

# Loss Prevention and Safety Promotion in the Process Industries

Proceedings of the 1st International  
Loss Prevention Symposium,  
the Hague/Delft, the Netherlands,  
28–30 May 1974

*A symposium  
organized by*

the Royal Institution of Engineers  
in the Netherlands (KIVI) and  
the Royal Netherlands Chemical Society (KNCV)

*and sponsored by*

the European Federation of Chemical  
Engineering (EFCE, 137th event)

*edited by*

**C. H. Buschmann**



ELSEVIER SCIENTIFIC PUBLISHING COMPANY  
AMSTERDAM — OXFORD — NEW YORK 1974

ELSEVIER SCIENTIFIC PUBLISHING COMPANY  
335 Jan van Galenstraat  
P.O. Box 211, Amsterdam, The Netherlands

AMERICAN ELSEVIER PUBLISHING COMPANY, INC.  
52 Vanderbilt Avenue  
New York, New York 10017

Library of Congress Card Number: 74-77583

ISBN 0-444-41230-1

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Elsevier Scientific Publishing Company, Jan van Galenstraat 335, Amsterdam

Printed in The Netherlands

Although this symposium on Loss Prevention and Safety Promotion in the Process Industries has been labeled the first International Symposium of its kind, this is only partly true. International symposia in this field have been organized before by local bodies in the United Kingdom, in The Netherlands and possibly in other countries, but this is the first to have been organized by an international committee.

During the 1971 Newcastle symposium, an international working group was formed to promote exchange of information and co-ordinate the organization of international symposia in this field, with the aims of stimulating progress and avoiding duplication of effort. This group has since become an official working group of the European Federation of Chemical Engineering.

This symposium is the first to be organized by this group and the list of contributions gives some idea of the vast scope of the field of Loss Prevention. At the same time the names of the contributors show that this symposium is a truly international one.

A quick look at the Contents of these proceedings will give the reader an idea of the great number of different problems connected with safety and loss prevention in the process industries which were treated during the symposium.

With regard to the number of individual papers the organizing committee had the very difficult task of making a choice between adopting only a limited number of entries and rejecting several equally interesting ones or of limiting the time of presentation for each of a larger number of contributions. It finally decided that it would best serve everybody's interest if as many contributions as possible were included. In this way the proceedings would become a more valuable document, containing the full written text of each contribution.

On the other hand this decision made it necessary to keep to a very strict time-table, allowing only 10 minutes for the presentation of each paper. It is largely due to the skill of the excellent chairmen of the different sessions and to the full cooperation of all authors that this arrangement never created difficulties, leaving sufficient time for discussion on all subjects.

The last afternoon of the three-day symposium was dedicated to group discussion on several case studies and on the question "How safe is safe enough", trying to find a quantitative approach to safety.

A short summary of all discussions, including the interesting exchange of view on these last subjects is contained in the proceedings.

Finally it is my pleasant duty to thank everyone who has helped to make this symposium into the success that undoubtedly was and who helped to prepare these proceedings

the members of the International Executive - and Paper Selection Committee for their advice and assistance in the selection of the papers,

the members of the Local Organizing Committee for all the effort and time they have spent to get the symposium underway,

the chairmen who so efficiently held the reins during the different sessions,

the authors of the papers who after all were the main performers,

the members of the discussion panels who made this experiment into a success,

the members of the editorial group who reported and summarized all discussions,

the Congress Office of the Royal Institution of Engineers in the Netherlands, without whom we would have been lost,

Mr. Snijder of RVO-TNO for his expert advice and his dedication to the many secretarial tasks.

The Editor.

OPENING ADDRESS BY DRS. BOERSMA (Minister of Social Affairs).

Mr. Chairman, Ladies and Gentlemen,

It is with pleasure that I have accepted the invitation of the Royal Institute of Engineers and the Royal Chemical Society to perform the opening of this first International Symposium on Loss Prevention and Safety Promotion in the Process Industries.

Our country is happy to have acquired over the last decades a fair share of different process industries. The importance of this branch of industry for our country can best be explained by a few relevant figures.

Since 1950 the total sales increased from 1.2 billion guilders then to 10.3 billion guilders in 1972. That is from 7.8% to 11% of the total sales of industry.

In 1972 the export of this group formed 15% of our total exports and the investments (1.5-2 billion guilders) formed 20% of all investments in industry.

About 100,000 people are directly employed by the process industries and many more in activities that are related to them. Without them therefore it would have been difficult to find employment for the increasing numbers of young men and women that leave our schools and universities. Without them our country would not have been as prosperous as it is to-day. And the quality of life we have achieved depends to a large extent on that prosperity.

Quality of life, however, comprises more than material things alone, and unfortunately the process industries also add to the problems we encounter in trying to ensure optimal conditions for everybody. Problems of safety, for workers and surroundings. Problems of clean air and clean water, of noise and of waste materials which are difficult to cope with.

More and more we become aware of the fact that the total costs for the society - both direct and indirect - of a certain activity have to be balanced against its utility value. Only in so doing can we decide where the optimal benefit of each activity for society lies in relation to the quality of life of every member of that society.

The extension of the activities of the process industries has been very rapid over the last few decades. This can be judged from the number of new units that have come into operation but even more so from the tremendous increase in scale of many units, which now sometimes measure ten times the capacity they had 10 years ago.

It is in fact this last development, the increase in scale, which adds a new dimension to the safety problems, particularly when dangerous materials are involved. Now the consequences of accidents under adverse conditions may also endanger the

general public outside the factory or along the transport routes. This places new responsibilities on industry to take adequate measures to effectively protect their neighbours against this threat. When I indicate that it is primarily the responsibility of industry, this does not mean there is no task left for the government in this field.

On the contrary, the government agencies concerned have the task to establish standards in the interest of the protection of society against possible adverse effects from industrial and other activities.

In view of the rapid development of new technologies and the even more rapid increase in scale in which they are applied, we find ourselves in a position where the social impact of these developments often can not be properly assessed. The task of standard-setting then becomes a very difficult one, which requires new research, study and analysis to predict the possible dangers and devise the necessary measures against them. It is particularly in this field of study that industry and government must join their forces and act together. This symposium which is about to begin forms a good example of possible joint actions.

I am glad that several people of my department take an active part in it but I am even more pleased that industry has taken the initiative for it on an international scale. For only in this way can the maximum profit be gained.

With regard to the situation in the Netherlands, I might say the following. Recently, in the introduction to the annual budget of my department for the fiscal year 1974, I explained these problems to Parliament. I stated that in devising measures against dangers of a hitherto unknown character or scope one had to find entirely new approaches.

Among other things we might study the possibilities of situating certain activities involving large quantities of dangerous materials on an artificial island in the North Sea, thus enlarging the distance to inhabited areas and proportionally decreasing the risk.

Also the possibility must be studied to minimise storage and transport of some very dangerous substances (we think of phosgene, hydrocyanic acid and chlorine) by so integrating production and use in one industrial area that intermediate transport is no longer necessary and only a small buffer storage is required. In this way the total amount of these substances present at any time might be very considerably reduced.

Further we have plans for legal provisions obliging certain industries to prepare a safety report containing a full analysis of possible risks in all phases of production, as well as a description of the measures taken to prevent these risks.

We are adopting the same line here that has been internationally adopted for nuclear energy reactors in those cases where the consequences of the maximum credible accident do present a major threat.



fortunately the number of large-scale accidents has been very small up to now and so was the number of casualties they have caused. We want to keep it that way however!

Safety of course is but one of the problems which the process industry has to deal with in relation to the quality of life. Pollution of water and air, safe disposal of waste materials, reduction of noise levels, they all constitute equally important problems. To ensure the rights of every citizen to live in safety, to breathe clean air and to drink pure water, laws and regulations must be kept up to date in a rapidly changing world. But perhaps more than laws we need technological development and research to give us the

the tools and know-how to reach our goals. It is only through knowledge and the will to apply it that we shall be able to keep up with the demands of a growing world without unduly increasing its problems.

I trust that this symposium, in giving a review of the state of the art will present us with some new tools and will give new ideas and incentives to all who participate to continue on the road towards a better quality of life for everyone.

Mr. Chairman, I wish you every success and declare this symposium opened!

## CLOSING ADDRESS BY THE SYMPOSIUM CHAIRMAN, MR.C.H. BUSCHMANN

The members of the Club of Rome, as this learned Institution is known here in Holland, have given the world an urgent warning. If we continue to grow at the rate we have attained over the last few decades several raw materials may be depleted in the foreseeable future. At the same time the accumulation of waste materials might endanger the world's population of the next generation. This faces us with a difficult dilemma. One solution, the most obvious one, would be to try and stop all further growth. This means in the first place that further growth of the world population has to be stopped. Even if birthrates in all countries, including the developing countries, could be sufficiently controlled, the world population would still increase for at least another 25 years. This is inevitable because babies born today can be expected to live longer than their parents.

It would moreover imply that the amount of energy and goods available for each inhabitant would not be allowed to rise any further. For the people in the affluent countries this would not be disastrous. But when we realize that people in most developing countries have at their disposal less than 1% of the energy and only a slightly larger fraction of the goods their richer neighbours consume today on a per capita basis, it is difficult to see how further growth can be prevented. A large part of the world's peoples would be condemned to poverty and starvation!

It seems, therefore, that even if we succeed in limiting the growth to a lower rate, we must still expect a considerable increase in years to come. This means that we have to find other solutions, like recycling of used products and development of new "clean" product to provide sufficient food, clothing, shelter and energy for all members of the population of the world of tomorrow, without the hazardous side-effects we are now beginning to recognize.

The process industries are going to play an important role in that development. They will have to find ways and means to provide acceptable new materials at an acceptable price to replace other materials which are depleted or cannot be produced in sufficient quantity; synthetic fibres for clothing, new plastics for construction, synthetic proteins as food additives, fertilizers and pesticides to enhance food production, and last but not least new energy sources to replace the fuels of today.

The introduction of nuclear energy plants already shows that this adaptation will not be easy. With the introduction of new materials and new methods and processes we may also introduce new risks. Particularly in the highly industrialized countries society is not going to take any chances with these new risks. It is willing to accept them, and then only grudgingly, when it can be clearly shown that they do not exceed an acceptable level and that advantages clearly outweigh

any possible disadvantages.

This had led to a completely new approach where a satisfactory risk analysis based on reliability studies and study of the maximum possible consequences of an accident (max. credible accident) is required before a new plant can be licensed. Of course this is the ideal way to tackle safety problems, but we must not forget that a similar analysis has never been made for the conventional equivalent which has to be replaced. We simply have learned to live with it.

I am not so sure that on another planet, where energy supply has been based for many years on nuclear energy, the discovery of coal and the subsequent study of the advisability of using it as a replacement for (the good old) nuclear energy might not lead to the conclusion that the use of coal would be too dangerous. It has to be dug out of mines several thousand feet deep. It contains silica which would cause silicosis in the miners. It contains sulphur which would endanger the population through its combustion products which are difficult to eliminate. Moreover the quantities to be transported would be many, many times that of nuclear fuel and could lead to many extra traffic accidents. All in all much too dangerous!

It would be interesting to organize a discussion on this subject between scientists of that other planet and ours.

This symposium clearly shows our belief that the approach of nuclear energy plants is the right one and that the process industry is becoming aware of the fact that this approach must also be applied to the larger units they are building today and the new products that are being developed. In a recent speech to the Business History Association, Mr. Jefferson, vice-president of DuPont de Nemours, put it this way: "It is certain that business will have to be ever more thoughtful and careful about the ways it applies technology, so that we can match science and engineering to human needs in more effective ways, and to avoid unwanted and possibly hazardous side-effects. The second- and third-order impacts are simply too important to be left entirely to chance, and while we can't always see them in advance, we have to try our best and move fast when we do encounter problems. Otherwise the responsibility for decisions in this area could well be taken entirely out of our hands."

The demands that society makes on industry have indeed changed radically in the last few years. In the decades following World War II, industry was required to produce as much as possible at a reasonable price to overcome the scarcity of good for private consumption caused by the war. In the industrialized countries at least industry has met this demand by building new process units of ever larger capacity. Now, however, society has become aware of new scarcities. Scarcity of raw materials, which calls for efficient

use and recycling of used materials where possible. Scarcity of amenities we have always taken for granted, like clean water. This calls for a more careful approach and limitation of wastes, for cleaner production methods. Particularly the giant scale of many new process units has raised questions about the safety, the reliability and the consequences of a possible accident for the workers and the public in the vicinity. Society can not ignore these questions and demands clear answers from industry.

This change in demands has placed the chemical engineer, the technologist, in the limelight of politics and he seems surprised to find himself in that unaccustomed place and has to adjust himself to this new role.

Technology now forms the centre of political discussions. And rightly so. Because politics are concerned with the choice of possible ways to change the world - or part of it - and engineers with their advanced tools of technology are in a better position to realize changes than ever before.

The first objective will have to be to restore confidence. For it is mainly lack of confidence which hampers the discussion between representatives of industry and other groups of society.

I hope this symposium has helped a little to restore this confidence in showing our efforts to find new ways to advance on the difficult road of adapting modern technology to the needs of society.

One of the most urgent tasks before us is to collect sufficient relevant data which give us the information we need to predict the reliability of technological systems over a given period of time, in order to be able to prove that the system is safe enough.

In the field of nuclear energy generation a good start has been made in this direction, as explained in his paper by Mr. Green of the UK AEA Systems Reliability Service. The process industry can probably use many of the collected data for their own needs, but additional data specific for this branch of industry will also have to be collected. As Mr. de Heer and Mr. Green both emphasised, we have to learn how to specify our demand for data in order to get useful answers.

The demands society puts before us simply force us to find means for better quantification of safety. It may therefore be necessary to organize a world-wide data collecting system for the process industry with a central data bank everybody may use. It might be one of the tasks of the International Working Group on Loss Prevention to explore the possibilities. Perhaps in the next symposium more time could be given to this matter.

Mr. Kletz's paper on some Myths in the process industry also underlined our needs for better quantification in safety. We should not throw away our old shoes before we have new ones.

But once the new ones are available we should certainly start comparing old and new.

I have given some time to quantification of risk because in my opinion this has been one of the main topics of this symposium. A topic which certainly needs further development in the future.

It is impossible to summarize for you the masses of interesting information which have come our way both in written and spoken form. It will be available in the proceedings of the symposium, which no doubt will find their place as a handbook on the shelves of many safety supervisors.

If I only mentioned the names of some of the authors it is not because the others were less good or the matter they dealt with (was) less interesting. It is only because it fitted in with my theme that further quantification of risk will be necessary if we really want to do a good job.



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CKROYD G.C., Fire Offices' Committee, London, England  
 KKER M. van den, Prov. Waterstaat Groningen, Groningen, The Netherlands  
 LDERS G.J., AKZO Zout Chemie, Hengelo, The Netherlands  
 LEXANDER J.M., ICI, Billingham, Teesside, England  
 MUNDSEN S.E., Dyno Industrier, Lillestrøm, Norway  
 NGEREN S. van, Ned. Middenstandsbank, Amsterdam, The Netherlands  
 SSEN J.M. van, Shell Int. Chemie Mij., The Hague, The Netherlands  
  
 ACHMANN E., Société des Usines Chimiques, Paris, France  
 AEKEL A. van, Janssen Pharmaceutica, Beerse, Belgium  
 ALEMANS A., Dir.-Gen. van de Arbeid, Voorburg, The Netherlands  
 ALLOTTA R., Gruppo Lepetit, Milano, Italy  
 ALT L., State Univ. Groningen, Groningen, The Netherlands  
 ARRETT J.W., Monsanto, London, England  
 ARTKNECHT W., Ciba-Ceigy, Basel, Switzerland  
 ASTIN F.J.H., Staatstoezicht op de Mijnen, Heerlen, The Netherlands  
 AYLEY E., FM Insurance Company, London, England  
 EAN N.W., British Chemical Industry, London, England  
 EAVMONT S., ICI, Middlesbrough, England  
 EDAF A. van, Cyanamid, Rotterdam, The Netherlands  
 EEK A. van, Inst. TNO for Mechanical Constructions, Delft, The Netherlands  
 EER J. de, Shell Int. Chemie Mij., The Hague, The Netherlands  
 ELL G.D., SRD, UKAEA, Warrington, England  
 ENNETT J.F., Berk, London, England  
 ERESFORD N., McKechnie Chemicals, Widnes, Lancashire, England  
 ERG H. van den, Dow Chemical, Terneuzen, The Netherlands  
 ERG J. van den, AKZO Zout Chemie, Rotterdam, The Netherlands  
 ERG J.H. van den, Shell Ned. Chemie, Rotterdam, The Netherlands  
 ERG P.J. van den, Delft Univ. of Technology, Delft, The Netherlands  
 ERG W.A. van den, Comprimo, Amsterdam, The Netherlands  
 ERTHOLD W., BASF, Ludwigshafen, Germany  
 EUKERS J.A., VNO, Rotterdam, The Netherlands  
 EVAN R., Unilever Research Lab., Wirral, Cheshire, England  
 EIJNUM J.R. van, Centrilab., Soest, The Netherlands  
 LAIR D.A., BP Refineries Dept., Rochester, England  
 LANKEN J.M., UKF-Mekog, IJmuiden, The Netherlands  
 LOEM B., Lummus Ned., The Hague, The Netherlands  
 LOMQVIST G., Research Inst. for National Defence, Sundbyberg, Sweden  
 LONK A.P., ESSO Chemie, Spijkenisse, The Netherlands  
 LCHOVE J., Philips Duphar, Weesp, The Netherlands  
 LDDAERT H.Ph., Chem. Lab. 'Dr. A. Verwey', Rotterdam, The Netherlands  
 DELHOUEW C., Univ. of Amsterdam, Amsterdam, The Netherlands  
 DER J. den, Van Marle, Rotterdam, The Netherlands  
 DER R.J. den, Van Marle, Rotterdam, The Netherlands  
 DESTEN A.D., Arbeidsinspectie, Voorburg, The Netherlands  
 DEIJE L.G., Shell Int. Chemie Mij., The Hague, The Netherlands  
 DGAERDT A.W.M. van den, Frans Halslaan 33, Middelharnis, The Netherlands  
 JOY C.G., AKZO-Engineering, Arnhem, The Netherlands  
 RICHARD A., Chemische Werke Hüls, Marl, Germany  
 RIGERS J.C., Prov. Waterstaat van Noord-Holland, Haarlem, The Netherlands  
 RISA M., Gruppo Lepetit, Milano, Italy  
 RIS G., Bureau Rebel, Bilthoven, The Netherlands  
 RUMAN W., Cyanamid, Rotterdam, The Netherlands  
 RURGUES J. de, 3M France, Paris, France  
 RYEN C., Stone & Webster, Rijswijk, The Netherlands  
 RYES Ph.C., Fire Research Station, Boreham Wood, Herts., England  
 RYMAN J.Ch., Sedgwick Forbes Int., London, England  
 RYARS C., Naval Ordnance Lab., Silverspring, Maryland, USA  
 RYANDS F., ICI, Rotterdam, The Netherlands  
 RYANIGIN B., McGraw-Hill World News, Brussels, Belgium  
 RYUCE D.F., Fire Brigade HP., Middlesbrough, Teesside, England  
 RYUGGEMAN A., Avebe, Veendam, The Netherlands  
 RYUGGEMAN B., Herman Gorterhof 149, Delft, The Netherlands  
 RYUN P., Kon. Shell Lab., Amsterdam, The Netherlands  
 RYUN M.C. de, Gulf Oil Raff., Brielle, The Netherlands  
 RYUMMER B.H., Dow Chemical. Bützflethersand, Germany  
 RYUNING H.J., Dir.-Gen. van de Arbeid, Voorburg, The Netherlands



BURG H., Ciba-Ceigy, Basel, Switzerland  
BUSCHMANN C.H., Directorate General of Labour, Voorburg, The Netherlands  
BUYTENEN C.J.P. van, Chem. Lab. TNO, Rijswijk, The Netherlands  
BIJLSMA A., Windmill Holland, Vlaardingen, The Netherlands

CALLAERTS R., Rijksuniversitair Centrum Antwerpen, Antwerpen, Belgium  
CATTOZZO P., Gruppo Lepetit, Milano, Italy  
CHEREAU P., Centre de Recherches du Bouchet, Vert-le-Petit, France  
CHEVALLIER J.P., Centrale Veiligheidsdienst Chemische Bedrijven, Geleen, The Netherlands  
CHITI M., Gruppo Lepetit, Garessio, Italy  
CITTERS E. van, Unilever Research, Vlaardingen, The Netherlands  
CLAESON B., Astra Pharmaceuticals, Södertälje, Sweden  
CLEUET A., INRS, Paris, France  
CLOETENS G.J.J., PRB, Brussels, Belgium  
COCK R., Dupont de Nemours, Dordrecht, The Netherlands  
CONRAD D., Bundesanstalt für Materialprüfung, Berlin, Germany  
COOK Ph., Air Products, New Malden, Surrey, England  
COOPER R.E., Hilton-Davis Chemicals, Dudley, Northumberland, England  
COPIER W.J., TNO-IBBC, Benthuisen, The Netherlands  
CORNU M.J.P. Le, ICI, Welwyn Garden City, Herts., England  
COWIE Ch., ICI, London, England  
CRITCHFIELD C., Unilever Safety Service, London, England  
CUBBAGE P.A., British Gas Corp., Solihull, Warwickshire, England

DAMSTEEG A.A., Depauw & Stokoe, Dordrecht, The Netherlands  
DANIEL F.W., Shell Int. Chemie Mij., The Hague, The Netherlands  
DARLING J.A., Mines Branch, Ottawa, Ontario, Canada  
DASSEN P.H., DSM-GOP, Geleen, The Netherlands  
DIEPGROND H., Naarden Int., Bussum, The Netherlands  
DIGGLE W.M.M., ICI, Middlesbrough, Teesside, England  
DIKLAND W.K., Ned. Reassurantie Groep, Hoevelaken, The Netherlands  
DISSSEL S.J. van, Shell Ned. Raffinaderij, Rotterdam, The Netherlands  
DOBROGOISKI A. von, Wallace & Tiernan Chemie, Guenzburg, Germany  
DONNADIEU R., S.N.P.E., Paris, France  
DONOGHUE J.K., British Nuclear Fuels, Sellafield, Seascale, Cumberland, England  
DOORN M.C.H. van, Gen. Electric Plastics, Bergen op Zoom, The Netherlands  
DOP G.H., Arbeidsinspectie, Deventer, The Netherlands  
DORSMAN G., Windmill Holland, Vlaardingen, The Netherlands  
DRYSDALE D.D., Univ. of Edinburgh, Edinburgh, England  
DUINTJER J.E., AKZO Chemie, Deventer, The Netherlands  
DUNKER H.W., Erdölchemie, Köln, Germany  
DUSSCHOTEN C. van, Mekog, IJmuiden, The Netherlands  
DVERGSTEN A., Dyno Industrier, Lillestrøm, Norway  
DIJK J.H.F. van, Cargill Soja Ind., Amsterdam, The Netherlands  
DIJK W.J.M. van, Inspectie voor het Brandwezen, The Hague, The Netherlands  
DIJKMAN H.K.M., AKZO Research & Eng., Arnhem, The Netherlands

EBERLEIN A.J., Carringtonworks, Manchester, England  
EBERSBERG G., Chemische Werke Hüls, Marl, Germany  
ECHTERNACHT J., Sierra Group, Brussels, Belgium  
EDMUNDSON J., ICI, Middlesbrough, Teesside, England  
EIGENMANN K., Ciba-Ceigy, Basel, Switzerland  
EK S., Research Inst. for National Defence, Sundbyberg, Sweden  
EKELENBURG P.J. van, Lummus Ned., The Hague, The Netherlands  
ENGELS H.J.M., AKZO Research Lab., Arnhem, The Netherlands  
ENGLAND V.Ph., Fisions, Felixstowe, Suffolk, England  
EVERS Th., ESSO Chemie, Spijkenisse, The Netherlands  
EYMANS J.J.A., AKZO Chemie, Deventer, The Netherlands  
EYNARD P., Société des Usines Chimique, St.Fons, France  
EYSBERG P.J., DSM, Geleen, The Netherlands

FAURE A.G., UniMills, Zwijndrecht, The Netherlands  
FEITER A., Océ-Ned., Venlo, The Netherlands  
FELSBOURG J., Arbeidsinspectie, Arnhem, The Netherlands  
FENNIS J.G., Cyanamid, Rotterdam, The Netherlands  
FIELD S.J., Robins Davies Expertise, Amsterdam, The Netherlands  
FITTT J.S., ICI, Billingham, Teesside, England

FIUMARA A., Stazione Sperimentale, Donato Milanese, Italy  
FONTAINE P., S.N.P.E., Paris, France  
FRITZEMEIER H., AKZO Research Lab., Arnhem, The Netherlands  
FROST H.J., BASF, Ludwigshafen, Germany  
FUCHS H., Mekog, IJmuiden, The Netherlands

GAALEN A.S. van, Dow Chemical, Rotterdam, The Netherlands  
GARDNER J., ICI, Billingham, Teesside, England  
GAUDRON J.L., 3M France, Paris, France  
GEERLING P.D.W., Shell Int. Petroleum Mij., The Hague, The Netherlands  
GETIGER W., Battelle, Frankfurt am Main, Germany  
GELDERBLOM D.B., CIAGO, Arnhem, The Netherlands  
GENT L. van, OCE-Ned., Venlo, The Netherlands  
GENT P. van, Safety and Oil Pollution Control, Ridderkerk, The Netherlands  
GERRITSEN J.C., Borg Warner Chemicals, Amsterdam, The Netherlands  
GIESECKE B., BP, Hamburg, Germany  
GILTAIRE M., Centre d'Études et Recherches des Charbonnages, Verneuil-en-Halette, France  
GOEDEREN P. de, Shell Ned. Chemie Mij., Rotterdam, The Netherlands  
GOEMANS A.M., Shell Int. Chemie Mij., The Hague, The Netherlands  
GOHAREL M., Rhône-Progil, Chauny, France  
GOLIGER J., Centre de Recherches du Bouchet, Vert-le-Petit, France  
GOLZ C., Union Rheinische Braunkohlen Kraftstoff, Wesseling, Germany  
GOLZI SAPORITI L., Gruppo Lepetit, Milano, Italy  
GOOR J. van, Arbeidsinspectie, Maastricht, The Netherlands  
GOOIJER H. de, Techn. Lab. TNO, Rijswijk, The Netherlands  
GORSING F., EKA, Surtel, Sweden  
GOULDING J.P., Dept. of Labour, Cork, Ireland  
GRAAF J.G.A. de, Nijverheidsorganisatie TNO, Rijswijk, The Netherlands  
GREEN A.E., SRS, UKAEA, Culcheth, Warrington, Lancashire, England  
GREWER Th., Farbwerke Hoechst, Frankfurt am Main, Germany  
GRIMM W.E.H., Reinsurance Company, München, Germany  
GRONEMAN J.L.Th., Gist-Brocades, Delft, The Netherlands  
GROOT J.W. de, Centraal Beheer Schadeverz., Apeldoorn, The Netherlands  
GROOTHUIZEN Th.M., Techn. Lab. TNO, Rijswijk, The Netherlands  
GROSSE-WORTMAN H., Chemische Werke Hüls, Marl, Germany

HABECK K., Allgem. Unfallversicherungs Anstalt, Wien, Austria  
HADAS J., Scientific Soc. of Mechn. Eng., Budapest, Hungary  
HAENDLER H., J.Haltermann, Kallo, Belgium  
HALLEGRAEFF E.G., Comprimo, Amsterdam, The Netherlands  
HANSMA H., AKZO Chemie, Deventer, The Netherlands  
HARTMAN S., UKF-Mekog, IJmuiden, The Netherlands  
HASSELDER W., DSM, Beek, The Netherlands  
HATTWIG M., Am Schlachten See 122B, Berlin, Germany  
HAWKINS G., Shell Int. Petr. Comp., London, England  
HEARFIELD F., ICI, Billingham, Teesside, England  
HEER H. de, DSM, Geleen, The Netherlands  
HEINSOHN G., BAM, Berlin, Germany  
HENDRIKS J., Stork, Driehuis, The Netherlands  
HERTZBERG O., Research Inst. of National Defence, Sundbyberg, Sweden  
HESLENFELD C.M., Gist-Brocades, Delft, The Netherlands  
HESS K., BASF, Ludwigshafen, Germany  
HEYL G., Bayer, Leverkusen, Germany  
HEYNS H.J., Nat. Occupational Safety Ass., Pretoria, South Africa  
HILTEN M. van, Prov. Waterstaat, The Hague, The Netherlands  
HINTE J. van, Arbeidsinspectie, Arnhem, The Netherlands  
HITTORFF K., Union Rheinische Braunkohlen Kraftstoff, Wesseling, Germany  
HOEK B.J., Dow Chemical, Terneuzen, The Netherlands  
HOEN W.J. 't, Borg Warner Chemicals, Amsterdam, The Netherlands  
HOFFMANN W., BASF, Ludwigshafen, Germany  
HOLM C., Dyno Industrier, Drammen, Norway  
HOLMERUD B., Dyno Industrier, Lillestrøm, Norway  
HOLMESLAND P.B., Norsk Hydro Elektrisk, Oslo, Norway  
HONTI G., Hungarian Chem. Eng. Center, Budapest, Hungary  
HOOVEN P. ten, AKZO Eng., Arnhem, The Netherlands  
HOPPENBROUWERS J.J.M., Philips, Eindhoven, The Netherlands  
HORST D.L. ter, Naarden Int., Naarden/Bussum, The Netherlands

HOUTMAN P., BP Raff., Rozenburg, The Netherlands  
HOWARD W.B., Monsanto, St. Louis, Missouri, USA  
HØY-PETERSEN R., Falconbridge Nikkelverk, Kristiansand, Norway  
HUISMAN K.J., Dupont de Nemours, Dordrecht, The Netherlands  
HULST J.C., Dienst voor het Stoomwezen, The Hague, The Netherlands  
HUMMELEN E.A., Arbeidsinspectie, Rotterdam, The Netherlands  
HUPKENS VAN DER ELST F., AKZO Chemie, Deventer, The Netherlands  
HUSBAND P., ICI, Billingham, Teesside, England  
HUTTON E., Laporte Industries, Widnes, Lanc., England  
HUYBEN G., CTI-TNO, Hengelo, The Netherlands  
HUYGEN D.G., UKF, Utrecht, The Netherlands  
HYPPONEN P., Avbrottsförsäkringsaktiebolaget OTSO, Helsingfors, Finland

ISAKSSON R., Keskinäinen yhtiö Teollisuusvakuutus, Helsinki, Finland

JACOBSEN H.V.N., Grindstedverket, Grindsted, Denmark  
JANSEN J.B., Mekog, IJmuiden, The Netherlands  
JANSEN P., Crawford and Russell, Leidschendam, The Netherlands  
JARVIS J., Stewart Wrightson, Kingston, Surrey, England  
JENSSEN A., Norwegian Defence Construction Service, Oslo, Norway  
JOCHEMS J., Dir.-Gen. van de Arbeid, Linschoten, The Netherlands  
JOHANSSON B., Pharmaceuticals Industry, Södertälje, Sweden  
JONGE S.L. de, AAGrunol, Groningen, The Netherlands  
JONKER J.A., N & T Int., Middelburg- The Netherlands  
JONKER M.C.W., Hoechst Holland, Vlissingen, The Netherlands  
JOSCHEK H.I., BASF, Ludwigshafen, Germany  
JOST W., Univ. of Göttingen, Göttingen, Germany  
JYLHÄ L., Kemira Oy, Oulu, Finland

KAFKA F.L., ICI, Rozenburg, The Netherlands  
KAMP J.M. van der, Royal Inst. of Engineers in the Netherlands, The Hague, The Netherlands  
KAMPEN J.P.M. van, AMVO, Amsterdam, The Netherlands  
KANTYKA T.A., ICI, Wilton, Middlesbrough, England  
KATWIJK J. van, Mees & Zoonen, Rotterdam, The Netherlands  
KJAERGAARD E., Arbejdstilsynets Vejle-kreds, Vejle, Denmark  
KJELLÉN U., Research Inst. for National Defence, Sundbyberg, Sweden  
KLAASSEN P.L., Shell Int. Chemie Mij., The Hague, The Netherlands  
KLETZ T.A., ICI, Billingham, Teesside, England  
KNOBBEN G.J., Nieuw Rotterdam Groep, Rotterdam, The Netherlands  
KNOPS J.J.A., DSM, Geleen, The Netherlands  
KOCH R., Kon. Wessanen, Wormerveer, The Netherlands  
KÖHLER B., Dow Chemical, Bützflethersand, Germany  
KOOIJMAN P.R., Orbis Verz. Mij., The Hague, The Netherlands  
KORJUSLOMMI E.O., Neste Oy, Kulloo, Finland  
KOTEN F.R. van, Shell Int. Chemie Mij., The Hague, The Netherlands  
KOVATS F., Hungarian Chem. Eng. Center, Budapest, Hungary  
KRAMERS H., AKZO, Arnhem, The Netherlands  
KRANENBURG W., Mees & Zoonen, Rotterdam, The Netherlands  
KRAPELS J., DSM, Geleen, The Netherlands  
KROON J., Naarden Int., Bussum, The Netherlands  
KRUISWEG J.G., AKZO Eng., Arnhem, The Netherlands  
KRUYT D.E.L., CTI-TNO, Hengelo, The Netherlands  
KUSTERS J., Am. Int. Underwriters-Europ., Brussels, Belgium

LAAG W.S. van der, Shell Int. Chemie Mij., The Hague, The Netherlands  
LANGENDAM J.H., Dupont de Nemours, Dordrecht, The Netherlands  
LANSBERGEN G.J.T., Unilever Research Lab., Vlaardingen, The Netherlands  
LARSSON A., Nat. Swedish Insp. of Explosives, Solna, Sweden  
LAUFKE H., Svenska Brandförsvarsförenigen, Stockholm, Sweden  
LEES F.P., Univ. of Technology, Loughborough, England  
LEEUEWEN C.J. van, Unilever Emery, Moordrecht, The Netherlands  
LEEUEWEN J.B. van, AKZO Zout Chemie, Hengelo, The Netherlands  
LEJEUNE F.J., D.S.M.-G.O.P., Geleen, The Netherlands  
LELOU J., INRS, Paris, France  
LEMKE E., Techn. Fachhochschule, Berlin, Germany  
LEMKOWITZ S.M., Delft Univ. of Technology, Delft, The Netherlands  
LENEMAN G.J., Hoechst Holland, Vlissingen, The Netherlands



LENZ G.H.P., Tate & Lyle Refineries, London, England  
 LEOPOLD L., Arbeidsinspectie, Hilversum, The Netherlands  
 LEUTSCHER A., Nijverheidsorganisatie TNO, Delft, The Netherlands  
 LEWIS D.J., ICI, Winnington, Northwich, Cheshire, England  
 LINDEN J. van der, ESSO Refinery, Rotterdam, The Netherlands  
 LINDENMANN W., Fire Prevention Service for Industry and Trade, Adliswil, Switzerland  
 LINDGREN A., Säteri OY, Valkeakoski, Finland  
 LINGEN R., Bayer, Leverkusen, Germany  
 LJUNGLÖF L.G., AB Astra, Söderälje, Sweden  
 LÖVOLD K., Dyno Industries, Nittedal, Norway  
 LÜCKER W., Ashland-Südchemie, Geertruidenberg, The Netherlands  
 LUDWIG P.W.P.H., Neratoom, The Hague, The Netherlands  
 LUNDQUIST S., Uppsala Univ., Uppsala, Sweden  
  
 MAAS W., DSM, Heerlen, The Netherlands  
 MÄDRICH O., Oberrheinische Mineralölwerke, Karlsruhe, Germany  
 MAESSEN J.Th.M.F., Naarden Int., Bussum, The Netherlands  
 MAHIEU A.P., Kon. Shell Lab., Amsterdam, The Netherlands  
 MAHIEU P., Boels & Begault S.N.C., Brussels, Belgium  
 MANUELE F., Marsh & McLennan, Chicago, Illinois, USA  
 MARCINOWSKI H.J.F., Stichting CONCAWE, The Hague, The Netherlands  
 MARMEREN A.C. van, AKZO Zout Chemie, Hengelo, The Netherlands  
 MARSHALL M.R., British Gas Corp., Solihull, Warwickshire, England  
 MATHISEN K., AGA, Lidingsö, Sweden  
 MAYR H., Erdölchemie, Köln, Germany  
 MEADS A., ICI, London, England  
 MEISSEN J.P., Chemisch Weekblad, Tricht, The Netherlands  
 MENSING W., Metallgesellschaft, Langelshei, Germany  
 MERRIFIELD R., Laporte Industries, Widnes, Lanc., England  
 MERZ H., Basler & Hofmann, Zürich, Switzerland  
 MEY H., Shell Int. Petroleum Mij., The Hague, The Netherlands  
 MEIJER M., Gist-Brocades, Delft, The Netherlands  
 MEIJER P., IG-TNO, Delft, The Netherlands  
 MEIJNEN J.K.G., AKZO, Arnhem, The Netherlands  
 MICHAIL P.D., BP Chemicals Int., London, England  
 MICHELS J., Kon. Luchtmacht, Delft, The Netherlands  
 MILLER R.L., Monsanto, St. Louis, Missouri, USA  
 MINER L.W., Shell, The Hague, The Netherlands  
 MINSHULL J.A., Allied Colloids, Bradford, Yorkshire, England  
 MOERMAN C.A., Naarden Int., Naarden/Bussum, The Netherlands  
 MOHR H., BASF, Ludwigshafen, Germany  
 MOL M.J.P.M., Mees & Zoonen, Rotterdam, The Netherlands  
 MOLLESON A.V.I., King-Wilkinson, The Hague, The Netherlands  
 MONSTER A.J., ICI, Rozenburg, The Netherlands  
 MOOLENAAR C., AKZO Chemie, Amersfoort, The Netherlands  
 MOORSE J., ICI, Billingham, Teesside, England  
 MOREAU D.J.J.S.M., Van Imhofstraat 2, The Hague, The Netherlands  
 MORRIS D.H., Monsanto, Southampton, Hampshire, England  
 MOSSELMAN H.G., AKZO Research Lab., Arnhem, The Netherlands  
 MOVILLIAT, Centre d'Études et Recherches des Charbonnages, Verneuil-en-Halette, France  
 MULDER H.N., DSM, Geleen, The Netherlands  
 MURPHY J., Dr. Karl Thomae, Biberach a.d. Riss, Germany  
 MUSSON M., Marsh & McLennan, Brussels, Belgium  
  
 NAPIER D.H., Imperial College, London, England  
 NEEF G.A.M. de, ICI, Werchter, Belgium  
 NETTESHEIM G., Wacker-Chemie, Köln, Germany  
 NIEUWSTAD M.G., Arbeidsinspectie, The Hague, The Netherlands  
 NIJHOFF D.F., Tulleners Van Buren, Rotterdam, The Netherlands  
 NIJZINK E., Bureau Rebel, Bilthoven, The Netherlands  
  
 O'CALLAGHAN M., Dept. of Labour, Dublin, Ireland  
 OEGEMA O., Dow Chemical, Terneuzen, The Netherlands  
 OFFERS R.J., Arbeidsinspectie, Groningen, The Netherlands  
 OHM A., AKZO, Arnhem, The Netherlands  
 OOSTERHOUP J.J. van, Shell Int. Chemie Mij., The Hague, The Netherlands  
 OOSTSTROOM A.P. van, General Electric Plastics, Bergen op Zoom, The Netherlands

OPSCHOOR G., CTI-TNO, Apeldoorn, The Netherlands  
O'REILLY B.M., H.M.F.I., London, England  
OS D.P. den, KNCV, The Hague, The Netherlands  
OTTER H.P. den, Halsterseweg 183, Bergen op Zoom, The Netherlands  
OVERSLUIZEN M., Inspectie Volksgezondheid, The Hague, The Netherlands  
OWEN A.J., EM2 (Home Office) Branch Royal Armament Research, London, England

PALMER K., Sedgwick Forbes Int., London, England  
PALMER K.N., Building Research Establishment, Borehamwood, Hertfordshire, England  
PAPE R., ISRE ERDE Procurement, Waltham Abbey Essex, England  
PASMAN H.J., Techn. Lab. TNO, Rijswijk, The Netherlands  
PATANÈ G., 3M Italia, Caserta, Italy  
PAULIN P., 3M France, Paris, France  
PEETERS D.C.J.M., Windmill Holland, Vlaardingen, The Netherlands  
PEPPEL G.W., Ned. Onderlinge Waarborg Mij., Groningen, The Netherlands  
PERBAL G., UKF, IJmuiden, The Netherlands  
PETERS A.W., Paktank, Rotterdam, The Netherlands  
PETERS H.J., AKZO Chemie, Mons, Belgium  
PFÖRTNER H., Schinnrainstrasse 15, Karlsruhe, Germany  
PIGNONI G., Fervet, Torre Annunziata, Italy  
PLANCKE J.P. van der, A.N.P.A.T., Brussels, Belgium  
PLAS H.J. van der, Shell Int. Chemie Mij., The Hague, The Netherlands  
PLOEG van der, Shell Int. Petr. Mij., The Hague, The Netherlands  
PORS C., Dow Chemical, Rotterdam, The Netherlands  
PØRTNER I., Arbejdstilsynet, Odense, Denmark  
POST P., Fluor Ned., Haarlem, The Netherlands  
POSTMA J.W., AKZO Chemie, Amsterdam, The Netherlands  
PREST B., Keskinäinen yhtiö Teollisuusvakuutus, Helsinki, Finland  
PUTTE T. van de, Dienst Centraal Milieubeheer Rijnmond, Schiedam, The Netherlands

QUAGLIOZZI E., Fervet, Torre Annunziata, Italy

RADEMAEKER E. de, Comprimo, Antwerpen, Belgium  
RAMACKERS L., Shell Ned. Chemie, Rotterdam, The Netherlands  
RAO S.R.C., Hindustan Steel, Bhilai (M.P.), India  
RAVID Y.J., H. Littner, London, England  
REE E. van, Veiligheidsinstituut, Amsterdam, The Netherlands  
REED J.D., ICI, Billingham, Teesside, England  
REGOORT R., AKZO Chemie, Amsterdam, The Netherlands  
REINSHAGEN P., Chemisch Weekblad, The Hague, The Netherlands  
RICKLES K.D., FMI, London, England  
RIELE R.H.M. te, Kon. Shell Lab., Amsterdam, The Netherlands  
RIETHMANN J., Ciba-Ceigy, Schweizerhalle, Switzerland  
ROSENFELD H.J., Crawford & Russell, The Hague, The Netherlands  
RUSELER H.C., Unilever-Emery, Gouda, The Netherlands  
RUTTEN G.D., Caleb Brett & Son, Rotterdam, The Netherlands  
RUIJTERMAN C., Neratoom, The Hague, The Netherlands  
RYDH T., Abastra, Södertälje, Sweden  
RIJK C.F. de, Mobil Oil Refinery, Amsterdam, The Netherlands

SAFFIAN L., Picatinny Arsenal, Dover, New Jersey, USA  
SANDE T., River and Harbour Lab., Techn. Univ. of Olsokhagen, Stavanger, Norway  
SANDERS G.M., DSM, Meerssen, The Netherlands  
SANTAMATO V., Montedison, Milano, Italy  
SCHÄFER H., Mobil Oil, Hamburg, Germany  
SCHAIK J. van, Borg Warner Chemicals, Bussum, The Netherlands  
SCHERMERHORN J., DSM, Beek, The Netherlands  
SCHIEMAN J.S., Hoechst Holland, Vlissingen, The Netherlands  
SCHIERWATER F.W., Berufsgenossenschaft der Chem. Industrie, Heidelberg, Germany  
SCHILPEROORD A.A., Techn. Lab. TNO, Rijswijk, The Netherlands  
SCHINKEL G., Arbeidsinspectie, Haarlem, The Netherlands  
SCHIPPER P.G., Metaalinst. TNO, Apeldoorn, The Netherlands  
SCHMIDT H., Chemische Werke Hüls, Marl, Germany  
SCHMIDT U., Neste Oy, Naantali, Finland  
SCHNEIDER T., Basler & Hofmann, Zürich, Switzerland  
SCHOLTEN A.J., Dir.-Gen. van de Arbeid, Voorburg, The Netherlands  
SCHÖNEBERG K., Dow Chemical, Bützfleth, Germany

SCHREIBER A., Metallurgie Hoboken-Overpelt, Hoboken, Belgium  
 SCHÜNGEL J.P., Shell Ned. Chemie, Oostvoorne, The Netherlands  
 SCHUSTER W., BASF, Ludwigshafen, Germany  
 SCHWARZ J.J., Ned. Inst. v. Prev. Geneeskunde TNO, Leiden, The Netherlands  
 SHARP D.H., Society of Chemical Industry, London, The Netherlands  
 SHAW A.W., ICI, Manchester, England  
 SHEPPARD G.T., ICI, Runcorn, Cheshire, England  
 SICCAMI E.H., Dir.-Gen. van de Arbeid, Voorburg, The Netherlands  
 SIMHAN K., Battelle, Frankfurt am Main, Germany  
 SLUIS J. van der, Dow Chemical, Rotterdam, The Netherlands  
 SMIT F.J., ESSO Refinery, Rotterdam, The Netherlands  
 SMIT W.P., Philips, Son, The Netherlands  
 SMITSHUYSEN F.W.L., Aluminium & Chemie Rotterdam, Rotterdam, The Netherlands  
 SNELLINK G., CTI-TNO, Apeldoorn, The Netherlands  
 SNIJDER G., Techn. Lab. TNO, Rijswijk, The Netherlands  
 SOLOMON Ch.H., ESSO Chemie, Rozenburg, The Netherlands  
 SPITZ H., Comprimo, Amsterdam, The Netherlands  
 SPRETER V., Battelle, Geneva, Switzerland  
 STAATS H., ICI, Sterrebeek, Belgium  
 STAMNES H., Sprengstoffinspekssonen, Tønsberg, Norway  
 STAUDINGER G., Kon. Shell Lab., Amsterdam, The Netherlands  
 STEEN H., Physikalisch-Technische Bundesanstalt, Braunschweig, Germany  
 STEEN D. van der, Unilever Research, Vlaardingen, The Netherlands  
 STILLEBROER C.R., Bouw- en Woningtoezicht, Rotterdam, The Netherlands  
 STOORVOGEL C., Gem. Bouw- en Woningtoezicht, Amsterdam, The Netherlands  
 STREUR R.H., Insurance Co., Rotterdam, The Netherlands  
 STUART R., Comprimo, Amsterdam, The Netherlands  
 STUBBERØD S.G., Insurance, Oslo, Norway  
 SULLIVAN Th., Prices Chemicals, Wirral, Cheshire, England  
 SUOMINEN T., Oy AGA, Kilo, Finland  
 SUTER H., BASF, Ludwigshafen, Germany  
 SWART K.H., Bundesanstalt für Materialprüfung, Berlin, Germany  
  
 VANIS P.Ch., AKZO Zout Chemie, Rockanje, The Netherlands  
 VAYLOR H., Keith Shipton Dev., London, England  
 VENNEVALL E., Arbelarskyttsstyrelsen, Stockholm, Sweden  
 VERRY M.J., Robins Davies, London, England  
 VONNISSEN C.J.C., Arbeidsinspectie, Arnhem, The Netherlands  
 VOMAS G., ICI, Welwyn Garden City, Herts., England  
 VOMPSON Th., BP Chemicals Int., Glamorgan, South Wales, England  
 VOM J.A. den, Arbeidsinspectie, Groningen, The Netherlands  
 VONSE R.W., Techn. Lab. TNO, Rijswijk, The Netherlands  
 VONMANN H., Bundesanstalt für Materialprüfung, Berlin, Germany  
 VONDER H.E., AKZO Coatings, Amstelveen, The Netherlands  
  
 WILIG D., Regierungspräsident im Darmstadt, Darmstadt, Germany  
 WILLEN A.P. van, KNMI, De Bilt, The Netherlands  
 WILTERLINDEN J., Försäkringsaktiebolaget Skandia, The Hague, The Netherlands  
  
 WIL J.L., Hendrikx Voeders, Boxmeer, The Netherlands  
 WIJEN P. van, Tollenaar & Wegener, Amsterdam, The Netherlands  
 WILBIEST A., Dir.-Gen. van de Arbeid, Voorburg, The Netherlands  
 WILBURG J.J.G., Prov. Waterstaat in Zuid-Holland, The Hague, The Netherlands  
 WILHELMST L.H., Ned. Stikstof Mij., Sluiskil, The Netherlands  
 WILGNE J., Cerchar Vernh., Creil, France  
 WILRINGA A., Arbeidsinspectie, Rotterdam, The Netherlands  
 WILRLOOP A.J., Arbeidsinspectie, Veldhoven, The Netherlands  
 WILRMIJS H.J.A., Chem. Industrie Rijnmond, Rotterdam, The Netherlands  
 WILRVETJES W.J., Dienst Centraal Milieubeheer Rijnmond, Schiedam, The Netherlands  
 WILRWEIJ A.K., AAgrunol, Groningen, The Netherlands  
 WILRKKALA T., Ministry of Trade and Ind., Järvenpää, Finland  
 WILRIS C.H., ENKA Glanzstoff, Emmen, The Netherlands  
 WILRASKAMP L.C.E., Arbeidsinspectie, Amsterdam, The Netherlands  
 WILRLIET J.T. van, Langeveldeweg 34, Noordwijkerhout, The Netherlands  
 WILROLLENHOVEN F.W. van, Shell Int. Petr. Mij., The Hague, The Netherlands  
 WILROORSCHUUR H., Heineken, Rotterdam, The Netherlands  
 WILRÖS M., Hungarian Chem. Eng. Center, Budapest, Hungary



VOS B., Kon. Shell Lab., Amsterdam, The Netherlands  
VRIES A.P.M. de, General Electric Plastics, Bergen op Zoom, The Netherlands

WALKIER J.A., AKZO Zout Chemie, Rotterdam, The Netherlands  
WANDREY P., Bundesanstalt für Materialprüfung, Berlin, Germany  
WEBSTER T.J., British Oxygen Co., Brentford, Middlesex, England  
WEERD J.M. van de, Kon. Shell Lab., Amsterdam, The Netherlands  
WEGEL S., Farbwerke Hoechst, Frankfurt am Main, Germany  
WENNER K., Bayer, Wuppertal, Germany  
WENTINK A., Ultra-Centrifuge Ned., Almelo, The Netherlands  
WESSELS E.C., TBB, Baarn, The Netherlands  
WESTBROOK G., ICI, Runcorn, Cheshire, England  
WEIJZEN J.H.M. ESSO Refinery, Rotterdam, The Netherlands  
WHITE M.C., Atomic Energy Control Board, Ottawa, Ontario, Canada  
WICHERS G.C., Mees & Zoonen, Rotterdam, The Netherlands  
WIERINGA E., Shell Int. Chemie Mij., The Hague, The Netherlands  
WIGMAN D., Arbeidsinspectie, Breda, The Netherlands  
WILDE B. de, MSA Ned., Amsterdam, The Netherlands  
WILSON B.R.W., BP Chemicals Int., London, England  
WILSON K., Air Products, New Malden, Surrey, England  
WINDEBANK C.S., The Insurance Techn. Bureau, London, England  
WINK D.A., UniMills, Zwijndrecht, The Netherlands  
WINKER N., Allg. Unfallversicherungs Anstalt, Wien, Austria  
WINKLER G.D., Wolff Walsrode, Walsrode, Germany  
WISSINK J.H., Windmill Holland, Vlaardingen, The Netherlands  
WITTENBURG H., BP, Hamburg, Germany  
WITTHAUS P.O., Maizena, Krefeld, Germany  
WRINGER P.H.J. de, Dienst Centraal Milieubeheer Rijnmond, Schiedam, The Netherlands  
WIJFFELS J.B., Shell Int. Chemie Mij., The Hague, The Netherlands  
WIJN J.A., Vondelingenplaat, Rotterdam, The Netherlands  
WIJTING L., AKZO Chemie, Deventer, The Netherlands

ZAHN E. von, Bundesanstalt für Materialprüfung, Berlin, Germany  
ZEE A.J. van der, ESSO Refinery, Rotterdam, The Netherlands  
ZELIS F., Shell Int. Petroleum Mij., The Hague, The Netherlands  
ZELM M. van, Chem. Lab. TNO, Rijswijk, The Netherlands  
ZIEGER A., BASF, Ludwigshafen, Germany  
ZOON J.C., ESSO Chemie, Rozenburg, The Netherlands  
ZWAM H.J. van, Diosynth, Oss, The Netherlands