Hillhouse Site
PO Box No 4 Thornton - Cleveleys
Blackpool FY5 4QD
Telephone: Cleveleys (STD Code 0253) 856161
Telex 67483 Iciplast Civlys

Imperial Chemical Industries PLC

Dr Carol Stack
Chemical Manufacturers' Association
2501 M Street NW
WASHINGTON DC 20037
U S A

Medical Department

Your ref | Our ref BB/MO | Tel ext 332 | Date 8 Nov 84

Dear Carol,

Thank you very much for meeting me in Washington and for giving me so much of your time. When we met, I promised to send you a copy of the UK VCM Code of Practice and the Guidance Note which goes with the Code of Practice, and the document "VCM and you", which is a document which will be given to each worker who works with VCM. The first two documents will be issued in the near future and, it is believed, in the present format. The latter document, "VCM and you", I anticipate will be altered, though the information will be in a similar vein. The changes I anticipate are on page 2, and the words, 'similar to Banti's Syndrome' will be removed, and on the penultimate page, health checks will not be offered to individuals if they cease to become a Registered worker. (In my area, we do offer medical examinations to individuals who remain within the Site perimeters, even though they are not registered. I am the only Works in the UK that offers this service).

I am also enclosing, as promised, the IOM Vinatex full and published report, along with Geoff Paddle's critique for you to use in any way you see fit.

I would like to mention the various surveys which are ongoing in the world at present with reference to VCM. I did mention these when we spoke, but feel it might be better to detail these for your information :

1) C.M.A.

I have written to Sir Richard Doll, asking about the possibility of he himself reviewing all the epidemiological data base, in order to perform a critical review for industry. I will forward the reply when I receive it.

2) Sir Richard Doll and myself are in the process of writing a Paper for publication with reference to the ASL Register. We are being helped by David Forman, who works for Sir Richard Doll, and therefore his name will go on the Paper. I myself have insisted that John Stafford's name should also be included.

/Over

SCC
4-0742

HH 2004

CONTENTS

SCC
4-0743

Notice of approval of the Code of Practice for the Control of Vinyl Chloride at Work by the Health and Safety Commission

By virtue of Section 16(1) of the Health and Safety at Work etc. Act 1974 and with the consent of the Secretary of State for Employment the Health and Safety Commission has on ..... 198- approved the Code of Practice entitled 'Control of Vinyl Chloride at Work .

The Code of Practice gives practical guidance with respect to the Control of Substances Hazardous to Health Regulations 198- (SI 198- No ....) and section 30 of the Factories Act 1961 where persons:-

(1) are employed in works in which vinyl chloride is produced, reclaimed, stored, discharged into containers, transported or used in any way whatsoever or in which vinyl chloride is converted into vinyl chloride polymers, and

(2) are likely to be affected by exposure to vinyl chloride in a working area.

The Code of Practice comes into effect on ..... 198-.

Signed

Secretary to the Health & Safety Commission
..... 198-.

Preface

1. This Code of Practice has been drawn up on the basis of joint discussions between representatives of the Confederation of British Industry, the Trades Union Congress and the Health and Safety Executive under the auspices of the Health and Safety Commission's Advisory Committee on Toxic Substances.

2. The Code has been approved by the Health and Safety Commission, with the consent of the Secretary of State, under Section 16 of the Health and Safety at Work etc. Act 1974 for the purpose of providing practical guidance with respect to the provisions of the Control of Substances Hazardous to Health Regulations 198- (SI 198- No ....) where persons:-

   (1) are employed in works in which vinyl chloride is produced, reclaimed, stored, discharged into containers, transported or used in any way whatsoever or in which vinyl chloride is converted into vinyl chloride polymers, and

   (2) are likely to be affected by exposure to vinyl chloride in a working area.

3. This Approved Code of Practice gives guidance on the requirements of the Control of Substances Hazardous to Health Regulations 198- with regard to vinyl chloride including acceptable methods of meeting those requirements. The Control of Substances Hazardous to Health Regulations 198- and this Approved Code of Practice give effect to the Directive of the Council of the European Communities (78/610/EEC) on the approximation of the laws, regulations and administrative provisions of Member States for the protection of the health of workers occupationally exposed to vinyl chloride monomer.

4. Although failure to comply with any provision of this Code is not in itself an offence, that failure may be used in criminal proceedings as evidence that a person has contravened a Regulation to which the provision relates. In such a case, however, it will be open to that person to satisfy the courts that he has complied with the Regulation in some other way.

5. Words and expressions which are defined in the Health and Safety at Work etc. Act 1974 or in the Control of Substances Hazardous to Health Regulations 198- have the same meaning in this Code unless the context requires otherwise.

6. Each section of the Code gives practical guidance on a specific Regulation, the number, title and content of which appear at the heading of each section.

Citation and commencement

Regulation 1

These Regulations may be cited as the Control of Substances Hazardous to Health Regulations 198- and shall come into operation on (198-).

Interpretation

Regulation 2

(1) In these Regulations, unless the context otherwise requires –

"the 1974 Act" means the Health and Safety at Work etc. Act 1974(a);

"adequate" means adequate having regard only to the nature of the substance and the nature and degree of exposure to substances hazardous to health; and adequately shall be construed accordingly;

"approved" means approved for the time being in writing by the Health and Safety Executive or the Health and Safety Commission as the case may be;

"approved list" means the list published by the Health and Safety Commission entitled "Information Approved for the Classification, Packaging and Labelling of Dangerous Substances" as revised or re-issued from time to time;

"characteristic properties" means the properties of a substance described in column 2 of Part I of Schedule 1 in accordance, where applicable, with the criteria set out in Part II of that Schedule;

"fumigation" means an operation in which a substance in the form of a gas, vapour or fume is released into the atmosphere to control or kill pests or other undesirable organisms and "fumigate" and "fumigant" shall be construed accordingly;

"human pathogen" means an organism liable to cause human disease;

"substance" means any natural or artificial substance whether in solid or liquid form or in the form of a gas or vapour and includes any human pathogen;

"substance hazardous to health" means

(a) a substance which is listed in Part 1A of the approved list as dangerous for supply within the meaning of the Classification, Packaging and Labelling Regulations 1984(b) and for which any indication of general nature of risk is specified as very toxic, toxic, harmful, corrosive or irritant or any other substance not so listed which by reason of its characteristic properties creates a risk to the health of any person;

(a) 1974 c.37. (b) S.I. 1984/-

(b) a human pathogen;

(c) dust of any kind, when present at a substantial concentration in air; and

(d) any other substance arising in the course of work, to which a person may be exposed and which may create a risk to the health of that person which is comparable to the risk to health created by substances to which sub-paragraph (a) above applies.

(2) In these Regulations, any reference to an employee being exposed to a substance hazardous to health is a reference to the exposure of that employee to a substance hazardous to health arising from or in connection with work which is being undertaken by his employer.

(3) In these Regulations, unless the context otherwise requires -

(a) a reference to a numbered Regulation or Schedule is a reference to the Regulation of, or Schedule to, these Regulations so numbered; and

(b) a reference to a numbered paragraph is a reference to the paragraph so numbered in the Regulation or Schedule in which that reference appears.

1. Certain words and expressions are defined in the Regulations and in Section 53 of the Health and Safety at Work etc. Act 1974 and such terms have the same meaning in this Code unless the context clearly requires otherwise.

2. The following additional definitions apply in this Code:-

(1) "Working area" means a section of a works with defined boundaries, which may comprise one or more workplaces, and which is characterised by the fact that within it an individual worker spends irregular periods of time at various work places in the course of his duty or duties, that the length of time spent at these individual work places cannot be more closely defined and that further sub-division of the working area into smaller units is not reasonably practicable;

(2) The "Annual Control Limit" means the value which should not be exceeded by the arithmetic mean concentration, averaged with respect to time, of vinyl chloride in the atmosphere to which workers in a working area are likely to be exposed, the reference period being one year and account being taken only of the concentrations measured during the periods the plant is in operation including, where necessary, maintenance time and of the duration of such periods;

(3) "Registered worker" means any worker identified under the assessment procedure of Regulation 6 as likely to be affected by occupational exposure to vinyl chloride.

(4) "Confined space" includes any chamber, tank, vat, pit, pipe, flue or similar confined space such as, for example, a reactor, duct, or bunker in which vinyl chloride vapour is present, is known to have been present or is liable to be present.

Duties under these Regulations

Regulation 3

(1) Where any duty is placed by these Regulations on an employer in respect of his employees, he shall, so far as is reasonably practicable, be under a like duty in respect of any other person who may be affected by the work activity carried on by the employer, whether at work or not, except that the duties of the employer –

(a) under Regulation 11 (health surveillance) shall not extend to persons who are not his employees; and

(b) under Regulations 10 and 12 (which relate respectively to monitoring and information, training etc) shall not extend to persons who are not his employees unless those persons are on the premises where the work is being carried on.

(2) These Regulations shall apply to a self-employed person as they apply to an employer and an employee and as if that self-employed person were both the employer and the employee, except that Regulations 9(2), 10(2), 11(1), 11(3) to (6) shall not apply to a self-employed person.

(3) Duties under these Regulations imposed upon the employer shall also be imposed upon the manager of a mine (within the meaning of Section 180 of the Mines and Quarries Act 1954[a]) in so far as those duties relate to the mine of which he is the manager and to matters under his control.

3. The Regulations place specific duties on employers, self-employed persons and employees and are in addition to general duties under the Health and Safety at Work etc. Act, under other health and safety legislation and under statutory requirements relating to other topics. Action taken to comply with the Regulations should have regard to other legislation which may apply.

4. Every employer is required to comply with all the Regulations in order to protect his employees.

5. Where an employee of one employer works at another employer's premises both employers will have duties under the Regulations. In many cases cooperation and collaboration between employers will be necessary to ensure that these duties are fulfilled.

6. Regulation 3 requires a self-employed person to comply with the Regulations for his own protection and for the protection of others.

7. An employee has a duty under s.7 of the Health and Safety at Work etc. Act 1974 to ensure his own health and that of other persons who may be affected by his acts or omissions at work. He must also cooperate with his employer so far as this is necessary to enable the employer to meet the employer's obligations. Regulation 8(2) requires employees to make full and proper use of any control measures, etc and to report defects. Regulation 11(1) of these Regulations requires an employee to attend for medical examinations and to furnish reasonable information about his health.

(a) 1954 c.70.

Prohibitions relating to certain substances

Regulation 4

8. This Regulation does not apply to vinyl chloride as the manufacture and use of this substance is not prohibited.

Application of Regulations 6 to 12

Regulation 5

(1) Regulations 6 to 12 shall have effect with a view to protecting persons against risks to their health, whether immediate or delayed, arising from exposure to substances hazardous to health except -

(a) where and to the extent that the following Regulations apply, namely -

(i) +the Asbestos Regulations 1969[a],

(ii) *the Coal Mines (Respirable Dust) Regulations 1975[b],

(iii) the Control of Lead at Work Regulations 1980[c],

(b) where the substance is hazardous to health solely by virtue of its radioactive, explosive or flammable properties, or solely because it is at a high or low temperature or a high pressure;

(c) where the risk to health is caused by a human pathogenic agent and arises directly from a person suffering from a communicable disease;

(d) where the risk to health is a risk to the health of a person to whom the substance is administered in the course of his medical treatment.

(2) In paragraph 1(d) "medical treatment" means medical or dental examination or treatment conducted in pursuance of a request or requirement for such examination or treatment made by a fully or provisionally registered medical or dental practitioner or some other suitably qualified person and includes any such examination or treatment conducted for the purposes of research.

(3) Nothing in these Regulations shall prejudice any requirement imposed by or under any enactment relating to public health or the protection of the environment.

(a) S.I. 1969/690 (b) S.I. 1975/1433, amended by S.I 1978/807 (c) S.I. 1980/1248

+ these regulations are to be replaced by the Control of Asbestos at Work Regulations 198-.

* new respirable dust regulations are proposed under Mines and Quarries legislation: they will deal with respirable dust in all mines. The exemption for respirable dust in coal mines will need to be extended accordingly.

Assessment of health risks created by substances hazardous to health

Regulation 6

(1) An employer shall not carry on any work which may expose any employee to any substance hazardous to health unless he has made an adequate assessment of the risks created by the substance to the health of those employees.

(2) Without prejudice to the generality of paragraph (1), that assessment shall –

(a) identify the nature of the substance and of the risk to health to which employees may be exposed and the nature and degree of exposure which may occur during the course of the work; and

(b) set out the steps to be taken in accordance with these Regulations to avoid those risks to health.

(3) Where work which may expose any employee to substances hazardous to health was commenced before the coming into operation of these Regulations or within six months after that date, it shall be a sufficient compliance with paragraph (1) if the responsible person makes the assessment required by that paragraph within six months after the date of coming into operation of these Regulations.

(4) The assessment required by paragraph (1) shall be reviewed forthwith and a new assessment substituted where –

(a) there is evidence to suspect that the assessment is no longer valid, or

(b) there has been a significant change in the work to which the assessment relates.

9. Assessment of occupational exposure to substances hazardous to health is a prerequisite for deciding what action is necessary for the control of that exposure under Regulation 9. During the assessment, sufficient basic information should be obtained or will be available to enable an informed judgement to be made on the nature and degree of that exposure. An initial assessment should be made before work involving vinyl chloride begins and validated afterwards where necessary.

10. The exposure to vinyl chloride which should be considered by the employer is that of –

(a) his employees engaged upon work with vinyl chloride and other of his employees who could be affected by the work activity;

(b) persons at his premises or place of work who are not his employees but who are, or may be, exposed to vinyl chloride, e.g. contractors maintaining plant;

(c) other persons who may be affected by the work activity, e.g. persons living near the workplace who may be affected by emissions or discharges from the workplace.

11. The employer should ensure that whoever carries out the assessment is competent for the purpose and has received adequate information, instruction and training. The self-employed person should either carry out the assessment himself or engage a person to do it on his behalf.

SCC
4-0750

12. In obtaining information on the degree of exposure, the person carrying out the assessment should consider the pattern of exposure, its frequency, duration and variations and should take into account the possibility of unusual circumstances such as breakdown of equipment or emergencies;

13. The data on the nature and degree of exposure should be used for deciding on appropriate action under each of the Regulations relating to information, instruction and training, control, personal protective equipment, use and maintenance of control measures, monitoring, records and health surveillance.

14. The results of the assessment should be recorded in writing and a copy provided on request at any time during working hours to employees and/or their representatives at the place of work.

15. The assessment should be revised whenever there is any evidence or reason to suspect that it is no longer valid, as a result of, for example –

(a) a significant change in the work activity; this could be a change in material, plant, processes or methods of work that might affect the nature or degree of exposure, such as the raising of process temperatures, changes in the form of substance or changes in engineering controls;

(b) monitoring at the work place revealing an increase in exposure;

(c) health surveillance;

(d) new information on health risks.

Control of exposure to substances hazardous to health

Regulation 7

(1) Every employer shall ensure that the exposure of his employees to substances hazardous to health is either prevented or adequately controlled, having regard in particular to any control limit which the Health and Safety Commission has approved for that substance.

(2) Prevention or adequate control of exposure under paragraph (1) shall be secured, so far as is reasonably practicable, by means other than the provision of personal protective equipment.

(3) Where the measures taken in accordance with paragraph (2) do not prevent, or provide adequate control of, exposure to substances hazardous to health of employees on the premises at which the work is being carried on, then, in addition to taking those measures, the employer shall provide those employees with such suitable personal protective equipment as will adequately control their exposure to substances hazardous to health.

(4) Where the personal protective equipment provided in accordance with paragraph (3) includes respiratory protective equipment and that respiratory protective equipment is provided for use in any of the circumstances set out in Schedule 3, then it shall be of a type approved or shall conform to a standard approved, in either case, by the Health and Safety Executive in respect of those circumstances.

(5) Nothing in this Regulation shall prejudice the requirements of Section 55 of the Mines and Quarries Act[a] and in particular the requirements of subsection (2)(a) of that section.

(a) 1954 c.70.

SEE 4-075;

16. Control should be considered adequate when exposure to vinyl chloride is kept within the Control Limits and as far below them as is reasonably practicable in the particular circumstances.

17. The annual Control Limit for vinyl chloride vapour in air is 3 ppm and is the value which should not be exceeded by the mean concentration, averaged with respect to time, of vinyl chloride monomer in the atmosphere of a working area. Only periods of plant operation including, where necessary, any maintenance time should be taken into account. This annual Control Limit is supplemented by an 8 hour time weighted average (TWA) Control Limit of 7 ppm which relates to personal exposure with the proviso that over the period of a year the exposure of an individual should not exceed the annual Control Limit.

18. The objective in applying material, plant and process control measures is to ensure the adequate control of exposure without recourse to personal protective equipment as far as is reasonably practicable. Control of exposure should be achieved by engineering controls as far as is reasonably practicable in the light of current medical and technical knowledge and the circumstances of use.

19. Irrespective of the size of plant, the following control measures relating to materials, plant and processes should be applied where reasonably practicable to prevent the exposure of personnel to vinyl chloride:-

(1) the design, installation, operation and maintenance of plant and processes should eliminate or minimise the risk of leakages of vinyl chloride from any part of plant into the working environment;

(2) plant from which there is a likelihood that emissions may occur should preferably be sited in the open air. If this is not reasonably practicable, good general ventilation should be provided in rooms and buildings in which processes involving vinyl chloride are undertaken;

(3) the design and operation of plant and processes should minimise the need for maintenance or other work requiring the breaching and/or entry of plant in which vinyl chloride is liable to be present;

(4) local exhaust ventilation systems should be provided at parts of plant where process or maintenance operations are undertaken by employees during which emissions of vinyl chloride may occur or which involve entry into confined spaces where vinyl chloride may be present;

(5) local exhaust ventilation should be provided at known points of persistent emission of vinyl chloride vapour from plant where these cannot be eliminated by other technical measures;

(6) adequate venting arrangements should be provided for ensuring that exhaust gases and vapour mixtures displaced from storage and process vessels during purging and filling or emitted from plant by the operation of pressure relief devices do not contaminate the working atmosphere nor any neighbouring locations where work is in progress. Such arrangements must conform to the requirements of HM Industrial Air Pollution Inspectorate in relation to the dispersal of emissions;

20. Any failure or malfunction of a part of the plant or apparatus or any other occurrence that gives rise to, or is liable to give rise to, abnormal increases in the concentration of vinyl chloride in the working environment should be reported, investigated and remedied without delay.

21. In order to detect abnormal increases in the concentration of vinyl chloride in the working environment, a monitoring system suitable for this purpose should be provided in places where such increases may occur. Similar precautions should be taken during periods of plant maintenance. The following concentrations of vinyl chloride in the atmosphere of a working area should be treated as alarm levels, signalling the need for remedial action:-

(1) 15 ppm when measured over a period of 1 hour,

or (2) 20 ppm when measured over a period of 20 minutes,

or (3) 30 ppm when measured over a period of 2 minutes.

22. Following an alarm, adequate and suitable respiratory protective equipment should be worn by any person remaining in the area until the alarm situation has disappeared.

23. Where the exposure of personnel to airborne concentrations of vinyl chloride is liable to exceed the 8 hour TWA Control Limit and the provision of further control measures for materials, plant and processes is not reasonably practicable, workers should be provided with adequate and suitable respiratory protective equipment for use in the airborne concentrations of vinyl chloride to which they are liable to be exposed.

24. The term 'adequate' with respect to respiratory protective equipment refers to the ability of the equipment to protect the wearer; 'suitable' refers to the correct matching of the equipment to the job and the person. To be considered adequate and suitable, respiratory protective equipment must be correctly selected and used. In the case of vinyl chloride this means compressed air line or self-contained breathing apparatus of a type approved by or conforming to a standard approved by the Health and Safety Executive.

25. Adequate and suitable respiratory protective equipment must be worn:-

(1) by any person remaining in a working area where exposure is liable to exceed the 8 hour TWA Control Limit, eg to check for and eliminate leakage, following an alarm as a result of abnormal increases in the concentration of airborne vinyl chloride due to failure or malfunction of plant not withstanding the requirements of paragraph 22.

(2) when opening equipment which may release appreciable quantities of vinyl chloride to the atmosphere, eg during the maintenance or repair of equipment and when it is not reasonably practicable to remove the vapour by local exhaust ventilation. No such operation should be conducted without a permit-to-work issued by a responsible person designated by the employer for this purpose. Precautions should be taken to ensure that other unprotected personnel in the vicinity are not liable to be exposed to concentrations of vinyl chloride above the 8 hour TWA Control Limit following release;

(3) during entry into confined spaces where concentrations of vinyl chloride in air are above the 8 hour TWA Control Limit or in which the atmosphere is, or is liable to become, deficient in oxygen to an extent which is likely to be injurious to health.

26. Under normal circumstances, where vinyl chloride is present within reliable enclosed plant, there may be no need for the wearing of special protective clothing by process workers. However, certain circumstances, such as entry into confined spaces or some maintenance work, may require the use of special protective clothing. Such situations should be identified as part of the general assessment. The standard of clothing necessary will depend upon the nature and degree of exposure.

27. Plant should be designed and operated so that the number of occasions on which a vessel has to be entered is reduced to the minimum and the actual time spent inside on such occasions should be kept as short as possible.

28. Before a person enters a confined space for any purpose, precautions should be taken to reduce and maintain the airborne concentration of vinyl chloride inside the space as low as is practicable. Concentrations of vinyl chloride should be measured by a suitable analytical method.

29. In order to reduce the potential short-term and long-term risks, entry into a confined space should be controlled by a permit-to-work system. A permit-to-work issued to any person should specify, among other things, the type and standard of personal protective equipment to be worn.

30. Except when the level of vinyl chloride vapour is below the 8 hour TWA Control Limit and will remain so during the period of entry and/or when the atmosphere is not deficient in oxygen, adequate and suitable respiratory protective equipment must be worn. Any permit-to-work which allows a person to enter a confined space without adequate and suitable respiratory protective equipment should state clearly that the person issuing the permit-to-work is satisfied that the concentration of vinyl chloride in air is below, and will remain below, the 8 hour TWA Control Limit during the period of entry and that in the light of the measures taken he does not foresee any circumstances in which the person entering the vessel may be exposed to concentrations of vinyl chloride in excess of that limit, ie all sources of vapour which might enter the confined space have been effectively isolated.

Use of control measures, etc

Regulation 8

(1) Every employer who provides any control measure, personal protective equipment or other thing or facility pursuant to these Regulations shall ensure that it is properly used or applied as the case may be.

(2) Every employee shall make full and proper use of any control measure, personal protective equipment or other thing or facility provided pursuant to these Regulations and if he discovers any defect therein he shall report it forthwith to his employer.

31. Procedures should be established for ensuring that control measures, personal protective equipment and any other thing or facility are properly used or applied. Employees should use the control measures in the way they are intended to be used.

Maintenance of control measures etc

Regulation 9

(1) Every employer who provides any control measure, personal protective equipment or other thing or facility pursuant to these Regulations shall ensure that it is maintained in an efficient state, in efficient working order and good repair.

(2) Every employer shall, where appropriate, keep a suitable record of work carried out in accordance with paragraph (1) and that record shall be kept for two years from the date on which it was made.

32. All plant, especially that from which vinyl chloride may escape or which is provided for the purpose of controlling exposure to vinyl chloride, should be maintained to a high standard in order to limit the exposure of workers to vinyl chloride. Where ventilation plant is provided in pursuance of Regulation 7, maintenance should include a visual check at least once per week to identify obvious defects and a thorough examination and test by a competent person at least once a year.

33. Maintenance procedures should also include regular and thorough examinations by a competent person at appropriate intervals of those parts of plant or apparatus at which leakages of vinyl chloride are likely to develop over a period of time. A suitable instrument giving a direct read-out of the concentration of vinyl chloride in air should be used for leak detection during such examinations. Regular examinations and tests should also be made of all ventilation equipment and other technical control measures by a competent person, using instruments where appropriate to check the performance of such equipment.

34. All personal protective equipment should be maintained in a clean state, in good repair and in efficient working order. It should be inspected on a regular basis, defects identified and remedied immediately. The maintenance schedules for respiratory protective equipment should include the source of compressed air in the case of compressed air line or self-contained breathing apparatus. The supplied air should contain not more than 5 ppm of carbon monoxide or 500 ppm carbon dioxide or 0.5 mg m^{-3} oil mist and, except for these, should be free from contamination by dust, dirt, metallic particles or any other toxic or irritant substances. The maintenance schedules should also include the air line, particularly the connections, and proper cleaning and reissue of equipment.

35. No respiratory protective equipment which has been used should be worn again by another person unless it has been thoroughly cleaned and disinfected.

36. Records of maintenance and inspection of respiratory protective equipment should include the following information:-

(a) name and description of equipment

(b) person issued to, if on personal issue;

(c) date of inspection;

(d) description of any defect found and action taken;

(e) name, signature and appointment of person making inspection.

Monitoring at the workplace

Regulation 10

10. (1) Where it is requisite for protecting the health of employees, the employer shall -

(a) have adequate monitoring procedures for monitoring the exposure of his employees to substances hazardous to health at the premises where the work is carried on; and

(b) monitor that exposure in accordance with those procedures.

(2) The employer shall keep a suitable record of any monitoring carried out in accordance with paragraph (1) and that record or a suitable summary thereof shall be kept for 30 years from the date on which it was made.

37. Routine atmospheric sampling for vinyl chloride should be carried out in order to estimate the exposure of individuals, including any maintenance workers, and to monitor the effectiveness of material, plant and process controls.

38. The objectives of monitoring concentrations of airborne vinyl chloride in working areas are:-

(1) to verify that any technical measures provided are controlling exposure of persons to vinyl chloride to the Control Limits and as far below them as is reasonably practicable;

(2) to detect any abnormal increases in vinyl chloride-in-air levels occurring as a result of the failure or malfuntion of some part of the plant or apparatus with reference to the short term alarm levels for vinyl chloride;

(3) to provide adequate records of the exposure of individuals for the purpose of epidemiology.

39. The arrangements for monitoring require careful planning to achieve effective and efficient use of resources. A formal air monitoring plan should be drawn up and made known to all employees working in areas where vinyl chloride is liable to be present. The plan should contain details of the air monitoring procedures and equipment that are to be used to meet the objectives stated above, including details of:-

(a) the parts of plant, working areas and occupational groups of employees to be monitored;

(b) the type of air sampling to be carried out in each of these cases, ie personal air sampling and/or fixed point air sampling;

(c) the frequency of air sampling and the siting of air sampling equipment so that the results obtained accurately reflect the conditions to which personnel are likely to be exposed;

(d) the types of sampling and analytical equipment to be used;

(e) arrangements for the testing and calibration of sampling and analytical equipment;

(f) the statistical analysis and presentation of the air sampling results.

The information obtained from the initial and any subsequent assessments should be used when planning or revising the details of the monitoring procedures.

40. Static sampling will be the main method used routinely for assessing compliance with the annual Control Limit and detection of alarm levels. In order to assess compliance with the 8 hour TWA Control Limit, personal monitoring will be necessary.

41. Static sampling may be either by discontinuous or continuously operating systems, except at enclosed vinyl chloride polymerisation plants where continuous or permanent sequential methods must be used.

42. Where discontinuous air sampling techniques are used, the frequency of measurements and number per year should be sufficient to be able to predict with a statistical confidence coefficient of at least 95% that there is compliance with the annual Control Limit, in other words that the Control Limit value falls above the upper 95% confidence limit for the true annual arithmetic mean for the working area. The required frequency will thus depend upon the variability of concentrations with time.

43. Where vinyl chloride is handled intermittently, monitoring of exposures by personal sampling should be done sufficiently often to ensure that the technical control measures and working procedures adopted are adequate to keep exposure below the Control Limits.

44. Large working area will normally require more than one monitoring point and in such cases the average value of the measurements recorded should be considered as the representative value when assessing compliance with the annual Control Limit.

45. The results of all atmospheric monitoring at fixed points should be available for inspection by personnel working in areas where vinyl chloride is liable to be present and their representatives at any time during a working period. Where continuously operating multi-point sequential sampling methods are employed, the results should be displayed within two hours of the end of each shift sampled. Where discontinuous methods and/or personal monitoring are used, the results should be displayed within 24 hours of completion of the sampling period. All results should continue to be displayed for at least two days.

46. Records of maintenance and monitoring should provide sufficient information to enable employers, self employed persons, persons in control of premises, employees and/or their representatives at the workplace, and enforcing authorities to:-

(a) ascertain whether maintenance or monitoring has been done and completed;

(b) monitor the performance or effectiveness of the measures taken to control exposure;

(c) gain access to information on any defects or matters requiring attention and on the remedial action taken;

(d) identify exposure trends.

47. The records should contain at least the following information:-

(1) Leakages of vinyl chloride

(a) description of area or plant covered by inspection;

(b) date of inspection;

(c) time of shift;

(d) statement of the defects or leaks found that might result in exposure to vinyl chloride vapour above the 8 hour TWA Control Limit or alarm levels;

(e) indication of action taken following discovery of fault;

(f) name, signature and appointment of person making inspection.

(2) Examinations of ventilation equipment

(a) location and type of plant;

(b) date of examination;

(c) results of instrument readings;

(d) defects noted;

(e) name, signature and appointment of person making examination.

(3) Excursions above the alarm levels as detected during area monitoring

(a) part of factory to which the record refers;

(b) precise location within the factory;

(c) date, time and (where known) duration;

(d) maximum and time weighted average concentrations recorded;

(f) result of investigation;

(g) action taken;

(h) name, signature and appointment of person making inspection.

(4) Personal monitoring

The results of personal monitoring, which should include name of employee, date, time and duration of exposure, time weighted average concentrations recorded and precise location within the factory, should be summarised on a monthly basis by job category in each plant in addition to shift results.

48. In the areas where continuously operating multi-point sequential sampling and analysing equipment is installed, results should be summarised on a shift basis for each identifiable working area showing the average concentration in that area. Basic details of the position and number of sampling points together with the frequency of sampling and analytical methods used should be included at the beginning of the series of records and thereafter need only be recorded when changes occur in the monitoring procedure.

49. In those working areas where sampling is not carried out on each shift, the time weighted average results should be recorded and summarised on a monthly basis showing the average concentration at each location with an analysis of the distribution of the results.

50. If respiratory protective equipment is worn by any personnel during air monitoring exercises, this should be recorded together with the nature and nominal efficiency of the equipment to enable an estimate of the 'actual' exposure to be made.

51. Records may be kept in any suitable form, including microfilm, computer or similar techniques, provided that they satisfy the foregoing requirements and can be retrieved readily when required.

52. Records of air monitoring and of the type and duration of work by registered workers should be kept for at least 30 years. Air monitoring results may be kept in the form of monthly summaries, but in this case the detailed shift records on which they are based should be kept for at least 1 year. Other records of leakages of vinyl chloride, examination of ventilation equipment and inspection of respiratory protective equipment should be kept for at least 2 years.

Health surveillance

Regulation 11

11 (1) Every employer shall ensure that an adequate occupational health record relating to each of his employees who is exposed to a substance hazardous to health is maintained and that record or a copy thereof is kept for at least 50 years from the date of the last entry made in it.

(2) Where it is requisite for protecting the health of employees who are or are liable to be exposed to a substance hazardous to health, the employer shall ensure that such employees are under adequate and suitable health surveillance which shall, in appropriate cases, include medical surveillance under the supervision of an employment medical adviser or appointed doctor.

(3) An employee to whom this Regulation applies shall, when required by his employer and at the cost of the employer, present himself during his working hours for such examination and tests as may be required for the purposes of paragraph (2) and shall furnish the person conducting the health surveillance with such information concerning his health as that person may reasonably require.

(4) Where health surveillance is carried out on the premises of the employer, the employer shall ensure that suitable facilities are made available for the purpose.

(5) On reasonable notice being given, the employer shall allow any of his employees access to the occupational health record which relates to him.

(6) Where an employee has been exposed to a substance hazardous to health and an employment medical adviser or appointed doctor has certified by an entry in his health record that medical surveillance should be continued after his exposure to that substance has ceased, the employer shall ensure that the medical surveillance of that employee is continued in accordance with that entry while he is employed by the employer or unless that entry has been cancelled by an employment medical adviser or appointed doctor.

(7) An entry in the health record made in accordance with paragraph (6) may specify the nature and frequency of the medical surveillance required and the period for which it is to be continued.

(8) Where an employee is liable to be exposed to any substance hazardous to health referred to in Schedule 4 and an employment medical adviser or appointed doctor has certified in the health record of that employee that in his professional opinion that employee should not be engaged in work which exposes him to that substance or that he should only be so engaged under conditions specified in the record, the employer shall not permit the employee to be engaged in such work except in accordance with the conditions, if any, specified in the health record unless that entry has been cancelled by an employment medical adviser or appointed doctor.

(9) Where an employee or employer is aggrieved by a decision of an employment medical adviser or appointed doctor under paragraph (8), he may, by an application in writing made to the Executive within 28 days of the date on which he was notified of the decision apply for that decision to be reviewed, and in such a case the Executive shall review that decision and the result of that review shall be notified to the employee and employer and entered on the health record of that employee by an employment medical adviser.

(10) In this Regulation –

"appointed doctor" means a fully registered medical practitioner who is appointed for the time being in writing by the Health and Safety Executive for the purposes of this Regulation;

"employment medical adviser" means an employment medical adviser appointed under Section 56 of the 1974 Act;

"health surveillance" includes biological testing.

53. The employer should ensure that any employee who is designated as a registered worker, is kept under medical surveillance by an Employment Medical Adviser or appointed doctor. The employer should ensure, before designating any person as a registered worker, that the person is medically assessed by an Employment Medical Adviser or appointed doctor as to his fitness to work with vinyl chloride. While he remains a registered worker, each person should be subject to medical reassessment:-

(a) at intervals of not more than 12 months;

(b) if he has reported symptoms which could be attributable to vinyl chloride exposure;

(c) if, in the opinion of the doctor, he requires further medical assessment;

(d) when he has been absent from work because of any illness for 4 weeks or more.

54. Other persons at work on site and contractors' employees should also be listed as registered workers where the assessment warrants such action.

55. Health surveillance of registered workers is intended to establish base line medical information about such workers and to review their continuing fitness for controlled exposure to vinyl chloride. Registration and health surveillance could also be of value in future epidemiological studies.

56. The medical assessment of each individual is the responsibility of the doctor concerned but will normally include:-

(a) a full medical and occupational history;

(b) a clinical assessment with particular reference to the abdomen, skin and extremities, and

(c) such further tests, including radiological examination and laboratory tests, as may be indicated by the results of (a) or (b).

57. The employer should ensure that the leaflet "Vinyl Chloride and You" is given to each registered worker at the initial examination. Copies can be obtained free of charge from any office of the Health and Safety Executive.

58. The employer should ensure that each employee is aware that he has the right to request a written record of the results of any health surveillance procedures, including biological monitoring procedures, performed on him.

59. The employer should also ensure that, where biological monitoring procedures and health surveillance are performed, employees or their representatives at the place of work are provided with a written record of the anonymous collective results at appropriate intervals.

60. Arrangements should be made for any employee who is a registered worker to present himself, during his normal working hours, for medical examinations and any additional tests as may be necessary. Employees should cooperate in such examinations and tests.

61. The basic occupational health record of a registered worker's health surveillance should consist of at least the following information:-

surname, forenames, birth surname, sex, date of birth, place of birth, (town and country), permanent address, National Insurance Number, National Health Service Number, date of commencement of present employment, and a historical record of jobs performed whilst in that employment, with appropriate details to indicate likely exposure.

62. These records may be kept in any suitable form provided that they satisfy the foregoing requirements and can be retrieved readily when required. The records of health surveillance should be kept in a form compatible with and capable of being linked to those for monitoring, so that it is possible to compare the nature and degree of exposure to vinyl chloride with effects on health.

Information, instruction and training for employees who may be exposed to substances hazardous to health

Regulation 12

(1) An employer who undertakes work which may expose any of his employees to substances hazardous to health shall provide that employee with such information, instruction and training as is adequate for him to know -

(a) the nature of the substance and of the risks to health created by such exposure; and

(b) the precautions which should be taken.

(2) Without prejudice to the generality of paragraph (1), the information provided under that paragraph shall include -

(a) information on the results of any monitoring at the workplace in accordance with Regulation 10 and in particular, in the case of any substance hazardous to health for which the Health and Safety Commission has approved a control limit, the employee shall be informed forthwith if the results of such monitoring show that the control limit has been exceeded; and

(b) information on the collective results of any health surveillance undertaken in accordance with Regulation 11(2) in a form calculated to prevent it from being identified as relating to any particular person.

Information

63. The information provided to employees must be adequate to ensure that persons at work on the premises are aware of:-

(1) the health hazards connected with vinyl chloride;

(2) the result of any assessment of occupational exposure to vinyl chloride;

(3) the results of monitoring at the workplace;

(4) the control measures, including permits-to-work and limitations of access, etc, relating to materials, plant and processes and the reasons for them;

(5) the reasons for personal protective equipment and clothing and the jobs where these are necessary;

(6) the role of health surveillance and their duty to attend for health surveillance procedures;

(7) the procedures for reporting defects in plant and equipment;

(8) the procedure for joint consultation on vinyl chloride.

This information should be brought to the attention of employees at regular intervals.

64. Without prejudice to the detailed requirements of Regulations 6 and 11, employees and/or their representatives at the workplace should be provided with information on the risks at the workplace from exposure to vinyl chloride, the results of measurements and the precautions taken to comply with the Control of Substances Hazardous to Health Regulations 198- and this Approved Code of Practice.

Instruction

65. The instruction given to employees must be adequate to ensure that persons at work on the premises do not endanger themselves or others through exposure to vinyl chloride. In particular, the instruction must be adequate for them to:-

(1) know what they should do, what precautions they should take and when they should be taken;

(2) know the procedures to be followed in an emergency.

Training

66. Training must be adequate to ensure that persons at work on the premises can effectively apply and use:-

(1) material, plant and process controls;

(2) personal protective equipment and clothing;

(3) the emergency measures.

SCHEDULE 1 Regulation 2(1)

Characteristic properties of certain substances hazardous to health

PART I

Table of classes and characteristic properties

Column 1 Class of Substance	Column 2 Characteristic properties
Very toxic	A substance which if it is inhaled or ingested or it penetrates the skin may involve extremely serious acute or chronic health risks and even death.
Toxic	A substance which if it is inhaled or ingested or it penetrates the skin may involve serious acute or chronic health risks and even death.
Harmful	A substance which if it is inhaled or ingested or if it penetrates the skin may involve limited health risks.
Corrosive	A substance which may on contact with living tissues destroy them.
Irritant	A non-corrosive substance which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
Carcinogenic	A substance which if it is inhaled or ingested or if it penetrates the skin may induce cancer in man or increase its incidence.
Teratogenic	A substance which if it is inhaled or ingested or it penetrates the skin may involve a risk of subsequent non-hereditable birth defects in offspring.
Mutagenic	A substance which if it is inhaled or ingested or it penetrates the skin may involve a risk of hereditable genetic defects.

PART II

Criteria for very toxic, toxic or harmful substances

"Very toxic", "toxic" and "harmful" mean in relation to a substance hazardous to health that the substance has a toxicity falling within the range set out in the table below for that category.

Category	Median lethal dose (LD_{50})		Median lethal concentration (LC_{50}) absorbed by inhalation in rat mg/litre (4 hours)
	Absorbed orally in rat mg/kg	Absorbed percutaneously in rat or rabbit mg/kg	
Very toxic	$\leqslant$ 25	$\leqslant$ 50	$\leqslant$ 0.5
Toxic	$>$ 25 to 200	$>$ 50 to 400	$>$ 0.5 to 2
Harmful	$>$ 200 to 2000	$>$ 400 to 2000	$>$ 2 to 20

If facts show that for the purposes of classification it is inadvisable to use LD_{50} or LC_{50} values as a principal basis because the substances produce other effects, the substances shall be classified according to the magnitude of these effects.

SCHEDULE 3 Regulation 7(4)

Circumstances in which respiratory protective equipment must be approved or conform to an approved standard

1. Regulation 7(4) (which requires respiratory protective equipment to be of a type approved, or to a standard approved, by the Health and Safety Executive) shall apply where respiratory protective equipment is provided in the circumstances set out in the following paragraphs.

2. Where work is carried on in an atmosphere which is rendered immediately dangerous to life by a substance hazardous to health.

3. Where the respiratory protective equipment is provided to protect employees against atmospheres containing one or more of the following –

(a) the following chemical elements or any compound of these elements, namely –

antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, indium, manganese, mercury, nickel, osmium, platinum, rhodium, selenium, silver, tellurium, thallium, uranium and vanadium;

(b) acrylonitrile, ammonia, arsine, benzene, bromine, carbon disulphide, carbon monoxide, chlorine, cyanides (organic and inorganic), cyanogen, cyanogen chloride, ethylene oxide, fluorine, hydrogen fluoride, hydrogen sulphide, isocyanates (–NCO), methyl bromide, phosgene, phosphine, sulphur dioxide, sulphur trioxide, sulphuric acid and vinyl chloride monomer;

(c) crystalline silica;

(d) a dangerous pathogen listed in Schedule 1 to the Health and Safety (Dangerous Pathogens) Regulations 1981[a];

(e) any medicinal product which is –

(i) a medicinal product as defined in section 130 of the Medicines Act 1968[b], or

(ii) a substance specified in an order made under section 104 or 105 of the Medicines Act 1968 which is for the time being in force and which directs that specified provisions of that Act shall have effect in relation to that substance as such provisions have effect in relation to medicinal products within the meaning of that Act.

(a) S.I. 1981/1011 (b) 1968 c.67

Note: The list is a rationalisation and extension of existing requirements to use approved respiratory protective equipment contained in the Factories Act and associated Regulations: ie, it covers circumstances where breathing apparatus is required, and circumstances involving hazardous substances covered by various Regulations. Other named substances or categories of substances have been added where there is considered to be a high risk of injury to health should the respiratory protective equipment used not be adequate.

HEALTH AND SAFETY

The Control of Substances Hazardous to Health Regulations 198-

Draft proposals for Regulations to be made under sections 15(1), (2), (3)(a), (4), (5)(b), (6)(a) and (b) and (9), and 82(3)(a) of, and paragraphs 1(1)(b) and (c) and (2), 2, 6(1), 8, 9, 11, 13(1) and (3), 14, 15(1) and 16 of Schedule 3 to, the Health and Safety at Work etc. Act 1974.

ARRANGEMENT OF REGULATIONS

Citation and commencement

1. These Regulations may be cited as the Control of Substances Hazardous to Health Regulations 198- and shall come into operation on (198-).

Interpretation

2.- (1) In these Regulations, unless the context otherwise requires -

"the 1974 Act" means the Health and Safety at Work etc. Act 1974[a];

"adequate" means adequate having regard only to the nature of the substance and the nature and degree of exposure to substances hazardous to health; and adequately shall be construed accordingly;

"approved" means approved for the time being in writing by the Health and Safety Executive or the Health and Safety Commission as the case may be;

"approved list" means the list published by the Health and Safety Commission entitled "Information Approved for the Classification, Packaging and Labelling of Dangerous Substances" as revised or re-issued from time to time;

"characteristic properties" means the properties of a substance described in column 2 of Part I of Schedule 1 in accordance, where applicable, with the criteria set out in Part II of that Schedule;

"fumigation" means an operation in which a substance in the form of a gas, vapour or fume is released into the atmosphere to control or kill pests or other undesirable organisms and "fumigate" and "fumigant" shall be construed accordingly;

"human pathogen" means an organism liable to cause human disease;

"substance" means any natural or artificial substance whether in solid or liquid form or in the form of a gas or vapour and includes any human pathogen;

"substance hazardous to health" means -

(a) a substance which is listed in Part 1A of the approved list as dangerous for supply within the meaning of the Classification, Packaging and Labelling Regulations 1984[b] and for which any indication of general nature of risk is specified as very toxic, toxic, harmful, corrosive or irritant, or any other substance not so listed which by reason of its characteristic properties creates a risk to the health of any person;

(b) a human pathogen;

(c) dust of any kind, when present at a substantial concentration in air; and

(d) any other substance arising in the course of work, to which a person may be exposed and which may create a risk to the health of that person which is comparable to the risk to health created by substances to which sub-paragraph (a) above applies.

(a) 1974 c.37. (b) S.I. 1984/-

(2) In these Regulations, any reference to an employee being exposed to a substance hazardous to health is a reference to the exposure of that employee to a substance hazardous to health arising from or in connection with work which is being undertaken by his employer.

(3) In these Regulations, unless the context otherwise requires -

(a) a reference to a numbered Regulation or Schedule is a reference to the Regulation of, or Schedule to, these Regulations so numbered; and

(b) a reference to a numbered paragraph is a reference to the paragraph so numbered in the Regulation or Schedule in which that reference appears.

Duties under these Regulations

3.- (1) Where any duty is placed by these Regulations on an employer in respect of his employees, he shall, so far as is reasonably practicable, be under a like duty in respect of any other person who may be affected by the work activity carried on by the employer, whether at work or not, except that the duties of the employer -

(a) under Regulation 11 (health surveillance) shall not extend to persons who are not his employees; and

(b) under Regulations 10 and 12 (which relate respectively to monitoring and information, training etc.) shall not extend to persons who are not his employees unless those persons are on the premises where the work is being carried on.

(2) These Regulations shall apply to a self-employed person as they apply to an employer and an employee and as if that self-employed person were both the employer and the employee, except that Regulations 9(2), 10(2), 11(1), 11(3) to (6) shall not apply to a self-employed person.

(3) Duties under these Regulations imposed upon the employer shall also be imposed upon the manager of a mine (within the meaning of section 180 of the Mines and Quarries Act 1954[a]) in so far as those duties relate to the mine of which he is the manager and to matters under his control.

Prohibitions relating to certain substances

4.- (1) Those substances described in column 1 of Schedule 2 are prohibited to the extent set out in the corresponding entry in column 2 of that Schedule.

(2) The importation into the United Kingdom of the following substances and articles is prohibited, namely -

(a) 2-naphthylamine, benzidine, 4-aminobiphenyl, 4-nitrobiphenyl, their salts and any substance containing any of those compounds, except, as the by-product of a chemical reaction, in any other substance in a total concentration not exceeding one per cent[1];

(b) matches made with white phosphorus;

(a) 1954 c.70.

(1) to be revised in line with a forthcoming EC Directive.

and any contravention of this paragraph shall be punishable under the Customs and Excise Management Act 1979[a] and not as a contravention of a health and safety regulation.

(3) A person shall not supply during the course of or for use at work, any substance or article the importation of which is prohibited by paragraph (2).

Application of Regulations 6 to 12

5.- (1) Regulations 6 to 12 shall have effect with a view to protecting persons against risks to their health, whether immediate or delayed, arising from exposure to substances hazardous to health except -

(a) where and to the extent that the following Regulations apply, namely -

(i) +the Asbestos Regulations 1969[b];

(ii) *the Coal Mines (Respirable Dust) Regulations 1975[c];

(iii) the Control of Lead at Work Regulations 1980[d];

(b) where the substance is hazardous to health solely by virtue of its radioactive, explosive or flammable properties, or solely because it is at a high or low temperature or a high pressure;

(c) where the risk to health is caused by a human pathogenic agent and arises directly from a person suffering from a communicable disease;

(d) where the risk to health is a risk to the health of a person to whom the substance is administered in the course of his medical treatment.

(2) In paragraph 1(d) "medical treatment" means medical or dental examination or treatment conducted in pursuance of a request or requirement for such examination or treatment made by a fully or provisionally registered medical or dental practitioner or some other suitably qualified person and includes any such examination or treatment conducted for the purposes of research.

(3) Nothing in these Regulations shall prejudice any requirement imposed by or under any enactment relating to public health or the protection of the environment.

(a) 1979 c.2. (b) S.I. 1969/690.

(c) S.I. 1975/1433, amended by S.I. 1978/807. (d) S.I. 1980/1248.

+ these regulations are to be replaced by the Control of Asbestos at Work Regulations 198-.

* new respirable dust regulations are proposed under Mines and Quarries legislation: they will deal with respirable dust in all mines. The exemption for respirable dust in coal mines will need to be extended accordingly.

Assessment of health risks created by substances hazardous to health

6.- (1) An employer shall not carry on any work which may expose any employee to any substance hazardous to health unless he has made an adequate assessment of the risks created by the substance to the health of those employees.

(2) Without prejudice to the generality of paragraph (1), that assessment shall -

(a) identify the nature of the substance and of the risk to health to which employees may be exposed and the nature and degree of exposure which may occur during the course of the work; and

(b) set out the steps to be taken in accordance with these Regulations to avoid those risks to health.

(3) Where work which may expose any employee to substances hazardous to health was commenced before the coming into operation of these Regulations or within six months after that date, it shall be a sufficient compliance with paragraph (1) if the responsible person makes the assessment required by that paragraph within six months after the date of coming into operation of these Regulations.

(4) The assessment required by paragraph (1) shall be reviewed forthwith and a new assessment substituted where -

(a) there is evidence to suspect that the assessment is no longer valid, or

(b) there has been a significant change in the work to which the assessment relates.

Control of exposure to substances hazardous to health

7.- (1) Every employer shall ensure that the exposure of his employees to substances hazardous to health is either prevented or adequately controlled, having regard in particular to any control limit which the Health and Safety Commission has approved for that substance.

(2) Prevention or adequate control of exposure under paragraph (1) shall be secured, so far as is reasonably practicable, by means other than the provision of personal protective equipment.

(3) Where the measures taken in accordance with paragraph (2) do not prevent, or provide adequate control of, exposure to substances hazardous to health of employees on the premises at which the work is being carried on, then, in addition to taking those measures, the employer shall provide those employees with such suitable personal protective equipment as will adequately control their exposure to substances hazardous to health.

(4) Where the personal protective equipment provided in accordance with paragraph (3) includes respiratory protective equipment and that respiratory protective equipment is provided for use in any of the circumstances set out in Schedule 3, then it shall be of a type approved or shall conform to a standard approved, in either case, by the Health and Safety Executive in respect of those circumstances.

(5) Nothing in this regulation shall prejudice the requirements of Section 55 of the Mines and Quarries Act[a] and in particular the requirements of subsection (2)(a) of that section.

(a) 1954 c.70.

Use of control measures, etc

8.- (1) Every employer who provides any control measure, personal protective equipment or other thing or facility pursuant to these Regulations shall ensure that it is properly used or applied as the case may be.

(2) Every employee shall make full and proper use of any control measure, personal protective equipment or other thing or facility provided pursuant to these Regulations and if he discovers any defect therein he shall report it forthwith to his employer.

Maintenance of control measures, etc

9.- (1) Every employer who provides any control measure, personal protective equipment or other thing or facility pursuant to these Regulations shall ensure that it is maintained in an efficient state, in efficient working order and good repair.

(2) Every employer shall where appropriate keep a suitable record of work carried out in accordance with paragraph (1) and that record shall be kept for two years from the date on which it was made.

Monitoring at the workplace

10.- (1) Where it is requisite for protecting the health of employees, the employer shall -

(a) have adequate monitoring procedures for monitoring the exposure of his employees to substances hazardous to health at the premises where the work is carried on; and

(b) monitor that exposure in accordance with those procedures.

(2) The employer shall keep a suitable record of any monitoring carried out in accordance with paragraph (1) and that record or a suitable summary thereof shall be kept for 30 years from the date on which it was made.

Health surveillance

11.- (1) Every employer shall ensure that an adequate occupational health record relating to each of his employees who is exposed to a substance hazardous to health is maintained and that record or a copy thereof is kept for at least 50 years from the date of the last entry made in it.

(2) Where it is requisite for protecting the health of employees who are or are liable to be exposed to a substance hazardous to health, the employer shall ensure that such employees are under adequate and suitable health surveillance which shall, in appropriate cases, include medical surveillance under the supervision of an employment medical adviser or appointed doctor.

(3) An employee to whom this Regulation applies shall, when required by his employer and at the cost of the employer, present himself during his working hours for such examination and tests as may be required for the purposes of paragraph (2) and shall furnish the person conducting the health surveillance with such information concerning his health as that person may reasonably require.

(4) Where health surveillance is carried out on the premises of the employer, the employer shall ensure that suitable facilities are made available for the purpose.

(5) On reasonable notice being given, the employer shall allow any of his employees access to the occupational health record which relates to him.

(6) Where an employee has been exposed to a substance hazardous to health and an employment medical adviser or appointed doctor has certified by an entry in his health record that medical surveillance should be continued after his exposure to that substance has ceased, the employer shall ensure that the medical surveillance of that employee is continued in accordance with that entry while he is employed by the employer or unless that entry has been cancelled by an employment medical adviser or appointed doctor.

(7) An entry in the health record made in accordance with paragraph (6) may specify the nature and frequency of the medical surveillance required and the period for which it is to be continued.

(8) Where an employee is liable to be exposed to any substance hazardous to health referred to in Schedule 4 and an employment medical adviser or appointed doctor has certified in the health record of that employee that in his professional opinion that employee should not be engaged in work which exposes him to that substance or that he should only be so engaged under conditions specified in the record, the employer shall not permit the employee to be engaged in such work except in accordance with the conditions, if any, specified in the health record unless that entry has been cancelled by an employment medical adviser or appointed doctor.

(9) Where an employee or employer is aggrieved by a decision of an employment medical adviser or appointed doctor under paragraph (8), he may, by an application in writing made to the Executive within 28 days of the date on which he was notified of the decision apply for that decision to be reviewed, and in such a case the Executive shall review that decision and the result of that review shall be notified to the employee and employer and entered on the health record of that employee by an employment medical adviser.

(10) In this Regulation -

"appointed doctor" means a fully registered medical practitioner who is appointed for the time being in writing by the Health and Safety Executive for the purposes of this Regulation;

"employment medical adviser" means an employment medical adviser appointed under Section 56 of the 1974 Act;

"health surveillance" includes biological testing.

Information, instruction and training for employees who may be exposed to substances hazardous to health

12.- (1) An employer who undertakes work which may expose any of his employees to substances hazardous to health shall provide that employee with such information, instruction and training as is adequate for him to know -

(a) the nature of the substance and of the risks to health created by such exposure; and

(b) the precautions which should be taken.

SCC
4-0773

(2) Without prejudice to the generality of paragraph (1), the information provided under that paragraph shall include –

(a) information on the results of any monitoring at the workplace in accordance with Regulation 10 and in particular, in the case of any substance hazardous to health for which the Health and Safety Commission has approved a control limit, the employee shall be informed forthwith if the results of such monitoring show that the control limit has been exceeded; and

(b) information on the collective results of any health surveillance undertaken in accordance with Regulation 11(2) in a form calculated to prevent it from being identified as relating to any particular person.

Provisions relating to certain fumigations

13.– (1) This Regulation shall apply to fumigations in which the fumigant used or intended to be used is hydrogen cyanide, ethylene oxide, phosphine or methyl bromide, except that this Regulation shall not apply to fumigations using the fumigant specified in column 1 of Schedule 5 when the nature of the fumigation is as specified in the corresponding entry in column 2 of that Schedule.

(2) An employer shall not undertake any fumigation to which this Regulation applies unless he has –

(a) notified the persons specified in Part I of Schedule 6 of his intention to undertake the fumigation; and

(b) provided to those persons the information specified in Part II of that Schedule,

at least 24 hours in advance or such shorter time in advance as the persons required to be notified may agree.

(3) An employer who undertakes a fumigation to which this Regulation applies shall ensure that, before the fumigant is released, suitable warning notices have been affixed at all points of reasonable access to the premises or to those parts of the premises in which the fumigation is to be carried out and that after the fumigation has been completed, and the premises are safe to enter, those warning notices are removed.

Exemption certificates

14.– (1) Subject to paragraph (2), the Health and Safety Executive may, by a certificate in writing, exempt any person or class of person or any substance or class of substance from all or any of the requirements or prohibitions imposed by these Regulations and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.

(2) The Executive shall not grant any such exemption unless having regard to the circumstances of the case and in particular to –

(a) the conditions, if any, which it proposes to attach to the exemption; and

(b) any other requirements imposed by or under any enactments which apply to the case,

it is satisfied that the health and safety of persons who are likely to be affected by the exemption will not be prejudiced in consequence of it.

Extension outside Great Britain

15. These Regulations shall apply to any work outside Great Britain to which sections 1 to 59 and 80 to 82 of the 1974 Act apply by virtue of Articles 6 and 7 the Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 1977[a] as they apply to work in Great Britain.

Defence in proceedings for contravention of these Regulations

16. In any proceedings for an offence consisting of a contravention of these Regulations it shall be a defence for any person to prove that he took all reasonable precautions and exercised all due diligence to avoid the commission of that offence.

Repeals, revocations and savings

17.- (1) The provisions of -

(a) the Mines and Quarries Act 1954[b] specified in column 1 of Part I of Schedule 7; and

(b) the Factories Act 1961[c] specified in column 1 of Part II of Schedule 7,

are repealed to the extent set out in the entry opposite thereto in the corresponding entry in column 2 of the respective Part.

(2) The Hydrogen Cyanide (Fumigation) Act 1937[d] is repealed.

(3) The Regulations and Orders specified in column 1 of Schedule 8 are revoked to the extent set out opposite thereto in column 2 of that Schedule.

(4) Any record or register required to be kept under any Regulations or Order revoked by paragraph 2 shall, notwithstanding that paragraph, be kept in the same manner and for the same period as if these Regulations had not been made, except that the Health and Safety Executive may approve the keeping of records at a place or in a form other than at the place where, or in the form in which, records were required to be kept under the Regulations or Order so revoked.

(a) S.I. 1977/1232.

(b) 1954 c.70. amended by S.I. 1974/2013.

(c) 1961 c.34. amended by S.I. 1974/1941.

(d) 1937 c.45. amended by S.I. 1974/1840.

SCHEDULE 1 Regulation 2(1)

Characteristic properties of certain substances hazardous to health

PART I

Table of classes and characteristic properties

Column 1 Class of Substance	Column 2 Characteristic properties
Very toxic	A substance which if it is inhaled or ingested or it penetrates the skin may involve extremely serious acute or chronic health risks and even death.
Toxic	A substance which if it is inhaled or ingested or it penetrates the skin may involve serious acute or chronic health risks and even death.
Harmful	A substance which if it is inhaled or ingested or if it penetrates the skin may involve limited health risks.
Corrosive	A substance which may on contact with living tissues destroy them.
Irritant	A non-corrosive substance which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
Carcinogenic	A substance which if it is inhaled or ingested or if it penetrates the skin may induce cancer in man or increase its incidence.
Teratogenic	A substance which if it is inhaled or ingested or it penetrates the skin may involve a risk of subsequent non-hereditable birth defects in offspring.
Mutagenic	A substance which if it is inhaled or ingested or it penetrates the skin may involve a risk of hereditable genetic defects.

PART II

Criteria for very toxic, toxic or harmful substances

"Very toxic", "toxic" and "harmful" mean in relation to a substance hazardous to health that the substance has a toxicity falling within the range set out in the table below for that category.

Category	Median lethal dose (LD50)		Median lethal concentration (LC 50) absorbed by inhalation in rat mg/litre (4 hours)
	Absorbed orally in rat mg/kg	Absorbed percutaneously in rat or rabbit mg/kg	
Very toxic	$\leqslant$ 25	$\leqslant$ 50	$\leqslant$ 0.5
Toxic	$>$ 25 to 200	$>$ 50 to 400	$>$0.5 to 2
Harmful	$>$ 200 to 2000	$>$ 400 to 2000	$>$ 2 to 20

If facts show that for the purposes of classification it is inadvisable to use LD50 or LC50 values as a principal basis because the substances produce other effects, the substances shall be classified according to the magnitude of these effects.

SCHEDULE 2 Regulation 4(1)

Prohibition of certain substances hazardous to health for certain purposes

Item No	Column 1 Description of substance	Column 2 Purpose for which the substance is prohibited
1.	2-naphthylamine; benzidine; 4-aminobiphenyl; 4-nitrobiphenyl; their salts and any substance containing any of those compounds, except as the by-product of a chemical reaction, in any other substance in a total concentration not exceeding one per cent.(1)	Manufacture and use for all purposes including any manufacturing process in which a substance described in column 1 of this item is formed.
2.	Sand or other substance containing free silica.	Use as an abrasive for blasting articles in any blasting apparatus (see note 1).
3.	A substance containing compounds of silicon calculated as silica to the extent of more than 3% by weight of the dry material.	Use as a parting material in connection with the making of metal castings (see notes 2 and 3).
4.	Carbon disulphide.	Use in the cold-cure process of vulcanising in the proofing of cloth with rubber.
5.	Oils other than white oil, or oil of entirely animal or vegetable origin or entirely of mixed animal and vegetable origin (see note 4).	Use for oiling the spindles of self-acting mules.
6.	Ground or powdered flint or quartzother than natural sand.	Use in relation to the manufacture or decoration of pottery for the following purposes:- (a) the placing of ware for the biscuit fire; (b) the polishing of ware; (c) as the ingredient of a wash for saggar trucks, bats, cranks, or other articles used in supporting ware during firing; and (d) as dusting or supporting powder in potters shops.

(1) To be revised in line with a forthcoming EC Directive.

BCC
4-0778

Item No	Column 1 Description of substance	Column 2 Purpose for which the substance is prohibite
7.	Ground or powdered flint or quartz other than:-	Use in relation to the manufacture or decoration of pottery for any purpose except -
	(a) natural sand; or	(a) use in a separate room or building for -
	(b) as part of paste or slop.	(i) the manufacture of powdered flint or quartz; or
		(ii) the making of frits or glazes or the making of colours or coloured slips for the decoration of pottery;
		(b) use for the incorporation of the substance into the body of ware in an enclosure in which no person is employed and which is constructed and ventilated to prevent the escape of dus
8.	White phosphorus.	The manufacture of matches.
9.	Hydrogen cyanide.	Use in fumigation when -
		(a) the hydrogen cyanide is applied from a cylinder containing liquid hydrogen cyanide through piping and applicators or
		(b) the hydrogen cyanide is generated by the pot method. (See note 5).

Notes

1. "Blasting apparatus" means apparatus for cleaning, smoothing, roughening or removin of part of the surface of any article by the use as an abrasive of a jet of sa metal shot or grit or other material propelled by a blast of compressed air or stea or by a wheel.

2. This prohibition shall not prevent the use as a parting material of the following substances:-

   natural sand;
   zirconium silicate (zircon);
   calcined china clay;
   calcined aluminous fireclay;
   sillimanite;
   calcined or fused alumina;
   olivine.

SCC
4-0779

3. "Use as a parting material" means the application of the material to the surface or parts of the surface of a pattern or of a mould so as to facilitate the separation of the pattern from the mould or the separation of parts of the mould.

4. "White oil" means a refined mineral oil conforming to a specification approved by the Health and Safety Executive and certified by its manufacturer as so conforming.

5. The "pot method" for the generation of hydrogen cyanide means the method whereby hydrogen cyanide is generated by adding sulphuric acid to sodium cyanide.

SCHEDULE 3 Regulation 7(4)

Circumstances in which respiratory protective equipment must be approved or conform to an approved standard

1 Regulation 7(4) (which requires respiratory protective equipment to be of a type approved, or to a standard approved, by the Health and Safety Executive) shall apply where respiratory protective equipment is provided in the circumstances set out in the following paragraphs.

2 Where work is carried on in an atmosphere which is rendered immediately dangerous to life by a substance hazardous to health.

3 Where the respiratory protective equipment is provided to protect employees against atmospheres containing one or more of the following:-

(a) the following chemical elements or any compound of these elements, namely:-

antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, indium, manganese, mercury, nickel, osmium, platinum, rhodium, selenium, silver, tellurium, thallium, uranium and vanadium;

(b) acrylonitrile, ammonia, arsine, benzene, bromine, carbon disulphide, carbon monoxide, chlorine, cyanides (organic and inorganic), cyanogen, cyanogen chloride, ethylene oxide, fluorine, hydrogen fluoride, hydrogen sulphide, isocyanates (-NCO), methyl bromide, phosgene, phosphine, sulphur dioxide, sulphur trioxide, sulphuric acid, and vinyl chloride monomer.

(c) crystalline silica;

(d) a dangerous pathogen listed in Schedule 1 to the Health and Safety (Dangerous Pathogens) Regulations 1981[a];

(e) any medicinal product which is:-

(i) a medicinal product as defined in section 130 of the Medicines Act 1968[b], or

(ii) a substance specified in an order made under section 104 or 105 of the Medicines Act 1968 which is for the time being in force and which directs that specified provisions of that Act shall have effect in relation to that substance as such provisions have effect in relation to medicinal products within the meaning of that Act.

(a) S.I. 1981/1011. (b) 1968 c.67.

Note: The list is a rationalisation and extension of existing requirements to use approved respiratory protective equipment contained in the Factories Act and associated Regulations: ie, it covers circumstances where breathing apparatus is required, and circumstances involving hazardous substances covered by various Regulations. Other named substances or categories of substances have been added where there is considered to be a high risk of injury to health should the respiratory protective equipment used not be adequate.

SCC
4-0780

SCHEDULE 4 Regulation 11(8)

Suspension on medical grounds

1 The substances referred to in Regulation 11(8) (which relates to suspension on medical grounds) are the following substances:-

(a) organophosphorus compounds; (regular use)

(b) chromic acid; sodium or potassium chromate or dichromate;

(c) any substance which when absorbed may cause methaemoglobinaemia, and in particular, any compound in which one or more ($-NO_2$) or amino ($-NH_2$) groups is directly attached to a benzenoid or aromatic ring system.

Note: Most of these substances are already included in current Regulations and in the Schedule to the Employment Protection (Consolidation) Act 1978.

SCHEDULE 5 Regulation 13(1)

Fumigations excepted from Regulation 13

Column 1 Fumigant	Column 2 Nature of fumigation
Hydrogen cyanide	Fumigations carried out for research.
	Fumigations in fumigation chambers.
	Fumigations in the open air to control mammal pests.
Methyl bromide	Fumigations carried out for research.
	Fumigations in fumigation chambers.
	Fumigations of soil or compost outdoors where not more than 10kg methyl bromide is used in any one period of 24 hours on the site.
	Fumigation under gas-proof sheeting inside structures where not more than 5kg methyl bromide in each structure is used in any period of 24 hours.
	Fumigation of soil or compost in greenhouses and in mushroom houses where not more than 5kg of methyl bromide is used in any one fumigation in a period of 24 hours.
	Fumigation of containers where not more than 5kg of methyl bromide is used in any one fumigation in a period of 24 hours.
Phosphine	Fumigations carried out for research.
	Fumigations under gas proof sheeting inside structures where not more than 100g phosphine in each such structure is used in any period of 24 hours.
	Fumigations in containers.
	Fumigations in individual impermeable packages.
	Fumigations in road or rail transport vehicles or freight containers.
	Fumigations in fumigation chambers.
	Fumigations in the open air to control mammal pests.
Ethylene oxide	Fumigations carried out for research.
	Fumigations in fumigation chambers.

SCHEDULE 6 Regulation 13(2)

Notification of certain fumigations

PART I

Persons to whom notifications must be made

1. In the case of a fumigation to be carried out within the area of a harbour authority, advance notification of fumigation shall, for the purposes of Regulation 13(2)(a) be given to -

(a) that authority;

(b) an inspector appointed under section 19 of the 1974 Act, if that inspector so requires; and

(c) where the fumigation -

(i) is to be carried out on a sea going ship, the chief fire officer of the area in which the ship is situated, and the officer in charge of the office of Her Majesty's Customs and Excise at the harbour, or

(ii) is the space fumigation of a building, the chief fire officer of the area in which the building is situated.

2. In the case of a fumigation, other than a fumigation to which paragraph (1) applies, advance notification of fumigation shall be given to -

(a) the police officer for the time being in charge of the police station for the police district in which the fumigation is carried out;

(b) an inspector appointed under section 19 of the 1974 Act if that inspector so requires; and

(c) where the fumigation is to be carried out on a sea going ship or is the space fumigation of a building, the chief fire officer of the area in which ship or building is situated.

PART II

Information to be given in advance notice of fumigations

1. The information to be given in a notification made for the purposes of Regulation 13(2) shall include the following:-

(a) the name, address and place of business of the fumigator and his telephone number;

(b) the name of person requiring the fumigation to be carried out;

(c) the address and description of premises where the fumigation is to be carried out;

(d) the date on which the fumigation is to be carried out and the estimated time of commencement and completion;

(e) the name of the operator in charge of the fumigation;

(f) the fumigant to be used.

SCHEDULE 7 Regulation 17(1)

Repeals

PART I

Repeals of the Provisions of the Mines and Quarries Act 1954

1 Provision	2 Extent of repeal
Section 74	In subsection (1); paragraph (b). In subsection (2) – the words from "or dust of such character" to "the persons employed", – paragraph (a), the words "or harmful", – paragraph (c), the words "or harmful" both times that they appear.
Section 112	The whole section.

PART II

Repeals of the Provisions of the Factories Act 1961

1 Provision	2 Extent of repeal
Section 4	The words from "and for rendering harmless" to the end of the section.
Section 63	The whole section.
Section 64	The whole section.
Section 67	The whole section.
Section 77	The whole section.
Section 78	The whole section.
Section 121	Subsections (1)(d) and (3)(b).

SEE
4-07784

SCHEDULE 8 Regulation 17(4)

Revocations of Regulations and Orders

1 Regulations or Order	2 Extent of Revocation
Regulations dated 12 December 1905 for the processes of sorting, willeying, washing, combing and carding wool, goat hair and camel hair and processes incidental thereto, (The Wool, Goat Hair and Camel Hair Regulations 1905), S.R. & O. 1905/1293; amended by S.I. 1980/1690.	The whole Regulations
Regulations dated 26 February 1906 in respect of the processes of spinning and weaving flax and tow and processes incidental thereto. (The Flax and Tow Spinning and Weaving Regulations 1906), S.R. & O. 1906/177.	Regulations 1, 2 and 12
Regulations dated 28 August 1907 for the processes of spinning and weaving hemp or jute, or hemp or jute tow and processes incidental thereto, (The Hemp Spinning and Weaving Regulations 1907), S.R. & O. 1907/660; amended by S.I. 1948/1696.	Regulations 1, 2 and 7
Regulations dated 20 December 1907 in respect of processes involving the use of horsehair from China, Siberia or Russia, (The Horsehair Regulations 1907), S.R. & O. 1907/984; amended by S.I. 1980/1690.	The whole Regulations
Regulations dated 18 December 1908 for the use of East Indian Wool, (The East India Wool Regulations 1908), S.R. & O. 1908/1287.	The whole Regulations
Order dated 22 March 1918 for securing the welfare of the workers employed in factories or parts of factories in which bichromate of potassium or sodium is used in tanning by the "two bath" process (The Tanning (Two-Bath Process) Welfare Order 1918), S.R.& O. 1918/368; amended by S.R. & O. 1930/312 and S.I. 1980/1690.	The whole Order

1 Regulations or Order	2 Extent of Revocation
Order dated 22 March 1918 for securing the welfare of the workers employed in factories or parts of factories in which bichromate of potassium or sodium is used in dyeing other than job-dyeing, (The Dyeing (Use of Bichromate of Potassium or Sodium) Welfare Order 1918), S.R. & O. 1918/369; amended by S.I. 1960/1690.	The whole Order
Order dated 15 August 1919 (The Fruit Preserving Order 1919), S.R. & O. 1919/1136.	Article 6
The Hollow-ware and Galvanising Welfare Order 1921, S.R. & O. 1921/2032.	The whole Order
The Hides and Skins Regulations 1921, S.R. & O. 1921/2076; amended by 1937/769 and S.I. 1980/1690.	The whole Regulations
The Indiarubber Regulations 1922 S.R. & O. 1922/329; amended by S.I. 1973/36 and S.I. 1980/1248.	The definitions – (a) "appointed doctor"; (b) "employment medical adviser"; (c) "fume process" The paragraph – "It shall be the duty of every person employed to observe Part II of these Regulations" Regulations 2 to 19.
The Chemical Works Regulations 1922, S.R. & O. 1922/731; amended by S.I. 1961/2435; S.I. 1973/36; S.I. 1974/1681; S.I. 1981/16 and S.I. 1981/917.	The definitions – (a) "appointed doctor"; (b) "employment medical adviser"; (c) "caustic"; (d) "caustic pot"; (e) "chrome process";

1 Regulations or Order	2 Extent of Revocation
(Chemical Works Regs) (Contd.)	(f) "nitro and amido process"; (g) efficient exhaust draft".
	Regulations 1 to 3
	Regulation 6
	Regulation 9
	Regulation 10
	Regulation 17(1)(a) and (b) and 17(2)(a) to (d), (f) and (g)
	In the application of Part II – paragraph I in paragraph II the words "or bleaching powder" paragraph III to V
	Regulations 18 to 24
	Regulations 25(a)(i) to (iv), and (vii) 25(b)(i), (ii) and (iv)
	Regulations 26 to 30
	In Regulation 31(a) the words "respirators goggles and gloves" and the words from "and shall deposit" until the end of that sub-paragraph
	Regulation 31(b) and (c)
The Grinding of Metals (Miscellaneous Industries) Regulations 1925, S.R. & O. 1925/904; amended by S.I. 1949/2225, S.I. 1950/688, S.I. 1970/535 and S.I. 1981/1486.	The whole Regulations

1 Regulations or Order	2 Extent of Revocation
The Grinding of Outlery and Edge Tools Regulations 1925, S.R. & O. 1925/1089; amended by S.I. 1950/370, S.I. 1970/535 and 1981/1486.	The whole Regulations
The Bakehouses Welfare Order 1927, S.R. & O. 1927/191; amended by S.I. 1960/1690.	The whole Order
The Biscuit Factories Welfare Order 1927, S.R. & O. 1927/872; amended by S.I. 1960/1690.	The whole Order
The Tanning Welfare Order 1930, S.R. & O. 1930/312; amended by S.I. 1960/1690.	Articles 6 and 7 Article 9
The Refractory Materials Regulations 1931, S.R. & O. 1931/359.	The whole Regulations
The Chromium Plating Regulations 1931, S.R. & O. 1931/455; amended by S.I. 1973/9.	The whole Regulations
The Sugar Factories Welfare Order 1931, S.R. & O. 1931/684.	Regulations 2 and 3 Regulation 5
The Patent Fuel Manufacture (Health and Welfare) Special Regulations 1946. S.R. & O. 1946/258; amended by S.I. 1973/36.	The whole Regulations
The Pottery (Health) Special Regulations 1947, S.R. & O. 1947/2161.	In Regulation 2, the definitions – (a) "ground or powdered flint or quartz"; (b) "potters' Shop". Regulations 5 and 6
The Jute (Safety, Health and Welfare) Regulations 1948, S.R. & O. 1948/1696.	Regulations 5 to 10 Regulation 12
The Blasting (Casting and Other Articles) Special Regulations 1949, S.I. 1949/2225; amended by S.I. 1981/1332.	The whole Regulations

1 Regulations or Order	2 Extent of Revocation
The Pottery (Health and Welfare) Special Regulations 1950, S.I.1950/65; amended by S.I. 1963/879, S.I. 1973/36, S.I. 1980/1248 and S.I. 1982/877.	In Regulation 2(2) the definitions – (a) "Fettling"; (b) "Damp fettling"; (c) "Flint or quartz milling"; (d) "Flintless stoneware"; (e) "Moist method"; (f) "Potters shop"; (g) "Suspension"; (h) "Thimble picking"; (i) "Wedging of clay"; Regulation 6 Regulations 9 to 14 Regulations 17 to 22 Regulation 26 Regulations 28 to 32 Schedule 2
The Grinding of Cutlery and Edge Tools (Amendment) Special Regulations 1950, S.I. 1950/370.	The whole Regulations
The Grinding of Metals (Miscellaneous Industries) (Amendment) Special Regulations 1950, S.I. 1950/688.	The whole Regulations
The Foundries (Parting Materials) Special Regulations 1950, S.I. 1950/1700.	The whole Regulations
The Hydrogen Cyanide (Fumigation of Buildings) Regulations 1951, S.I. 1951/1759; amended by S.I. 1982/695.	The whole Regulations

1 Regulations or Order	2 Extent of Revocation
The Hydrogen Cyanide (Fumigation of Ships) Regulations 1951, S.I. 1951/1760.	The whole Regulations
The Iron and Steel Foundries Regulations 1953, S.I. 1953/1464; amended by S.I. 1974/1681 and S.I. 1981/1332.	In Regulation 2(2) the (a) "approved respirator"; (b) "dressing or fettling operations"; (c) "knock-out operations" The proviso to Regulation 3(2) Regulation 7 Regulations 8(1)(b) and (2) In Regulation 10(1), the number "7"
The Mule Spinning (Health) Special Regulations 1953, S.I. 1953/1545; amended by S.I. 1963/879 and S.I. 1973/36.	The whole Regulations
The Indiarubber Regulations 1955, S.I. 1955/1626.	The whole Regulations
The Shipbuilding and Ship-repairing Regulations 1960. S.I. 1960/1932; amended by S.I. 1969/690, S.I. 1969/1681, S.I. 1980/1248 and 1983/644.	In Regulation 4(1)(a), for the number 77 substitute the number 76 Regulation 53 Regulation 76 and 77
The Construction (General Provisions) Regulations 1961, S.I. 1961/1580; amended by S.I. 1966/94 and S.I. 1974/1681.	Regulation 20 Regulation 22
The Non-ferrous Metals (Melting and Founding) Regulations 1962, S.I. 1962/1667; amended by S.I. 1974/1682 and S.I. 1981/1332.	In Regulation 2(2) the definition "approved" Regulations 11 to 13 Regulation 19
The Carcinogenic Substances Regulations 1967, S.I. 1967/879; amended by S.I. 1973/36.	The whole Regulations

1 Regulations or Order	2 Extent of Revocation
The Carcinogenic Substances (Prohibition of Importation) Order 1967, S.I. 1967/1675.	The whole Order
The Anthrax (Cautionary Notice) Order 1968, S.I. 1968/2005.	The whole Order
The Abstract of Factories Act Order 1973 S.I. 1973/17, amended by S.I. 1983/978.	Schedule 1 shall be revoked as follows – in paragraph 4 the words from "All practicable measures " to the end of that paragraph. Paragraph 9 Paragraph 13 Schedule 3 shall be revoked as follows. in paragraph 8, the words from "Everyone who employs" to "are mixed". Schedule 4 shall be revoked as follows – in paragraph 8, the words from "Everyone who employs" to "are mixed".
The Chromium Plating (Amendment) Regulations 1973, S.I. 1973/9.	The whole Regulations
The Abstract of Special Regulations (Pottery – Health and Welfare) Order 1973, S.I. 1973/37.	In Schedule 1 and 2 (each of which abstracts parts of the Pottery (Health and Welfare) special Regulations 1950 (No. 65) the following paragraphs in each Schedule shall be revoked in so far as the reference applies to that Schedule. In paragraph 2(2) the definitions – (a) "Fettling"; (b) "Flint or quartz milling"; (c) "Flintless stoneware";

1 Regulations or Order	2 Extent of Revocation
The Abstract of Special Regulations (Contd)	(d) "Moist method"; (e) "Potters shop"; (f) "Thimble picking"; (g) "Wedging of clay"; Paragraph 6(1)(vii) to (xi) In paragraph 7(2) the words from "due notice" to the end of the sub-paragraph. Paragraphs 9 to 14 Paragraphs 17 to 22 Paragraph 26 Paragraphs 28 to 32 The second schedule
The Employment Medical Advisory Service (Factories Act Orders etc. Amendment) Order 1973, S.I. 1973/36.	In Part II of the Schedule the following entries relating to - (a) The Indiarubber Regulations 1922; (b) The Chemical Works Regulations 1922; (c) The Patent Fuel Manufacture (Health and Welfare) Regulations 1946; (d) The Mule Spinning (Health) Special Regulations 1953; (e) The Carcinogenic Substances Regulations 1967.
The Hydrogen Cyanide (Fumigation) Act 1937 (Repeals and Modifications) Regulations 1974, S.I. 1974/1840.	The whole Regulations

1 Regulations or Order	2 Extent of Revocation
The Health and Safety (Agriculture) (Poisonous Substances) Regulations, S.I. 1975/282*.	The whole Regulations
The Health and Safety (Animal Products) (Metrication) Regulations 1980, S.I. 1980/1690.	The whole Regulations
The Chemical Works (Metrication) Regulations 1981, S.I. 1981/16.	In the schedule the entries relating to – (a) Regulation 1; (b) Regulations 18, 20, and 21; and (c) Regulation 28
The Health and Safety (Foundries etc.) (Metrication) Regulations 1981, S.I. 1981/1332.	In the Schedule the entries relating to – (a) The Blasting (Casting and other Articles) Special Regulations 1949.
The Grinding of Metals etc. (Metrication) Regulations 1981, S.I. 1981/1486.	The whole Regulations
The Pottery (Health etc.) (Metrication) Regulations 1982, S.I. 1982/877.	In the Schedule the entries relating to the following Regulations of the Pottery (Health and Welfare) Special Regulations 1950 – (a) Regulation 6; (b) Regulation 12; (c) Regulations 17 and 22; and (d) Regulation 29
The Hydrogen Cyanide (Fumigation of Buildings) (Amendment) Regulations, S.I. 1982/695.	The whole Regulations

* Poisonous Substances in Agriculture Regulations 198- will be substituted when made.

Typed by the HSE's Specialist Typists, Specialist Typing Unit, 25 Chapel Street, London NW1 5DT.

Further copies of this publication can be obtained from the Health and Safety Executive, Enquiry Point, St Hugh's House, Trinity Road, Bootle, Merseyside, L20 3QY. Telephone 051 951 4381

ISBN 07176 02133

Appendix ~ [illegible]

App. 7 included [illegible] not [illegible] under "Contents"

ACTS/VCM/WG/GN/83/6

NOT FOR PUBLICATION

24 AUGUST 1984

GUIDANCE NOTE EH ++

VINYL CHLORIDE: TOXIC HAZARDS AND PRECAUTIONS

SCC
4-0795

CONTENTS

APPENDIX I

PROPERTIES OF VINYL CHLORIDE

SYNONYMS		VC, Vinyl Chloride Monomer, VCM, Monochloroethylene, Monochloroethene
CHEMICAL FORMULA		$CH_2 = CHCl$
PROPERTIES		
General		Vinyl Chloride is a colourless gas at ambient temperature and pressure with a sweetish odour at high concentrations. It is normally stored and handled under pressure as a colourless liquid
Physical	Boiling Point	-13.9°C
	Freezing Point	-153.7°C
	Flash Point (open cup)	-78°C
	Liquid Density	0.983 (at 20°C)
	Vapour Density	2.15 (relative to air at 20°C)
	Solubility	Readily soluble in most organic solvents but only sparingly in water
Chemical		Vinyl chloride will polymerise exothermically under the influence of light, air, oxygen and initiators such as benzoyl peroxide. Pure vinyl chloride is thermally stable to quite high temperatures, however, peroxides formed by slow reaction with oxygen in air may initiate polymerisation. Stablisers, such as benzoquinone or p-methoxyphenol, and storage in an oxygen free atmosphere innibit adventicious polymerisation

APPENDIX 3

Dear Doctor

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 198-
APPROVED CODE OF PRACTICE FOR THE CONTROL OF VINYL CHLORIDE AT WORK

Mr/Mrs/Miss .....

Date of Birth .....

Address .....
.....

is about to leave/has just left employment here where he/she was registered as a worker potentially or actually exposed to vinyl chloride monomer (VCM).

Exposure to high levels of VCM has been associated with angiosarcoma of the liver, portal hypertension due to non-cirrhotic periportal fibrosis and acro-osteolysis particularly of the terminal phalanges of the hands.

Other effects have been reported as occurring in workers chronically exposed to vinyl chloride monomer at similar levels of exposure, although such reports have been disputed by others. These include tumours of the brain, lung, haemo-lymphopoietic system, and skin (malignant melanoma), lung function disorders, thrombocytopoenia and immune complex disorders. Effects on reproduction have also been reported.

Whilst exposure to such levels is unlikely to have been incurred since 1975, the latent period particularly for the first two above mentioned conditions may be prolonged.

May I therefore suggest that this letter which (together with the patients form of consent) has been approved by the General Medical

APPENDIX 4

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 198-
APPROVED CODE OF PRACTICE FOR THE CONTROL OF VINYL CHLORIDE AT WORK

MEDICAL SURVEILLANCE

(Give surname and full fore-names, give date of birth thus eg 3 SEPT 36

I, ... born .....

of .....

.....

hereby give consent for the Appointed Doctor or the Area Employment Medical Adviser to discuss with my family doctor my medical and occupational history and I also consent to the release to my family doctor of such records insofar as they relate to my exposure to Vinyl Chloride Monomer.

I confirm that Dr ....., Appointed Doctor has explained to me the reasons for this consent being sought and I believe that I have understood these reasons. I agree to a copy of this consent and explanatory letter, which I have seen, being sent to my present family doctor, Dr .....,
of .....

Signed .....

Date .....

Witness .....

APPENDIX 5

RECORDS

The records which should be kept in relation to the control of vinyl chloride at work are summarised below with cross references to the relevant paragraphs of the main text of the Guidance Note.

(a) Assessment (paras 22-29);

(b) Atmospheric monitoring (paras 55-57);

(c) Maintenance of monitoring equipment (para 58)

(d) Leakages of vinyl chloride (para 59(1);

(e) Examinations of ventilation equipment (para 59(2));

(f) Excursions above the alarm levels during area monitoring (para 59(3));

(g) Personal monitoring (para 59(4));

(h) Names of persons trained and authorised to use respiratory protective equipment (para 66);

(i) Inspections of respiratory protective equipment (para 69);

(j) Permits-to-work (paras 71 and 77);

(k) Maintenance of control measures (paras 79 and 80);

(l) Register of registered workers' (para 83)

(m) Occupational health records of registered workers (paras 91 and 92).

Records may be kept in any suitable forms, including microfilm, computer or similar techniques, provided they can be reviewed readily when required.

Occupational health records should be kept for 50 years after the last entry made in them. Records of atmospheric monitoring should be kept for at least 30 years. All other records should be kept for a minimum of 2 years.

INTRODUCTION

1 Vinyl chloride is a colourless, highly flammable gas at room temperature and atmospheric pressure. It is normally stored and handled under pressure as a colourless liquid. It has a slightly sweet odour detectable at concentrations above 2000 ppm. In the UK virtually all vinyl chloride is used as starting material for the production of polyvinyl chloride (PVC) homopolymer; a small amount is used for copolymerisation with vinyl acetate. PVC is used extensively in pipes, flooring, home furnishings, electric cable insulation, blow moulded containers, packaging and records.

2 This Guidance Note has been prepared on the basis of joint discussions between representatives of the Confederation of British Industry, the Trades Union Congress and the Health and Safety Executive within a Working Group of the Health and Safety Commission's Advisory Committee on Toxic Substances.

3 This Guidance Note provides practical guidance for employers, self-employed persons and persons in control of vinyl chloride monomer manufacture and polymerisation plants to assist them in complying with the Control of Sustances Hazardous to Health Regulations 198- and Approved Code of Practice for the Control of Vinyl Chloride at Work. References in this note to 'employers' should be taken to include self-employed persons. This Guidance Note may also be helpful to safety representatives in fulfilling their statutory functions under the Safety Representatives and Safety Committees Regulations 1977. The guidance will be used by Inspectors of the Health and Safety Executive (HSE) as part of their criteria for assessing compliance with the Health and Safety at Work Act 1974 and other relevant statutory provisions.

4 The Control of Substances Hazardous to Health Regulations 198- apply to all toxic substances used at work, including vinyl chloride. The Directive of the Council of the European Communities (78/610/EEC) on the approximation of the laws, regulations and administrative provisions of the Member States on the protection of the health of workers exposed to vinyl chloride monomer applies to the protection of those workers who:-

(a) are employed in works in which vinyl chloride is produced, reclaimed, stored, discharged into containers, transported or used in any way whatsoever or in which vinyl chloride is converted into vinyl chloride polymers, and

(b) are likely to be affected by exposure to vinyl chloride in a working area.

5 VINYL CHLORIDE IS HIGHLY FLAMMABLE AND PRESENTS A CONSIDERABLE FIRE AND EXPLOSION HAZARD; THIS GUIDANCE NOTE DOES NOT GIVE ADVICE ON SUCH RISKS. Vinyl chloride comes within the group of substances defined in Class 2 of Part II of Schedule 1 of the Notification of Installations Handling Hazardous Substances Regulations 1982. It also comes within the definition of a flammable gas as set out in Schedule 1(c)(i) of the Control of Industrial Major Accident Hazards Regulations 1984. Some of the requirements of these Regulations overlap with certain sections of this Guidance Note. Where this occurs reference is made in the text and the Regulations should be consulted for further details.

6 This Guidance Note does not give detailed advice on the control of emissions of vinyl chloride to the atmosphere. HM Industrial Air Pollution Inspectorate is responsible for the control of air pollution arising from industrial processes involving the production of PVC and copolymers from vinyl chloride monomer. For detailed guidance on the control of emissions, reference should be made to the HSE Note on Best Practicable Means BPM 3/79 : Petroleum Works (PVC Polymer Plants).

PROPERTIES OF VINYL CHLORIDE

7 The properties of vinyl chloride are set out in Appendix 1.

HEALTH HAZARDS

8 Vinyl chloride is a gas at room temperature and atmospheric pressure and the most common route of absorption into the body is by inhalation.

9 Acute exposure to vinyl chloride vapour causes central nervous system effects, the severity of which increase with exposure. At exposures of 50-500 parts per million (ppm) in air for 7 hours no apparent acute effects have been found in humans. However, exposure to 20,000 ppm (2%) for 3 minutes resulted in dizziness and disorientation. Incapacitation occurred at concentrations above 80,000 ppm (8%) over 5 minutes. Exposure to concentrations of 300,000 - 400,000 ppm (30-40%) is rapidly fatal.

10 Chronic exposure to vinyl chloride has been associated with angiosarcoma of the liver, liver or spleen fibrosis (similar to the perilobular fibrosis known as Banti's Syndrome), circulatory disorders in the hands and feet (similar to Raynaud's Phenomenon, also known as white finger), scleroderma (a degenerative lesion characterised by stiffness of the skin and soft tissues) and acro-osteolysis (a deterioration of certain bones, most commonly the terminal phalanges of the fingers). Such effects have usually occurred after chronic exposure to levels in excess of 100 ppm (see para 12). Vinyl chloride is a proven human carcinogen with no known threshold of effect.

11 Other effects have been reported as occurring in workers chronically exposed to vinyl chloride monomer at similar levels of exposure, although such reports have been disputed by others. These include tumours of the brain, lung, haemo-lymphopoietic system, and skin (malignant melanoma), lung function disorders, thrombocytopoenia and immune complex disorders. Effects on reproduction have also been reported.

12 The general consensus of opinion is that polymerisation workers between 1940 and 1975 might have been exposed to levels of vinyl chloride of the following order:-

1945-55	1000 ppm
1955-60	400 - 500 ppm
1960-70	300 - 400 ppm
Mid-1973	150 ppm
1975	5 ppm

Throughout the world there will have been variations around these figures because of differences in plant design or process operation.

RESPONSIBILITIES

13 Employers must do all that is reasonably practicable to safeguard the health of their employees and others who may be affected by work activities involving vinyl chloride. In particular, they have a duty to comply with the provisions of the Health and Safety at Work etc. Act 1974, the Control of Substances Hazardous to Health Regulations 198- and the ACoP on Vinyl Chloride. Employers may also have a responsibility to comply with the Factories Act 1961 and other associated health and safety legislation (see Appendix 5).

14 Section 2(3) of the HSW Act requires employers, with certain exceptions, to prepare, and revise as appropriate, a written statement of their general policy with respect to the health and safety at work of their employees and the organisation and arrangements used to carry out that policy and to bring the statement and any revision of it to the notice of all of their employees. The arrangements within the organisation for a formal system of joint consultation between management and employees and their representatives on all aspects of the Approved Code of Practice on Vinyl Chloride should also be set out in the safety policy.

15 In the safety policy, a member of senior management should be given responsibility for ensuring that the matters covered by the Vinyl Chloride ACoP, the Health and Safety at Work etc. Act and the Factories Act, etc are implemented. These include the responsibility for safe systems of work, safe places of work, training, monitoring, emergency procedures, joint consultation etc. He should be provided with appropriate support as may be necessary.

16 Responsibility for implementing particular aspects of the Approved Code of Practice and this Guidance Note should be allocated at each appropriate level within the organisation with a clear line of communication from plant operatives to the person in overall charge. Steps should be taken to ensure that individuals understand and accept their responsibilities.

17 Employees should cooperate with management in implementing health and safety precautions and in making proper use of the equipment and facilities provided for their protection. They should report immediately to their supervisors any suspected faults or material defects in plant or deficiencies in the control measures taken to contain vinyl chloride and reduce exposure.

18 Safety policies need to be reassessed at regular intervals to ensure that they are still appropriate and effective, particularly when significant changes in plant or work activities occur. Such assessment should include, of course, the organisation and arrangements for complying with the legislation, code of practice, etc relevant to vinyl chloride.

CONTROL LIMITS

19 The Control Limit for occupational exposure to vinyl chloride vapour in air is an Annual Control Limit of 3 ppm and is the value which should not be exceeded by the concentration, averaged with respect to time, of vinyl chloride monomer in the atmosphere of a working area over a period of one year. Only periods of plant operation including, where necessary, any maintenance time should be taken into account. Periods during which alarm level concentrations are measured need not be taken into account when assessing compliance with the Annual Control Limit. In practice, the atmosphere of working areas should be monitored regularly (see paragraphs 37-62) and the results summarised on a shift and monthly basis. A 'rolling average' time weighted average concentration of vinyl chloride-in-air can then be calculated and over any period of 12 successive calendar months it should not exceed 3 ppm. In this way, past compliance with the Annual Control Limit can be checked and trends noted. This Annual Control Limit is supplemented by an 8 hour time weighted average (TWA) Control Limit of 7 ppm for personal exposure with the proviso that the Annual Control Limit is not exceeded. These Control Limits have been judged after detailed consideration to be reasonably practicable for the whole spectrum of work activities in Great Britain and should not normally be exceeded.

20 For substances, such as vinyl chloride, for which there are no known thresholds below which adverse effects do not occur not only should exposure be kept below the Control Limits but it should also be reduced still further until the point is reached where the costs of further control measures are not justified in terms of the additional reduction in risk.

ALARM LEVELS

21 In vinyl chloride monomer manufacturing and polymerisation plants there should be a system for the automatic detection of high levels of airborne vinyl chloride in places where these may occur (see para 54). The following concentrations of vinyl chloride in the atmosphere of a working area should be treated as alarm levels, signalling the need for evacuation and remedial action:-

(a) 15 ppm when measured over a period of 1 hour, or

(b) 20 ppm when measured over a period of 20 minutes, or

(c) 30 ppm when measured over a period of 2 minutes.

Where a continuous multi-point analyser (see paragraphs 40-41) is used, two successive readings above the appropriate concentration will determine the existence of an alarm level, ie 15 ppm over a period of 1 hour and 20 ppm over a period of between 20 and 30 minutes.

ASSESSMENT

22 Under the Control of Substances Hazardous to Health Regulations an employer must not carry on any work which may expose his employees to any substance hazardous to health unless he has made an adequate assessment of the risks to health created by the substance. The assessment involves identifying the nature of the substance, the risks to the health of persons who may be exposed, the nature and degree of exposure which may occur during the course of work and the steps to be taken to avoid risks to health. In order to ensure effective control of exposure to vinyl chloride, it is necessary to collect and assess adequate data on the circumstances under which exposure may arise. In existing plants, most of these data will already have been obtained. All work activities which may involve exposure should be assessed to identify actual and potential sources of emission of vinyl chloride vapour into the working atmosphere. The nature and degree of exposure should be studied in each case. In Appendix 2, a flow chart sets out a sampling strategy for the assessment of exposure to toxic substances. Assessment permits the formulation of plans for the development and introduction of effective engineering, operational and other measures for the prevention or control of exposure, for the maintenance

of such measures and for the long-term monitoring of their effectiveness. It also indicates activities where the only reasonably practicable method of preventing exposure is by using respiratory protective equipment. In existing plants, operating experience and monitoring data should already have led to the introduction of most of these control measures.

23 The employer should ensure that whoever carries out the assessment is competent for the purpose and has received adequate information, instruction and training.

24 Examples of work activities which may give rise to exposure to vinyl chloride include:-

(a) transport, storage, discharging into containers, breaking down from bulk, polymerisation, reclamation and sampling of vinyl chloride or materials, including waste, containing it in residual or unreacted form;

(b) the operation, cleaning, maintenance and repair of any apparatus or process plant used in the production and conveyance of vinyl chloride or in its polymerisation and the handling and storage of freshly polymerised material.

25 An employer should consider not only the exposure of his employees engaged upon work with vinyl chloride but also that of:-

(a) other of his employees not directly involved with vinyl chloride who could be affected by that work activity;

(b) other people who may be exposed while on the premises, eg the employees of outside contractors engaged on maintenance;

(c) members of the public who may be affected by emissions and discharges from the workplace.

26 To estimate the degree of exposure to vinyl chloride by inhalation, it is usually necessary to carry out a comprehensive personal atmospheric sampling survey. However, vinyl chloride in air estimations need not be carried out in every individual case, particularly when sufficient information based on

previous measurements is already available in relation to a specific work activity or where it may be possible to group employees on the basis of similarity of degree of exposure and type of work done to enable an adequate assessment of likely exposure to be made. It is important to study the pattern of exposure of workers in different jobs and locations over whole workshifts and to identify when and where the highest exposures are likely to occur taking into account the possibility of unusual circumstances such as plant breakdowns or emergencies.

27 It is important to carry out sufficient sampling to enable accurate 8 hour time-weighted average concentrations to be calculated. However, shorter term sampling may assist in the assessment of the performance of engineering controls. The survey of exposures should be extended over sufficient workshifts to ensure that the variability of exposure is adequately studied. Further detailed information and advice is available in HSE Guidance Note EH 42 - 'Monitoring Strategies for Toxic Substances'.

28 It is recommended that the results of the assessment be recorded and a copy provided on request at any reasonable time during working hours to employees and/or their representatives at the place of work.

29 The assessment should be revised whenever there is evidence or reason to suspect that it is no longer valid, as a result of, for example:-

(a) a significant change in the work activity; this could be a change in plant, processes or methods of work that might affect the nature or degree of exposure, such as the raising of process temperatures or changes in engineering controls;

(b) results of air monitoring at the work place revealing an increase in exposure;

(c) data arising from health surveillance;

(d) new information on health risks becoming available.

CONTROL MEASURES FOR MATERIALS, PLANT AND PROCESSES

SCC
4-0809

30 When considering appropriate control measures for reducing exposure to a toxic substance, the first strategy to examine is substitution with less

hazardous materials, including the alteration of synthesis routes to avoid using or producing toxic intermediates. Users or potential users of vinyl chloride and polyvinyl chloride should consider the use of a less toxic substance but if that is not possible control measures should be applied as far as is reasonably practicable, irrespective of the size of the plant, to minimise exposure of personnel to vinyl chloride.

31 Control may be considered adequate when exposure to vinyl chloride is effectively controlled to the occupational Control Limits and as far below them as is reasonably practicable in the particular circumstances. The objective in applying materials, plant and process control measures is to ensure adequate control of exposure without recourse to personal protective equipment so far as is reasonably practicable.

Design and operation

32 Equipment and processes should be designed and operated to eliminate or minimise the risks of leakages and spillages of vinyl chloride and to minimise the need for maintenance or other work which requires the breaching of and/or entry into plant in which vinyl chloride is liable to be present.

General ventilation

33 Good general ventilation should be provided for rooms and buildings in which processes involving vinyl chloride are carried on and as far as possible plant should be sited in the open.

Local exhaust ventilation

34 Vinyl chloride should be handled in enclosed equipment provided with local exhaust ventilation at any points where the emission of vapour cannot be eliminated by improved design or maintenance. Local exhaust ventilation should also be provided at specific locations in process plant to ensure that maintenance operations can be carried out safely.

Venting

SCC
4-0810

35 HM Industrial Air Pollution Inspectorate and HM Factory Inspectorate should be consulted on any points relating to plant or storage where there is the potential for the emission of vinyl chloride into the atmosphere to ensure that both the public and the workforce are not at risk.

Cleaning and waste disposal

36 Waste polyvinyl chloride slurry containing significant levels of residual vinyl chloride should be stripped of vinyl chloride prior to suitable treatment of the liquid waste for general disposal. Solid polyvinyl chloride waste should preferably be dried before disposal. Wastes arising from vinyl chloride processes should be handled and disposed of in accordance with the Department of Environment Waste Management Paper No 15: 'Halogenated Organic Wastes - A Technical Memorandum on Arisings, Treatment and Disposal including a Code of Practice'.

AIR MONITORING

37 The objectives of monitoring concentrations of airborne vinyl chloride in working areas are:-

(1) to verify that any technical measures and working procedures maintain adequate control of exposure;

(2) to detect abnormal increases in vinyl chloride-in-air levels which may occur as a result of failure or malfunction of some part of the plant or apparatus, with references to the short term alarm levels for vinyl chloride;

(3) to provide adequate records of the exposure of individuals for the purpose of epidemiology.

38 The arrangements for monitoring require careful planning to achieve effective and efficient use of resources. A formal air monitoring plan should be drawn up and made known to all employees working in areas where vinyl chloride is liable to be present. The plan should contain details of the air monitoring procedures and equipment that are to be used to meet the objectives set out in para 37, including details of:-

(a) the parts of plant, working areas and occupational groups of employees to be monitored;

(b) the type of air sampling to be carried out, eg personal air sampling, fixed point air sampling;

(c) the frequency of air sampling and the siting of air sampling equipment;

(d) the types of sampling and analytical equipment to be used;

(e) arrangements for the testing and calibration of sampling and analytical equipment;

(f) the statistical analysis and presentation of the air sampling results.

The information obtained from the initial and any subsequent assessments should be used when planning or revising the details of the monitoring procedures.

39 Static sampling will be the main method used routinely for assessing compliance with the Annual Control Limit and detection of alarm levels in vinyl chloride monomer production and polymerisation plants. In order to assess compliance with the 8 hour TWA Control Limit personal monitoring will be necessary.

40 Static sampling may be either by discontinuous or continuously operating sequential systems, except at vinyl chloride polymerisation plants sited within buildings where only the latter methods should be used.

41 Where discontinuous air sampling techniques are used, the frequency of measurements should be sufficient to predict with a confidence coefficient of at least 95% that there is compliance with the Annual Control Limit, in other words that the Control Limit value falls above the upper 95% confidence limit for the true annual arithmetic mean for the working area. The required frequency will thus depend upon the variability of concentrations with time.

42 Where vinyl chloride is handled intermittently, monitoring of exposures by personal sampling should be done sufficiently often to ensure that technical control measures and working procedures are adequate to keep exposure below the Control Limits.

43 Large working areas will normally require more than one monitoring point and in such cases the average value of the measurements recorded should be considered as the representative value when assessing compliance with the Annual Control Limit.

Measuring equipment

44 The sensitivity, range, selectivity and speed of response of an analytical device should be appropriate to the duty it is required to perform. Electrical equipment in flammable atmospheres should be suitably constructed, protected and installed; guidance is available in BS Code of Practice 1003.

45 The following techniques are among those suitable for detection and measurement of vinyl chloride:-

(a) gas chromatography

(b) infra-red absorption analysis

(c) flame ionisation detection

Flame ionisation detection is not specific for vinyl chloride and may therefore give readings which are greater than the actual concentration.

46 Gas samples may be taken by any technique which is recognised and acceptable for the analytical technique to be used.

47 A comprehensive description of the various analytical techniques available for the measurement of vinyl chloride are given in 'The Determination of Vinyl Chloride: A Plant Manual - Analytical Methods for the Control of Vinyl Chloride Concentrations In and Around Manufacturing and Process Plants' published by the Chemical Industries Association Limited, Alembic House, 93 Albert Embankment, London SE1 7TU. Details of one of the personal sampling methods used by HSE are available in MDHS 24 - 'Vinyl Chloride in Air: Laboratory method using charcoal absorbent tubes, solvent desorption and gas chromatography'.

Location of sampling points for fixed analysers or automatic sequential fixed point sampling systems

48 Sampling points should be located within the working area to sample air representative of that breathed by the workers. The probes should normally

be sited at breathing height and at local places where the air movement is representative of the general working area and should not impede the movement of workers, access to or operation of equipment.

49. Other locations for sampling points may also need to be chosen so that any increase in concentration of vinyl chloride arising as a result of leakage or plant malfunction can be detected as soon as possible (see para 54).

Accuracy and calibration

50 If a measuring system is used which records vinyl chloride and other substances without being capable of distinguishing between them, the results obtained should be regarded as representing vinyl chloride only. Special consideration may need to be given to the interpretation of results where there are indications that the Control Limit is being exceeded but it is known that this is due to other substances.

51 The precision and accuracy of the sampling systems used should be investigated over the vinyl chloride in air concentration range of 1-30 ppm. An accuracy of ± 10% within this range is satisfactory. The method used and the results obtained should be recorded.

52 Measuring equipment should be calibrated regularly, in accordance with the agreed air monitoring plan, using the most appropriate technical methods. The calibration of automatic air sampling systems should preferably involve the injection of air samples containing known amounts of vinyl chloride into the system at sampling points, rather than directly into the analysing instruments.

Leak detection

53 Leak detection may be carried out by the following means:-

(a) portable analyser;

(b) mobile sample line attached to a non-portable analyser;

(c) ultra-sonic leak detector.

SCC
4-0814

Alarm systems

54 Whatever sampling system is used for routine monitoring, there should also be a system for the automatic detection of high levels of airborne vinyl chloride in places where these may occur, eg in the event of plant failure. The alarm system may be integrated with a continuously operating or permanent sequential system provided for the purpose of air monitoring.

Recording and presentation of results

55 The results of all atmospheric monitoring at fixed points should be available for inspection by personnel working in areas where vinyl chloride is liable to be present and their representatives at any time during a working period. Where continuously operating multi-point sequential sampling methods are employed, the results should be displayed as far as possible within two hours of the end of each shift sampled. Where discontinuous method and/or personal monitoring are used, the results should be displayed within 24 hours of completion of the sampling period where possible.

56 In the areas where continuously operating multi-point sequential sampling and analysing equipment is installed, results should be summarised on a shift basis for each identifiable work area showing the average concentration in the area. Basic details of the position and number of sampling points together with the frequency of sampling and analytical methods used should be included at the beginning of the series of records and thereafter need only be recorded when changes occur in the monitoring procedure.

57 In the areas where sampling is carried out other than on each shift, the individual time weighted average results should be recorded. These should be summarised on a monthly basis showing the average concentration at each location with an analysis of the distribution of the individual results.

58 Records of maintenance and monitoring should provide sufficient information to enable employers, self employed persons, persons in control of premises, employees and/or their representatives at the workplace, and enforcing authorities to:-

(a) ascertain whether maintenance or monitoring has been carried out;

(b) monitor the performance and effectiveness of control measures;

(c) gain access to information on any defects or matters requiring attention and on the remedial action taken;

(d) identify exposure trends.

59 The records should contain at least the following information:-

(1) Leakages of vinyl chloride

(a) description of area or plant inspected;

(b) date of inspection;

(c) time of inspection and shift;

(d) statement of any defects or leaks found that might result in the release of vinyl chloride vapour above the 8 hour TWA Control Limit or alarm levels;

(e) significant uncontrolled or abnormal emissions of vinyl chloride to the atmosphere reported to HMIAPI;

(f) indication of action taken following discovery of faults;

(g) name, signature and appointment of person making inspection.

(2) Examinations of ventilation equipment

(a) location and type of plant;

(b) date of examination;

(c) instruments used and results of instrument readings;

(d) defects noted;

(e) action taken;

(f) name, signature and appointment of person making examination.

(3) Excursions above the alarm levels as detected during area monitoring

(a) part of factory to which the record refers;

(b) precise location within the factory;

(c) date, time and (where known) duration;

(d) maximum time weighted average concentrations recorded;

(f) result of investigation;

(g) action taken;

(h) name signature and appointment of person making inspection.

(4) Personal monitoring

(a) name of employee;

(b) date;

(c) time and duration of exposure;

(d) time weighted average concentrations recorded;

(e) precise duty and working area within factory;

(f) nature and nominal efficiency of respiratory protective equipment (if worn).

SCC
4-0817

The results of personal monitoring should be summarised on a monthly basis by job category in each plant in addition to shift results.

60 If respiratory protective equipment is worn by any personnel during air monitoring exercises, this should be recorded together with the nature and nominal protection factor of the equipment to enable an estimate of the 'actual' exposure to be made.

61 Records may be kept in any suitable form, including microfilm, computer or similar techniques, provided they satisfy the foregoing requirements and can be retrieved readily when required.

62 Records of air monitoring should be kept for at least 30 years. In the long term, air monitoring results may be kept in the form of monthly summaries, but in this case the detailed shift records on which they are based should be kept for at least 1 year. Records of leakages of vinyl chloride and examination of ventilation equipment should be kept for at least 2 years.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory protective equipment

63 Where adequate control of exposure to vinyl chloride cannot be achieved by normal engineering controls and the provision of further control measures for materials, plant and processes is not reasonably practicable, workers should be provided with adequate and suitable respiratory protective equipment. The term 'adequate' with respect to respiratory protective equipment refers to the ability of the equipment to protect the wearer; 'suitable' refers to the correct matching of the equipment to the job and to the person. To be considered adequate and suitable, respiratory protective equipment must be correctly selected and used. It should be noted that the nominal protection factor of respiratory protective equipment can only be achieved if the face fit of the equipment is very good. In the case of vinyl chloride, this means compressed air line or self-contained breathing apparatus of a type approved by or conforming to a standard approved by the Health and Safety Executive.

64 In particular, adequate and suitable breathing apparatus must be worn:-

(1) when it is not reasonably practicable to remove vinyl chloride vapour by local exhaust ventilation, e.g. when opening equipment which may release appreciable quantities of vinyl chloride to the atmosphere and during the maintenance or repair of equipment. No such operation should be conducted without a permit-to-work issued by a competent person designated by the employer for this purpose. Precautions should be taken to ensure that other unprotected personnel in the vicinity are not liable to be exposed to concentrations of vinyl chloride above the 8 hour TWA Control Limit;

(2) during entry into confined spaces which have not been certified by a competent person as being safe for entry without breathing apparatus.

65 Following an alarm, adequate and suitable breathing apparatus should be worn by any person remaining in an affected area until the alarm is over. The source of an escape of vapour should be identified and appropriate corrective action taken without delay.

66 It is recommended that no person should be required to rely for protection on respiratory protective equipment unless he has successfully completed a training or refresher course on the use of such equipment within the previous 12 months and has been issued with a certificate to this effect. The training or refresher course could include the following:-

(a) principles of operation and use of equipment;

(b) practical use, correct fitting, etc;

(c) limitations of the equipment;

(d) common defects and action required;

(e) company arrangements for issue, cleaning, maintenance, etc;

(f) when it is to be used.

67 A register of authorised personnel trained in the use of respiratory protective equipment should be kept together with a record of each person's training. All breathing apparatus should be maintained in a clean state, in good repair and in efficient working order. It should be inspected every 14 days and defects identified and remedied immediately. The maintenance schedules should specify that the compressed air supplied to the wearer of breathing apparatus should contain not more than 5 ppm carbon monoxide or 500 ppm carbon dioxide or 0.5 mg m^{-3} oil mist and except for these should be free from contamination by dust, dirt, metallic particles or any other toxic or irritant substances whatsoever. The maintenance schedules should also include the source of compressed air, the air line, particularly the connections, and proper cleaning and reissue of equipment.

68 No respiratory protective equipment which has been used should be worn again by another person unless it has been thoroughly cleaned and disinfected.

69 Records of maintenance and inspection of respiratory protective equipment should include the following information:-

(a) name and description of equipment;

(b) person issued to, if on personal issue;

(c) date of inspection;

(d) description of any defect found and action taken;

(e) name, signature and appointment of person making inspection.

These records should be kept for at least 2 years.

Protective clothing

SCC
4-0820

70 Under normal circumstances, where vinyl chloride is handled within

enclosed plant, there may be no need for the wearing of special protective clothing by process workers. However, certain circumstances, such as entry into confined spaces or some maintenance work, may require the use of special protective clothing. Such situations should be identified as part of the general assessment. The standard of clothing necessary will depend upon the nature of exposure. For example, where substantial body contact can be foreseen a high standard of protective clothing should be provided, eg completely enclosing air-fed suits (where respiratory protective equipment is also necessary) of wire reinforced PVC, or overalls of PVC-proofed material, completed in all cases by PVC gloves and boots. Where an area is relatively free of vinyl chloride, having perhaps been cleaned by means of high pressure hoses or other methods, overalls of materials such as terylene or cotton, may be adequate.

PERMITS TO WORK

71 A permit-to-work is essentially a document which sets out the work to be done and the precautions to be taken. It predetermines a safe procedure and is a clear record that all foreseeable hazards have been considered in advance and that all appropriate precautions are defined and taken in correct sequence. It does not, in itself, make the job safe but is dependent for its effectiveness on the persons concerned conscientiously carrying out the requirements of the permit. There should be provision on the permit-to-work for the persons authorising the work to sign to this effect and for the persons carrying out the work to sign the document at each stage of the operation as it is completed. Permits to work should be issued for all entries into confined spaces and for certain maintenance operations. Copies of all permits-to-work issued should be kept for a minimum period of 2 years.

Confined spaces

72 In this Guidance Note the term 'confined space' includes any chamber, tank, vat, pit, pipe, flue or similar confined space such as, for example, a reactor, duct, or bunker in which vinyl chloride vapour is known to be or is liable to be present.

73 Unless adequate precautions are taken, entry into a confined space involves a particular risk of exposure to very high levels of vinyl chloride or lack of oxygen. Concentrations of vapour may even be such as to involve a

risk of persons being overcome with a consequent risk to life, in addition to the possible long-term effects of exposure. Plant should be designed and operated so as to reduce to a minimum time spent in vessels and the number of occasions requiring entry.

74 In order to reduce the potential short-term and long-term risks, entry into confined spaces should be strictly controlled. A permit-to-work system should be operated and other special precautions taken as outlined in HSE Guidance Note GS 5 - 'Entry into Confined Spaces'.

75 Whenever a person enters a confined space for any purpose, a lifeline should be worn or, where this is not practical, some other method should be used, to enable a second person posted outside the confined space to keep in constant contact. The second person should be able to raise the alarm and equipment and trained personnel should be readily available for rescue purposes. All workers involved in any way with work in confined spaces should be fully trained and conversant with the organisation's agreed emergency procedures.

76 Unless a confined space has been certified in writing by a competent person as being, for a specified period, safe for entry without breathing apparatus and the period has not expired no person should enter or remain in the confined space for any purpose unless he is wearing suitable breathing apparatus. The permit-to-work should specify the type and standard of personal protective equipment to be worn and all other necessary precautions to be taken.

77 Entry into a confined space without breathing apparatus should not be authorised by a competent person unless:-

(a) effective steps have been taken to prevent the entry of any vinyl chloride vapour or other dangerous fume and

(b) any sludge or other deposit liable to give off vinyl chloride or other dangerous fumes has been removed and no other material liable to give off dangerous fumes is present and

(c) the space has been adequately ventilated, tested for vinyl chloride and other dangerous fumes and has a supply of air adequate for respiration.

If there is a possibility that the proportion of oxygen in the air of a confined space has been substantially reduced no person should enter or remain in such a space unless he is either wearing suitable breathing apparatus. Alternatively the space should be adequately ventilated and a competent person should test and certify it as safe for entry without breathing apparatus.

Maintenance operations

78 When a non-routine operation or malfunction may result in the release of vinyl chloride to the atmosphere, adequate and suitable breathing apparatus of a type approved by HSE should be worn. Wherever possible special measures should be taken to prevent emissions of vinyl chloride. Such operations should not be conducted without permission in the form of a permit-to-work from a competent person designated by the employer for this purpose. Precautions should be taken to ensure that other personnel are not exposed to levels of vinyl chloride above the Control Limit.

MAINTENANCE OF CONTROL MEASURES

79 All plant, especially that from which vinyl chloride may escape or which is provided for the purpose of controlling exposure to vinyl chloride, should be maintained to a high standard in order to limit the exposure of workers to vinyl chloride. Maintenance procedures should include regular and thorough examinations by a competent person at appropriate intervals of those parts of the plant at which leakages of vinyl chloride may develop over a period of time. A suitable instrument giving a direct read-out of the concentration of vinyl chloride-in-air should be used for leak detection during such examinations. All defects found should be remedied promptly and the results of maintenance examinations and details of remedial action taken recorded.

80 Regular examinations and tests should be made of ventilation equipment and other technical control measures by a competent person, using instruments where appropriate, to check the performance of such equipment as part of a planned preventive maintenance programme. Where ventilation plant is provided in pursuance of Regulation 7 of the Control of Substances Hazardous to Health

Regulations, maintenance should include a visual check at least once a week to identify obvious defects and a thorough examination and test by a competent person at least once a year. Details of such examinations and tests, defects found and remedial action taken should be recorded.

EMERGENCY PLANNING

81 A procedure for dealing with a substantial escape of vinyl chloride should be prepared and updated as often as is necessary. The objective is to ensure that all employees who may be affected are trained and practiced in the arrangements for dealing with such emergencies. The emergency plan should cover:-

(a) the definition of the type of situation to be considered as an emergency;

(b) raising the alarm;

(c) evacuation of the immediate area and adjacent areas liable to be affected;

(d) control of the occurrence using site resources;

(e) plant shut-down and containment of vinyl chloride leakage, and

(f) obtaining assistance from the emergency services.

The booklet "Recommended Procedures for Handling Major Emergencies", published by the Chemical Industries Association Ltd., Alembic House, 93 Albert Embankment, London SE1 7TU, provides useful information and advice on this subject. It should be noted that the Control of Industrial Major Accident Hazards Regulations 1984 will apply to some vinyl chloride installations and may require the preparation of on-site and off-site emergency plans.

82 Whenever abnormal emissions occur which affect the environment significantly, the District Inspector of HM Industrial Air Pollution Inspectorate and the local authority must be informed immediately. Production should not be continued with emissions outside the limits allowed without

having consulted the District Inspector. Under the Notification of Accidents and Dangerous Occurrences Regulations 1980 the sudden, uncontrolled release of 1 tonne or more of vinyl chloride, eg. by rupture of a bursting disc, must be notified to the HSE immediately.

REGISTERED WORKERS

83 In plants subject to the requirements of the Vinyl Chloride ACoP, any worker identified during the assessment procedure required under Regulation 6 of the Control of Substances Hazardous to Health Regulations as likely to be affected by occupational exposure to vinyl chloride should be designated as a 'registered worker'. A register of such workers should be kept by the employer. Any worker generally spending less than 25% of his working year exposed to vinyl chloride need not be designated as a registered worker. Consideration should also be given to designating other persons working regularly on site, eg contractors' employees, as registered workers where there is the potential for exposure to vinyl chloride on a scale similar to that for an employer's own employees and the assessment warrants such action.

HEALTH SURVEILLANCE

84 Health surveillance of registered workers is intended to detect, as early as possible, any harmful effects associated with exposure to vinyl chloride at work. The initial assessment considers the individual's fitness to work with vinyl chloride and establishes baseline medical information with regard to registered workers.

85 Workers should be subject to periodic assessment to check their fitness to continue working with vinyl chloride. The assessment may also provide additional information which might lead to a fuller understanding of the toxicological effects of vinyl chloride. Such data could also be of value in any future epidemiological studies. Each person should be subject to medical reassessment:-

(a) at intervals of not more than 12 months;

(b) if he has reported symptoms which could be attributable to vinyl chloride exposure;

(c) if, in the opinion of the appointed doctor, he requires further medical assessment;

(d) when he has been absent from work because of any illness for 4 weeks or more.

86 The medical assessment of each individual is the responsibility of the appointed doctor but it will normally include:-

(a) a full history, both clinical and occupational;

(b) a clinical assessment with particular reference to the abdomen, skin and extremities, and

(c) such further tests, including radiological examination and laboratory tests, as may be indicated by the results of (a) or (b).

87 The employer should ensure that the leaflet "Vinyl Chloride and You" is given to every worker on commencement of his employment. Copies can be obtained free of charge from any office of the Health and Safety Executive.

88 The employer should also ensure that each employee is aware that he has the right to request a written record of the results of any health surveillance procedures. If abnormal findings are present the individual may, if he consents, be referred to his Family Practitioner.

89 Where medical examinations need to be carried out adequate facilities should be made available. The facilities should comprise a room which is properly cleaned, adequately warmed, well ventilated, suitably furnished and provided with a wash basin equipped with hot and cold running water, soap and a clean towel. If it is not reasonably practicable to provide hot and cold running water, a means of heating water should be provided within the room. The room should be suitably quiet and not permit ordinary conversational voices to be heard outside its walls. The room should be set aside for the exclusive purpose of health surveillance whenever it is required.

Where the number of employees to be examined or assessed is substantial, a suitable waiting area should be provided. An adjacent lavatory with hand-washing facilities should be provided for employees who may be required to provide specimens for biological testing.

90 Arrangements should be made for any employee who is a registered worker to present himself, during his normal working hours, for medical examinations and any additional tests as may be necessary. Employees should cooperate in such examinations and tests.

91 The basic occupational health record of a registered worker's health surveillance should consist of at least the following information:-

> surname, forenames, birth surname, sex, date of birth, place of birth, (town and country), permanent address, National Insurance Number, National Health Service Number, date of commencement of present employment, and a historical record of jobs performed whilst in that employment, with appropriate details to indicate likely exposure.

92 These records may be kept in any suitable form provided that they satisfy the foregoing requirements and can be retrieved readily when required. They should be kept in a form compatible with and capable of being linked to those for monitoring, so that it is possible to compare the nature and degree of exposure to vinyl chloride with effects on health. The health record of a registered worker should be kept for at least 50 years from the date of the last entry.

93 Some of the conditions associated with exposure to high levels of vinyl chloride, particularly angiosarcoma of the liver and portal hypertension due to non-cirrhotic periportal fibrosis, may have prolonged latent periods with symptoms not appearing until several years after exposure, possibly after a vinyl chloride worker has retired or transferred to other work. In all cases when a vinyl chloride worker leaves a company, ceases to be a registered worker or transfers to another location, a letter should be sent to his Family Practitioner by the Appointed Doctor. Appendix 3 contains a suggested letter for sending to an employee's Family Practitioner and Appendix 4 a suggested form for the employee to give his consent for the Appointed Doctor to discuss his medical and occupational history with regard to his exposure to vinyl

chloride with his Family Practitioner. Both the suggested letter and form of consent have been approved by the Ethical Guidance Committee of the General Medical Council. Appointed Doctors are recommended to place copies of any letters and forms of consent in the occupational health records of the employees concerned.

94 When an employee ceases to be a registered worker, but continues to work at the same location and for the same employer, the Appointed Doctor shall offer to continue the employees health surveillance programme as in paras 85, 86 and 88.

INFORMATION, INSTRUCTION AND TRAINING

95 Employers should ensure that employees receive adequate information, instruction and training, so that they are aware of the nature of the hazard, the extent of the risks from exposure to vinyl chloride, the precautions to be observed to minimise these risks and the role of joint consultation. Employers should also ensure that employees of contractors and other persons working in areas involving potential exposure to vinyl chloride have received similar information, instruction and training. The topics covered should include the following:-

(a) health hazards of vinyl chloride;

(b) contents of the vinyl chloride ACoP;

(c) general methods outlined in this Guidance Note and the leaflet 'Vinyl Chloride and You' for protecting persons from the health hazards of vinyl chloride and the need for health surveillance;

(d) correct operation of the plant with which the employee is concerned;

(e) role of the employee in observing safe working methods;

(f) correct use of respiratory protective equipment and any other personal protective equipment;

(g) significance of monitoring procedures and results;

(h) relevant emergency procedures;

(i) relevant rules relating to vinyl chloride;

(j) procedures for reporting defects in plant and equipment.

It should be noted that Regulation 4 of the Control of Industrial Major Accident hazards Regulations 1984 requires a manufacturer to provide evidence that persons working on a site are informed, trained and equipped as necessary to ensure their safety.

96 Basic information, instruction and training should be provided on recruitment and should be supplemented at regular intervals by training, "on-the-job" refresher courses, talks, notices, leaflets or other methods in order to create and sustain a high level of awareness amongst employees.

97 Any person who carries out any assessment, air monitoring or maintenance tasks which require the use of instruments should be given additional instruction and training concerning their use including:-

(a) objectives of air monitoring;

(b) correct use of the instruments;

(c) sampling techniques;

(d) analysis, interpretation and recording of results.

FACILITIES

Washing and changing facilities

98 Adequate washing and changing facilities of a high standard should be provided. All the facilities should be kept clean, warm and in good repair. Washing facilities should include showers for the use of persons whose skin may be contaminated by vinyl chloride. Changing facilities should be designed to ensure that clean clothing and that which may be contaminated by vinyl chloride are kept separate.

Arrangements for eating, drinking and smoking

99 Employees should not eat, drink or smoke in areas liable to be contaminated by vinyl chloride, so suitable facilities for these purposes should be made available.

100 Where a number of employees are involved, suitable facilities for use by persons who remain on the premises during main meal intervals should consist of a canteen, mess-room or other suitable eating area. This should be provided with suitable tables and chairs and facilities for the storage of food and drink, whether the food and drink is supplied by the employers or the employees. If drinking fountains are provided they should be installed so as to prevent the water from becoming contaminated.

101 Smoking should not be permitted except in areas set aside for the purpose because of the fire and explosion risks associated with vinyl chloride.

NOTIFICATION TO THE HSE

102 Employers are requested to notify HMFI at HSE Area Offices and HMIAPI at District Offices of proposals for the installations of new plant or modification of existing plant. Such notifications should be made at the design stage. Vinyl chloride comes within the group of substances defined in Class 2 of Part II of Schedule 1 of the Notification of Installations Handling Hazardous Substances Regulations 1982. The Regulations require initial

notification to HSE of any site handling quantities of vinyl chloride in excess of 25 tonnes with renotification at three times this figure. Vinyl chloride also comes within the definition of a flammable gas as set out in Schedule 1 e(1) of the Control of Industrial Major Accident Hazards Regulations 1984. Notification to HSE is required under Regulation 4 at 50 tonnes of vinyl chloride and for Regulations 7-12 at 200 tonnes for process and storage or 300 tonnes for isolated storage. Notification to HSE is also required of significant modifications to the industrial activity for inventories exceeding 200 or 300 tonnes for process and storage or isolated storage respectively. For further details, reference should be made to the appropriate Regulations (see Appendix 6) and associated guidance published by HSE.

RECORDS

103 There are a number of references in various sections of this Guidance Note to the keeping of registers and records. For ase of reference these requirements are summarised in Appendix 5.

104 Where an employer ceases to operate, it is recommended that the Health and Safety Executive be notified and the records of air monitoring and employees' occupational health records transferred to HSE.

Council, be filed in your patient's NHS record card. Should any clinical suspicions along these lines arise in the future you might like to consider contacting me or my successor. I hold, and enclose a copy of, your patient's signed informed consent to this which means that you need not hesitate from taking such a step early in your considerations of differential diagnosis from fear of groundlessly alarming your patient.

Should this factory have ceased trading, the Employment Medical Adviser for your area, who can be found in the telephone book under Health and Safety Executive would know the whereabouts of your patient's factory medical and exposure records which are being preserved for 50 years from the end of his/her employment here.

If you would like any further information or explanations, please do not hesitate to contact me now or in the future. I will be glad to assist in any way possible in the interests of your patient's, our ex-employee's, well-being.

Yours sincerely,

APPOINTED DOCTOR

SEC
4-08[illegible]

REPORT NO. TH/82/4

UDC 612.2 :
678.743

AN EPIDEMIOLOGICAL STUDY OF THE LUNG FUNCTION OF WORKERS AT A FACTORY MANUFACTURING POLYVINYLCHLORIDE

by

MH Lloyd
S Gauld
L Copland
CA Soutar

JANUARY 1982

of employees who were either more susceptible or were exposed to a greater degree of hazard. Another plausible explanation is that recruitment policy has changed since 1969. A large number of men of quite variable health might have been recruited in 1969 to staff a plant considered to be completely safe, whilst, since 1975, relatively few comparatively fit men have been recruited to a plant known to contain hazardous materials. Without transfer factor data at pre-employment medical, as well as the data collected in this study, it is impossible to say which of several possibilities is the real cause of what is, in any case, a barely abnormal health pattern.

G M Paddle
4 2 1982

REPORT NO. TM/82/4

UDC 612.2 :
678.743

AN EPIDEMIOLOGICAL STUDY OF THE LUNG FUNCTION OF WORKERS AT A FACTORY MANUFACTURING POLYVINYLCHLORIDE

by

MH Lloyd
S Gauld
L Copland
CA Soutar

JANUARY 1982

PREFACE

ACKNOWLEDGEMENTS, SIGNIFICANT CHANGES AND COMMENTS

1) Since John Stafford's retirement from ICI, I am pleased to say that he has been elected an Honorary Fellow of the Faculty of Occupational Medicine at the Royal College of Physicians, London.

2) I would like to thank Dr Paglialunga for all his patience and hard work in helping me to acquire the necessary facts which enabled me to place the recent Pansac ASL in the Register.

3) I would like to thank Dr Laundrie, General Tire and Rubber Company, Akron, Ohio, and Dr Dacey, Robert A Taft Laboratories, Cincinnati, for informing me of recent ASL cases.

4) I am grateful to Dr Contassot for sending me information about three new ASL cases which have occurred at the St Fons' Factory in Lyons, and also for the full account which he gave.

5) I should be very grateful if I could be kept up to date with the five ASL cases which I have placed in the Register, who are all still alive at this present time.

6) I would like to express my appreciation for all the help I have been given in carrying on the work of John Stafford by everybody who has sent me their helpful comments and communications.

7) On taking over the Register, I discussed with Dr John Stafford his present format. We both felt this would be the appropriate time to consider any worthwhile comments about its presentation, and also suggestions for any way it could be improved, in order to benefit future analysis.

B BENNETT
17 Jan 84

Liver Angiosarcoma Cases

Circulation

Dr A Ross Adams, Air Products
Mr P N Anderson, Wilton
Dr W C Barnes Jr, Monsanto USA
Dr John Barr, Air Products
Dr Peter Baxter, EMAS
Dr Brian Bennett, Hillhouse (20 copies - ICIA, AECI, Duperial)
Dr Pietro Bertazzi, Milan University
Dr Besche, Dynamit Nobel, Troisdorf
Dr F W Bast, Everberg
Dr C Bishop, EMAS
Dr E Bouges, AECI Ltd, Plastics Div'n, PO Box 1122, Johannesburg 2000, South Africa
Dr David Bryson, AQ Division
Mr David Burgess, ICI Americas
Dr David Byrne, Kemanord
Dr J T Carter, BP
Mr C Calla, Montepolimeri
Mr M Chance, VCM Technical Manager, Mond
Mr P G Claus, APME
Mr Harold Clayton, Norsk Hydro
Dr Contassot, Chloe Chimie, St Fons
Dr E W Dacey - NIOSH, Cincinatti
Mr J G Davies, Everberg
Sir Richard Doll, Warden, Green College, Oxford
Mr G Dupont, APME
Mr H Emminger, VKE
Dr W Ernst, Berufsgenossenschaft der chemischen Industrie, Nurnberg
Dr Henry Falk, CDC Atlanta
Dr D M Ferguson, ICI Americas
Dr H P Friedel, Berufsgenossenschaft der chemischen Industrie, Heidelberg
Prof L Golberg, Duke University Medical Center, Box 2914 Durham, North Carolina 27710, USA
Dr H E Gomztonyi Jr, Tennaco Chemicals, Saddle Brook (NJ)
Dr Walter D Harris, Uniroyal Inc
Dr Donald W Hillman, Diamond Shamrock
Dr Robert K Hindarer, BF Goodrich (Cleveland)
Mr J Hodgson, EMAS
Dr W A Hogg - Imperial Oil Ltd, Canada
Dr J K Howard, Wellington Clinical School of Medicine, University of Otago, Wellington Hospital, Wellington, New Zealand
Dr N F Humphry, ICI Australia Operations Pty Ltd, PO Box 4311 Melbourne, Victoria 3001, Australia
Mr J Jauvert, Chloe Chimie, Paris
Mr H R Jervis, Millbank
Dr M N Johnson, BF Goodrich
Dr Bruce Karrh - Dupont
Dr R A Krueger, BF Goodrich
Dr J P Laloine, Solvay
Mr J Lawrence, SPI
Dr F I Lee, Victoria Hospital, Blackpool
Prof W K Leibach - University of Bonn
Dr D A Lewison - St Bartholomew's Hospital, London
Dr P Lewis, CIA
Mr Lolivier, Solvay
Prof R M M MacSween - Western Infirmary, Glasgow
Dr J M Maillard, Medizinische Abteilung, Suva, Postfach 6002, Luzern, Switzerland
Prof C Maltoni, Bologna
Dr Renzo Mattiussi, Montedison
Mr Mokka, Neste Oy
Dr R Montesano, Iarc, Lyons
Dr A A Motti, Duperial SAIC, Buenos Aires
Dr A Munn, Monsanto, Brussels
Mr M Munoz Mouton - Rio Rodano
Mr S Nakamura, Japanese PVC Association
Dr John J O'Sullivan Mond
Dr R Owen - TUC
Dr G M Paddle
Dr S Paglialunga - Montedison
Dr Hans Popper, Mount Sinai Medical Centre
Dr J Pumberg, Wacker
Dr James Purdham - Canadian Centre for OHS
Mr P Rungnes, Norsk Hydro
Dr R Saracci, Iarc, Lyons
Dr David Seronne, Diamond Shamrock
Dr Paul M Smith, Llandough Hospital
Dr R Spirtas - NCI/NIH Bethesda
Dr Carol Stack, CMA Washington
Dr J Stafford
Mr Stehnecker, BASF
Prof C M Tamburro - University of Louisville
Dr Gary Ter Haar, Ethyl Corporation
Dr B Terwiesch, CWH
Dr Gilles Theriault - McGill University
Prof Dr Thiess, BASF
Dr E Thiis - Evensen, Norsk Hydro
Dr W Tordoir, Shell
Dr T R Torkelson, Dow
Mr J R Wallace, Esso Chemical, Sarnia, Canada
Mr S O Wajdling, Kemanord
Mr R N Wheeler, UCC
Dr J Whitton, Hillhouse
Mr K H White, Duperial SAIC, Buenos Aires
Dr I W Williams, Norsk Hydro
Dr D M J Williams, BP Barry
Dr K S Williamson
Dr Peter Wright, P & P Wilton
Mr John York, Everberg

4-0827

BD

12 Jan 84

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER ANGIOSARCOMA CASES (REVIEW DATE - 1 JANUARY 1984)

Table Sequence

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 January 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
BELGIUM															
01		12.01.13	Solvay	Jemappe	00.07.58	00.05.76	63	18	17	29.06.76	Yes	High 1958-1968 exposed to 200 ppm for 8 hrs per day and certainly under 500 ppm in 6 to 9m^3 autoclaves 1968-1972 exposed to 50-200 ppm 8 hrs per day in 25m^3 autoclaves 1972-1974 exposed to 50-200 ppm in auto-clave room 1974-100 ppm 1975- 50 ppm RETIRED 1 Feb 1975	Autocleaner 14 yrs Polyworker 3 yrs	Driller in a foundry (2 yrs) Farmer (15 yrs) Work in glass ind. & chemical industry	Hepatic tests in Oct 1974 were normal. Retired Feb 1975 Hospitalised May 1976 Complete Clinical and career details are given in a paper by Huriet et al in Arch. Belg. Med. Soc., Hyg. Med. Trav. Med. Leg. 1977 pages 601-622

SOC
4-0830

APPENDIX 6

LEGAL REQUIREMENTS

Some additional legal requirements relevant to the handling of vinyl chloride may be found in the following:-

The Health and Safety at Work etc Act 1974
The Factories Act 1961
The Alkali etc Works Regulation Act 1906
The Emissions into the Atmosphere Regulations 1983
The Control of Pollution Act 1974
The Control of Substances Hazardous to Health Regulations 198_
The Notification of Installations Handling Hazardous Substances Regulations 1982
The Control of Industrial Major Accident Hazards Regulations 1984
The Dangerous Substances (Conveyance by Road in Road Tankers and Tank Containers) Regulations 1981
The Dangerous Substances (Conveyance by Road in Packages etc.) Regulations 198-
The Classification, Packaging and Labelling of Dangerous Substances Regulations 1984
The Notification of Accidents and Dangerous Occurrences Regulations 1980
The Reporting of Accidents and Dangerous Incidents Regulations 198-

APPENDIX 7

CHECKLIST OF MAIN CONTROL MEASURES

CONTROL MEASURES FOR MATERIALS, PLANT & PROCESSES (Paras 30-36)	- Plant should be designed and operated to minimise exposure to vinyl chloride - Plant should be sited in the open wherever possible - Good general ventilation should be provided in process buildings - Local exhaust ventilation should be provided where emissions from plant may occur that cannot be eliminated by improved design and maintenance
CONTROL OF EXPOSURE (Paras 19-20)	- Personal exposure to vinyl chloride should be controlled to below 7 ppm 8 hour TWA - Vinyl chloride in the air of working areas should be controlled to below 3 ppm averaged over a year
AIR MONITORING (Paras 37-62)	- Personal monitoring is required to check compliance with the 8 hour TWA Control Limit - A static monitoring system is required for the monitoring of vinyl chloride in the air of working areas
ALARM LEVELS (Para 21)	- Air monitoring system required for the detection of high levels of vinyl chlori and to sound an alarm at the following levels: 15 ppm measured over 1 hour 20 ppm measured over 20 minutes 30 ppm measured over 2 minutes
PERMITS-TO-WORK (Paras 71-78)	- Permits-to-work required for all work in confined spaces and some maintenance - All personnel involved must be properly trained
RESPIRATORY PROTECTIVE EQUIPMENT (Paras 63-69)	- Required for certain operations, eg entry into confined spaces, maintenance, dealing with leaks of vinyl chloride, emergencies, etc - Only equipment of a type approved or to a standard approved by HSE to be used - To be used only by trained and authorise personnel
MAINTENANCE OF CONTROL MEASURES (Paras 79-80)	- Regular and thorough examinations of plant required, especially where leaks may occur - Regular examinations and tests of ventialtion equipment required - Regular checks of other control measures

EMERGENCY PLANNING (Paras 81-82)	- Suitable plans required to deal with foreseeable emergencies - All employees should be familiar with relevant emergency procedures
HEALTH SURVEILLANCE (Paras 84-94)	- Registered workers should undergo regular medical examinations
INFORMATION, INSTRUCTION & TRAINING (Paras 95-97)	- All employees should receive adequate information, instruction and training on the hazards of vinyl chloride, the precautions to be observed and the role of joint consultation

DRAFT: 3 September 1984

Vinyl Chloride

(VCM)

&

YOU

SCC
4-0843

Why must you have a 'permit-to-work'

. Employers will have identified potentially dangerous jobs and you will not be allowed to do such work without a permit. The permit will specify exactly what work is to be done and the necessary precautions and their correct sequence.

. The permit does not in itself make the job safe. Safety depends on you carrying out the job properly and taking all the necessary precautions set out in the permit.

Why do I need to wear protective equipment?

. There may be some tasks, such as working in confined spaces, maintenance work, etc. where levels of VCM gas cannot be reduced below the Control Limit. For this type of work you will be required to wear breathing equipment, provided by your employer, for short periods of time. This equipment, which must be of a type approved by the Health and Safety Executive for use with VCM, will prevent exposure. Protective clothing will help prevent VCM entering your body through your skin.

Are medical examinations necessary?

. Yes. Your employer is responsible by law for monitoring your health. These check ups are intended to detect, as early as possible, whether working with VCM is effecting your health. You should always tell the company doctor if you feel unwell.

. Arrangements for check-ups and any tests that may be required will be made during your normal working hours.

. You are entitled to ask for a written record of the results of your check ups and tests.

. Your employer is responsible for keeping a comprehensive medical record for you while you work with VCM.

Why must you see the company doctor when you've been away ill?

. If you are away from work because of illness, for longer then 4 weeks, you will automatically be re-examined, on your return to work, to check your fitness to continue working with vinyl chloride.

What happens when you stop working with VCM?

. When you leave, transfer or retire from your job, your GP will be notified that the employer has your medical record should it be required in the future. If you transfer to a different job, with the same employer, where you are not classed as a 'Registered' worker, the company doctor will offer to continue your health check-ups.

Not to be circulated in final document

. Your permission will be sought before the company doctor can discuss your occupational medical history with your GP.

What about contractors?

. Contractors who come to work on your site are required by law to observe the same safety precautions.

. Before starting work, such workers must check with your employer the precautions required.

SCC
4-0845

Where can I get more information on VCM?

This leaflet can only tell you few of the main facts about working with VCM. If you want to know more ask your Safety Officer or ring the local office of the Health and Safety Executive. What about the Company Medical Adviser

REMEMBER VCM IS A HAZARDOUS SUBSTANCES. Every effort is made to safeguard you. Your employer has a duty to protect you. You have a duty to co-operate. USE THE CHECK LIST:

1. Be constantly alert to the dangers of working with VCM - for your own safety and for the safety of your colleagues;

2. Dont smoke in unsafe areas;

3. Make sure you are trained for your job;

4. Obey all safety precautions;

5. Observe safe working methods;

6. Use protective equipment when issued;

7. Report any defects in plant or equipment;

8. Attend for your medical check ups;

9. Tell the company doctor if you have any health problems or worries.

Reprinted from British Journal of Industrial Medicine 1984;41:328–333

Epidemiological study of the lung function of workers at a factory manufacturing polyvinylchloride

M H LLOYD, S GAULD, L COPLAND AND C A SOUTAR

British Medical Association, Tavistock Square, London WC1H 9JR

Comments on 'An Epidemiological study of the lung function of workers at a factory manufacturing polyvinylchloride'

1. In considering such a long report, it is best to start by eliminating those sections which are of minimal impact. Regression analysis with the use of standardised residuals is an adequate way to deal with age, height, weight and smoking history. The FEV_1 data can be ignored, unless one is tempted to compare them with the Hillhouse findings. Exposure categories and noxious occupations add little or nothing to the picture.

2. All that is left are the transfer factor results, the case-control study based on standardised residuals, and comparisons between Vinatex and the foundry and between employment pre and post 1975.

3. Section 3.1. almost condemns the study out of hand. Ideally, there should have been a fourth category consisting of ex-foundry men, but one can well understand why there was not. The response rates are very poor and could introduce sufficient bias to outweigh even very convincing results.

4. Table 6 demonstrates no significant difference between the proportions of cases at Vinatex and in the foundry. The slight numerical difference could be partly attributable to the absence of ex-foundry workers. Table 6 would normally terminate any investigation as nothing worthy of further study has arisen.

5. Table 6 is even less exciting given that the study was 'carried out to investigate a report that some men ..... had abnormally low values ....' Who were these men, and were they included in the study? The report tells us nothing further about them.

6. The case-control study resulted in Table 14 which summarises the only statistically significant finding in the whole report. The inclusion of volunteer ex-employees has made this Table rather worse than it would otherwise have been, but nonetheless there is clear evidence that the cases included a high proportion of pre-1975 recruits. The report gives one sensible explanation for Table 14 and does so in very moderate language. It is possible that conditions prior to 1975 led to a reduction of transfer factor in a small percentage

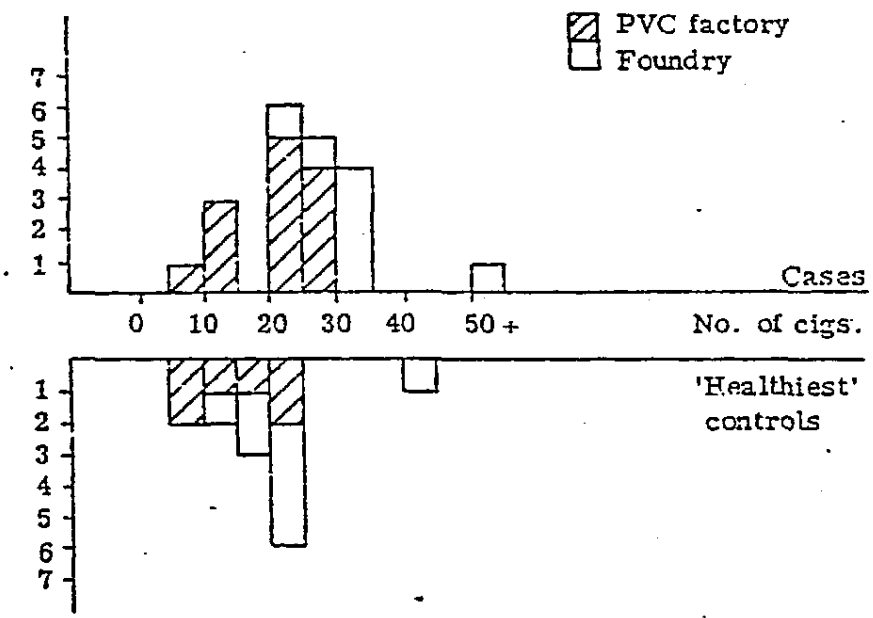

Fig. 5 Number of cigarettes smoked per day at weekends by Tuco cases and 'healthiest' controls, at the PVC factory and the foundry, who are current smokers.

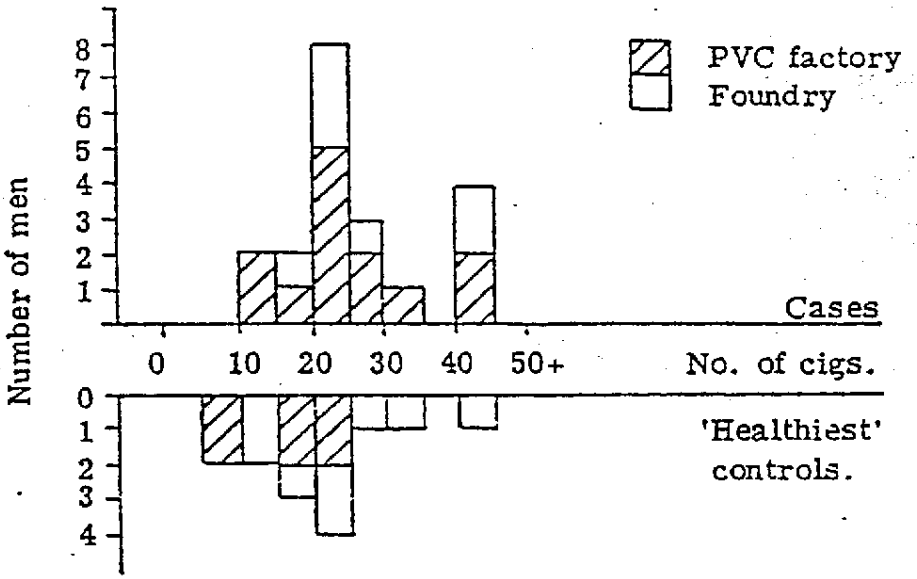

Fig. 6 Maximum number of cigarettes regularly smoked per day by Tᵢco cases and 'healthiest' controls, at the PVC factory and the foundry, who are current smokers.

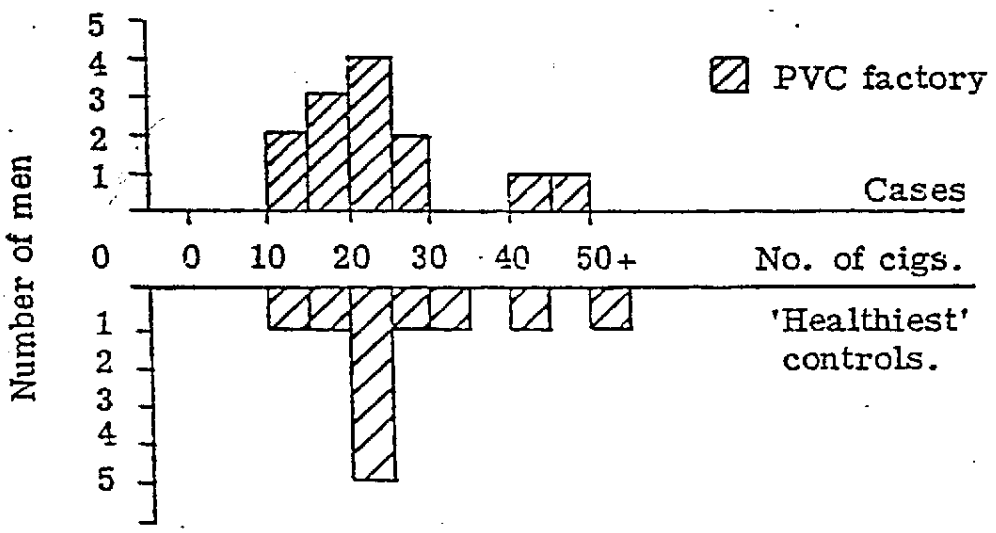

Fig. 7 Maximum number of cigarettes regularly smoked per day by FEV_1 cases and 'healthiest' controls.

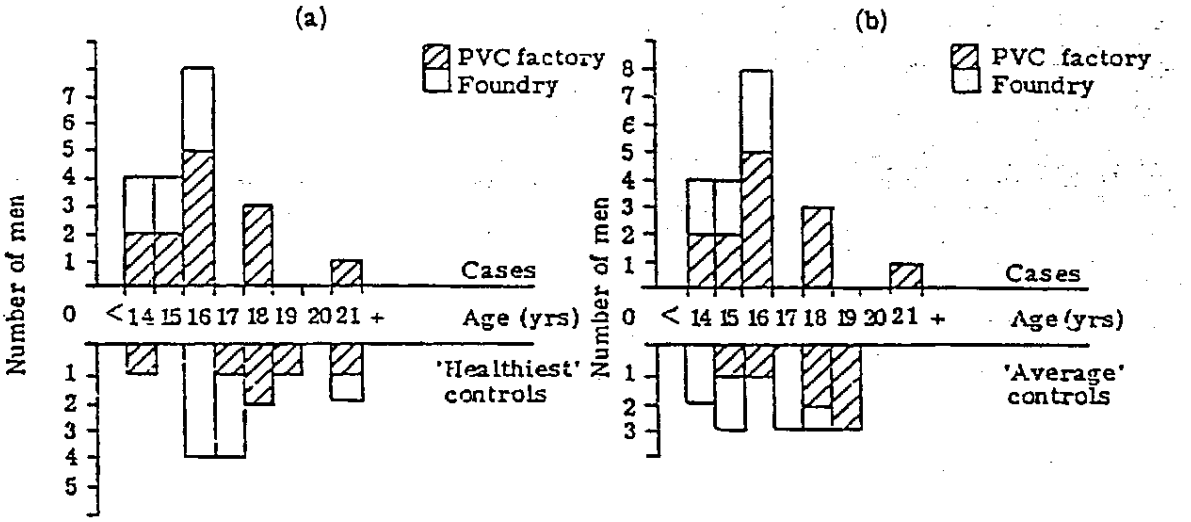

Fig. 8 a) Age when started smoking cigarettes, for T.co cases and 'healthiest' controls at the PVC factory and the foundry, who are current smokers.

b) Age when started smoking cigarettes, for T.co cases and 'average' controls, who are current smokers.

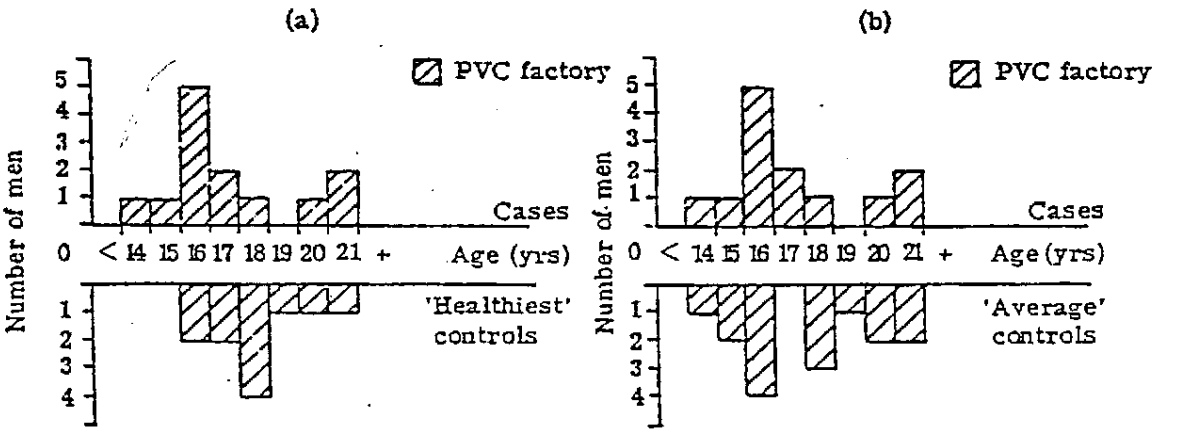

Fig. 9 a) Age when started smoking cigarettes, for FEV_1 cases and 'healthiest' controls, who are current smokers.

b) Age when started smoking cigarettes, for FEV_1 cases and 'average' controls, who are current smokers.

APPENDIX 1

SMOKING QUESTIONNAIRE

1 Do you smoke?

If NO

1a Have you ever smoked as much as one cigarette a day (or one cigar a week or an ounce of tobacco a month) for as long as a year?

If NO to both parts of question 1, omit remaining questions on smoking.

2 How old were you when you started smoking regularly?

3 How old are you now?

4 Do (did) you smoke manufactured cigarettes?

If YES

4a How many do (did) you usually smoke per day on weekdays?

4b How many do (did) you usually smoke per day at weekends?

4c What was the greatest number of cigarettes you ever smoked regularly per day?

4d For how long were you smoking that many?

4e Since starting smoking tobacco have there been periods during which you did not smoke cigarettes?

If YES, for how long altogether were you not smoking cigarettes?

4f (Apart from those times) what was the least number of cigarettes you ever smoked regularly per day?

4g For how long were you smoking that many?

5 Do (did) you smoke hand-rolled cigarettes?

If YES

5a How much tobacco do (did) you usually smoke per week in this way?

6 Do (did) you smoke a pipe?

If YES

6a How much pipe tobacco do (did) you usually smoke per week?

7 Do (did) you smoke small cigars?

If YES

7a How many of these do (did) you usually smoke per week?

8 Do (did) you smoke other cigars?

If YES

8a How many of these do (did) you usually smoke per week?

For ex-smokers:

9 When did you last give up smoking?

APPENDIX 2

NOXIOUS OCCUPATIONS

In the classification of noxious occupations the following jobs were included in the category 'other'. Although it is recognized that some of the jobs included in this category are not widely recognized as 'noxious', it was considered that they may on occasions be associated with health hazards and should therefore be included in the classification of noxious occupations

Brewing
Baker
Flour miller
Farm worker
Wood cutter/sawmill worker
Construction worker
Bricklayer
Plasterer
Quarryman
Paper mill worker
Electrician
Joiner
Glassworker
Welder
Scrap burner
Foreman
Coking plant worker
Furnace operator
Car body repairer
Paint sprayer
Painter/decorator
Tarmacadam exposed workers

APPENDIX 3

Development of the multiple linear regression model used in the analysis of the data from the total survey population

Preliminary multiple linear regression analysis indicated the anticipated relationship between TLco and age, height and weight and between FEV_1 and age and height.

These relationships were looked at again after allowing different intercepts and age slopes for non-smokers and all smokers whether current or ex-smokers. For the TLco analysis, this was a significant improvement in the amount of variation explained. However, this group of smokers did not have a significantly lower mean TLco after age, height and weight had been taken into account than non-smokers and the age slopes were similar. The model used for TLco (but not the FEV_1 model) was further improved by introducing different intercepts and age slopes for three categories of smoking, non-smokers, current smokers and ex-smokers. This analysis showed that for ex-smokers the mean value of TLco was significantly higher than that of current smokers ($P < 0.05$) but that they experienced a greater loss of TLco with age than current and non-smokers although these differences were not statistically significant (Table 1).

Further expansion of this model by allowing different intercepts and age slopes for the different employment categories (current and former employees at the PVC factory and foundry employees) within the three smoking groups did not make a significant improvement to the model. However, this analysis did indicate that the mean TLco level for leavers from the PVC factory who were current smokers was significantly lower ($P < 0.1$) than current PVC factory employees who were non-smokers. However, the age slope of this group did not differ significantly from that of current PVC factory employees who were non-smokers. Hence the model used was the one in which different intercepts and age slopes were allowed for the three smoking groups.

For reasons of consistency the FEV_1 analysis was also based on this same model although there was no significant improvement in the amount of variation explained as there had been for the TLco analysis. The results for FEV_1 analysis show that there was a significant difference ($P < 0.1$) in the rate of loss of FEV_1 with age between non-smokers and current smokers who experienced a greater rate of loss of FEV_1 (Table 2).

TABLE 1 Regression for T_{Lco} (ml/min. mm Hg) allowing different intercepts and age slopes for three smoking groups.

Variables	Units	Mean	Regression coefficient	t	P
Age	Years	42.2	-0.2246	-5.74	< 0.001
Height	cm	173.8	0.1552	4.74	< 0.001
Weight	kg	80.2	0.0572	3.23	< 0.002
			Constants (Intercepts)		
Constant for non-smokers			10.3052		
Effect on intercept of:					
Current smokers			-2.5288	-1.34	NS
Ex-smokers			1.4554	0.69	NS
Effect on age slope for:					
Current smokers			-0.0154	-0.33	NS
Ex-smokers			-0.0537	-1.08	NS

TABLE 2 Regression for FEV_1 (ℓ) allowing different intercepts and age slopes for three smoking groups.

Variables	Units	Mean	Regression coefficient	t	P
Age	Years	42.2	-0.0309	-4.55	< 0.001
Height	cm	174.3	0.0420	7.13	< 0.001
Weight	kg	80.4	0.0003	0.09	NS
			Constants (Intercepts)		
Constant for non-smokers			-2.1725		
Effect on intercept of:					
Current smokers			0.4209	1.24	NS
Ex-smokers			0.2675	0.75	NS
Effect on age slope for:					
Current smokers			-0.0149	-1.81	< 0.10
Ex-smokers			-0.0096	-1.13	NS

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

* All dates use UK system
DAY - MONTH - YEAR
** Data published in Journal of
Occ Med 1978 pages 338-340
*** Many of dates altered to fit NIOSH 31/1/77 list

Canada Sheet 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
CANADA			SHAWINIGAN												
01		15.12.13			1944	1955	41	11	11	02.09.55	Yes		Reactor cleaner	Operator polymerisation	Smoker
02		06.03.14			1943	1957	43	14	14	21.12.57	Yes		Maintenance, millwright, pipefitter	Operator	Worked overtime Smoker
03		26.08.19			1941	1962	42	21	20	23.03.62	Yes		Operator, foreman		Worked overtime Non-smoker
04		05.04.19			1945	1967	48	22	22	21.01.68	Yes		Reactor cleaner	Operator, foreman, water cooling unit	Worked overtime Smoker
05		07.05.11			1944	1968	57	24	05	05.07.68	Yes		Reactor cleaner	Water cooling unit	Worked overtime Smoker
06		15.12.19			1947	1971	51	24	23	10.04.71	Yes		Reactor cleaner	Maintenance, millwright	Worked overtime Smoker *
07		09.11.19			1946	1972	53	26	25	24.12.72	Yes		Reactor cleaner	Machine shop operator and poly unit	Worked overtime Smoker
08		13.05.20			1961	1973	53	12	05	12.06.73	Yes		Reactor cleaner	Maintenance machine shop	In plant 25 yrs! Smoker
09		19.07.21			1946	1974	53	28	26	04.09.74	Yes		Furnace op. pipefitter maintenance		Worked overtime Smoker

* Paper by Dr F DELORME in Annales d'Anatomie pathologique Paris, 1978 Vol 23 No 2 pp105-114 claims this case had both a hepatoma and ASL simultaneously.

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cause - (Review Date: 1 Jan 1984)

DAY - MONTH - YEAR
* All dates use UK system
** Data published in journal of Occ Med 1978 pages 338-340
*** Many of dates altered to fit NIOSH 31/3/77 list

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
CANADA															
10		16.05.15			1953	1976	61	23	14	00.04.77	Yes		Reactor cleaner	Furnace op. maintenance, packaging	Ex-smoker

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
CZECHOSLO-VAKIA															
01		28.06.28	State Co	Novaky	01.07.57	24.12.73	45	16	16	24.12.73	Yes		Autoclave Cleaner	IARC letter of 1-4-82 giving details from Prof A David of Centre Ind Hygiene and Occ diseases.	
02		06.07.27	State Co	Novaky	01.11.50	27.11.64	37	14	15	26.11.64	Yes		Autoclave Cleaner	IARC letter of 1-4-82 gave somewhat altered dates for this case. I have accepted the changes since the dates come from Prof A David of the Centre of Industrial Hygiene and Occupational Diseases. My dates come originally from NIOSH.	

SCC
4-0856

LIVER Angiosarcoma Cases – (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
FRANCE															
01	M	15.04.24	RP	Roussillon	00.01.46	18.02.67	43	21	19	19.02.67	Yes	High	Autoclave worker and cleaner 19 yrs		Ref. Ravier et al Arch. Mal. Prof. 1 30 n° 3 Nov 75 p 171-177
02	SIH	03.06.11	PCUK	Brignoud	06.07.59	15.01.75	63	16	12	24.01.75	Yes (NIOSH no comment)	High	2 yrs on monomer 10 yrs on polymerisation	Italian origin	Ref. G Bonneton et al "Nouvelle presse medicale" 5 Nov 1977 p 735
03	NAV	06.01.20	RP	St Fons	00.00.46	15.01.75	55	29	29	29.06.75	Yes	High	Polyworker 10 yrs as autoclave cleaner Compounding 3 yrs	VCM production 16 yrs Italian POW Shepherd, Sawyer, Mason	Ref. Raty et al Arch. Mal. Prof. 1 37 n° 6 June 77 p 551-555
04	MOR	27.01.27	PCUK	Brignoud	19.10.49	16.01.76	49	26	26	04.01.76	Yes	High	Monomer production worker 8 yrs PVC filtration 18 yrs		
05	B	29.01.38	PCUK	Brignoud	18.01.65	13.05.76	38	11	11	13.05.76	Yes	High	Polyworker 11 yrs	1) Thoracotomy 9th Feb 1976 costal angiosarcoma 2) Scintigraphy found ASL 3) Haemorrhage from ASL 4) Right Hepatectomy	Ref. P Coudere et al "Semaine des hopitaux 10 Septembre 1976 Previously had bone angiosarcoma" Also Pilichowski et al "La Nouvelle Presse Medicale 7th July 1979 Page 2485

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

France
Sheet 2

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
FRANCE															
06	Pa	14.04.34	PCUK	Brignoud	01.03.58	12.08.76	42	18	13	11.09.76 (NIOSH says 12.09.76)	Yes	Moderate	(1958-1960) 2 yrs filtration 10-11 yrs polyworker and works lab?		This man had AOL prior to AS. Ann. de Hal. Prof. July '77 p 645 & 6. AOL was found in 1971 five yrs before ASL
07	CIR	26.04.27	RP	St Auban	01.07.50	After death NIOSH says 00.07.76	49	26	22	02.07.76	Yes (NIOSH no comment)	High	Plant foreman in polymerisation	1972-6 admin section in St Auban	Died of aepticaemia Small liver lesion found after autopsy
08	B	01.04.34	Solvay	Tavaux	23.05.57	03.12.75	42	19	19	30.01.77	Yes	Moderate	6 yrs packer & autoclave clnr 14 yrs autoclave worker		Had been tunnel worker previously
09	RFX	08.10.14	RP	St Fons	10.01.48	26.04.76	61	28	28	25.12.77	Yes	Very High 1948-1966 Lesser Exposure 1966-1976	Polymerisation operator, autoclaveur, autoclave maintenance	10 yrs in sulphuric acid factory, storekeeper & general services	Operated 4.76 for removal of tumour from liver and died after second surgical operation for bile bronchial fistula Paper by Dr Rety et al In Archives de Maladies Professionals Vol 40 No 6 1979 pages 741-3.

SCC 4-0861

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
France															
10	VP	24.05.19	RP	St Fons	00.12.56	10.01.78	58	21	21	10.01.78	Yes	High	Autoclave cleaner	10 yrs in mechanical engineering industry 1946-1956	Died of pulmonary embolism 5 days after surgery
11	L	15.02.12	RP	St Fons	00.01.41	12.08.78	66	37	31	13.11.78	Yes	High	1941-1946 polymerisation general purpose worker 1946-1972 VCM synthesis (HCl & Acetylene) Foreman (agent de maitrise) 1972 retired		
12		16.08.14	PCUK	Brignoud	09.02.49	00.05.79	65	30	27	23.06.79	Yes	High	Monomer production and polymerisation operator		
13		19.01.31	Solvay	Tavaux	23.09.63	26.06.79	48	16	13	22.08.79	Yes		Autocleanor 2 yrs, Auto-operator 9 yrs, Copolymers 4 yrs	2 yrs as cycle mechanic, 10 yrs as enameller in sanitary ware manufacture	Cigarette smoker until 1974. Ill all of 1977 due to Oesophageal varices. Surgical intervention 25.05.79 (right hepatectomy)
14	HJ	05-04-24	Chloe Chimie (Formerly RP)	St Fons	1943	00.07.81	57	38	36	29.07.81	Yes	Very High 1943-1975 and Intermittently 1975-1979	1943-1975 All types of jobs on manufacture & maintenance in VCM Poly Process	1975-1979 maintenance work	

SLC
4 0352

IMPERIAL CHEMICAL INDUSTRIES LIMITED
PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
France															
15	DEP	03.01.37	Chloe Chimie (formerly RP)	St Fons	07.07.55	28.09.82	45	27	27	Alive	Yes	High-20 yr Moderate 7 yrs	Autoclave cleaner 1955-1962 autoclave operator 1962-1982		J C Contassot Letter of 5 10 1983
16	GTH	13.07.22	Chloe Chimie (Formerly RP)	St Fons	27.10.41	05.01.83	61	41	38	Alive	Yes	High-33 yrs Moderate- Low - 5 yrs	Polymerisat-ion Process Man Maintenance Worker Health & Safety Agent		Retired Jan 1979. J C Contassot Letter of 5 10 1983
17	HAK	22.02.23	Chloe Chimie (Formerly RP)	St Fons	17.06.48	03.04.83	60	34	28	03.04.83	Yes	High - 23 yrs	Autoclave Cleaner 1948-1971	Other sectors of St Fons Factory 1971-1978	Retired 01.01.79 J C Contassot Letter of 5 10 1983

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

Germany Sheet 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
GERMANY															
01		00.00.30	Dynamit	Troisdorf	01.10.56	19.09.68	38	12	12	25.01.69	Yes (NIOSH)		Polyworker		
02		00.00.31	Dynamit	Troisdorf	14.10.57	25.09.70	39	13	11	14.12.71	Yes (NIOSH)		Polyworker		
03		00.00.30	Dynamit	Rheinfelden	09.06.52	00.03.73	43	21	16	10.10.73	Yes (NIOSH)		Filling pesticide aerosol cans with VC		Reported under non polymerisation workers in NIOSH list of 31.3.77. This of course is strictly correct. However I wonder whether this man had high exposure to VCM in his can filling operation?
04		00.00.30	Wacker	Burghausen	16.04.57	26.11.74	44	17	17	25.11.74	Yes (NIOSH)	200-500 ppm but high during 1 yr autocleaner	Polyworker & temporary autocleaner	1958 was autocleaner for 1 yr	Clinical details in paper by Gokel et al Virchows Arch A Path 1976 372 p 195-203

SCC 4-0884

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
GERMANY															Confirmed
05 (NIOSH gives as Case 06)		00.00.36	Hoechst	Frankfurt	02.04.60	10.12.73	38	13	05	16.12.74	Yes (NIOSH)		BG Chemie says "chemistry laboratorian in the Techno-logical Research Department" (NIOSH says assistant factory chemist which may be wrong translation)		Reported under non-polymer-isation workers in NIOSH list of 31.1.77 and 1.78. I don't think this is a correct classification by NIOSH. The man may have been involved in VCM polymerisation in pilot plant or in main plant.
06 (NIOSH gives as Case 05)		00.00.32	Lonza	Waldshut	16.12.62	00.00.75	43	13	12	09.01.75	Yes		PVC - Manu-facture Shift Leader		
07		00.00.26	Wacker	Burg-hausen	15.04.54	12.11.75	49	21	21 (NIOSH says 12)	13.11.75	Yes		PVC Manu-facture and all work incl auto-cleaning 12 yrs (1954-66) Foreman Tech Dev 8 yrs (1967-1975)		
08		00.00.17	Dynamit	Troisdorf	19.07.54	06.04.75	58	20	20	25.12.75	Yes	†	Polyworker	†	

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

Germany
Sheet 3

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
GERMANY															
09		00.00.34	CWH	Harl	20.02.61	16.06.76	41	15	13	24.03.78	Yes	High peaks	12 yrs poly-worker incl 17% auto-clave cleaning Control room 1 yr		10/78 Confirmed Average exposure first 9 yrs 150 ppm, occ 1000 ppm, Next 3 yrs av, 75 ppm. Last yr av 35 ppm
10 (NIOSH given as Case 11)		00.00.36	CWH	Harl	01.01.61	00.01.77	40	16	10	07.01.77	Yes	High peaks	10 yrs poly-worker incl 17% auto-clave cleaning		Average exposure first 9 yrs 150 ppm, occ 1000 ppm. Last yr av 75 ppm. CWH letter of 21.04.78
11 (NIOSH gives as Case 10)		00.00.29	Wacker	Burg-hausen	10.10.55	28.06.77	47	21	22	28.06.77	Yes	High	3 yrs auto-clave cleaner 19 yrs filter operator		
12		00.00.38	Dynamit	Troisdorf	00.00.61	00.10.77	39	16	6	07.10.77	Yes	?	PVC Manu-facture Autoclave worker for 6 yrs		

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO (1)	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
GERMANY															
13		00.00.14	Lonza	Waldshut	00.00.60	08.04.78	63	18	14	19.05.78	Yes				F W Best letter of 30th June 1980 enclosing data from Mr H P Friedel of BG Chemie
14											Not an Angiosarcoma In his letter of 21 12 81, Mr Friedel said this was a "Plattenepithelkarzinom Der Speiserohre" (a carcinoma of the oesophagus) not attributable to VCM & not recognised as an industrial disease				F W Best letter of 30th June 1980 enclosing data from H P Friedel of BG Chemie withdrawing this case
15 (HIOSH gives this as Case 13)		00.00.29	Wacker	Burghausen	19.10.53	09.10.78	49	25	25	23.10.78	Yes	?	Autoclave cleaner and worker. Drier operator. Later shift leader.		Angiosarcoma confirmed 09/79. Some detail of this & also cases 9, 13, 15, 16 & 17 given in NRW Report for 1978
16		00.00.23	Dynamit	Troisdorf	10.01.55	07.08.78 (Leibach suspected ASL at Feb 1975 laparotomy)	55	23	20	07.08.78	Yes ASL and Hepatocellular Carcinoma	High	Autoclave worker till 1964. Leader and master		Angiosarcoma confirmed, full details of illness since March 1973 given in NRW Med Insp Rep for 1978. Different details given in "VC Associated Diseases" by Leibach and Marxmiller (1981) p71.

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
GERMANY															
17 (HIOSH gives as Case 15)		00.00.37	Dynamit	Troisdorf	01.11.61	14.08.78	41	16	11	28.08.78	Yes	High	Autoclave worker	No	Angiosarcoma confirmed. Annual report of the North Rhine Westphalia Medical Inspectorate for 1978 pages 347-377 gives full details. Vinyl chloride disease diagnosed 02-02-73. Oesophageal varices. Radiologically confirmed acro osteolysis.
18		00.00.13	Hoechst	Gendorf	00.00.55	25.12.79	66	24	21	25.12.79	Yes		Autoclave Worker		
19		00.00.25	Dynamit	Troisdorf	18.10.54	00.08.79	54	25	18	22.02.80	Yes Metastasing ASL	High	Autoclave Worker		Dr Besche letter of 13-04-82 to Dr W G F Adams
20		00.00.15	Dynamit	Troisdorf	14.02.61	00.04.80	65	19	13	19.10.80	Yes Haemangio Endothelioma of liver with Metastases	High	Autoclave Worker		Dr Besche letter of 13-04-82 to Dr W G F Adams
21		00.00.13	Dynamit	Troisdorf	01.01.62	00.09.79 pronounced clinical liver symtoms)	66	17	13	19.06.80	Yes Haemangio Endothelioma of liver with Metastases	High	Autoclave Worker and worked in drying shop		Dr Besche letter of 13-04-82 to Dr W G F Adams
22		00.00.21	Dynamit	Troisdorf	15.10.61	17-09-80	59	18	11	06.12.81	Yes Metastasing ASL	High	Autoclave Worker	Chargehand, subsequently Foreman	Dr Besche letter of 13-04-82 to Dr W G F Adams

SCC
4 00868

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

* Should this case be removed from the list? NIOSH have it on their supplementary list relating to non-polymerisation workers exposed to VCM.

JS 1/8/77

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
ITALY															
01 (On NIOSH supplementary list)	LG	15.06.34	PANSAC		00.00.65	19.04.71	36	06	03	16.04.71	?Yes		PVC Bag extruder		* Primary tumour may have been pericardium. Not homogeneous with other cases. ** ***
02	SE	13.11.29	Montedison	Porto Marghera	00.00.57	13.12.72	43	15	06	27.12.72	Yes		Polyworker		** ***
03	VC	14.03.20	Solvay	Ferrara	00.01.53	10.07.75	55	22	21	10.07.75	Yes	High	Autocleaner 8 yrs (1953-61) Autoclave operator 12 yrs (1961-72)	1972-5 did a variety of jobs including PVC packing.	***
04	FB	20.07.37	ANIC	Ravenna	00.04.59	00.01.81	43	21	21	30.03.81	Yes	12 yrs - Very High 5 yrs - Medium 4 yrs - Low	1 yr - Monomer operator 20 yrs - Autoclave operator & other duties in suspension polymerisation. Area Foreman in same Dept since 1975.	Never cleaned autoclaves. See paper by CHIAPPINO et al Med Lavoro Vol 6 (1982) pp 555-563	*** Non-smoker. Consumed little alcohol. No AOL.
05	G Danesin	19.03.37	Pansac	Mira Venice	00.00.67	07.03.83	46	16	8	06.04.83	Yes	Medium-? High	Bag extruder 1967-1975 Commercial Dept 1976-1983		S Paglia-lunga telex of 2 Aug 1983

** See Maltoni Med di Lavoro 65 p445, 1974. Further details in letter from Dr Montesano of IARC on April 1st 1982.

*** Also see Maltoni and Rondinella in Acta Oncologica Vol 1 1980 pages 35 - 49. (ICI has made a translation of this paper into English and copies of the translation can be made available on request).

SCC 4-0869

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
JAPAN															
01	Tomoji Mori	01.08.22	Mitsui Toatsu (no comment by Jap PVC Assoc)	Nagoya	00.04.53	24.10.75 *	53 *	22 *	13	24.10.75	Yes	PVC Assoc says not known. * Japan Times indicated on 25.10.75 exposures often at 3000 ppm up to 1974	13 yrs autoclave cleaner 1964 - assigned to different work since had ill health		Japan Times 25.10.75 & Japanese PVC Assoc letter of 31.03.78
02	SO	02.08.39			00.11.58	10.08.76	37	17	13	10.08.76	Yes	Not known	In polymerisation work including autoclave cleaning		Japanese PVC Association letter of 31.03.78

* In his letter of 1st April 1982, Dr Montesano of IARC says Japanese Ministry of Labour give

Date of diagnosis - 21-08-74
Age of diagnosis - 52
Years of exposure - 22

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
NORWAY															
01	AH	23.12.15	Norsk Hydro	Herøya	00.03.50	21.12.71	56	22	21	04.01.72	Yes	High	Foreman & Autoclave supervisor		Confirmed by Dr Thiis-Evensen of NH. At APME Mtg of 9 June 1978 Mr P Rangnes stated that AH had been a member of a start-up team. VCM & PVC were made in same building. The VCM was made from acetylene

SCC 4-0871

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
SWEDEN															
01	ND	23.06.27	Kemanord	Sundsvall	14.08.51	20.10.70 *	43	19	18	20.10.70	Yes		Polyworker		
02	BL	27.11.11	Kemanord	Sundsvall	00.01.45	00.08.72 *	61	27	27	16.08.72	Yes	High	VCM production		Mr Sjoalin's letter of 28 March 1978 confirms BL was a monomer worker who was heavily exposed, probably even more so than a normal reactor cleaner
03	NR	10.06.10	Kemanord	Sundsvall	00.05.47	18.03.76	65	29	21	19.03.76	Yes	High	Polyworker		
04	AL	16.11.14	Kemanord	Sundsvall	00.00.46	12.05.77	62	31	31	12.05.77	Yes	High	1946-1958 polymerisation worker (12 yrs) & 1958-1977 foreman (19 yrs)		In first 12 yrs of employment had been heavily exposed. In 1974, liver abnormality and necrosis diagnosed. Date confirmed in Dr D Byrne letter 18.8.77 to CEFIC
05		12.03.19	Kemanord	Sundsvall	11.05.64	22.11.80	61	16	16	22.11.80	Yes	High - 6 Years Low - 10 Years	1964-1970 centrifuge operator (1970-1980) drier operator		Letter of 2nd Nov 1981 from Dr David Byrne

SCC 4-0872

* In his letter of 1st April 1982, Dr Montesano of IARC says in Sweden's [illegible]onal Board of OS Health gives 20-02-70 as date of [illegible]osis for Case 01 and 15-05-72 for Case 02.

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
UK															
01	WJ	20.04.01	ICI	Hillhouse	04.04.44	03.12.72 (Fox & Collier paper says 23.12.72)	71	28	22	03.12.72 (Fox & Collier paper says 23.12.72)	Yes	500' ppm	1944-7 VCM 1947-8 Drier 1948-61 Autoclave operator 1961-66 Drier		Lea and Harry Lancet 29-06074 pages 1316-8
02															Dubious fabrication case
03	RJW	02.06.37	BP	Barry	00.02.66	00.12.74	37	09	3.5	24.12.74	Yes	High	Autoclave cleaner		Exposure limited to 2.66 - 9.69
04	JSR	23.06.20	ICI	Hillhouse	26.04.54	00.06.79	59	25	18	12.10.79	Yes	Medium-high	54-5 Bagging Plant 55-6 Drier Plant 56-58 Autoclave worker 58-61 Chargehand Drier Plant 61-72 Foreman C 2/3 Plant	Pre-war fish packer 1939-45 army vehicle maintenance 1945-54 fish packer	

SCS 4-0372

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
UK															
05	JK	30.03.14	BP	Barry	08.01.51	00.10.79	65	28	21	19.11.79			1951-52 Polycleaner 1952-55 Latex 1955-60 Polyfloor 1960-64 Poly Chargehand 1964-70 Charging operator 1970-72 Drier operator		
06	GEP	1931	BP	Barry	1962	09.01.80	48/9	18	12	09.01.80			7 yrs Poly Floor Operator 5 yrs Greaser on Poly Floor		
07	RCB	26.04.20	BP	Barry	1963	00.00.80	60	17	82	13.06.80			Polycleaner 1963-5 Recovery 1965-1971		
08	WTH	08.05.24	BP	Barry	19.09.50	27.11.81	57	31	24	25.12.81		1950-1958 500 ppm 1968-1974 200 ppm	1950-51 Autoclave operator 1951-1957 Chargeman autoclave building 1957-1974 Shift supervisor autoclave building - Never cleaned autoclaves but supervisor's job entailed entering autoclaves to inspect them	1938-1948 Motor Mechanic 1948-1950 Operator on Acetylene Production Plant	

SCC
4-6874

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

UK
Sheet 3

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
UK 09	EICP	07.05.25	BP	Barry	15.02.50	02.03.83	58	33	29	24.02.83	Yes	Medium	Polyworker	2 years on Acrylonitrile Resin Plant. Also prior to 1950. 4 years RAF maintenance. 3 years motor car paintshop. 2 years in Graving Dock.	

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Data: 1 Jan 1984)

*UK system of dates
DAY - MONTH - YEAR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
USA															
01	Earl Parks	17.10.23	BFG	Louisville	09.12.48	03.03.73	49	24	21	03.03.73	Yes		Pot Cleaner (Block Jama 1974) p 53	History given in Annals NY ACAD SCIENCES Vol 329 (1979) page 190 in Paper by B R Cottine of OSHA	Rolling Stone Art Ref 1 NY Acad of Sc Symp 1974 Also Block Jama 1.7.74 p 53
02		19.08.33	BFG	Louisville	15.11.55	00.05.70	37	14	13	27.09.71 (NIOSH says 28.09.71)	Yes		Pot Cleaner (Cf Block)		Ref 1 Also Block JAMA 1.7.74 p 53
03	Edward Dinwiddie	25.05.15	BFG	Louisville	28.11.45	19.12.73	58	28	28	19.12.73	Yes		Pot Cleaner (Cf Block)	Louisville Courier Journal 02-09-80	Ref 1 Also Block
04		15.01.24	BFG	Louisville	06.07.52	19.08.67	43	15	15	07.01.68	Yes		Pot Cleaner (Cf Block)		Ref 1 Also Block
05		25.01.12	BFG	Louisville	19.06.44	09.04.64	52	20	20	09.04.64	Yes		Pot Cleaner (Cf Block)		Ref 1 Also Block
06	Ray Austin Jones?	23.11.28	BFG	Louisville	17.01.62	00.02.74	45	12	12	24.07.75	Yes		US Air Force Pot Cleaner (Cf Block)		Ref 1 + Louisville Times 23.7.75 Retired April 1974 Also Block
07	Charles T Smart	03.05.22	UCC	S Charleston	27.08.44	00.00.68	45	24	17	23.03.68	Yes				Ref 1
08		06.05.20	Goodyear	Niagara	07.10.46	00.08.61	41	15	15	29.08.61	Yes				Ref 1

SCC
4-0876

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

*UK system of dates
DAY - MONTH - YEAR

USA
Sheet 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
USA															
09	Raymond Cattle-Finger?	08.11.31	BFG	Louis-ville	28.05.45	01.03.74	43	29	24	11.03.75	Yes	2000 ppm			Ref 1 has wrong figures re first exposure. Louisville Times 29.10.74, 12.3.75, 10.3.76
10		16.08.13	Goodyear	Niagara	12.06.51	00.05.68	55	17	17	10.05.68	Yes				Ref 1
11		27.05.09	Goodyear	Niagara	14.10.46	00.03.70	61	23	23	16.03.70	Yes				Ref 1
12	Francis A Bachman	17.11.18	Firestone	Portstown Pa	13.07.49	02.05.69	50	20	19	02.05.69	Yes	High 10 yrs	10 yrs as reactor op. (not cleaner - separate crew cleaned autoclaves)	Utility & Service op. Bagger Dryer op. Stripping op. 3 yrs prior service in tyre plant	Ref 1 + letter of 26 April 1978 from Russell A Park to J T Sewell of HCA
13	Richard Edward Clendenin	01.12.21	UCC	S Charle-ston	11.12.42	00.05.74	52	32	26	07.04.74	Yes	2000 ppm			Charleston Daily Mail 21.7.75
14															Dubious fabrication case
15															Dubious fabrication case

SCC 4-0877

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date:) Jan 1984)

USA
Sheet 3

* UK System of dates
DAY - MONTH - YEAR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
USA															
16	James Howard	04.11.27	BFG	Louisville	08.05.50	00.00.69	41	19	04	27.03.69	Yes		1951-4 VCM polymerisation	From 1954 onwards in Army and other service. 46-50 Army	Table 4 in Wagoner Testimony to US Senate Confirmed in H N Johnson ltr 07.08.78
17	Puerenboom	06.05.31	BFG	Louisville	23.06.55	11.10.74	43	19	19	16.10.80	Yes on 11.10.74 but no post-mortem 16.10.80				Dr H N Johnson letter of 24.2.81 confirmed death 6 years after diagnosis
18	Charlie Arthur	22.04.28	BFG	Avon Lake	15.09.54	00.00.75	46	21	13	02.11.75	Yes	13 yrs autocleaner 8 yrs on Estol plasticiser & Carbonet operation	Navy Tyre Store		Confirmed in H N Johnson ltr 07.08.78 Also Rolling Stone mag. 15.01.76
19	Virgil Christian	00.00.15	UCC	S Charleston	00.00.43	19.06.75	60	32	32	06.04.76	Yes	2000 ppm			Williamsport Sun Gazette 21 June 1975 Charleston Daily Mail 21.7.75
20		31.08.17	Goodyear	Niagara	00.00.55	30.01.76	58	21	18	30.01.76	Yes				NIOSH letter of 25.10.79
21	Chester Hinkle	02.09.09	UCC	S Charleston	00.12.46	Early 77	67	30	22	02.01.77	Yes				28 yrs with UCC at SC Retired News release 21.2.77

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
USA															
22		02.10.23	BFG	Louis-ville	11.07.47	00.01.76	52	29	28	04.12.76	Yes				Louisville Times 26.1.76 said he was the 10th AS victim at Bells Lane of whom 8 had died by 26.1.76 In his letter of 16.09.81 Dr H N Johnson confirms this is the case described by Dannaher Tamburro & Yam in Feb 1980 Am J Medicine Vol 70 p280
23		00.00.23	Great American Chemical Company	Fitchburg Mass.	08.09.58	06.04.73	50	15	14	06.04.73	Yes				
24	Charles Edward Moore	17.05.17	UCC	S Charle-ston	1939	27.05.77	60	38	24? (NIOSH says 26)	27.05.77	Cholangio-sarcoma (R Kaminski 26/2/79)	Medium to high for 24 yrs	1941-65 non-solvent vinyl resin unit and dispersion vinyl resins unit first as fitter helper, then shift utility man	1937-39 was off and on labourer 1939-41 may have been exposed as reactor cleaner 1943 became shift fitter 1946 became shift utility man 26.04.65 employment was terminated	H N Wheeler letter of 18.8.77 to J Stafford gives details Rose Kaminski letter of 26/2/79 R Kaminski (5 Nov 1980) suggests that NIOSH will retain on register since this neoplasm may be associated with ASL.
(25)		Removal from register confirmed in R Kaminski letter of 5 November 1980													R N Wheeler letter of 20/2/79 and Rose Kaminski letters of 26/2/79 and 5/11/80

4-0879
SCC

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

*UK system of dates DAY - MONTH - YEAR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
USA 4)															
26	John Berry	07.07.23	BFG	Louisville	03.10.47	00.00.77 (up to 2 years after death)	52 (death)	28 (death)	- 18	11.02.75	Yes	Exposed in some degree to 22 chemicals but main exposure was to VCM, probably high	Various jobs in PVC plants from cold room to paste recovery to PVC charging operator to paste charging. III August 1965. Terminated employment Jan 1966		R Kaminski letter of 26/2/79 and Prof. Tamburro letter of 9/1/79
27	J L Forrest	11.05.16	UCC	S Charleston	01.07.41	30.11.78	62	37	20 (NIOSH says 27 and C Daily Mail 25)	25.11.78	Yes	High	Operator to 10.10.76	Exposure in bulk and dispersion PVC manufacture	R N Wheeler ltr of 4 Jan 1979 and Charleston Daily Mail 30.11.78 and R Kaminski 26/2/79
28		11.04.17	UCC	S Charleston	00.08.44	03.11.78	61	34	33	03.11.78	Yes				R Kaminski letter of 6/4/79
29		12.10.07	UCC	S Charleston	00.05.42	00.03.80	72	38	16	01.03.80	Yes				R Kaminski Letters of 19th June 1980 & 5th Nov 1980
30	WN	22.07.22	Tenneco Chemicals	Flemington	11.06.64	30.12.80	58	17	15	30.12.80	Yes	6 - Unknown 9 - Minimal	Maintenance Mechanic 6 yrs Elsewhere 1½ yrs Boiler house Operator 9 yrs		
31		08.11.23	UCC	S Charleston	12.05.46	01.08.81	57	35	13	02.04.82	Yes	High (But not as high as reactor cleaner would experience) Worked as labourer from June 1941 to May 1946 and may have cleaned reactors in that time	Chemical Operator in charge reactor	From 1959 to 1976 Aliphatic Chemicals operator and from July 1976 to date Foreman Aliphatic Chemical Operation	Dr Ducey letter 16.10.81 and R N Wheeler letter of 9.11.81. Also Dr Ducey letter of 07.01.83 re date of death.

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

*UK system of date
DAY - MONTH - YEAR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
US 32	C W Giroux	22-02-08	Monsanto	Springfield Mass	15-10-51	00-07-79	71	28	14 (in PVC autoclave area)	17-05-80	An autopsy was done and immediate cause of death given as "Angiosarcoma"	The death certificate gave Mr Giroux' usual occupation as "kettle operator" in "chemicals industry".	1940-1951 Various jobs in polymer manufacture BUTVAR LUSTREX 1951-1964 Various jobs in and around PVC autoclaves 1964-1973 Various clerical jobs in PVC polymerisation facility/ Retired 01-03-73.		Information given in letter of 24 February 1982 from Dr Walter C Barnes of Monsanto Springfield to Dr A Munn of Monsanto Europe.
US 33	S Ferguson Jnr	08-10-27	BFG	Louisville	09-09-54	11-05-82	54	28	28	Alive	Yes		Multiple jobs including Poly Operator + Polycleaner.		Prof Tamburro letter of 12 Aug 1982 + Dr H N Johnson letter of 28 Feb 1983.
US 34	Mr Byrum	29-01-34	BFG	Louisville	1955	03-11-82	48	27	10	Alive	Yes + Leiomyosarcoma		Poly Operator + Autoclave Cleaner 1955-65.	1965 left BFG to become a Clergyman.	Dr H N Johnson letter of 3 Nov 1982 and 28 Feb 1983.
US 35		09-03-12	UCC	S Charleston	23-07-44	18-07-83	61	39	14	18-07-83	Yes	High from 1944 to 1955. Medium from 1955-1958			Dr Ducey letter of 5 Sept 1983.
US 36		27-08-32	The General Tire and Rubber Co	Ashtabula	11-06-56	21-08-83	50	27	27	Alive	Yes	Moderate	1956-56 labourer 1956-57 prod helper 1957-70 operator 1970-75 electrician 1975-present operator		K W Laundrie letter of 12 Sept 1983 spotted at medical May 1983. Testing commenced May 1983

SCC 4-0881

IMPERIAL CHEMICAL INDUSTRIES PLC
PETROCHEMICALS AND PLASTICS DIVISION

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1984)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
YUGOSLAVIA															
01		05.04.14	Jugo Vinil	Split	00.00.53	08.04.73	59	20	20	08.04.73	Yes				SARIC et al paper Env Health Perspective Vol 17, pp 189-192 1976
02		15.11.31	Jugo Vinil	Split	00.00.50	12.07.73	42	23	18	12.07.73	Yes*		VCM Production		*In his letter of 3 Oct 1978, Dr Spirtas of NIOSH changed the status of Case 02 to VCM production employee. Dr Spirtas also notified a new Case 03 also a VCM production worker
03		21.12.31	Jugo Vinil	Split	04.06.54	11.01.76	45	22	22	11.01.76	Yes*		VCM Production		
04		11.06.30	Jugo Vinil	Split	15.12.58	03.09.78	48	20	18	03.09.78	Yes				Rose Kaminski Letter of 19th June 1980 and IARC letter of 1 April 1982

TABLE 1

Incidence of ASL Cases Per Annum

	By date of death
1955	1
6	0
7	1
8	0
9	0
1960	0
1	1
2	1
3	0
4	2
5	0
6	0
7	1
8	5
9	3
1970	2
1	3
2	5
3	7
4	6
5	11
6	11
7	9
8	10
9	5
1980	10
1	4
2	1
3	4
Total	103

N.B. 1 Does not include Italian 01 but does include German 03.

2 The 1977 total includes US case 24 which is a Cholangiosarcoma.

3 The 1982 total does not include US 33 and 34 who are alive and F 15 who is alive.

4 The 1983 total does not include US 36 and F 16, who are alive.

(Review Date - 1 Jan 1984)

TABLE 2

Distribution of ASL Cases by Country

USA	33	***
W Germany	21	**
France	17	***
Canada	10	
UK	8	
Sweden	5	****
Yugoslavia	4	*****
Italy	4	*
Czechoslovakia	2	
Japan	2	
Belgium	1	
Norway	1	
Total	108	

* Omit It01 - atypical case of PVC bag extruder.
** Includes GE03 aerosol can filler.
*** Includes case US 24 which was diagnosed as Cholangiosarcoma & US 33, 34 and 36; and F 15 and 16 who are alive.
**** Includes one monomer worker.
***** Includes two monomer workers.

i.e	Western Europe	57
	North America	43
	Rest of World	8
	Total	108

(Review Date - 1 Jan 1984)

TABLE 3

Pattern of ASL Cases by Factory

(a) W Europe

Of the 57 cases in W Europe, 46 have occurred in clusters at 10 factories. Of the 21 German cases, 18 have occurred in clusters at 4 factories.

	ASL Cases
Kemanord, Sundsvall	5
PCUK, Brignoud	5
Dynamit, Troisdorf	10
Chloe Chimie (Formerly RP), St Fons	8
Wacker, Burghausen	4
CWH, Marl	2
ICI, Hillhouse	2
BP, Barry	6
Solvay, Tavaux	2
Lonza, Waldshut	2
	46

NB: There are 31 pre 1962 PVC plants in W Europe; 18 of these have had ASL cases (Ref Table 8)

(b) N America

Of the 43 cases in N America, 37 have occurred at four factories out of a total of 49 factories - in N America 39 plants have not had ASL cases.

	ASL Cases
BFG, Shawinigan	10
BFG, Louisville	13
UCC, S Charleston	10
Goodyear, Niagara	4
	37

NB: There are 29 pre 1962 PVC plants in N America; 10 of these have had ASL cases (Ref Tables 9 & 10)

(c) Rest of World

The 8 ASL cases are believed to be in 1 cluster of 4 and 2 clusters of 2 cases.

(Review Date - 1 Jan 1984)

TABLE 4A

Latency Periods (Years from first Exposure to Diagnosis)

		No of Cases	Total Years	Average
W Europe	Belgium	1	18	18
	France	17	438	25.76 *
	Germany	21	385	18.3 *
	Italy	4	74	18.5
	Norway	1	22	22
	Sweden	5	122	24.5
	UK	8	189	23.62
		57	1248	21.89
N America				
	US	33	835	25.30 *
	Canada	10	204	20.4 *
		43	1039	24.16
Rest of World				
	Czechoslovakia	2	30	15.0
	Japan	2	39	19.5
	Yugoslavia	4	85	21.2
		8	154	19.2
Summary				
	W Europe	57	1248	21.89
	N America	43	1039	24.16
	Rest of World	8	154	19.2
		108	2441	22.60

SCC
4-0886

* Of the countries with > 10 cases, France and USA have average latency period above world average and Germany well below.

DISTRIBUTION OF LATENCY PERIODS

TABLE 4B

(Review Date - 1 Jan 1984)

	0-9 yrs	10-14 yrs	15-19 yrs	20-24 yrs	25-29 yrs	30-34 yrs	35+ yrs	Total	Average Latency Period
Belgium			1					1	18
Canada		3		5	2			10	20.4
Czechoslovakia		1	1					2	15.0
France		1	4	2	5	2	3	17	25.76
Germany		4	9	6*	2			21	18.3
Italy			2	2				4	18.5
Japan			1	1				2	19.5
Norway				1				1	22
Sweden			2		2	1		5	24.5
UK	1		2		3	2		8	23.62
USA		2	7	7	8	4	5	33	25.30
Yugoslavia				4				4	21.2
TOTAL	1	11	29	28	22	9	8	108	22.60

* Includes G 03 aerosol can filler

TABLE 4C

LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE

MAX POSSIBLE LATENCY PERIOD	YEAR OF FIRST EXPOSURE	LATENCY PERIOD	ARITHMETIC MEAN OF LATENCY PERIODS	
44	1939	38*		
43	1940		244/7 = 34.86	
42	1	37,21,37, 41 ***		
41	2	32,38		
40	3	38,14,32		
	4	28,11,24,20,24,34, 39	718/27 = 26.59	
	5	27,22,28,29		
	6	21,29,31,26,28,15,23, 30,35***		
36	7	29,24,29,28		
35	8	28,24,34		
	9	30,26,20	458/19 = 24.11	
	1950	26,22,31,19,23,14,33		
	1	19,28,17,28		
31	2	21**,15		
30	3	25,22,23,22,20		
	4	21,21,25,25,21,28***, 22	592/28 = 21.14	
	5	22,23,24,14,19,21,27**, 27***		
	6	21,12,27***		
26	7	19,17,15,13,16		
25	8	18,18,15,17,20		
	9	16,21	328/20 = 16.4	
	1960	13,18		
	1	15,16,16,16,19,18,12		
21	2	13,18,17,12		
20	3	16,17		
	4	16,17	102/7 = 14.57	
	5	11		
	6	9		
16	7	16		
15	8			
	9			
	1970			VIOLA
	1			
11	2			
10	3			MALTONI
	4			GOODRICH
	TOTAL	108	2442/108 = 22.61	

* Cholangiosarcoma
** Aerosol can filler
*** US33, 34 and 36; and F15 and 16 still alive.

TABLE 4D

LATENCY PERIODS OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE AND GEOGRAPHICAL LOCATION

MAX POSSIBLE LATENCY PERIOD	YEAR OF FIRST EXPOSURE	LATENCY PERIODS IN WESTERN EUROPE	NORTH AMERICA	ROW
44	1939		38*	
43	1940			
42	1	37,41***	21,37	
41	2		32,38	
40	3	38	14,32	
	4	28	11,24,20,24,34,39	
	5	27	22,28,29	
	6	21,29,31,33	26,28,15,23,30,35***	
36	7	29	24,29,28	
35	8	28,34	24	
	9	30,26	20	
	1950	26,22,31	19	23,14
	1	19,28	17,28	
31	2	21**	15	
30	3	25,22	23	22,20
	4	21,21,25,25	21,28***	22
	5	22,23,24,27***	14,19,21,27***	
	6	21,12	27***	
26	7	19,17,15,13		16
25	8	18,18	15	17,20
	9	16,21		
	1960	13,18		
	1	15,16,16,16,19,18	12	
21	2	13,18,17	12	
20	3	16,17		
	4	16	17	
	5	11		
	6	9		
16	7	16		
15	8			
	9			
	VIOLA 1970			
	1			
	2			
	MALTONI 3			
	TOTAL	57	43	8

* Cholangiosarcoma
** Aerosol can filler
*** US33, 34 and 36; and F15 and 16 still alive

TABLE 4E

PLANT	START UP DATE	LATENCY PERIODS OF ASL CASES	NO OF CASES	AVERAGE LATENCY PERIOD
LOUISVILLE	1940?	12,14,15,19,19,20,24,27,28,28,28,29,29	13	22.46
SHAWINIGAN	1941?	11,12,14,21,22,23,24,24,26,28	10	20.5
S CHARLESTON	1939?	24,30,32,32,34,35,37,38,38,39	10	33.9
TROISDORF	1954	12,13,16,16,17,18,19,21,23,25	10	18

TABLE 4F

LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE AND SPECIFIC PLANT

YEAR OF FIRST EXPOSURE	S CHARLESTON	LOUISVILLE	SHAWINIGAN	TROISDORF
1939	38			
1940				
1	37		21	
2	32,38			
3	32		14	
4	24,34,39	20	11,24	
5		28,29,27	22	
6	30,35		26,28	
7		29,28	24	
8		24		
9				
1950		19		
1				
2		15		
3			23	
4		28		21,25
5		14,19		23
6				12
7				13
8				
9				
1960				
1			12	16,16,19,18,
2		12		17

TABLE 4G

PLANT	START-UP DATE	LATENCY PERIOD OF ASL CASES	NO OF CASES	AVERAGE PERIOD
SUNDSVALL	1945	16,19,27,29,31	5	24.4 years
BRIGNOUD	1950	11,16,18,26,30	5	20.2
ST FONS	1939	21,28,29,37,38,27,41,34	8	31.88
BARRY	1948	9,17,18,28,31,33	6	22.66
BURGHAUSEN	1933	17,21,22,25	4	21.25
NIAGARA	1947	15,17,21,23	4	19
SPLIT	1941	20,20,22,23	4	21.25

TABLE 4H

LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE AND SPECIFIC PLANT

YEAR OF FIRST EXPOSURE	SUNDSVALL	BRIGNOUD	ST FONS	BARRY	BURGHAUSEN	NIAGARA	SPLIT
1939							
1940							
1			37, 41				
2							
3			38				
4							
5	27*						
6	31		29			15,23	
7	29						
8			28,34				
9		26,30					
1950				31,33			23*
1	19			28		17	
2							
3					25		20
4					21		22*
5			27		22	21	
6			21				
7					17		
8		18					20
9		16					
1960							
1							
2				18			
3				17			
4	16						
5		11					
6				9			

* Monomer workers

TABLE 5

Annual Incidence of ASL Cases (Date of Death) by Geographical Area

	Western Europe	North America	Rest of World	Annual Total	Cumulative Total	Key Events
1955		1		1	1	
7		1		1	2	
1961		1		1	3	
2		1		1	4	
4		1	1	2	6	
7	1			1	7	
8		5		5	12	
9	1	2		3	15	
1970	1	1		2	17	Viola
1	1	2		3	20	
2	4	1		5	25	
3	1	4	3	8	33	Maltoni
4	3	2	-	5	38	Goodrich
5	6	4	1	11	49	
6	6	3	2	11	60	
7	6	3		9	69	
8	7	2	1	10	79	
9	5	-	-	5	84	
1980	6	4	-	10	94	
1	4	0	-	4	98	
2	0	1	nil to date	1	99	
1983	3	1	nil to date	3	103	
TOTAL	55 * **	40**	8	103		

* Includes G03 aerosol can filler but omits It 01 bag extruder

** Does not include US33, 34 and 36; and F 15 and 16. All still alive.

TABLE 6

ASL CASE NUMBERS BY YEAR OF DEATH AND GEOGRAPHICAL LOCATIONS (EXCLUDING IT01)

KEY EVENTS		WESTERN EUROPE	NORTH AMERICA	REST OF WORLD
	1955		C1	
	6			
	7		C2	
	8			
	9			
	1960			
	1		US8	
	2		C3	
	3			
	4		US5	Cz2
	5			
	6			
	7	F1		
	8		C4,C5,US4,US7,US10	
	9	G1	US12,US16	
Viola	1970	Sw1	US11	
	1	G2	C6,US2	
	2	N1,Sw2,UK1,It2	C7	
Maltoni	3	G3**	C8,US1,US3,US23	Y1,Y2,Cz1
Goodrich	4	G4,G5,UK3	C9,US13	
	5	F2,F3,G6,G7,G8,It3	US6,US9,US18,US26	Jap1
	6	B1,F4,F5,F6,F7,Sw3	US19,US20,US22,	Jap2,Y3
	7	F8,F9,G10,G11,G12,Sw4	C10,US21,US24*	
	8	F10,F11,G9,G13,G15	US27,US28	Y4
		G16,G17		
	9	F12,F13,UK4,UK5,G18		
	1980	UK6, UK7,G19,Sw5,G20,G21	US17, US29, US30, US32	
	1	It4,F14,UK8,G22		
	2		US31	
	3	UK09, It5, F17	US35	
	Total	55 ***	40***	8

* Cholangiosarcoma
** Aerosol can filler
*** Does not include US33, 34 and 36; and F15 and 16. All still alive.

TABLE 7

ASL CASE NUMBERS BY YEAR OF FIRST EXPOSURE AND GEOGRAPHICAL LOCATION (EXCLUDING IT01)

KEY EVENTS		WESTERN EUROPE	NORTH AMERICA	REST OF WORLD
	1939		US24*	
	40			
	1	Fr11,Fr16***	C3,US27	
	2		US13, US29	
	3	Fr14	C2,US19	
	4	UK1	C1,C5,US5,US7,US28,US35	
	5	Sw2	C4,US3,US9	
	6	Fr1,Fr3,Sw4	C7,C9,US8,US11,US21,US31	
	7	Sw3	C6,US22,US26	
	8	Fr9, Fr17	US1	
	9	Fr12,Fr4	US12	
	50	Fr7,N1,UK8,UK9	US16	Y2, Cz2
	1	Sw1,UK5	US10, US32	
	2	G3**	US4	
	3	G15,It3	C10	Jap1,Y1
	4	G7,G8,UK4,G19	US18,US33***	Y3
	5	G11,G16,G18, Fr15***	US2,US17,US20,US34***	
	6	FR10,G1	US36***	
	7	Fr8,G4,It2,G2		Cz1
	8	Fr6,B1	US23	Jap2,Y4
	9	Fr2,It4		
	60	G5,G13		
	1	G9,G10,G12,G17,G20,G22	C8	
	2	G6,UK6,G21	US6	
	3	Fr13, UK7		
	4	Sw5	US30	
	5	Fr5		
	6	UK3		
	7	It5		
	8			
	9			
Viola	70			
	1			
	2			
Maltoni	3			
	Total	57	43	8

* Cholangiosarcoma
** Aerosol can filler
*** US33, 34 and 36; and Fr 15 and 16 are still alive.

TABLE 8

WESTERN EUROPE PVC PRODUCERS - START-UP DATES vs ASL CASES (OMITTING 003)

START-UP YEAR	COUNTRY NAME	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st Exposure
1931	West Germany	BASF	Ludwigshafen		
1933	West Germany	Wacker	Burghausen	04,07,11,15	57,54,55,53
1938	Italy	Montecatini	Acna		
1939	France	Rhone Poulenc	St Fons	03,09,10,11,14,	46,48,56,41,43,
				15,16,17	55,41,48
1940	United Kingdom	ICI	Runcorn		
1940	United Kingdom	ICI	Hillhouse	01,04	44,54
1945	Sweden	Kemanord	Sundsvall(Stockvik)	01,02,03,04,05	51,45,47,46,64
	Switzerland	Lonza	Sins		
1946	France	Rhone-Poulenc	Rousillon	01	46
1947	Italy	Montedison	Porto Marghera	02	57
1948	United Kingdom	BP Chem	Barry	03,05,06,07,08,09	66,51,62,63,50,50
	West Germany	Huls	Marl	09,10	61,61
1949	Belgium	Solvic	Jemeppe	01	58
1950	France	Puk	Brignoud	02,04,05,06,12	59,49,65,58,49
	France	Rhone-Poulenc	St Auban	07	50
	Holland	Shell	Pernis		
	Norway	Norsk	Heroya	01	50
1951	Italy	Montedison	Brindisi		
1952	Italy	Montedison	Terni		
1953	Austria	Halvic	Hallein		
	France	Solvic	Tavaux	08,13	57,63
	Italy	Solvic	Ferrara	03	53
	Spain	Rio Rodano	Hernani		
	United Kingdom	BIP	Aycliffe		
	West Germany	Hoechst	Gendorf	18	55
1954	West Germany	Dynamit	Troisdorf	01,02,08,12,16,	56,57,54,61,55,61,
				17,19,20,21,22	54,61,62,61
1955	Spain	Monsanto Iberia	Monzon		
1956	Spain	Caiqsa	Sabinanigo		
		Hispavic	Torrelavega		
1958	West Germany	Solvay	Rheinberg		
1960	Italy	S C Ravenna	Ravenna	04	59
1960	West Germany	Lonza	Waldshut	06,13	62,60
1962	Portugal	Cires	Oporto		
1965	France	Rhone-Poulenc	Montlucon		
	Italy	Pozzi	Ferrandina		
	West Germany	Wacker	Cologne		
1966	West Germany	Hoechst	Knapsack(Frankfurt)	05*	60
1967	France	ATO Chimie	Balan		
	Spain	Rio Rodano	Miranda de Ebro		
	Greece	Esso Pappas	Diavata Salonika		
1968	Belgium	Badiphil	Antwerp		
1969	United Kingdom	Vinatex	Staveley		
	Italy	Rumianca	Cagliari Sardina		
1970	Italy	STR	Porto Torres Sar		
	United Kingdom	ICI	Runcorn		
1971	Italy	S C Ravenna	Ravenna		
	Spain	Hispavic	Martorell		
	Sweden	Kemanord	Stenungsund		
	United Kingdom	BP Chem	Baglan Bay		
1972	Finland	Pekema	Svartback		
	Holland	DSM	Beek Limburg		
1976	France	Soc Art D'vinyl	Mazingarbe		
1977	Spain	Monsanto Iberia	Tarragona		

* Laboratory worker in Research Department

**Pansac, Mira Venice, case not included. (It 05) due not knowing start up date of the Plant.

TABLE 9

USA PVC PRODUCERS - START-UP DATES vs ASL CASES

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
1939?	*UCC	S Charleston	07,13,19,21,24, 27,28,29,31,35	44,42,43,46,39, 41,44,42,46,44
1940?	*BFG	Louisville	01,02,03,04,05, 06,09,16,17,22, 26,33,34	48,55,45,52,44, 62,45,50,55,47, 47,54,55
1946?	*UCC	Texas City		
1947	Goodyear	Niagara Falls	08,10,11,20	46,51,46,55
1948	Firestone	Pottstown	12	49
	Uniroyal	Painesville (closed 1975)		
1950	Monsanto	Springfield	32	51
1952	Dow	Midland		
	BFG	Avon Lake	18	54
1953	Diamond	Deer Park		
1954	General Tire	Ashtabula	36	56
1956	Air Products	Pensacola		
	Atlantic Refining	Brooklyn		
	Borden	Leominster		
	Conoco	Hebronville		
	BFG	Niagara		
	Great American Plastics	Fitchburg	23	58
	Hooker	Hicksville		
	Pantasote	Passaic		
1957	Atlantic Tubing	Cranston		
	Tenneco	Flemington NJ	30	59
1958	Keysor Century	Saugus, Cal		
1960	BFG	Watson, Cal		
	Air Products	Calvert City (closed March 1982)		
	Borden	Illiopolis		
1962	Tenneco	Burlington NJ		
1963	Conoco	Aberdeen, Miss		
	Stauffer	Long Beach, Cal		
1965	Conoco	Assonet, Mass		
	Ethyl	Baton Rouge		
1966	Diamond	Delaware City		
	General Tire/Pantas	Mt Pleasant W Va		
	BFG	Henry, Ill		
	Stauffer	Delaware City		
1967	Allied	Painesville, O (sold to Robintech)		
	Hooker	Burlington NJ		
1968	Firestone	Perryville		
1969	BFG	Pedrickton NJ		
	Goodyear	Plaquemine		
	Olin (Formerly Conoco)	Assonet, Mass		
1971	Conoco	Oklahoma City		

USA PVC PRODUCERS - START-UP DATES vs ASL CASES

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
1972	Nat Starch	Meredosia, Ill		
1973	Borden	Springfield		
	Robintech	Painesville, O (sold to Georgia Pacific who converted to polystyrene)		
1974	Atlantic Tubing	Cranston RI		
	Shintech	Freeport, Tex		
1975	Certain-teed	Lake Charles		
	Georgia Pacific	Plaquemine, La		
	Tenneco	Pasadena, Tex		
1979	Firestone	Plaquemine		

* My databank has no information on UCC before 1946 or BFG before 1950

NB Some of the plants in this list were closed down, some have changed ownership over the years

TABLE 10

CANADIAN PVC PRODUCERS - START-UP DATES vs ASL CASES

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
1943 (1941?)	Goodrich	Shawinigan	01,02,03,04,05 06,07,08,09,10	44,43,41,45,44, 47,46,61,46,53
1951	Monsanto*	La Salle		
1957	Goodrich	Welland		
1966	Esso	Sarnia		
1979	Diamond Shamrock Alb	Fort Saskatchewan		

* Terminated 1975

TABLE 11

EASTERN BLOC PVC FACTORIES - START-UP DATES vs ASL CASES

START-UP YEAR	COUNTRY NAME	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st Exposure
Pre 1939	East Germany	State Company	Schopau		
1941	Russia	State Comps	Vladimir et al		
1950	Yugoslavia	Jugo Vinil	Split	01,02,03,04	53,50,54,48
1951	Czechoslovakia	State Comps	Novaky	01,02	57,50
1955	East Germany	State Comps	Bitterfeldt		
1956	Rumania	State Comps	Icechim		
1957	Poland	State Comps	Osweicim (Dwory)		
	Rumania	State Comps	Tirnaveni		
			Turda		
1958	Rumania	State Comps	Risnov		
1959	Hungary	State Comps	Berente Borsod		
1961	Rumania	State Comps	Borzesti		
1963	Yugoslavia	Ohis	Skopje		
1965	Bulgaria	State Comps	Varna		
1967	Poland	State Comps	Tarnow		
1969	Russia	State Comps	Djerjinsk		
1970	Rumania	State Comps	Rimnicu Vilcea		
	Russia	State Comps	Volgograd		
1972	Yugoslavia	Vinilplastika	Zadar		
1975	Czechoslovakia	State Comps	Neratovice		
	Russia	State Comps	Kalush Area		
1976	Yugoslavia	Hip	Pancevo		
1977	Rumania	State Comps	Rimnicu Vilcea		

TABLE 12

JAPANESE PVC PRODUCERS - START-UP DATES vs ASL CASES

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
1950	Chisso Corp	Minamata		
	Kanegafuchi Kag	Osaka		
	Tekkosha	Sakata		
1951	Mitsui Toatsu	Nagoya	01, 02	53, 58
1952	Mitsubishi Mon	Yokkaichi		
	Sumitomo Kag	Kikumoto		
1951	Denki Kagaku	Shibukawa		
	Nippon Zeon	Kambara		
	Toa Gosei	Tokushima		
1955	Ryo-Nichi	Uozu		
1956	Nippon Zeon	Takoaka		
	Nisshin Kagaku	Takeo		
1957	Kureha Kasei	Nishiki		
	Shinetsu Kag	Naoetsu		
1960	Denki Kagaku	Ohmi		
	Kanegafuchi Kag	Takasago		
1964	Chisso Corp	Chiba		
1966	Tokuyama Seksui	Tokuyama		
1967	San Arrow Kagak	Tokuyama		
	Sumitomo Kag	Chiba		
1968	Ryo-Nichi	Mizushima		
	Shinetsu Kag	Tokuyama		
1970	Chisso Corp	Mizushima		
	Denki Kagaku	Goi (Chiba)		
	Kanegafuchi Kag	Kashima		
	Kawasaki Yuki	Kawasaki		
	Mitsui Toatsu	Sakai		
	Nissan Kagaku	Chiba		
	Shinetsu Kag	Kashima		
1971	Tekkosha	Yokkaichi		
1973	Asahi Glass	Hayatsuki		
1974	Toyo Soda	Sakata		
		Yokkaishi		
1975	Central Kagaku	Kawasaki		
	Toyo Soda	Yokkaichi		
1977	Unknown	Kashima		

TABLE 13

SOUTH AND CENTRAL AMERICAN PVC PRODUCERS

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
1953	Monsanto Mexica	Lecheria (Mexico)		
1954	Policyd	Mexico City (Mexico)		
1955	Geon Do Brazil	Sao Paulo (Brazil)		
1956	Elchlor	Sao Caetano (Brazil)		
1960	Electrochlor	Capitan Bermudez(Argentina)		
	Viplastic	Mendoz (Argentina)		
1961	Indupa	Cinco Saltos (Argentina)		
1965	SOC Paramanga	Paramonga (Peru)		
	PET Columbiana	Cartagena (Colombia)		
1966	Carburo De Col	Medellin (Colombia)		
1967	Plasticos Omega	Mexico		
1968	Primex	Puebla (Mexico)		
1970	Policasa	Managua (Nicaragua)		
	Petro Dow	Conception (Chile)		
1971	Polimeros Mex	St Martin Puebla (Mexico)		
1975	Rico Chemicals	Guyanilla (Puerto Rico)		
1976	Petroplas	EL Tablazo (Venezuela)		
1977	Indust Resistoc	Tlazcala (Mexico)		
1978	Huls Brasil	Cubato (Brazil)		
	Polychem	El Salvador		
	Policyd	Coatzacoalcos (Mexico)		
1979	PET Camacari	Camacari Bahia (Brazil)		