

CIGRE STUDY COMMITTEE NO. 15

Working Group SC 15/WG-02

"Askarels"

Minutes of Meeting held at UNESCO Building, Paris,
on 5 September 1972.

PRESENT:

Prof. M. Beyer	Germany
Mr. P. L. Boyer	Switzerland
Mr. C. A. Bozzini	Belgium
Mr. C. R. Coleman	UK
Mr. J. Courtet	France
Mr. G. Crepy	France
Mr. A. Csernatony-Hoffer	Hungary
Mr. G. A. Curtis	UK
Dr. T. W. Dakin	USA
Dr. H. Elsner	Switzerland
Mme. B. Fallou	France
Mr. R. Fournié	France
Mr. G. A. Gertsch	Switzerland
Mr. G. Gros Lambert	Belgium
Dr. W. Held	Germany
Mr. P. Jay	France
Dr. E. Knust	Germany
Mr. Z. Krasucki	UK (Secretary)
Mr. G. Martin-Vallas	France
Mr. P. G. Mochi	Italy
Dr. R. Müller	Germany
Mme. S. Muren	Yugoslavia
Dr. M. Nakamuta	Japan
Mr. P. Peiser	Italy
Mr. Th. Praehauser	Switzerland
Mr. A. Rabanit	France
Mr. E. H. Reynolds	UK (Chairman)
Mr. J. Schober	Switzerland
Dr. J. Vermeer	Netherlands
Mr. L. T. G. Virsberg	Sweden
Dr. R. Wilputte	Belgium
Mr. L. E. Wirsen	Sweden

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The Chairman opened the meeting and welcomed the delegates.

1. MINUTES

Dr. Nakamuta offered to answer in writing the outstanding questions relating to the document 15-70 (WG-02) Nakamuta-1-IND.

The Minutes of the 6th Meeting of WG-02 held at KEMA, Arnhem, on 2 June 1971 were approved.

2. MATTERS ARISING

Referring to the Meeting of IEC Committee TC10, which was held in Ljubljana, the Chairman said that the unconfirmed minutes of the meeting constituted an important document which should be studied by the Working Group 15-02. If any delegate found difficulty in obtaining a copy, the Chairman would be pleased to provide one upon request.

3. TITLE

The Chairman suggested that, in order to be consistent with IEC, the title "Askarels" of the Working Group 15-02 should, perhaps, be changed to "Dielectric Liquids other than Hydrocarbons". Other names for the Working Group, such as "Liquids" and "Dielectric Liquids", were suggested at the Meeting but no decision was taken, and further consideration was deferred until the next meeting when delegates would have had more time to consider the matter further.

4. ENVIRONMENTAL LIMITATIONS ON USE OF ASKARELS

The Chairman said that in view of the world-wide concern about pollution by PCB's, it was imperative that CIGRE make an authoritative statement on any possible hazards due to the use of PCB's in electrical equipment. The following documents were considered by the Meeting:-

- (i) 15-72 (WG-02) Reynolds-1-IWD: "Chemicals: Task Force finds PCB's no Hazard to Health, but recommends use Restrictions", Industry and Agriculture, No. 95, (DER) 5-15-72.
- (ii) 15-72 (WG-02) Reynolds-2-IWD: Statement by Charles C. Edwards, M.D., at PCB Press Briefing, September 29, 1971.

- (iii) 15-72 (WG-02) Reynolds-3-IWD: A letter to Mr. P.G. Benignus of Monsanto from Mr. Katayama, on the subject of the ban on PCB's in Japan.
- (iv) 15-72 (WG-02) Reynolds-4-IWD: Notification issued by Heavy Industries Bureau, M.I.T.I., to Japanese Industry concerning the ban on the use of PCB's.
- (v) 15-72 (WG-02) Boyer-1-IWD: "Use of Chlorinated Diphenyls (PCB) and Protection of the Environment: Problems set to Capacitor Manufacturers in Switzerland".

Delegates were invited by the Chairman to present a brief resumé of the present position in their own country and outline any statutory limitations which were being contemplated or introduced.

Dr. Nakamuta commented that in Japan the use of PCB's in the manufacture of capacitors, although still possible, was being discouraged. Manufacturers were going over to the use of mineral oil and silicone oil as impregnants for capacitors. PCB's in transformers, used by Japanese National Railways, were not going to be allowed after October 1973.

Mr. Boyer said that in Switzerland a new law had been passed, banning, after 30 September 1972, the sale of products containing PCB's. His own company took special precautions during manufacture and after the sale of capacitors to ensure that pollution hazards by PCB's were minimal. In Switzerland PCB's are classified as toxic substances. Users of electrical equipment want Section 9 of the new law changed and they believe that an authoritative statement on the subject of PCB's issued by an international body like CIGRE would be helpful.

Mr. Schober said that electrical industry in Switzerland was not consulted before the law was introduced. He believed that it would help Swiss manufacturers in their negotiations with their Government if CIGRE prepared a code of practice for handling askarels.

Mr. Wirsen presented a document (15-72 (WG-02), Nerf-1-IWD) summarising legislation relating to PCB's which was introduced in Sweden. A law was passed in June 1971 which authorised the Swedish Government to prescribe rules concerning the importation, manufacture, sale and use of PCB's and all products containing PCB's. According to a proclamation issued in February 1972 capacitors larger than 2 kVAr containing PCB could be sold and taken into service beyond

June 1972 only if permission were obtained from the Swedish Environmental Protection Board. Capacitors smaller than 2 kVAR containing PCB must not be sold or taken into service. A further proclamation relating to PCB's is expected to be issued soon. PCB's are regarded by Swedish authorities as pollutants rather than toxic liquids and their use in all products other than capacitors and transformers is banned. Disposal of waste containing PCB's is subject to rules issued by the Environmental Protection Board.

Mr. Peiser said that in Italy PCB's are not widely used in transformers, the principal use being in the manufacture of capacitors. The Italian Ministry of Health found little evidence for PCB contamination and it is unlikely that a law will be introduced limiting the use of PCB's, although controls are being introduced for their small-scale applications. It is important to draft a code of practice for the use and disposal of PCB's since this may help to delay the introduction of obstructive legislation for a few years. A summary of a paper from:-

"Nuovi Annali d'Igiene e Microbiologia"

under the designation: 15-72 (WG-02), Serena-1-IWD would be circulated.

Dr. Knust said that in Germany the use of PCB's has been stopped in products other than transformers and capacitors. There is a tendency to follow the Swedish practice and discussions are currently taking place as to whether 2 kVAR should be the limiting size below which capacitors must not contain PCB's. Bayer, as the producer of the product, is prepared to dispose of waste PCB's by incineration.

Dr. Held said that at least two firms in Germany will have facilities for disposing of waste capacitors containing PCB's.

Dr. Dakin indicated that, apart from Monsanto, several companies in USA carry out disposal of waste PCB's by incineration. A Federal Bureau document is being prepared, according to which the use of PCB's in sealed containers is to be allowed. The trend is to install capacitors in places where no drainage is available. Manufacturers using PCB's have to give an undertaking to Monsanto that they accept the responsibility for any future pollution by PCB's which they buy. Extensive studies are being made to find satisfactory alternatives to PCB's.

Mr. Jay mentioned the existence of a document on PCB's entitled:-

"Polychlorinated Biphenyls and the Environment"

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prepared by Interdepartmental Task Force on PCB's, Washington, DC, May 1972. The document contains 181 pages and is distributed by:-

National Technical Information Service,
US Department of Commerce,
5285, Port Royal Road,
Springfield, Va. 22151.

Dr. Vermeer stated that in the Netherlands a law has been passed concerning pollution of the soil by PCB's. The effects of this law have not been serious, since there is only a very limited use of PCB's in the country. There is, however, a real need for a code of practice on the utilisation of PCB's to be prepared by CIGRE.

Mr. Coleman presented a document entitled "Control of Polychlorinated Biphenyl Pollution in the United Kingdom". He said that since January 1972 PCB's in the UK have been restricted in use to electrical equipment in sealed containers. In answer to a question Mr. Coleman said that incineration of waste PCB's requires a temperature of at least 800°C.

5. TOXICOLOGY

The Chairman presented the document 15-72 (WG-02) Reynolds-5-IWD on "Current Toxicology Status of PCB's" by Albert C. Kolbye, Jr., MD, MPH, JD, Deputy Director of Foods, Food and Drug Administration.

Mr. Coleman presented his report 15-72 (WG-02) Coleman-1-IWD describing some studies being made on biodegradation of PCB's and PCB residues. He said that cultures produced at Monsanto laboratories were not found to be very efficient but led to a development of experimental techniques for biodegradation studies. Professor W.C. Evans has produced two cultures, C2 and C3, with characteristic times for achieving 50% biodegradation level in single isomers and simple mixtures of between 2 and 50 days. No definite conclusions are yet available on biodegradation rates for commercial PCB mixtures. The results of Professor Evans' studies will be published. At a meeting of PCB Biodegradation Study Group held a few months ago at London Airport a preliminary report by Liggit and Volden of Monsanto was presented and discussed. This report will be published. In answer to a question, Mr. Coleman said that Figs. 3 and 4 in his report refer to single isomers or mixtures of 2 isomers. In answer to a further question, he said that biodegradation studies are also being made in Japan and that a professor in Tokyo University has developed a culture which degrades PCB's. Commenting further, Mr. Coleman said that Monsanto's attitude is that it is proper to carry out biodegradation studies on PCB's. The rate of input of PCB waste into the environment has been reduced so much in recent years, however, that the risks of pollution by PCB's are now very alight.

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6. HANDLING OF ASKARELS (PCB's)

The Chairman asked the delegates to state whether draft or official codes of practice for handling askarels existed in their respective countries.

Mr. Jay explained that there was no code of practice for askarels in France.

Mr. Wirsén said that a draft code of practice is under consideration in Sweden.

Mr. Csernatony-Hoffer reported that discussions were in progress in Hungary on the code of practice for askarels and that he will write on this subject to the Chairman in January 1973.

It was reported that there were no codes of practice for handling askarels in Belgium, Netherlands and Yugoslavia.

Mr. Peiser said that in Italy a draft is being prepared and will be ready by the end of 1972.

In Switzerland and UK no official drafts existed but company drafts for handling askarels were available.

In Japan an official draft for askarels is being prepared.

Dr. Knust said that in Germany two guides existed for PCB's, one for the manufacturer and one for the users of askarels. These guides are being brought up to date.

In answer to a question asked by the Chairman, the delegates agreed that it would be generally helpful if CIGRE prepared a code of practice for handling PCB's.

Dr. Dakin said that use could be made for this purpose of the US "ANSI" draft which is being prepared and will be ready by November 1972.

The Working Group then set up a Task Force for Askarels consisting of Mr. Jay (Chairman), Dr. Knust, Mr. Boyer, Mr. Vodden, Mr. Bozzini, Dr. Müller and Mr. Fournié for the purpose of drafting the CIGRE code of practice for handling PCB's.

It was agreed that the title of the draft to be produced should be: "Askarels, their properties and use in electrical equipment".

The Chairman asked Mr. Peiser to ensure that the document, when produced by the Task Force, is distributed through IEC to the various National Committees, and it appeared that this could be arranged.

7. MEASUREMENTS

The Chairman, referring to IEC work on test cells and test methods for liquids, said that Mr. Serena sent him details of the new test method which is being considered by TC10.

Mr. Wilputte reported that TC15 is considering the revision of IEC document No. 247 and will also discuss the draft document of TC10 at their next meeting in September. The Chairman asked Mr. Wilputte to send him a copy of the TC10 document after the September meeting.

It was noted that a paper has been published on "FMC two-fluid, three-terminal dielectric test cell for thin films" by Glen O'Neal Jr. (FMC Corporation, August 26, 1971).

The Chairman asked whether there was any interest in relating the resistivity of a variety of dielectric liquids with $\tan \delta$ measurements at power frequencies.

Mr. Jay said that a relationship between zero-time resistivity and $\tan \delta$ had already been established by Mr. Coquillion for askarels.

8. SUBSTITUTES FOR ASKARELS

It was noted that the document 15-71 (WG-02) Reynolds-1-IWD on "Replacement of Aroclor as a Capacitor Impregnant" had been circulated to the delegates.

Mr. Boyer, referring to some recent work which they have done, said that he will soon be able to submit to WG-02 a short report on chloro-silicone fluids.

Mr. Schober commented that askarels are widely used not only because of their properties but also because they are relatively cheap. With the introduction of a requirement that waste PCB's be incinerated, the cost of askarels will rise. There are a number of interesting liquids, which could replace askarels, but they are much too expensive.

The Chairman said that for high-voltage cables, say, in excess of 400 kV, the extra cost of a new liquid would not matter much, provided the properties of the liquid were satisfactory. He reported that in Japan an impregnated-extruded cable has been developed. The impregnant used initially was silicone fluid and subsequently a mixture of silicone fluid and mineral oil. Various new liquids may be of interest in HV cables, especially when paper is replaced by other materials. It might be desirable at the next meeting of the Working Group to consider data on various new liquids and to compare experiences gained in exploration of the properties of these liquids and their compatibility with solid dielectric materials in film, tape or laminar forms.

Mr. Jay presented his report 15-72 (WG-02) Jay-1-IWD on "Substitute Impregnant for Capacitor Askarel: The Chloralkylene 12". Chloralkylene 12 is suitable for impregnation of mixed dielectric capacitors. It contains 80% of alkylchlorobiphenyl isomers and 20% dichlorobiphenyl but penta-, tetra- and trichlorobiphenyls are absent. Compared with trichlorodiphenyl, chloralkylene 12 has a lower chlorine content, the same permittivity and a somewhat higher viscosity. The price of Chloralkylene 12 is about twice that for trichlorodiphenyl.

In answer to questions, Mr. Jay said that Chloralkylene 12 has a flash point about 10°C lower than the fire point, its class of toxicity is IV, its biodegradation characteristics are being studied and that Chloralkylene 12 will be available commercially by the end of 1972.

Commenting on the general problem of finding a substitute for trichlorodiphenyl, Mr. Coleman said that before a chemical manufacturer invests in a costly installation required for the manufacture of any given new liquid he will require assurances that in 10 or 20 years the liquid will not be subjected to environmental pressures which are now being applied to askarels.

9. PURIFICATION OF DIELECTRIC LIQUIDS BY ELECTRODIALYSIS

The Chairman said that the document 15-72 (WG-02) Reynolds-6-IWD had been circulated in error and asked for the co-operation of delegates in destroying it.

Commenting on electrodialysis Dr. Knust stated that with high-permittivity liquids the problem was not so much the removal of ionisable impurities but the elimination of subsequent ionisation of the liquid itself.

Mr. Jay referred to some results published by Professor Felici on purification of PCB's which showed that electrodialysis gave poorer results than were obtained using normal methods of purification.

10. DUBLIN CONFERENCE ON DIELECTRICS

Mr. Krasucki presented his document 15-72 (WG-02) Krasucki-1-IWD summarising the proceedings of the 4th International Conference on Conduction and Breakdown in Dielectric Liquids, which was held in Dublin on 25-27 July 1972.

11. LIQUIFIED GASES

The Chairman mentioned the document 15-72 (WG-02) Reynolds-7-IWD on "Bibliography of Recent Work on Electrical Properties of Liquified Gases", which was circulated to the delegates before the meeting, and enquired to what extent WG-02 was interested in considering liquified gases.

Dr. Dakin said that breakdown of liquified gases depends on many parameters and that he will prepare for the next meeting a report on the dielectric behaviour of liquid nitrogen.

It was agreed to include an item on liquified gases on the agenda for the next meeting.

12. DATE OF NEXT MEETING

The next meeting of the "Askarels" Working Group will be held in September 1973 in London.

ATTACHED: Appendix. List of Working Papers
tabled at the meeting.

APPENDIXDocuments circulated during the meeting of WG-02
in Paris on Tuesday, 5 September, 1972.

1. 15-72 (WG-02) REYNOLDS-1-IWD: "Chemicals: Task Force finds PCB's no Hazard to Health, but Recommends Use Restrictions", Industry and Agriculture, No. 95, (DER) 5-15-72.
2. 15-72 (WG-02) REYNOLDS-2-IWD: Statement by Charles C. Edwards, M.D., at PCB Press Briefing, September 29, 1971.
3. 15-72 (WG-02) REYNOLDS-3-IWD: A letter to Mr. P.G. Benignus of Monsanto from Mr. Katayama, on the subject of the ban on PCB's in Japan.
4. 15-72 (WG-02) REYNOLDS-4-IWD: Notification issued by Heavy Industries Bureau, M.I.T.I., to Japanese Industry concerning the ban on the use of PCB's.
5. 15-72 (WG-02) BOYER-1-IWD: "Use of Chlorinated Diphenyls (PCB) and Protection of the Environment: Problems set to Capacitor Manufacturers in Switzerland".
6. 15-72 (WG-02) REYNOLDS-5-IWD: "Current Toxicology Status of PCB's".
7. 15-72 (WG-02) COLEMAN-1-IWD: "Control of Polychlorinated Biphenyl Pollution in the United Kingdom".
8. 15-72 (WG-02) JAY-1-IWD: "Substitute Impregnant for Capacitor Askarel: The Chloralkylene 12".
9. 15-72 (WG-02) SERENA-1-IWD*: "A Review of the Official Investigations of Environmental Pollution in Italy Resulting from Use of PCB".
10. 15-72 (WG-02) NERF-1-IWD*: "Legislation in Sweden for the Use of PCB".
11. 15-72 (WG-02) KRASUCKI-1-IWD*: "Dublin Conference on Dielectric Liquids".
12. 15-72 (WG-02) REYNOLDS-7-IWD: "Bibliography of Recent Work on Electrical Properties of Liquified Gases".

* Circulated with the Minutes.

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