy, Berthollet, and Vauquelin in 1808 — zinc white paints did not become popular in France until Jean Leclaire published the results of his experiments (1835-1843). After Roquette and Mathieu had failed, Leclaire succeeded in manufacturing zinc oxide in large quantities at the same cost as white lead and produced a number of zinc paints which were unaffected by sulphurous fumes. He also produced a leadless drying oil with a manganese base. Eventually, by perseverance and after trying his processes on more than two thousand houses and public buildings, he succeeded in introducing zinc white paints into common use¹. The substitution of zinc white for white lead received the approval, on grounds of technique and of health, of many of the best experts of the period.

Jean Leclaire had proved in practice that the use of white lead in painting could be suppressed, since his zinc white paints possessed not only their own peculiar properties but also those attributed to white lead paints. Even Stas recognised this in 1855; it was no longer a matter of small-scale laboratory experiments. The report of A. Chevalier (31 January 1849), the

¹ For sources, see under "Statistics". Cf. also reports to the French Chamber of Deputies and Senate, 1868, 1907, etc. Also F. L. CANTINEAU: *Une grave question d'hygiène professionnelle et sociale: la Céruse*.

appointment by the French Minister of Public Works of a committee to examine the processes advocated by Leclaire, the pronouncement of the Architectural Committee of the Department of the Seine in 1850, and so on, were further testimony to the value Leclaire's work and the need for painters to familiarise themselves with the use of zinc white paints.

But the phrase "technical possibility of substitution" is open to more than one interpretation, and its meaning was the first question faced by the Dutch commission of enquiry appointed by Decree of 12 September 1903.

The practical function of paint is to preserve the objects painted against deterioration, particularly the injurious effects of atmospheric agents. It must therefore be renewed as soon as it loses its cohesive power and ceases to protect. Damp has a particularly injurious effect on paint, and since there is less damp inside buildings than in the open air paint is more durable indoors. In view of this, the Dutch commission made the following statement:

Apart from a very few exceptional cases it has now long been the rule among competent members of the trade to finish indoor painting with zinc white. On the other hand, white lead is still preferred for exterior painting, except on buildings adjoining the polders or dirty evil-smelling canals of many of our towns, where white lead rapidly blackens and discolours in patches owing to the action of sulphuretted hydrogen and other gases.

The first step must therefore be to investigate the possibility of producing a zinc white paint with greater durability for external painting, as compared with white lead, than those habitually used up to the present. If, however, the difference remained too great — i.e. if zinc white or any other paint were so much less durable than white lead for exterior painting that it had to be renewed at much shorter intervals — the higher cost of labour over a given period, among other things, would be a weighty pecuniary drawback to the use of substitutes.

Opinions vary considerably on this point among experts, even, indeed, with the same expert. For example, J. M. Kippel in one of his writings¹ pronounces definitely against substitutes, as did V. D. Kloes, though his opinion, from the first² less unfavourable than that of Mr. Kippel, was modified still further in a later publication³. Nevertheless, these two experts, who were members of the Dutch Commission of enquiry, both signed its conclusions, more or less in favour of zinc whites. In a most interesting paper on the commission's report given by Mr. Kippel and Mr. W. C. Metzelaar

¹ *Handleiding voor Huischilderen*; quoted by Bakker Schut: *Verbod van loodhoudende verven*: Amsterdam, 1907 (Bibliography).

² Quoted by Bakker Schut, *op. cit.*

³ Kloes and van den Beek (1903), quoted by Bakker Schut, *op. cit.*

before The Hague branch of the Society for the Advancement of Architecture, both experts declared that zinc white was quite sufficiently durable even for exterior painting¹.

The technical possibility of replacing white lead by other substances has always had supporters and opponents; every committee of enquiry hears arguments in favour of white lead and of zinc whites. It therefore seems more logical to refer to the reports of committees which themselves carried out experiments than to those which simply heard evidence from technical experts, employers' organisations, and trade unions.

I. — ADVANTAGES OF WHITE LEAD PAINTS

The admitted advantages of white lead paints are: a high covering power — and, when ground in oil, a glossy finish — density, opacity, resistance to the air, and relative cheapness, since white lead needs less linseed oil than other pigments². White lead is the only paint with the reputation of being invariably satisfactory and the only one which intelligent painters can adapt to any operation³.

Among the disadvantages, in addition to its affinity for sulphur fumes which causes blackening, it may be noted that white lead lends itself to adulteration which is difficult to detect⁴. According to experts⁵, commercial white lead is not pure basic carbonate of lead, although it is this which gives its reputed covering power. With a view to increasing the covering power or to cheapening the product the lead carbonate is mixed with cheap powders, such as lime, kaolin, or plaster⁶. But the substance which least affects the power to "mask" other colours, when the paint mixed with linseed oil is spread on them, is sulphate of barium. A sul-

¹ Quoted by Bakker Schut, *op. cit.*

² This argument is not now (1926) as conclusive as it was formerly. (Cf. the prices of white lead and other pigments given later.)

³ U.S. DEPARTMENT OF COMMERCE: *Paint and Varnish*. Washington, 1917 (see p. 73 for practical information on painting operations given by the National Lead Company).

⁴ SOMMERFELD, *op. cit.*

⁵ P. ALESSANDRI: *Merccologica tecnica*. Vol. 2. Milan, Hoepli.

⁶ *Ibid.* See also note (317). At the Geneva Conference, Mr. Navas, one of the experts, laid stress (Cf. *International Labour Conference*, 1921, p. 452) on the enormous quantities of fraudulent white lead constantly on the market, which was perhaps the sole reason for the insistence of white lead vendors on its continued and general use, and asked for action by the public authorities.

phate of barium is therefore now produced by precipitation for the sole purpose of being mixed with white lead. It has the further property of never yellowing or blackening under the action of sulphur fumes as white lead does, whence its name of "fixed white". There are on the market, therefore, in addition to pure white lead, mixtures containing one, two, three, or even four parts of baryte to one of white lead, under various trade names: Krems white (almost pure white lead); Venetian white (equal parts of white lead and baryte); Hamburg white (one part white lead to two parts baryte); Dutch white (one part white lead to three parts baryte), etc. Obviously these mixtures are not fraudulent if their composition is declared, since, according to Alessandri, the mixture of white lead and baryte does not decrease the efficiency of the paint for certain operations.

At the Third Session of the International Labour Conference (Geneva, 1921) Dr. Bopp, expert for the German employers, describing the advantages of white lead in painting, said that the chief of these was its durability, arising from the fact that white lead combines with linseed oil to form a water-resisting and elastic soap. Further, the insoluble compound formed under the action of sulphurous and sulphuric fumes becomes fixed in the coat of white lead paint and resists the action of the air. White lead paint, once dry, is very elastic, adapting itself to contraction of the painted surface, which it covers without flaking. It is the base of every priming coat put on a surface to be painted. Dr. Bopp, nevertheless, admitted that the combination of white lead with sulphuretted hydrogen to form a black substance was certainly a drawback¹.

II. — SUBSTITUTES: ZINC WHITES

The arguments advanced in Great Britain in favour of white lead and against the use of substitutes² indicate that insufficient attention has been paid to the experiments carried out in Great Britain, France, Italy, and other countries.

At least fifty white mineral paints are sold to-day under various names as substitutes for white lead, but there is no doubt that zinc

¹ *International Labour Conference, 1921, pp. 438-439.*

² OLIVER: "Industrial Lead Poisoning in Europe". *Bulletin U.S. Bureau of Labour Statistics*, No. 95, p. 28.

white is the best of them¹. It is produced by either the direct or the indirect method, each type of process giving a pigment with special qualities.

Whiteness of tint, covering power, protective power, and easy mixing with oil are the properties which give zinc white their pre-eminence. When exposed to sulphurous fumes they do not discolour, since zinc sulphide is as white as zinc oxide, does not perish, and does not become transparent.

To balance these admitted advantages, the criticisms of zinc whites should now be noted. In the first place, undercoatings of zinc white do not adhere sufficiently to the previous coats, and when they flake off carry with them the coats above, thus destroying the paint and exposing to the weather the surfaces which they ought to protect².

Further, being extremely fine, zinc white mixes perfectly with the oil, and very thin coats can be obtained. But in order to make the paint sufficiently thick and durable the worker is obliged to lay on a larger number of coats with zinc white than with white lead, so that the higher cost of labour makes painting with zinc white much more expensive³. This defect can, however, be overcome by adding to the zinc white some substance such as barium sulphate, which forms a fairly coarse powder and has what painters call a "mordant".

For a reasonable judgement the materials compared must be of the best quality, and they must be not only properly prepared but applied by the best technical methods. The workers' delegates to the International Labour Conference insisted on this point:

A painter can make his paint flake off if he likes, whether white lead or zinc white is used; it all depends how he mixes his paint. If I put on a first coat of "thick" paint, i.e. one which will take more oil than turpentine or drier, and twenty-four hours later add a coat of thin paint, two or three weeks later there will be blisters in the paint⁴.

All supporters of substitutes for white lead agree that as a rule zinc white demands greater care and intelligence in its application than white lead. The misgivings felt by some workers and even employers about substitutes are sometimes the result of a single unsuccessful experiment.

¹ P. BECK, in *Die chemische Industrie*, 36. Jhrg., No. 14, p. 433. Among other substitutes, those prepared from antimony, titanium, etc. should be mentioned. (See below.)

² Dutch report: *Rapport der Loofwitcommissie benoemd bij besluit van den Minister van binnenlandsche zaken d. d. 12 September 1903, No. 7216, afdeeling a.* (Uitgegeven door het Departement van landbouw, nijverheid en handel.) The Hague 1910.

³ *International Labour Conference, 1921, p. 446.*

III. — EXPERIMENTS WITH ZINC WHITES

The various enquiries conducted have brought to light experiments made with zinc white paints and other substitutes for white lead. The results and conclusions of official experiments commissions in certain countries may be consulted in the Appendices to the present Report. Here a few instances only need be mentioned. In Great Britain Mr. Chappell, a master painter, referred to the experiments made by the National Association of Master Painters in 1910, which produced entirely satisfactory results for indoor painting¹. Members of the association, while pointing out that the experience of four years was not enough to test the efficacy of substitutes, admitted that the facts collected might justify prohibition of the use of white lead in interior painting². The experience of the British Office of Works and of Cadbury Brothers, Ltd., indicated that leadless paints could be used satisfactorily for all kinds of painting³. There is much evidence to the same effect: the experience of the Belgian and Italian railways in coach and house painting (zinc paints have been used for years at Rome and Milan); not to mention the data furnished by France and the Netherlands; the results noted by the recently-appointed committee in Belgium, where interesting evidence had been collected before the war; the results obtained by Sulzer and Company, of Wintherthur, by Sommerfeld in Germany as a result of his experiments at the Charlottenburg Welfare Museum, and by the Siemens and Halske works at Berlin; the views of expert workers and of a minority of employers — such a variety of confirmatory evidence provides the necessary data to establish beyond doubt that the adoption of substitutes for white lead in interior painting is justified by technical principles and practical experience.

Thus in the matter of interior painting there is agreement. But when we come to exterior painting the evidence is conflicting, as was shown by the discussions in the White Lead Committee at the Geneva Conference. The minority of the Committee — a large minority, consisting mainly of workers' delegates, but

¹ OLIVER : *op. cit.*

² Great Britain : *Report of the Departmental Committee on the Use of Lead in the Painting of Buildings* (Cd. 7882), 1915; subsequently cited as "*British Report, 1915*".

³ The proposal to repeat experiments with paints was also advanced by a contributor to the *Journal of Decorative Art*, who thought, however, that a period of three years would be necessary.

⁴ *British Report, 1915.*

including also some factory inspectors — admitted this divergence, though expressing the opinion that "it is possible to find a substitute for white lead for exterior painting".

It may be well to review the facts briefly, and in the following pages the essentials of a good paint are examined in turn, in order to ascertain how far substitutes for white lead fulfil the conditions.

COVERING POWER AND OPACITY

The term "covering power" means the area in units covered by a given quantity of paint. "Opacity" is the term used for the capacity of a paint to hide a surface or obliterate a different colour¹. The two terms are often confused, and "covering power" is popularly used to indicate opacity.

These two qualities have always been attributed to white lead paints. It has also been claimed that thinner coats could be used as the paint is so opaque. The reply to this is that relative covering power is often difficult to determine, for the conditions of tests for this purpose have never been defined (weight of ingredients, colours, skill of the worker, etc.); further, it may be better in some cases to put on four coats of a paint with less covering power, but cheaper, than three coats of an expensive paint, if they produce the same result or even if the lower cost admits of more frequent renewals.

France

Apart from these possible replies, however, in relation to the main question it should be noted that in France the architectural committee of the Department of the Seine stated as early as 1850 in its report² that this objection was not well-founded, since three coats of zinc white covered the pores of wood as completely as three coats of white lead, and were of a better white. In 1901 Mr. Ogier denied that zinc white had less covering power than white lead. Some contractors in France even claim that the white lead of to-day, which is inferior to the old types, has less covering power than zinc white. The superior covering power of zinc white was confirmed by the results of experiments made at the *Conservatoire national des arts et métiers*, which agree with those arrived at by the Pasteur Institute in 1902 and by Lenoble.

¹ *International Labour Conference, 1921, p. 417.*

² J. LAWRENCE : *Pigments*. London.

³ See Appendices, under *France*.

Italy

The committee appointed in 1908 by the municipality of Milan found, after experiments with zinc oxide ("Old Mountain" and "National") and "National" white lead, that on walls their covering power was the same in interior painting but that of zinc was superior in exterior work; on wood their covering power was the same in both indoor and outdoor painting; on iron it was the same in interior painting but that of white lead was greater in exterior work, although the paint was rather yellowish. After further experiments, however, the committee decided that the covering power of white lead, measured with the apparatus of Dr. Beck, of Hamburg, was the greatest, followed by the lithopones and then zinc white ("Old Mountain").

Germany

Members of the painting trade with exhaustive technical training have long declared that the high covering power attributed to white lead mixed with barytes could easily be given to other preparations¹. In addition there were so many drawbacks to the use of white lead that its advantages, cited in opposition to substitutes, became quite subsidiary². According to the *Leitfaden für die Anstreicher* (Painters' Guide) zinc white is little if at all inferior to white lead; the specific gravity of zinc white being considerably less than that of white lead, weight for weight it will cover at least as great an area.

Great Britain

In the course of a discussion among technical men meeting in London in 1910, Cruikshank Smith stated that a gallon of lead paint covered 69.5 square metres, a gallon of Dutch zinc paint 82.7, a gallon of American zinc white paint 82.7, and a gallon of Silesian zinc white paint 82 square metres. Thus the various zinc whites were about equal, while white lead was quite inferior in covering power. If account were taken of covering power, opacity, and resistance together the difference was even more remarkable.

Again, before the departmental committee on house painting a representative of the Aberdeen branch of the Scottish Painters' Society quoted experiments from Cassell's *House Decorator*, edited

¹ SOMMERFELD: *Les industries insalubres*, p. 61. Basle, 1908.
² *Ibid.*

by Paul Haeluck and published in 1911, pointing to the conclusion that "it is possible to produce an oxide of zinc paint whose opacity is equal to that of white lead paint". A science committee of the Royal Institute of British Architects found, in the course of experiments from 1908 to 1910, that in interior work, "while the covering power of zinc is less than that of lead the spreading power of zinc is greater". In reply to objections regarding the opacity and covering power of zinc white, Laurie¹ maintains that, although the painted surface is thinner and more coats are required, yet weight for weight zinc white covers as well, if not better than white lead, since it is not so liable to crack and blister.

Netherlands

Interesting experiments on this subject were made by the Dutch commission of enquiry. Ten planks one metre square were coated with white lead paint and zinc white paint on the most approved methods. These prepared surfaces were then painted in squares like a chessboard (18 white squares and 18 black). The commission decided that, if the paints used were similar to those prepared under its direction for the experiment, which were known to be excellent for ordinary use, zinc white paint was in no respect inferior in covering power to white lead paint, and it might even be said to be slightly better.

Results as satisfactory as those obtained with white lead have been achieved with substitutes produced in recent years through progress and improvements in industrial processes.

PERMANENCE AND DURABILITY

The "permanence" of a paint is its faculty of resisting natural destructive agents without changing colour. "Durability" is its power to resist similar influences without changing its composition, apart from changes of colour². It should also be noted that among its other properties the pigment should not combine with the oxygen in the air, should not destroy the elasticity of the paint film, and should not combine with the substance of the object covered, if, for example, this is of iron. Since the solidity of a paint is in direct relation with the impermeability of the coats, it is desirable that the pigment should be light, since it is then possible to obtain thick coats with an adequate covering power by the use of only a small weight of pigment.

¹ Quoted by OLIVER, *op. cit.*, p. 28.
² LAWRENCE, *op. cit.*

France

The architectural committee of the Department of the Seine stated in 1850 that the permanence of zinc white could be chemically demonstrated beyond the possibility of doubt. The committee appointed on 3 July 1850 by the Prefect of Toulon on the instructions of the Minister of Marine reported that zinc white had all the properties ordinarily required to secure permanence and durability. A great many experiments had been carried out on very large surfaces (about 1,000 square metres). The different paints had been simultaneously kept in the shade and exposed to all atmospheric changes and the same fumes and vapours. For colour and density zinc white was always the best, although the experiments were too short to permit of a final judgment on the relative durability of the two paints. The committee concluded, however, that the various causes of rapid deterioration in white lead did not affect zinc white so rapidly or so profoundly; zinc white resisted sulphur fumes a little better, although it also yellowed, and washing with soapy water did not restore its colour. (The Dutch commission arrived at the opposite conclusion on this point.) Mr. Ogier's report stresses the special quality of zinc white, that when acted upon by sulphurous gases or fumes it turned into a white sulphide. The permanence of zinc white was also admitted by the General Council of Civil Construction.

Referring to the objection that substitutes for white lead would not produce lasting paints, Mr. Boulin, in the White Lead Committee of the Geneva Conference, cited the case of the Gare d'Austerlitz in Paris. The contractor was asked to guarantee that the zinc white paint would last for five years; he guaranteed it for ten years, and the station was not actually repainted for twelve years. Again, the assertion that zinc paint deteriorates so readily through damp that it cannot be used in cotton mills, green-houses, and above all in damp climates, was refuted by Mr. Boulin; he pointed out that in the Lille district a woollen spinning mill, where much greater humidity is required than in cotton spinning, had been successfully painted with zinc white, and that in bath-rooms, where the paint is always exposed to the action of steam, the enamel coat is always made with zinc white. Sulphurous or sulphuric acid fumes are found to be injurious to zinc paints only when their action is continuous — an extremely rare circumstance, especially in the interior of buildings.

¹ *Rapport J.-L. Breton*, 1907, p. 16. *Chambre des députés*, No. 799.

Belgium

According to a report presented by the Society of Operative House and Ship Painters and Decorators to the meeting of Belgian and British painters held in London in May 1924, a measure of the relative resistance in wear of zinc white and white lead is afforded by the experiments of many of the Belgian municipalities, which have always remained faithful to leadless paints, while the experiments were conducted in the strictest conditions.

Of the two piers at Ostend one was painted with lead compounds, the other with zinc compounds. A number of specialists, including Mr. Rongy, who visited a great many buildings and other works, among them the Ostend piers, appear to have been convinced that preparations of zinc are really better than lead compounds.

The technical committee appointed in 1914 adopted in October 1921, with only one dissentient and one abstention, a resolution in the following terms:

The committee is of opinion that on certain conditions exterior painting can be successfully carried out without the use of lead.

Nevertheless, recognising that the use of lead colours for exterior work presents advantages in certain circumstances, and being convinced that regulations which merely prohibited the use of lead paints for interior work would be very difficult to put into operation, the committee considers that neither complete prohibition nor the maintenance of the *status quo* are an acceptable solution free from drawbacks.

The committee is rather of the opinion that there is no objection to regulation based on the principle of total prohibition in interior painting, tempered in exterior painting by facilities for obtaining such exemptions as may be admitted to be necessary.

Netherlands

The commission of enquiry found that, although lithopones showed little resistance to the action of air and weather, zinc white could quite bear comparison with white lead. Experiments in the durability of paint had proved that zinc white peeled off less readily than Dutch white (lead) and much less readily than German white.

Great Britain

The Science Committee of the Institute of British Architects found that in interior painting zinc white and white lead were equally satisfactory. Among the witnesses before the committee on lead, many asserted that white lead was indispensable for

¹ *Industrial and Labour Information*, Vol. X, No. 8, pp. 25-26.

exterior work, but others stated that a zinc paint, properly prepared, was as satisfactory as white lead. The report gives many examples of buildings painted externally with zinc oxide, which had withstood wear remarkably well. The experience of the Office of Works and the Admiralty need not be recounted here, but that of the Society of Operative House and Ship Painters and Decorators may be mentioned; the society stated in 1921 that many of the substitutes for white lead were both economical and effective. Laurie considers that zinc white has greater resistance to the weather when the necessary care is employed in mixing the paint. Further evidence is contained in the following table drawn up by Cruikshank Smith to show the relative durability and cost of different paints:

Base of paint	Covering power per 100 kg. (in sq. yds.)	Cost per 100 kg.	Cost of materials per 100 sq. yds.	Re-new-als in 20 years	Cost of labour per 100 sq. yds. in 20 years	Total cost of paints and renew-als per 100 sq. yds. in 20 years
Zinc oxide	870	46	5.29	4	66.66	87.82
Red lead	424	28	6.60	4	66.66	93.06
White lead	614	28	4.56	5	83.33	106.13
White lead	816	32	3.97	6	100.00	123.82
Oxide of iron	1,080	24	2.22	7	116.66	132.20

The objection that there are no substitutes for white lead on exterior painting in damp countries (such as Great Britain) is refuted by the statements of several witnesses before the British committee who mentioned successful painting with substitutes in various British towns, by the results obtained by the Dutch commission of enquiry, and by the very widespread use of zinc whites in Norway and other countries where the large towns are in much the same latitudes as those of Great Britain and climatic conditions are as varied.

GRINDING IN OIL

Linseed oil is certainly used more generally than any other for grinding paints. When fresh it contains a number of fatty acids which the oxygen in the air converts into stearic isolinolenic, dioxy-stearic, and other acids. With continued oxidation the oil forms an elastic, solid, and dry film on a thin coat of paint.

Opponents of substitutes make two statements in this connection: (1) that zinc whites do not combine "chemically" with the oil, as white lead does; (2) zinc paint is more expensive because it requires more oil than lead paint.

White lead is said to react on the free acids of linseed oil and form a homogeneous and stable compound, doubtless an oleate of lead, which resists atmospheric action. White lead and zinc white are not interchangeable, for in combination with oil they produce lead or zinc soaps which act in very different ways. Hydrolysis of lead soaps is slow and gradual while that of zinc soaps is more rapid. Consequently, it is argued, coats of zinc white offer less resistance to the air (which is always more or less charged with moisture) than coats of white lead.

The *Bulletin* of the Institute of Industrial Research at Washington notes that H. A. Gardner confirmed by repeated experiments the conclusions of Dr. Blakmer, that zinc oxides react on the free acids of linseed oil as thoughtfully as white lead; 5 grammes of zinc oxide mixed with 5 grammes of linseed oil and left for a month produced 0.105 per cent. of soluble zinc compounds, while white lead in the same conditions produced 0.116 per cent. of soluble lead salts.

The chief experts who have given evidence before commissions of enquiry are of opinion that zinc whites combine perfectly well with linseed oil; they do not consider that, as has been asserted, zinc paints are a mixture of an inert substance and a liquid substance. The conclusions of Stas, it is true, have been cited for the last ten years as proof that zinc whites do not saponify in combination with oil; but it is impossible to ignore the progress of technique and the new facts daily brought to light by science¹.

¹ Since white lead is a mixture of carbonate and hydrocarbonate of lead, and is therefore a comparatively unstable salt, it is possible — according to Stas — that the carbonic acid displaced by the fatty acids of the oil in which it is ground, forms an oleate of lead, as Stas thought, or, as is now believed, a fatty lead salt. In this reaction, which is certainly more complex than Stas thought, the fatty acids take the place of the carbonic acid, which, converted into gas, escapes into the air.

The fixed idea of supporters of white lead is to show that the durability of white lead paints depends on the property of white lead of combining with the fatty acids of the oils. But it may be questioned whether this alleged power of resistance is as great and as general as it is claimed to be. G. Petit is not of this opinion, and in 1914 he drew attention to the fact that the results of painting with zinc white at the seaside and those obtained in Lille, northern France, and London were not favourable to white lead. He recalls, too, that some British municipalities require in their specifications that exterior painting must be renewed every three years.

In 1855 one might argue that zinc oxide was insoluble in linseed oil, and even to-day this is true in the experimental conditions encountered by the Belgian chemist; but it is not so in other conditions. It is now known that by suitable processes zinc oxide can be rendered soluble in oil previously oxidised by the formation of oxylinoates; the Dutch commission succeeded in mixing paints with a larger proportion of zinc white than was usually ground.

Nevertheless Mr. Meissl, the Austrian expert at the Geneva Conference, again insisted on this point, stating that the substance which gives a paint its adhering power, its durability and resistance to atmospheric action is lead soap in white lead and zinc soap in zinc whites and lithopones. Obviously the most durable paint would be that containing the substance with the strongest resistance to atmospheric conditions and especially to sunlight. Sunlight and damp cause strong oxidation and destroy the paint by attacking the vehicle. The inferiority of substitutes for white lead is an established chemical fact; zinc soap is readily affected by damp and light, and the paint disintegrates in two years or even less, having lost its binding agent. Lead soap, on the other hand, according to Mr. Meissl, resists these factors and is not destroyed for six or eight years—even, in favourable conditions, ten or twelve years. Mr. Meissl emphasised, however, that his remarks applied only to exterior painting¹.

Another objection which is said to have some practical importance is that zinc whites require more oil for grinding and are therefore more extravagant. But this very characteristic is an important practical advantage. The French Marine Committee of 1850 found that, although zinc whites did require more oil, 923 grammes of mixed paint were sufficient for a surface requiring 381 grammes of white lead paint; in spite, therefore, of an original cost 30 per cent. higher, the use of zinc white represented a saving of 11.31 per cent. It was also found that, although white lead absorbed only 30 per cent. of its own weight of oil where zinc white took an amount equal to its own weight, this apparent defect was actually a most important guarantee of good work, since the durability and body of a paint are mainly conditioned by the proportion of oil employed.

All experts admit that the larger proportion of oil required for grinding zinc whites is a sign of superiority. In 1910 it was

¹ *International Labour Conference, 1921, p. 421.*

pointed out at a meeting of experts in London that the value of a paint was not determined solely by its chemical composition—a remark which applies particularly to zinc whites. A zinc white may be absolutely pure chemically and yet be of little or no value as a pigment if it has not sufficient affinity with oil and consequently produces a paint with inadequate spreading power¹.

Although zinc white required more oil than white lead, it must not be imagined that even so the proportion is high. In Great Britain zinc white is made and sold in paste perfectly ground with 7 per cent. of oil²; in Dutch factories zinc white is ground with 12 to 15 per cent. of linseed oil and white lead with 10 to 12 per cent. The comparative costs as ascertained by the Dutch Commission, with the same labour costs, show a slight difference in favour of zinc white, which would be inexplicable if it required double or more than double the quantity of oil.

DRYING POWER

Boiled oil is partially polymerised, which makes it more suitable for paints. If it is boiled in the open air oxidation is more rapid and also causes the film to dry more rapidly. This drying power is increased by boiling the oil with lead salts or lead oxides.

Thus the selection and combination of pigments, oils, and thinners are of the utmost importance. Even with lead pigments, which tend to dry the linseed oil, a drier must as a rule be added to the paint to assist the drying of the oil, i.e. to enable it to absorb oxygen from the air more rapidly. It is common knowledge that nowadays work is done at high speed and "quick-drying" paints are demanded, this amounting to premature destruction of the paint. If slow-drying paints are properly mixed and contain no foreign bodies they should be more durable. The most usual driers are lead acetate, red lead, litharge, lead borate, manganese borate, manganese dioxide, and cobalt acetate. There are many types of drier on the market, each specially suited for different uses.

It has been complained that zinc whites do not dry as well as white lead; certainly experiments have shown that in some cases at least white lead paints dry more rapidly. But the opinion of

¹ See the theory as to the action of white lead on the oil in the process of grinding advanced by H. HILLIG in the *Malerzeitung* (Berlin), 24 Oct. 1920, and the reply of Mr. Groll.

² Letter from M. VAN ZWEELEN in *Montiteur de la peinture*, 1919, No. 15.

experts is that zinc paints can be made to dry as rapidly as lead paints by the addition of manganese products (borate, resinates) in liquid or powder form, as Leclair¹ proposed.

COLOURS

One quality of zinc whites which is always admitted is that they give an excellent white colour, better than that of white lead, and are not blackened or yellowed by sulphurous fumes. Further, coats of zinc paint are easily washable and their freshness is thus restored. Zinc white is therefore preferred, especially for interior painting. According to the British Association of Master Painters, zinc substitutes for white lead remain white longer than white lead. But the question is not limited to white paints; for decorative work paints of many different colours are required. Many pigments at present used with a lead base are themselves leadless, for example, all the blues prepared with Prussian blue, cobalt, and ultramarine; the various yellows, maroons, and browns obtained from ochres, Stenna and other earths; the purplish reds prepared with the iron compound known as "crocus Martis".

It has been said that yellows, greens, and reds with a lead base are much in demand at present; some witnesses give the proportion of lead in ordinary chromate (yellow) paints as from 10 to 20 per cent. But others put it at less than 5 per cent. of lead soluble in dilute hydrochloric acid. This indicates that leadless yellows are not difficult to make¹. Restrictions on the use of lead beyond this amount could be accepted if the lead chromate colour is mixed with a leadless paint.

The foregoing also applies to green colours. It should be carefully noted that in coloured paints the colouring matter itself is of little importance, as was found, among others, by the Austrian commission.

From its later investigations the Dutch commission drew the following conclusions:

- (a) Surfaces painted with zinc white retain a clearer, fresher tint than those painted with white lead paints.
- (b) Surfaces painted with zinc white mixed with other colours in time darken more than white lead paints. The darkening disappears in both paints if they are washed, but zinc paints are generally more improved by this than white lead paints.
- (c) Coats of the zinc white used by the commission were brighter from the first and for a longer period than those of white lead.

¹ *British Report*, 1915.

Other lead paints are used to a very limited extent as compared with white lead, but it must not be forgotten that one lead compound — red lead — is also a poisonous substance which should be considered in the protection of the workers.

In reply to the questionnaire of the International Labour Office several Governments, among others those of Denmark and Italy, drew attention to the desirability of beginning immediately to consider the other lead paints in use which are dangerous to the health of the workers and possibly of submitting the problem of their prohibition to future Conferences.

IV. — HOUSE PAINTING

EXTERIOR AND INTERIOR PAINTING

The problem of finding substitutes for white lead in house painting was at first confined to interior work¹. This point need not be stressed at length, since the objections have since disappeared. But it is not without interest to recall the results of experiments in various countries, since they apply to exterior as well as interior painting. The experience of each country will be dealt with in turn.

Experience Prior to the Enquiries of the International Labour Office

France

Reference has already frequently been made to the conclusions of the commissions of 1850, 1852, and 1901 and of the commission on insanitary housing (1891); they were all favourable to interior painting with zinc white, because it "does not imperil the durability of the painting, adversely affect its appearance, or increase the cost". The commissions admitted that for exterior painting zinc white would not last so long. Since these enquiries were conducted, however, improvements in the manufacture of substitutes have led to the production of paints more suitable for exterior work. The Prefecture of the Seine has entirely forbidden the use of white lead for any kind of painting by the conditions

¹ Cf. *Memoranda of the Düsseldorf Chamber of Commerce*, 1903 and 1921; also the reply of the German Government to the questionnaire of the International Labour Office. For Great Britain, cf. E. JONES: "Notable Contracts", in the *National Builder*, Dec. 1921 and Jan. 1922.

of tender for municipal contracts. This prohibition was approved on 25 November 1925. Clause XI prescribes the use of zinc white composed exclusively of pure unalloyed zinc oxide and of no other zinc white. This condition has caused no difficulties. The Prefecture of the Seine is nevertheless in favour of the use of white lead on iron, since this is a case of decorative rather than protective painting.

Belgium

In a report presented to the World Exhibition of 1855 the Belgian chemist Stas wrote as follows about zinc white paints:

I approach this subject with some hesitation, for, desirous though one be of discovering the truth, it is difficult to disentangle it from the mass of error with which it has been surrounded by private interests, which exaggerate both its defects and its qualities. My judgment is therefore based solely on precise official data furnished by an absolutely impartial public office and on a series of facts which I have myself ascertained. I will then endeavour to support my conclusion by analysing the chemical composition of the rival paints....

When used on interiors zinc white paint retains its whiteness more generally than paint made with white lead. Zinc white paint is very durable in ordinary circumstances; it can even be polished, but when newly applied it tends to soften with heat owing to the high proportion of oil which it requires. Although it is quite as hard as white lead paint it collects the dust more readily and also gets dirty more quickly. It is more successful than white lead paint because it does not discolour under the action of illuminating gas and sulphurous animal fumes which may be found in the interior of dwellings or public buildings.

When used on exteriors its effects vary with the manner in which it is exposed to the weather and the nature of the surface which it covers, but these conditions being equal its solidity, i.e. its durability, is less than that of white lead paints....

From the foregoing it follows that:

(1) for the interior of buildings and decorative painting zinc white paint can in every respect take the place of white lead paint; it has the considerable advantage of not discolouring with sulphurous fumes;

(2) on the exterior of buildings exposed to sun and damp it has less resistance to the factors destructive of paint in general; it is less durable and therefore protects the surfaces to which it is applied for a shorter period. For exterior work zinc white is thus not an economic substitute for white lead.

Later Stas explains the differences in durability between zinc white and white lead paints by the different chemical nature of zinc and lead soaps, but he concludes that:

In the interior of buildings, where the combined influence of daylight, air, and water has little or no effect, zinc white paint — or any paint made of linseed oil and some substance which does not itself destroy the dried oil — can be used to great advantage.

Unless I am mistaken as to the function, in white lead paint, of lead oxide, which becomes soluble, is transformed into (and remains) lead linoleate and margarate in the oil before and after it dries, it should be possible to prepare a paint with the same resistance on exteriors as white lead with zinc white, or any other inert substance, and linseed oil in which is

directly dissolved a suitable quantity of these lead salts or any other white metallic linoleate with the same properties as linoleate of lead. Although paints of this kind would probably be discoloured by sulphurous fumes, it is, nevertheless, most desirable that a large-scale trial should be made.

However that may be, and even if zinc white, mixed with oils containing metallic soap, can never provide a paint with the same resistance to deterioration as white lead, its use on the interior of houses and public buildings will always afford it such scope that its manufacture on a large scale at a very moderate price and its use in painting may fairly be hailed as one of the most glorious achievements of our age.

Belgian experts and public officials have testified to the superiority of zinc white for interior painting and consider that in most cases it is at least equal to white lead for exterior painting¹. The letter of the Belgian Minister of Railways, reproduced in the report of the British committee of 1911, contains the following passage²:

The zinc white need not be absolutely pure, but must contain at most 4 per cent. of lead compounds and 0.2 per cent. of arsenious acid. The most careful investigation which has been made, and the opinions given by the most competent authorities on the subject have established the conclusion that this permitted limit could not present any serious objections from the point of view of the health of the staff engaged in painting operations. From the point of view of durability, there is no difference between white lead and zinc white for interior painting. After washing, carried out under proper conditions, zinc white paint work recovers its pristine freshness. This is not the case with white lead paint work. Zinc white for interior work is therefore superior to white lead. But in special cases (for example, at the sea-side) white lead painting possesses a certain superiority over the other. White lead in this case has a greater durability and affords a better protection to the surfaces on which it is applied. In spite of this advantage, the administration of State railways do not hesitate to prohibit white lead.

Langendoeck stated that the superiority of zinc white for interior painting was no longer contested, while only a few biased or short-sighted persons still asserted that it could not take the place of white lead for exterior painting.

Recent experiments (1914-1919) have all been equally favourable; they point to the conclusion that with certain precautions exteriors can be successfully painted without lead paints.

Great Britain

According to information received by Sir Thomas Oliver from the Association of Master Painters, in April 1913 43 master painters were in favour of white lead for exterior painting, while 17 preferred zinc white for interior work. As regards interior

¹ CHEMINS DE FER DE L'ÉTAT BELGE: *Rapport supplémentaire du Sénat français*, 1909, 11-67, pp. 5, 6, 7, 11.

² *British Report*, 1915, Cd. 7882, p. 94.

decoration there was no reason why zinc white should not be more frequently used, but for exterior painting of houses the majority of master painters appeared to be in favour of white lead¹.

Witnesses before the departmental committee generally admitted that white lead was not necessary for interior painting and that zinc white was more and more widely used, in Liverpool and Newcastle, for example, in exterior painting. Some witnesses even said that they would rather risk the use of substitutes than submit to stringent regulation. Before the 1911 committee it was indeed stated that although substitutes for white lead could be used for interior painting, this would have detrimental results in exterior work. But during the five or six years following the first enquiry a number of experiments and cases of practical experience cast doubts on the alleged superiority of white lead for exterior painting. This accounts for the opinions given before the second committee by representatives of paint and colour manufacturers.

Some witnesses who were unfavourable to the use of substitutes often admitted that they had not adopted the proper methods in using substitutes or else were simply repeating the opinion of others without forming one of their own.

Denmark

The Ministry of the Interior consulted the National Experimental Station, which reported that it was possible to prohibit the use of white lead in interior painting, while tests might be carried out to ascertain how far it could be prohibited in exterior painting.

¹ OLIVER: *Lead Poisoning*, 1914, p. 63. It may be recalled that exterior painting is of secondary importance in house painting as a whole. For example, it is stated that in the majority of British towns, apart from London, there is very little exterior painting (ARMSTRONG and KLEIN: *Lecture to the Royal Society of Arts*, 14 July 1921).

For confirmation of the successful use of substitutes by H.M. Office of Works, cf. *British Report*, 1915, and *Parliamentary Reports, House of Commons*, 30 May 1921. Cf. also *Daily Intelligence*, Vol. II, No. 45, p. II. In January 1925 the War Office issued an Army Council instruction prohibiting the use of lead paint containing more than 2 per cent. of white lead or sulphate of lead (expressed as metallic lead) in painting buildings internally, except in so far as it was necessary to use up existing stocks of paint. The instruction, however, was shortly afterwards cancelled.

Austria

The experience of Vienna is favourable to the use of substitutes for interior painting; some experts think it possible in exterior work also. In general they consider that white lead is not essential, that it can be replaced. As early as 1906 Teleky stated that at most 25 per cent. of the houses in Vienna were painted externally with lead paints, and foremen painters supported this statement. Further, it was ascertained in the Austrian enquiry that in 1903-1905 only 22 or 23 per cent. of interior painting was done with white lead¹. The widespread use of zinc in Vienna was attributable to its low cost, the effects of propaganda, the existence of good substitutes, and the general dislike for the yellow discolouration which is a peculiar defect of white lead.

On prohibition of the use of white lead on exteriors opinions were divided; in the Vienna enquiry into interior painting it was unanimously agreed that prohibition was possible and indeed desirable². In view of these statements, the Austrian enquiry recommended prohibition of white lead for interior work, and this has been in effect in Austria since 1908. A departmental circular dated 11 November 1913 confirmed the conclusions of 1907, stating that lead paints, particularly white lead, could be entirely replaced for interior painting by substitutes such as lithopone and zinc white³.

Italy

The committee appointed by the municipality of Milan arrived at the same conclusion and recommended prohibition of white lead for interior work⁴. The same prohibition is in force in Turin.

Germany

Fischer stated in 1912 that the results of experiments had proved that white lead could be replaced by substitutes not only for interior painting but also for certain kinds of exterior painting. It is unnecessary to give here the long list of German States

¹ Report of the enquiry.

² *Ibid.* Cf. also memorandum of the Düsseldorf Chamber of Commerce (see English translation in INTERNATIONAL LABOUR OFFICE: *The Use of White Lead in Painting*; Studies and Reports, Series F, No. 4).

³ Cf. *Bulletin of the International Labour Office* (Basle).

⁴ The report of the enquiry at Rome points out that the cornice and bas-reliefs inside the Transpontine Chapel, painted with four coats of zinc paint, were in good conditions twenty-two years afterwards.

which had decided to discontinue the use of white lead on the interior of public buildings. Some municipalities had forbidden its use even for exterior painting¹. In Fischer's opinion prohibition of lead paints for interior painting would be a good beginning with a view to more complete prohibition later, if this proved feasible. On the other hand Rambousek, an opponent of substitutes, said (1906-1912) that the replacement of white lead by substitutes even for interior painting could be considered for the moment as nothing more than a subject for discussion. But in general prohibition of white lead for interior painting is no longer discussed in German trade circles; even the Association of Painters' Guilds of the Rhineland and Westphalia simply stated in October 1920 that there is no substitute for white lead "on exteriors". Opinions favourable to the use of substitutes in interior painting are frequently to be found in the writings of German trade and hygiene experts.

On 7 December 1920 the committee of the Federation of German Master Painters adopted a resolution containing the following passage: "The committee is of opinion that substitutes for white lead can be used for interior painting and that there is no reason to oppose prohibition of white lead in such work". The resolution continued, dealing with exterior painting: "There is, however, no substitute for white lead here, for the chemistry of paints has not yet progressed sufficiently to produce a pigment with the same durability as white lead".

Nevertheless, Richard Groll, of Dresden, a paint chemist and lecturer at the municipal trade school and the school of arts and crafts, drew attention on 13 April 1921 to the good quality of the zinc whites which he had used for exterior painting, their success having been confirmed by many experts. He wrote as follows:

At the old gasworks at Reick, near Dresden, the four walls of the staff office were painted under my direction in 1910. On a priming coat of good linseed oil varnish we applied three coats of a light-coloured zinc

¹ Fischer, in *Mitteilungen des Instituts für Gewerbe-Hygiene*, 1912. A curious opinion advanced is that zinc white is a paint for the northern parts of Europe (*Memorandum of the Düsseldorf Chamber of Commerce*, p. 13).

"White lead is practically no longer used for interior painting, but it is still very widely used for exteriors; painting experts and paint manufacturers regard it as essential for this type of work" (*Protokoller (Hannover)*, 16 July 1921). But later the author, who is opposed to prohibition, states: "White lead is used in exterior painting only for whites. Browns, yellows, greys, etc., contain no lead. It is also established that white paint is very little used on exteriors."

oil paint. To-day, two years later, the paint is in a condition which could not be surpassed by a white lead paint. While white lead paint was often completely blackened by the sulphurous gases, the zinc paint is not discoloured.

This expert considers zinc paints far superior to white lead paints.

Netherlands

The experiments carried out by the Dutch commission at the Amsterdam law courts for exterior painting, and at Delft University for interior work, had the following results. During the first three years the zinc paints were distinctly more satisfactory than the white lead ones; they took the brush better and showed no defect of any kind. But the following year certain defects were observed here and there in the paint applied to wood: drops of rain or condensed vapour remained suspended on it, and once this had started deterioration rapidly set in. Elsewhere, however, on smooth vertical wood surfaces, on cement, iron, and zinc, zinc paints were in every way as satisfactory as white lead paints.

Inspection of the interior painting showed that four years after it was done and put into use all the paints, whether made with white lead, zinc white, or lithopone, were in excellent condition and that there was no appreciable difference of quality among them.

Switzerland

As an experiment the Swiss Federal Council bound itself, by an Order of 5 June 1904, to prohibit the use of white lead for four years in all painting undertaken directly or by contract for the Federal Government. The Cantons of Basle, Zurich, Schaffhausen, and St. Gall in the same year issued similar orders prohibiting the use of white lead in interior painting done for the Cantonal Government.

In pursuance of the Federal Order, valuable information was obtained as to the possibility of using substitutes for white lead. The almost universal opinion of competent judges, supported by the facts of experience, was that there was no obstacle to prohibiting the use of lead paints on the interior of buildings, although the use of other paints appeared to increase the cost of maintenance. In the light of these reports and at the suggestion of the Department of Industry, the Federal Council decided on 30 June 1908 to request all branches of the Federal administration to prohibit the use of white lead in interior painting executed directly or under contract. (See also Appendix II, under "Switzerland".)

Enquiries of the International Labour Office

The following passages relating to the point now under consideration are extracted from the replies of Governments to the questionnaire of the International Labour Office.

The reply of the *German* Government was, in part, as follows:

In the opinion of the large majority of German painters and users of colours, no substitute for white lead which is completely satisfactory for all purposes, especially as regards external painting, has yet been discovered. It has repeatedly been found in Germany that all the substitutes offer less resistance to the weather and to damp than white lead, and this has been confirmed by the experiments made by the Railway Administration. In these circumstances the German Government considers that there are at the present time certain objections to issuing a general prohibition of the use of white lead in painting. It considers that it would be desirable to begin with the consideration of a prohibition of the use of white lead in internal painting.

The *Austrian* Government stresses the dangers inherent in interior painting, dangers too great to be removed even by the most stringent protective regulations. This fact was fully confirmed by the returns collected by the Office of Labour Statistics in the former Royal and Imperial Ministry of Commerce. The Government considered that:

The first necessity is to prohibit the use of lead paint for all kinds of interior painting. The use of white lead for exterior painting should be allowed, but every effort should be made to limit the danger to the workers by suitable protective regulations.

The *Finnish* Government stated that:

The employment of white lead in painting has considerably diminished, and it is only used now for outdoor work, paints with a zinc base being generally employed for indoor work.

The reply of the *Netherlands* Government recalled that:

The conclusions of the special commission, set up by the Dutch Ministry of the Interior, which from 1903 to 1909 examined in detail the technical possibility of employing substitutes for white lead, prove that it is possible to replace white lead entirely for internal painting of buildings, and that it is also possible more frequently than not to replace white lead for external work, although in places subject to extreme humidity the resistance of white lead is stronger than that of substitutes. White lead cannot, however, be replaced for external work in such places as stations and bridges which are exposed to sulphurous fumes, e.g. from locomotives and steamers.

We are ... of opinion that the possibility should be envisaged of accepting legal prohibition as a general rule while admitting certain exceptions to be indicated by the competent authorities. These exceptions will include in the first place the above-mentioned classes of work and perhaps also external painting of houses with a frontage on stations, etc.

The *French*, *Greek*, and *Italian* Governments replied wholly in favour of prohibition. The *Swedish* Government pointed out that "it is only with regard to certain kinds of painting out of doors that it can be regarded as difficult to find a substitute for white lead".

The *Swiss* Government pointed out that:

The Federal Factory Inspectorate confirms the views of the Federal Department of Public Health and remarks that the use of white lead has much diminished in Switzerland; indeed, it has almost completely disappeared as far as internal painting is concerned.

At the Third Session of the International Labour Conference (Geneva, 1921) Mr. Navez, expert to the Belgian employers, who had made a scientific study of the problem, voiced the feeling of the group which he represented:

Our feeling is that white lead paint must be retained at least for exterior work. Needless to say, however, we have observed that the very high resistance of white lead is not so prominent when it comes to interior painting. Indeed, in several countries painters have acquired the habit of using zinc white very extensively. ... It is certain that, with or without statutory prohibition, zinc white paint is constantly gaining ground, simply because the question is not, in this case, whether it is as good as white lead, but whether it is good enough for practical requirements¹.

Mr. Boulin, reporting for the minority of the White Lead Committee of the Conference, stated that no really objective and sound proof had been produced regarding interior painting in the course of the prolonged discussions in the Committee. On the other hand, he found ample proof of the efficiency of substitutes for interior painting. The Düsseldorf and Cologne chambers of commerce, the British committee, and, quite recently, the Belgian technical commission and Meissl, the Vienna expert, had all been of the opinion that it is possible and indeed desirable in certain cases to replace white lead by substitutes in indoor work². Meissl himself stated that in interior painting white lead can easily be replaced by paints with a zinc or lithopone base³.

The Australian press reports the *Queensland* Minister of Labour as saying that the use of white lead in that State presents a very complicated problem owing to climatic conditions⁴. Under the intense rays of the sun paint disintegrates and perishes very rapidly, constituting a danger to anyone touching it, especially children. To realise this, one need merely pass one's hand over the white railings which enclose public gardens; unless the paint has been put on only a few days ago, a perceptible quantity of white lead will adhere to the hand. Very satisfactory results

¹ *International Labour Conference, 1921*, p. 452.

² *Ibid.*, pp. 415-416.

³ *Ibid.*, p. 422.

⁴ *Brisbane Daily Mail*, 21 Nov. 1921. (Cf. also Appendix.)

had been obtained by the use of leadless paints. When an annexe to the Petrie Terrace school was built, nothing but leadless paint was used, and the results were entirely satisfactory although the cost of the work was no higher.

Enquiries Subsequent to those of the International Labour Office

According to the report of the British departmental committee on industrial paints (1923), published after the enquiries of the International Labour Office, the views of witnesses as to the behaviour of substitutes for inside painting indicate that in public buildings, which are liable to hard usage and become very dirty, the frequent washings which are absolutely necessary have a very rapid action on the zinc paints hitherto used and that in these places lead has proved itself superior to zinc. For the painting of most interiors the witnesses were agreed that substitutes, which at present are mainly zinc substitutes, are satisfactory. On the other hand many witnesses agreed as to the failure of substitutes in external painting; this failure was particularly marked in some areas owing to the action of sea air and fumes from factories. The committee therefore concluded that :

From a general review of the evidence that has been placed before us, and in the light of the experience gained since the previous committees reported, we feel we cannot support their recommendation that the use of lead paint, for the painting of buildings, be entirely prohibited. We are satisfied that for outside painting, and for certain kinds of internal painting, there is at present no efficient substitute for lead paint.

The Belgian committee, which was appointed in 1914 and resumed its enquiries on the conclusion of hostilities in 1922, presented its report to the Minister of Industry and Labour, with the following conclusion :

The committee is of opinion that on certain conditions exterior painting can be successfully carried out without the use of lead paints. Nevertheless, recognising that the use of lead colours for exterior work presents advantages in certain circumstances, and being convinced that regulations which merely prohibited the use of lead paints for interior work would be very difficult to put into operation, the committee considers that neither complete prohibition nor the maintenance of the *status quo* is an acceptable solution free from drawbacks. The committee is rather of the opinion that there is no objection to regulation based on the principle of total prohibition in interior painting, tempered in exterior painting by facilities for obtaining such exemptions as may be admitted to be necessary.

In New Zealand experiments have been carried out to ascertain the efficacy of certain products which may serve as substitutes for white lead. An arrangement was made with the Railway Department to test a hydrated zinc oxide. As this test was considered inadequate, further arrangements were made, in agreement with the Department of Labour, to make another series of experiments covering all four seasons of the year¹.

The enquiry conducted by the Swiss Federal Labour Office in 1925 brought several facts to light. It was found that the special regulations on painting work issued in 1910 had fallen into oblivion. The Federal Railway Administration expressed the opinion that prohibition of the use of white lead for interior painting was not impracticable, since lead paints were indispensable only in exterior painting. The Swiss Association of Master Painters and Plasterers insisted that white lead was essential for exterior painting, while the Trade Union Federation, on the other hand, thought that a harmless substance could be used in place of white lead without injury to the appearance or quality of the paints. A resolution adopted by the Trade Union Committee on 9 July 1925 refers to the enquiry conducted by the Federation of Building and Wood Workers among many of its branches in May 1925; it was found that only 133 out of 600 painting firms still used white lead, and of that number only 87 used it for interior painting.

Most of the Cantons which replied to the circular sent out by the Federal Labour Office were in favour of prohibiting the use of white lead for interior painting (see Appendices). The Canton of Thurgau replied that "the use of white lead on interiors is avoided as far as possible" and that "apart from decorative painting, white lead is no longer used for indoor painting except in special circumstances". The Master Painters' Association of Schaffhausen and district reported that its members practically never use white lead for any but exterior work.

The report of the Federal Labour Office states, among other conclusions, that "some of the replies from the Cantons and the statements of the Swiss Trade Union Federation indicate that the use of white lead has markedly declined, chiefly in interior painting"².

¹ *Annual Report of the Department of Labour, 1923-1924.*

² *OFFICE FÉDÉRAL DU TRAVAIL : Rapport provisoire sur la question de la céruse, p. 34. Nov. 1925.*

RUBBING DOWN OF PAINT

It is now generally recognised that lead-containing dusts are the chief factor in the production of lead poisoning, and that dry rubbing down of old paintwork or newly painted surfaces¹ are operations dangerous to painters, since they give rise to the greatest quantities of dust. To remove this danger the logical step would be to do away with dry rubbing down, but the feasibility of this is one of the most disputed aspects of the problem.

It should be noted in the first place that the appliances adopted in factories for the removal of poisonous dusts produced by certain operations cannot at present be applied to the work of the house painter. Again, there are obvious objections to the use of respirators, on which it is unnecessary to enlarge here².

Opponents of white lead assert that, as dry rubbing down is unavoidable in most high-grade work, white lead must be replaced by substitutes. Opponents of prohibition, on the other hand, consider that satisfactory regulation of dry rubbing down is impossible, and therefore advocate wet rubbing down.

DAMP RUBBING DOWN : EXPERIENCE AND OPINION

Great Britain

According to the report of the 1923 committee, experiments in moist rubbing down with ordinary sandpaper gave promise of a measure of success, but the prospects of success were somewhat modified by the rapid wearing away of the sandpaper, the increased cost due to expenditure on sponges, the increased quantity of sandpaper required, the longer time taken over the work, the fact that grit would be left in the quirks of mouldings and would prove troublesome on the application of the subsequent coats of paint, and the difficulty of drying off walls rubbed down by the damp process, especially in wet weather.

¹ The question does not, as a rule, arise in exterior painting.
² The German Painters' Union, in its pamphlet, states that: "The respirators and damp sponges suggested as effective means of protection are quite unsatisfactory, as they hamper the workers' breathing, which is quickened by the effort of rubbing, and the workers show a very natural repugnance to wearing them". As *SOMMERFELD* states (*op. cit.*) "the respirator must fit hermetically on the mouth and nose, which heats the face and makes breathing most difficult". *STERNBERG* (*op. cit.*) speaks even more severely of the use of sponges and respirators: "No worker will willingly use them. Moreover, their efficacy is comparatively slight, since clinical experience leads us to believe that the poison is carried to the mouth by the hands." The subject was also discussed by the British committee.

The report adds, however, that recently (in 1921) waterproof sandpaper had been introduced and was very durable under the special conditions appertaining to damp rubbing down. The trade now admitted that dry rubbing down was no longer necessary and that this work could be done by a damp process. This view was incorporated in the draft agreement between the Home Office and the Painters' and Decorators' Industrial Joint Council of Great Britain (see Appendix).

A writer in the *Journal of Decorative Art* (June 1923) stated that workers who have tried the new waterproof sandpaper realise its advantages, in some cases at any rate, over the ordinary sandpaper for certain processes. "But", he adds, "every practical painter, employer or operative, knows quite well that the modern demand is for a high-class finish, particularly on enamelled or varnished work, and that present-day output demands that even the high-class finish must be produced without any faddy or messy processes."

According to the report presented by Messrs. Gibson and Pickles to the meeting of Belgian and British painters in 1924, the Belgian house painter realises as clearly as his British comrade that rubbing down by a moist process is of no practical use. The practical difficulty is no longer that sandpaper when damped rapidly wears into holes and tears, for the new waterproof sandpaper avoids this defect, but that dry rubbing down is irreplaceable, if not for old paintwork, at any rate for all work on edges, mouldings, cogs, etc. Damp rubbing down is also much slower and therefore more costly for new paintwork; there must be a long delay before the coat of paint is hard enough to bear damp rubbing down without peeling off, and this is a particularly awkward necessity in a trade such as house painting, which is liable in most countries to sudden rushes and checks. Trade experts also point out the inconsistency of leaving plaster and woodwork to dry for months before painting them and then putting water on them for damp rubbing down. It is added that with old paintwork damp rubbing down may cause serious damage to wallpaper, hangings, inlay, and floors.

On the whole the problem does not appear as yet to have been solved; there are very many cases where it would be most inadvisable to wet or moisten the paint before it is rubbed down. This is shown by the fact that some of those who wish to see dry rubbing down prohibited have suggested that such paints should be moistened with turpentine.

There is also the financial side of the question to be considered. If the surface to be rubbed down is moistened, a kind of paste will be produced which will adhere to the surface instead of the dust; but this paste must not dry on the paint or further dust will be produced. The painter, after rubbing a certain area, must wipe it with a damp sponge to take off the paste, which he will then wash out of the sponge in a pail of water. These very lengthy operations will certainly increase the cost of the work by an amount which some experts put at as much as 20 or even 60 per cent. of the cost of dry rubbing down.

Mr. Bailey, speaking on behalf of the Institute of British Carriage Manufacturers, said that the wet process could be used but that the industry would probably object, as it was longer and more costly. Another witness before the Committee on Coach Painting said that where sandpapering was unavoidable it would be necessary to have a fan or exhaust appliance to carry off the dust as it was created.

Dr. R. V. Edginton, certifying factory surgeon for North Birmingham, described a system of dust removal in his district, but did not consider it quite efficient. Mr. Maythorn, president of the Institute of British Carriage Manufacturers, considered that any such system of dust removal would be ineffective, and would prefer prohibition of the use of white lead — an opinion which was shared by the committee.

Germany

The German Painters' Union has definitely opposed the statement that rubbing down, scraping, and burning off can be done by a damp process and that the problem of dry rubbing down and scraping is readily solved by the mere adoption of precautionary measures. The pamphlet issued by the union¹ emphasises the absolute necessity for dry rubbing down:

Although dry white lead powder ceases to form dust as soon as it comes into contact with oil, it is impossible to prevent the production of much greater quantities of dust in the treatment of old or of newly-dried coats of paint. In particular, the prohibition of dry rubbing down, which is included in numerous protective regulations, is quite useless in practice. In simple and rapid painting work, for the removing of dry pieces of dirty paint and of dust from a newly-dried coat of paint and for smoothing it over superficially before a second coat is applied, wet rubbing down with

¹ *Report of the Departmental Committee on the Use of Lead in Painting of Coaches, etc.* Cmd. 680. Subsequently cited as *British Report*, 1920.
² English translation in *Studies and Reports*, Series F, No. 5.

pumice-stone is impossible for technical reasons as well as on account of the cost. In the first place, the new coat of paint is still very delicate and could not resist wet rubbing down with pumice-stone, but would be destroyed; in the second place this procedure would increase the cost of the work out of all proportion. A strict application of the prohibition of dry rubbing down would involve the abandonment of the use of white lead in painting, as it would make its use unprofitable.

The same applies also to old coats of paint, in regard to which wet rubbing down, at any rate in some cases, is technically possible. Even in this case, however, the work requires so much time in comparison with dry rubbing down that the cost is greatly increased. This makes the temptation to evade the law almost irresistible, especially as the places of work are so scattered that supervision is very difficult. Again, wet rubbing down produces a sludge which soils the floor and is therefore avoided, especially in inhabited rooms. Not all the places which have to be rubbed down, such as cornices, mouldings, etc., can be treated with pumice-stone, and so sand or emery paper has to be used dry. Again, it is almost impossible to tell whether or not old coats of paint are lead-containing, so that even the strictest regulations for wet rubbing down can generally be evaded, because it can always be said that the coat of paint to be rubbed down does not contain lead, and this statement is very difficult to check.

Dry rubbing down is thus technically necessary and economically justified. The amount of dust produced in this process is, however, enormous, and some of it is necessarily inhaled by the workers, first, because the body is brought close to the surface which is being worked on, as a certain amount of exertion is required for rubbing down, and, secondly, because the surfaces to be rubbed are often high up, and the work has to be done with the arms and face raised, which soon quickens the breathing and so facilitates the inhaling of the poisonous dust floating in the atmosphere. The destructive action of the dust on the respiratory and digestive organs is thus set up at once.

Belgium

The report drawn up for the Congress of Master Painters at Liège in 1905 confirms that "the operations of dry rubbing down and scraping are of necessity followed by dusting off which, by stirring up lead dusts, poisons the air". Prohibition of dry rubbing down and scraping is therefore "impossible except in a few kinds of work, since good workmanship practically always demands dry rubbing down. It is impossible, for instance, to burn off old paint in a damp state or to substitute for burning off one of the alkali paint removers; almost invariably these have an injurious effect on exterior woodwork, and affect both the surface covered and the paint used to cover it."

France

Master painters told Bargeron, in the course of his investigations that rubbing down is not so harmless as it seems, for even when it is done with pumice-stone the workers may forget to damp it and rub the paint down dry, thus creating lead-containing dust exactly as if they were using sandpaper.

Discussion of the Question at the International Labour Conference

The matter naturally came before the White Lead Committee of the International Labour Conference in 1921. According to the employers' representatives, recent experience has proved that new coats of paint can be rubbed down by a wet process. The paint is moistened with a damp sponge, then sandpapered, again wiped with the damp sponge, and so on.¹ This process, which is used by thousands of British painters and has been adopted by a large painting firm in London, can be applied to any kind of paint and would make prohibition of dry rubbing down possible.

The workers' representatives, however, expressed a diametrically opposite opinion. According to them an attempt was being made to present to-day as a novelty a process on which judgment had already been passed. Mr. Gibson, a British workers' delegate, pointed out that in 1911 this method was not as satisfactory as dry rubbing down; it had been demonstrated by trial that sandpaper disintegrates with damp, and the glue thus set free is spread on the surface to be painted and cannot be removed with cold water. If a special waterproof sandpaper was advocated, the workers replied that the proposed method would destroy the edges of mouldings and make it impossible to apply varnish or enamel.

The same objections were raised to damp rubbing down with powdered pumice-stone and felt. To secure passable results with this method, it is necessary to take the greatest precautions, which render the process almost impracticable. The same is true of work on wood and ceilings. According to Mr. Gibson, the tests carried out in Great Britain were not conclusive: the work done was not finished, since a final coat of varnish or enamel was not applied.

The question was again discussed in full Conference. Mr. Flament, Belgian workers' delegate, said²:

Dry rubbing down can be avoided in an office but not in a building yard or on a ladder. Theoretically it is possible, but I beg to state that good painting cannot be done without dry rubbing down. I wish also to point out, as I did in the Committee, that if we did succeed in rubbing down the paint on buildings with water or by a damp process, it would be so expensive that no one would use white lead. For ornamental work dry rubbing down is quite impossible. For priming coats on plaster and wood-work common sense shows that it is impossible. After waiting two years

¹ *International Labour Conference, 1921, p. 411 et seq.*
² *Ibid.*, p. 445.

for the ceilings to dry thoroughly before applying a first coat of paint, one will hardly rub them down immediately by a wet process. I wish also to point out that new paint cannot be rubbed down wet less than two months after it is put on, or it will peel off.

Mr. Navez, the Belgian employers' expert, also emphasised this point:

The most dangerous work is rubbing down, of which we have heard a great deal here. This rubbing down, which we are told to-day to do with some liquid to keep down the dust, is practically impossible in most cases by this method. Mr. Flament has just told you briefly what he thought of it. Although in practice my interests are not always identical with his, I am obliged to admit that he is right. Rubbing down is certainly the longest, most troublesome, and most unpleasant of all the work that a house painter has to do. One may practically say, too, that when all the rubbing down is finished the painting of the house is finished. It is also the preparation of the building which is relatively the most expensive. So our concern here is to know whether the most important part of our work is to be regulated by people who are not in the trade. I venture to make such a statement because one must have actually done rubbing down to appreciate its extreme difficulty. In Brussels, before the war, we had a very large building guild; we built five thousand houses a year in our city alone. That is enough to show you how extremely important new work, now building, is for us. Now when a painter has to paint a building for the first time, he obviously has to deal with relatively fresh surfaces of plaster and ceilings and very delicate surfaces in the case of woodwork. If in future we are obliged to use damp rubbing down on woodwork which has had only a single priming coat, we should obviously wear out the paint and damp the woodwork so that it would be ruined. We have all met instances of this in practice. We have always preferred to rub down dry rather than have to make good inevitable damage. It is precisely the same with ceilings. Rubbing down is impossible with very new paint — damp rubbing down, that is to say. So whether we like it or not we have to come back to dry rubbing down.

PAINT VEHICLES AND THINNERS

Reference has already been made to the grave risk to the painter's health which may be caused by the fumes of the thinners used in all paints, whether containing lead or not. The British committee of 1911 drew attention to the importance of investigating the possible effects on health of vapours arising from the linseed oil and turpentine or turpentine substitutes used in ordinary paints. Sir (then Mr.) Kenneth Goadby in his evidence described experiments on animals subjected to turpentine vapours, which, when a sufficient quantity was inhaled, were shown to be capable of producing severe symptoms and even death. The Australian States, in replying to the questionnaire, laid stress on the harmful effects of the fumes of linseed oil (carbon monoxide, poisonous aldehydes, etc.: see Appendix). Although Professor Armstrong stated before the British Committee that the quantity of turpentine used in painting operations was insufficient to cause ill effects — and in fact compared it with smelling salts, which would also be

dangerous if taken in quantity — it might be found that turpentine and other substances used in paints could produce ill-effects sufficient to require action on the part of the Home Office. The British committee therefore considered that, in any Bill to be laid before Parliament to give effect to its recommendations, powers should be provided for the Secretary of State to make Regulations, if he found it necessary, similar to those which he can establish in factories and workshops under section 79 of the Factories and Workshops Act, 1901¹.

The factory inspectors' reports in various countries, notably Germany, draw attention to the possible ill-effects resulting from the use of volatile oil of tar or turpentine substitutes in paints, varnishes, and quick-drying enamels; these include dermatitis of the hands, arms, and face and symptoms of poisoning characterised by malaise, nausea, vertigo, drunkenness, headache, etc. These symptoms are especially severe among ship painters, particularly when they are employed on submarines and torpedo-boats, owing to the cramped spaces in which they have to work².

The danger is known to arise less from the poisonous action of the pigment than from the rapidity with which the various substances dry and evaporate, making the air difficult to breathe. Thinners may thus injure the worker's health, and even if white lead was prohibited the other poisonous agents would remain. Nevertheless, prohibition would at least put a stop to the combination of symptoms of lead poisoning and those due to the thinners; it would then be easier to delimit clinically the field of poisoning by thinners and to take steps for its removal or prevention.

V. — COACH AND CARRIAGE PAINTING

The painting of carriages and railway wagons affords a singularly favourable field for testing the qualities of white lead substitutes, since these vehicles, being exposed to weather, smoke, vibration, and shocks and in continuous service, require more than any other object painted with a high resistance.

Substitutes for white lead have been employed successfully by the great railway and tramway companies of Belgium, France, Great Britain, Italy, and elsewhere.

¹ *British Report*, 1916.

² The matter was investigated by the Hamburg factory inspectorate in 1919 and dealt with in Circulars from the Chancellor dated 18 July 1917 and 8 April 1918 and in the Order of 21 April 1921 (see Appendix).

According to Bargeron, the technique varies with locomotives, passenger coaches, and goods wagons. With wagons cased in sheet iron the first operation is to burn off the old paint, after which the surface is rubbed down with spirit. A first white priming coat is then applied, followed by three filling coats and a coat of stain to show up any irregularities. When this is dry the surface is rubbed down with pumice-stone and water; defects and unevenness are filled up with a stopping paste. The surface then receives three further filling coats and is again stopped; the dry stopping is sandpapered. After being dusted, the surface is given a yellow undercoating and then two coats of enamel paint, the first being wiped with a cloth covered with powdered pumice-stone. The painting proper is then finished; there remain only the decoration and lettering.

Omnibuses and tramcars are painted on methods very similar to those for railway passenger coaches. The workmanship is rather less careful, it appears, but these vehicles are more frequently overhauled and renovated.

There are differences in the painting of motor bodies and chassis, according as the vehicle is a lorry, a commercial car, an ordinary private car, or a very high-grade car.

Perambulators are not as a rule so elaborately painted as other vehicles. All that is done, after cleaning the wood, is to put on a priming coat of white lead or zinc white, followed by two filling coats of Meudon white (white lead) laid on with a knife; the filling is sandpapered. Next comes a thin undercoating of the required colour, and the final coat of enamel paint, with what lining and decoration is desired.

Paint spraying appliances are finding increasing use in the painting trades, especially coach painting. The dangers to the workers inherent in this new method, especially when lead paints are used, have already been described. It should be noted, however, that with sprays white lead substitutes or pyroxylin paints are most generally used.

Notes are given below on expert opinion as to the use of white lead or substitutes in coach painting and the results of enquiries into the subject.

Germany

The Railway Administration has reversed its decision, taken in 1907, in favour of the use of substitutes for white lead in the

painting of rolling stock. Government Departments have received very severe criticisms of this step¹.

Austria and Italy

The Austrian² and Italian railways, tramway construction companies, and others have long successfully used substitutes for white lead. For example, the Rome enquiry³ covered vehicles largely painted with zinc white, either for priming or for finishing coats. The Rome Tramway Company uses zinc inside and white lead outside its cars. High-grade private cars are painted with zinc white. Many painters use white lead for lining, but others prefer zinc white for this work.

Belgium

The report of the British committee of 1911 contains the reply of the Belgian Ministry of Railways on painting done for the railway administration, including locomotives and rolling stock, buildings, bridges, and signals:

Since 1909 white lead has been prohibited for the above works and has been replaced by zinc white. The figures for the years 1908-1912, so far as concerns the consumption for rolling stock and the light, are respectively 47,968, 51,661, 52,057, and 50,254 kg. of unground zinc white⁴.

Australia

The report of the New South Wales Board of Trade (see Appendix) describes the experience of the various Government workshops in this connection. It is noted that the Metropolitan Board of Water Supply has for two years made extensive use of zinc paints. In the State railway shops, which employ 400 operative painters, white lead substitutes are used for the interior of coaches and a substitute has been found even for the roofs. Cases of lead poisoning are very infrequent in these two departments. In the Randwick tramway shops, again, lead compounds are even less generally used than in the railway workshops.

¹ The German factory inspectors' reports for 1918 state that a wagon-building firm in Hesse has abolished the use of lead paints and oils.

² See report of the Austrian enquiry.

³ RANALLETTI: *op. cit.*

⁴ Belgian manufacturers who supply foreign customers with railway and tramway stock, etc., are often obliged against their will to use lead paints on the vehicles, since this is required by their contract with the foreign authority (information received by the International Labour Office).

France

Mr. Bageron, departmental factory inspector in Paris, made an exhaustive investigation of the painting industry in the Paris district and presented a report on it to the committee on industrial hygiene attached to the Ministry of Labour. His investigations covered public vehicles, such as trains, omnibuses, and trams; automobiles of various types — commercial, passenger, and de luxe cars; and perambulators.

The manager of the Villeneuve-St-Georges workshops of the P.L.M. Company stated that for many years, on the instructions of the supervising State officials, the company had used no white lead but solely zinc white; the workers were perfectly accustomed to this material, which had proved quite satisfactory. The position was the same in the other railway companies; Bageron says that in this branch of public transport lead paint has been proved unnecessary by long experience. The manager's personal opinion was that white lead is an excellent base for paint. But, in view of the stringent regulation proposed and the difficulty of compelling the workers to make proper use of the washing facilities, etc., placed at their disposal, he would prefer prohibition, which would involve no technical difficulties.

White lead is also not used on the heavy tramcars and omnibuses. The manager of the central workshops expressed the opinion that, if carefully applied, priming coats of zinc white were as good as those of white lead, but that they required rather more careful workmanship. With white lead there was no need of particular care, and it could be applied by any worker. In the light of information furnished by the largest tramway and omnibus company in France, Mr. Bageron considers that the suppression of the use of white lead would have no marked effect on this branch of industry.

Conditions are rather different in the painting of motor bodies and chassis. Firms using white lead varnishes fully realise the risks run by their workers. The manager of the painting shop in one of these firms appeared surprised that the Daimler Company of Coventry can dispense with white lead (as the British report announces) and that Breteau Frères, coachbuilders, of Paris, do not use it. The manager said that he had tried materials other than white lead, but they had not given good results; leadless paint rapidly cracked along the mouldings with the vibration, while white lead did not. His tests, it is true, were applied to only ten

bodies, but he was nevertheless convinced that there was no substitute for white lead. Therefore, being logical in the extreme, he would prefer regulation, with all its drawbacks, to prohibition of white lead. If it were prohibited, he was certain that the quality of the work done would suffer.

The Breteau Frères coachbuilding workshops in Paris specialise in large motor bodies, such as delivery vans, charabancs, etc. From 30 to 60 working painters are employed, and three or four hundred vehicles are turned out annually. The foreman of the painting shop, who has been with the firm for thirty years and has great experience in his trade, made the following statement:

We no longer use white lead except for stopping, where we still use a paste of powdered white lead and a mixture of flaking paint and gold size, and for certain white ground coats on vehicles which are to be painted white. In all we use from 150 to 200 kilograms a year. For the rest we use zinc white, of which we buy every year about 4,500 kilograms ground in oil. The change was made only three years ago, and we have no reason to regret it. None of our customers has made the slightest complaint, and we have an old high reputation to maintain. White lead is not in the least essential; our experience shows that you can do without it perfectly well, even where we still use it, and we would much rather have it prohibited than submit to severe and complicated regulations.

The Automobile Trade Association informed Mr. Bargerön that its members were almost unanimous in advocating the use of white lead in mixing paints. The Citroën and De Dion Bouton companies use lead paints for priming and finishing coats. Rochet-Schneider uses mainly white lead for jointing pipes. In general the members of the Association considered white lead essential in painting on the ground of its elasticity and adhering power, which any paint subject to vibration must possess and which no other paint possesses in the same degree. They are therefore in favour of strict regulation rather than prohibition of the use of the substance. It should, nevertheless, be noted that the Association has not yet been able to consult many of its members, and from the evidence of those consulted it appears that one at least (Rochet-Schneider) does not use white lead for painting.

According to the reply sent to Mr. Bargerön by the Coachbuilding Workers' Union of the Department of the Seine, white lead is mainly used for priming coats. White lead is much more economical, for the paints are more opaque and coats applied over white lead last longer than others. The appearance of the paintwork is also better. The Union therefore preferred regulation to prohibition.

One of the largest perambulator manufacturers in France, the *Société des établissements Parizot*, Paris, stated that it used absolutely nothing but zinc white, which gave as good results as white lead.

Great Britain

An investigation conducted in 1903¹ in 603 British workshops and factories in the coach-painting industry covered the number of persons employed in painting with lead paints, the methods of rubbing down adopted, and substitutes which had been tried in place of white lead. The number of persons using lead paint was 9,608. In 52 factories rubbing down was not practised at all; in 178 only the damp process was used, while in 334 the dry process was used for certain classes of work. In 94 factories substitutes were used, but only for stopping and jointing and not for priming or filling coats. The statement that 178 factories rubbed down only by a damp process may be accepted with some reserve, for the first two filling coats (which cannot be rubbed down damp) and the final coat on the lower parts of carriages, steel motor chassis, and curved surfaces are almost universally sandpapered dry. It should also be noted that the 52 factories and workshops which did no rubbing down were nearly all engaged in the repair of wagons, work which does not require a high degree of finish. Further, 39 factories which used only sandpaper for rubbing down (which is quicker and cheaper than pumice-stone) only executed simple jobs.

Rubbing down takes a great deal of time (estimated at a third of the worker's day) and is very dangerous, especially when done close to the face. The sandpapering of wheels is the most dangerous part of the work and some kind of exhaust dust remover is required. By technical research some modification of vacuum appliances should be invented and put within the reach of the workers. As yet no means has been discovered of removing the dust created in painting bicycles, safes, perambulators, etc.; this work is undeniably a permanent cause of poisoning if done with lead paints.

In 1909 the factory inspectors spoke of progress in the adoption of leadless paints for new railway wagons (e.g. at Newcastle). Among the witnesses before the departmental committee who favoured zinc white were the Great Eastern, Yorkshire, and South-Eastern and Chatham Railway Companies.

¹ *British Report*, 1920.

The Daimler Motor-Car Co., Ltd., of Coventry, uses no lead in the painting of bodies. It has never received any complaints from its customers on the ground of insufficient durability or otherwise. The representative of the company stated that the use of lead paints could be abandoned generally.

Mr. T. Jordan, representing the Midland Railway Company, Carriage and Wagon Department, Derby, stated that no white lead had been used in painting either carriages or wagons since 1905, and that zinc compounds had been found equally good for their purpose. The change from lead to zinc had not entailed any inconvenience, and there had been no complaints from the workers regarding the use of leadless materials.

The Bradford City Tramways, represented by Mr. C. J. Spencer, as a result of experiments extending over three years, had abandoned the use of all lead paints. The cost of painting has not been materially affected. If the leadless paint was covered with a coat of varnish its durability proved equal to that of lead.

Mr. W. Readman stated that on the London County Council tramcars zinc white stopping had entirely replaced lead stopping. His general opinion was that zinc white could be satisfactorily used.

The Brush Electrical Engineering Co., Ltd., Loughborough, represented by Mr. J. Steinitz, gave up lead pastes for jointing and stopping at the end of 1904; the lead pastes were replaced by leadless pastes, the exclusive use of which had given absolutely satisfactory results. For ordinary painting, however, lead had not been discontinued.

Mr. H. B. Baker, representing a leading perambulator firm, stated that they had abandoned the use of lead and found the leadless materials for all practical purposes as good as lead paints. No additional coats of paint were given and the finish and durability had been quite satisfactory¹.

The departmental committee on the use of lead in coach painting arrived at the following conclusions :

The committee have carefully reconsidered the recommendations . . . drafted by them five years ago, and see no reason to modify the conclusions then made.

¹ The Marmet Baby Carriage Works, Letchworth, found that lead poisoning was on the increase among the workers in the painting section; after consulting the factory inspectors, the company decided to abolish lead paints. Since May 1921 leadless paints only are used in the works. (*Parliamentary Debates, House of Commons*, July 1921, cols. 2220-2221 and 2231-2232.)

While the committees have come to the conclusion that the amount of soluble lead in paints should not exceed 5 per cent., they consider that a period of three years should be allowed to elapse before this restriction comes into force, and that during that period the Home Office should use every endeavour to furnish the whole of the paint industry with all information which will help them to conform to the new law.

The committees have been informed that one of the reasons for the widespread use of white lead in the past has been the consistent composition of this material, and they consider that it is essential that similar conditions should apply to the various leadless paint materials. It is obviously important that, in replacing lead paints by others in which the amount of lead is closely restricted, the best materials should be used for the latter. Very large paint users, such as railway companies, provide for the testing of the materials they purchase by analysis in their own laboratories, but there is an obvious difficulty in the way of smaller paint users safeguarding themselves in like manner. As it is desirable that all users of paint should have an opportunity of ascertaining, by independent analysis, the composition of any particular paint, so as to enable them to determine whether the standard of quality is sufficiently high to justify its general use, the committee think the Home Office should keep this matter in view, and should consider in what way these difficulties might be met.

The subject was again considered by the departmental committee of 1923, which found that in regard to the painting of vehicles there seemed to have been relatively little or no change in the pre-war position. The results obtained with substitutes were more satisfactory than in house painting, although even for this purpose the view was still held in many quarters that lead paints were superior. It is nevertheless remarkable that the majority of experts gave evidence in favour of the substitutes. In the tramway repair depots of the London County Council, employing 135 painters, only leadless paints are used. In the carriage and wagon department of the Midland Railway Company's works at Derby, where 300 painters are employed, the use of leadless paints is still the rule. The report adds :

We were particularly interested to hear from the chief foreman painter that the wagons, which are not varnished, are treated with three coats (one priming and two finishing) of a zinc oxide base paint made up almost entirely with zinc oxide paste and boiled linseed oil, and that this lasts normally for four or even five years before repainting. In order to make sure that there was no mistake as to the composition of this paint we caused samples to be taken and these were analysed in the Government Laboratory. These analyses confirmed the leadless composition as given by the witness. The requirements of a rough railway wagon cannot be fairly compared with those appertaining to house painting, and we have had no evidence of a paint of this composition having been used on buildings, but the fact that such a paint gives the above service in practice is sufficiently interesting to call for record.

¹ Small percentages of lead sulphate were found in the samples, maximum 1.2.

The committee arrived at the conclusion that :

As regards coach painting, there is a good deal more to be said for complete prohibition than in the case of house painting. In this trade there is evidence that important firms of carriage and wagon builders use no lead at all.

It is difficult to understand why the committee does not draw the logical conclusion from these premises, but on the contrary continues :

But we feel even here that there is not yet sufficient evidence to show that all the qualities of white lead can be found in its substitutes ; and, provided therefore that Regulations prohibiting dry rubbing down and otherwise protecting the workers are enforced, we do not recommend prohibition.

Switzerland

In Switzerland, on the other hand, experiments carried out in 1903 in the use of leadless paints on the outer surfaces of rolling stock and iron buildings exposed to the air gave negative results ; the report states that it is impossible to dispense with lead paints for these purpose, referring particularly to the use of red lead on iron.

As the enquiry recently conducted by the Federal Labour Office referred chiefly to house painting, it gives no later information on the problem in the coach-painting industry.

VI. — PAINTING OF FURNITURE, SIGNS, AND MACHINERY

Substitutes for white lead are successfully employed for painting wooden and metal furniture, signs, agricultural machinery, etc.; the last-named are frequently treated by a spraying or submersion process. The technical difficulties of replacing white lead in this case have not proved insurmountable.

Austria

The report of the Austrian enquiry states that in Vienna white lead is used only in the proportion of 10 to 15 per cent. for imitation walnut graining and 20 per cent. for oak graining. One expert preferred zinc white for painting interior woodwork because it held the colour better than white lead and, used as a varnish for the finishing coat, gave a more even effect.

France

Bargeron collected the following information :

Furniture painting of varnishing is not so complicated an operation as coach painting. As a rule there is simply one priming and two filling coats ; the article is then rubbed down and finished with two coats of varnish paint of the desired colour. Rubbing down is generally done dry with sandpaper.

According to statements by the President of the Paris Furnishing Trade Association, white lead has not been used in the industry since 1914. Leadless whites are now used and give almost as good results as white lead. White lead is not essential and can be abolished "if our chemists are told to do their best to find a good substitute, for leadless whites are not as yet satisfactory substitutes".

It should, however, be added that Bargeron found proof in other factories that zinc whites could be successfully employed. He also investigated other industries, such as the painting of signs, blinds, tarpaulins, advertisements, etc., machinery of various kinds, particularly agricultural implements. He invariably found that white lead could be dispensed with and that substitutes gave good results.

In the course of an enquiry in the works of the *Compagnie internationale des machines agricoles* at Wasquehal (Nord), Bargeron found that already this very large works had abandoned the use of lead paints. The head of the painting department made the following note :

The paints which we use are absolutely free from lead compounds. They are as follows : (1) zinc white ; (2) ultramarine blue, made with a sulphosilicate of aluminium ; (3) Para red, made with an ingredient to which is added 5 per cent. of organic colouring matter ; (4) chrome yellow (barium chromate) ; (5) chrome green (chrome oxide) ; (6) Vandyke brown (carbonate of iron) ; (7) yellow ochre.

To prepare these paints we grind them with 20 per cent. (in winter) or 25 per cent. (in summer) of a drying oil and 8 to 12 per cent. of benzine. The paste so obtained is then diluted with benzine to make a bath as liquid as possible.

The care with which the colours are mixed is doubtless not without effect on the durability of the paints when applied to the agricultural machinery. Possibly also the failure of some experimenters with zinc whites on metal is due to insufficient care in the mixing or application of the paint.

VII. — PAINTING OF IRON AND STEEL BRIDGES

Substitutes for white lead paints, when applied to iron bridges and engineering works generally, have withstood the action of damp air and bad weather. Here the question whether iron should

be painted with or without white lead is complicated by the problem of priming with red lead. Efforts have long been made to find a method of replacing this lead compound by a harmless substance with the same power of protecting metal against rust. This, however, is a matter entirely distinct from that under consideration here, which is solely the problem of white lead and its substitutes.

Experiments on bridges made in London by the South-Eastern and Chatham Railway and in Italy, where the Garibaldi Bridge over the Tiber at Rome was painted with zinc white, show that excellent results may be obtained with substitutes. The girders of the bridge at Rome were painted in 1910 with only two coats of zinc white paint on a priming coat of red lead; twelve years later the paint was still in excellent condition, although the girders had frequently been submerged by floods, the first time only a month after the painting was done.

In the Netherlands the commission of enquiry found that the zinc white paint on the largest girder in the railway bridge over the Westerdok canal had suffered severely from sulphurous acid, especially while it was still fresh; this was due to the smoke from the many steamers berthed in close proximity, the action of the wind, and the smoke and fumes from locomotives crossing the bridge. The commission made a new experiment; iron plates, some of which had first been painted and dried in the workshop, were placed on the bridge. As a result of this and other experiments the Commission decided that the cause of the slighter resistance of the paint on the canal bridge was not the material employed but the effects of sulphurous gases — a conclusion confirmed by laboratory tests.

Mr. Philip, chemist to the Admiralty, stated before the British committee that red lead had long been replaced by red iron oxide for double bottoms. Even the employers are agreed on the good quality of red lead substitutes and the possibility of dispensing with the lead product. Mr. H. Tausch, chief factory inspector in Austria, states (*Zeitschrift für Gewerbehygiene*, 1914), after studying the matter, that the use of leadless paints to protect iron against rust is common. Leadless paints are also almost invariably used on the iron or steel parts of buildings (for example, those directly under the roof). For outdoor work on metal (e.g. bridges, cranes, ships) the paint used is almost always leadless. Red lead is still used for the priming coat only, although certain leadless substitutes have proved satisfactory. Some of these substitutes, though possessing the qualities of white lead, are less durable; the paint must be frequently renewed, which obviously occasions greater expense than when white lead is used. As

The fact that the painting of bridges with substitutes during the war proved unsatisfactory cannot be used as an argument against them.

It should, nevertheless, be remembered that many experts consider white lead irreplaceable for painting on iron, even when the priming coat is always red lead or iron oxide and white lead is used only for the final coats. The Austrian Government, replying to the questionnaire, wrote as follows:

Experience has also shown that iron paint (*Eisengrün*) lasts four to five years, while lead colours and lead soap last six to eight years. This causes great differences in the cost of painting. It is stated that, on the assumption that the cost of painting an iron construction is on an average three per cent. of the total amount of the invoice, and that if the painting is done with lead colours it must be renewed more than fifteen times in a hundred years, the cost of renewal for that period will be equal to 50 per cent. of the invoice amount. If iron paint is used, however, the cost of renewal will be 75 per cent. and, if zinc paints are used, 150 per cent. of this amount. The prohibition of the use of lead paints would thus seriously diminish the use of iron constructions in the open air, because stone or cement construction would be cheaper as the cost of maintaining them would not be so great. This would involve serious economic disadvantages for Austria, as the iron industry is of great importance to that country.

At the Geneva Conference Mr. Meisel, the Austrian expert, who had been a painting contractor for more than forty years, said that in his lifetime he had painted more than 9,500 bridges, 3,500 of them with white lead. In his experience white lead paint lasts about six or eight years, zinc paint two years, and lithopone one or two years. Costs of maintenance were higher if a substitute for white lead were used. With substitutes the frequent repainting involved such expense that it would be cheaper to substitute for iron bridges (which must be repainted at regular intervals) concrete or cement bridges, which need practically no attention. In that case, however, the iron and steel industry would lose so heavily that it could no longer meet foreign competition.

constructions of iron are generally built by the Government, the State has to bear the additional expense. Cf. also HANZON: *Possibilités de remplacer le minimum de plomb*; Paris, 1921.

In Italy (see Appendix) "the use of iron oxide and mica paints for metal work has become so general that it may be hoped no return to lead paint will be necessary" (*Telekv: op. cit.*, p. 57). See also the letter from Belgian experts in *British Report*, 1915.

¹ *International Labour Conference*, 1921, pp. 421-422.

VIII. — SHIP PAINTING

France

The first technical committee to consider the replacement of white lead in ship painting was appointed in 1786 by the Minister of Marine, Marshal Castries. After a number of experiments on board the "Languedoc" the committee reported in favour of zinc white, although Guyton de Morveau's preparation dried more slowly and was not so fine a colour as white lead.

Another special committee, appointed in 1850 by the Maritime Prefect of Toulon on the instructions of the Minister of Marine, made comparative tests with zinc white and also zinc grey, a colour much in use in the Navy. The committee concluded as follows :

Although our experiments were of short duration, the Committee considers that zinc paints, while not entirely innocuous, are considerably safer as regards health than lead paints. The committee finds that already :

- (1) snow white can be used in place of silver white to the very limited extent that it is required in the Navy ;
- (2) in respect of colour, cost, and durability zinc white can profitably be substituted for white lead ;
- (3) the adoption of zinc grey would effect economies in many cases where only red lead could be used. The Committee must await the results of longer experience before pronouncing on the use of zinc grey and greens for iron hulls¹.

In its reply to the questionnaire of the International Labour Office, the French Government stated that the Ministry of Marine considered the problem solved and saw no obstacle to total prohibition ; a circular issued in 1911 forbade the use of white lead, litharge, and red lead stoppings.

The information collected by Mr. Barger on in the course of his investigation was necessarily limited by the scope of his enquiries. It appears, however, from data supplied by the head of the *Chantiers et Ateliers de la Basse-Seine* that white lead is very little used there. The firm uses annually 5,000 kilograms of iron oxide, 3,000 of red lead, 3,000 of gas tar, 1,000 of artillery grey (zinc grey), but only 600 kilograms of white lead for caulking ships' bottoms. Even so he said that that white lead was not essential and could be replaced by zinc white. He was nevertheless opposed to prohibition, but this was obviously because he feared that the prohibition would extend to red lead, which he considered absolutely essential and irreplaceable.

¹ *Rapport Breton*, p. 17.

Mr. Barger on also learned that the *Compagnie générale transatlantique* used large quantities of zinc white every year, which suggests that the company does not make extensive use of white lead. Again, in the list of paints used in 1911 by the *Compagnie des Chargeurs réunis* white lead does not appear.

Since in addition the Navy uses annually hundreds of tons of zinc white in place of white lead, it appears to be demonstrated that, for these purposes at any rate, there is no grave technical drawback to the use of substitutes for lead carbonate and that prohibition of its use would have no evil consequences.

Great Britain

Before the British committee of 1911 the Admiralty representative stated that white lead had been replaced to a considerable extent during recent years by zinc white, and zinc enamels have proved the most satisfactory for the inside of cabins. He considered that the widespread belief that lead paints are best was to be ascribed to the length of time that painters have been accustomed to them. In his opinion leadless paints would be equally as serviceable as lead for the outside painting of navy vessels.

Lead paints were very generally used on the bottoms, inner bottoms, cabins, and turrets of wooden vessels, and on the bottoms, freeboard and superstructure, inner bottoms, cabins, turrets, and floors of steel vessels ; the coats of lead paint might or might not be preceded by a stopping of linseed oil and white lead, and might or might not be followed by a coat of varnish, according to the degree of finish required.

Ship painting is almost always done under very difficult conditions, owing to the cramped size of cabins, the depth of tanks, holds, etc.¹ ; the danger involved is still further increased by the high temperature — from 40° to 50° C. — generally found in cabins exposed to the sun during the summer, the smoke of hand lamps, and the fumes given off by some quick-drying paint thinners (benzol, benzine, petrol, etc.), which often oblige the worker to leave his work owing to indisposition, and sometimes cause death (see above).

¹ Dr. CHAEN, in *Bulletin de l'inspection médicale du travail de Belgique*, 1920, No. 1.

The British Government states that the cases of lead poisoning notified annually in the shipbuilding industry averaged 31 (8 fatal) in the period 1910-1914 and 16 (2 fatal) in the period 1915-1919; it should be noted, however, that the latter period includes the war years.

The number of cases of lead poisoning among British shipbuilding workers was as follows :

Period	Cases notified	Annual average	Fatal cases
1900-1910	290	26.36	12
1911-1914	132	33.00	14
1915-1920	26	9.00	4
1921	4		1
1922	12		1
1923	7		1
1924	8		1
1925	13		1

The figures show how difficult it is to mitigate the risk in work where dust cannot be removed by exhaust appliances. But the measures adopted by the Admiralty and the increasing use of substitutes led to a decline in the cases of lead poisoning notified in Navy shipyards from 110 (1899-1904) to 60 (1905-1910), while in other yards the figure rose from 60 to 87 in the same periods¹.

Witnesses before the 1911 committee admitted that leadless paints could quite well be used for exterior painting also²; others drew attention to the large quantities of zinc oxide base paints used on the six super-Dreadnoughts which were completed about that time. Another witness reported the good results of using zinc paints on the exterior of a vessel, where they withstood the effects of sea-water and sun; he recalled, however, that a ship is generally repainted at least once a year. The Great Eastern Railway Company reported most satisfactory results from its shipyards at

¹ LEGG and GOSNEY : *Lead Poisoning and Lead Absorption*, p. 294. The law and parliamentary committee of the National Federation of Building Trades Employers considered the Lead Paints (Protection against Poisoning) Bill during the summer of 1926. This Bill did not include ships and yachts, although men working on these vessels frequently had to work in very cramped quarters and could not avoid inhaling dust. The committee therefore decided to support the inclusion of all paints in the regulations, and to draw attention to the omission of yacht and coachbuilding. (*National Builder*, July 1926, p. 288.) (See Appendix III.)

² *British Report, 1915*, p. 87. Evidence of Mr. Philip, of the Admiralty.

Parkeston Quay, Harwich¹; so did the Orient Line, which had used zinc paints for thirty-five years and was experimenting with their use on parts of vessels which had previously been painted with white lead².

Netherlands

The Dutch commission of enquiry experimented with the two paints on the police boat "Argus". The vessel went to sea in 1904, immediately after it had been first painted. On its return the zinc white paint was found to be in better condition than the lead paint. The "Argus" was repainted in April 1905; on its return from the second voyage the commission again found that the zinc paint was in slightly better condition. In view of these favourable results the Dutch Admiralty decided to make more extensive use of the zinc paint employed by the commission, with most successful results.

The commission was unable to discover, in the conditions in which the tests were made, any difference in the durability of the two paints when applied over a priming coat of iron oxide or red lead. It appeared, however, that iron oxide could not be used on the outside of the hulls of vessels below the water-line.

Austria

The subject was also considered by an Austrian committee. The expert from Trieste stated before the committee that the consumption of white lead in the shipbuilding yards there had been reduced to 6 per cent. of the total quantity of paint used.

Italy

The results of an investigation made by Rubino, Porri, and Chiesa were favourable to zinc white paints. A Genoa firm has for years used nothing but zinc paints for the interior of vessels³.

¹ *British Report, 1915*: "The change is being made entirely from a business point of view and not out of regard for the danger of lead poisoning" (p. 47). Likewise the Admiralty state that, although in regard to painting work inside cabins "the first cost of a zinc white enamel is greater than that of a white lead paint, the former is so much more durable that in the end it is more economical".

² Other companies, mentioned on p. 47 of the report, had used leadless paints for forty-five years.

³ See Part III, "Statistics", under Italy.

The Genoa enquiry also produced instructive information on the incidence of lead poisoning among ship painters. It was observed that most of the painters were ignorant of the composition of the paint they used and had little knowledge of the subject as a whole.

IX. — THE ECONOMIC ASPECT OF THE PROBLEM

One of the arguments most frequently advanced by supporters of white lead is that of economy. This really covers two points — the cost and supply of materials (ores, pigments, oils, etc.) and the problem of labour supply.

The British departmental committee of 1928 stated not unreasonably that :

The prohibition of the use in paint of these lead compounds, and particularly of white lead, is impracticable unless an adequate supply of equally efficient but non-poisonous substitutes is available to replace them. This substitution also must be capable of being effected without appreciable increase in painting costs. The committees of 1911 were convinced that efficient non-poisonous substitutes were available in adequate quantity, and that their compulsory use would not involve financial loss, but they did not, themselves, initiate any definite tests. Zinc bases (with a proportion of varnish) were the chief substitutes for white lead, which were at that time regarded as satisfactory.

It will be seen later, however, that other substitutes have been advocated and subsequently adopted.

COMPARATIVE COSTS OF PIGMENTS

Before the war committees of enquiry almost all agreed that some economies could be effected by the use of white lead substitutes. Even in 1850 the French report denied that they would involve increased labour costs ; about the same time the French marine committee stated that the preparation by machinery of the zinc white paste meant a great saving of labour, work, and time, while the cost of zinc white paints was from 5 to 14 per cent. less than that of white lead paints. Ogier stated that the additional cost of zinc would work out at 0.0152 francs per square metre, allowing both for materials and labour ; the substitution of zinc white for white lead would cause no difficulties over labour supply in any kind of painting and would not increase costs appreciably. This view was also held by the General Council of Civil Construction.

These old data for France are confirmed by more recent experience in several countries. In Great Britain representatives of the

Royal Institute of British Architects were convinced that the cost of materials made from 1906 to 1910 that the cost of materials was the same with either product¹. Representatives of manufacturers stated that, although lead paints are (very rarely) cheaper than zinc paints, the latter cover a 10 per cent. greater area and keep their colour better ; thus, although the price of zinc paints is higher, in the long run they are cheaper. Lawrence wrote as follows in 1921² :

White lead alternatives have not dropped in price to the same extent as white lead, and this fact has no doubt modified the extent to which leadless whites are used in place of lead. It may be pointed out, however, that face price is not the only consideration here, for leadless whites on an average yield about one gallon more paint per hundredweight than white lead. Ten gallons of paint on each half ton of material form a considerable inducement for the use of zinc whites, even with equal weight prices, especially in view of the superior opacity possessed by the best of such materials.

Kloss considers³ that the difference in cost between the two substances is negligible, if indeed it exists at all. Langendock states in his report⁴ that it takes 1,500 grammes of mixed white lead paint to cover 10 square metres, where only 1,200 grammes of mixed zinc paint are needed.

The committee of enquiry appointed by the municipality of Milan found that on inside walls the cost of painting, exclusive of labour costs, was in all the experiments less with lithopone than with white lead and still less than with zinc white. Rubino, Porrini, and Chiesa at Genoa were told by 33 witnesses that the substitution had not increased the cost of materials, while 51 made the opposite statement, and 50 were doubtful ; 40 witnesses thought that the cost of labour had increased, 36 said it had not, and 68 were doubtful.

A manufacturer of lead paints in Rome informed Ransalietti that in 1912 the cost of painting a square metre with white lead was 11 centesimi and with zinc white 9 centesimi ; this meant a saving of 18 per cent. on materials, plus the saving in labour.

¹ *British Report, 1915* ; also replies from painters' trade unions (*Industrial and Labour Information*) and *Vereinsanzeiger*, 1921, No. 30 ; also the reply of the Italian Government to the questionnaire.

² James Lawrence : " Craft Principles and Modern Conditions ". *Journal of Decorative Art*, June 1921.

³ Quoted by Bakker Schut, *op. cit.*

⁴ Brussels, 1902.

This explains the preference for zinc whites in Rome. The Geneva Committee of Enquiry, on the other hand, received conflicting evidence on this point. A comparison of costs in the United States (1912-1914, Pratt in New York) was also in favour of zinc white.

In 1912 A. Souris gave the cost of a kilogram of white lead mixed ready for use as 0.6852 francs and that of zinc white as 0.7246 francs. But, as he calculates that it takes 1.5 kilograms of white lead and 1.1 of zinc white to cover 10 square metres, the cost per square metre works out at 0.099 or 10 centimes for white lead and 0.078 or 8 centimes for zinc white. All such information, however, must be completely revised at the present time to allow for changes in the cost of materials and labour and the increased cost of the proposed method of damp rubbing down.

The following table gives information as to the costs, in Belgian francs at Brussels, of white lead, lithopone, and zinc whites :

Material	1922 (end of Nov.)	1923 (end of Dec.)	1924 (end of Dec.)	1925 (end of Nov.)	1926 (April)
Zinc White					
Powder, red seal, No. 1, pure, per Kg.	2.05-2.75	3.30-3.55	3.70-4.20	4.30-4.50	4.70-4.90
Ground red seal, per Kg.	2.80-3.05	3.60-3.85	4.25-4.75	5.05-5.45	5.90-5.10
Lithopone					
Red seal, guaranteed 30 per cent. powdered zinc sulphate, per Kg.	1.90-2.05	3.10-3.35	2.25-2.50	2.30-2.60	2.85-3.15
Ground, per Kg.	2.25-2.45	2.10-2.35	2.85-3.20	2.90-3.25	3.55-3.85
Snow White					
Powder, per Kg.	3.40-3.65	4.00-4.75	4.50-5.00	4.70-5.10	5.10-5.50
Ground, per Kg.	—	4.75-5.25	5.00-5.60	5.05-5.45	5.30-5.70
Linseed Oil					
Raw, genuine, per litre	2.75-3.00	4.30-4.60	4.40-4.65	4.00-4.25	4.30-4.60
Boiled, per litre	3.20-3.40	4.80-5.00	4.80-5.00	4.50-4.80	4.70-5.00
Turpentine , per litre	8.25-8.30	6.50-7.00	6.50-7.00	6.00-6.50	6.25-6.75
White lead (ground in linseed oil)					
Dutch process, pure lead, per Kg. ¹	2.75-3.00	4.05-4.30	4.95-5.25	5.20-5.40	5.20-5.45
Superfine, per Kg.	—	3.60-3.95	—	—	—
Fine, No. 1, per Kg.	—	3.60-3.75	—	—	—
Fine, No. 2, per Kg.	—	3.40-3.55	—	—	—

¹ Sale, transport and use (in powder) prohibited by section 1, subsection 1, of the Act of 28 August 1901.

At the end of August 1926 the prices of zinc oxide and lithopone (red seal, 30 per cent.) were as follows¹:

Material	Great Britain	France	Germany	United States	Italy
Lithopone, red seal, 30 per cent.	£ per ton 20-22.5 44-45 ²	Francs per 100 Kg. 285 680-900 ²	Marks per 100 Kg. 41 79	Cents per lb. 5 1/2-6 7 1/2	Lire per 100 Kg. 325-375 ¹ 550 ¹

¹ End of March 1926. ² 99 per cent. ³ Green seal. ⁴ S.V. zinc white. White lead is quoted at 600 lire.

A further point to be considered is the cost of oil, which naturally varies according to the amount required for grinding the various paints. As was noted, zinc whites take more oil, but the difference is not great. In Great Britain zinc white is sold in paste perfectly ground with 7 per cent. of oil; in Dutch factories zinc white is ground with 12 to 15 per cent. of linseed oil and white lead with 10 to 12 per cent. The comparative costs as ascertained by the Dutch Commission, with the same labour costs, show a slight difference in favour of zinc white, which would be inexplicable if it required double or more than double the quantity of oil².

DECREASED CONSUMPTION OF WHITE LEAD FOR PAINTING

The adoption of substitutes for white lead is resisted by some workers, who dislike using a material to which they are not accustomed; being used to white lead, when they are required to use zinc white they have at first to pay the greatest attention to their work. But they rapidly acquire the habit, as is shown by numerous examples, among them those of the Leclaire firm of Paris, the British Office of Works, and the Belgian State railways. The use of white lead substitutes is making definite progress; the enquiries conducted in France, Great Britain, Italy, Austria, Switzerland, and elsewhere have produced long lists of municipalities,

¹ Taken from the *Giornale di chimico industriale*, Milan.

² Letter from Mr. ZOULEN to the *Moniteur de la peinture*, 1913, No. 15.

manufacturing establishments, painting firms, etc. which are successfully using substitutes for white lead in interior and even exterior painting on wood, walls, and iron. In some countries, indeed, such as those of Scandinavia, white lead is practically no longer used.

Scandinavian Countries

Zinc and lead are not manufactured in Norway or Sweden. As early as 1903 Kiaer, replying to the questionnaire sent out by the International Labour Office of Basle, said that in Sweden, apart from decorative painting and certain operations where white lead was found essential, substitutes were very widely used and that white lead was much less frequently ground, outside factories, than formerly.

The imports of paints into Sweden from 1911 to 1914 were as follows (in kilograms) :

Year	Leadless paints			White lead
	Zinc white	Lithopone and other white leadless paints	Total	
1911	3,350,006	734,026	4,085,432	622,111
1912	3,172,228	1,130,260	4,311,606	561,156
1913	3,946,776	1,216,318	5,166,096	608,404
1914	4,203,674	1,411,061	5,615,535	609,450

In 1920 Sweden imported about 500,000 kilograms of white lead and five million kilograms of zinc white.

The imports of white paints into Norway have been as follows (in kilograms) :

Year	Leadless paints			White lead
	Zinc whites	Lithopones and other paints other than white lead	Total	
1912	1,728,410		1,728,410	136,000
1913	2,414,140		2,414,140	87,500
1914	2,199,850		2,199,850	92,820
1915	2,394,740		2,394,740	159,200
1916	2,353,430	364,069	2,717,499	80,520
1917	2,191,150	310,032	2,501,182	104,400
1918	1,536,280	218,145	1,754,425	2,400
1919	1,505,267	225,426	1,730,693	64,329
1920	1,966,264	400,778	2,367,042	59,160

Germany

Even before the war exports of lead substances were declining or stationary, while those of leadless paints were increasing considerably. This is shown by the following table, which gives net exports (excess of exports over imports) :

Product	1907		1910		1913	
	Quantity (metric tons)	Value (thousand marks)	Quantity (metric tons)	Value (thousand marks)	Quantity (metric tons)	Value (thousand marks)
Red lead	8,935.5	3,782	8,891.8	2,783	6,425.7	3,219
White lead	10,624.3	4,402	10,814.5	3,841	10,422.5	48,829
Zinc oxide (white & grey)	10,685.4	5,983	18,058.7	7,894	27,555.0	9,345
Lithopone	7,286.3	2,135	7,217.1	1,444	14,442.7	3,248

The red lead exported can have been used very little for the painting industry, as is confirmed by the use made of red lead in Germany itself. Prohibition of lead paints in other countries would therefore lead one to expect some decline, but not a large one, in the exports of red lead.

Before the war the exports of white lead were stationary ; prohibition of its use would lead to a very marked decline in the exports. But even before the war, in 1913, the exports of lithopone and zinc white exceeded 11 millions marks, while those of white lead were only 4.8 millions. Exports of lithopone to France rose from 1,950 metric tons in 1909 to 5,000 in 1913, and to Great Britain from 3,600 to 5,370. If these countries restricted the use of white lead, German exports of zinc paints would probably increase very greatly, thus counterbalancing the decline in the export of white lead. The resources of Germany are sufficient to supply the additional export of zinc. Flegel and Tornow¹, analysing the statistics of German ores, point out that the German Customs in 1912 recorded imports of 122,800 tons of lead ore, as compared with 142,800 tons extracted in the country. The metallic content of lead of these ores was 95,043 tons, which represented only 43 per cent. of the total consumption of lead ; this explains

¹ This analysis applies to the pre-war territory of Germany, but does not hold good for the post-war territory, especially since the loss of Upper Silesia. For example, in 1924 the total output of lead on the present territories of Germany was 50,200 tons and the consumption 88,700 ; the output of zinc was 41,400 tons and the consumption 78,000 tons.

the market increase in the imports of lead. The zinc situation, according to the same authors, was exactly the reverse; the metallic content of native ores raised in 1912 was 301,521 tons, while the total consumption was only 194,000 tons. Germany was thus well able not only to supply the home demand but to export large quantities.

There is much information to show that the use of white lead and lead paints is on the decline in Germany, especially for indoor work; this is emphasised by the leaders of the Painters' Union.¹ Figures for the whole of Germany in 1903, published by the Düsseldorf Chamber of Commerce, show the proportions in which white lead and its substitutes were used for interior painting:

	Per cent.
White lead	38
Zinc white	35
Lithopone	15
Lime	12

If lime is excluded, the figures are as follows:

	Per cent.
White lead	48
Zinc white	40
Lithopone	17

In exterior house painting white lead was used in the proportion of 80 per cent. to 20 per cent. of other paints.

In 1906 the Painters' Guild of Breslau decided to discontinue the use of lead paints.² Efforts to use substitutes in place of white lead then multiplied — in Cologne (1906), Wiesbaden (1907), Luneburg (1910, in an engineering works, following a case of serious poisoning), Hesse (1906), Wartemburg and Oldenburg (1906), Saxe-Coburg-Gotha and Saxe-Meiningen (1907), and Brunswick (1910).³

At Oberfalz in Bavaria it was found⁴ in 1910 that substitutes were widely used; often lithopone was preferred to white lead on the ground of its lower cost. The reports of the Bavarian district medical inspectors state that the use of white lead had been very much restricted, especially in large works; in some factories, where the foreman or employer had been poisoned, lead paints had been entirely replaced by harmless ones.

¹ Information supplied to the International Labour Office.

² See under "Coast Painting". In 1913 the municipality of Carlsruhe defended the use of lead paints on the interior of buildings.

³ For sources see Part III: "Statistics", under Germany.

⁴ Report by Mr. Kozlisch, medical inspector.

France

The change from white lead to substitutes was an accomplished fact almost everywhere in France as early as 1901.¹ Where white lead had not been entirely abandoned, 90 per cent. of it was delivered by the manufacturers ready ground and only 10 per cent. in powder form. There is one firm, that of Leclair, which has used zinc white alone since 1848.

Austria

Investigations made in Vienna painting shops in 1903 showed that 22.5 per cent. of the interior painting was done with white lead, 62 per cent. with zinc white, and 15.5 per cent. with lithopone. In Lower Austria, at the request of the House Painters' and Decorators' Sick Fund, the use of white lead and other lead paints on State building undertakings was forbidden by an Order of 27 August 1906.²

United States

Quite recently Mr. G. B. Heckel, secretary of the Paint Manufacturers' Association of the United States, wrote as follows:³

A conspicuous development has been the rapid increase in the use of exterior paints containing lithopone, zinc oxide, and small percentages of inert pigments. Products of this type are now being produced by a number of manufacturers, and are widely used by painters, with apparently satisfactory results. The success of such products is subversive of all the older paint theories and was made possible by the production of light-resistant lithopones. Another conspicuous innovation is the growing use of paints made of titanium oxide.

Other Countries

In Greece, according to information supplied by the Government, some of the provincial authorities use zinc white almost exclusively. In the Netherlands and Belgium many municipalities have forbidden the use of white lead on municipal works.

Elsewhere a list is given of the many provincial and municipal authorities which have abolished the use of white lead on public works, but the facts given above are typical examples of the decline in the use of white lead and the progress made by leadless paints.

¹ For sources, see Part III, "Statistics", under France.

² Report of the commission of enquiry.

³ *Factory*, Jan. 1926, p. 182.

THE SUPPLY OF ZINC

A further argument advanced by those who support the continued use of white lead is that the supply of zinc is inadequate to meet the increased demand which would result from prohibition of white lead.

The question was discussed theoretically before all three British committees. Mr. Pisart stated before the house painting committee of 1911 that in the period 1901-1910 the consumption of metallic zinc was already increasing by 6.2 per cent. annually, while that of white lead increased only by 2.9 per cent. per annum. If the use of lead in paints were restricted by law there would certainly be a temporary rise in the price of zinc. This would be due to the necessity for supplying the war material immediately. If the prohibition were only to come into force at the end of five years he thought there would be no rise in price. With a two years' time limit there might be a small rise but this increase of price would not be permanent, as the supply of zinc adjusts itself to the demand. In fact, eventually the price might fall, since with a large additional demand zinc oxide would be made from very low-grade ores by the direct process; this would tend to cause the reopening of a great number of mines which are now useless because their ores are not good enough for making metallic zinc.¹

As regards the British situation, it was stated before the 1911 committee that the British Empire produces about the same proportion of the world's output of both lead and zinc. In 1909 the

Empire produced 227,000 metric tons of lead as against 726,000 from other countries, representing 21.5 per cent. of the world's output. The output of zinc was 155,000 metric tons from the British Empire, 701,000 from other countries, the British share being 18.1 per cent. In 1924 the proportion was 20.7 per cent. for zinc and 11.9 for lead.

The committee thought that an additional supply of 50,000 tons of zinc would be needed in the United Kingdom if white lead were prohibited. The increase in consumption would probably not cause any rise in price; from 1908 to 1906 and 1907 to 1910 consumption increased by 50,000 tons per annum, but far from sending up prices, was accompanied by an average reduction of more than seven shillings a ton. The syndicate which practically settles the price of zinc on the British market voluntarily restricted the supply of zinc in 1914 by 15 to 18 per cent. or 150,000 tons — more than three times the additional 50,000 tons which would be required if white lead were prohibited. The additional supply would thus be easily procured.

An official publication dated 1921¹ points out that some of the world's greatest reserves of zinc ore are to be found within the British Empire, at Broken Hill in Australia, Bawdwin in Burma, Broken Hill in Rhodesia, and in British Columbia.

But the problem involves a much wider field than the British Empire. It may be asked whether the additional demand for zinc would exceed the capacity of the world's resources to satisfy it. Zinc smelting is in progress everywhere — in Australia, India, Canada, Great Britain, the United States, Japan, Norway, and Sweden. The table given below, showing the increasing output of zinc in recent years, indicates that the potentialities of extraction are far from exhausted.

There is another objection, of an economic character, which links together the problems of zinc and of lead and seems to indicate a further danger involved in a more extensive use of zinc and the prohibition of lead in the painting industry. This objection was placed before the Geneva Conference by representatives of the Government and of the organised employers of Australia. In their view, prohibition of white lead — even for interior painting alone — would have the effect of reducing the output not only of lead but of zinc also. The mining and treatment of plumbous zinc

¹ The treatment of low-grade or complex zinc ores has recently been solved by the patented Cambi and Modighiani process. The zinc in the ore is treated with sulphuric acid to produce zinc sulphate, which is precipitated from the solution by a process of electrolysis. This method has been used commercially since the autumn of 1917 in various undertakings in northern Italy. It is hoped as a result to export metallic zinc instead of the ore, as hitherto. (Cf. U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF MINES, Bulletin No. 108: *Recovery of Zinc from Low-Grade and Complex Ores*, by Dr. A. Lyon and C. Ralston; Washington, 1919. Also G. Arduini: "Idrometallurgia dei minerali di zinco", in *Giornale di chimica industriale e applicata*, 1920, No. 10.) Recent progress in the treatment of complex lead and zinc ores by hydraulic classifiers, which are now almost universally used, has had far-reaching economic results. The recovery of zinc, which in the western United States, for example, was always sacrificed to lead, has been resumed since 1925 because the lead smelters have abolished the penalties previously imposed for zinc found in lead ores and pay for the zinc at the same rate as the lead. The use of hydraulic classifiers has made it possible to handle small lots of ore bought from small producers and to separate the zinc and lead. Mines have been reopened and works built in Utah, Colorado, Idaho, British Columbia, etc., under the stimulus of the high prices now ruling for lead and zinc. (*Revue universelle des Mines*, 1 May 1906, pp. 110-125.)

¹ Issued by the IMPERIAL MINERAL RESOURCES BUREAU; London, 1921. See also *International Labour Conference*, 1921.

OUTPUT OF ZINC IN ORE (THOUSAND METRIC TONS)

Country	1913	1920	1921	1922	1923	1924
North America	314.6	438.5	205.9	346.6	480.3	404.3
Canada	18.1	18.1	24.0	25.2	27.2	24.9
United States	314.6	420.4	181.9	321.4	453.1	409.4
Europe	654.5	247.8	214.8	332.7	406.4	451.4
Austria ¹	17.4	84.3	66.2	112.3	148.1	103.0
Belgium	204.2	2.1	3.2	2.0	2.2	6.9
Czechoslovakia ²	67.9	20.1	24.2	30.7	40.3	55.6
France	109.4	16.1	27.1	34.8	32.2	41.4
Germany ³	24.3	1.2	0.5	3.1	3.7	5.6
Italy	0.2	2.0	6.4	13.0	16.4	18.2
Netherlands	102.3	86.8	66.9	0.2	0.8	0.9 ⁴
Norway				84.7	96.4	93.0
Poland ⁵						
Serb-Croat-Slovene Kingdom ⁶	4.3	1.5	0.4	1.6	1.9	2.1
Spain ⁷	6.0	9.6	6.7	3.3	10.9	12.4
Sweden	2.1	18.8	3.5	1.6	1.2	3.5
United Kingdom	26.4	18.3	7.7	33.4	43.3	48.4
Asia						
China ⁸	1.0	15.9	11.7	12.7	14.1	14.3
Japan	1.0	0.2	1.3	0.2	0.3	0.3
Oceania	4.2	9.8	1.7	24.1	41.8	47.1
Australia	4.2	9.8	1.7	24.1	41.8	47.1
The World	974.3	712.0	434.1	716.1	932.6	1007.1
Index number (1913 = 100)	100	73	45	73	96	103

¹ Much of this quantity is probably now produced on the territory of Czechoslovakia; there is no data from which the proportion could be calculated.
² Present territory.
³ Estimated based on expert figures.
⁴ Estimate.

is one of the chief Australian industries. The lead produced is specially suited for manufacture into white lead, and about half the ore now exported is used for this purpose. The residues which contain a high enough proportion of zinc are sent to the manufacturers of zinc concentrates. From 1905 to 1914 large quantities of zinc concentrates were exported from Australia to Europe, and the growth of zinc foundries and certain chemical industries in Europe is directly dependent on this supply of raw materials. If the production of lead were restricted that of zinc concentrates would simultaneously fall to a level at which the demand of English and Australian works only could be satisfied; there would be no surplus for other European countries. The production of zinc concentrates at Broken Hill is entirely dependent on the raising of lead ore, which in turn is conditioned by the price of lead.

OUTPUT OF PIG LEAD (THOUSAND METRIC TONS)

Country	Average 1909-13	1920	1921	1922	1923	1924
North America	417.9	405.2	404.7	464.8	574.0	650.6
Canada	17.1	13.5	27.8	30.6	45.6	75.7
United States	400.8	451.7	376.9	445.2	528.4	574.9
Central America ¹	50.5	81.5	58.6	106.9	136.8	130.8
Mexico	50.5	81.5	58.6	106.9	136.8	130.8
South America	2.2	4.1	3.0	4.3	4.2	5.1
Argentina	1.0	3.5	2.5	3.6	3.6	4.5
Peru	1.2	0.6	0.5	0.7	0.6	0.6 ²
Europe	409.6	228.8	231.0	238.3	266.4	307.4
Austria ³	4.4	4.0	3.3	3.4	4.3	5.0
Belgium	53.6	16.0	29.8	50.3	51.1	53.7
Czechoslovakia ⁴	4.7	2.0	2.4	2.2	2.5	2.3
France	28.8	15.1	15.5	13.9	17.4	21.0
Germany ⁵	86.0	15.0	25.0	25.0	31.9	50.2
Italy	21.7	15.9	12.5	10.7	17.1	22.1
Greece	18.3	5.0	5.6	4.4	4.2	5.0
Poland ⁶	41.6	18.0	13.7	14.5	17.2	20.2
Rumania ⁷	0.5	0.2	0.4	0.2	0.4	0.4
Serb-Croat-Slovene Kingdom ⁸	9.4	5.1	4.8	8.4	9.3	11.5
Spain ⁹	108.8	120.0	115.0	100.0	104.0	110.0
Sweden	1.2	0.9	0.5	0.3	0.2	0.6
United Kingdom	30.6	11.6	2.5	5.0	6.8	5.4
Asia						
China	23.8	31.4	48.2	50.9	53.7	62.2
India	0.1 ¹⁰	2.0	2.5	2.5 ¹¹	2.3 ¹²	2.5 ¹³
Japan	6.0	24.2	34.3	39.8	46.8	52.6
Turkey	3.8	4.2	3.1	3.2	2.7	2.9
Africa	13.9	1.0	8.3	5.4	1.4	5.1
Rhodesia	1.5	27.1	31.3	34.9	26.5	23.1
Tunisia	0.3	14.8	18.0	20.8	11.2	6.4
Union of S. Africa and S. W. Africa	1.0 ¹⁴	11.4	12.6	13.1	14.3	15.7
Oceania	0.2	0.9	0.7	1.0	1.0	1.0
Australia	115.6	6.1	57.2	109.0	124.0	130.5
The World	1111.6	843.7	833.6	1028.5	1185.0	1309.1
Index number (1909 = 100)	100	76	75	93	107	118

¹ Guatemala produces a small quantity of lead.
² Present territory.
³ Estimate.
⁴ Estimated figures, excluding lead extracted from residues. Including this, the figures are: 146.1 in 1913, 52.5 in 1920, 72.9 in 1921, 77.9 in 1922, 56.1 in 1923, 66.4 in 1924.
⁵ The 1913 figure possibly includes a certain amount of lead extracted from residues.
⁶ The estimated figures given since 1920 have been recalculated to exclude if possible double counting in the "official figures". These figures are as follows: 121.4 in 1920, 135.9 in 1921, 119.2 in 1922, 127.5 in 1923, 141.8 in 1924.

A South African delegate, again, referring to the statement of the White Lead Committee that prohibition of white lead would lead to a rise in the price of zinc, drew attention to the importance of zinc to the South African gold mines and the danger to them

if the price of zinc should rise; many of the mines, he said, would be unable to carry on¹.

Experts, however, are less pessimistic, and think that prohibition of white lead will not have the effect noted above. In actual fact the potential supplies of zinc are more than adequate to meet all demands without an increase in price. The prohibition of the use of white lead for interior painting has had no ill effects in this respect, for the quantity of white lead actually put out of use is very small. Moreover, it must not be forgotten that other substitutes for white lead may be found; for example, in the Scandinavian countries and the United States titanium whites, and in Great Britain oxide of antimony, have been put on the market.

EFFECTS ON THE PRODUCTION OF LEAD

In 1921, and frequently since, the supporters of white lead laid great stress on the disastrous economic effects of prohibition. In 1924 an anonymous publication issued in Belgium attempted to enumerate them.

The world's consumption of lead is about 1,200,000 metric tons; as the United States did not take part in the Geneva discussions and the question of prohibition does not, therefore, concern that country, its production should be left out of count. The world's production so diminished would be about 800,000 tons.

Specialists estimate the proportion of the total output which is made into white lead at 20 per cent. or 160,000 tons. The proportion used for paints may be reckoned at 75 per cent. or 120,000 tons. Thus, if total prohibition came into force, there would be 120,000 tons of white lead without their present market. This represents about 10 per cent. of the world's production of lead, and it should be remembered that there would be a corresponding increase in the consumption of zinc².

¹ *International Labour Conference*, 1921, p. 457.

² Some experts put the figure at 200,000 to 250,000 tons, i.e. 20 per cent. of the total output. They state that the replacement of this quantity would require the treatment of 4½ million tons of zinc ore; thus the 450,000 tons of lead necessarily produced to procure the amount of zinc required (since many ores contain the two minerals) and the 250,000 tons used for making white lead — 670,000 tons in all — would be simply "useless waste". It should be added that, although the price of both metals fell considerably from November 1925 to June 1926, the rise which followed will continue, in the opinion of experts, for a year or two. Taking the London price of a ton (avoidupois) as base, this gives the following prices:

These figures, though only averages, probably correspond roughly to the facts of the situation. It should be noted, however, that they are based on the hypothesis that white lead would be entirely prohibited in painting, whereas the Geneva Convention provides only for prohibition in interior painting, which is not responsible for a fifth of the white lead used in the industry.

If the course of lead prices and production be examined, a striking feature is the high price of metallic lead in recent years; this is doubtless due to the constant increase in the demand from the electrical industry for accumulators, wireless installations, etc., and by the absence of any new discoveries of lead veins. There is talk to-day of a "lead crisis"; lead is called a precious metal. With the demand for lead steadily growing, there is little cause to fear the economic effects prophesied for prohibition of white lead. On the other hand, substitutes are multiplying, processes are being improved; at the present time there are not only zinc paints and lithopones but paints with a base of titanium, antimony, or a combination of the two.

Country	Year	Lead		Zinc	
		Price	Index number	Price	Index number
Germany (per 100 Kg.)	1901-1910 1924	Mk. 28.77 64.28	100 223	Mk. 43.56 63.21	100 145
Belgium (pig)	Nov. 1925	74.97	260	Fr. 328.25 410.00	172
United States (pig, per 100 lb.)	Nov. 1925	Fr. 341.28 300.00			
France (Paris) (common grade)	1901-1910 1924	\$ 4.64 8.28	100 178	\$ 5.40 6.72	100 124
	Oct. 1925	9.60	207	8.70	161
Great Britain (soft foreign' per ton)	1901-1910 1924	Fr. 40.04 325.31	100 812	Fr. 61.26 309.04	100 505
	Nov. 1925	404.00	1234	540.50	862
New Zealand (sheet, per ton 1016)	1901-1910 1924	£13 15 9½ 32 12 0½	100 243	£21 1 10½ 33 13 5	100 152
	Nov. 1925	36 9 10½	364	38 14 8½	175
	1901-1910 1924	£20 14 8½ 51 7 8	100 248	£32 4 4½ 71 16 10½	100 223
	Sept. 1925	60 5 10	291	68 5 7½	212

	Lead per ton	Zinc per ton
	£	£
7 November 1925	82 1/4	84 3/8
20 February 1926	80 1/4	82 1/8
17 April "	29	32 3/8
9 June "	39 1/4	35 1/8
6 October "	38 3/4	39 7/16

THE ALLEGED POISONOUS CHARACTER OF ZINC WHITES

The supporters of white lead allege that zinc whites are in some degree poisonous. There are those who say that they are as dangerous as lead, or that some zinc whites have a lead content (sulphate of lead) sufficiently high to cause poisoning in the long run among the painters who use them.

Schoofs, of Liège, has declared that chronic poisoning was unknown in zinc foundries and zinc oxide works. Similarly A. Firket, Inspector-General of the Belgian Mines, considers zinc oxide absolutely innocuous to man¹. The letter from the Belgian Minister of Railways to the British Committee, again, recalls that:

The most careful investigation which has been made, and the opinions given by the most competent authorities, on the subject have established the conclusion that this permitted limit (maximum of 4 per cent) could not present any serious objections from the point of view of the health of the staff engaged in painting operations.

The British committee decided that, from the point of view of the risk of poisoning, a lead content of less than 5 per cent. in zinc white was quite harmless. Experts also emphasise the fact that limitation of the lead content is justified on technical as well as hygienic grounds, since zinc white with too large a lead content tends to blacken.

The International Labour Office did not intend, when it raised the question of "plumbous zincs" in its questionnaire, to put forward this type of zinc white as the best substitute for white lead, but rather to bring up the question of the possible danger from the minute quantities of lead contained therein. The Conference suggested that the lead content should be restricted to 2 per cent.

Although it is comparatively easy to prove that the zinc whites, including those containing lead, used in painting cannot be a real danger to the workers using them, it nevertheless appears desirable to give this proof.

Pure Zinc Whites

The daily practice of medicine shows that pure zinc white, in the form of ointment or powder, causes absolutely no trouble, even in children. Toxicologists, again, have never reported any injury or symptom among workers engaged in mixing or using pure zinc whites.

¹ *Annuaire des Mines belges*, Vol. VI, 1901.

W. Salant's experiments on animals with metallic zinc have proved¹ that when taken with food it has no bad effect on the animals' general health, although the quantities of metal used for these experiments were much larger than a human being could absorb with his food in the course of the day. Sacher in 1893 produced symptoms in rabbits and cats, but he gave them from 6 to 34 milligrams per kilo per day for 15 or 30 days. Lehmann in 1897 made the same experiments, but no ill effects were produced by doses of 0.5 milligrams every day for 243 days.

The experiments of Salant and others show that zinc is absorbed by the intestine, the organ which eliminates metals, the kidneys performing a very subsidiary function in this process. More recent research by Hennik, McIntyre, and Fresno with zinc, bismuth, and cadmium further prove that that these substances are not nearly as poisonous as lead. Experiments on cats and dogs have also shown that animals can stand very large quantities of zinc oxide.

Plumbous Zinc Whites

The question of the so-called "plumbous" zinc whites perhaps deserves more detailed consideration. Doses of plumbous zinc oxide produce no different symptoms in animals from those observed in the case of pure zinc oxide. If the question is the effects on the workers employed in zinc white factories, the class mainly to be considered are the packers, for whom no special precautions are taken, who work often in most unhygienic conditions and in some factories handle as much as three or five thousand kilograms of plumbous zinc every day. It is noteworthy that, even if these workers show signs of chronic lead absorption they have never shown symptoms of poisoning (colic, nephritis, hypertension of the arteries, anaemia, paralysis, etc.).

In 1899-1900 and again in 1906, the Dutch medical inspectors made an investigation in two plumbous zinc white factories, covering all the workers and especially the sifters and packers. The clinical history of each worker was considered and everyone who came into contact with the finished product was carefully examined. The inspectors found no symptom of disease which could be attributed to the effects of chronic arsenic or lead poisoning; there were no skin diseases or affections of the digestive, motor, or sensory organs.

¹ *Journal of Industrial Hygiene*, June 1920, p. 73.

All the medical experts, therefore, were compelled to recognise that these workers were on the whole in very good health, for their slight absorption of lead had no perceptible effect and might be described as negligible when compared with the effects of white lead. "Place this table beside that for white lead and show the statistics to a health expert: he could not hesitate." "If the workers handled white lead in the same fashion as they do zinc white the operations of the works would be gravely hampered by the same prevalence of lead poisoning which made the Clichy white lead works notorious.

In their replies to the questionnaire of the International Labour Office certain States of the Australian Commonwealth insist on the "remarkably poisonous character" not only of zinc oxide but also of barytes. The report of the New South Wales Board of Trade states "that zinc is present in the paints in poisonous doses; it does not produce the same definite symptoms as white lead but it is present in sufficient quantities to cause some effect on the health of the workers, especially when associated with turpentine.

Lehmann states "that no case of poisoning by zinc oxide has been found in zinc foundries. In some villages the inhabitants drink water containing from 7 to 9 milligrams of zinc oxide but their health is not affected. He also says that the presence of from 2 to 6 milligrams of zinc per litre of air in galvanised iron works is no danger to the workers, and that if cases of poisoning have occurred they were caused by carbon monoxide or lead also present in the air. In the light of his experiments he concluded "that oxide and carbonate of zinc should be ranked as industrial poisons with copper, and that he found nothing in a works manufacturing zinc oxide and lithopone to prove that zinc is poisonous.

If cases of lead poisoning have been found among painters using non-poisonous substitutes, it should be remembered that, as many writers have pointed out, zinc white, though less easily adulterated than white lead, is often sold mixed with lead carbonate or sulphate*. Too often nowadays paints with a base of lead sulphate are sold under a proprietary name and labelled falsely "non-poisonous, contains no lead". Frequently, too, a worker painting with substitutes has to rub down old lead paint.

* BROUARDL.

* P. xivi.

* *Lehrbuch der Arbeitshygiene*, p. 218.

* *Ibid.*, p. 219.

* RANALLETI, *op. cit.*, and other works.

SUBSTITUTES OTHER THAN ZINC WHITES

It may be briefly noted here that there are on the market substitutes with a base of zinc sulphide (a hydrated sulphide containing zinc oxide) with a covering power equal if not superior to that of white lead¹; others with bases of zinc oxide and sulphides in varying proportions known as "silicate paints"²; others with a sulphide base made by special processes³, said to have great advantages and giving very good results in laboratory tests; substitutes with a base of zinc sulphide and barium sulphate (sanitary white lithopone), well known and used in all countries.

As regards lithopone it must be admitted that, as with zinc white, manufacturing processes were for long far below their present standard of accuracy. It is hardly surprising, therefore, that some committees and painters have criticised it rather severely in the past. The characteristics of the lithopone now on the market, as manufactured by large works in Great Britain, France, Belgium, Germany, the Netherlands, and elsewhere are as follows: absolute purity; a guaranteed molecular zinc sulphide content of 29 or 30 per cent.; total absence of natural barium sulphate or any impurity. It produces brilliantly white paints with greater opacity and covering power than white lead (1.2 kilogramme of lithopone to 1.5 of white lead); when it does not contain chlorides it resists sunlight, antiseptic washing, and sulphuric fumes. During the war lithopone was much used for painting the interior of British, French, and German hospitals; it is now extensively used in painting.

It is considerably cheaper than white lead and is one of the best substitutes for indoor work. Moreover, on the principle of complex paints (mixtures in suitable proportions) technical progress has reached the stage of producing lithopone paints which have given the best results even on exteriors.

The most recent physical and chemical research in white pigments has produced substitutes equal or superior to white lead. These are the white titanium paints, produced mainly in Norway and the United States⁴. Titanium, the oxide of which is a pig-

¹ *Revue scientifique*, 1907, 2nd series, p. 307; *Bulletin de la Société chimique*, July 1907.

² *Revue de chimie industrielle*, Jan. 1907; *Bulletin de la Société d'encouragement pour l'industrie nationale*, Nov. 1908. Paris.

³ D. M. GOLDSCHMIDT: *Die weissen Farben in Natur und Technik*. (Ostwald Sammelserie: *Die Farbe*, Abt. III, Al. 2, 1921.)

ment, takes the first place for covering power, permanence, and harmlessness. Schoofs' experiments have shown¹ that pure titanium oxide is inert physiologically and has no toxic properties.

Experiments have recently been made in Great Britain with oxide of antimony paints; an American expert has reported very favourably on this pigment, which contains from 25 to 50 per cent. of zinc oxide². In practice it has proved to be only very slightly poisonous, very durable, and resists sulphurous smoke. According to British experience this paint, containing from 5 to 25 per cent. of zinc oxide, has excellent covering power and opacity³. Experiments have also been made with an oxide of aluminium.

Washable water paints and distempers and enamel paints are also useful preparations which contain no white lead.

No mention need be made here of mixed zinc and lead paints (containing 20 to 40 per cent. of lead sulphate and 80 to 60 per cent. of zinc oxide), with more or less large proportions of barium sulphate, calcium carbonate, etc., or the lead sulphate placed on the market as a "harmless" substitute for white lead. Reference was made on an earlier page to the opinion of German and American hygiene experts and to investigations proving the appearance of poisoning among workers engaged in mixing or using these paints. It is also unnecessary to mention the "lead-zinc" or "lead-zinc" obtained from ore containing both lead and zinc. The composition of these paints naturally varies with the nature of the rock and its richness in one or the other mineral.

¹ *Académie royale de médecine*, 1922; Brussels. (Cf. also F. BINDER: "L'oxyde de titane", in *Chimie et industrie*, Paris.)

² *International Labour Conference*, 1921; *White Lead Committee*, Tenth Sitting, p. 10.

³ Cf. *National Builder*, 1923, p. 285.

PART

LEGISLATIVE

I. — REGULATION OF

There are only two possible workers employed on lead composition. In 1908 Leymann wrote¹:

There are two ways open to us in poisoning: prohibition of the use of white workers, and of these two the first alone

Before the adoption of a measure consequences, efforts were made to poisonous substance could not be so less to the workers. There can be the best solution of the problem that it could be carried out in such the danger, that enforcement was the experience of countries where health had been adopted demonstr

II. — ESSENTIALS FOR SUCH

Regulation of an industry processes so extensive technical processes so extensive can be detected. Further, the report 1907 stated that any effective regulation principle: "Never abuse power and forceable and ineffective laws." be precise and strict².

¹ *Die Bekämpfung der Bleigefahr in*

² Vague phrases such as "not in protected", should be avoided. The prescribe stringent preventive measures prohibition (Rambousek: *Chemiker-Zeitung*)

POINTS TO BE COVERED

Below are given the essential points which must be covered by effective regulation of the use of white lead in industry ; as will be seen, there are no less than seventeen of these.

(a) Technical :

- (1) Prohibition of the sale or offering for sale of white lead except in paste or ready for use.
- (2) Compulsory labelling of receptacles containing lead paints or colours with a notice of their lead content.
- (3) Restriction or abolition of lead compounds in linseed oils.
- (4) Prohibition of dry scraping of old paint and dry rubbing down of new paint.
- (5) Limitation of working hours.
- (6) Supply to the workers of tools which prevent or reduce contact with the poisonous substances.

(b) Hygienic :

- (7) Supply to the workers of working clothes, which should be washed at least once a week.
- (8) Provision of cloakrooms for the workers, with two divisions, one for working clothes and one for ordinary clothes.
- (9) Installation of washing accommodation with hot and cold water and shower-baths, soap (powder, paste, or liquid), individual nailbrushes and toothbrushes, individual towels, to be changed weekly. The worker should be allowed five minutes to wash his hands before each meal or break.

(c) Preventive :

- (10) Provision of mess-rooms where the workers will take their meals.
- (11) Supply of milk and wholesome drinks.
- (12) Prohibition of distilled liquors in workshops and years ; prohibition of smoking and chewing tobacco during work.
- (13) Medical inspection of the worker on engagement.
- (14) Periodical medical examination, the doctor being empowered to suspend the worker temporarily if he finds it necessary. He should be empowered to discharge the worker if there are recurrent acute morbid symptoms, indicating chronic lead poisoning.

- (15) Notification of lead poisoning to the authorities.
- (16) Facilities for the workers to take sulphur baths.
- (17) Instruction of the workers in the dangers arising in the course of their work and the best means of averting them.

Regulations have been issued in the following countries, among others : Belgium (25 July 1901) ; Germany (27 June 1905) ; Netherlands (16 July 1920) ; Norway (April 1916) ; the Serb-Croat-Slovene Kingdom (25 October 1921) ; Sweden (19 February 1926) ; the Swiss Confederation (5 January 1904), and the Cantons of Neuchâtel (7 August 1903), Lucerne (22 October 1907), Griesons (4 May 1906), Geneva (26 October 1907). The regulations issued cover the points enumerated above in varying degrees.

In addition to this positive action, there are a number of proposals. A large manufacturer of white lead stated before the British Committee that regulation and education of the worker in the care of health had given excellent results elsewhere, and presented draft regulations to the Committee with this in view.

In 1921 the Painting Trade Materials Committee of Great Britain and Ireland, which represents the National Federations of Master Painters in the British Isles, informed the International Labour Office that it viewed with some alarm the proposal to prohibit the use of white lead in painting, which it considered too stringent a measure, and thought that a comprehensive and well devised code of regulations could effectively cope with any danger to the health of painters. The Committee submitted to the Office draft regulations (see Appendices) which, if enforced, would in its opinion afford effective protection against all risk of poisoning from paint in general and white lead in particular.

This being the tendency of regulation, whether actually in force or proposed, opinions on the seventeen points enumerated earlier may now be considered.

CRITICISMS OF POSSIBLE REGULATIONS

- (1) No objection has been raised to prohibition of the sale of white lead otherwise than in paste or ready mixed for use. This rule has long been in force in some countries.
- (2) No objection has been made to the proposal to label receptacles with the amount of poison in their contents.

(3) Restriction or abolition of lead compounds in linseed oils presents no difficulties. In fact, regulation might go so far as to prohibit the use of any lead-containing drier, since either the oil can be boiled or other non-poisonous driers can be used.

(4) There is general agreement that dry scraping of old paint-work should be prohibited; but, as was shown in Part IV, the proposal to prohibit dry rubbing down of new paint is strongly opposed by operative painters and some experts.

(5) Employers are unwilling to agree to limitation of working hours. The coach-painting industry as a whole is not in favour of such limitation¹. The New York Painters' Federation, however, supports the five-day week now in force in New York City and Yonkers and presented, among its arguments in favour of the shorter week, which is "essential for the health and life of painters", information supplied by American experts, among them Mr. Harris, Director of the Bureau of Preventable Diseases in the New York Department of Health and formerly chief of the Division of Health².

(6) Tools to prevent or limit contact with poisonous materials are already supplied in some towns. Geneva painters mix their paints on palettes and apply them with a brush or a knife, rarely by hand. But it is frequently objected that workers are rarely as highly trained in the technique of their trade as those of Geneva, and that there would be great difficulty in enforcing this regulation. The French factory inspectors state that the workers very often refuse to use palettes for handling stopping, regarding them as "clumsy and inconvenient".

Even the Belgian master painters stated³ in 1905 that it was practically impossible to prevent splashes and direct contact between materials and the hands.

(7) There is now general agreement on the practical importance of wearing complete protective working clothes. Evidence before the Austrian and British committees, for example, shows that the employers were not opposed to providing overalls and washing facilities at their own expense, although some of them doubted the value of overalls and most of them said that it would be a very expensive obligation for them. The French factory inspectors' reports show that French master painters also were not opposed to the idea.

¹ *British Report*, 1920.

² *The Call Magazine*, 26 March 1922.

³ *Rapport des patrons peintres*, Liège, 1925.

(8) The question of cloakrooms, also important, is not yet settled in many countries. As a rule, when the workers have overalls their ordinary clothes are hung in the room where they are working and are thus liable to collect poisonous dust and splashes.

(9) and (16) The importance of personal cleanliness is disputed by no one. It is therefore necessary to supply washing facilities and to give the workers time to wash before meals or breaks. Rambousek, a hygienist and experienced public official, could not deny the need for enforcing the regulations adopted with the utmost severity. He even said that the worker exposed to the risk of lead poisoning should wash in a solution which would convert the lead adhering to his skin into a harmless sulphide, shown on the skin by clearly visible black specks. This would provide a personal check, if the workers did not object to it; they have an obvious dislike for it owing to the unpleasant smell of the solution, the colour of the skin, etc. Suggestions which cannot be accepted are that sulphur (which does not produce lead sulphide) should be used, or that hydrochloric acid should be added to the water, for lead is soluble in a solution of this acid and thus could not be detected.

The provision of hot as well as cold water is necessary for the removal of paint from the hands; it is generally an easy matter in modern industrial undertakings, if not in painting shops and workplaces. The Geneva report states that "the painter washes because there is a tap in every building under construction, and the worker is accustomed to make a brief toilet before leaving his work". A "brief toilet", however, is not enough.

In connection with the provision of washing facilities two questions arise: are the workers prepared to use them? And are they, and can they be, generally supplied?

The president and other members of the British Association of Master House Painters and Decorators, the representative of the London Association of Master Decorators, the Austrian commission, the Belgian and Italian investigators, and others state that it is very difficult to induce painters to observe personal cleanliness.

A number of reports note, however, that this reluctance is due to the inadequacy of the washing facilities. Painters generally take the paint off their fingers by rubbing them on their clothes or on rags; they hardly ever use a brush. They ordinarily eat their dinner in the room where they are working without washing

their hands. They can hardly be blamed severely for this, considering that often ten or more workers have only a single pail barely full of water to wash their hands and face. Soap and nailbrushes, which would make washing effective, are unknown.

Pratt wrote in 1912 that sanitary conditions in the building industry are difficult to regulate, since all arrangements are temporary for the period of construction and there is generally the greatest difficulty in even supplying water on the different floors. He also points out that the constant shifting of workplaces and the consequent makeshift nature of the fittings, added to the workers' ignorance of the risk of lead and the short breaks allowed for meals, encourage their carelessness.

Every year the Belgian and French factory inspectors report the great difficulty of obtaining water in some yards, while when work is done in private houses customers sometimes show no readiness to facilitate cleanliness among the painters¹.

The greatest difficulty is, nevertheless, the enforcement of the regulations, which would be difficult enough even where constant supervision is possible, as in factories and large painting shops². In fact, any regulations would be complicated to draft and difficult to carry out.

One cannot in practice require the worker to spend part of his day manipulating a handful of toothbrushes, nailbrushes, etc. He cannot be compelled to use a special protective appliance, however simple, because he will not grasp its importance until he has been attacked by the disease, unless by good luck his neighbour is affected first.

All practical men are agreed that there is no possible means of preventing even a cleanly and sober worker from contracting poisoning, for however careful he is he will never be free from a certain fatalistic indifference, while some workers could never be protected from lead poisoning if they came in contact with lead³.

(10) and (11) The law may require that mess-rooms must be apart from places contaminated with lead dust, and there are such mess-rooms in many workshops⁴ but only a minority of house

¹ *Rapport des patrons peintres belges.*

² Before the French Parliamentary Committee of 1902, an employer asked whether cleanliness meant simply washing the face and hands with soap or whether it went further. What appliances would be needed? Was soap enough or would it mean a whole bathroom?

³ BROUARDEL: 1904 Lecture. GAUTIER: evidence in 1905. LABORD: 1901 Lecture. MOLLE: 1906 Lecture.

⁴ *British Report*, 1915.

painters leave their workplace for meals. Representatives of employers stated before the British Committee of 1911 that in many cases it was impossible to provide mess-rooms.

(12) There are dangers in the habit of smoking or chewing tobacco while working, keeping cigar or cigarette ends in the pocket, or — what is worse — making one's own cigarettes with fingers soiled by lead paints. It is absolutely essential to prohibit this.

(13) and (14) Medical examination on engagement and periodically afterwards is not only an effective means of preventing occupational diseases but also an invaluable means of educating the workers in the care of health. Examination on engagement would eliminate workers with physical defects, rendering them more liable to poisoning. Subsequent periodical examinations should be frequent, but not too frequent, as this would be directly contrary to the principles of reasonable hygiene.

In *Germany* official and very detailed instructions for the medical examination and health inspection of workers employed in undertakings manufacturing lead paints and other lead compounds were issued in January 1920 (see Appendix IV). In *Poland* weekly medical examination of painters is required with a view to detecting any symptom of lead poisoning at an early stage. The *Serb-Croat-Slovene* Labour Act, 1921, also prescribes (Part V) permanent medical supervision in all undertakings.

Schmidt advocates medical examination on engagement only in extremely unhealthy industries, in order to protect nervous, alcoholic, and weakly subjects from the effects of lead poisoning; Glaser and Müller recommend it also for persons suffering from anaemia, tuberculosis, or predisposed to it, and kidney diseases. Schröder¹ considers it necessary for all workers in lead industries, as does Koelsch².

According to Holtzmann, Dreschke, Isermeyer, Gerbis, and others³, the periodical medical examination of workers exposed to the risk of lead poisoning should be conducted by skilled doctors who are thoroughly acquainted with the methods of chemical analysis (blood and urine tests, etc.). Opinions are divided on the intervals at which medical examinations should be made. It is unanimously agreed that they should be more frequent than once

¹ *Frühdiagnose der Bleivergiftung*, pp. 29 et seq.

² *Ibid.*, p. 30.

³ *Ibid.*

in three or six weeks, especially for young workers. Böttlich, Jacob, Hübner, Schenk, Schmidt, and others think that even weekly examinations would not be sufficient to prevent serious effects of lead poisoning, such as paralysis¹.

The difficulties in the way of applying these measures to painters are the same as in the case of facilities for cleanliness. It may be asked whether medical examination will protect them from poisoning, whether it can be so organised as to reveal the worker's real state of health and permit of timely action. Experience in Belgium and elsewhere seems to indicate the extreme difficulty, if not impossibility, of enforcing regular medical inspection. The worker frequently changes his employer and even his trade; he is very ready to set up as a jobbing painter. In these circumstances it is doubtful whether the doctor responsible for examining him will be able to keep him under effective observation from one quarter to another.

Any kind of debility predisposes the worker to lead poisoning, and every worker who handles lead paints runs the risk, even if he is strong and healthy, so that thorough medical examination on engagement would have the effect of still further reducing the already inadequate number of workers admitted to the painting trade. Strict periodical examinations, if practicable, would so soon reveal in many workers symptoms of chronic lead poisoning requiring their suspension or discharge that there would soon be a shortage of workers in the industry².

¹ *Ibid.*, p. 46.

² The Belgian master painters wrote as follows in their report (Liège, 1906):

We will not labour the absolutely inhuman character of this section of the infringement of the freedom of labour and the rights of man involved in recording the names of the unhappy victims of white lead in an official register with reports on the state of their health on which will depend their re-engagement and consequently their livelihood. Those who oppose total abolition of white lead ought bitterly to regret their attitude, for, if they are sincere in stating that good painting cannot be done without white lead, they should also admit that it can still less be done without good workers. This would be the result of enforcing section 10; as lead poisoning often takes effect very slowly, it is the skilled and experienced workers who suffer most severely. Nine times out of ten, therefore, it would be the most efficient workers who were sacrificed. All medical reports agree that after some years in the trade every house painter is affected more or less noticeably. In view of this morbid condition in working painters generally, there can be no doubt that, if the Government doctor took his instructions literally, the permanent or temporary elimination of part of our working force would so upset the organisation of our works as to make it quite impossible to undertake a contract with the assurance of executing it successfully.

Moreover, in countries where there is an organised medical inspection of working painters, this has not proved successful. In Germany L. Fischer and Fleck in 1912 indicated the obstacles to the medical supervision prescribed by the Order for lead industries. Teleky in Austria complains of the same difficulties, especially in small towns. The Belgian medical factory inspectorate states that the workers object to the examinations, or after one or two no longer appear for them. The figures for 1906 were as follows:

Quarter	Undertakings	Workers	
		Total	Not examined
First	134	635	595
Second	114	693	660
Third	105	672	450
Fourth	93	473	300

While reporting the workers' protests against medical examination, the Belgian inspectors note that the protests refer mainly to the discriminating character of the regulation, which applies only to house painting and not to other industries using lead colours¹.

¹ The 1908 report also stated:

The workers, as always hostile to any innovation, regard the quarterly medical examination, whose preventive purpose they entirely fail to understand, as a humiliating formality infringing their personal freedom, or at best as a useless imposition. Some of them who are more or less suspected of lead poisoning are afraid of being suspended from work. These prejudices keep up the general opposition, which is strengthened by financial considerations. If the examination is made on a working day, it involves loss of time and wages for all the workers. If the doctor chooses a Sunday, various objections are raised, among them the expense of a special journey. Matters are still further complicated by the conditions under which painting operations are normally carried on. As everyone knows, house painters are essentially nomad workers, compelled by the needs and chances of the trade to move about continually, so that one can very rarely find all the employees of even a small firm at one spot.

Account should also be taken of the essentially intermittent and seasonal character of painting work, the ease with which an out-of-work can pick it up, and the even greater ease with which a real painter can become temporarily a painting contractor. These different factors produce complete instability and mobility in the trade, an extraordinary variation in the number of employers and workers, incessant changes, a constant coming and going of workers, and prolonged unemployment. It has even been found that some employers arrange to have only a small number of workers at the time of the examination, and simply re-engage their normal force a few days later.

Supervision is still further hampered by the fact that house painting is not confined to exteriors, but is done inside inhabited houses and other places to which inspectors have normally no right of access.

In 1910 the Belgian medical inspectorate also drew attention to the excessive expense laid on small employers by the prevailing charges for the periodical medical examinations'. As the 1911 report said :

On the whole master and operatives are hostile to the periodical examinations, and in some cases the representatives of the authorities have had to struggle against stubborn resistance from both workers and employers. As a result, the Order of 25 July 1910 is far from being generally observed. Without the co-operation of those concerned no enactment, however excellent in theory, will be anything but illusory in practice.

The reports for 1912 and 1913 emphasise the impossibility of tracking all the workers and keeping them under continuous observation — so much so that periodical medical examinations have been discontinued since then.

The Painting Trade Materials Committee of Great Britain and Ireland is in favour of periodical medical inspection of operative painters, although in 1911 Messrs. G. Pouchon and Ricker Devroede, of Brussels, wrote to the chairman of the British committee as follows :

Of all these regulations the most iniquitous is the medical inspection imposed on the operative painter; this provision, which is voracious and humiliating, is without any effect.

The Corporation of Painters would prefer the total suppression of white lead in their work.

Before the British committee 14 master painters and 6 workers said they were prepared to agree to medical examination, 5 masters agreed to it if they did not have to bear the expense, and 6 masters and 2 workers were opposed to it; of the 5 representatives of the Institute of British Carriage Manufacturers and the Society of Motor Manufacturers and Traders, 4 said they would agree to it if it were necessary.

(15) The notification of lead poisoning should provide all the data needed, and should be exhaustive and complete. Laws prescribing medical examination also require every industrial undertaking to record the result of the examinations in a special book and to notify any case of lead poisoning.

¹ "As for the workers, their shortightedness and outlook change very slowly. Far from realising the preventive value to themselves of regular medical examination, in many towns they persist in regarding it as a vexatious formality, with no effect but to waste their time. It must be admitted, too, that many heads of undertakings, instead of trying to counteract this attitude, tend rather to encourage it and thus evade a statutory obligation which involves them in some expense."

² Appendices to British reports, 1915 and 1920 (Cmd. 681). Cf. also views of Swiss employers. For the difficulties of enforcing regulations and the incidence of lead poisoning, see memorandum of the Düsseldorf Chamber of Commerce, pp. 6-7.

(17) Although instruction of the workers may be considered a valuable aid in the campaign against the danger of lead poisoning, experience shows that all attempts in this direction have up to the present produced insignificant results'.

To sum up, the various points regarded as essential to successful regulation are by no means all simple to apply. The following are more or less easily achieved : prohibition of the sale of white lead otherwise than in paste ; labelling of receptacles containing lead paints ; limitation of lead compounds in oils ; provision of working clothes, wholesome drinks or milk for the workers ; prohibition of alcoholic liquors in workplaces ; notification of lead diseases ; and instruction of the workers. On the other hand opinion is definitely against the practicability of providing washing accommodation with hot and cold water, etc., the provision of mess-rooms, medical examination on engagement and periodically afterwards, and the provision of shower baths or sulphur baths for the workers. In the circumstances it may well be questioned whether regulation is practicable.

III. — DIFFICULTIES OF ADMINISTERING REGULATIONS

The difficulty of carrying out sound regulations was the subject of much discussion in the British committee of 1911. Several employers, asked whether they would prefer regulation or prohibition of the use of white lead, said that they would prefer prohibition (9 out of 10 representatives of the Federation of Building Trades Employers ; 9 out of 26 other employers), because the observance and enforcement of detailed regulations seemed to them to involve complications injurious to the industry. Some witnesses, among them the Admiralty representatives, stated that the most stringent and strictly-enforced regulations would not solve the problem. The Admiralty had long observed the strictest precautions, but cases of lead poisoning had nevertheless occurred among its workers.

The British committee on coach painting stated that :

It does not, therefore, appear that the establishment of a drastic code of regulations for the coachbuilding industry would be impracticable, and, although it was maintained that it would constitute but a partial solution

¹ ERISMAN : *op. cit.* (Cf. Instructions to Workers, Appendix IV.)

of the lead poisoning question, there is good reason to suppose that, as in other industries, e.g. the manufacture of white lead, the enforcement of such a code would greatly reduce the number of lead poisoning cases to which the industry is at present liable.

In the committee's opinion the effective adoption of regulations in the house-painting trade is an impossibility, because the work is not carried out in factories and workshops, as coach painting is, and cannot be so easily supervised by the factory inspectors. The point seems to be of secondary interest however, as the balance of opinion was against stringent regulation, and coach builders, especially large firms, have already adopted substitutes for white lead. (See above.)

French employers told Mr. Barger on that strict regulation, of the type which would be necessary, would cause much greater inconvenience to the industry, other things equal, than the few additional precautions involved in the successful use of substitutes.

As regards Belgium, Mr. Flament, on behalf of the workers' delegates, demonstrated, with documentary proof in his hands, to the White Lead Committee of the Geneva Conference that regulation of the use of white lead must inevitably be impotent. Dr. Gilbert, who as a Government official has for long perseveringly striven to enforce in his country regulations covering all the points advocated by the committee, which have been in force since 13 May 1905, made the following statement, with the authority of sixteen years' experience of regulation, on 16 November:

I wish to draw your attention most particularly to this point, for it is a very different matter to regulate an industry which is carried on in enclosed and accessible premises which are always the same, and to apply regulations to essentially variable industries carried on in open workplaces. These regulations of 1905 applied solely to house painting and, like the later ones, they applied equally to operatives and to master painters.

Further, it should be noted that up to this moment no suggestion has been made of a possible regulation which has not been embodied in our code for sixteen years. For example, we have prohibition of dry rubbing down; prohibition of contact between the paint and the hands; protection against splashes; compulsory provision of overalls and even head coverings reserved exclusively for work. It is also compulsory to keep constantly at the workers' disposal the appliances required for cleaning the teeth, hands, and face. In short, we have all the rules which have been described here.

We have also — a point which seems to attract some attention — periodical examination of working painters. Gentlemen, you have no idea of the violent and continual protests and complaints which have been made from the first actual enforcement of this rule, so much so that as early as 1907 — a full year after the regulation came into force — the Master Painters' Trade Association of Brussels solemnly voted in favour of abolishing it and replacing it by prohibition of the use of white lead.

¹ *International Labour Conference, 1921, p. 428.*

Subsequently, far from declining, complaints increased, and protests grew more strenuous. Parliament took the matter up, and a new Act, dated 20 August 1909, was passed to supplement the first and increase the regulations imposed on the painting trade. This Act, which is still in force, was completed by a Royal Order which harmonised the old and the new regulations. It also filled in gaps by detailed provisions prohibiting the sale, transport, or use of white lead for painting in any form other than as paste ground in oil.

Well, these regulations have been in force for eleven years, and I can assure you that they have had very little useful result. In fact, they have only had the following drawbacks: they have profoundly annoyed painting contractors; they have heightened the workers' opposition to these measures, said to be for the protection of their health; and they have thoroughly discouraged the officials who have had to enforce them.

That is not surprising; it explains why any similar form of regulation, no matter how well devised, is unworkable. It is impracticable for many reasons, of which I will mention only the most important.

The first is that it interferes with working methods which have proved their efficacy and lays down rules which most men in the trade regard as unworkable in practice.

The second is that in Belgium — and I think in most, if not all, European countries — there is no right of access to private dwellings. Then how are we officials to supervise what goes on in private dwellings?

There is a third reason, arising from the nature of the painting trade and the great variety of places in which it is carried on. Owing to their extraordinary number and excessive mobility it would need an absolutely impossible number of supervisors to enforce regulations of this type; it would take armies of officials to scour the country in the hunt for breaches of the regulations.

These principal reasons have resulted in our seeking, with our traditional common sense, to find a better way. This is the present position in Belgium: master painters — by which I mean the heads of house-painting firms — and Government officials have agreed in principle that a compromise was necessary. This compromise involves prohibition of the use of leads paints on interiors, and very considerable freedom, subject to a few detailed conditions, to use them on exteriors and objects to be exposed to the weather.

From personal experience, Gentlemen, I am of opinion that, whatever the regulation which you propose, we shall have worked in vain here; I am convinced that the question of prohibiting the use of white lead paints for interior painting is bound inevitably, by force of circumstances, to reappear on the Agenda of a future International Labour Conference.

Medical inspectors from Great Britain, Italy and Bavaria were all of the same opinion; all stated that protective regulation is always inadequate and very difficult to administer.

IV. — DIFFICULTIES OF ENFORCING REGULATIONS

OPINIONS

Supervision and enforcement of regulations are an essential condition of their success. If supervision is impossible in practice the most drastic regulation will be a dead letter. This is strikingly proved by the results of regulation in the house-painting industry.

In 1901 the French Labour Office wrote¹:

House-painting shops are so extremely scattered that it is impossible to protect the workers employed there by compulsory protective measures, such as the wearing of respirators. Such a provision, the only effective one, would not be accepted by the workers, and no factory inspectorate could see that it was observed.

Similarly, in 1903 J. Klompke emphasised that house painters' places of work are so scattered and changeable that inspection would be extremely difficult². About the same time Sommerfeld wrote that:

Personally, I fully realise the extreme difficulty of such regulation, because it affects a very large number of undertakings operating in the most various conditions, most of them small, and also because the trades in question are generally carried on not in workshops but outside, in houses belonging to third parties and other buildings of this kind³.

In conclusion Sommerfeld summarises what should be contained in sound regulations, and recommends that the employer should be made responsible for non-observance of the regulations issued by the authorities. If cases of lead poisoning occur after these measures have been taken, lead paints and especially white lead must be prohibited, for experience will have proved that measures which are theoretically possible can hardly be enforced in small workshops. The factory inspectorate cannot be blamed if it fails to exercise in practice the supervision expected of it in theory.

At the Health Congress of 1907 speakers already mentioned pointed out, in connection with health regulations in the lead-using industries, that while large-scale industries could be inspected it would be difficult to supervise the hygiene of small shops and yards; they concluded that "regulation which would be helpful for white lead makers would be useless for painters".

In 1908 Rambousek himself, so often cited by white lead corrodors, wrote that there should be no illusions as to the efficacy of regulations; they were impotent to diminish the risk or remove the root of the evil⁴.

In Germany hygiene experts⁵ and the Painters' Union found that the Order of 1906 was very inadequately observed; even the Düsseldorf Chamber of Commerce admitted, while deploring, the fact in its memorandum (pages 6-7).

¹ *Les poisons industriels*. In Germany the factory inspector for the Cassel district (1920, p. 538) stresses the difficulty of carrying out the Decree of 27 January 1920 on lead paint factories.

² *Op. cit.*

³ The same view was expressed in the petition of the German Association for Labour Legislation.

⁴ *Über die Verhütung der Bleigefahr*, p. 6.

⁵ Cf. FLECK, FISCHER, TEIZKY, etc., *op. cit.*

Some experts demand even more stringent regulations than those already in force; but the Düsseldorf Chamber of Commerce, anticipating this, replied as follows:

These measures satisfy the conditions laid down by the specialists. As they stand, they are sufficient to hinder, if not prevent, the development of lead poisoning. As was pointed out by Regierungsrat Dr. X., success depends entirely on precise observance and practical execution of these regulations, and if they are not observed, they naturally fail entirely to give the protection intended. It must be admitted, however, that the peculiar nature of the painter's trade places greater obstacles in the way of carrying out these Orders than is generally the case with laws in Germany. The trade is carried on as a rule not in workshops but in workplaces which are constantly changing. This mobility makes it very difficult for the authorities to enforce the regulations, particularly in small undertakings. To these difficulties must be added the fact that the workers are loath to adopt the precautions designed to protect their health during their work. The inevitable result of this state of affairs is that, even since the Order came into force, the number of cases of lead poisoning — as shown by the statistics of the sickness funds up to the beginning of the war — has remained very high, and that strenuous demands are again being made for protective measures, going even so far as prohibition of the use of white lead.

EXPERIENCE

The extreme difficulty of enforcing regulation is shown by the very small number of prosecutions in countries where regulations are, or have been, in force. In France the number of breaches of the Decree on the use of white lead in painting noted in official reports was only 284 in twelve years (1902-1913). This is due to the fact that effective supervision of building yards, workshops, and all the places where painting is done would require an impossibly large force of inspectors. At the present time, "with the best will in the world the inspectors cannot visit each establishment in their districts even once a year, since they are responsible for enforcing all our social legislation". As Mr. Clemenceau said, "it would need one inspector permanently attached to each painter".

In Belgium the inspectors' reports state that "it is often very difficult to ascertain whether the regulations are observed"; "work is generally done without their knowledge and escapes their supervision"¹. In more than three years, from 2 September 1910 to the end of September 1913, there were only 44 reported breaches of the Royal Order of 26 July 1910 in the whole of Belgium, where there are from twelve to fifteen thousand painting establishments.

¹ *Rapports des inspecteurs du travail*, 1910.

In Austria, Germany, and indeed everywhere the same complaints are made : incomplete observance of the law, great difficulties of inspection, frequent evasions of prohibition.

As a theoretical conclusion one may quote the grounds given by the British committee of 1911 for rejecting regulation of the painting industry, especially house painting, as quite impossible :

- (1) the inadequacy of regulations to cope with the evil ;
- (2) the difficulty of prohibiting dry rubbing down ;
- (3) the cost and difficulty of complying with various precautionary measures ;
- (4) the insuperable difficulty of enforcing regulations by adequate inspection.

As a practical conclusion one may point to the example of France, where regulation first of house painting and then of all industrial painting (Decrees of 18 July 1902 and 15 July 1904) was superseded by the Act of 1909 prohibiting the use of white lead on the interior or exterior of buildings¹.

V. — PARTIAL PROHIBITION OF THE USE OF WHITE LEAD

The principle of prohibition was supported by speakers at the fourteenth International Congress of Hygiene and Demography (Berlin) as follows :

Manufacturing processes and industrial technique should be changed if they can thus be rendered harmless. But if in practice it is difficult to regulate the manipulation of the poisonous product, or if the danger is only slightly decreased thereby, its use should be prohibited without hesitation. Since, for example, painters' workplaces are so scattered as to make inspection impossible, their technical methods can with difficulty be altered, their health conditions are bad and their disease rate high, we should advocate the substitution of harmless substances for white lead. Once it has been proved that a poisonous substance can be replaced by a harmless one, the former should be strictly prohibited.

These principles have been at the root of French legislation, which since 1849 has prescribed the use of zinc whites in place of white lead ; the principle has found many supporters in subsequent years among technical experts, legislators, and even employers.

Prohibition is thought technically possible by experts in other industries than building, such as coachbuilding, furniture making, etc. In 1921 the Belgian technical committee on the use of

¹ A new Decree of 1 October 1918 applied to work other than house painting the provisions contained in the repealed Decrees, which applied only to house painting, where they had been replaced by total prohibition.

white lead stated that on certain conditions good painting could be done, even on exteriors, without lead paints. At the same time Bageron found in the course of his investigations that prohibition of white lead would cause no technical difficulty in other industries, such as the manufacture of agricultural machinery, vehicles, signs, blinds, etc.

All this goes to show that experts do not always agree with the report of the Geneva enquiry when it asserted that to prohibit white lead would be an abuse of legislative authority because it was based on the argument that " some workers not belonging to the trade are clumsy in handling white lead ". The reply to this is that labour legislation should not, and cannot, be based on a principle which divides workers into " skilled workers " and " labourers " or " transients ", with the idea that the second class have no need of statutory protection. It must be remembered that in most cases there are two matters to be considered : classes of persons who require special protective measures, and certain substances which are exceptionally poisonous.

In his treatise on industrial hygiene Lehmann says that lead poisoning could be quite effectively restricted by prohibiting the use of white lead inside buildings or even prohibiting merely lead paints in any form other than paste, and enforcing cleanliness of clothes and hands.

Supporters of partial prohibition are to be found even among employers and manufacturers. At the Geneva Conference Mr. Navez, the Belgian employers' expert, who was convinced that white lead was essential for paint on houses exposed to the weather, stated nevertheless that this use of white lead should be allowed only as an exception to a general statutory prohibition. Thus he, too, supported the Belgian point of view, of which Dr. Glibert was a most authoritative interpreter.

Partial prohibition should probably allow of temporary individual exceptions, notably, for lead base pigments of definite colours required by the painting industry. Such exceptions should refer only to greens, yellows, oranges, and reds.

It is also, no doubt, desirable that, as was suggested by the British committee of 1923, certain important technical questions should be investigated by paint and varnish technologists ; nevertheless, such investigation must on no account be made, even without deliberate intention, a means for postponing a measure of social protection which is regarded as eminently desirable and quite practicable by the majority of competent judges.

In the final analysis, however, there is no denying that there will be serious obstacles to the enforcement of partial prohibition. The first of these is that in most countries the factory inspectors have no general right of access to private dwellings, which are the painter's most usual place of work. Next there is the difficulty on some occasions of distinguishing and delimiting interior and exterior painting. Finally, the inspectors will inevitably find themselves in a difficult position when they discover white lead paints in an establishment and have to secure evidence that they are used solely for exterior work and not illicitly for interior painting¹.

VI. — TOTAL PROHIBITION OF LEAD COMPOUNDS AND WHITE LEAD IN PARTICULAR

Some advocates of total prohibition are of opinion that in matters of labour legislation either every use of a poisonous substance must be prohibited or there must be no prohibition at all. In the case of white lead and lead paints in general they do not agree that prohibition should apply only to one kind of work and then be extended after two or three years to the others. They consider this a specious distinction²; it makes enforcement, which is essential for any real solution of the problem, even more difficult.

¹ The presence of lead and even its content of metallic lead can, it is true, be ascertained by chemical analysis of a scraping taken from a coat of paint. The proportion of 5 per cent. generally adopted may be accepted, for industrial experience has shown that if this is not exceeded the risk of lead poisoning is eliminated practically. The Geneva Conference, however, thought it desirable to reduce the percentage to 2. The use of lead compounds as driers in oils would also have to be prohibited.

The difference between this proportion and that proposed by the British committee, for example (5 per cent. of a soluble lead compounds), is slight, since the atomic weight of lead is always greater than that of other ingredients of paint.

The presence of lead compounds in coats of paint can be detected by applying sodium monosulphide. There is also a well-known appliance which indicates the amount of lead in paint and thus reveals whether it exceeds the proportion allowed or not. (Cf. Duval, in *Bulletin de l'Inspection des Travaux* (Paris), 1911, p. 174.)

² The Geneva report of 1907 stated (p. 67): "The distinction made between indoor and outdoor work is specious and we do not understand it. If white lead is dangerous, it is equally so whether used inside or outside. Again, what is 'interior' and what 'exterior'? And what of intermediate cases: an open passage exposed to the weather, for example, or the inside of a door or window-frame?"

Tauxky (op. cit.) recommends that prohibition should also apply to the outside painting of windows, garden furniture, and, eventually, carriages and motors.

For Queensland, see Appendices.

In 1921 Koelsch stated that from the purely medical point of view total prohibition of white lead was desirable; his refusal to support it in practice was due to the fact that, being much concerned, like other German hygienists, over the economic side of the question, he wished first to have the opinion of competent judges on the problem of substitutes — a problem which, as has been shown, may now be considered solved.

In actual fact France has, by the Act of 1909, prohibited the use of white lead and lead-containing oils in all house painting, whether indoor or outdoor. This example has recently been followed by Chile, Greece, Russia, and other countries (see Appendices). Some of them extend prohibition to shipbuilding (e.g. Greece) and even to the manufacture of lead paint (Russia). Other Governments have expressed the opinion that prohibition of the use of white lead should apply to all painting operations and that consideration should also be given to the possibility of prohibiting the use of other lead products, such as red lead.

Thus there are many experts who think, and many Governments who attest by their legislation, that total statutory prohibition would not be an exaggerated measure. The Geneva report provides a very strong argument in its favour when it states that "prohibition of white lead for certain work is so hard to observe that it may be asked whether it is not beyond the powers of the industry to do so, since it makes it extremely difficult for contractors to guarantee satisfactory work".

¹ In 1909 the German Association for Labour Legislation wrote in its petition: "The report does not declare in favour of total statutory prohibition of the use of white lead, while experience has shown that it is impossible to prevent lead poisoning by protective legislation; this amounts practically to unconditional approval of prohibition, for experience on all sides has proved conclusively that observance of protective measures is impracticable in painters' workplaces, which, being generally scattered, escape rigorous inspection".

Koelsch, again, in 1911 said: "From the medical standpoint intensification of the Order of 1905 by the restrictions mentioned above is absolutely necessary. But if the use of lead paints is as unrestricted as in the past, I cannot consider preventive measures, even if increased, as adequate and effective from the standpoint of industrial hygiene, for they cannot secure the improvement which is so much needed in the painting industry".

It should further be noted that, as was pointed out in the questionnaire of the International Labour Office (p. 30), ratification of the Convention will only cause a restriction of the use of white lead. Prohibition will apply only to interior house painting, where white lead has almost everywhere been replaced by substitutes; it can still be used, with certain precautions, in exterior house painting, although this does not now form a very large part of the operations of the painting industry.

VII. — POSSIBLE METHODS OF CARRYING OUT PROHIBITION

POSSIBLE EXCEPTIONS

Total prohibition of the use of white lead in painting might be accompanied by transitional measures to protect the interests of the industry as far as possible. Some delay in enforcing prohibition might be allowed so that employers would have time to alter their equipment.

Exceptions would have to be considered, among others for work on old paintwork containing lead, especially when repairs and renewals were done, and for mixing paints for rooms where the paint is exposed to steam or sulphur fumes. Needless to say, the rubbing down of old white lead paint would have to be regulated and all precautions taken where lead paints were involved.

ENFORCEMENT OF PROHIBITION

Mere prohibition of the use of lead paints is not enough; there must also be effective inspection. The difficulties have been described; inspection must therefore be simple and as inexpensive as possible. The best method of attaining these objects is to institute inspection of the sale, purchase, and transport of paints and not of their use.

Existing laws generally provide for inspection of all undertakings employing not less than five or ten workers. It would have to be extended to cover those with five workers, for small undertakings cannot be allowed to escape supervision.

SUPPLEMENTARY MEASURES

It might also be suggested that the proportion of lead compounds less soluble than white lead in paints should also be limited, their content in metallic lead being defined, whatever the method of analysis adopted. (See above.)

Where the use of white lead is permitted, each State should explicitly lay down the health rules which painters must observe. In the opinion of Mr. Navez, any master painter applying for permission to use white lead, bought in paste, should be required

to state beforehand what quantity he proposes to use. Obviously such permission should be granted only on condition that the persons concerned undertake to observe implicitly all the precautions imposed; this has already been done by Greek legislation.

The sale, transport, and use of white lead paints intended for painting should be permitted only if they are in the form of paste ground in oil and the receptacles are labelled to indicate their contents.

Another useful step is to prohibit the sale to private individuals of white lead and other white lead base paints as well as lead paints ready for use. The legislation recently adopted in Belgium may be cited as a model in this respect. (See Appendices.)

There could be no more fitting conclusion to the present Report than the wise and noble words of Mr. Justin Godard, French Government delegate, at the Geneva Conference:

Faced with all these private interests which are pleading their own cause — and I repeat that they have a right to do so — we have to consider a higher interest, the interest of humanity. I by no means admit the accusation of sentimentality which business men and industrialists often hurl at those who talk of the interests of humanity. I believe that by protecting human life, especially at the present time, by preserving the health of thousands upon thousands of workers, we shall do better service to the economic world and the wealth of all than by permitting the use of white lead, even if it is proved to give a longer life to the materials which it covers, even if its cost is lower.

APPENDICES

In *France* after long and patient research, after publication of numerous memoranda, after several experiments and lengthy preliminary debates, a law was voted on 20 July 1909 on the use of white lead in painting of buildings, whether interior or exterior.¹ The following are its principal provisions :

Article 2. — At the end of the fifth year subsequent to the passing of the present law, the use of white lead or linseed oil containing lead, or any special product containing white lead, shall be prohibited in all essential operations of whatsoever kind executed by working painters whether on the exterior or the interior of buildings.

Article 33. — A regulation of the public administration, drafted after consultation with the Advisory Committee of Arts and Manufactures and with the Industrial Hygiene Committee, may specify if necessary the special operations to which exemption from the preceding provisions may be granted.

In *Austria* the use of white lead for the interior of buildings has been forbidden since 1 April 1909 in the terms of the Order of 15 April 1908 issued by the Ministry of Commerce and the Ministry for Home Affairs. This Order comprises hygiene and safety regulations for persons employed in operations of industrial painting, lacquering, and decorative work. The Order in question was issued as a result of a detailed study on the use of colouring matters with a lead content in coating, varnishing and painting operations, and of an enquiry in the course of which employers as well as workers declared in favour of the prohibition of the use of white lead or lead-bearing compounds for interior house painting.²

The following are the principal provisions of this Order of 15 April 1908 :

4. No white lead or other colours and putties containing lead shall be used for internal painting when carried on for the purposes of trade.

For the purposes of this Regulation "internal painting" means such painting as is not continuously exposed to, or specially designed to withstand exposure to, the direct influence of the weather.

Provided that this Regulation shall not apply to the process of laying on the first priming coat over old lead paint when pure white paint is being removed, or to the process of laying on paint which is frequently exposed to the influence of aqueous or other vapours.

The industrial authorities when establishing the precautionary measures elsewhere stated may grant an exemption permitting the use of the substances named in paragraph I of the Regulation for internal painting in the case of work which would otherwise not be carried out in this country.

¹ Report carried out on behalf of the Committee of Public Health appointed by Mr. G. L. Berton, to examine the Bill voted by the Senate in regard to the use of lead compounds in the house painting industry. Chamber of Deputies, Session of 1907, No. 799.

² Kk. ARBEITSSTATISTISCHES AMT UND HANDELSMINISTERIUM : *Bleivergiftungen in hüttenmännischen und gewerblichen Betrieben, Ursachen und Bekämpfung*. V. Teil : *Bericht über Erhebungen in Farbenfabriken und in Betrieben mit Anstreicher-, Lackierer- und Malerarbeiten*. VI. Teil : *Protokoll über die Expertise betreffend die Farbenfabriken und die Betriebe mit Anstreicher-, Lackierer- und Malerarbeiten*. A. Hölder, Vienna, 1907.

In other countries where similar general measures have not so far been issued, administrative authorities have prohibited the use of white lead in operations executed under their orders. Thus :

The *Swiss Federal Council* by its decision of 30 June 1908 has requested the Federal Administrative Service on all occasions to prohibit the use of white lead for painting operations in the interior of the buildings executed directly by them, or by means of public contract. The Federal Council by way of experiment passed a decision on 5 January 1904 imposing a similar restriction in regard to work executed for the Confederation. The Cantons of Basle and Zurich and the town of Zurich during 1904 followed the example of the Federal Council by prohibiting similarly the use of white lead for work effected on their account.

In *Belgium* the Minister of Justice by the circular of 29 November 1902 and the Minister of War by the circular of 7 December of the same year, prohibited the use of white lead for work executed on their behalf.

In *Germany* the general management of the railways of the Kingdom of Wurtemberg decided from the end of 1905 to prohibit the use of paints with a lead content in its workshops.

The general management of the railways in the Grand Duchy of Baden passed a similar measure, with the result that since January 1907 white lead has been abolished from its workshops.

The municipal building committee of Berlin has recently prohibited the use of white lead for municipal constructions, that of Charlottenburg has decided to introduce prohibition for a period of three years by way of experiment.

In *France* similar prohibitive Decrees have been issued by : the Ministry of Commerce, 25 March 1901 ; the Ministry of Public Works, 19 December 1900 ; the Under-Secretary for the Postal and Telegraph Department, 20 February 1901 ; the Minister of Public Works, 1 June 1901 ; the President of the Council, 11 July 1901 ; the Minister for War, 21 October 1901 ; the Minister for Public Instruction, 30 November 1901 ; the Admiralty, 21 August 1902.

Many French towns have similarly prohibited the use of white lead on work executed by their order.

¹ L. REYMAN : *Die Bekämpfung der Bleigefahr in der Industrie*, Jena, 1908, p. 206. 191 Vorschriften des preussischen Kriegsministers vom 13. September 1899. Erlass des preussischen Handelsministers vom 22. April 1902. Bekanntmachungen des Reichskanzlers vom 8. July 1898, vom 26. May 1903 and 27. June 1905.

KAUP : *Die bisherigen Erfolge und die Durchführung der deutschen Bleiweisverordnung für Maler-, Anstreicher- und Lackiererarbeiten*. Concordia, XIV. Jahrg., No. 18. Soziale Praxis, XVII. Jahrg., p. 182 ; XIX. Jahrg., p. 121 ; XIX. Jahrg., p. 678.

² *Les Industries Insalubres*. Reports published in the name of the INTERNATIONAL ASSOCIATION FOR LABOUR LEGISLATION and preceded by a Preface by Etienne BAUER. Les Soudiers, Paris, 1908, p. L.

As the above-mentioned legislative prohibition only comes into force after the lapse of five years, these Ministerial Decrees have not so far been repealed.

In *Austria*, the Prefect for Lower Austria, by a Decree of 27 August 1906, declared that henceforward all contractors executing painting on behalf of the Imperial and Royal hospitals and all State constructions executed under the order of the prefecture would be required to use colours free from lead. This measure, which exceeds the scope of the Ministerial Decree of 15 April 1908 already mentioned, is still in force at present time.

In other countries preliminary enquiries are being vigorously conducted with a view to the introduction of partial or total prohibition of the use of white lead.

In the *Netherlands*, a committee set up by the Minister Kuyper issued its report after five years of research and experiment. It declares that white lead can, to a great extent, be replaced by colours with a zinc basis, especially in so far as concerns work in the interior of buildings¹.

In *Denmark*, the Minister for Home Affairs accepted the advice of the National Research Centre, which reported on the possibility of prohibiting white lead for interior work and the eventual execution of experiments in regard to prohibition for exterior work.

All these enquiries and all these legislative and administrative measures issued subsequent to a lengthy and complete study of the question and numerous investigations — measures which have further been confirmed as practical by experience lasting several years — prove clearly that prohibition of the use of lead colours, and particularly of white lead for interior work, is capable of practical application.

On the other hand, experiments instituted with a view to protecting working painters by means of prophylactic provisions introduced in several countries not possessing partial or total prohibition of the use of white lead have clearly shown their impracticability. The obstacles encountered by effective administrative supervision in regard to the observance of such provisions in constructional workshops and private dwellings render the application thereof illusory. Thus, for example, the application of the Decrees of the French Minister of Commerce, dated 18 July 1902 and 15 July 1904, leaves much to be desired². Similarly, the application of the Order of the German Federal Council, dated 27 June 1906 and relating to establishments where painting, whitewashing or varnishing are carried on, would appear to be rather unsatisfactory³.

¹ *Rapport der Looftcommissie benoemd bij Besluit van den Minister van Binnenlandse Zaken, d. d. 12 Septemb. 1903. Uitgegeven van door het Departement van Landbouw, Neiverheid en Handel. The Hague, 1909.*

² Report by Mr. BERTON, p. 686.

³ UNION OF GERMAN PAINTERS, LACQUEMENS, etc.: *Die Bekämpfung der Bleivergiftung im Maler- und Anstreichergewerbe. Notice relative to the application of the Lead Law, p. 34. Hamburg, 1909.*

Thus prohibition of colours with a lead content would appear to be the sole effective means of preventing lead poisoning in the painting trade. On the other hand, numerous experiences have shown that there exist substitutes for lead colours the use of which is practical, especially for interior work, that is to say, where the danger of poisoning is greatest¹.

Already during the sittings of the committee appointed by the General Assembly of the Association for the Legal Protection of Workers, which took place in Cologne in 1902, the necessity of special measures for assuring the application of provisions relative to the use of white lead was demonstrated by the Dutch delegate, Mr. Kerdijk. He suggested asking the executive of the International Association to submit a report to the next general assembly of the committee "on the question of ascertaining the best means of assuring the carrying into effect of the prohibition of white lead for painting operations in the interior of buildings"².

The meeting at Lucerne in response to the text relative to the prohibition of white lead above referred to, introduced into its resolutions the following motion:

Prior to the coming into force of general prohibition of the use of lead colours, all vessels and packing in which substances with a lead content are placed on the market, or used in commerce, must bear a clear written indication of their contents, which may be read by all handling them — "containing lead and poisonous".

The attention of workers engaged in the manufacture or use of painting materials containing lead must always be called to the risk of poisoning.

In voting this resolution it was in no wise the intention of the meeting to propose a measure calculated in any manner whatsoever to replace the prohibition of the use of lead colour. It simply desires to indicate an indispensable means of assuring the application of the provisions in force, and particularly of partial prohibition, which constitutes in its opinion the only effective measure so long as absolute prohibition has not been passed. Even more advanced measures, such as the recent French law of 20 July 1909, still leave scope for certain possible exemptions to the principle of prohibition.

In voting the above resolution, the Lucerne assembly followed two guiding principles: it recognised that if prescriptions relative to the use of lead colour were to be effective, it was indispensable that those responsible for applying them should be able to recognise easily the harmful products. Now it is impossible for the worker to know whether colours bought and mixed by his employer contain

¹ *Bleivergiftungen in hättenmännischen und gewerblichen Betrieben. V. Teil, p. 44.*

² *Report of the Deliberations of the Committee appointed by the Second General Assembly of the Council of the International Association for the Legal Protection of Workers, held at Basle, 9, 10 and 11 September 1908, p. 31 (typed report).*

or do not contain lead, unless the latter informs him. In order that the making of such a declaration by the employer can be effectively checked, a measure insuring for substances with a lead content the exclusive use of recipients which bear the mark of their contents must be enforced. In order that employers and foremen may be in a position to make such declarations with accuracy, it is absolutely necessary that they should be informed as to the nature of the product with which they are supplying their workers, and for this purpose it is necessary that all vessels and packing in which harmful substances are placed on the market by colour manufacturers and merchants should bear a clear and legible indication that they contain substances "with a lead basis and poisonous".

White lead and other lead colours cannot be distinguished by any exterior sign from other substances except by a higher specific gravity. Further, great experience is necessary to distinguish at sight between pure white lead and pure zinc white when, as is the rule in practice, these substances are mixed with barytes to a fairly considerable extent. The difference in specific gravity is considerably reduced with the effect that for such substances and still more so for colours containing, in addition to leadless constituents (zinc white), a more or less extensive quantity of white lead, this criterium of specific gravity is completely lacking, even for experts.

A great part, if not the majority, of colouring matters on the market contain barytes¹. Colours containing white lead and zinc white in variable proportions occupy an important place in the painting and lacquering trade. Colour merchants buy them as such and prepare them by mixing the ingredients themselves. It therefore happens that the majority of colours possess no exterior sign recognisable by employers or workers of their lead-bearing or leadless contents.

In order to know the chemical composition of the products purchased, the buyer of colouring matters is therefore entirely dependent on the colour merchants and these in their turn on the manufacturers.

Now, lead colours and their substitutes are generally placed on the market under designations which provide no means of recognising their intrinsic properties. Lead compounds bear at times designations referring to their place of origin or to some other particular quality and at times, as in the case of their harmless substitutes, fancy names often applied with no object other than that of concealing their true nature.

Thus, in Germany and Austria white lead is known in commerce under the names of Krem's White, Venetian White, Hamburg White, Dutch White, Cologne White, Magdeburg White, Lithographic White, Slate White, and Pattison White.

¹ Bleivergiftung in Hüttenmännischen und gewerblichen Betrieben, V. Tell, pp. 15 and following. Rapport Breton, p. 684.

Red lead is known as "Paris Red" (*Rouge de Paris*) or Saturn Vermilion (*Vermillon de Saturne*). The following colours have also a lead content: Chrome Vermilion, Chrome Red, Chrome Yellow, Patent Yellow (*Patentgelb*), Turner Yellow, Montpeller Yellow, Verona Yellow, Naples Yellow, Paris Yellow, Cologne Yellow, Leipzig Yellow, Cassel Yellow, English Yellow, Mineral Yellow, New Yellow, Royal Yellow, Lemon Yellow, Green Vermilion, Leaf Green, Oil Green, Patent Cinnabar (*Patentzinnöber*), "Carminette" and Lacquer Red (*Lackrot*).

The following colours finally contain white lead¹: platinum colour (*platinfarbe*), "Glimmerfarben" and amongst these the "Schuppenpanzerfarben" of Graf, the "Rostinit" of Weber, the "Bessemmerfarbe" of Lutz, the "Rubigoni" of Jelinek, the "Krokodilschuppenfarbe" of Lambrecht.

Similarly in France there are on the market many kinds of lead colours as well as white lead and red lead. These are "Silver White", "Clichy White", "Mulhouse White", "Chrome Yellow", "Orange Yellow", "Naples Yellow", "Turner Yellow", "Litharge", "Orange Ore" (*mine d'orange*) "Milor Green", "English Green", "Building Green".

In Great Britain a colour preparation containing red lead, white lead, and barytes is known under the name of "vermilionette".

It has already been stated that the substitutes for lead colour also bear fancy names; in fact the enquiry instituted by the German Federation of Working Painters, Varnishers and White-washers² has revealed the existence, besides lithopone and zinc white, of twenty other names of substances used for painting operations as substitutes of lead-bearing colours. The following may be mentioned: "Metal White", "Dresden White", "Royal White", "Mineral White", "Edelweiss", and "Victoria White".

It is evident that thanks to this diversity of names it becomes impossible for the buyer to know whether the preparation offered him contains lead or zinc or a mixture of those two substances. Many of these names in fact would appear to have been expressly invented to deceive the buyer or the worker as to the chemical nature of the product in question, or at least with a view to leaving him in doubt on this subject. Amongst the number of so-called substitutes, there is for example a "Hanoverweiss" which appears to be very suspicious, and even a "Saturn White", *saturnum* being the Latin translation of lead.

¹ Bleivergiftung in Hüttenmännischen- und gewerblichen Betrieben. Part V, p. 20.

² Minutes of Evidence taken before the Departmental Committees on the Various Lead Industries, No. 2784. London, 1894.

³ Die Bekämpfung der Bleivergiftung im Maler- und Anstreicherverbe, p. 94.

APPENDIX I

PETITION

MADE BY THE EXECUTIVE AND SECTIONS OF THE
INTERNATIONAL ASSOCIATION FOR LABOUR LEGISLATION
RELATIVE TO THE CAMPAIGN AGAINST LEAD POISONING
AMONG WORKERS OCCUPIED IN PAINTING
AND VARNISHING

At its first meeting, 28 November 1901, and at all subsequent meetings, the International Association for Labour Legislation dealt with the question of lead poisoning.

At the general meeting which took place at Basle in 1904, the following resolution was passed:

In regard to the use of white lead in the painting industry the Association desires to maintain without modification the proposal already voted calling for suppression of the use of this product for all work for which other substitutes can be applied to replace it. It considered further that very strict regulations must be immediately drafted and issued where total suppression cannot yet be obtained¹.

At the general meeting in 1908, which took place at Lucerne, the following resolution was adopted:

The assembly of delegates repeats the resolutions of preceding assemblies in regard to suppression of the use of lead colours. It considers that as regards white lead all experience has shown that its application for interior work is absolutely useless and may be discontinued. It expresses the desire that the Governments should cause experiments to be undertaken relative to the possibility of abolishing entirely for all work the use of the various lead colours and particularly white lead for exterior work, and of red lead for all work².

As a result of detailed enquiry and meticulous experiment demonstrating the advantages and durability of zinc colours, several Governments, in the course of the last few years, have passed legislation involving complete or partial prohibition of the use of white lead.

¹ Report of the 3rd General Assembly of the Committee of the Association for Labour Legislation, p. 178. Berger-Levrault & Cie, Paris, 1905.

² Report of the 5th General Assembly of the Committee of the International Association for Labour Legislation, p. 212. Berger-Levrault & Cie, Paris, 1909.

In view of this confused terminology, intentional or accidental, the introduction of a compulsory declaration at the sale of a product would appear to be an undisputed necessity, and so long as lead colours have not been withdrawn entirely from the market compulsory declaration on use, such as has been proposed above, becomes essential as the indispensable complement of initial reform. In *Austria* the above-mentioned Decree of 15 April 1908 has expressed as follows the principle of compulsory declaration on use:

3. In painting, varnishing, and decorating establishments as well, as in all establishments where painting, varnishing and decorating are executed industrially, lead-bearing colours and putties may not be kept or used except in recipients bearing in a visible, legible and easily comprehensible manner a statement of the lead-bearing nature of the contents.

Further, a Decree of the Ministries of Home Affairs, Finance and Commerce of 26 April 1909 in regard to restrictions of importation and buying and selling of lead-bearing colours and putties, provides also for a similar compulsory declaration.

These measures of publicity certainly facilitate the application of provisions relative to the industrial manipulation of lead. They do not, however, suffice for the protection of employers and workers, not warned of the dangers of poisoning presented by lead colours. Moreover, besides the usage made of them in painting priming and lacquering operations, these substances are used at least occasionally in many other industries. This is true notably of the printing and pottery industries, which should be made the subject of special regulations, but it is also true of the glove, hat and shoe industries, the manufacture of walking sticks and of lace, of designs for samples of embroidery and many other industrial processes besides, in certain of which, for example, fitters and locksmiths are obliged to handle white lead and even red lead. Though it is true that painters as well as workers in the printing trades are not all yet thoroughly warned as to the danger presented by the use of lead colours, the members of these other trades just mentioned are often totally ignorant of these risks even when they are aware of the name of the substance which they are handling. It is therefore necessary, in order that workers may be warned of the risk to which they are exposed, that packing and recipients containing lead colours should bear besides the inscription "With a lead content" the supplementary label "Poisonous". In industries in which knowledge of the toxicity of lead-bearing substances is widespread, the label "With a lead content and poisonous" will act as a permanent warning to the employers and workers affected.

¹ GROSSMANN: "Ueber einige neue Quellen der gewerblichen Bleivergiftung in Wien." Article which appeared on p. 1395 of the *Wiener Klin. Wochenschrift*, 1907.

TELEKY: "Gewerbliche Bleivergiftungsfälle mit seltener Entstehungsursache." Article which appeared 2 April 1908 in the *Wochenschrift für soziale Medizin*.

The introduction of a similar compulsory declaration does not by any means constitute an innovation from a legislative point of view. It existed already in numerous legislative Codes where its introduction was due to prophylactic considerations or to the desire to protect the buyer, or finally for various other reasons. It is chiefly in regard to regulation of the sale of alimentary products that legislators have had recourse to compulsory declarations of this kind. Thus:

In *Switzerland* in the terms of Article 54 of the law of 8 December 1905 relative to the sale of alimentary products and common objects:

The Federal Council issues provisions calculated to safeguard the public health and to prevent fraud in the sale of merchandise and objects subject to supervision applied under the present law.

It shall prescribe for wholesale and retail commerce in alimentary products the use of precise designations rendering impossible all error as to the nature and origin of the merchandise. A declaration of diluting matter and addition of accessory products shall be rendered compulsory.

The Order issued by the Federal Council to carry into effect the provisions of the above text and dated 29 January 1909, provides for compulsory declaration for a whole series of alimentary products such as "milk other than cows' milk" "cheese manufactured with milk other than cows' milk" "skimmed milk"; "artificial cheese", "lard coming from overseas", "mixed fats" and "edible oils", "all kinds of cereals and vegetable products and products made by grinding these"; the use of fancy names such as "flowers of flour" (*fleurs de farine*), "*Helvetia semolina*", "*Imperial flour*", etc., are expressly prohibited. Colouring matters intended for the colouring of alimentary products are dealt with by Article 236 and must not be placed on the market except in sealed recipients or packing labelled distinctly and indelibly "harmless colours for alimentary products" and bearing as well the name of the firm which manufacture or sell it.

In *Germany* the law of 15 June 1897 relative to the sale of butter, cheese and melted fat and their substitutes provides for compulsory declaration for margarine, cheese made with margarine, and artificial edible fat. The law of 9 July 1898 dealing with notification for alimentary products manufactured with the aid of such substances.

A Ministerial Circular of 27 May 1899 regulating the milk trade in Prussia provides similarly for compulsory notification in regard to boiled and sterilised milk.

In *Austria* a Decree issued by the Minister for Home Affairs, Commerce and Justice, dated 17 July 1906, demands that the packing of harmless colouring matters intended for colouring alimentary products must bear the following inscriptions:

- (1) "For colouring alimentary products."
- (2) "Harmless within the meaning of the Ministerial Decree of 17 June 1906."
- (3) The name of the selling firm and, when such substances are made of a combination of several artificial organic colours, the precise designation of the constituent elements of such combination.

Further, boxes of colours for children may not be sold without bearing the inscription "for children" or "harmless" or "non-poisonous".

In the terms of a Decree issued by the Minister for Home Affairs, Commerce and Agriculture on 20 April 1898, the sale to customers of cakes and pastries or sweets made with saccharine is prohibited unless the packing and recipients containing them are marked indelibly "saccharine product".

The law of 25 October 1901 prohibits the placing on the market of margarine, margarine fat, and cheese made from margarine except when these bear an indication of their actual composition. The Order issued in application of this law, 1 February 1902, prescribes in detail the manner in which such indication must be affixed to the merchandise. Finally, there may be mentioned section 15 of the Decree of the Minister for Home Affairs and for Commerce, issued 21 April 1876, in virtue of which chemical preparations of a harmful character, such as poisonous metallic salts and other similar products, must be kept in recipients bearing indication of their contents. It is seen in short that numerous legislative analogies in the matter of compulsory declaration exist, and these are an indispensable factor in the application of all provisions relative to lead colours, the introduction of which is strongly to be recommended.

* * *

In the first part of this document we consider that we have shown that no obstacle of a technical kind is encountered by interdiction on a very large scale of the use of lead colours, and that such interdiction alone will perceptibly improve the hygienic conditions of working painters by total suppression of the lead risk in the industry in question.

We believe, further, that we have established the necessity for, and the practicability of, compulsory declaration in regard to lead colours. In supporting these two points we take the liberty of presenting a twofold request. We ask that :

(1) In the States in which neither laws nor administrative regulations yet provide for interdiction of the use of lead colours, such interdiction may be introduced at the earliest possible date, particularly as regards the use of such substances for house painting (interior work).

(2) It may be decreed by the competent authorities that lead colours should be withdrawn from the market and — where an absolute restriction of this kind does not exist — that they may not be placed on the market unless the packing and recipients containing them bear a clear written indication easily read by all to the effect that they are "prepared from a lead basis and poisonous".

Basle and St. Gall, 15 December 1909.

INTERNATIONAL ASSOCIATION FOR LABOUR LEGISLATION

The Chairman :

H. SCHERRER, State Councillor.

Secretary-General :

Professor Etienne BAUER.

APPEAL TO THE WORKERS IN ALL COUNTRIES

THE INTERNATIONAL CONVENTION PROHIBITING THE USE OF WHITE LEAD IN PAINTING

Its Interpretation ; Its Scope ; Rights of the Organised Workers

In reply to a letter from Mr. Gérard Rongy, Labour Senator of Belgium, Mr. Albert Thomas, Director of the International Labour Office, has explained the interpretation which should, in the opinion of persons competent on the matter, be placed on the Draft Convention prohibiting the use of white lead and sulphate of lead in the internal painting of buildings. The letter of the Director clearly defines the limits of the minimum degree of protection for painters demanded by the Third International Labour Conference.

The important point to which the workers' organisations of Great Britain, Belgium, and Switzerland wish to draw the attention of the workers of the world is that the Draft Convention only represents a minimum of protection. We must have the courage to admit that this minimum is quite inadequate to protect painters from what is at once the most terrible and the most easily avoided of industrial poisons.

In order to respect the undertakings which we have given we must, nevertheless, as far as those countries where the use of white lead has not yet been entirely prohibited are concerned, wait until a new conference gives us back the freedom of action which we voluntarily renounced at Geneva in 1921, when we agreed to the text of the Draft Convention. This text was in the main the result of an agreement between the three elements of the British Delegation, the Government representative, Sir Montague Barlow, the employers' representative, Mr. Butterworth, and the workers' representative, our faithful comrade Poulton, with all their respective mandates and advisors.

Since, however, the use of white lead is not totally prohibited, there are certain measures which the workers should at all costs insist on having inserted in the legislation of their own country. These measures should be definitely and formally laid down in the various instruments of ratification.

(1) As the use of white lead is allowed for external and certain other kinds of painting, the use of the quantities which are allowed should be strictly supervised. This could be done by means of the same provisions as, or similar provisions to, those which Belgium has been careful to insert in its national legislation in its anxiety to avoid passing a law which exists only on paper. The provisions in question are those of Art. 5 of the Belgian Bill, which is quoted below.

(2) Care must be taken that the maximum proportion of 2 per cent. of lead which is allowed in zinc white paints is mentioned in each legislative measure. Otherwise, as Senator Rongy justly points out in his letter of 25 September 1923 to Mr. Albert Thomas, if the maximum amount of white lead which is allowed to be present in paint is not laid down, it is possible to use white paint containing eight, ten or even fifty per cent.

lead salts due to the process of manufacture. Although such salts are not lead carbonate, they are soluble, and therefore dangerous, even if they are not prohibited by law.

The Director of the International Labour Office states that in such a case the spirit of the Convention would not be respected. The spirit of the Convention, however, has no validity before the courts unless it is embodied in the law of the land. Any law which does not contain the clause of the Convention which prohibits the use in the internal painting of buildings of white lead, sulphate of lead, or any pigment containing more than 2 per cent. of lead expressed in terms of metallic lead will fail to prevent the use of paints containing a higher proportion, according to the well-known legal axiom that everything which is not forbidden by law is allowed.

These two measures are of such importance that if they are not adopted it may be said that nothing or almost nothing has been done to provide workers in the building industry with effective protection against poisoning by white lead and other lead compounds.

The organised building workers of Great Britain, Belgium and Switzerland urgently appeal to the workers of the whole world to use their influence in favour of the ratification of the Convention prohibiting the use of white lead.

They point out that they may be effectively supported by the Red Cross Societies, which join with them in holding that the avoidable ills from which humanity suffers should be presented and that labour should bring life, not sickness, misery and death.

For the Belgian Workers

For the British Workers

For the Swiss Workers

APPENDIX II

REPORTS OF THE COMMITTEES APPOINTED TO ENQUIRE INTO THE LEAD RISK IN THE PAINTING TRADE

Australian Commonwealth

In order to provide full information to the questionnaire received from the International Labour Office relative to the prohibition of the use of white lead in painting, which formed an item of the Agenda of the 1921 Conference, the Australian Government submitted a questionnaire for examination by each of the separate States of the Commonwealth.

The replies of the States, however, did not arrive at the International Labour Office until after the close of the 1921 Conference. The report of the Director-General of the Health Department has already been given in summary¹ (see *Statistics*).

This report concludes, on the basis of the information received, that the damage done may justify a certain amount of regulation of the use of white lead, but, at least as far as concerns Australia, no such measure as absolute prohibition. It recommends, however, that before an ultimate decision be arrived at, the Health Minister of the Commonwealth should be requested to make a very complete investigation by means of a detailed enquiry lasting six to twelve months.

New South Wales

The New South Wales Board of Trade decided to conduct an enquiry on the use of white lead in painting, its dangers and their prevention. During the enquiry, which opened on 22 June 1921, 19 public sittings were held, in the course of which 52 witnesses were examined. The results arrived at were published as a comprehensive report².

The volume published by the New South Wales Board of Trade contains first a general report of 79 pages divided into several chapters including: Introductory: Questionnaire of the International Labour Office; The Chemical and Physiological Data; The Public Vital Statistics and their Interpretation; The Evidence from Administrative and Trade Experience; General Conclusions. This part is followed by the verbatim report of the sittings, statistical tables, and other appendices, making in all 771 pages.

According to this report (pages XII-XIII) the numbers of persons occupied in silver-lead and zinc mines were as follows:

Year	Silver-lead and zinc	Year	Silver-lead and zinc
1911	8,405	1916	6,461
1912	9,062	1917	7,619
1913	9,357	1918	7,585
1914	8,242	1919	6,556
1915	5,564	1920	1,931

¹ For the State of Queensland, see *Statistics*.

² NEW SOUTH WALES, BOARD OF TRADE: *Report of the New South Wales Board of Trade on White Lead as used in the Painting Industry: Its Dangers and their Prevention*. With Appendices, Evidence, Addresses and Exhibits. LXXIX + 771 pp. Sydney, William Applegate Gullick, Government Printer, 1921. [38569 (a).]

And the numbers of persons occupied in lead-corroding works and the manufacture of zinc since 1910 were :

Year	Employed in lead-corroding works	Employed in manufacture of zinc
1911-1916	—	—
1917	—	16
1918	60	23
1919	72	30
1920	81	28
1921	102	32

The number of house painters, glaziers, paperhangers and signwriters amounted to about 5,698 in 1911.

The output of lead and zinc during the last few years has been as follows (in tons) :

Year	Metal produced		Concentrates exported	
	Lead	Zinc	Lead	Zinc
1911	94,966	1,703	111,765	188,669
1912	101,811	2,545	97,736	194,214
1913	106,432	4,121	117,903	184,149
1914	99,925	5,014	88,173	146,400
1915	101,090	5,308	9,819	71,049
1916	128,438	5,277	16,428	69,141
1917	138,006	4,694	6,181	43,912
1918	155,306	5,622	3,178	21,926
1919	80,175	7,119	2,425	18,146
1920	1,749	10,565	3,025	21,742

The chief subjects discussed in the chapter on the physiological data are the channels through which the poison may gain entrance to the body and the distinction between "lead absorption" and "lead poisoning". After a reference to the cumulative action of lead the varying degrees of poisonousness of different lead compounds, there is a survey of the commonest forms of lead-poisoning. The proper definition of lead poisoning is discussed and the extent to which individual characteristics increase or decrease susceptibility to poisoning. The different symptoms for the diagnosis of lead poisoning are then discussed : blue line on the gums, colic, paralysis, presence of basophile granules in the red corpuscles, and nephritis. The experience of Professor Chapman and Dr. Smith provides grounds for laying special emphasis on the last of these symptoms.

Without any wish to undervalue the Australian report, it is none the less to be regretted that the only authorities quoted in this interesting enquiry are a portion of the report of the British departmental committee, the book *Lead Poisoning and Lead Absorption* published by Dr. Legge and Sir Kenneth Goadby in 1912, Dr. Hamilton's pamphlet *Hygiene of the Painter's Trade*, and Sir Kenneth Goadby's lecture before the Royal Society of

Arts on *Immunity and Industrial Diseases*. It would have been interesting to have had also some account of the experience of other countries, such as France, Germany, Austria, Italy, the Netherlands, Belgium, and others.

The report then proceeds to an analysis of statistical data relative to painters which has already been reproduced (see "Statistics").

An enquiry on the frequency of tuberculosis and of pneumoconiosis among the miners of Broken Hill gives the report the opportunity of discussing the connection between tuberculosis and lead poisoning. The irritant effect of dust on the respiratory system is, of course, admitted ; the question at issue is rather how far tuberculosis among painters is directly due to lead poisoning. There has been prolonged discussion on the question and some authors are not yet agreed on a definite answer to it. In this case, too, it does not seem very easy to compare the working conditions of the miners, who are exposed to more or less silicious dust containing a very high percentage of galena and blende, with the working conditions of painters.

Attention is also called to the question of arterio-renal symptoms in persons suffering from lead poisoning to a greater or less extent. The opinion is expressed that there are strong grounds for attributing many of the cases of nephritis occurring among painters to substances other than lead, namely, zinc oxide and turpentine. The data quoted in support of this theory are, however, the result of experiment rather than of clinical observations. The occupational poisoning of painters is not at all comparable with the acute and sub-acute symptoms observed in animals exposed to the action of turpentine and zinc oxide. Further, if it is admitted, as it has been, that chronic nephritis can to some extent be caused by the dust of lead sulphide (a substance which most writers consider to be only very slightly poisonous or even—with Rambousek—harmless on account of its insolubility), and if Legge and Goadby's conclusion is accepted (that chronic nephritis among workers in lead industries might be one of the sequelae of lead poisoning), it does not seem necessary to bring in turpentine in order to explain lead poisoning among painters, who use a lead compound which is much more poisonous than lead sulphide (galena).

The chapter on administrative and trade experience deals first with hours of work, which are of only secondary interest for the subject. It goes on to discuss the right to compensation under the Workmen's Compensation Act of 1916 and points out that the Act has only been applied to very few cases. It then describes the experience of various State and Federal establishments with respect to lead poisoning. It may be noted in particular that the Metropolitan Board of Water Supply has made considerable use of zinc white during the last two years. In the workshops of the State Railway Department, where about 400 painters are employed, substitutes for white lead have been used for inside painting of

railway coaches, and a satisfactory substitute is reported to have been found for the roofs of carriages. Cases of lead poisoning are very rare in both of these establishments. In the Randwick Tramway Workshops, too, lead compounds are not generally much used. In the Naval Dockyard, for inboard painting, lead paint is used only for the first coat.

The report states that the data collected by the enquiry on the sickness rates of workers in State and Federal workshops are insufficient to determine the real extent of lead poisoning among painters.

The Board also tried to ascertain the opinion of employers and workers in the painting trade as to the dangers of white lead. The employers invariably stated that the risk due to its use was insignificant and that the effect of the industry on the health of the workers was not worse than that of most other trades. The workers' representatives, on the contrary, expressed great alarm with respect to the dangers of white lead and quoted the conclusions reached by the Operative Painters' and Decorators' Union during its enquiries of 1918 and 1921.

In face of these contradictory opinions the Board, at its second sitting, proposed the formation of a medical committee composed of persons having no direct interest in the question, to examine the risks of lead poisoning. The proposal was supported by the workers' advocate. Counsel representing the lead mining, corrod- ing, and other employers' interests, however, expressed agreement in principle, but asked for time to consult his expert advisers before giving a decision. On 20 June the President of the Board addressed a letter to the Railway Commissioners asking them to undertake the proposed enquiry on painters and painters' labourers employed in their workshops. The Board's proposal was that a medical committee should be appointed for the purpose, consisting of three doctors, one the Railway Medical Officer, the second an officer of the Department of Public Health, and the third chosen by the parties concerned in the enquiry. The Railway Commission- ers agreed to the suggestion, but on 15 August, after the last public sitting of the enquiry, counsel for the employers informed the Board that he and his clients could not accept the proposal in view of the practical difficulties which would undoubtedly be encountered.

The Board is of opinion that the evidence from administrative and trade experience is conflicting and unsatisfactory, but tends, nevertheless, to support the conclusions drawn from statistics. It thinks that much of the obscurity surrounding the question, which seems to exist from the industrial standpoint, might have been clearly illuminated by the proposed survey and considers it extremely regrettable that the employers represented before the Board would not adopt the proposal.

The last chapter of the report contains the general conclusions arrived at by the Board as a result of the enquiry. The most important passages are given below :

The Board is able to pursue its enquiry to a conclusion without settling for its purposes the vexed question whether there are efficient and commercially available substitutes for white lead as a paint base. If it were technically possible to replace white lead in painting by efficient substitutes there would still be reasons why a Draft Convention prohibiting the use of white lead in painting should not be submitted in the name of this State to the Geneva Conference.

If the Board's view as to the co-efficiency of lead and zinc as causes of the tuberculosis of painters be correct, then a paint base containing 5 per cent. of carbonate of lead, or 20 per cent. of sulphate of lead, with a residue of zinc oxide, might be the cause of evils which would again give occasion for a convention of the nations.

Lead, as used in the painting industry, that is, lead principally in the form of a basic carbonate or white lead, is a substantial cause of injury and death to painters and other workmen engaged in the painting industry. As a cause of death lead is more effective in this industry than in any other occupation, but its toll of deaths, as recorded, does not by any means indicate its deleterious influence or destructive power.

The Board then states that the figures disclosed by the British Departmental Enquiry were considered sufficiently grave to call for some action. In America, too, the question of lead poisoning is considered serious, though the recorded death rate is comparatively low. "It is rather because of complications resulting from gradual lead absorption as a factor in other diseases, including pulmonary tuberculosis, than as a direct cause of death that lead poisoning assumes importance in occupational or industrial hygiene."

The average number of deaths of painters in New South Wales from lead poisoning may not be impressive, but the pure death rate is strictly comparable with English experience, and the complication death rate, while unknown, is at least substantial. The attack rate is another matter. It is not possible to derive an attack rate of painters on the basis of factory experience in New South Wales, but it is perhaps reasonable to make certain inferences in relation to painters from the experience of the Technical Commission of Enquiry at Broken Hill. Nine per cent. of the 8,968 persons included in the Broken Hill survey were found to show arterio-renal symptoms which might have been due to lead absorbed as the result of exposure mainly to the dust of sulphide and oxide ores. This mixed dust must have been much less soluble, and therefore much less noxious, than the carbonate of lead dust to which painters are exposed. In fact the vital statistics show that for every nineteen miners who die from lead poisoning in a series of years there are twenty-two painters who die from the same cause. If the dusts were equally noxious, and the exposure comparable, the same consequences might be expected to arise in each case; and a rate of prevalence of lead poisoning of 9 per cent. in the case of painters might thus be derived. But the uncertain factor of the relative exposure need not be given undue weight, for the vital statistics show that whatever the degree of exposure in the case of the painter, the joint effects of exposure and toxicity of the carbonate of lead dust make his position distinctly more sinister than that of the miner. The rate of prevalence of arterio-renal lead poisoning amongst painters would thus be in the neighbourhood of 11 per cent. The Broken Hill Survey indicated that there were 113 who showed symptoms not arterio-renal that might have been due to lead, and 254 who exhibited signs of pneumoconiosis and tuberculosis. If all these persons be regarded as the subjects of lead poisoning and if the rate

of prevalence amongst painters be thus derived at 22 per cent., the conditions of the New South Wales painters would be only half as bad as those of the 402 actively employed New York painters who were examined by Dr. Louis I. Harris, the Director of the Bureau of Preventable Diseases, New York City Department of Health, in 1917-1918.

In the absence of morbidity statistics it is only possible to base conclusions as to the prevalent degree of sickness from lead poisoning on the mortality rates. Mortality statistics are of little value in a study of lead poisoning. "Rarely", says Dr. Alice Hamilton, "does a painter die of uncomplicated and typical lead poisoning. The immediate cause of death is usually some chronic lesion which has been set up by the slow absorption of lead, but the physician, in making out his death certificate, gives the disease which is, strictly speaking, a secondary cause of death, as the principal cause, and the underlying chronic plumbism is either omitted or mentioned as a contributory cause." Interpreting, then, the death statistics for lead poisoning and for the allied group of diseases, as the Board considers they ought to be interpreted, the conclusion arrived at is that the health conditions of the painting industry in New South Wales are as prejudicial as they have been found to be in England, and present real evils which are preventable and call for determined action in the public interest.

The Board, having arrived at the conclusions indicated, has carefully considered what should be the nature of the action to be taken in the public interest. Immediate prohibition or restriction of the use of white lead is, the Board finds, not the appropriate remedy for the evils disclosed. There is, perhaps, no more reason at the moment for the prohibition of the use of white lead in paints than there is for the prohibition of lead mining at Broken Hill or elsewhere in the State, and, indirectly, for the prohibition of the mining of precious metals that are to be found in geological association with lead bodies.

Further on, the Board quotes the opinion of various English medical authorities who see no necessity for prohibition of the use of white lead in painting, and hold that the evidence in favour of prohibition is still incomplete. The Board also agrees that the case for prohibition is not yet made out and thinks that there is not much hope of the question being settled until medical science draws a clearer line between lead absorption and lead poisoning. The report continues:

Prohibition of the use of lead might render the dust inhaled by the painter innocuous if a combination of zinc dust and siliceous particles did not prove equally deleterious. . . . Again, by common consent of the medical witnesses and the English medical authorities, lead dust and turpentine vapours are independent if co-existent causes of the arterio-renal disease from which painters suffer, but to what extent the health conditions of painters are seriously prejudiced by these vapours, or, indeed, those of the other volatile substances with which they are in daily contact, science cannot at present say. Some proportion, however, of the damage caused to the painter's health by the materials with which he works must be assigned to turpentine, and possibly to a combination of turpentine vapours and lead dust. The prohibition of the use of lead in paints will probably not prevent paint sickness of the nephritic type.

The Board cannot recommend even partial restriction of the use of white lead in paints or pigments in view of the serious effect, comparable with that of complete prohibition, which it would have on the local lead-mining industry. It can see no way of measuring the degree of restriction which would be necessary in order to prevent dangers arising from the unrestricted use of white lead in paints. Regulation of the painting industry it does, however,

consider immediately necessary, both in the interests of the painters and of the community. In support of this view, it quotes the measures prescribed by the English Factory and Workshop Act (protection against dust, provision of washing accommodation, mess rooms, overalls, cloak rooms, etc.) but adds that these provisions, admirable as they are in many ways, would, in the opinion of the British Departmental Committee, be costly and difficult to apply in the painting industry.

The Board suggests the possibility of framing a law to deal with lead poisoning on the lines of the English Workmen's Compensation (Sileciosis) Act of 1918. Regulation, to be complete, would have to give the doctors power to suspend or prohibit the employment of persons threatened with lead poisoning. The scientific aspect of the problem is that the specially susceptible should be saved from the accidents to which an industry may expose them and that all necessary safeguards should be provided for the others.

With respect to the employment of women and young persons, the Board recommends measures of special protection on the lines of the English Women and Young Persons (Employment in Lead Processes) Act of 1920, which was passed on the recommendations of the International Labour Conference held at Washington in 1919.

Western Australia

The engineer-in-chief and the principal architect of the Public Works Department state that they are opposed to a Draft Convention prohibiting the use of white lead in painting. They consider that all that is necessary is that ordinary precautions should be taken in the way of carefully washing the hands before eating and the use of gloves whilst working. They base this opinion on the following points, on which all the authorities on lead industries and on occupational diseases which they have been able to consult appear to agree:

- (1) White lead paint has been known on numerous occasions to produce disease, and on rare occasions death.
- (2) The deleterious effects of the constant use of this material are only partly ascribed to the white lead; at least part of the effect, and, according to some authorities, the greater part, is to be ascribed to the linseed oil and thinning oils.
- (3) By far the greater part of the white lead poisoning is due to absorption of the lead in the alimentary canal, next in importance is absorption in the lungs, of least importance is absorption through the skin of the hands.
- (4) Owing to there being no dry lead dust associated with a mixed paint, painters are far less affected by plumbism than workers in potteries, smelters, etc., where the air is often charged with lead dust or fume, which is inhaled and partly collects on the back of the throat and nostrils and is ultimately swallowed, partly passing into the lungs.
- (5) Painters do suffer from lead poisoning by absorption through the hands, but more frequently from scraping or turning off old paint and inhaling the dust or fume produced.

(6) More sickness is said to be caused amongst painters by the fumes from the liquid vehicle with which the white lead is mixed, viz., linseed oil and thinning oils.

(7) Linseed oil on exposure to the air, when mixed with lead pigments, gives off carbon monoxide gas, a well known and powerful poison, as well as poisonous aldehydes, also gaseous.

(8) The vapour of turpentine, benzene and petroleum spirit are all known to be injurious to the system to a very appreciable extent when inhaled continuously. All three are used as thinning oils.

(9) Much of the prevalent lead poisoning could be prevented by thorough cleansing of the hands before eating, or better still, by the wearing of gloves whilst working.

(10) White lead stands in a class by itself as a white pigment, no other substitute approaching it in opacity (body) and in the purity of its whiteness. Further, most substitutes, such as barytes and zinc oxide, are themselves appreciably poisonous.

(11) Linseed oil is incomparably better than any other available oil as a medium. It sets very quickly, produces a better surface, and is more resistant to the atmosphere than any substitute. From a health point of view, its rapid setting is a distinct advantage. Any substitute would doubtless yield carbon monoxide and poisonous aldehydes to somewhere about as great an extent as linseed oil does whilst drying.

(12) All readily volatile oils used as thinners and dryers are injurious when inhaled, but research may show that some are less injurious than others. There is no existing data dealing with this aspect of the question.

South Australia

The reply of the Government of South Australia is as follows :

I desire to inform you that careful enquiries have been made through the State Director of Chemistry, the Chief Inspector of Factories, and two of the leading Insurance Managers dealing with Workmen's Compensation in respect to the matter of the injurious effect of the use of lead in paints. These gentlemen are practically unanimous that under present conditions cases of the disablement or death due to lead poisoning from paints are so rare that no records are available in respect of same in this State.

In the circumstances, this Government cannot see its way to support any legislation to prohibit the use of White Lead in paints, as the evidence available does not warrant any interference with such an important industry as that of the manufacture of white lead.

Tasmania

The reply of the Government of Tasmania is as follows :

According to evidence it appears that no efficient and satisfactory substitutes for white lead are available. It therefore becomes a matter to be considered from the economic point of view ; further, it does not yet appear to be definitely settled by experts whether the ill effects occurring to those who use white lead are really due to the white lead or whether they arise from the dust and fumes from hydrocarbons such as turpentine, which would still be a potent factor in the use of any pigment.

Under these circumstances, the opinion is held that prohibition should not be imposed on the use of white lead until research has definitely proved its injurious effects ; and from the economic point of view until such time as proof is forthcoming that reliable substitutes are available.

Austria

At the sitting of the Austrian Parliament of 16 March 1903, the Deputy Baernreither demanded that the Government should undertake investigation into the position of industries involving exposure to the lead risk.

The Office for Industrial Statistics under the Ministry of Commerce, entrusted with this enquiry, followed the English method of appointing special committees to deal with the different industries involved. A committee under the chairmanship of Mr. Mataja studied conditions in colour factories and establishments employing varnishers and painters.

Part V of the enquiry contains the report of the committee and Part G the evidence of witnesses¹.

In the introduction the report gives the approximate number of workshops and persons employed in the painting industry, 7,930 workshops giving employment to 13,759 workers. It is interesting to find at this point that account is taken of the extreme sub-division of workshops. It was in fact computed that workshops employing 1-5 workers numbered 6,303 (79.4 per cent.), those employing 6-20 workers numbered 561, while those employing a greater number of workers numbered 47.

The report gives an analysis of the methods of work and the use of lead colours, the laboratories in which paints were prepared on the premises of the employers, the execution of painting operations, the use of white lead for interior as well as for exterior work, and the hygienic installations in the painting workshops.

It is not necessary to revert to these points, already dealt with in summary, nor to refer to the account of the health conditions of painters. It is further impossible to follow the extremely detailed statistics of the report, which provide information as to the incidence of lead poisoning, the duration of cases, relapses relative to each morbid manifestation amongst painters during the period 1902-1905, the turnover amongst workers in a group of 25 workshops (made the subject of study during four years), and the importance of seasonal unemployment, etc.

One part of the report is devoted to the working conditions of painters in factories, in workshops for the manufacture of constructional iron, of wagons, and of furniture and in shipbuilding establishments, etc. In order not to repeat here what has already been discussed in previous pages and will be found again in the conclusions drawn up by the Committee, it will suffice to say that the Committee reported the ever increasing use of zinc white as compared with the use of white lead. In fact, it is computed that in general the use of the first product as compared to that of the second for interior work shows certainly a ratio greater than 62 = 28.

The use of lithopone is also very widespread, especially in small towns. The total figure rose from 9,000 kilograms in

¹ Part V : *Bleivergiftung in Mäntelmänn u. gewerbli. Betriebeben Uraachen u. Bekämpfung*. Vienna, 1907, loc. cit.

1903 to 11,400 in 1905. The report brings into evidence a remarkable decrease in the use of white lead for interior work, and despite the fact that the total consumption of white lead has remained about the same, this fact must be attributed to its ever increasing use for exterior work and in other industries. In any case the committee stated that at the period in question the use of substitutes for white lead even for exterior work has reached a period of experiment and trial.

Nevertheless, it desired to draw attention to the fact that the railways and naval dockyards had perceptibly reduced the use of white lead and red lead for all operations, even exterior work. One dockyard stated that the use of substitutes had given good results both from the point of view of solidity and from that of resistance to weathering.

In July 1907 a draft Order dealing with the protection of painters, whitewashers, and varnishers was submitted to the groups affected for their opinion on the subject. This draft Order, which contained interdiction of the use of lead colours for interior painting, became later the Ministerial Order of 15 April 1908, which came into force on 1 April 1909.

There should here be mentioned the Bill introduced by the Social-Democratic Party of the Chamber of Deputies tending towards absolute prohibition of the use of white lead as well as an extensive scheme of compulsory declaration in regard to lead colours.

At the request of the Sickness Fund and the Painters' and Varnishers' Union the Government of Lower Austria, by a Decree dated 27 August 1906, ordered that in future when painting of buildings financed by hospital budgets or, in a general way, all State constructions were put out to contract, it should be stipulated that the use of lead colours was forbidden.

The Committee responsible for the construction of the new hospital building at Vienna, XVI, on the initiative of its chairman (a master painter), restricted the use of white lead by prohibiting the use of lead colours for interior painting. The Municipal Council of Vienna at the request of the Corporations of the painting and plumbing trades (5 November 1907) also decided to restrict the use of white lead and of red lead.

The conclusions of the report on the enquiry made in regard to colour factories and painting, varnishing and whitewashing establishments, etc., are as follows:

The report distinguishes between colour factories, and painting, varnishing, and whitewashing establishments, the latter being themselves sub-divided into small and large establishments and, on the other hand, into firms engaged exclusively or partially on the work in question. This classification, however, only answers to superficial characteristics. For instance, the three classes of establishments have recourse to the same operation of grinding lead colours. Similarly, priming, filling, and painting are effected in the same way in the special establishments as in the others. The passing of protective legislative measures or regulations would therefore have the effect of uniting the different categories dealt with separately in the report.

Nevertheless, different opinions may be held, notably, as regards the question of causes of poisoning. It is necessary before all to take into account objective factors and personal factors, the relative value of which varies with the kind of work in question. For operations requiring to be carried out with preparations having a lead basis, it would seem that the objective factor, that is to say, the danger of the liberation of toxic dust when the colours are being mixed, is of greater importance than the personal factor; in other words, the danger of introducing into the system particles of colour with which food may become contaminated on account of dirty hands. The hands of the grinder in fact do not very easily come into contact with the colour in powder or paste form; and, on the other hand, contamination resulting from such contact when it occurs is so considerable that the worker is, so to speak, automatically obliged to wash thoroughly thereafter. As for the danger arising from the liberation of dust produced by the work itself, it only exists during a very short period with the result that, for instance, it has no relation with the danger presented by the absorption of dusts in the course of vigorous and prolonged rubbing down of coating material with a high white lead content. These results and observations which it has been possible to make in regard to cases of poisoning occurring amongst grinders, would not, however, seem to confirm the widespread opinion according to which it is said to be sufficient to restrict delivery to the factories, to white lead ground in oil only, in order to eliminate the principal cause of cases of lead poisoning. Doubtless it cannot be questioned that painting firms could reduce the risk of poisoning by ceasing to effect themselves the operation of grinding and leaving it to the colour factories or large warehouses. The relative importance of the various factors is the same as regards the manufacture of chrome yellow and chrome green; the liberation of dust presents there also greater danger than direct contamination.

In the manufacture of varnishes and driers, neither liberation of dust nor contamination constitute considerable danger, for manipulation of red lead and litharge are only engaged in for a very few moments.

As regards the fundamental operations of filling and painting, it is advisable to make various distinctions which do not depend on the class of establishment in question. A clear distinction must first of all be made between interior painting and painting in the open air. This distinction figures already in the part of the report relative to undertakings exclusively engaged in painting by hand. In industrial establishments painting in the open air is much more usual than inside painting for all operations of whitewashing and varnishing. For work in the open air as well as for interior work, the substance of the objects to be painted varies greatly. For interior painting it is principally a question of wooden articles sometimes of walls and more rarely of iron or metal articles. Work executed in the open air involves on the contrary principally iron objects and only to a secondary degree walls and wooden objects. It is well known that the properties of the colours required for these two kinds of painting are extremely different. Interior painting demands great resistance against interior atmospheric effects, notably, against the effects of certain gases. Painting in the open air demands on the other hand considerable power of resistance against exterior atmospheric effects, sudden changes of temperature, and dampness. Experts are of the opinion that the yellowing of coats of paint used for interior work is precisely due to the use of white lead for the final coat and does not occur if zinc white is used. On the other hand, it is stated that white lead presents a great advantage over other pigments, such as zinc white and lithopone for painting in the open air, a question which will be reverted to later. Interior painting and exterior painting differ again according to the nature of the lead colours used for them. For ground coats in mural painting and the painting of wooden objects, white lead only is used for interior work and red lead only in those rare instances in which iron objects are dealt with. On the other hand, for open air painting the use of white lead is only predominant for rolling stock, red lead being also frequently used for numerous iron objects. Other lead colours, such as chrome yellow and chrome green, are more or less equally distributed and are besides only of secondary importance.

down (pages 19 and 20). The coats applied to iron objects are but rarely rubbed down, and carriages and wagons, similarly to objects in fine cabinet making, are only subjected to wet rubbing down, an operation which does not involve any risk. It is advisable again to point out that dry rubbing down of priming, of filling, and of coats of paint containing white lead is not the only cause of danger. The cases reported (No. 9, page 17, and No. 17, page 19) prove in fact that the use of thinners and oxidisers containing red lead and litharge (varnishers and driers) mixed with the pigments, present in themselves a certain risk.

In presence of these facts, which prove the dangerous nature of dry rubbing down and which are besides confirmed by studies and enquiries undertaken abroad, it is advisable to enquire whether wet rubbing down, which is the practice in cabinet making and fine carriage building, might not be applied generally to all rubbing down operations. A witness, a painter from the cabinet making trade (Case No. 6, page 16) stated that wet rubbing down only involved additional work to the extent of 15 per cent. as compared with the dry process. The exclusive application of wet rubbing down encounters this obstacle, namely, that it may well be applied to ground coats but not to the final coat, which must always be rubbed over dry with glass paper. Now, the enquiries carried out in the same establishments have shown that the *apparently* harmless operation of dry rubbing down of coats of paint is accompanied by the liberation of a quantity of fine lead dust, by no means negligible (pages 16-17).

It has not, unfortunately, been possible to determine what fraction of the total number of cases due probably to rubbing down should be attributed to dry rubbing down of putties, primary colours, and colours with a lead basis.

In regard to interior painting, other considerations equally merit attention. It has already been stated that for the final coat zinc white and not white lead is principally used; for the first coat, lead putty, and the ground coats the use of white lead varies enormously. It has been stated in the part of the report dealing with methods of applying colours that certain employers do not use white lead at all for interior work, and this is the case in small towns, even for construction work and interior furnishings of the first grade. Further, many Viennese employers, who at this period still used white lead for interior work, stated in reply to the questionnaire directed to them that it was perfectly possible to give up immediately the use of white lead for this class of work and that its use was continued merely because of routine practices and by no means because of necessity. The establishments which by almost exclusive use of white lead caused great risk to the health of their workers have not often been able to give any serious reason for their practice.

The following figures relative to Vienna show in what measure white lead has actually been replaced by substitutes on interior work. The painting employers in Vienna have used for this class of work:

Per cent.	
In 1908 :	22.5 white lead
	62 zinc white
	15 lithopone
In 1904 :	28 white lead
	62 zinc white
	15 lithopone

It must be noted that the proportion varies for large and small undertakings. The 88 large undertakings in which besides there occurred the largest number of cases of lead poisoning used:

Per cent.	
	26 white lead
	62 zinc white
	12 lithopone

whilst the 170 establishments of lesser importance used:

Per cent.	
	16 white lead
	59 zinc white
	25 lithopone.

As regards the quantities of lead colours used in Austria in the course of the last few years, the figures quoted as well as other data give the following results: for interior painting about 2,750 cwt. of white lead were used almost exclusively for painting constructional woodwork, furniture, and the interiors of ships. On the other hand, for open air painting 5,500 cwt. of white lead and 4,000 cwt. of minium were used, 4,000 cwt. of white lead and all the minium being applied for the painting of the iron parts of bridges, machines, and rolling stock, and the remainder of the white lead being applied to walls and the wooden parts of carriages and wagons. The greater importance of lead colours for open air painting is therefore evident, the proportion being 1 to 3.

As regards the distribution of toxic colours, it is of interest to compare briefly the cases of poisoning produced by the two categories of work, taking into account the quantities of lead colours used. Calculations undertaken with this object show that in painting enterprises in Vienna about 163 cases of poisoning per annum occurred on interior work with a consumption of 1,600 cwt. of white lead¹, whilst a total consumption of white lead and minium on open air work for the whole country, amounting to 9,500 cwt., involved hardly 80 cases of poisoning, 50 of which occurred in Vienna. It must, however, not be forgotten that no precise data in regard to cases of poisoning are available except for the town of Vienna, and that therefore the computation of the quantities of white lead and red lead used in this locality for outdoor work amounting to half of the total consumption, in other words, 4,750 cwt., is only approximate. For the rest of the country, on the contrary, the uncertainty is much greater in regard to the number of cases of poisoning than in regard to the quantities of lead colours used. Despite this reservation and even by applying to all lead colours used in open air painting the proportion established in Vienna, where the workers taken amongst large painting establishments in Vienna, where the workers handled continuously highly concentrated toxic colouring substances, there exists a considerable difference between interior work and open air work from the point of view of the incidence of cases of lead poisoning; in fact, were the proportion the same, the cases caused by open air painting would have amounted to 300.

It is therefore obvious that interior painting involves particularly dangerous operations which do not exist in open air painting. Now, the colours used for ordinary interior painting work, especially that of wooden objects, are just the non-toxic colours such as zinc white, lithopone, vegetable colours, much more harmless than the lead colours applied to iron objects in the open air. The particular cause the influence of which is felt here (see pages 15-19 of the report) consists in dry scraping and rubbing down of coats of paint with a lead content. The determining feature is the liberation of lead dust which contaminates the atmosphere in which the worker is obliged to remain. The connection between dry rubbing down and the incidence of cases of lead poisoning has been pointed out (page 29). From the preceding explanations it results that of 163 cases observed in Vienna and attributable to interior painting, 48 only originated from the operation of painting, if the proportion between the number of cases and the consumption of lead colours observed in course of the detailed study, which was made amongst establishments engaged on the painting of iron, be taken as basis. This figure is even reduced to 13 by taking as basis the proportion observed throughout the whole of Austria for open-air work. This difference of at least 115 cases and, perhaps of 150, may therefore be attributed with a certain degree of certitude to dry scraping and rubbing down. The opinions of the workers entrusted with these operations have been quoted (page 29). Dry rubbing down presents no importance except on interior work, for the coats used for outer walls are, so to speak, never rubbed

¹ The consumption of white lead for wooden constructions and walls amongst painting enterprises in Vienna has been estimated at 2,000 cwt. There should be deducted from this figure the 400 cwt. used for painting exterior walls.

The difference in the risk which threatens the health of workers in these two categories of establishments has already been referred to (pages 28-30). It is usual for the small employers in Vienna to use less white lead, resembling in this manner the employers in the small towns, who, as has already been stated, hardly use white lead at all and consume on the contrary much zinc white and lithopone. The following data refer to the total consumption of zinc white and white lead in Austria during the years 1901, 1902, 1903 and 1904. Taking account of the data relative to production and the quantity imported and exported, the consumption of white lead for Austria is estimated at 10,300, 13,800, 13,200, and 13,000 cwt. To be quite accurate there should be deducted from these figures about 2,000 cwt., representing barytes mixed by factories with inferior quantities. In this way there is obtained the figure of 11,000 cwt. (given on page 12). On the other hand, the consumption of zinc white during the same years as obtained from the same source amounts to the following figures: 18,000, 18,050, 16,500, 17,900, and finally 20,000 cwt., for 1905. It is therefore seen that only taking account of the total quantities the consumption of zinc white is much more extensive than that of white lead. It must be remarked in favour of zinc white that it is not applied for industrial use except in the proportion of 10 per cent. at most, and that it is much less used than white lead for painting in the open air. For the whole of Austria the true proportion of white lead to zinc white in interior painting is therefore under 23-62, but is probably even still less than that observed in small undertakings in Vienna. Further, it appears that lithopone is considerably used in small towns in view of the fact that the consumption of this colouring matter in the painting trade has risen from 9,000 cwt. in 1903 to 11,400 in 1905. Vienna, however, consumes relatively little.

It is similarly worth noting that a diminution in the use of white lead for interior painting has occurred for several years past in the small towns, and in Vienna, even in the course of the last few years. Though in spite of that fact the total consumption for white lead in Austria has remained practically constant, the cause must be sought in the increase in the use of this product for open air painting and in industry.

The situation is very different for open air painting. Here the use of white lead and red lead to a considerable extent only involves a relatively small number of cases of lead poisoning. It is not possible to give here a detailed account of the indisputable advantages of white lead for open air painting and of red lead for painting iron work, advantages insisted on by all people in the trade, so much the more so as the question of substitutes for open air painting is still in its experimental stage. We may only recall the fact already referred to, that the Austrian naval construction establishments and undertakings engaged in the production of railway material have recently considerably reduced the use of white lead and of red lead, even for open air painting. A naval construction establishment which has been using substitutes for some months states that these have "up to the present time given every satisfaction from the point of view of duration as well as that of protection against atmospheric influences". On the other hand, it would seem that the railway works have not met with equally good results in regard to the substitutes. The prescriptions referred to, of measures applied by employers in the painting trade and industrial establishments, only show too clearly that much still remains to be done in the way of protecting the health of workers using white lead and red lead for open air painting.

All past experience permits of the conclusion that vigorous application of hygienic measures would reduce to a minimum the number of cases of lead poisoning caused by the operations in question.

Belgium

The Belgian working painters, who had also suffered from the damage wrought by white lead like their comrades in other countries, only enjoyed very meagre protection against such

injury. Moved by these conditions the painters' organisation for Brussels petitioned the public authority for suppression of the use of white lead in work executed on behalf of the communes. The question being brought before the notice of the Government, the Health Council in its sitting of 30 July 1902 passed the motion that "public administrations should insert in contracts for painting done on their behalf a clause forbidding the use of white lead".

The legal regulation relative to the use of white lead was applied as a consequence of a proposed law dated 26 November 1903 stipulating that the use of white lead should be prohibited in house painting. In 1904 the Ministry for Industry and Commerce and the Ministry for Agriculture and Fine Arts proposed during the discussion of the question to restrict action to regulation by means of an Order which should be appended to the law of 2 July 1899 relative to the health and safety of workers. An Order was passed on 13 May 1905 containing safety provisions in regard to mixing, grinding, handling and use of white lead, as well as scraping and dry rubbing down of surfaces painted with white lead. Two years later the parliamentary committee again took up the question. The Order of 13 May 1905 had in the meantime been unfavourably received. The industrial inspectors, as well as the General Federation of Master Painters, considered supervision in regard to the provisions of this Order to be highly difficult and the provisions themselves as useless and inapplicable. The parliamentary committee then reverted to the idea of special regulation. In order, however, not to encounter opposition on the part of the majority of Belgian white lead factories, it felt obliged to restrict its action to the prohibition of the sale, transport, and use of white lead in a form liable to cause dust. This solution seemed all the more advisable since 50 per cent of the total production of white lead was already placed on the market in the form of ground paste. After consultation with the Health Council and with the inspector of factories, the reporter of the parliamentary committee, Mr. Verhaegen, presented a counter proposition, which was adopted unanimously, excepting one abstention, by the parliamentary committee. This Bill was placed before the Chamber of Deputies on 19 February 1909, adopted without essential modification in 1909, and became the law on 20 August 1909, the essential features of which are as follows:

(a) Prohibition of the sale, transport, and use of white lead in powder, in small pieces or cubes, when this substance is destined for use in the painting trade.

(b) Permission to sell, transport, or use white lead for purposes of painting when it is ground and mixed with oil.

(c) Prohibition of scraping or dry rubbing down on surfaces painted with white lead.

It is to be noted that the law of 20 August 1909 does not cancel the previous regulation relative to the use of white lead by painters. This regulation, which dates from 1905, was fixed by

the Royal Decree of 25 July 1910, issued in its turn, in virtue of the law on Health and Safety of 2 July 1889, and brought into conformity with the law of 1909.

In practice all those affected agreed in recognising its absolute inefficacy. For this reason on 23 December 1913 certain representatives, amongst them the Minister of State, Mr. Bertrand, placed before the Committee of the House a legislative proposal prohibiting the use of white lead in outside as well as inside painting.

This proposed measure was duly considered and referred for action to a parliamentary committee. The effect of this was to open up controversies and finally, on the suggestion of the Minister of Industry and Labour of the period, Senator Hubert, a temporary committee was constituted with instructions to elucidate the peculiar aspect of the question. This committee was composed of health experts, engineers, architects, and direct representatives of employers and workers in the painting trade.

The committee commenced its deliberations on 6 May 1914. These were interrupted by the war, but after the Armistice the question was again taken up, and at the instance of Mr. Wauters, Minister of Industry, Labour, and Reconstruction, the committee arrived at a solution by agreeing to the following terms:

- (1) Prohibition of the use of white lead for interior work.
- (2) Simplified regulations for use of white lead on exterior painting.

It should be noted that this first technical committee was given the task of determining if and to what extent it is possible to replace white lead by other pigments in the different branches of the painting industry. It is perhaps relevant to quote here the resolution which it voted at its sitting of 14 October 1921:

The committee is of opinion that under certain conditions satisfactory exterior painting can be executed without the use of lead pigments.

Recognising, however, on the one hand the advantages offered under certain circumstances for outside work by the use of colours with a lead basis, and convinced on the other hand of the considerable difficulty to be encountered in applying a regulation which prohibits the use of lead pigments only for interior work, the committee holds that neither absolute prohibition nor the *status quo* constitute satisfactory solutions free from serious inconvenience.

The committee, on the other hand, holds that no obstacle is met with in enforcing regulation based on the principle of total prohibition for interior work and modified as regards exterior work by the possibility of granting exemptions where such are recognised as essential.

The vote was unanimous, but for one exception and one abstention (the latter due to personal reasons, since the representative of the zinc white factories considered himself as an interested party).

¹ The report of the first technical committee on the use of white lead in the painting industry was published *in extenso* in the *Bulletin du Service médical du travail*, 1922, No. 1, Chapter II.

In the course of the enquiry the committee took into account the opinion based on comparative experiments and of long experience of the technical organisations and the ministries and of provincial and communal authorities in regard to the question of using substitutes for white lead on interior and exterior painting.

At the request of the committee four ministries pronounced themselves in favour of absolute prohibition of the use of white lead in the painting industry; three provinces for absolute prohibition and four for prohibition in regard to interior work. Seven communes for absolute prohibition, four for prohibition in regard to interior work. Twenty-four declared themselves in opposition, though many of these communes make provision in their contracts for the use of zinc white for interior painting. According to several communal authorities white lead paints offer greater resistance to frequent washing than paints with a zinc white basis, but for special work (woodwork and giving a marble and mottled effect, etc.), operations which require a large number of coats, zinc white paint is preferable.

As regards the dates of application and prohibition of the use of white lead, they will be found to be as follows: 1908 for the Ministries, 1906 for the Provinces of Brabant, 1904 for that of Liège, 1901 for the town of Verniers, 1905 for the town of Liège, 1903 for Molenbeck St. Jean, 1910 for Arlon, 1906 for Namur, 1908 for Schaerbeck, 1913 for Etterbeck, 1914 for Brussels (town) for interior work and 1923 for exterior work, 1925 for Antwerp (even for the painting of metallic hangars), etc. Comparative tests were organised between 1903 and 1908 by Brussels, Schaerbeck, Liège, Verniers, Charleroi, etc., with favourable result except in three cases.

As regards the cost and solidity of the work it may be stated that the trials proved satisfactory even for exterior work (Ministries, Province of Brabant, Liège, Molenbeck St. Jean, Verniers, etc.), that certain authorities refer to an advance in price of 30 per cent., and that others declare that these paints were found to offer better resistance to the action of sea-water. At Liège, on the other hand, it was found that no advance in price had occurred (since 1903); in Brussels and Schaerbeck it was found that painting without white lead was dearer for exterior work. Etterbeck, St. Josse ten Noorde, Liège, and Verniers found it to be less resistant for exterior work, whilst in Brabant it was judged necessary to apply a supplementary coat for exterior work.

After the passing of the Geneva Convention it remained only to give practical application to the resolutions adopted at Brussels.

At first sight it seemed that modifications of actual practice enforced by Royal Orders would suffice. In reality, however, considerable legal difficulties were met with, and it was found necessary to have recourse to the constitution of a new technical committee appointed this time by Mr. Moyereoen, Minister of Industry and Labour, in order to bring the present Belgian regulations into line with the Draft Convention of Geneva in regard to

the use of white lead in painting, and to investigate the technical and economic consequences which would follow the application of regulations in conformity with the conclusions arrived at by the former committee. The experts chosen to sit on this committee assured its competence in the matter.

It comprised in fact authorised representatives of working painters, managers of painting establishments, colour and varnish merchants, a representative of the railway administration, an architect, and chemical specialists.

The committee directed its efforts to effecting a simple solution of a practical character, which should be easy of application without raising embarrassing obstacles and without including measures calculated to lead to unnecessary annoyance.

From the first exchange of points of view the members unanimously recognised that the initial step to be taken was to prohibit the sale to the public of white lead pigments and of colours containing these pigments.

They were led to enquire, however, whether, in the present instance, it might be possible to impose restrictions based on the law of 2 July 1899 and affecting all citizens in general. The Committee was inclined to the negative view, but, constituted as it was, it judged it advisable to have recourse to the opinion of qualified lawyers. It was for this reason that, on the intervention of the Industrial Medical Service, the Legislative Section of the Labour Office was consulted, and its opinion, which confirmed the views of the committee, has been expressed in a legal statement annexed to the report.

While aware of certain imperfections in the solution arrived at, the committee, keeping in view the general interest, set itself to prepare a text which should be wide enough to offer the necessary guarantees against fraud and at the same time leave sufficient scope to prevent obstruction of technical work of all kinds, in which white lead compounds should be necessary.

As regards the question of preventing the small employee or working painter engaged in painting his own dwelling from procuring for this purpose white lead or other white pigments containing lead which he might think necessary for the work, the committee after deliberation were forced to the conclusion that despite the interest of this special case, it was essential to maintain absolute restriction in order to avoid impairing the whole system by a latitude unduly favourable to fraud, and dangerous besides to the person involved and to those who should later be called on to do the repainting.

In examining other situations which might arise, for instance, the case of a horticultural worker desiring to do painting or filling with white lead on hot-houses, the committee came to the conclusion that in such a case or other similar cases the worker in question would be justified in claiming the exemption provided for in cases of "technical necessity".

Subsequently, in comparing the provisions included in the Geneva Draft Convention to those measures adopted to form the basis of the Belgian regulations, the committee decided that for decorative painting as well as for fine "line work" there would be grave disadvantage in prohibiting the use of paint with lead basis. It therefore expressed the opinion that the quantities of the substance used for the above work being of such slight importance and the substances being sold in the form of colour ground into a soft paste contained in a tube, it would be advisable to propose limiting the weight of these tubes to the maximum weight at present placed on the market, that is to say, 500 grammes.

The committee agreed to admit two per cent. of metallic lead for white pigments, a similar concession to that made by the Geneva Convention. As regards the restriction on painting of "stations and factories", where the use of white lead would be allowed, the committee were of the opinion that this restriction was expressed in terms which were unduly general. For this reason it adopted a text limiting the use of salts of lead only to really special cases, and suggested the use of salts "for those parts of industrial constructions where the operations engaged in cause liberation of sulphurous fumes".

The Geneva Draft Convention imposes compulsory notification of cases of lead poisoning. Though at present it is not possible to carry it out in Belgium, where compulsory notification does not even exist for the most contagious diseases, it would be easy and present no obstacles to adopt as regards lead poisoning the method followed by the Public Health Service for voluntary notification.

Further, the very principle of this article of the Convention would be observed partially at least, thanks to the supervision exercised by factory doctors.

As regards Article 3 of the Draft Convention relative to the employment of women and young persons under 18 years of age, these provisions will ultimately receive satisfaction by a Royal Order passed in terms of the Social Laws at present in force in regard to Health and Safety in industrial establishments and to the work of women and children.

The draft regulations made the subject of study by the committee have received the unanimous adhesion of all its members, whose aim it was to make a practical contribution to the very essential work of improving health conditions. The members of the Committee considered that the conscientious application of a system of regulations based on the principles adopted would certainly result in putting a stop to the controversies which for years back had divided the partisans and the adversaries of the use of white lead. It calls to attention besides the great preventive importance of entrusting to the communal police authorities the task of suppressing dry scraping and dry rubbing down for walls painted with white lead¹ (see Appendix III, "Legislation").

¹ See also Report of the Committee of Industry and Labour and Social Insurance appointed to examine the Bill (Belgian Senate Meeting of 17 November 1925; No. 7).

France¹

As early as 1786 the Minister of Marine took the initiative of appointing a technical committee to examine the efficiency of the zinc white advocated by the chemist Guyton de Morveau as a substitute for white lead in the painting of ships.

As a result of Leclaire's propaganda in favour of zinc white, a special committee was appointed in 1848 to consider the question, and a letter from Vivien, Minister of Public Works, indicating the conclusions of this committee, has been preserved. On 24 August 1849 an Order was issued requiring the exclusive use of zinc white for painting done on government buildings. In 1850 the architectural committee of the Department of the Seine presented a report, dated 18 June, to the Prefect of the Department, containing the following passage:

Since zinc white paint is more economical, of better appearance, and more durable than white lead paint, it is desirable to request the architects of the city to adopt it on the works which they direct.

On 3 July of the same year a special committee appointed by the Minister of Marine to make comparative tests of paints presented a report which is summarised later.

In 1852 the Minister of the Interior issued a circular recommending the use of zinc white on departmental and communal buildings.

On 6 March 1853 the Government appointed the Tardieu committee to consider whether it was desirable to prohibit the use of white lead in painting and even to prohibit its manufacture.

The campaign was resumed in 1900 and 1901. On 4 March 1901 Mr. Ogier presented to the Advisory Committee on Public Health a report on the substitution of zinc white for white lead in painting done for public offices. The following extracts are relevant to the matter under consideration:

Many contractors use zinc white to the total exclusion of white lead. They recognise that there is no difficulty and may be certain advantages in the use of zinc white for coats of paint proper. Zinc fillings dry less rapidly, but filling can very well be done with a paste made entirely with zinc oxide.

As regards the durability of the two products on exteriors, opinions are on the whole more favourable to white lead. Some painters assert that white lead is essential for certain operations, but others declare that in every case it can be replaced by zinc white. It is known that some contractors use nothing but zinc white for all their work.

Consultation with competent and unprejudiced men leaves the definite impression that zinc white can be substituted for white lead, with no special difficulty over labour or appreciable increase in cost, in almost all painting operations; some say, indeed, in all without exception.

¹ See reports to the Chamber of Deputies: G. TRAUILLLOT, No. 401; J.-I. BRETON, 1902, Nos. 515, 790; 1903, No. 941; 1909, No. 2642; TRAUILLLOT, 1905, No. 282. Also reports to the Senate by PÉREPINOU, VIVIANI, etc. BRETON: *L'interdiction de la céruse dans l'industrie de la peinture*; Paris, 1905. E. CHAMAILLARD: *La question de la céruse et la protection ouvrière*; Paris, 1906. LUCIEN: "Céruse et blanc de zinc", in *Revue économique internationale*, 1906.

Substitution appears possible in the vast majority of painting operations.

Government offices would consequently set a salutary example and confer a great benefit on health if they required, whenever possible, that zinc white should be used in place of white lead in work done under their orders.

The General Council of Civil Construction gave its opinion on the use of substitutes in place of white lead, which was, apart from details, as follows:

Whereas zinc white is, for interior painting, as durable as white lead, has a finer colour, and is as easy to use for a worker who has accustomed himself to it; and whereas its cost may be considered the same as that of white lead . . . we are of opinion that white lead could be replaced without decreasing the durability of interior painting, affecting its appearance injuriously, or increasing its cost. (For exterior painting, however, substitutes would be less durable.)

As a result the Ministers of Public Works, Commerce, Industry, and Postal Services issued a circular dated 1 June on the replacement of white lead by zinc white in Government painting contracts.

It became possible to consider the prohibition of white lead for outside painting when industry had succeeded in placing on the market preparations which met the demands of practical men for exterior painting.

The results of consulting the chief engineers of the Roads and Bridges Department, on the instructions of the Minister of Public Works, were as follows:

Of 113 reports received 107 give a definite reply; of these 73 are entirely in favour of zinc white for both interior and exterior painting, 32 propose that zinc white only should be used for interior painting, but white lead for exterior work as it is more durable and regarded as less dangerous to health under those conditions; only 2 reports are opposed to the adoption of substitutes.

Enquiries from Prefects elicited the information that the use of white lead in municipal painting contracts had already been forbidden or regulated in 384 municipalities, among which the following may be mentioned: Paris, Lyons, Bordeaux, Montpellier, Nancy, Bar-le-Duc, Montluçon, Bourges, Troyes, Quimper, Châteauneuf, Nantes, Tours, Orléans, Rheims, and Roubaix.

The movement in favour of zinc white in France has been described, as well as the success which crowned Leclaire's efforts. Assisted by E. Barnuel, Leclaire put on the market a cheaper zinc white, a drying oil devoid of any lead product, and a series of harmless and fadeless yellow and green paints. The quality of these preparations has been tested on more than two thousand houses and public buildings and confirmed by fifty years' experience.

It is neither necessary nor possible to describe here the innumerable investigations, enquiries, evidence, laboratory experiments, and practical experience which have been seen in France, and which now have chiefly a historical interest. (See, for example, the series of Decrees of the different Ministries.)

The next point to note is the memorandum presented to the Academy of Science by the scientist Berthelot on 5 June 1903; his conclusions were as follows:

I consider that the various experiments which I have described embody new and decisive arguments in favour of substituting zinc base paints for lead base paints; this substitution, which is so desirable from the standpoint of health, from the purely technical standpoint can offer nothing but advantages.

It has been objected that Berthelot's study was purely theoretical; in any case it expressed the view generally held in the scientific world. Side by side with this, however, may be mentioned a number of experiments carried out under ordinary trade conditions.

Although Lenoble, Livache, and Potain concluded that zinc white was not equal to white lead in covering power, the experiments carried on over a period of years (1902 to 1906) by the Society of Public Medicine, in agreement with the Paris Master Painters' Trade Association, under conditions corresponding more closely with reality, provide practically the last word on the subject. In a few cases zinc white was found to be slightly inferior to white lead, but on the whole the behaviour of the two substances was identical; these stringent comparative tests are hardly likely to weaken the case for substitution.

The tests were carried out on the gable of a grain loft facing due south-west; two iron shutters already painted, facing south-west, on two ground-floor windows of a small house; three sheet-metal panels forming the lower part of a door with three leaves; wooden doors and posts, etc.

On the first examination, a year after the paint was applied, no difference was found between the two paints, whether inside or outside. The Committee repeated its examination of the painted surfaces every year, and as a general result found that zinc white paint had less covering power than white lead paint, and snow white less than zinc white. But weight for weight zinc white produces a larger painted surface than white lead; according to Stas, the respective areas on new deal are 307 and 365 square metres. Stress was laid on the whiteness and fresh tint of the zinc paints, which give them an undoubted superiority over white lead for interior decoration. It was also proved that the objection regarding the difficulty of using zinc paints was not well founded. A single typical example may be given: since 1872 all the Paris painting contractors have accepted, without the least complaint, the same rate of payment for the two paints¹.

It has also been found that other minor objections could easily be met. Experiments carried out by the annexe to the Pasteur Institute have shown that if a very small proportion of some drier (such as resinate or borate of manganese) is added to zinc paints

¹ *Onliac, op. cit.*

they will be fully comparable to white lead base paints in drying power, while their appearance, quality, and cost will be unaffected. Leclaire had already found that refined linseed oil, heated for a long time with peroxide of manganese until it becomes reddish, acquires great drying properties and retains them when mixed with zinc white. Sorel advocated chloride of manganese, Barraud borate, while later Genthe and Ostwald achieved the same result by treating the oil with ultra-violet rays.

The Bill on the use of lead compounds in house painting was introduced by the Government on 30 October 1902, passed by the Chamber of Deputies on 30 June 1903, and sent to the Senate on 22 October. The Bill provided that after two years from the date at which it came into operation the use of white lead and linseed oil containing litharge for priming, stopping, and filling should be prohibited; after three years from the same date the prohibition would be extended to all painting work in the interior of buildings. In exceptional cases the Minister might grant exemptions and the consulting the Committee on Arts and Manufactures and the Committee on Industrial Hygiene in each individual case.

Mr. Treille presented the report of the Senate Committee on 20 April 1905; the conclusion, which was adopted on 8 December, was as follows:

Before coming to a final decision the committee has resolved to await the findings of the committee appointed by the Ministry of Commerce to examine the comparative efficiency of the various materials used in paint. We consider that it is also necessary to know the results of the new medical investigation ordered by the Ministry of Commerce and the decisions which may arise from examination of the Bill on occupational diseases. We are of opinion that, after consultation with actual members of the trade, and in the light of legislation in force abroad, notably in Germany, it will be easily possible to make practical and effective regulations for the use of all lead compounds which will be acceptable to both workers and employers.

After considering Mr. Poirier's opposition Bill, the Senate committee in 1906 approved the Chamber's Bill with amendments regarding exemptions and with the addition of the principle of compensation to manufacturers injured by the Act. By 224 votes to 55 it was agreed to adopt the procedure for urgent business. Mr. Gourju presented an opposition Bill invoking the alternative of regulation for removing the danger of white lead, but it was rejected. The Senate rejected the prohibition of the use of white lead for exterior painting, which was implied in the Bill as passed by the Chamber. It also rejected the clause providing that prohibition of white lead might be extended to all exterior painting by public administrative regulation.

The Bill so amended was sent to the Chamber of Deputies, which in 1907, after declaring it a matter of urgency, adopted it as passed by the Senate, with further amendments, and sent it to the Committee on Industrial Hygiene. Amendments were made in Clause 2, by the substitution of the word "containing lead" "for containing litharge", and in Clause 3. The Chamber also rejected the Senate's amendment providing for compensation to

manufacturers injured by the Act. Up to May 1909 the Senate continued to insist on compensation to white lead makers. The Chamber, having rejected this principle, therefore instructed its Committee on Industrial Hygiene to meet the Senate Committee in order to arrive at an agreed text. The Senate, yielding to the arguments of those who advocated prohibition without compensation, passed the Bill, which should have come into operation on 1 January 1915.

In order to reach this happy result the two committees had to make mutual concessions. The majority of the Senate Committee, while not abandoning the principle of compensation, thought that it could be embodied in the agreed text by a prolongation of the period before prohibition of the use of white lead should come into force. The committee of the Chamber agreed to increase this period from two to five years. Thus the use of white lead and linseed oil containing lead was prohibited in all painting after the expiration of five years from the coming into force of the Act.

This long delay gives manufacturers the necessary time to make trade modifications and considerably decreases the indirect injury done them. Similarly, the indirect prejudice to travellers and agents, workers and foremen in the white lead industry (to whom the Senate Bill granted compensation), will be much diminished by the fact that they will have a long period of warning in which to find employment in some similar industry. Section 2 specifies that the painting operations covered by the Act are those carried out by "operative painters". The Bill presented by the joint committee, "destined to prevent many sufferings and to preserve many human lives", was passed on 20 July 1920.

Measures to regulate the use of white lead and diminish the danger of lead poisoning were taken by the Decree of 18 July 1902, which forbids the use of white lead in the building industry otherwise than in paste form, direct application of it, dry rubbing down, etc., and recommends the use of overalls and the provision of washing facilities. By the Decree of 15 July 1904 these provisions were extended to all kinds of painting work, while the Decree of 1 October 1913 repeated and codified all these measures. (See Appendix III: "Legislation".)

Meeting in December 1921, the Supreme Council of Public Health adopted the following resolution:

- (1) That, notwithstanding the resolution adopted by the International Labour Conference, the French regulations on the use of white lead should continue to be strictly enforced;
- (2) That the provisions of section 79 of the Labour Code concerning prohibition of the use of white lead in house painting should be extended to the painting of vehicles of all kinds (carriages and ships).

In 1925 the Chamber of Deputies adopted the report of its committee on labour, which had examined the Bill to amend Title II, Chapter IV, of the Labour Code (special provisions respecting the use of white lead in painting work), and the report in favour of ratifying the Geneva Convention.

On 26 January 1926 the Senate unanimously adopted the two Bills on the use of white lead in painting (Geneva, 1921) and the adaptation of existing legislation to the terms of the Convention. Both Acts came into operation on 31 January 1926¹.

The Act amending the Labour Code runs as follows:

1. The heading of Chapter IV of Title II of Book II of the Code of Labour and Social Welfare shall be amended to read as follows:

"Special provisions relating to the use of lead compounds in painting work."

2. Section 79 of Book II of the Code of Labour and Social Welfare shall be amended to read as follows:

"79. The use of white lead, lead sulphate, and linseed oil containing lead, and of any specially prepared product containing white lead or lead sulphate, shall be prohibited in all painting work, irrespective of its nature, carried out on the exterior and interior of buildings".

3. The last paragraph of section 173 of Book II of the Code of Labour and Social Welfare shall be amended to read as follows:

"Any person guilty of contravening the provisions of sections 66 b and 79 of this Book shall be liable to the same penalties under the same conditions. Nevertheless, the said penalties shall not apply if the painting work covered by section 79 is carried out by the proprietor or tenant of the buildings himself".

The Senate came to its decision on the basis of the report presented by Mr. Pottevin on behalf of the committee on public health, assistance, social insurance and welfare, which gives a complete survey of the problem of prohibiting the use of white lead in painting.

As regards the persons covered by the prohibition, the report, after emphasising that existing legislation (Section 79 of the Labour Code) imposed prohibition only for painting work, irrespective of its nature, carried out by operative painters on the exterior or interior of buildings, states that, although the Convention requires prohibition to be extended to employers also, it would be extremely difficult to include everyone, down to private individuals, in the prohibition. On this point the report makes the following observations:

We should have to be prepared to empower either the factory inspector or some other supervising body to enter private premises, take a sample of the paint the private individual is using, and if necessary report contraventions for prosecution. This might involve, if not prohibition of the manufacture, importation, and sale of white lead — which would result

¹ *Industrial and Labour Information, Vol. XVII, No. 10.*

² Section 79, which is thus amended, was as follows: "As from 1 January 1925 the use of white lead, linseed oil containing lead, and any specially prepared product containing white lead, shall be prohibited in all painting work, irrespective of its nature, carried out by operative painters on the exterior or interior of buildings".

in prohibiting its use in operations which are not at the moment in question — at least minute regulation. We would not recommend that you should hesitate to take such measures if they were justified by the gravity of the danger, but in our opinion this is not the case.

The private individual who from time to time does a few small jobs of painting in his own house in reality runs no risk. What constitutes the danger is the cumulative effect of minute doses absorbed daily over a long period. It threatens no one but members of the trade. There is therefore no reason for extending prohibition to private individuals.

The Act as passed by the Senate thus excludes private individuals, since it provides that the penalties for breaches of the law shall not apply when the forbidden painting operations are executed "by the proprietor or tenant of the buildings himself".

The report mentions the points where existing legislation or regulation already conforms to the Convention or even goes further — for example, in prohibiting the use of white lead in all painting operations whether interior or exterior. It then points out the amendments which might be made in existing regulations to render the new legislation effective. For example, the prohibition, in Article 3 of the Convention, of the employment of women or young persons under 18 in any painting work of an industrial character involving the use of white lead, sulphate of lead, or other products containing these pigments, could be carried into effect by an addition to the Decree of 21 March 1914 on dangerous work for women and children. Again, on the subject of Article 5, which lays down suitable methods of regulating the use of these poisonous products in operations for which their use is not prohibited, the report enumerates a series of new provisions which could be inserted in existing regulations, as follows :

- (a) The provisions of the Decree of 1 October 1913 concerning the use of white lead in painting operations could be extended to include the use of sulphate of lead.
- (b) The factory inspectorate should proceed to investigate the steps needed to remove the danger arising from the application of paint in the form of spray.
- (c) The Decree of 1 October 1913 mentioned above could be completed by a clause compelling employers to provide cloakrooms so equipped that working clothes would be kept separate from ordinary clothes.
- (d) A further clause should be added to the same decree requiring medical inspection by a doctor appointed and paid by the head of the undertaking.
- (e) The Decree of 1 October 1913 might be further amended to compel employers to post up, or distribute to workers on their engagement, a notice drawn up by the industrial hygiene committee on the dangers of lead poisoning and the precautions to be observed in order to prevent its effects as far as possible.

Great Britain

On 20 January 1911 two departmental committees were appointed to investigate the danger of lead poisoning in the painting industry, and two reports were presented : one in November

1914 on the use of lead compounds in house painting, the other in January 1920 on the their use in coach painting. A third volume contains the appendices¹.

The committee on house painting met on 49 days, of which 37 were occupied in taking evidence. In all 118 witnesses were examined, of whom 93 were selected and called by the committee as adequately covering all the aspects of the problem submitted for solution ; these included 38 employers of house painters, 11 operatives' representatives, 25 representatives of makers of paint or paint materials, 2 consultants to paint makers, 4 chemists, 2 witnesses representing the Royal Institute of British Architects, 4 doctors and others with special knowledge of lead poisoning in the house-painting industry, 5 witnesses who dealt mainly with ship painting, 2 witnesses who dealt mainly with bridge painting. The remaining 25 witnesses were brought forward by the White Lead Corroders' Section of the London Chamber of Commerce and included a certain number of persons from the Continent.

The report first summarises and then analyses the evidence presented. It indicates the extent of lead poisoning among house painters, as shown both by the absolute figures and by comparison of mortality rates among painters and workers in other industries for the fourteen years 1900-1913. The committee received evidence as to preventive action taken in other countries (France, Austria, Germany, Belgium, Netherlands, Switzerland), and criticised preventive regulations in the light of scientific data concerning the causation of lead poisoning.

The report, after summarising the evidence of witnesses in favour of a code of regulations for the use of white lead, indicates the difficulty of enforcing regulations and their inadequacy even when enforced. The committee conclude that "it is impossible to deal with the evil in question by regulations for four principal reasons : (1) the inadequacy of regulations to cope with the evil ; (2) the difficulty of prohibiting dry rubbing down ; (3) the cost and difficulty of complying with various precautionary measures ; (4) the insuperable difficulty of enforcing regulations by adequate inspection".

¹ Report of the Departmental Committee appointed to investigate the Danger attendant on the Use of Paints containing Lead in the Painting of Buildings ; Cd. 7882, 1915.

Report of the Departmental Committee appointed to investigate the Danger attendant on the Use of Lead Compounds in the Painting, Enamelling, and Varnishing of Coaches and Carriages ; Cmd. 630, 1920.

Appendices to the reports ; Cmd. 631. Minutes of Evidence ; Cmd. 632. London, H.M. Stationery Office.

Criticism of the conclusions of the 1911 committees during 1920 led the Government to appoint a new committee to secure further information and to re-examine the whole question. *Parliamentary Debates, House of Commons*, Vol. 144, No. 103, cols. 2450-2451 (July 1921). Cf. the report of the 1923 committee, summarised below.

After noting the evidence of witnesses in favour of prohibition of lead paints, the efficiency of zinc paints, even for exterior use, the results of the long experience of H.M. Office of Works, Cadbury Brothers, Ltd., the Belgian railways, etc., the committee made the following recommendations :

The committee accordingly recommend that a law should be introduced prohibiting in this country the importation, sale, or use of any paint material which contains more than 5 per cent. of its dry weight of a soluble lead compound when determined in the following manner :

If the paint of wash be mixed with water, turpentine, oil, varnish, size, or other adhesive or waterproofing substance, it shall first of all be freed as far as possible from such vehicle or adhesive of waterproofing substance by drying or by treatment with ether, petroleum, spirit alcohol, water, or other neutral solvent or solvents. If the residual substance so obtained should contain insoluble varnish matter, size, or other adhesive material which cannot be removed except by the action of reagents which affect the other constituents of the paint or wash, then the proportion of such varnish matter, size, or other adhesive material shall be ascertained by suitable means, and a deduction be made for the same from the weight of residual matter taken for the determination of the soluble lead so that the proportion of soluble lead found to be present shall be calculated as a percentage of the dry matter free from varnish matter, size, etc. For the determination of soluble lead a weighed quantity of the dried or dry material freed as far as possible from oil, or other vehicle or adhesive substance above described, is to be continually shaken for one hour, at the common temperature, with 1,000 times its weight of an aqueous solution of hydrochloric acid containing 0.25 per cent. of actual or real hydrochloric acid. This solution is thereafter to be allowed to stand for one hour, and to be passed through a filter. The lead salt contained in an aliquot portion of the clear filtrate is then to be precipitated as lead sulphide and weighed as lead sulphate.

In conjunction with such a restriction, it would be necessary to exempt specifically certain special classes of colours, such as those used by artists ; and in addition it would be desirable to provide powers of granting exemptions applicable only to very special branches of the general painting industry, where it could be shown to the satisfaction of the Secretary of State that the use of lead paints containing more than 5 per cent. of soluble lead, calculated as above, cannot as yet be dispensed with ; in such cases the Secretary of State should have power to enforce adequate precautionary measures, viz., abolition of dry rubbing down, provision for overalls, mens rooms, cloakrooms, lavatories, medical examination and the like, all of which should be made compulsory and be enforced by adequate inspection. The supply of lead materials to any user to whom such an exemption is granted could be controlled by only permitting paint manufacturers to supply the materials in question on condition of sending written notice of the customer's name and address to the proper Government Department.

The committee have endeavoured to indicate, in this Report, all the principal considerations on which these recommendations have been based ; in formulating their opinion they have devoted much time to the most careful study of every point laid before them in the evidence, and consider that on that evidence they could arrive at no other logical conclusion ; they have, moreover, every confidence that the restriction recommended will cause no undue difficulties to employers in the industry, and that it will ensure the ultimate stamping out of the lead poisoning evil among their operatives.

To give adequate time for paint grinders and others to arrange for supplies of non-poisonous materials, and also to facilitate the introduction of modifications in painting methods where special work necessitates such changes, the committee recommend that the restriction of the amount of lead in paints to not more than 5 per cent. of soluble lead should not be brought into force until three years have elapsed from the date of publication of this report.

Mr. G. W. Sutherland, a member of the committee, presented a memorandum criticising rather vigorously the evidence and facts obtained by the committee. He states that the extent of lead poisoning had been exaggerated, since diagnosis in the past had left something to be desired ; lead poisoning was notified much more often than it really occurred.

He also endeavours to show that many symptoms diagnosed as those of lead poisoning are produced by the vapours given off from oil and turpentine, especially the latter, in the mixing and drying of the paint. It is unnecessary to explain here that symptoms which may be attributed to turpentine are not wrongly diagnosed lead poisoning but additional complications to the lead poisoning already existing.

Mr. Sutherland states that washing accommodation was practically always provided, but that hot water was not necessary. He considers a better solution to be the total prohibition of dry rubbing down, although he suggests that lead dust had not up to that time been suspected as a danger.

Mr. Sutherland's statements provoked individual and collective replies from his colleagues on the committee ; they protest against the implication of lack of fairness on the part of the chairman, whose conduct of the whole enquiry had been entirely impartial.

The departmental committee on the use of lead in the painting of coaches, etc., met on 36 days, of which 28 were occupied in taking evidence and 8 were devoted to visits of inspection. The witnesses examined numbered 26 and included 14 employers of coach painters, 9 operative coach painters, 1 maker of paint materials, 1 perambulator manufacturer, and 1 safe-maker's representative. Other witnesses examined were the same as those who appeared before the house painting committee.

H.M. Medical Inspector of Factories handed in statistics¹ for the coach-painting industry which demonstrated the need for immediate action to protect the workers. The committee examined the principal sources of danger in the work of coach painters and once again analysed the best methods of dealing with the lead poisoning danger. It then considered the possibility of using substitutes in place of lead paints, particularly white lead, and visited works where leadless paints were used.

The recommendations of the committee were as follows :

The committee, accordingly, after most careful consideration of all the evidence submitted to them, have decided to make a recommendation on lines identical with those of the recommendation of the committee on the use of lead in house painting². As all classes of coach-building works are

¹ See Part III, "Statistics", under Great Britain.

² The committee stated that "the experience of various paint materials gained during the war does not appear to be of much practical value to our committee", and saw no reason to modify the conclusions made five years earlier (in 1915). (*Report*, 1920, p. 42.)

under the Factory and Workshop Acts, and as powers are provided by section 79 of the Act of 1901 for the Secretary of State to make regulations affecting the use of dangerous materials, the committee advise that a regulation should be made prohibiting the use in such works after three years from the date of this Report of any painting, filling, stopping, or similar material which contains more than 5 per cent. of its dry weight of a soluble lead compound.

The committee also thoroughly examined the conditions under which high-grade pigments are used in coach-painting works for (a) heraldic painting; (b) fine lining.

For such work some coloured lead pigments, owing to their greater density, have an appreciable advantage over zinc paints, and in this respect the committee are of opinion that considerable latitude can safely be allowed. At the same time they are satisfied that zinc white, if properly mixed, is at least as good as white lead for the drawing of fine white lines, and therefore any exemption granted should apply to colours only. As, moreover, there is some slight risk of fine lining colours being used carelessly or in such a manner as to constitute an abuse of the exemption, the committee recommend that the exemption should apply only unless and until terminated by notice in writing by H.M. Chief Inspector of Factories, who should be given the necessary powers to give such notice in any case in which he may find it desirable.

Before the house painting committee a British manufacturer stated that "education and regulations have been successful elsewhere". He thought that similar methods should be adopted in Great Britain and presented the following list of points which should be included in regulations.

For Both Inside and Outside House Painting

- (a) The affixing of notices calling attention to the regulations and to the dangers attendant on painting work; each employer to be responsible that every workman has a copy of the regulations and instructions before engaging him.
- (b) Prohibition of mixing and use of dry colours except in white lead or grinding works under Home Office regulations.
- (c) Prohibition of dry pumice-stoning and dry scraping off of all paints.
- (d) Clear labelling of vessels containing lead.
- (e) Provision and weekly washing of aprons or overalls or both, and head coverings; washing facilities to be provided in all cases, including hot water if convenient, otherwise special soap to be provided for use with cold water, and nailbrushes; ten minutes to be allowed for washing before meals and on leaving work.
- (f) Quarterly or half-yearly inspection by a doctor; proper register; system of self-blood examination.
- (g) Workmen to submit themselves to prescribed medical examinations, and to produce to the employer or inspector their card showing date of last medical inspection.
- (h) Doctor to have power to suspend for prophylactic reasons.
- (i) Master to have power to dismiss and not to re-engage for same reasons.

(j) If medical inspector certifies a man to be alcoholic, he is not to be employed where he would come into contact with lead or other metallic poisons.

(k) No workman to be employed without a certificate of good health from an approved doctor.

(l) Workmen handling white lead to work in such a way as to avoid contact of the substance with the hands and also to avoid splashes.

(m) Workmen so employed to wear clothing and headgear exclusively reserved for this work, and to keep them in a good state of cleanliness and to take them off before leaving the workplace.

(n) Before taking food or drink and before leaving the workplace, workmen to rinse their mouths, and also to wash hands and faces with special soap. Food brought into the workplaces to be enclosed in boxes or coverings kept well shut until the meal-time.

(o) Workmen to keep the material and tools under their charge in a good state of cleanliness.

(p) Workmen to be forbidden to bring spirits or tobacco or to consume either in the workplace.

(q) Breaches of any of these regulations to be punished by a fine.

(r) Increased fines for repeated offences.

Additional for Inside House Painting Only

(a) Rubbing off and pumice-stoning old paint only after previous and complete moistening. Everything rubbed off to be removed before it becomes dry.

(b) Foremen to be responsible for above, and for seeing that a copy of the regulations and instructions is displayed on every job.

The Painting Trade Materials Committee of Great Britain and Ireland, which represents the National Federations of Master Painters in the British Isles, addressed to the International Labour Office certain observations on the item of the Conference Agenda concerning prohibition of the use of white lead in painting. The committee viewed the proposal, which they considered to be very drastic, with alarm, and maintained that white lead has unique qualities as a protective painting material. The committee considered that a comprehensive and well-devised code of regulations could affectively cope with any danger to the health of painters which might arise from the use of white lead, and submitted for the consideration of the Office the following draft regulations, which they suggest would act as an effective safeguard against paint poisoning generally and against white lead poisoning in particular.

Suggested Regulations for the Use of White Lead

(1) *Rubbing Down.* — It shall not be lawful to rub down or scrape by means of a dry process any surface which has been painted more than three months previously with any paint made on a metallic base.

(2) *Labelling Packages.* — All packages containing paints for sale on a metallic base or ground in volatile medium shall bear a label marked "poisonous" in letters not less than a quarter of an inch in depth.

(3) *Supply of Paints in Moist Form.* — White lead shall be supplied by the manufacturers only in moist form, i.e. ground in oil, water, turpentine or other suitable liquid medium.

(4) *Overalls.* — All workmen engaged in painting shall wear overalls, which shall be washed at least once weekly.

(5) *Washing Time.* — The employer of any workman handling paints shall allow five minutes for washing before meals and stopping time, and facilities for washing shall be provided on all jobs.

(6) *Medical Inspection.* — All painters shall be inspected at intervals not longer than six months by a competent medical officer appointed by the Ministry of Health, and a certification of such inspection shall be entered on cards to be provided for the purpose.

(7) *Notification of Lead Poisoning.* — All cases of workmen suffering from poisoning arising from the use of paints shall be reported to a Government authority within seven days of their diagnosis.

(8) *Printed Advice.* — Printed advice as to the dangers of metallic dust and turpentine poisoning and as to the means of prevention shall be put in workshops and handed to workmen.

In 1923 there appeared the report of the departmental committee appointed in August 1921 by the Home Secretary to re-examine the danger of lead paints to workers in the painting trades and the comparative efficiency and cost of lead and leadless paints. The members of the committee were Sir Henry Norman (chairman), and Messrs. Gerald Bellhouse, O. J. Kaufmann, T. M. Legge, Alan Munby, Alexander Scott, and H. O. Weller.

After hearing 26 witnesses, the committee presented a remarkably precise report, which is summarised below.

The committee first recall the conclusions of the two departmental committees appointed in 1911 to investigate the incidence of lead poisoning in the two largest trades concerned with painting — building and vehicle building. Both committees recommended that the use of lead compounds in paint, except for special classes of decorative painting work of very minor importance, should be entirely prohibited with the exception of a small percentage. Both committees were satisfied that the extent of lead poisoning among painters was serious and that efficient non-poisonous substitutes were available in adequate quantity.

The house painting committee rejected the alternative of regulation on four main grounds: (1) the inadequacy of regulations to cope with the evil; (2) the difficulty of prohibiting dry rubbing down; (3) the cost and difficulty of complying with various precautionary measures; (4) the insuperable difficulty of enforcing regulations by adequate inspection.

¹ *Daily Intelligence*, Vol. II, No. 17, pp. 218-219.

² COMMITTEE ON INDUSTRIAL PAINTS: *Report of the Departmental Committee appointed to re-examine the Danger of Lead Paints to Workers in the Painting Trades and the Comparative Efficiency, Cost, and Effects on the Health of Workers of Lead and Leadless Paints, and to Advise whether any Modification of the Conclusions and Recommendations of the Departmental Committees appointed in 1911 have become necessary.* London, H.M. Stationery Office, 1923. (Cf. *Industrial and Labour Information*, Vol. VI, No. 7.)

The coach painting committee were of the opinion that regulations were practicable for that industry because it is carried on in factory or workshop premises, but nevertheless recommended the prohibition of lead as the best solution of the problem.

The 1923 report then describes the measures taken since the war to protect workers engaged in the use of lead paints; these were the Women and Young Persons (Employment in Lead Processes) Act, 1920, and the Draft Convention on the Prohibition of the Use of White Lead in Painting adopted at the Third Session of the International Labour Conference, Geneva, 1921.

The committee examined carefully the evidence submitted on the extent of lead poisoning in the painting trades, and gives statistics of the notified cases of lead poisoning in coachbuilding and shipbuilding (compulsory notification), house painting, and other industries using paints (voluntary notification).

Having carefully examined the available evidence the Committee conclude that there is not sufficient ground to warrant them in accepting the view that turpentine poisoning is the cause of the leading symptoms commonly attributed to either acute or chronic lead poisoning, nor in attributing to the inhalation of the fumes of turpentine and other thinners the occurrence of chronic Bright's disease. Enquiries in works where the workers are exposed to the fumes of turpentine alone confirmed the opinion of the Committee, which made enquiries from coachbuilding works using leadless paints.

The committee then analyse the causation of lead poisoning among painters and emphasise that the respiratory system is the chief channel of lead absorption. The 1911 committees found that prohibition of dry rubbing down was not a practicable step and that it would be difficult to introduce a damp process. The 1921 committee, on the other hand, points out that the problem can easily be solved, especially since waterproof sandpaper has been introduced. In view of the draft agreement between the Home Office and the Painters' and Decorators' Industrial Joint Council of Great Britain, the committee conclude that "dry rubbing down is no longer necessary", and recommend its prohibition.

In the last part of the report the committee discuss experience of lead and leadless paints during the war; they point out that no painting was given proper care and attention at that time, and that it was often done by inexperienced workers.

Important evidence was given by the Office of Works, which has had, in the light of experience, to change its views on the efficiency of substitutes. When requested to effect economies in future work, the Director of Works found that there was serious depreciation and lack of durability in the zinc base paints used, both externally and on interiors, particularly of public buildings, where frequent washings are necessary.

For the painting of most interiors the witnesses were agreed that substitutes, which at present are mainly zinc substitutes, are satisfactory. The chief exceptions were places where there was excessive humidity or hard wear. The committees of 1911 anticipated that the use of varnish would be necessary to render the zinc substitutes entirely successful.

In regard to the painting of vehicles there seemed to have been relatively little or no change in the pre-war position.

The 1921 committee concluded that they could not support the recommendation of the previous committees that the use of lead paint for the painting of buildings be entirely prohibited.

We are satisfied that for outside painting, and for certain kinds of internal painting, there is at present no efficient substitute for lead paint. At the same time the statistics of lead poisoning, arising from lead paint, in its production and in its use, are unquestionably sufficiently serious to make it most desirable to limit its use as far as practicable, and, where it is used, to make its use subject to statutory regulations, as is already done in its production.

We accordingly recommend that legislation should be passed to give effect to the principles therein (in the Geneva Convention) contained, having regard to the accurate definition of internal and external painting. It will be necessary to defer enforcement of the prohibition of the use of white lead and sulphate of lead for the internal painting of buildings till 1927, as laid down in the Convention, in order to give sufficient time for the necessary trade modifications to be introduced, but we think that regulations to deal with the continued use of lead paint should be brought into force at the earliest possible moment.

The committee pointed out that any prohibition of the use of lead paints for certain purposes is likely to involve an increase of cost.

The views of the committee on the exceptions provided in the Geneva Convention for certain classes of building (railway stations and industrial establishments) were as follows :

The exemptions which may be allowed under this heading are strictly limited and circumscribed, and we feel that other cases will be found where claims for exemption may be equally justifiable. For instance, the interior paint work in certain classes of public buildings which are not industrial establishments becomes very dirty and frequent washings are necessary, e.g. police and county courts, post offices and other buildings much frequented by the general public. Under these circumstances leadless paints up to the present have proved less durable than white lead.

¹ The passage in question (Article 1) is as follows :

"Each Member of the International Labour Organisation ratifying the present Convention undertakes to prohibit, with the exceptions provided for in Article 2, the use of white lead and sulphate of lead and of all products containing these pigments in the internal painting of buildings, except where the use of white lead or sulphate of lead or products containing these pigments is considered necessary for railway stations or industrial establishments by the competent authority after consultation with the employers' and workers' organisations concerned."

As regards painting elsewhere than in building (e.g. coach painting, preparatory priming work in joinery establishments, ship painting, and the like), the committee recommend that the use of lead paint in all these classes of industrial painting should be made subject to regulations, and in particular that dry rubbing down of lead paint should be made illegal.

The committee recommend that the provisions of the Factory and Workshop Act, 1901, regarding the notification of cases of suspected lead poisoning should be extended, *mutatis mutandis*, to cases of suspected lead poisoning contracted in the painting of buildings. By this means it would be possible to compile the full statistics of lead poisoning contemplated by Article 7 (a) of the Geneva Convention. The Registrar-General's mortality statistics already satisfy the requirements of Article 7 (b) of the Convention.

The committee suggest that a technical committee, composed of experts from the different associations involved under government direction, should undertake further investigation into the following, among other matters : relative efficiencies of various mixtures of bases ; difficulties connected with the standardisation of paints ; testing of new paint bases and other new paint materials ; exemptions from prohibition requirements ; relative values of different substitutes for turpentine.

In 1924 the Labour Government introduced a Bill to prohibit the use of white lead, but its progress was arrested by the dissolution of Parliament. The new Government preferred the alternative of regulation, and in 1925 introduced a Bill to empower the Home Secretary to make regulations for the use of white lead in paint. The Home Secretary stated in the House of Commons that there were great difficulties in getting through a Bill for prohibition of the use of white lead in painting ; in his opinion, the best thing to do was to proceed as far as possible by regulation and then, if this did not prove satisfactory and reduce morbidity and mortality rates very considerably, to ask for further powers. The Bill became law, as the Lead Paint (Protection against Poisoning) Act, 1926, on 15 December 1926, and came into operation on 1 January 1927.

On 26 March 1926 the Government issued regulations for coach painting based on the same principles as the Act for house painting.

Italy

The importance of the lead and zinc industry in Italy could be shown by the fact that Italy has considerable supplies of zinc sulphide and barium sulphate (used in lithopone), antimony salts (used for antimony lithopone), and salts of iron and of manganese (which can very well be used in the manufacture of substitutes for lead oxides).

¹ The Government's views on this report were explained by the Minister of Labour in the House of Commons on 9 May 1926.

Information supplied to the International Labour Office by the Italian Government on the production, imports, exports, and home consumption of the products in question shows that the consumption of white lead has declined considerably since 1910; this decline is all the more remarkable since it coincided with an increase in the population and in industrial activity. There was a similar decline a little later in the consumption of lead oxides. There is no relation between home production and imports or exports; imports were always considerable even when home production was large.

Both before and after the war the imports of zinc whites were markedly greater than the exports, and the difference has increased during the last three years. This, however, is due to the closing down of the Montepioni works through lack of coal. Before the war the consumption of zinc whites tended to rise rapidly, and this tendency has continued since the war, although home production has declined very considerably.

According to reports from the factory inspectors, there are in Italy 4 factories with 69 workers manufacturing white lead only; 2 factories with 49 workers manufacturing white lead and lead oxides; 2 with 12 workers manufacturing lead oxides only; and 2 with 41 workers producing white lead, lead oxides, and zinc whites.

By a letter dated 27 June 1908 the municipality of Milan instructed the Laboratory for the oil and fats industry of Milan to investigate the substitution of zinc oxide for white lead in the manufacture of paints, from the point of view of adhesive qualities, resistance, and covering power.

A committee was appointed, consisting of four representatives of paint and varnish works and two lecturers from the technical school who were specialists. At the first meeting Messrs. Marzotti and Broggi, of Milan, stated from long practical experience that white lead is on the whole more durable for exterior painting, while zinc white is better for interiors.

The committee decided to use the types of pigment most generally used in Italy according to Italian methods; these were the Sbertoli Company's white lead, "Old Mountain" zinc oxide, and the "National" zinc oxide manufactured by Giachetti and Co. The paints were to be tested inside and outside, on walls, iron, and wood, etc., in various positions and conditions.

The results of these observations and the order in which the paints were classified, after three months' application, were as follows:

¹ R. Istituto tecnico superiore, Scuola-laboratorio per industrie olii e grassi Milano: *Relazione dei lavori eseguiti dalla Commissione municipale incaricata delle prove comparative della biacca e dei suoi surrogati*, 1908. 2 Vols.

Inside Wall:

Colour. — Old Mountain white best, then National zinc, then white lead (yellowish).

Covering power. — The three whites were equal.

Drying. — White lead always dries rather more quickly than the two zinc whites; the National zinc white comes next. Although white lead is cheaper, it is not suitable for inside walls, as its colour and covering power are inferior.

Outside Wall:

Colour. — As above.

Covering power. — White lead second, National zinc white third.

Drying power. — As above.

In view of the slight difference in cost, Old Mountain white is to be preferred.

Interior Woodwork:

Colour. — As above.

Covering power. — The three are equal.

Drying. — As above.

In view of the great difference in cost per square metre of white lead, its quicker drying and its equal covering power, it would be better for painting interior woodwork, apart from the question of health.

Exterior Woodwork:

Colour. — The two zinc whites are equal and white lead inferior.

Drying. — Ditto.

Covering power. — Equal.

General conclusions: as above.

Interior Ironwork (Glossy):

Colour. — The two zinc whites equal, white lead rather yellowish.

Covering power. — Equal.

Drying. — Ditto.

In view of the small difference in cost, white lead is not suitable for painting interior ironwork.

Exterior Ironwork (Glossy).

White lead has greater covering power, but has a rather yellowish tinge. In view of the small difference in cost, the two zinc whites are better, Old Mountain the best of the two.

In 1909 experiments were made with lithopones, and the previous experiments were checked. The lithopones employed were those of the Société anonyme des Industries chimiques de Wilsaele, Louvain "Eclatant" and "Helionice" brands, and of the Chemische Industrie, Bochum. The results, after the three whites had been tried for thirteen months and the lithopones for five, were as follows:

Inside Wall:

Colour. — Eclatant, Old Mountain, Helionice, Bochum, white lead.

Covering power. — White lead; the rest equal.

Amount per square metre. — The three whites about equal; a larger quantity of white lead is needed.

Drying. — Lithopones about the same as Old Mountain white.

Cost. — The lithopones are cheaper than white lead and much cheaper than the zinc whites.

Wall with Red Ground:

Colour. — Old Mountain, Helionice, Eclatant, Bochum, white lead.

Covering power. — White lead, Old Mountain, Helionice, Bochum.

Amount. — As above.

Interior Woodwork :

Colour. — Old Mountain, Bochum, Eclatant, white lead.
Covering power. — White lead, Helionice, Eclatant, Bochum.
Amount. — Equal.

Exterior Woodwork :

Colour. — Old Mountain, Bochum, Eclatant, white lead.
Covering power. — Helionice, Old Mountain, Bochum, white lead.
Amount. — Equal.

Resistance :

Inside wall. — The three materials are equal.

Outside wall. — White lead is best.

Interior and exterior woodwork and ironwork. — About equal, but on exterior ironwork Old Mountain is best.

Covering Power. — Measured with Dr. Beck's apparatus (Hamburg) white lead has the greatest covering power, followed, by the lithopones, then Old Mountain white.

Conclusions. — In view of the good results obtained with substitutes for white lead, and of the importance of the health aspect of the problem, the Committee recommended the municipality of Milan to lay down the principle of prohibition of the use of white lead for interior painting.

The use of white lead on municipal works was prohibited as from 1 January 1915. At Turin the conditions of tender for municipal contracts require contractors to use only high-grade leadless colours and varnishes. Preference must be given to the corresponding zinc salts. The same step was taken by the municipality of Milan in June 1912.

The report on the enquiry into lead poisoning carried out in Rome in 1912¹ states that it is both technically and economically possible to use substitutes for white lead. In Rome zinc white has been used for twenty years for painting all buildings, both for newly-erected ones and for such important edifices as the Quirinal, Vatican, etc.

The quantity of white lead manufactured and used in Rome is smaller than that of zinc white. In addition to the advantages mentioned in other countries, it is thought in Rome that zinc white can be more quickly mixed to a paste than white lead, which represents an economy of labour.

In resistance zinc white is inferior, with an equal number of coats, but with one additional coat it is better than white lead. Although the use of white lead has been entirely abandoned in Rome, the risk of lead poisoning has not entirely disappeared, because the zinc white employed is often adulterated with lead. Moreover, in Italy, apart from local health by-laws in certain towns, there are no health regulations for the painting industry.

The Italian State Railways have issued a circular directing that zinc base paints shall be used for painting locomotives and tenders².

¹ RANALLETTI : *op. cit.* (*Bollettino Ispett. ted. e. lav.*, Vol. IV, Nos. 7-8. Atti Congr. Naz. mal. profess., Rome, 1913.) For the Genoa enquiry, see Part III : " *Statistica* ", under Italy, also Part IV : " *Technical Data* ", under " *Ship Painting* ", Italy.

² *Istruzione tecnica N. 7 per la coloritura delle locomotive, dei tender e dei vetcoli* (1 June 1909) and *Istruzione N. 92* (5 August 1909).

Netherlands

The commission of enquiry was set up by a Decree of the Minister of the Interior dated 12 September 1903, under the chairmanship of Mr. L. Aronstein, professor at the Delft Polytechnic. The commission, which included representatives of employers, workers, and technical experts, appointed sub-committees for experimental work, architectural work, engineering, shipbuilding, chemical experiments, and other laboratory research.

The task of the commission was to consider how far white lead paints could be replaced in the Netherlands by zinc white or other paints and the technical and economic objections which might be raised to the proposal for such replacement.

Comparative experiments were made with white lead, zinc white and other substitutes on new and painted wood, on plaster, and on zinc exposed to the air, and to climatic and other factors to which Dutch towns are subject. Experiments were also made with iron, woodwork exposed to damp air (e.g. bridges) and sea air; with iron under the same conditions, and with woodwork inside buildings. The experiments were deliberately conducted under unfavourable conditions.

The commission used Dutch and German white lead, Maastricht plumbous zinc, pure leadless zinc (Old Mountain and Silesian), lithopone (Griffith's White, a material recommended as a substitute for white lead), and a special zinc white prepared by Mr. N. N...., which the inventor claimed had greater resistance to weather.

Great care was given to the selection and mixing of the raw materials. It was decided to use pure raw linseed oil, left to settle for a long time, and boiled under the supervision of the commission without the addition of lead compounds. The purity of all paints and oils was tested by analysis. The chemical committee was responsible for supervising the painting experiments, grinding and mixing the paints finely, seeing that the experiments were carried out in comparable conditions, and making comparative experiments with paints of the same composition as those used by the French commission.

After much discussion the commission decided to carry out tests with slightly tinted paints and with a less dangerous substitute (oxide of iron), also much used, for red lead¹. It was decided :

- (1) To use the proportions and methods of preparing paints which experienced painters had for many years recognised as satisfactory.

¹ It may perhaps be noted that Messrs. G. Pouchon and Ricker Devroe, of Brussels, in their letter previously cited, state that red lead is not essential and can easily be replaced in practice. (On the protection of metals against rust, see L. Bangeron, in Publications of the *Moniteur de Peinture*, No. 1, 1921.)

(2) To ascertain the maximum quantity of zinc white which could be conveniently used in zinc paints; hitherto too much oil had been used, in the hope of giving greater opacity.

The mixing was done by much finer and more thorough grinding than is usual. If zinc white is mixed with the oil in an appliance known as a "cone grinder", the mixture is much more complete than if it is simply worked up by hand. In practice, however, the grinding mills wear rapidly, and in the hurry of work they are not repaired and adjusted as they should be. About this time machines, cylinder grinders, were introduced with a very high-grade paint could be mixed. The commission used one of these machines for mixing paints for the experiments, with absolutely satisfactory results. The paints so mixed contained a much higher proportion of zinc white than had been used previously, and in consequence were of similar quality to white lead paints.

Attempts were made to render first coats less hard and more elastic, thus considerably decreasing the risk of deterioration and flaking, by the addition of ochre or washed chalk.

The experiments were carried out under constant and close supervision from the various members of the commission, and the surfaces painted were subsequently inspected twice a year.

In spite of these precautions, however, the results published in a preliminary report gave rise to criticisms from painters, who formulated them in a number of articles. In order to meet these objections as far as possible the commission decided to make further experiments; once again it was unanimously agreed that zinc white paint always had better covering power than white lead paint.

On the instructions of the commission the Government had other experiments made after the issue of the 1906 report, and the Admiralty announced that zinc white, used extensively, had proved satisfactory.

The commission received still further proof of the good quality of these paints, which were extensively used in the Haarlem prisons, the Government beggars' ward at Veenhuizen (as a result of steps taken by the Ministry of Justice), and at the harbour of Feijenoord, where one of the railway bridges was entirely painted with zinc white by the company running the State Railways. At the beginning of 1908 an iron footbridge over the Heyden-Nederwaard canal was painted, by order of the "Waterstaat", with white lead and zinc white. The results of these different experiments were as described below.

In the prison the paint almost invariably remained in excellent condition for about three years, but soon after that it cracked and formed flakes which peeled off at a touch, especially in places

¹ In this case the pigment is mixed with the oil simply by shaking, so that a fine mixture is impossible.

exposed to trickling water or steam. At Veenhuizen, where zinc white had been applied on large areas more than three years previously, the paint was in excellent condition and no defects were found, except in two houses; here the paintwork of windows, shutters, and doors had deteriorated seriously. The Commission attributed this to the fact that the wood was probably not sufficiently dry when the paint was first put on, and stated that under similar circumstances white lead would have given little better results. Apart from one or two purely mechanical defects, the paint on the Feijenoord bridge was in excellent condition two years after it had been applied. On the Heyden canal bridge the zinc white paint was in better condition than the white lead paint applied at the same time.

Among the conclusions drawn by the commission from its investigations were the following:

Surfaces painted with zinc white without the addition of other colours remain brighter and fresher than those painted with white lead.

Surfaces painted with zinc white and other colours for the finishing coats in the long run become rather darker than those painted with white lead base paints. If the paint is washed this defect disappears and the zinc white paint is brighter than the white lead.

The zinc white finishing coats used by the commission were brighter to begin with, and for a longer period, than the white lead paints.

The commission points out that its experiments are not without importance from the architect's point of view, although the difference in cost between the two materials is usually so small as to be negligible. The commission endeavoured to produce zinc white paints which would withstand air and bad weather; they were certainly more satisfactory than those used by the French commission for its comparative experiments. Nevertheless, the commission could not ignore the possibility of longer and more detailed research in zinc whites by paint experts. Further experiment might produce zinc paints which would stand the Dutch climate better than those used by the commission. It expressed the hope that others would be encouraged to undertake further research, in view of the unfavourable results, in some respects, obtained by the commission. It was nevertheless doubtful whether the prejudicial effects on zinc white paints of sulphurous and sulphuric acids could ever be neutralised.

Taking into consideration all the evidence on the subject of white lead, the Commission arrived at the following conclusions:

(1) Zinc paints withstand hydrosulphuric acids much better than lead paints, which soon blacken. Such acids are often found near the foul canals, etc. of our towns; zinc paints should therefore be used instead of white lead in these localities.

(2) Zinc paints are less capable of withstanding constant sulphurous fumes than lead paints. These fumes often occur in the smoke from locomotives, steamers, factory chimneys, etc. Zinc paints would rapidly deteriorate if exposed to such smoke, for example, inside railway stations, and cannot, therefore, be used in place of white lead under these conditions.

(8) If not frequently exposed to sulphurous fumes, zinc paints applied on zinc, Portland cement, or iron (previously primed with a coat of red lead or red oxide or iron) wear as well in the open air, for five years, as lead paints. They are a complete and satisfactory substitute in these conditions.

(4) If not frequently exposed to sulphurous fumes or excessive damp, zinc paints applied on wood, iron, zinc, Portland cement, or plaster inside buildings wear as well as lead paints and can therefore replace them completely under these conditions.

(6) If not frequently exposed to sulphurous fumes, zinc paints applied to exterior woodwork frequently wear as well, for five years, as lead paints and can therefore very well replace them. But in any place where damp accumulates, for example, below windows, cornices, etc., they deteriorate so much after three or four years, or frequently even less, that fresh coats have to be added to preserve the woodwork; in this respect they are inferior to white lead.

(6) Zinc white paints, such as were successfully used by the white lead commission, have a covering power at least as great as the white lead paints used in the Netherlands. The zinc white putty used by the commission can be used equally well with the ordinary white lead putty.

(7) Zinc white paint, such as was used by the commission for new painting on the outside of buildings, is no more costly than white lead paints used for the same purpose.

(8) It costs as much to repaint exterior woodwork with zinc white paints as used by the commission as with white lead, owing to the additional cost of preparing woodwork painted with zinc white for finishing coats of white lead paint.

It is probable that woodwork exposed to the open air under damp conditions (see under (5) above) will need repainting earlier than if it had been painted with white lead.

These facts still further increase the cost of upkeep of woodwork painted with zinc whites and exposed to the open air, since the paint does not last as long as white lead.

(9) Lithopones cannot be used as substitutes for lead paints in the open air; they were proved to be quite unsatisfactory for this purpose.

(10) For work above the water level, priming coats of iron oxide proved as satisfactory, for a period of five years, as those of red lead.

Iron oxide, however, cannot be used for painting below the water level. Coats of iron oxide are cheaper than those of red lead, but their application requires greater technical skill.

Spain

At its meetings of 21 March and 11 April 1921 the Institute of Social Reform discussed the question of white lead and recognised the grave dangers to the health of the workers involved in the manufacture and use of this substance. It was agreed that the Conference ought to consider the suppression, so far as this was possible, of the use of white lead in painting. Questions as to the technical possibility of replacing white lead by substitutes and arguments of an industrial character should give way before the main problem of protecting the worker against lead poisoning.

There are no statistics of lead poisoning among painters in Spain. During the discussion of the questionnaire on 31 March, Mr. Martinez Angel presented statistics of sickness benefit paid by a white lead works. These figures, however, are quite inadequate as a

basis for conclusions; they give simply the total amount of benefit paid and the number of working days for which it was paid; the relation between the two is calculated (page 10).

The report presented by the Director of the Labour Office at the same meeting gives the production of lead and zinc ore in 1919 as follows:

	Lead ore	Zinc ore
Volume (metric tons)	178,055,999	103,608
Value (pesetas)	56,388,998	5,612,649
Workers employed	16,321	4,269

Statistics for factories are as follows:

Industry	Factories in operation	Number of workers	Output	
			Volume (kilograms)	Value (pesetas)
White lead	2	105	2,228,000	3,336,880
Zinc	2	1,042	16,313,727	25,651,341
Red lead	—	—	860,000	1,204,000
Lead (including silver-bearing iron oxide and mineral paints)	15	2,834	125,721,451	77,905,963
	4	81	4,487,000	599,240

The same report gives (pages 22) the following prices for the two products under consideration here: a kilogram of white lead costs 1.90 pesetas and one of zinc white 3.50. A paint made with 1 kilogram of white lead, 300 grammes of linseed oil, and 100 grammes of turpentine costs 3.36 pesetas, while a paint made with half a kilogram of zinc white, 372 grammes of oil, and 100 grammes of spirit costs 3.47 pesetas — a difference of 0.11 pesetas.

Switzerland

The use of lead base paints, particularly white lead, in painting has been the subject of intensive study and investigation in Switzerland. In response to an appeal for prohibition of white lead from the Painters' and Plasterers' Union, the Federal Council decided on 5 January 1904 to request all public services and the Federal administration to use only leadless paints, as an experiment for four years, and at the end of that period to report on their experience.

The reports sent in at the end of 1907 and the beginning of 1908 indicated that there was no complete substitute for white lead in all kinds of painting, and that particularly for painting the outside of buildings and in the open air zinc white had proved inferior to white lead in durability and resistance to atmospheric changes. The use of leadless paints had also led to an increase in costs.

The Federal Council nevertheless decided to continue the tests, and instructed the administrative departments to forbid the use of white lead for interior painting. (Decision of 30 June, 1908.)

On 3 February 1904 Mr. Wyss, deputy, interrogated the Geneva Council of State on the use of white lead in painting. He said that steps should be taken in the matter and that tests in the abolition of lead materials for certain uses should be made, as the Federal Government and the Canton of Zurich had decided to do. The Council replied that these were questions of fact, which it would examine. The matter was summarily considered, and on 28 February 1908 the Council drafted a Bill which it submitted, together with a report on the subject, to the Great Council on 28 February.

The committee stated¹ that the problem, a very complex and difficult one for everybody, "had been cleared up by the investigation" which it had thought necessary to conduct.

The committee had set itself four questions " (1) Does the use of white lead in Geneva create a risk of lead poisoning for house painters? (2) If so, how great is this risk in the Canton of Geneva? (3) If this risk is recognised as a social danger, what steps must be taken to remove it? (4) Is the use of white lead necessary in the house-painting industry, and if so, to what extent? "

The committee, although forming a judgment on a scientific and industrial problem, confined its enquiries to the collection of evidence, by means of circulars, from employers and architects, mutual benefit societies, a number of doctors, and the Geneva Union of Painters and Plasterers.

The general conclusions resulting from this enquiry were as follows :

- (1) The use of white lead in Geneva does not create a risk of lead poisoning for house painters.
- (2) White lead is a material still needed by the industry and cannot be entirely replaced by zinc.
- (3) The operation of painting with white lead presents no real danger if simple precautions are taken.
- (4) White lead dust is dangerous if inhaled for too long and in too large amount.
- (5) If white lead is used in paste no dust is produced.

¹ Information supplied by the Swiss Government. The results of the tests were as follows :

- (a) Leadless paints cannot take the place of white lead for exterior work.
- (b) On the other hand there is no reason, to judge by experience and the opinion of experts, why white lead should not be prohibited for interior painting. Substitutes appear to be more costly than white lead.
- (c) Leadless paints did not give satisfactory results when used on rolling stock and ironwork in the open air.
- (d) Prohibition could not be made general : in particular red lead cannot be included, as it is essential for painting iron and other work.
- (e) There was found to have been a considerable decline in the use of lead paints.

² La Céruse : *Rapports et enquêtes de la Commission*. Geneva, 1907.

(6) Dry scraping off of old white lead paint produces dust and it is difficult, if not impossible, to prevent its inhalation.

(7) Dry rubbing down of new paint is dangerous only if prolonged and if the worker does not take elementary precautions, such as keeping his face away from the paint surface.

(8) The trade fears the inevitable rise in the price of zinc which would follow total prohibition of white lead.

(9) Precautions of cleanliness and general hygiene do not as yet appear to be observed with sufficient strictness in all undertakings in the absence of compulsory regulations.

(10) On the whole, lead poisoning is a rare disease in Geneva.

(11) Among workers in the trade in Geneva there is no special movement for the suppression of white lead.

The committee recognised that the use of white lead in the form of powder is a source of danger which must be finally removed ; that dry scraping, rubbing down, and burning off of old paint-work are dangerous operations ; and that direct handling of white lead should be prohibited. It then formulated a number of precautionary regulations which have been mentioned earlier.

Of the 31 witnesses questioned by the committee, 17 stated that the use of white lead involved little or no danger if certain simple precautions of cleanliness and hygiene were observed ; 2 admitted that the dangers would be reduced by health precautions, though agreeing to prohibition (trade union witnesses) ; 17 (including one worker) stated that white lead was necessary to the industry ; 6 were in favour of substitutes for white lead in interior painting ; and 10 stated that zinc could take the place of lead in every case, apart from the question of cost.

Of the 51 employers who replied, 5 approved total prohibition of white lead and 46 did not approve of it or ask for partial prohibition. Of the 11 architects, 9 did not approve of prohibition, one agreed to it for interior painting, and one for all work.

Nevertheless, 44 employers, holding that precautions of cleanliness and sobriety were sufficient to avert the danger involved in the use of white lead paste, recognised the value of health regulations ; 24 were of opinion that zinc could take the place of white lead for interior painting, 8 placed restrictions on this possibility, and 2 stated that substitution was always possible. Four architects were of the same opinion and one admitted the possibility in some cases.

Rubbing down was stated by 25 witnesses to involve little or no danger with certain precautions ; 19 stated that it was a real danger ; 46 employers objected to prohibition of scraping off of old paint on the grounds that there were processes which obviated the danger and the adoption of simple precautions was sufficient.

In a minority report, Mr. Wyss criticises the report of the majority as a long argument presenting extenuating circumstances in favour of an industrial poison and trade routine. He finds the facts adduced in the report inconclusive because they are incomplete ; he draws attention to the fact that the enquiry stopped

abruptly just before the time at which large numbers of seasonal workers usually arrive, and regrets that the majority of the committee could not prolong the enquiry by a few months at least. Additional information could then have been included in the report and the conclusions would have been perceptibly modified.

Mr. Wyss made additional enquiries and questioned the seasonal workers; he drew the conclusion that of the three or four hundred house painters normally employed in Geneva, about 3 per cent. every year are severely attacked by lead poisoning, not to mention a large number who are slightly affected and dislike applying for admission to hospital (8 or 10 instead of the 3 mentioned by the majority).

Mr. Wyss recalls that a large building erected at Geneva with government funds was painted, as prescribed in the contract and approved by the Department of Public Works, solely with zinc oxide and not white lead. According to Mr. Wyss the majority suffered from exaggerated scruples and refused to have an expert examination, which would have proved the satisfactory execution of the work testified to by members of the trade who had visited the building.

Mr. Wyss then quotes a writer whose authority and impartiality the majority cannot dispute — Mr. Petit, an engineer, who for years had made extensive and minute comparative tests of the compounds in question for building work. On one occasion he wrote: "I believe that zinc oxide, suitably treated, can produce a compound with all the qualities of white lead. . . . I have succeeded in obtaining zinc white pastes with a high covering and drying power resistance".

Mr. Wyss sums up his objections and asks for more complete enquiries covering not the past but a future period of three or four years at least. He does not agree with the police methods of repression proposed by the majority, but advocates more liberal methods of persuasion and example until such time as white lead is abolished.

In a Message dated 4 May 1923 to the Federal Chambers on the Conventions and Recommendations adopted at the Third and Fourth Sessions of the International Labour Conference, the Federal Council pointed out *inter alia* that the White Lead Convention was the result of a compromise to which the Swiss Government delegates had agreed, and which the Federal Council approved, in so far as the matter admitted of judgment at the moment. The Message added that ratification of the Convention would necessitate the preparation of the Federal Act, that the necessary preliminary work was in progress, and that a complete report on the subject would be presented later.

In conformity with the conclusions of the Federal Council, the Federal Assembly decided to await this final report before deciding whether Switzerland should ratify the Convention.

In November 1925 the Federal Labour Office issued a provisional report on the white lead problem¹. This report describes the preparatory work undertaken by the Federal Office and the present position. The object of the report is stated to be "to give information to those concerned and if possible to elicit further information from them".

After describing in detail the Geneva Convention, the report mentions the steps taken before 1921 by the Federal Cantonal and municipal governments to prevent painters' lead poisoning. The Federal Council first took action with two Orders in 1904 and 1908. The Order of 5 January 1904 requested all branches of the Federal administration, as an experiment for four years from 1 January 1904, to use only leadless paints for work which they executed directly; for painting done under contract the use of leadless paints exclusively should be made a condition of tender and of the contract. During the trial period of four years government offices were to collect information, which might influence the decision to be taken as to a general prohibition of the use of lead paints.

In 1908, on the suggestion of the Department of Industry, the Federal Council, by an Order of 30 June, requested all branches of the Federal administration to prohibit the use of white lead for interior painting executed directly or under contract.

The Federal Act of 13 June 1911 on insurance against sickness and accidents included painting workshops among the undertakings subject to compulsory accident insurance.

Still in the sphere of Federal legislation, an Order of the Federal Assembly, dated 3 February 1922, approved the Washington Recommendation concerning the protection of women and children against lead poisoning. This Order raised the minimum age for the employment of young persons in work involving great risk of poisoning to 18 (as prescribed in the Geneva White Lead Convention also) instead of 16, the age previously fixed by the Act on employment in factories. The Federal Act of 31 March 1922, on the employment of young persons and women in arts and crafts, confirmed this amendment of the Factory Act and empowered the Federal Council to specify, in industrial undertakings even when not subject to the Factory Act, unhealthy work on which women and young persons under 18 might not be employed or might be employed only on certain conditions.

In addition to the Federal Government, some of the Cantons and the City of Zurich have taken legislative or administrative measures to check painters' lead poisoning.

Even before the issue of the first Federal Order in 1904, the Canton of Neuchâtel had issued an Order on 7 August 1903 prescribing strict precautions in all occupations where lead or lead derivatives were used and providing fines for breaches of the

¹ Cf. *Industrial and Labour Information*, Vol. XVII, No. 10.

Order. The Order prohibits the use of white lead powder form, scraping, polishing and dry rubbing down of lead base paint, and the application by hand of lead materials.

Orders similar to that of the Federal Council dated 5 January 1904 — i.e. requiring public departments to prohibit the use of white lead and lead paints in all contracts as an experiment for four years and to report on the effect of this step — were issued in 1904 by the Cantons of Zurich (21 January), Schaffhausen (24 February), St. Gall (22 March), Basle-Town (31 December), and Basle-Rural.

Like Neuchâtel, Geneva adopted, by an Act of 26 October 1907, provisions applying not only to contracts with the public authorities but to all private house painting, whether the employer was subject to the Federal Factory Act or not. The Act prohibits the use of white lead in powder form, scraping, dry rubbing down, and direct handling of white lead materials. It requires that the workers in all workshops and workplaces shall be provided with working clothes and the necessary tools and appliances to prevent contact of the hands with white lead, etc.

The city of Zurich in 1911, the Canton of Schaffhausen in 1913, and the Canton of Basle Town issued Orders for the protection of house painters in both public and private work. These Orders require that lead paints shall be dispensed with as far as possible in painting work.

At the end of June 1923 the Federal Labour Office began making enquiries from master painters and operatives, trade associations, and the Federal Cantonal departments concerned. The object was to obtain authoritative opinions on the principle of Switzerland's adhesion to the White Lead Convention, and, as a secondary matter, on the drafting of general instructions on the use of white lead, as provided in Article 5 of the Convention.

The provisional report of the Federal Labour Office summarises the replies received from various sources — operative and master painters, trade associations, cantonal authorities (15 out of 26 Cantons). It also gives the latest statistics of morbidity and mortality due to lead poisoning, notably, those compiled by the National Accident Insurance Institute at Lucerne.

The conclusions drawn by the Federal Labour Office from the information and reports received during the last three years are given below, but the Labour Office does not consider that the highly controversial question of white lead is entirely cleared up by this information.

On the contrary, differences of opinion continue as in the past, and even among competent representatives of the trade matters of fact are presented differently by employers and workers. Some of the reports are based on impartial and personal study of the facts but reproduce solely the opinion of the persons most concerned. These conditions make it even more difficult for the Federal authorities to adopt a definite attitude to the problem, and call for further enlightenment.

It must first of all be pointed out that the question of white lead must not be considered solely in relation to the International Convention but that it is also a national problem of labour legislation. When, as in this case, the health and producing power of a section of our population are threatened, it is impossible not to consider the question and seek means of remedying the position. If the present investigations lead to the same conclusions as those which prompted the provisions of the Convention, there can be no reason why Switzerland should not ratify the Convention, though a Federal Act giving effect to its mandatory provisions must first be drawn up. On the other hand, it is found that there are more suitable means than those laid down by the Convention for removing the dangers of white lead, there can be no reason for following the Convention strictly merely in order to be able to ratify it.

We feel bound to extract, from the information supplied to us, certain essential points which, in our opinion, must be made clear. These are, briefly, as follows:

(1) The statistics of lead poisoning are incomplete and do not indicate precisely the effects of the use of white lead in painting on the health of the workers and the economic system. The investigations of the National Accident Insurance Institute have provided a valuable addition to the data in our possession, but it may be questioned whether they cover a sufficiently long period to justify final conclusions.

In spite of the defects of the statistics, it is clear that lead poisoning causes the death of a certain number of painters every year (6.2 on an average). A striking fact is that those who succumb to lead poisoning are almost entirely persons not covered by accident insurance. If it may be deduced from this that compulsory insurance has a salutary effect, as regards lead poisoning, on the undertakings covered by it, it may be that the solution is to extend insurance to all undertakings which use white lead. This is possible under the Act. All that is needed is to amend in this sense Section 16 of Order No. 1, dated 25 March 1916, on accident insurance, issued in execution of section 60bis (1) (b) of the Federal Act of 13 June 1911 on insurance against sickness accidents. It should be noted, however, that this extension of insurance would not cover employers and members of their families.

(2) Complete prohibition of white lead would certainly be the only means of removing for ever the risk of poisoning caused by this pigment. But such a step cannot be contemplated, since there is no substitute which can entirely take the place of white lead in all kinds of painting, particularly outdoor painting.

Efforts to check the dangers of white lead can therefore be considered only in the form of restrictions on the use of white lead (partial prohibition) or precautionary measures, or a combination of the two.

(3) Some of the replies from the Cantons and the information collected by the Swiss Trade Union Federation show that the use of white lead has declined considerably mainly in interior painting. If this is so, it may be admitted that prohibition of the use of white lead in interior painting, as provided by the international convention, would not involve the economic drawbacks attributed to it by some of the master painters and white lead makers. This observation is fruitful of consequences; the white lead question then appears as a problem in which economics and health must be weighed in the balance.

United States of America

The American report already referred to expresses the opinion that if a comparison of the formulae proposed by the National Lead Company for General Painting and the New Jersey Zinc Company for Painting be compared, both will be found to present advantages. Taking everything into account, paints with a red

lead basis are preferable for metals, but for painting of wood, zinc white is superior to paints containing only white lead. The report indicates, however, that the formulae might be extended and that, by changing the composition of the pigments within the desired limits, it might be possible by following the fluctuations of the market to obtain the most advantageous prices. The following are the limits proposed :

Oxide of zinc, not less than 25 per cent. and not more than 50 per cent.

White lead (basic carbonate of lead) not less than 20 per cent. and not more than 75 per cent.

Basic sulphate of lead, not more than 35 per cent.

Coagulating colours (silicate of magnesium, silicoon, or sulphate of barium), a total not exceeding 15 per cent.

As regards finishing coats these limits are good, but for priming coats a greater proportion of volatile thinners is to be recommended. The following modifications have therefore been suggested as regards the "vehicle".

Before applying the paint the painter should dilute it by adding in the desired proportions appropriate liquids such as crude and light linseed oil and a liquid drier free from resin, turpentine, or mineral alcohol. The whole of the volatile diluting agent, including that contained in the drier, should not exceed for all coats, with the exception of the final coat (known as the "gloss finish"), 25 per cent. of the whole vehicle and for the gloss finish it should not exceed 10 per cent.

It has similarly been proposed to give to the different coats slightly varying shades. For instance, when it is desired to apply white paint, the ground coats should have a grey or natural tone, the first coat being darkest and the following coats becoming gradually lighter until the final coat, which should be white. This process in no wise affects the quality of the painting and offers certain facilities in the execution of the work.

It is interesting to quote here the first safeguards proposed for the health of the workers of the United States by the Workers' Health Bureau and accepted by the Association of Master Painters and Decorators of the City of New York, the Society of Interior Decorators and the Cabinet Makers Employers' Association, and the New York District Council No. 9, Brotherhood of Painters, Decorators and Paperhangers of America.

RULE No. 1. (a) To minimise injurious effects of paint fumes on the health of men, windows shall be kept open while painting ceilings or walls to assure a sufficient supply of fresh air.

(b) Where fresh air is not available, a five-minute rest period in each hour shall be allowed.

RULE No. 2. (c) Paint containing benzol shall not be used; nor shall benzol as such be added to any paint material on the job. Where penetrating stains or removers containing benzol are used, a many men as practicable shall be employed to minimise the period of exposure to the injurious effects of benzol.

(b) Shellac cut in wood alcohol shall not be used; nor shall wood alcohol as such be used on any job.

RULE No. 3. Paint materials which are suspected of being injurious to health are to be investigated by the Trade Board for the purpose of their regulation or elimination.

RULE No. 4. The Joint Trade Board is on record as favouring and advocating legislation requiring the labelling of paint materials in original containers to show ingredients as manufactured or offered for sale.

RULE No. 5. (a) To reduce the hazards of lead poisoning, surfaces painted with lead paint shall not be sandpapered or scraped by a dry process.

(b) By carrying lead into mouth, smoking is a source of lead poisoning and should therefore be avoided during working hours.

RULE No. 6. Where running hot or cold water is not available in or about the clothes locker, a sufficient supply of pails of water and soap powder shall be furnished to the men twice a day to provide adequate facilities for clean washing. No common pail or bucket shall be used for washing by more than five (5) men.

RULE No. 7. Fresh drinking water and sanitary cups shall be provided twice a day during working hours.

RULE No. 8. Men shall not eat their lunch in paint or clothes locker on new operations.

RULE No. 9. (a) Drop cloths shall be maintained in a sanitary condition by the employer.

(b) Overalls shall be kept clean by the journeymen.

RULE No. 10. Men, no matter how slightly injured, shall be immediately taken care of by a physician.

APPENDIX III

LEGISLATION

Australia (New South Wales)

Factories and Shops Act, 1912, Part II, Division 5, 45 (2) and Regulations thereunder, dated 29 April 1913, provide for a certificate of fitness for workers in colour factories, white lead and varnishing factories as well as in painting and varnishing shops.

Australia (Western)

An Act to amend further the Factories and Shops Act, 1920, No. 41 of 1923 (Assented to 22 December 1923); see Article 78a. (L.S., 1923—*Austral.* 6.)

Order in Council: The Factories (Poisoning Substances) Regulations, 1924. Dated 28 January 1925. (*Ibid.*, 1925—*Austral.* 1.)

Australia (Victoria)

Regulations regarding the manufacture of white lead, red lead and litharge. Dated 8 September 1920.

Austria

Order of the Minister of Commerce in agreement with the Minister of the Interior issuing regulations for the protection of persons employed in painting, varnishing and decorating. Dated 15 April 1908. (*Bulletin of the International Labour Office* (Basle), Vol. III, 1908, pp. 31-33.) Repealed by :

Order of the Federal Minister of Social Administration issuing regulations for the protection of the life and health of persons employed in industrial undertakings in the production of lead compounds, lead alloys and lead articles. Dated 8 March 1923. (*L.S., 1923—Aus. 1.*)

Belgium

Act concerning the use of white lead and other white pigments containing lead. Dated 30 March 1926. (Superseding the Act of 20 August 1909.) (*L.S., 1926—Bel. 2.*)

Royal Edict regulating the buying, sale, transport and usage of white lead and other white compounds containing lead destined for trade purposes. (*Moniteur Belge*, 23 September 1926, page 5112.)

Royal Decree concerning the use in painting of white lead, other white pigments containing lead, as well as all white pigments having a lead content exceeding 2 per cent. calculated as metallic lead. (*Idem*, page 5113.)

Ministerial Edict prepared in execution of Articles 2, 4, 5 and 7 of the Royal Edict regulating the buying, sale, transport and usage of white lead and other white compounds containing lead. (*Idem*, page 5115.)

Canada (Quebec)

Special regulations for boxing and canning of paint and white lead. (*Industrial Establishments Act*, 1909.)

Czechoslovakia

Act issuing regulations for the protection of the life and health of persons employed in painting, varnishing and decorating. Dated 12 June 1924. (*L.S., 1924—Cz. 1.*)

France

Act to amend Chapter IV of Title II of Book II of the Labour Code (Special provisions respecting the use of white lead in painting work). Dated 31 January 1926. (*L.S., 1926—Fr. 1.*)

Special regulations of 1 October 1913 [Lead and lead compounds]. (*Bulletin of the International Labour Office* (Basle), Vol. IX, 1914, pages 69 et seq.)

Germany

Order concerning establishments in which painting, white-washing and varnishing are carried out [R.G. Bl. 555] [with a Memorandum on the lead risk : R.G. Bl., No. 203, pages 558-560]. Dated 27 June 1905. (*Bulletin of the International Labour Office* (Basle), French Edition, Vol. IV, Nos. 5-7, 1905, pages 182-185.)

Order of the Minister of the Interior (Württemberg) concerning the trades in which painting, whitewashing and varnishing are effected. Dated 11 January 1906.

Order respecting the installation of establishments for the manufacture of lead colours and other lead compounds. Dated 27 January 1920. (*L.S., 1920—Ger. 4-6.*)

Notification respecting the Lead Notice. Dated 27 January 1920. (*Ibid.*)¹

Notification respecting service instructions for the medical examination of lead workers. Dated 27 January 1920. (*Ibid.*)

Order respecting the painting of ships' holds. Dated 2 February 1921. (*Ibid., 1921—Ger. 1.*)

Great Britain

Act to make provision for the better protection of women and young persons against lead poisoning. Dated 23 December 1920. (*L.S., 1920—G.B. 10.*)

Manufacture of White Lead : Code of Special Rules established under the 1891 and 1895 Acts. Factory and Workshop Orders. (*Edit.*, 1919, pages 296-299.)

Manufacture of Paints and Colours. No. 17, 1907. (*Ibid.*, pages 86-88.)

Manufacture of certain compounds of lead (carbonate, sulphate, nitrate or acetate). Dated 23 August 1921.

The Vehicle Painting Regulations, dated 12 March 1926.

Lead Painting (Protection against Poisoning) Act, 1926. An Act to make better protection against lead poisoning of persons employed in painting buildings. 15 December 1926.

The Lead Paints Regulations, 1927, made by the Secretary of State under section 1 of the Lead Paints (Protection against Poisoning) Act, 1926.

Rule, dated 24 December 1926, as to the method of treatment to be applied for the purpose of ascertaining whether any paint or other material used in painting is "lead paint" within the meaning of the lead paints (Protection against Poisoning) Act, 1926.

¹ Directions for Procedure in Special Examination to Verify the Presence of Lead Poisoning are appended to the German Order of 27 January 1920.

Greece

Act No. 2654 respecting the prohibition of the use of white lead, red lead and litharge in the building industry and in other work. Dated 6 August 1921. (*L.S., 1921—Gr. 2.*)

Order of the Commission appointed in pursuance of section 3 of the Royal Administrative Decree under Act No. 2654 respecting the exemption of certain products from the prohibition contained in Act No. 2654 of 1921 respecting the prohibition of the use of white lead, etc., in the building industry and in other work. No. 7059. Dated 288 January, 1922. (*L.S., 1922—Gr. 1.*)

India

Indian Factories Act of 1911 provides regulations for factories engaged in the manufacture of carbonate sulphate and chromate of lead. Section 23 of Act No. IX, Title V, dated 5 March 1923, provides regulations in regard to the prevention of lead poisoning. (*L.S., 1923—Ind. 2.*)

Act No. XV of 1922 to regulate the employment of child labour in ports in British India. Provides in Chapter II, Article 6 (o) for the regulation of the employment of persons engaged in cleaning or painting vessels. (*L.S., 1922—Ind. 3.*)

Italy

Regulation relative to painting of vessels in the port of Genoa (approved by the Presidential Decree of the Autonomous Consortium of the port of Genoa, 25 September 1905). (*Bulletin of the International Labour Office* (Basle), Vol. V, No. 2, page 175, French Edition.)

Netherlands

Decree dated 21 August 1916: Articles 90, 299, and 240 deal with measures of personal hygiene in workshops employing more than 10 workers. Decree issuing public administrative regulations under section 10, sub-section 1 of the Labour Act, 1919; dated 10 August 1920. (See Chapter II, Division II, Class A, Articles 34-43, and Division IV. (*L.S., 1920—Neth. 8.*)

Norway

Act dated 18 September 1915, Article 18, authorises the Crown to issue more stringent provisions in specially dangerous undertakings, amended by Act of 11 July 1919. (*L.S., 1919—N. 1.*)

Royal Decree dated 3 March 1916. Protection regulations for workers in the painting trade.

Serb-Croat-Slovene Kingdom

Regulations concerning measures for hygiene and safety in undertakings. Dated 25 October 1921. (Use of white lead for painting, Articles 149-153.) (*L.S., 1921, Part II—S.C.S. 3.*)

Spain

Royal Decree to provide that the use of white lead, sulphate of lead and all products containing these pigments shall be prohibited in Spain in the interior painting of buildings as from 1 November 1928, subject to the exceptions laid down in this Decree. Dated 19 February 1926 (*Gaceta de Madrid*, 1926, No. 51, page 934). (*L.S., 1926—Sp. 3.*)

Sweden

Provisional Act prohibiting the use of white lead in house painting. Dated 23 May 1913.

Act confirming the above prohibition in regard to house painting and issuing measures of prevention against the lead risk in relation to the use of paints with a lead basis. Dated 25 February 1916.

Act to prohibit in certain cases the employment of workers in painting work in which lead colours are used. Dated February 1926. (*L.S., 1926—Swe. 1.*)

Notification made by the Department for Social Affairs regarding the form for notification of cases of lead poisoning in the painting trade. Dated 30 June 1926.

Switzerland

Instructions issued by the Federal Inspectors of Factories for workers manipulating lead or its compounds, 1897.

Federal Order of 5 January 1904 in regard to the experimental use of colours without lead in painting by the State.

Federal Order of 30 June 1908 prohibiting the use of white lead on interior painting carried out on behalf of the branches of the federal administration or by contract with painting establishments.

Orders similar to that of the Federal Council of 5 January 1904 have been issued by the Cantons of *Zurich* (21 January 1904), *Schaffhausen* (24 February), *St. Gall* (22 March), *Basle Town* (31 December), *Basle District* (date unknown).

Canton of Neuchâtel: Order of 7 August 1903 applying strict regulations for trades in which lead or its compounds are used. *Canton of Geneva*: Law of 26 October 1907 on the use of lead and its compounds in public work and private house painting.

Canton of Basle Town: Regulations of 27 June 1914, 24 May 1924 and 3 July 1925 containing protection measures for house painters and exhorting them to dispense as far as possible with the use of lead colours for all classes of painting. Similar measures have been issued by the Cantons of:

Zurich Town (Order of 11 May 1911, Article 56); *Schaffhausen* (9 February 1913); *Neuchâtel* (7 August 1903); *Grisons* (4 May 1906); etc. (*Bulletin of International Labour Office* (Basle).)

Tunisia

Decree relating to the use of white lead, dated 10 April 1922. (*L.S., 1922—Tun. 1.*)

U.S.S.R.

Order No. 496/498 respecting the manufacture, sale and use of white lead. Dated 16 December 1924. (*L.S., 1924—Russ. 1.*)

United States of America

No federal law exists in regard to the use of lead compounds in industry. As regards legislation in the different States, it must be noted that the labour laws provide restriction in regard to the employment of women, children and young persons and in regard to health precautions in industries where there is a lead risk, for example, the State of *New York*, Law of 1 August 1922.

Lead poisoning is dealt with by legislative measures in regard to compensation for industrial diseases in the States of: *New Jersey* (1914), *Ohio* (October 1913), *Pennsylvania* (July 1913), *Missouri* (1913), *Illinois* (July 1911, amended July 1921). Compensation for lead poisoning is also provided by the following States: *Minnesota*, *Massachusetts*, *Wisconsin*, *California*, *Connecticut*, *Hawaii*, *Porto Rico*, *North Dakota*, *New York*.

Notification of lead poisoning is compulsory by the doctor in charge of the case in the States of *Ohio*, *New Jersey*, *Rhode Island*, *New Mexico*, *Maryland*, *Massachusetts*, *New Hampshire*, *Connecticut*, *Michigan*, *Wisconsin*; by the doctor who examines the workers periodically in the States in which lead industries are dealt with in a legislative measure: *New Jersey*, *Missouri*, *Pennsylvania*, and *Illinois*; by each doctor in charge of the case of a patient who can claim compensation in terms of the law dealing with accidents in *California*; by employers in accordance with this same law in *Minnesota*.

A special system of regulations in regard to lead exists in the State of *New Jersey* (since 1914) and in *Virginia* (since 24 March 1922) in respect of which the use of white lead in paste form and labelling of containers is demanded, etc.

APPENDIX IV

INSTRUCTIONS TO WORKERS

As a type of the instructions which may be distributed to workers in the industries involving the risk of lead poisoning may be quoted the warning annexed to the German Order of 27 January 1920 fixing the terms of the notice regarding the dangers of lead poisoning, and "regulations in regard to the prevention of lead poisoning," edited by the Factory Inspectorate of Holland.

LEAD NOTICE

Any person who in the course of his occupation comes into contact with lead or lead compounds (with the exception of galena) or substances containing lead is exposed to the danger of lead poisoning. This danger is the greater owing to the fact that the poison does not betray its presence to the worker either by smell or by taste (except in the case of acetate of lead) and thus he may take it into his system unawares.

Lead poisoning is usually caused by lead, which is left sticking to the hands or clothes or beard, being taken into the mouth in very small quantities during eating, drinking, smoking, snuff-taking, or chewing tobacco, or inhaled in the form of dust during work.

The lead gradually accumulates in the body, and symptoms of lead poisoning appear sooner or later according to the quantity of the poison absorbed and the resisting power of the worker.

A blue-grey line on the gums ("blue line") close to the teeth is a sign that lead has already been absorbed by the body in considerable quantities, and that disease due to lead poisoning is about to declare itself. The presence of a blue line should therefore cause the worker to take more care than before that he absorbs no further quantities of lead in the course of his work; it is at this stage possible that he may escape actual illness. On the other hand, it often happens that within a very short time, but sometimes not for some weeks or even months, lead poisoning specifically declares itself, and this is usually very painful, protracted, and in certain cases dangerous to life.

Prevention of Lead Poisoning

Care and cleanliness are the surest protection against lead poisoning. In particular, the following directions should be observed:

- (1) Hands and working clothes must during work be protected as far as practicable from contamination with lead, lead compounds, or substances containing lead. The nails must always be kept short. Smoking, snuff-taking, and chewing tobacco during work must be discontinued. Cigarettes, tobacco, pipes and other smoking utensils must not be brought into the workrooms.
- (2) Workers must not take food and drink, or leave the workplace, till they have removed their working clothes and thoroughly washed their hands with soap and nailbrush. The face, and especially the beard, must also be carefully cleansed if they have been soiled during work.
- (3) The prescribed working clothes must be worn for all work in connection with lead. Respirators, damp sponges or bandages covering mouth and nose must be worn during all work involving the raising of dust, unless the dust is immediately and completely removed by exhaust ventilation, in order to prevent the inhalation of dust containing lead.
- (4) The widespread belief that the regular use of certain remedies (iodide of potassium, sulphur tablets, Glauber salts and other aperients), or milk drinking, is sufficient to prevent lead poisoning is incorrect. On the other hand, a certain value must be attached to nourishing and fat-forming diet, and to that extent to milk drinking also. The use of alcoholic drinks, especially brandy, facilitates the attack of lead poisoning, and is therefore to be avoided.
- (5) Exercise in the open air, gymnastics, baths, etc., increase the resisting power of the body, and should therefore be encouraged as much as possible.

If a worker who comes into contact with lead, lead compounds or substances containing lead, becomes ill, he should immediately in his own interest and in that of his family, consult a doctor, and at the same time tell him that he has come into contact with lead during his work.

PREVENTION OF LEAD POISONING

Nearly all lead substances, especially white lead and oxide of lead, are poisonous.

Lead poisoning is caused by lead compounds which penetrate into the human organism either in small quantities over a long period, or in more considerable quantities in a short time.

The penetration of lead substances into the body takes place principally in the three following ways:

- (1) By way of the hands, the hair, the beard, soiled clothing, by way of the mouth, in eating, drinking, smoking, chewing tobacco, or snuff-taking.
- (2) By way of the mouth and nose in inhaling lead dust as may often occur when mixing powdered white lead with oil or in removing old coats of paint, etc.
- (3) By way of the skin.

The effects of the penetration of lead do not make themselves felt immediately. On the contrary symptoms do not occur until weeks, months, or even years have elapsed, until, in fact, the accumulations of lead substances in the body are such that they set up symptoms of lead poisoning.

Lead poisoning becomes manifest first, as a general rule, by the appearance of a blue-gray edge on the gums, known as the Burton line; by a dull pallor of the face and lips. The various symptoms which develop in the successive stages of the disease are of different kinds: constipation and stomach-ache (colic); pain in the limbs and joints; paralysis, especially of the fingers and of the wrist, and in very grave cases cerebral symptoms, such as violent headaches, delirium, fainting and blindness.

The best preventive measure against lead poisoning is the strict observance of the greatest possible cleanliness:

- (1) Change your clothes for working suits on entering the factory, and never hang your outdoor clothes in the workshop.
- (2) Avoid as far as possible contamination of the face, hands and clothes with lead substances, and never put dirty hands or brushes near the mouth.
- (3) Never put the handle of a brush in the mouth.
- (4) Keep the nails well cut and clean.
- (5) Rinse the mouth with pure water during rest intervals and on quitting work, and wash the hands in warm water as often as possible, using soap and a nailbrush.
- (6) Give every assistance to your employer in his efforts to maintain cleanliness in the workshop, clean and orderly washing accommodation and clean working-suits.
- (7) When mixing powdered white lead with oil wear a respirator or a sponge carefully applied to the nose and mouth, a sponge which should always be fresh, clean and wet, and frequently washed in pure water.
- (8) Never eat or drink in the workshop: avoid smoking, chewing tobacco, or snuff-taking while working: never keep eatables in the workshop, and always rinse the mouth before eating or drinking.
- (9) Never come to work fasting, for good nutrition helps the system to resist lead poisoning. With this purpose in view the consumption of milk and of fat (bacon fat), etc., is to be recommended.
- (10) As soon as the slightest symptoms occur (constipation, gastric affections of any kind whatsoever) seek medical advice. It is dangerous to shake or brush in a dry state any articles whatsoever, to sweep floors, or dust walls, or to engage in any operation likely to raise lead dust. Should the work necessitate any of these operations, all objects likely to liberate dust should first be damped. The consumption of alcohol increases predisposition to lead poisoning.

APPENDIX V

PROHIBITION OF THE USE OF WHITE LEAD
IN PAINTING

AT THE THIRD SESSION
OF THE INTERNATIONAL LABOUR CONFERENCE
(GENEVA, OCTOBER 1921)

The question of protection against lead poisoning has already occupied the attention of the International Labour Conference during its First Session held at Washington in November 1919¹. The portions of the Report of the Commission on Unhealthy Processes relating in particular to the use of white lead have already been reproduced in the *questionnaire* issued by the International Labour Office, together with a brief indication of the steps which led the Governing Body to place the question of "the prohibition of the use of white lead in painting" on the Agenda of the Conference. On 4 January and 11 February 1921, the International Labour Office addressed to the States Members of the International Labour Organisation a *questionnaire* on this item. In respect to this *questionnaire*, the question was raised as to whether the item on the Agenda related to the prohibition of the use of white lead in painting industries generally or only in house painting. This was submitted to the Governing Body of the International Labour Office during its Seventh Session held at Geneva from 12 to 14 April 1921. After full consideration it was decided that, in view of the terms in which this item had been framed, the question of the prohibition of the use of white lead in painting should be brought before the Conference in its general aspect, and that it was for the Conference itself to decide whether the measures which it might propose for adoption should be applied to painting industries as a whole or to certain special branches only. This decision in no way invalidates the *questionnaire* prepared by the International Labour Office, and during the discussion which took place at the meeting of the Governing Body it was pointed out that the form in which the *questionnaire* had been drawn up afforded the Governments themselves the opportunity to make observations with regard to the painting industries to which they might think it desirable for the present to limit the prohibition of the use of white lead.

¹ Taken from the Introduction to report VI on the "Prohibition of the Use of White Lead in Painting", prepared by the International Labour Office for the Geneva Conference, 1921.

This decision of the Governing Body was communicated to the States Members of the International Organisation on 16 May.

The text of the *questionnaire* addressed to the Governments was as follows

1. In view of the fact that it is now possible to replace white lead in painting by efficient substitutes, are you of opinion that a Draft Convention, prohibiting the use of white lead in painting, should be submitted to the Conference?
2. If so, do you consider that a period should be allowed before the prohibition would come into force? Please indicate what period you think necessary, and why?
3. What measures of supervision and control in the application of this prohibition do you suggest?
4. If your Government does not approve of a Draft Convention prohibiting the use of white lead in painting, what measures do you propose in order to meet the dangers arising from its manufacture and use?

The replies of the Governments to the first question of the *questionnaire* as to whether they were of the opinion that a Draft Convention prohibiting the use of white lead in painting should be laid before the Conference may be summarised, in tabulated form, as follows¹:

Affirmative	10	(Canada, China, Finland, France, Greece, Italy, Japan, Norway, Poland, Serbian, Croat-Slovene-Kingdom).
Affirmative with reservations.	3	(Belgium, Netherlands, Sweden).
Affirmative for internal painting only	3	(Austria, Czechoslovakia, Germany).
Further investigations needed	3	(Denmark, Great Britain, Switzerland).
Reserved	2	(South Africa and Spain).
Negative	1	(India).
Ambiguous	1	(Rumania).

It calls for note that there is considerable variation as regards the extent to which white lead is used in the various countries from which replies have been received. Specific reference to this fact and to its corollaries has, indeed, been made in certain of the replies communicated by States which do not employ white lead to a large extent. At the same time it is clear that the existing situation in respect to the employment of white lead in any given country is not one that is not subject to possible modifications, and neither economic and commercial repercussions nor the joint effort at collaboration required of all Members of the International Labour Organisation in the improvement of labour conditions

¹ Taken from Chapter IV of the report referred to in the previous footnote.

throughout the world leave it open to any Member to be able to disinterest itself in questions under discussion by the Conference. It will be seen from the above table that there is almost unanimous agreement that the danger of the employment of white lead in painting is such that the possibility of adopting a Draft Convention on this subject should be examined by the Conference: the Indian Government alone suggests that a Recommendation should be submitted to the Conference.

The question of the serious risks run by painters using white lead has occupied great attention for many years, and has been the subject of prolonged discussion between the advocates and opponents of a substitute for it. The problems involved have already been submitted to elaborate investigations in their technical, medical, economic and legislative aspects, but even at the present time there is no general consensus of opinion as to how far it would be practicable to envisage a total prohibition of the use of white lead in painting.

Two main problems are raised by the question. The one is the medical problem of the precise degree of danger from lead poisoning incurred in the use of paints with a white lead basis; the other is that of finding a substitute or substitutes for white lead in painting with at least as good qualities as white lead itself.

The treatment of the general question of the prohibition of the use of white lead in painting has perhaps been somewhat vitiated in the past by the separate treatment of these two problems — the hygienic and the technical — involved in it, and it will be for the Conference carefully to examine these two aspects in conjunction in order to arrive at a solution. The progress achieved in the last twenty years, both in the hygienic and technical fields, has now resulted in widespread acceptance of the danger of plumbism as a most important task of industrial hygiene and in the discovery of ever-increasing possibilities of employing substitutes for white lead in painting.

There is general concurrence as to the unsatisfactory nature of the available statistics of cases of lead poisoning. While this is in part due to the material difficulties of recording every given case, it is also, and to a far greater extent, due to the particular forms which lead poisoning may take, and to the slow, indirect, and insidious manner in which it frequently works. The clinical symptoms of lead poisoning are not confined to colic and paralysis, and it must be emphasised that lead poisoning is not always accompanied by these two pathognomonic symptoms. On the other hand, while methodical examination will reveal the signs of lead absorption, the sick worker is not in the habit of consulting the doctor until, often after many years of more or less marked anaemia, the acute symptoms of advanced poisoning manifest themselves; there is in consequence the great difficulty of allowing for the number of sick persons, treated for various maladies, who are in reality suffering from the effects of lead poisoning.

That plumbism is annually responsible for a number of deaths is not, however, disputed. Expert enquiries, moreover, now leave no doubt as to the fact that white lead is a poison of the gravest danger, and that working painters, and especially house painters, have a high sickness rate, and are less capable of resisting infectious diseases, e.g. typhoid fever. This has not failed to bring about the conviction that further and special measures are required against it. It is upon the precise nature of these special measures that, as is well known, there has been sustained controversy for many years past.

It is, at the same time, a striking fact that even those who, on technical grounds, oppose the prohibition of the use of white lead in painting, admit the danger of its use by supporting proposals for the enforcement of numerous and elaborate regulations as to its employment. Such preventive measures have been taken with good effect in factories, but in the case of small establishments, and again especially in the case of house painters, it would seem impracticable to lay down and to attempt to enforce complicated and expensive regulations. It appears to be of great difficulty to put into general practice such proposals as that, in the case of specially dangerous processes (e.g. rubbing down and scraping), hours of labour should be reduced, apprentices excluded, and respiratory masks worn. Even simpler measures can scarcely be applied with the rigour of law to scattered groups of workmen. As is pointed out in several of the replies, it is above all in the case of painters of buildings working in very small groups and constantly moving from one place of work to another that protective regulations against plumbism appear impracticable to apply and impossible to control.

On the technical question of the possibility of finding a substitute or substitutes for white lead a large number of experiments carried out over a series of years have been made in various countries and important investigations are being continued, e.g. in Belgium and Great Britain. As regards external painting, however, the division of opinion mentioned above still exists, although there is evidence that during recent years the necessity for the employment of white lead in external painting has in a number of instances been recognised as not being essential. In addition to the evidence to be found in the report of the British Departmental Committee on the use of lead in the painting of buildings, particular attention may be called to the investigations carried out in Belgium and the Netherlands, and to the replies of those Governments, as well as to the experience available in Norway and France, as to substitutes for white lead in external painting.

It may be presumed that the first task which the Conference in dealing with this item of the Agenda will desire to undertake will be the determination of the classes of painting to which prohibition might be applied. In any such determination, the question of the

possibility of control will, however, be of primary importance in deciding between the adoption of any form of prohibition and procedure by way of protective regulations.

Of the replies received, those of the States which employ white lead to the greatest extent state either :

- (1) that prohibition should not be adopted without reservations for certain forms of external painting, or in the case of certain types of contracts (Netherlands, Belgium) ; or
- (2) that prohibition should be adopted solely for internal painting (Austria, Czechoslovakia, Germany) ; or
- (3) that the possibility of satisfactory substitutes for white lead is still undecided, and that further technical investigations should therefore be carried out (Great Britain, Switzerland).

In connection with (1) it may be remarked that the specification in contracts of conditions entailing the use of white lead in painting would be precisely one of those practices which ratifications of a Draft Convention on the prohibition of the use of white lead in painting would render impossible.

While it would seem clear that the Conference would be prepared to give favourable examination to a proposal for the prohibition of the use of white lead in internal painting, it is, at the same time, indicated by the replies communicated by a number of Governments that the extension of such prohibition to cover external as well as internal painting of buildings would not raise serious difficulties on their part. As has already been mentioned, it is in the case of the painting of buildings particularly that the danger of plumbism is greatest, and, although this danger is admittedly greater when the work is being performed in confined spaces indoors, it would seem difficult in practice to demarcate satisfactorily the line between external and internal painting of buildings, and to require the application of different regulations in each case. In addition, white lead is relatively little used in the external painting of buildings. The Conference will require, however, to examine with particular care the question as to how far such prohibition could be applied in all countries to all types of buildings. It would, further, appear necessary in any case to take into consideration the difficulties which might arise in the case of repainting work which had been performed in the first place with paints containing white lead.

After a careful review of the whole question it has been considered that the draft of the Convention prepared to serve as a basis of discussion by the Conference should provide for the prohibition of the use of white lead in both external and internal painting of buildings, and for the adoption of special measures of hygienic protection in such cases where white lead might be permitted to be used in painting work other than the painting of buildings. In this last respect it has seemed best to limit the enumeration of hygienic measures to a few widely accepted measures which it is thought would be adopted without difficulty by the States Members. Among these may be singled out as of

special importance prohibition of dry rubbing down or scraping and of the transport of white lead except when mixed with oil, compulsory notification of cases of lead poisoning, and periodical medical examinations. It will be noted that these measures figure prominently in the replies of many Governments. It is not of course intended that the list should be complete, but that the measures enumerated should be compulsory by the States which ratify, while it would be left open to them to adopt any further measures which the particular conditions of their workers or country may render suitable.

The main provision of the draft of the Convention is, therefore, the prohibition of the use of white lead for the painting of buildings. Artistic painting, painting of pottery, and fine lining would not be covered by such a stipulation, but precise regulations would be required in each State defining these forms of painting of plumbism.

In almost all countries some period of delay would be necessary before any form of prohibition were applied. The following summary shows in tabular form the replies received in answer to the question asked as to this point.

Without delay	2	(Finland, Netherlands.)
As soon as possible	1	(Serb-Croat-Slovene-Kingdom.)
With a short delay	1	(Austria.)
From 3 to 6 months	1	(Germany.)
6 months	1	(Poland.)
1 year	1	(Denmark.)
At least 2 years	2	(Belgium, Sweden.)
At least 3 years	4	(Czechoslovakia, Great Britain, Japan, Switzerland.)
Suitable, but no specified delay 2 Norway, Spain.)		

It requires, however, to be emphasised that the different Governments in replying to this question stated the time limit which in their opinion should be accorded with express reference to their answers to Question 1 and to conditions in their own countries. It is not open to question that an adequate interval would be required for alteration of methods, re-equipment and economic adjustments. In view of the very considerable changes that would be required in the event of such prohibition, and in view of the fact that, if a Draft Convention were adopted, it may be expected that at least six months would elapse before ratification in any given country was entirely certain, it is suggested that a period of five years from the date of the closure of the Conference might be taken as the maximum period of delay.

Reference may be made to the report for a statement of the fundamental principles on the basis of which the draft of a Convention for submission to the Conference was based. The Considerations referred to in the preceding pages find expression in the text of the draft of a Convention prepared by the Office :

Article 1. — The employment of white lead and of all specialised products containing white lead shall be prohibited in all painting work, subject to the conditions and exceptions hereinafter provided.

Article 2. — This prohibition shall come into force five years from the date of the closure of the Third Session of the International Labour Conference.

Article 3. — The provisions of Article 1 shall not apply to artistic or fine painting. The Government shall define the limits of such forms of painting, and shall prohibit the use for these purposes of white lead or specialised products containing white lead except in the form of paste or ready made. The competent authority shall be charged with the duty of controlling the execution of the provisions of this Article, full account being taken of the provisions of Article 6.

Article 4. — In the case of painting work which is to be permanently or continually exposed to the open air — with the exception of the painting of buildings, for both the external and internal painting of which the employment of white lead is prohibited — the Government, after consultation with the employers' and workers' organisations concerned, may accord exceptions to the provisions of Article 1.

The form of the annual report on this Convention provided for in Article 408 of the Treaty of Versailles, Article 353 of the Treaty of St Germain, and Article 270 of the Treaty of Neuilly shall make provision for the full statement by each Government of the particulars as to any such exceptions granted in accordance with the first paragraph of this Article.

Article 5. — Any exceptions granted in virtue of Article 4 shall not cover women and young persons under 18 years of age.

Article 6. — In the case of any exceptions granted in virtue of Article 4, the competent authority shall be charged with the duty of enforcing regulations necessary for the hygienic protection of the workers against the dangers of plumbism. These measures shall include more particularly :

- (1) Prohibition of the transport, sale or use of white lead for painting purposes except in the form of paste or ready made, and the labelling of all vessels containing it.
 - (2) Provision of adequate arrangements for the personal cleanliness of the workers; overalls to be cleaned once a week; changing rooms; washing apparatus.
 - (3) Prohibition of dry rubbing down and dry scraping.
 - (4) Medical examination of each workman on taking up his employment and subsequent medical examination at frequent intervals.
 - (5) Compulsory notification of cases of lead poisoning.
 - (6) Special register for each workman containing all necessary particulars as to health, etc.
 - (7) Prohibition of eating and smoking at the place of work.
 - (8) Posting up of notices and distribution of pamphlets explaining the danger of plumbism and the protective measures necessary to guard against it.
- Article 7.* — In painting operations which involve the removing of old coats of paint with a lead basis, the competent authority shall be charged with the duty of enforcing the regulations laid down in accordance with Article 6.

* * *

The twenty-first sitting of the Third Session of the International Labour Conference was held on Wednesday, 16 November 1921, Lord BURNHAM presiding.

The Conference opened discussion of the report of the White Lead Committee¹.

¹ Taken from the Provisional Record of the Conference.

Sir Kenneth GOADBY (Great Britain), Reporter of the White Lead Committee, said :

I have the honour to present to the Conference the Report of the Commission on White Lead, appointed by the Third International Labour Conference at its fourth sitting on the 28 October, to consider Item No. 6 of the Agenda. The Governing Body placed the question of the prohibition of the use of white lead in painting on the Agenda of this Conference in consequence of the Report of the Commission on Unhealthy Processes appointed at the 1st Annual Meeting of the International Labour Congress at Washington in 1919. This Commission was set up "to consider the question of the employment of women and children in unhealthy processes"; during the Session of that Commission the question of the use of white lead in painting was raised but deemed not to come within its terms of reference: the Reporter, Dr. Legge, in his report says "I express the general feeling of the Commission in pointing out the importance of this subject (the use of white lead in house painting operations)" and saying how action has already been taken in certain countries, and the subject studied in others. Consequently, the Committee was of the opinion that the subject should be referred to the International Labour Office to be placed on the Agenda of the next Conference.

After the submission of that report to the Conference, Dr. Boulvin pointed out that the Commission requested that studies be made by the International Labour Office.

On 4 January and 11 February 1921 the International Labour Office addressed to the States which are members of the International Labour Organization, a questionnaire on this item: attached to the questionnaire was a Memorandum containing certain general statements concerning the painting industry and its dangers. The replies of the various Governments to the questionnaire had already been issued, and distributed to all members of the Conference. In accordance with the Washington precedent, the Third International Labour Conference appointed at its fourth sitting on 28 October the Commission on White Lead to consider Item 6 of the Agenda. The Commission was composed of twenty-four representatives, eight of each Group:

¹ Government representatives: Dr. Glibert (Belgium, Technical Adviser), Mr. R. Urdelinens (Bolivia), afterwards replaced by Mr. Lassen, Denmark), Mr. Obed Smith (Canada), Mr. A. Fontaine (France, with Mr. Boulvin, Technical Adviser), Dr. Leymann (Germany, with Dr. Frey and Dr. Lehmann, Technical Adviser), Dr. Legge and Mr. Werner (Great Britain, Technical Adviser), Dr. G. Loriga (Italy, Technical Adviser), Count de Alcaza (Spain, with Mr. Aguilera and Dr. Gonzales y Castro, Technical Advisers).
Employers' representatives: Mr. Cookson (Australia, with Prof. Armstrong and Mr. J. H. Smith, Technical Advisers), Mr. Blake Robertson (Canada, Technical Adviser), Mr. G. Ernest (France, Technical Adviser), Mr. Pönsen (Germany, with Prof. Curschmann and Dr. Bopp, Technical Advisers), Mr. Bayley (Great Britain, with Mr. Butterworth and Sir Kenneth Goadby, Technical Advisers), Mr. Versteven (Netherlands, Technical Adviser), Mr. Benet Raabo (Spain, Technical Adviser).
Workers' representatives: Mr. T. B. Merry (Australia), Mr. Flament (Belgium), Mr. L. Jothaux (France), Mr. O. Ströme (Germany), Mr. Gibson (Great Britain), Mr. Amundsen (Norway), Mr. Caballero (Spain), Mr. Schurch (Switzerland).

The Commission was referred by the Conference to "the report on the question of the prohibition of the use of white lead in painting prepared by the International Labour Office" as the basis of their discussion.

At the opening sitting of this Commission, held on 31 October 1921, Mr. Obed Smith (Canada) was elected Chairman, Mr. A. Fontaine, Vice-President; and Sir Kenneth Goadby, Reporter.

A proposal to set up a series of sub-committees of the Commission to examine the special technical questions which were likely to come before the Commission was rejected because the whole Commission desired to know as much as possible of this important matter. The Commission sat daily except Sundays.

The Commission having formally adopted as the basis of discussion the report referred to it by the Conference, proceeded to examine the question in detail. In the course of fourteen Sessions, sixty-one speeches, other than those made in general discussion, were delivered; 20 by Government representatives, 22 by employers' representatives and 19 by the workers' representatives. In addition the Medical Sub-Commission had four Sessions, which are referred to in the proper place.

The Second and Third Sessions were devoted to a general discussion upon the economic, statistical and medical sides of the question. In this discussion the medical question predominated.

During its Third Session the Secretary-General addressed the Commission and replied to various criticisms concerning the memorandum attached to the questionnaire, which was stated not to be an impartial document. The Secretary-General admitted the questionnaire was hurriedly prepared, and quoted in justification of the publication by the International Labour Office of the memorandum and questionnaire, Section 115 of the report of the Commission of Enquiry of the League of Nations, whose conclusions had been approved by the Assembly of the League itself.

At the commencement of the Third Session, the Commission adopted a motion proposed by Dr. Glibert, seconded by Sir Kenneth Goadby, that the consideration of the Commission be primarily directed towards the medical question in the following terms:

The Commission is of opinion that it is desirable to consider separately, and in order, the following points:

- (A) Diagnosis of lead poisoning from a medical standpoint;
- (B) Importance of lead poisoning in the painting industry;
- (C) Technical value of the substitutes for white lead;
- (D) Social and economic consequences of such substitution.

The remainder of the Session was devoted to matters relating to the diagnosis of saturnism, and became so highly technical that the Commission adopted a resolution proposed by Mr. Lehmann, and seconded by Mr. Oersted, to refer to a Medical Sub-Commission the following question:

Is medical science, generally speaking, in a position properly to diagnose lead poisoning?

The Medical Sub-Committee, after a prolonged and careful examination of the subject, arrived at a unanimous conclusion and reported to the Commission at its Fifth Sitting as follows :

Medical Science has been able for a long time to diagnose satisfactorily typical and severe cases of saturnism.

Modern methods of diagnosis in the hands of specially trained medical men enable them :

- (1) to recognise saturnism in most doubtful cases ;
- (2) to exclude cases of alleged saturnism ;
- (3) to recognise lead absorption and lead intoxication at an earlier stage than heretofore.

This report was adopted, and the Commission proceeded to consider the second medical question on the programme.

The medical questions subsequently discussed were (a) the statistics of saturnism in white lead generally ; (b) notification and certification of the disease ; (c) the channels and methods by which painters became subject to lead poisoning. The general discussion showed that much of the medical knowledge relating to lead poisoning was derived from other industries than the painting trade, and as regards medical statistical questions the Commission found considerable difficulty in envisaging the subject in all its complicated ramifications. By the end of the Sixth Sitting it was decided to refer the whole question of medical statistics relative to saturnism in painters to the Medical Sub-Commission, previously appointed. The terms of reference are as follows :

- (1) What is the degree of risk of lead poisoning attaching to the painting industry, according to statistics ?
- (2) What are the channels by which lead penetrates most frequently into the organism of the body ?

This motion was seconded by Dr. Gilbert.

Mr. Cookson proposed to add as an amendment to Mr. Loriga's motion a third question to be referred to the Medical Sub-Committee :

Amongst painters' diseases sometimes attributed to white lead, should any proportion properly be attributed to any other cause than white lead ?

The amendment was seconded by Mr. Blake Robertson.

The amendment was put to the vote and defeated by 12 votes against 11.

Mr. Loriga's motion, on being put to the vote, was carried by 16 votes to 7.

The Medical Sub-Committee sat during the whole of the 7 November, but succeeded in finally coming to a unanimous conclusion and reported to the Commission at its Eighth Sitting as follows :

A. *As to the first question (What is the degree of risk of lead poisoning attaching to the painting industry, according to statistics ?)* :

The Medical Sub-Committee is of opinion that in so far as it concerns painters using white lead or other lead compound, saturnism is the chief professional risk, but that the statistics are vitiated :

1. As to mortality,

(a) Primarily, by the exclusion of cases of death due to saturnism, which are grouped under other headings.

(b) Secondly, by the inclusion under saturnism of cases of death due to other causes.

2. As to morbidity, by defects in notification and certification, and by other imperfections.

The Sub-Committee adds :

That obligatory notification by a medical practitioner of suspected cases of saturnism, and the certification of these cases by an independent medical man appointed by the State, would give (as is the case in certain countries) satisfactory statistics.

B. *As to the second question (What are the channels by which lead penetrates most frequently into the organism of the body ?)* :

1. By far the most important danger is from dust, which enters through the nose and mouth.

2. Penetration of lead directly through the skin is without any practical importance, but in many ways lead can be deposited on the skin, and be carried thence to the mouth.

3. The Sub-Commission call attention to the danger of paint spraying, and also to the less danger of splashes given off during painting.

The general discussion on economic and technical matters was continued whilst the Medical Sub-Committee was sitting. In view of the two reports on the medical questions the Commission decided to discontinue the medical discussion and proceed to the examination of the relative value of substitutes, if any, for white lead. The question was exhaustively dealt with from the point of view of the paint chemist, the paint technologist, and the operative painter. The whole subject was explored, the discussion proceeding along two main lines : the possibility of the employment of substitutes for white lead in (a) external and (b) internal painting. A sharp cleavage of opinion was disclosed regarding the existence of efficient substitutes for white lead in external painting, both as to their resistance to atmospheric variations, and as to changes due to atmospheric pollution. A similar cleavage of opinion existed with regard to the replacing of white lead by zinc oxide and other paints for internal painting. The same technical and practical arguments were advanced on both sides, for and against the two classes of pigments as regards their durability and protective qualities.

Following this full discussion on the technical question, the Commission proceeded to examine the question of regulations. Again considerable divergence of opinion existed in regard to the feasibility of carrying out efficient and effective regulations for the protection of the working painter. The opinion of the Medical Sub-Committee, as well as the general opinion expressed throughout the meeting of the Commission, has been that the chief occupational risk of the painters is saturnism due to poisonous dust from dry rubbing down, and that, could this dust risk be eliminated from the painters' occupations, the incidence of saturnism would be greatly diminished, if not entirely eliminated.

The differences of opinion expressed by various members of the Commission were, on the one side, a fear that regulations, already existing in some countries, would be ineffective; on the other hand, the great reduction in disease in officially regulated industries was cited; there was, however, agreement that no regulations could be effective without the co-operation both of employers and of the persons employed. A further divergence was manifested in regard to the operation of dry rubbing down of painted surfaces. This technical question was especially discussed by the operative painters and one master painter, as well as by experts in paint technology, chemists and doctors. It was maintained on the one hand that dry rubbing down was essential in certain types of painting, whereas it was advanced on the contrary that "moist" and "wet" rubbing down are commonly made use of by many working painters and in some industries are constantly used; but it was agreed that, if dry rubbing down could be dispensed with, the greater part of the danger from the poisonous dust would disappear.

Finally, the economic question engaged the attention of the Commission. It was contended that, by reason of the geological occurrence of a mixed lead and zinc ore in the mines, which are the chief source of supply, and because of the intimate association of the metallurgical operations in separating the two metals, the decreased demand for lead which would be caused by the prohibition of the use of white lead for painting would make it impossible to work these mines remuneratively, since the increased demand for zinc (for zinc oxide paints) could not be met without working a corresponding quantity of lead, the cost of production being thrown almost entirely upon the zinc: that this would not only affect the supply of zinc, but would also affect the economic working of gold mines and other allied industries, and that unemployment on a very large scale would be the inevitable consequence. Against this point of view it was urged that the whole situation would rapidly readjust itself, and that the humanitarian principles involved were paramount.

At the termination of the ninth sitting, in concluding his speech, Professor Armstrong proposed the following resolution for the consideration of the Commission.

Inasmuch as no proof is given that a generally effective substitute for white lead in painting has been found.

Inasmuch as the diagnosis of the diseases incident to the painter's occupation is in a state of uncertainty and it is in no way established that the cases of poisoning by lead are exceptionally numerous.

Inasmuch as it is generally admitted that the chief source of risk to painters is dust, and there is reason to believe that the production of dust will be overcome by a process of wet rubbing down, such a process having been devised and effectively used.

This Commission is of opinion, that it is neither necessary in the interests of the painter for the protection of his health, nor desirable in the interests either of users or of producers, to conclude an international convention for the prohibition of the use of white lead in painting.

This Commission further considers that the risks incidental to the painter's occupation will be entirely overcome by the acceptance of a convention with the following objects in view.

(A) The prevention of diseases arising from:

- (i) Paint dust of all forms.
- (ii) Vapour arising from volatile materials.
- (iii) Uncleanliness.

(B) Medical examination.

(C) Notification and certification of all cases of lead poisoning.

(D) Distribution of information on the question of the special hygiene of the painting trade.

At the subsequent sitting, Mr. Gibson proposed the following amendment to Professor Armstrong's motion, considering that satisfactory substitutes for white lead were available. This was seconded by Monsieur Flament:

The employment of white lead and for all specialised products containing white lead shall be prohibited in all painting work. A transition period of three years shall be allowed before effect shall be given to this prohibition.

The above provisions shall come into force three years after the closure of the Third Session of the International Labour Conference.

At the conclusion of the sitting, the Chairman announced that there were 6 amendments to Professor Armstrong's motion, and an original motion of Count de Altea.

At the twelfth sitting, Mr. Gibson's amendment to Professor Armstrong's motion was rejected by 41 votes to 9, one abstention being recorded.

The second amendment, proposed by Mr. Boulvin, was as follows:

The use of lead pigments shall be prohibited for inside painting. For outside painting the use of lead pigments is only to be allowed by permit of the competent authorities.

This was rejected by 19 votes to 10 (1 abstention).

A further amendment was submitted by Dr. Gilbert:

The use of white lead pigments in interior painting shall be prohibited. The pigments are allowed to contain a maximum of 4 per cent lead expressed in terms of metallic lead.

In the case of exterior painting or in the painting of materials exposed to the weather the use of such pigments shall be subject to supervision by the competent authorities.

This amendment was rejected by 12 votes to 11, with one abstention.

The amendment by Mr. Benet to Dr. Gilbert's amendment was withdrawn.

The consideration of the two remaining amendments of Dr. Legge and Dr. Oersted, which had some points in common, was postponed until the next session, the proposers having agreed to reduce the two amendments to one form. At the 18th Session Dr. Oersted and Dr. Legge submitted their combined amendment

stated that the worker's group would abstain from voting on a Recommendation. Count de Altea moved that "Convention" be inserted in the amendment instead of "Recommendation". In reply to the Chairman, Mr. Jouhaux stated a new position had arisen. The Conference was therefore suspended for consultation, Dr. Legge observing that in voting for the amendment he did not commit the British delegation on the question of prohibition as against regulation. On resumption, Count de Altea's amendment was carried unanimously by a show of hands, but by an unfortunate misunderstanding the amended amendment was only carried by 13 votes and 11 abstentions.

The amendment, put as a substantive motion, was carried by 14 votes with 10 abstentions.

The Draft Convention for Regulations is set out below.

The Commission considers

A. That a Draft Convention should be adopted for the protection of painters against risks from paint: that on account of differences of law, custom, and industrial tradition, it is inexpedient to frame a detailed code of international regulations, but that regulations should be made for the use, in painting, of white lead, or mixtures containing it, in each country based upon the following principles:

1. (a) Arrangements to secure the handling by painters of white lead, or mixtures containing it, solely in the form of paste, or of paint ready for use.
(b) Means to avoid the danger of applying paint in the form of spray.
(c) Means, wherever practicable, to avoid the danger of dust arising from dry rubbing down and scraping.
2. (a) Provision of adequate washing facilities.
(b) The use of overalls.
(c) Arrangements to prevent soiling of outdoor clothes by paint or painting material.
3. (a) Compulsory notification and verification of cases of saturnism and suspected saturnism.
(b) Power, where necessary, to require medical examination of workers.
4. Distribution of information in regard to the special hygiene of the painting trade.

B. The competent authority shall take such steps to secure the observance of the Regulations as it may consider necessary after consultation with associations of employers and of workers concerned.

C. That statistics of morbidity and mortality among painters from saturnism should be ascertained and recorded in each country.

On the motion of Dr. Leymann the question of the last item on the Convention was referred to the Medical Sub-Committee for report. The Medical Sub-Committee met, and after discussing the statistical question reported as follows:

D. (1) *Morbidity*: The Governments should be invited to take measures necessary to obtain the notification and scientific control of all cases of saturnism amongst painters.

(2) *Mortality*: The Sub-Committee can only suggest that each Government request the assistance of its Registrar-General in devising a method of determining which of the most important diseases of painters exceeded those of the general standard population.

The President mentioned the fact that the conclusions arrived at by the Committee had been embodied in a series of resolutions which were not a Convention. He would therefore allow the Chairman or the Reporter of the Committee to move, by way of amendment, to substitute a Draft Convention for the resolutions on the paper if it should be desired to avoid referring the report back to the Committee.

Mr. Boulou (France), Reporter of the Minority Committee on White Lead, presented the following report:

The discussions which have taken place in the White Lead Commission established:

1. That operative painters are exposed to the danger of lead poisoning, and that this represents the principal occupational risk.
2. That medical science has for a long time been in a position to distinguish definitely cases of lead poisoning, either by clinical or other diagnostic methods.
3. That whilst regulation has given good results in undertakings other than house painting, because they are carried on in workshops where supervision of protective measures is possible, it has failed in house painting for the following reasons:

- (a) The impossibility of the practical application of certain of these measures;
- (b) Insurmountable obstacles to supervision: on the one hand, the inviolability of private property; on the other hand, the excessive increase of the inspectorate which would be necessitated by the large number of premises where painters are employed and their continual change, and by the seasonal character of the industry.
4. That the rubbing down and scraping of painted surfaces represent the longest, most fatiguing, and most important operations in house painting.
5. That the creation of dust in the process of dry rubbing down constitutes the most serious danger to operative painters when this dust contains particles of lead compounds.
6. That it is impossible to adopt the process of wet rubbing down in the majority of cases; and that the obligation to perform this process, in cases where it is possible, would considerably increase the expenses of production.

Moreover, it is essentially in interior work, where the danger of poisoning is greatest and supervision is impossible, that the necessity for dry rubbing down appears.

7. That the arguments raised against substitutes for white lead have referred specially to exterior painting.

8. That a large number of experiments have proved conclusively that, for interior work efficient substitutes can be found to replace white compounds of lead.

For these reasons the members of the Minority of the Commission would have preferred the complete prohibition of the use of white lead in painting, or, at least, for work performed in the interior of buildings.

This minority report has been signed by the following members of the Commission:

Messrs Glibert, Boulou, Loriga, Streine, Flament, Jouhaux (represented by Mlle. Bouvier), Gibson, Amundsen, Caballero, Schurch.

Sir Thomas Oliver¹ (Australia, Government) declared that the Government of the Australian Commonwealth was opposed to the prohibition and the restriction of white lead. It recognised that the health of the workers must be the first consideration, and it would welcome and carry out loyally any Recommendations or Resolutions for improving the conditions of labour and safeguarding the health of the workers. Australia was particularly interested in this question as she was one of the largest producers of lead in the world. Lately the Government of New South Wales — a Labour Government — had instituted an enquiry as to whether it was necessary to regulate, restrict, or prohibit the use of lead in paint. Fifty-two witnesses had been examined, including doctors, scientists, employers and workers, and the finding which was issued as late as September, was that neither restriction nor prohibition was necessary or desirable, and that proper regulations were sufficient.

He mentioned experiments which he had caused to be carried out which proved that any inhibitory influence on the life of micro-organisms was mainly, if not entirely, due to the solvents that were used, and not to the white lead itself.

As to wet rubbing down, he was confident that this could be easily done. He mentioned his experience as to the use of lead in the potteries, and he stated that since insoluble forms of lead were used for glazing purposes, the number of cases of lead poisoning had decreased, from over 200 in the year 1900 to 21 in 1919. At Newcastle-on-Tyne, where he had practised for many years, the number of cases of lead poisoning decreased from 204 cases in 1900 to 4 in 1919, due to the introduction of regulations. Sir Thomas Oliver also quoted his experience in Hungary, where owing to the regulations introduced in the potteries, lead poisoning had been reduced to a minimum.

The question of the use of phosphorus in matches, which had been brought forward as an instance of what prohibition could do, was not quite a parallel case, for as a result of the enquiries made at the time, another compound of phosphorus was substituted for the one already in use. In the case before them, they were asked to substitute one metal for another, which was quite different.

Sir Thomas Oliver quoted the rates charged by insurance companies for the different trades. These were less for painters than, for example, for carpenters, builders, and bricklayers.

Concluding, he said that it was his own opinion and that of the Government which he represented, that the time was not yet ripe for prohibition.

Mr. Meisel (Austria, Employers) considered that he was competent to speak with authority in the matter of the use of white lead and its substitutes in painting. After having acquired a knowledge of chemistry he became, through a series of fortuitous

circumstances, a master painter. He had been one for over 40 years. Before the war his firm was the largest undertaking in Europe for interior painting. He had, for example, painted in the course of his existence over 9,500 bridges, of which 8,500 were painted with white lead, and 1,000 with substitutes.

It was his experience that exterior painting done with white lead lasted from six to eight years; with zinc colours it lasted two years, and with lithophone from one to two years. Mr. Meisel then gave the chemical and practical causes of this durability.

The Association of Painters and Varnishers of Vienna had declared unanimously that white lead was indispensable for exterior painting because of its durability. If substitutes were employed, the expense in connection with the upkeep of objects exposed to atmospheric influences would be three times greater than if white lead were used. Iron bridges would have to give way to cement bridges; the iron industry would suffer enormously.

For Austria the prohibition of white lead would be a disaster. They had lead mines in abundance, but no zinc mines. They would therefore be obliged to import from abroad, and for this they were too poor.

Mr. Meisel declared that all that he had said applied only to exterior painting. For interior work, which was not subject to the continual influence of the light of the sun or of moisture, white lead could easily be replaced by zinc white or lithophone.

Mr. Okamoto (Japan, Government) declared that his Government was in favour of international action in fighting against lead poisoning. The regulations which had been submitted to them for approval would, however, involve difficulties which were too great, and the Japanese Government delegates would be unable to vote for the draft Convention submitted in the majority report.

Mr. Loriga (Italy, Government) drew attention to the medical side of the white lead question, which envisaged two points of great importance, i.e. the gravity of the evil and the means of preventing it. As to the former, they were all agreed. As to the means of prevention, three methods were proposed:

- (a) To fight the cause directly, i.e. to avoid it or suppress it. This was the method already adopted with regard to white phosphorus.
- (b) To prevent the production and dispersion of harmful matters, or to secure their rapid elimination by a suitable method. This was the method usually adopted in factories for protection against dust, gas and smoke.
- (c) To protect the workers individually by means of masks, special clothing, etc., and by the encouragement of personal cleanliness.

The first was the only sure and efficacious method, and the last the least sure, the most difficult to apply, the most annoying, and the most costly.

The declaration of cases of lead poisoning and medical examination were methods whose object was rather to cure than to prevent the malady.

¹ Taken from the summary published in *Daily Intelligence*, Vol. IV, No. 26, pp. 508 et seq.

Why should the workers alone be obliged to take all the precautions against industrial diseases? Why not forbid the employers to manufacture, to sell, and to employ such a terrible poison as white lead?

Mr. Butterworth (Great Britain, Employers), as a practising master painter, declared that it was the practically unanimous opinion of the British employers that not only was the use of substitutes unsatisfactory, but it was extremely disastrous in the interests of the public, who had to pay the bills. Most exhaustive experiments, carried out by employers in Great Britain, had proved that no efficient substitute existed for white lead under British conditions, either for outside or inside work.

He himself used zinc white, and would continue to use it for those purposes for which it was suitable, but in a damp atmosphere it was not suitable. With regard to wet rubbing down, Mr. Butterworth said:

So satisfied are the master painters of England that the wet rubbing down even of newly painted woodwork is possible, that I am authorised to state on their behalf that if regulations are imposed or suggested by this Conference having for their object the prevention of lead dust, which is generally admitted to be the chief cause of poison, they will be quite ready and glad to co-operate.

The master painters firmly believed that prohibition was neither necessary nor desirable in the public interest, and that simple regulations would entirely remove the danger.

Dr. Gilbert (Belgium, Government) speaking as an old official* who had experience in the application of regulations to industries which of the impossibility of applying regulations to industries which are not carried on in workshops. He cited the difficulties with regard to the question of white lead in Belgium. He asked, for example, how could an inspector invade a private house to control the application of the regulations by painters working therein. In Belgium they had been obliged to arrive at a solution of a mixed character, i.e. the prohibition of the use of lead pigments for interior work and the right to use them in exterior work or for objects exposed to the weather.

He was convinced that whatever regulations they might now impose, the question of the prohibition of the use of white lead was bound inevitably to come before another International Labour Conference.

Mr. de Lavegne (France, Employers) thought that the prohibition of white lead would be dangerous. In the first place, in its consequences to the zinc and lead industries, and secondly, with regard to the upkeep of buildings.

He quoted several examples of different organisations which had voted in favour of white lead in preference to a substitute. They in France had a law prohibiting the use of white lead, but the amount of white lead imported into Paris alone was enormous. The reason of this was that many small master painters, who did not come under this law, used white lead because they found that it satisfied better all needs.

He therefore was opposed to prohibition and asked for regulation.

Mr. Zameta (Venezuela, Government) considered that the proposal of the minority, with perhaps some revision, was that which harmonised best with the interests of all.

Mr. Bopp (Germany, Employers) gave the chemical reasons why white lead was less sensitive to acids and moisture than zinc paints. He came to the conclusion that the dangers of white lead are not such as to justify its total prohibition.

Mr. Justin Godart (France, Government) declared (sitting of 17 November) that the French Government representatives would vote against the majority report and would accept any proposal for the prohibition of the use of white lead in the building industry, both for outside and for inside work. In France they had tried both methods. In 1902 they had introduced regulations on the lines of those proposed to the Conference, but they proved ineffective. In 1911, in the Paris hospitals alone there were 298 cases of lead poisoning, and of these 162 affected painters in the building industry. In 1912 there were 361 cases, of which 198 were painters. In 1913, 342 cases, of which 186 were painters. Seeing the poor results of regulation, the law of 20 July 1909 was passed prohibiting the use of white lead for workers in the building industry for both inside and outside work. This law came into force only five years later, on 1 January 1915. The result was that in 1916 there were in the Paris hospitals 42 cases of lead poisoning; in 1917, 8 cases; in 1918, 7 cases; in 1919, 12 cases; and 6 cases in 1920. The French Government would therefore support a Convention prohibiting the use of white lead in the building industry for both inside and outside work, and establishing the regulation of the use of white lead in industries other than the building industry.

He understood perfectly that the interests concerned should be defended before this Conference, but there was a higher interest, i.e. the health and the life of human beings.

Mr. Oersted (Denmark, Employers) stated that in his country no white lead whatever was manufactured, and he was therefore not interested in that side of the question. He did not think that they could do without white lead.

It had been said that regulation could not be properly carried out for two reasons: first, that painters do not work in factories, but are scattered; and secondly, that it was impossible to control them in private houses. Both of these arguments applied with equal force with regard to prohibition. He thought that one of the chief advantages of setting up regulations would be to advertise the danger and call the attention of every painter to the risk and the way to avoid it. It was well known that painters were ignorant or oblivious of the risks. Mr. Oersted also drew attention to the difficulty of drawing the line between outside and inside painting.

Mr. Flament (Belgium, Workers) informed the Conference that he had been a working painter for 26 years.

Twenty years ago, when he was an apprentice, he noticed that the first coating in interior work was of white lead, whilst the last coating was zinc white. This was because the latter did not become yellow as did white lead.

He declared that no painter can escape lead poisoning during the first ten years. He himself had had painter's colic.

The great argument of white lead manufacturers was that no substitute could be found for white lead for inside work. It was his own experience over many years that substitutes could be, and have been, found and used.

Mr. Butterworth had spoken yesterday of dry rubbing down and scraping, but he (Mr. Flament) affirmed that the wet process could only be employed in some cases. The work done would not be satisfactory, and would be so expensive that nobody would wish to have it. For ornate work it was impossible to employ the wet process. The same was true of painting on wood and plaster.

Dr. Bopp had said that painting done with zinc white sealed off. This did not depend on whether the paint used was white lead or zinc white, but on the mixing of the paint, and on the skill with which the painter applied it afterwards. He could apply a coat of paint which would scale off in a fortnight or three weeks.

He protested against the poisoning of workers because financial interests so desired it.

Mr. Robinson (Australia, Government) stated that his Government was opposed to either prohibition or restriction. It favoured, regulation. In Australia, where more lead was handled than in most countries, there was no prohibition and no restriction of the use of white lead in painting, and yet the insurance companies there asked a smaller premium to insure against risks of lead poisoning than for bricklayers, carpenters, or any other building operatives. In New South Wales, the conclusion had been arrived at that neither restriction nor prohibition was necessary or desirable, and that proper regulations alone sufficed.

He drew attention to the international value of the Australian mining industry, for any steps affecting the maintenance or prosperity of that industry would cause an immediate reflection in European countries. In the Australian mines, lead and zinc were closely associated. In order to get the zinc, lead must be produced first. Any measures affecting the lead industry would therefore have an immediate effect on the output and price of zinc, of which Australia supplied an enormous quantity to European countries.

He hoped that the proposals for prohibition or restriction would be rejected, and that the principle of regulation to ensure the health of the workers would be adopted by the Conference.

Mr. Benet (Spain, Employers) spoke of the influence which the prohibition of white lead would have on Spain and also on Mexico. 17,000 workers would be out of work, so that humanity obliged them to look at this side of the question as well as the other.

When the question of prohibition was first raised and put on the agenda of the Conference, an enquiry had been made in Spain,

and it had been unanimously agreed that in the different lead factories the dangers mentioned did not exist. In a communication from Barcelona he found that not one case of a claim for lead poisoning had been made before the Industrial Court of that city. He himself had assisted at all the sittings of the Committee which had sat on the question, and he was convinced that all the groups were agreed fundamentally on the question. It was only necessary to find a formula. He thought that this would be found in the proposals submitted in the majority report.

Mr. Navez (Belgium, Employers) thought that in a case like this the interests of the painting profession itself should be considered above all others. The master painters had not raised the question, but now, in the face of the intervention of the authorities, the opinions of the medical profession, and the numerous recriminations of the workers, they were obliged to examine the question of the prohibition of white lead.

One of the principal reasons why master painters preferred white lead to any other pigment was that when the day's work was over, all they had to do in order to keep the mixture intact was to plunge it in water. His opinion was that white lead should be kept for outside work. It was certain that, with or without prohibition laws, the use of white lead for inside work was gradually decreasing simply because it was not a question as to the relative merits of the different paints, but that substitutes had been found to be sufficiently good for the purpose.

If total prohibition of white lead were proposed to them, the master painters, in their own interest, would have to protest. On the other hand, they would protest also against the regulation proposed, because of its inefficiency. He agreed with Mr. Flament in regard to the wet process of rubbing down and scraping. It was impossible on woodwork, on plaster, and on ceilings. It could not be employed on newly-painted objects.

He thought therefore that the regulations proposed were insufficient, and they would only find that the whole question would have to be raised again if they were adopted.

Mr. Schurch (Switzerland, Workers) pointed out that in Switzerland between the years 1901 and 1919 there were 8 deaths from lead poisoning. If this was the case for a small country like Switzerland, where, according to the report furnished by his own Government, the use of white lead had very much decreased and almost completely disappeared for inside work, how serious the situation must be in other countries.

Mr. Merry (Australia, Workers) saw no reason for prohibition, but he was in favour of regulation. He was convinced that all difficulties could be solved by an agreement between employers and workers. In Australia they used zinc white for inside work, and they would continue to use it, but it had been proved impossible to use any other paint than white lead for other work. He considered that the rubbing-down question could be dealt with by regulation.

Mr. Streine (Germany, Workers) said that regulations such as those proposed could not be carried out in practice, owing to the fact that painters are scattered and are continually moving from place to place.

He declared that for inside work zinc white was better than white lead. If the Conference was not willing to vote in favour of a complete prohibition of the use of white lead, he hoped that it would at least vote for a prohibition of its use for inside work.

Mr. Gemmill (South Africa, Employers) pointed out the indirect effect of the prohibition of the use of white lead on various industries, as, for example, the gold industry of South Africa. He thought that, in face of such enormous difference of opinion it would be better to leave the matter open until they had arrived at a definite conclusion.

Mr. Roy (Canada, Government) said that his opinion on this matter was not that held by the Delegates of his Government, but that of a Canadian from the province of Quebec, a province whose Government would be called upon to ratify any Convention which might be passed. He saw in this discussion a conflict of interests, the interests of certain capitalists on the one hand, and of human life on the other. If this Conference, whose only influence was in its prestige, was going to decide to increase the dividends of the manufacturers in order to send more people to hospital, it would meet with the just universal reprobation, which would be equivalent to suicide.

Mr. Tom Moore (Canada, Workers) proposed the closure of the general discussion.

This was accepted by 52 votes to 8.

Mr. Obed Smith (Canada, Government), Chairman of the White Lead Committee, moved a formal motion to transform the resolutions presented by the majority into a draft Convention.

Sir Kenneth Goadby (Great Britain, Employers) seconded. This was adopted by 43 votes to 20.

Mr. Justin Godart proposed, and Mrs. Kjelsberg (Norway, Government) seconded, that the following text should be substituted for that of the majority of the Committee:

Article 1. — The use of white lead, plumbiferous linseed oil, and any other specialised product containing white lead is prohibited in any work of whatsoever kind done by operative painters, either in exterior or interior house painting.

Article 2. — For any painting other than house-painting the Members of the International Labour Organisation undertake to take the special protective and hygienic measures laid down in the following Articles.

Article 3. — In cases where the use of white lead is not prohibited, white lead may be used only in the form of paste.

Article 4. — Direct handling of products with a white lead basis in painting is prohibited.

Article 5. — Dry scraping and dry rubbing down are prohibited in the case of painting done with white lead.

Article 6. — For wet scraping and wet rubbing down and for any work in connection with white lead painting, employers shall provide their workers with overalls exclusively reserved for their work.

They shall be responsible for seeing that such overalls are kept in good order and frequently washed.

The workers shall be provided, at their actual place of work, with the materials necessary for their personal cleanliness.

The implements and instruments used by the workers shall be kept in a good state of cleanliness, and shall be cleaned without dry rubbing down.

Article 7. — Employers, directors, or managers shall post up in places where workers are engaged or paid:

(1) The provisions of this Draft Convention;

(2) A factory regulation obliging workers to use the overalls and the materials necessary for their personal cleanliness, with which they are provided by virtue of Article 6.

Mr. Schurch, in the name of the minority, supported the amendment.

A record vote was then taken, and the amendment was carried by 45 votes to 44.

At the twenty-third sitting the President explained to the Conference that the Report of the White Lead Committee having been subsequently replaced, as a result of the vote taken at the morning sitting, by the Draft Convention drawn up by Mr. Godart, it was open to the meeting before proceeding to discuss the Convention Article by Article, to engage in general discussion on this Draft Convention.

It mentioned, however, that the Selection Committee had placed on the agenda of the previous day the decision made to terminate the work of the Conference on Saturday evening, which would be difficult if a long general discussion on the Draft at present before the Conference were to be engaged in.

Mr. Poulton (Great Britain, Workers) reminded the President that he had informed him of an amendment which he wished to propose.

The President informed him that he could propose this amendment when the first article of the Draft Convention was under discussion. Mr. Poulton agreed to this procedure.

Mr. Blake Robertson (Canada, Employers) said that the question now before the Conference was: Should there, or should there not, be total prohibition of white lead in house painting? In Canada, climatic conditions demanded that buildings, bridges, etc., should be protected by paint. Scientific investigation had fully demonstrated that white lead was the best preservative. If, instead of white lead, inferior substitutes were used — and all substitutes were inferior — great economic loss would follow. Mr. Blake Robertson then quoted a number of authorities in Australia, in the United States and in Germany, who stated that zinc was of no use as a substitute for white lead. He also quoted the New Jersey Zinc Company, which says that zinc by itself does not constitute a good paint, and that in the different formulae which they furnish, 35 per cent. to 55 per cent. of white lead must be used.

In the Province of Ontario, lead poisoning was almost unknown. There was in that province a Workmen's Compensation Act, and the officials of the Department administering that Act told him that from 1915 to the end of 1919 there was only one serious case of lead poisoning in the Province.

Canada was a heavy lead-producing country. They manufactured there the lead paint that they use. From the Canadian standpoint, he would vote against any prohibition.

Mr. Poulton (Great Britain, Workers) proposed that in Article 1 of Mr. Godart's amendment, the words "either in exterior or interior house painting" should be replaced by "in all interior painting". He would have liked to have had the whole of the Article adopted, but he believed that by proposing an excision of part of this Article, making it apply to interior painting only, they were making a very considerable concession. They did not abate one jot of their claims as proposed in the Article, but they did not wish to have the whole of the work of the Committee go for naught, by insisting on the prohibition for exterior painting.

Mr. Largo Caballero (Spain, Workers) supported the proposal of Mr. Poulton, not because he did not think that white lead ought not to be entirely prohibited, but simply in a spirit of conciliation. He then went on to deal with the hygienic, technical, economic, and moral aspects of the question.

In Spain the question had been discussed by the Institute of Social Reform, and this body, composed of delegates elected by the Government, the Employers, and the Workers, pronounced unanimously against the use of white lead. Count de Altea, the Spanish Government representative here, was among those who had voted thus. He had evidently changed his opinion since.

He thought that the Conference should take into account more the sentimental aspect of the problem, which, he considered, had a considerable repercussion on the economic aspect, for at a moment when the workers are asked to produce more in order to meet the economic crisis, there was need of a strong and healthy working-class. In defending the workers' health, they were defending the general economy of the countries.

Count de Altea, Government Delegate (Spain), who considered that a personal attack had been made upon him by Mr. Caballero, rose to answer the latter. He explained that the Institute for Social Reform was an advisory body, and that its opinions did not necessarily express the opinion of the Government. Besides, it had never said that the use of white lead should be absolutely forbidden. It had merely pronounced in favour of the prohibition of white lead as far as possible. The opinion of the Spanish Government was expressed in the answer to the questionnaire of the International Labour Office, and they, the Spanish Government delegates, voted in accordance with that opinion. He added that it was he personally who had proposed the Draft Convention instead of a Recommendation to the Committee.

At the twenty-fourth and twenty-fifth sittings (18 November) the Conference continued discussion of the Draft Convention relative to the prohibition of the use of white lead.

Mr. Lederer (Austria, Government) declared that the Austrian Government Delegation could not vote for the first Article of the Draft Convention moved by the French Delegation, as they thought it went too far. Neither could they accept the Draft Convention presented by the majority of the Committee, but they were ready to accept the amendment proposed by Mr. Poulton, as they thought that white lead could be replaced by other materials, as far as interior house painting was concerned.

Dr. Leymann (Germany, Government) accepted the principle contained in the amendment proposed by Mr. Poulton, but he wished to make certain changes in it:

- (a) to add the words "sulphate of lead", because this was as harmful as white lead;
- (b) to suppress the words "plumbiferous linseed oil";
- (c) to require a transitory period before prohibition is put into force.

For that reason he suggested Article 1 (b) of his amendment, which runs as follows:

This prohibition shall come into force two years from the date of the closure of the Third Session of the International Labour Conference.

He wished to add "industrial establishments" amongst the exceptions.

Mr. Poulton, (Great Britain, Workers) was prepared to accept Dr. Leymann's amendment of Article 1 as follows:

The use of white lead, or sulphate of lead, is prohibited, with the provisions provided for in Article 3 in interior painting. The white pigment may be allowed to contain a maximum of 2 per cent. lead expressed in terms of metallic lead.

The Workers' Group agreed with this amendment.

Dr. Legge, Government Delegate (Great Britain) proposed that the Conference be adjourned for a short time to consider whether a compromise could not be arrived at on the matter.

Mr. Barrett (South Africa, Government) seconded.

After the adjournment, the text agreed upon was read to the Conference as follows:

Article 1. — Every Member of the International Labour Organisation ratifying the present Convention undertakes to prohibit, with the exceptions provided for in Article 3, the use of white lead or sulphate of lead, and of all products containing these pigments in internal painting operations, except in railway stations and factories, where the use of white lead or sulphate of lead is considered necessary by the competent authority after consultation with the employers' and workers' organisations concerned. The white pigments may be allowed to contain a maximum of 2 per cent. lead expressed in terms of metallic lead.

Article 2. — This prohibition shall come into force six years from the date of the closure of the third session of the International Labour Conference.

Article 3. — The provisions of Article 1 shall not apply to artistic or fine painting. Each Government shall define the limits of such forms of painting and shall prohibit the use of white lead for these purposes in conformity with the provisions of Articles . . .

Article 4. — The use of white lead in exterior painting operations and in artistic and fine painting shall be prohibited for women and young persons under the age of 18 years.

Article 5. — The regulation provided for in Article 1 shall be based on the following principles :

1. (a) Working painters shall not handle white lead or pigments containing white lead except in the form of paste or of paint ready for use.
- (b) All serviceable measures shall be taken in order to avoid the danger resulting from the application of paint in the form of spray.
- (c) Measures shall be taken, wherever practicable, to avoid the danger of dust caused by dry rubbing down and scraping.
2. (a) Every facility shall be provided to enable working painters to attend properly to their personal cleanliness, whether during or after their work.
- (b) Overalls shall be worn by working painters, and their use during the whole of the working period shall be compulsory.
- (c) Accommodation shall be provided so as to prevent the soiling of outdoor clothes by paint or other painting material.
3. (a) Cases of saturnism and of suspected saturnism shall become the subject of compulsory notification and of subsequent medical verification by an independent medical man appointed by the competent authority.
- (b) The competent authority may demand, when necessary, a medical examination of workers.
4. Instructions with regard to the special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

Article 6. — In order to ensure the observance of the system of regulation provided in the preceding articles, the authorities shall take all steps as they consider necessary, after consultation with the employers' and workers' organisations concerned.

Article 7. — Statistics with regard to lead poisoning among painters shall be obtained :

- (a) *Morbidity* — by notification and certification of all cases of saturnism ;
- (b) *Mortality* — by a method devised by the Registrar-General in each country.

Mr. Obed Smith (Canada, Government), Chairman of the White Lead Committee, stated that as a result of the short break in the sitting of the Conference, a meeting of the Committee on White Lead had been held, and the agreement just quoted had been reached. He moved therefore that this agreed draft Convention be an amendment to the report of the Committee on White Lead.

Sir Kenneth Goadby (Great Britain, Employers) seconded, drawing particular attention to the statistics of lead poisoning. The Committee, he added, were of opinion that each country should be asked to develop a statistical enquiry as to the exact incidence of the disease.

Mr. Cookson (Australia, Employers) having suggested a small alteration in the draft, M. Poulton suggested that a small

competent body should go to the Drafting Committee and settle the exact text so that no general discussion in the Conference should take place on the matter.

The President agreed.

The above text was then put to the vote and adopted, and referred to the Drafting Committee, by 76 votes to 3.

At the twenty-seventh sitting, 19 November, the President read an amendment standing in the name of Dr. Leymann (Germany, Government) as follows :

Add to Article 3 a second paragraph, worded as follows :

The competent authority shall have power, after consulting the employers' and workers' organisations, to permit the employment of painters' apprentices in the work prohibited in the preceding paragraph, with a view to their education in the trade.

Mr. Bopp (Germany, Employers) seconded the amendment.

Mr. Zaalberg (Netherlands, Government) considered that the amendment was a very dangerous one. The amendment would lead to a system under which every young man would be apprenticed to an employer, and would be free to do painting work with white lead.

Dr. Leymann considered that apprentices should have the chance of learning to do this work.

Dr. Legge (Great Britain, Government) expressed the hope that Mr. Zaalberg would see his way to withdraw his objection.

Dr. Legge continued :

I myself feel very strongly indeed that that Article ought never to have got in at all. It seems to me to be contrary to certain conclusions which we came to at Washington. But rather than raise any point which would create a difference of opinion on the voting on this Convention, I am saying nothing at all about it.

The amendment was declared carried by 56 votes to 14.

The Article as amended was then declared carried by 59 votes to 1.

Mr. Okamoto (Japan, Government) explained why he intended to abstain from voting :

In the Washington Convention concerning night work of young persons employed in industry, the minimum age was fixed at 18, and an exception was made for Japan for satisfactory reasons, making the minimum age 16 instead of 18. Thus the standard age of 16 for the protection of young persons in industry has already been established in Japan. But Article 8 of the present Convention prohibits the employment of males under 18. It is difficult to ignore the established standard in a particular branch of industry, as it will lose balance and uniformity and make the application extremely difficult for Japan.

Sir Montague Barlow (Great Britain, Government) stated that on the basis of the compromise which had been reached, agreed to by all concerned, and in order to avoid technical difficulties with regard to machinery, the British Government's vote would be cast in favour of the Convention.

The Draft Convention as amended was then read as follows :

Article 1. — Each Member of the International Labour Organisation ratifying the present Convention undertakes to prohibit, with the exceptions provided for in Article 2, the use of white lead and sulphate of lead and of all products containing these pigments, in the internal painting of buildings, except where the use of white lead or sulphate of lead or products containing these pigments is considered necessary for railway stations or industrial establishments by the competent authority after consultation with the employers' and workers' organisations concerned.

It shall, nevertheless, be permissible to use white pigments containing a maximum of 2 per cent. of lead expressed in terms of metallic lead.

Article 2. — The provisions of Article 1 shall not apply to artistic painting or fine lining.

The Governments shall define the limits of such forms of painting and shall regulate the use of white lead, sulphate of lead, and all products containing these pigments, for these purposes in conformity with the provisions of Articles 5, 6 and 7 of the present Convention.

Article 3. — The employment of males under 18 years of age and of all females shall be prohibited in any painting work of an industrial character involving the use of white lead or sulphate of lead or other products containing these pigments.

The competent authorities shall have power, after consulting the employers' and workers' organisations, to permit the employment of painters' apprentices in the work prohibited by the preceding paragraph, with a view to their education in their trade.

Article 4. — The prohibitions prescribed in Articles 1 and 3 shall come into force six years from the date of closure of the third session of the International Labour Conference.

Article 5. — Each Member of the International Labour Organisation ratifying the present Convention undertakes to regulate the use of white lead, sulphate of lead, and of all products containing these pigments, in operations for which its use is not prohibited, on the following principles.

1. (a) White lead, sulphate of lead, or products containing these pigments shall not be used in painting operations except in the form of paste or paint ready for use.
- (b) Measures shall be taken in order to prevent danger arising from the application of paint in the form of spray.
- (c) Measures shall be taken, wherever practicable, to prevent danger arising from dust caused by dry rubbing down and scraping.
2. (a) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
- (b) Overalls shall be worn by working painters during the whole of the working period.
- (c) Suitable arrangements shall be made to prevent clothing put off during working hours being soiled by painting material.
3. (a) Cases of lead poisoning and of suspected lead poisoning shall be notified, and shall be subsequently verified by a medical man appointed by the competent authority.
- (b) The competent authority may require, when necessary, a medical examination of workers.

4. Instructions with regard to the special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

Article 6. — The competent authority shall take such steps as it considers necessary to ensure the observance of the regulations prescribed by virtue of the foregoing Articles, after consultation with the employers' and workers' organisations concerned.

Article 7. — Statistics with regard to lead poisoning among painters shall be obtained :

- (a) As to morbidity — by notification and certification of all cases of lead poisoning.
- (b) As to mortality — by a method approved by the official statistical authority in each country.

Article 8. — The formal ratification of this Convention under the conditions set forth in Part XIII of the Treaty of Versailles and of corresponding parts of the other Treaties of Peace, shall be communicated to the Secretary-General of the League of Nations for registration.

Article 9. — This Convention shall come into force on the date on which the ratification of two Members of the International Labour Organisation have been registered by the Secretary-General.

It shall be binding only upon those Members whose ratifications have been registered with the Secretariat.

Thereafter, the Convention shall come into force for any Member at the date on which its ratification has been registered with the Secretariat.

Article 10. — As soon as the ratifications of two Members of the International Labour Organisation have been registered with the Secretariat, the Secretary-General of the League of Nations shall so notify all the Members of the International Labour Organisation. He shall likewise notify them of the registration of ratifications which may be communicated subsequently by other Members of the Organisation.

Article 11. — Each Member which ratifies this Convention agrees to bring the provisions of Articles 1 to 7 into operation not later than 1 January 1924 and to take such action as may be necessary to make these provisions effective.

Article 12. — Each Member of the International Labour Organisation which ratifies this Convention engages to apply it to its colonies, possessions, and protectorates in accordance with the provisions of Article 421 of the Treaty of Versailles and of the corresponding Articles of the other Treaties of Peace.

Article 13. — A Member which has ratified this Convention may denounce it after the expiration of ten years from the date on which the Conventions first comes into force, by an act communicated to the Secretary-General of the League of Nations for registration. Such denunciation shall not take effect until one year after the date on which it is registered with the Secretariat.

Article 14. — At least once in ten years the Governing Body of the International Labour Office shall present to the General Conference a report on the working of this Convention and shall consider the desirability of placing on the agenda of the Conference the question of its revision or modification.

Article 15. — The French and English texts of this Convention shall both be authentic.

The Draft was declared adopted by 90 votes to 0, with 1 abstention.

Interpretation of Article 3 of the Draft Convention

The Treaties of Peace have conferred upon the International Labour Office no special authority for the interpretation of the decisions of the Conference. The Office has always been prepared, however, to assist by all the means within its power, as for example by the examination of the debates and documents relevant to any particular case, in the elucidation of the difficulties which have arisen in the examination of the texts of the decisions of the Conference.

In the present case¹, the Office made an examination of the proceedings of the Conference and of the Commission on White Lead, and addressed the following letter to a number of experts who were present at the meetings of the Drafting Committee when the terms of the Draft Convention as finally adopted by the Conference were drawn up:

DEAR SIR,

It has been brought to the notice of the International Labour Office that a certain doubt has arisen with regard to the interpretation of Article 3 of the Draft Convention concerning the use of white lead in painting adopted by the General Conference of the International Labour Organisation on 19 November 1921.

As you were one of the experts who, at the request of the Chairman of the Drafting Committee, accompanied the Chairman of the White Lead Commission at the sitting of the Drafting Committee which elaborated the text of the Draft Convention as it was finally adopted by the Conference, I should be much obliged if you would let me have your observations on the point, and in particular if you would indicate what in your opinion was the intention of the Committee when it adopted the text in question.

Article 3 of the Draft Convention as finally voted by the Conference is as follows:

The employment of males under eighteen years of age and of all females shall be prohibited in any painting work of an industrial character involving the use of white lead or sulphate of lead or other products containing these pigments.

The competent authorities shall have power, after consulting the employers' and workers' organisations concerned, to permit the employment of painters' apprentices in the work prohibited by the preceding paragraph, with a view to their education in their trade.

The point which has been raised is whether the words "any painting work of an industrial character" are to be interpreted in their most general sense, or whether, in the light of the other Articles of the Convention dealing with prohibition in which only the painting of buildings is dealt with, the words are to be interpreted in the more narrow sense of applying to painting work of an industrial character connected with buildings.

It has been represented to the Office that if the more general interpretation must be taken as representing the decision of the Conference it would, for instance, prohibit the employment of women in the painting of perambulators, toys and other manufactured products with pigments containing white lead and would probably lead to difficulties as regards ratification in certain cases.

It seems, however, that in considering the possibilities of the prohibition of the use of white lead both the White Lead Commission and the Conference had in view only the painting of buildings, and that whereas by Article 1 the prohibition of the use of white lead was, for workers in general, confined to the internal painting of buildings, Article 3 was intended to exclude women and young persons entirely from employment in the painting of buildings in which the use of white lead was involved.

It will be remembered that the text of the Draft Convention adopted by the Conference for submission to the Drafting Committee contained as Article 4 the words:

The use of white lead in exterior painting operations and in artistic and fine painting shall be prohibited for women and young persons under the age of eighteen years.

The Conference, when it adopted this text, suggested that it should be revised by the Drafting Committee with the assistance of such competent persons as the Chairman of the White Lead Commission might wish to bring with him. When the Drafting Committee met, it took as a basis for the Draft Convention a text drawn up at a preliminary meeting of the experts, some of whom sat on the White Lead Commission, of which Article 4 ran:

The employment of males under eighteen years of age and all females shall be prohibited in any work involving the use of white lead or other products containing these pigments where such use is not prohibited by Articles 1 or 3.

It was pointed out that this text appeared to prohibit women from using white lead in painting pictures or in decorative work, and the words "in any painting work of an industrial character" were substituted for the words "in any work" and the words following "pigments" were deleted. The text thus modified (with an amendment proposed by Dr. Leymann in favour of the exemption of painters' apprentices from the above prohibition) was adopted by the Conference on 19 November as the final text of Article 3 of the Draft Convention concerning the use of white lead in painting.

Thus it would seem that the Conference and the Drafting Committee were mainly preoccupied with the question of prohibition of the use of white lead in the painting of buildings, and that it was intended that the prohibition should be stricter and more extensive in the case of females and young persons than in the case of men.

The actual text adopted, however, is capable of interpretation in a wider sense as involving the prohibition of the employment of females and young persons in all industrial work whatsoever involving the use of white lead.

The Office would therefore be glad to have your opinion as to what the intention of the Drafting Committee was in order to enable it to afford all possible information concerning the text in question in response to any enquiries which may be received concerning the extent of its application.

Yours faithfully,

ALBERT THOMAS.

All the experts to whom this letter was addressed have now replied, and below are given the essential elements of their letters:

1. *From Mr. J. Obed Smith, Canadian Government Delegate and Chairman of the Commission on White Lead.*

In the Drafting Committee, and at the sittings of the Commission itself, the general and whole tenor of the discussion was exclusively dealing with the use of white lead in painting, exterior and interior, of buildings, and other works were mentioned so incidentally that it is quite clear to my mind now, as it was then, that the whole of the decisions of the Commission, the Drafting Committee, and the Conference, dealt with the painting of buildings only.

I have no difficulty in stating that my opinion is that Article 3 of the Draft Convention did not intend to deal with the prohibition therein mentioned further than the use in painting of buildings, bridges, and similar out-door structures. I do not find anything in my notes or recollection to warrant the wider interpretation which would prohibit all females and males under 18 years of age from using white lead, sulphate of lead, or other products containing these elements in any industrial work at all.

2. *From Mr. Pierre Boulin, Technical Adviser to the French Government Delegates.*

(Translation.)

In reply to your letter of 8 May with regard to the meaning of the words "painting work of an industrial character" I have the honour to inform you that I believe my memory to be correct in saying that you have properly interpreted the sense which the Drafting Committee desired to give to these words. . . .

3. *From Mr. J. E. Butterworth, Technical Adviser to the British Employers' Delegate.*

. . . I feel quite confident that none of the members of the Commission (or indeed of the Conference) ever contemplated giving this particular Article an application to processes not covered by other Articles.

Consequently, I am of opinion that Article 3 was intended only to apply to painting work of an industrial character connected with buildings. . . .

4. *From Mr. A. Flament, Technical Adviser to the Belgian Workers' Delegate.*

(Translation.)

. . . It is certain that the main purpose of the authors of Article 3 was to prohibit the use of white lead in all painting work connected with buildings, especially in view of the fact that experience has shown that it is in this type of work that white lead has the most terrible effects.

Nevertheless, whoever followed closely the work of the Conference could have noted that the delegates showed a desire to obtain a more complete and more general prohibition as regards work of an industrial character carried out by women and young persons.

In short, first of all prohibition of the use of white lead in all painting work in connection with buildings, and then the continuation of the struggle for the complete abolition of the use of this poison. . . .

5. *From Mr. J. A. Gibson, Technical Adviser to the British Workers' Delegate.*

. . . As one who accompanied the Drafting Committee, there is no doubt, so far as I am concerned, that the question was solely one of the prohibition of the use of white lead in the painting of buildings, and the Convention in my view only applies to painting work of an industrial character connected with buildings. . . .

6. *From Dr. D. Gilbert, Technical Adviser to the Belgian Government Delegates.*

(Translation.)

. . . As I conceived it, this restriction was to apply to work carried out in the workshop on articles destined to be used out of doors, such as the painting of vehicles, including perambulators. I should not like to affirm that such was the opinion of all the members of the Drafting Committee. It may be that in certain countries custom permits the frequent employment of protected persons in the painting of buildings. . . .

The opinion of Sir Kenneth Goadby, the Reporter of the Commission on White Lead, had already been expressed in a memorandum on the subject communicated to the International Labour Office. The following extract is taken from this memorandum :

In order to understand the exact meaning intended by Article 3 it is essential to go back to the English version of the text of the Convention, as originally decided upon by the Conference and sent to the Drafting Committee.

Article 4 of this document, which was changed by the Drafting Committee to Article 3 of the final Convention, states : "the use of white lead in exterior painting operations, and in artistic and fine painting shall be prohibited for women and young persons under the age of eighteen years".

In the Minority Report submitted to the Conference before the compromise was arrived at, in the amendment proposed by Mr. Schürch, and in the Draft Convention suggested by the French Delegates, the following words are used : "The use of white lead in exterior painting operations, and in artistic and fine painting, shall be prohibited for women and young persons under the age of eighteen years" — "the quantities of white lead used in exterior painting, and in artistic and fine painting shall be controlled", etc.

At the Drafting Committee it was suggested that Article 4 prevented the employment of apprentices and would preclude them from learning their trade, but that the Drafting Committee were unable to make such a vital alteration in the text submitted to them, and an amendment was therefore proposed and carried in the Conference, amending the age to sixteen years.

It is not in the power of the Drafting Committee to increase or diminish the scope of any Article submitted to it by the Conference.

Article 4 of the Draft Convention sent to the Drafting Committee specifies the prohibition of women and young persons from the use of white lead in exterior painting operations and in artistic and fine painting, the latter two terms signifying special decorative work and not the painting of pictures.

The Drafting Committee therefore had in its mind throughout in the drafting of the Convention finally submitted and passed by the Conference that the provisions of the Articles related entirely, as is set out in Article 1 of the Convention, to the painting of buildings, railway stations, or industrial establishments.

It will be noted that the Chairman and the Reporter of the Commission and all the experts who attended the Drafting Committee, with one exception, are clearly of opinion that the prohibition of the employment of males under eighteen years of age and of all females in painting where white lead is used, embodied in Article 3 and adopted by the Conference, is intended to extend only to the painting of buildings.

It would obviously lead to great confusion and might result in difficulties as regards ratification if the application of the Article in question were understood in different ways in different countries. It does not seem contrary to the practice of international law that a State ratifying an international convention should indicate at the same time what interpretation it places upon a particular phrase or clause. If this procedure were generally adopted in the present case, that is to say, if each State ratifying the Draft Convention under consideration were to indicate to the Secretary-General at the same time that in its view the prohibition contained in Article 3 applied only to the painting of buildings, an uniform application of the Convention would be obtained and the difficulties foreseen would be avoided.

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