

F.L. Vinyl Chloride

Court Upholds EPA's Decision On Vinyl Chloride

WSJ — 11-5-76

By STEPHEN WERMIEL

Staff Reporter of THE WALL STREET JOURNAL
WASHINGTON — A federal appeals court, saying the Environmental Protection Agency has great leeway in setting clean air goals, upheld the agency's decision against tightening air pollution standards for vinyl chloride.

In a 2-1 decision, the appeals court said that whenever the health effects of different levels of air pollution are uncertain, the EPA may set air quality standards that take into account the cost to industry and the technological feasibility of complying.

Environmental groups said the decision, if upheld on appeal, will permit the EPA to weaken federal air quality enforcement efforts. "It's hard to imagine a statute that is clearer than the Clean Air Act when it says that health is the only factor to be considered in EPA's standards," said David Doniger, lawyer for the Natural Resources Defense Council. The group challenged the EPA's handling of vinyl chloride regulations.

But the appeals court, in an opinion written by Judge Robert Bork, didn't agree that the law was clear. The court said that because the benefits of setting lower levels for vinyl chloride were unknown, the EPA was entitled to consider factors other than public health, including a form of cost-benefit analysis.

Vinyl chloride, a gaseous chemical used by industry to manufacture plastics, is widely viewed as a cancer-causing substance.

In 1976, the EPA announced air quality levels for vinyl chloride that industry was required to meet. At the time, the EPA said federal law allowed the agency to set air standards that weren't way out of proportion to industry's cost in complying with them.

The standards were challenged by environmental groups, and while the case was pending, Jimmy Carter replaced Gerald Ford in the White House. The EPA agreed to settle the lawsuit by proposing tougher standards in June 1977.

But the tough standards were never made final. Last year, the EPA withdrew them and proposed returning to the 1976 regulations. The Natural Resources Defense Council appealed to the federal appeals court in the District of Columbia.

The appeals court relied on a 1984 Supreme Court ruling that said when a federal regulatory law is ambiguous, federal courts should give considerable weight to the decisions of the agency that enforces the law.

The section of the federal clean air law that calls for regulation of hazardous pollution is ambiguous and the EPA's decision to consider cost "was reasonable," the appeals court said.

Judge Skelly Wright dissented, agreeing with the Natural Resources Defense Council that the law "is as devoid of ambiguity . . . as any statutory provision probably can be."

EPA officials said the ruling reaffirmed their view of the law. "We felt we had discretion in implementing this section of the law," said Charles Carter, an EPA assistant general counsel.

But the Natural Resources Defense Council's Mr. Doniger said that when the Supreme Court ruling "is taken to this extreme, it's difficult to think of what Congress could say to eliminate ambiguity." He said the decision may affect other pending challenges to EPA standards for benzene and for radioactive air pollutants.

Mr. Doniger also argued that the ruling conflicts with past decisions of the appeals court and said he probably will ask the full 11-member appeals court to review it.

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Record of Meeting

of
Vinyl Chloride Panel Meeting
with

Environmental Health Associates

Date: September 8, 1986
Time: 9:30 a.m.

Place: Environmental Health Associates
Oakland, CA

List of Attendees:

William Gaffey	Monsanto Company
Sally Cowles	Shell Oil Company
Donald Whorton	Environmental Health Associates
Otto Wong	Environmental Health Associates
Has Shah	CMA

- 1.0 Dr. Bill Gaffey discussed comments received by CMA on the Epidemiology Study of Vinyl Chloride Workers draft report. Some of the comments made by Air Products could not be incorporated in the final report because they would require additional work not included in the scope of work for the current contract. Dr. Gaffey will prepare a written record of comments that could not be addressed for various reasons.
- 2.0 EHA will revise the draft report based on the comments received and will submit the final report by the end of September.
- 3.0 A Panel meeting will be scheduled soon after the final report is received to discuss a future course of action.
- 4.0 The meeting adjourned at approximately 12:00 noon.

UPL 13761

Hasmukh Shah

Has Shah, Ph.D.
Manager, Vinyl Chloride Program



CHEMICAL MANUFACTURERS ASSOCIATION

March 17, 1986

[Handwritten signature] @ WDAH file
Dear Vinyl Chloride Panel and Research Coordinator Member:

Dr. Brian Bennett of ICI sent me the enclosed "Register of Cases of Angiosarcoma of the Liver Due to Exposure to Vinyl Chloride." Please note that the register is marked confidential, and therefore should be used for your internal purpose only. Also enclosed is an article I received from Mr. John Barr on "Occupational Exposure and Brain Tumors."

Sincerely,

Has Shah

Has Shah, Ph.D.
Manager
Vinyl Chloride Panel

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Enclosures

Air Products and Chemicals, Inc.
Box 538
Allentown, PA 18105
Telephone (215) 481-4911

AIR
PRODUCTS

27 February 1986

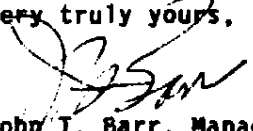
Dr. Has Shah
Chemical Manufacturers Association
2501 M Street, N.W.
Washington, D.C. 20037

Dr. Roy Gottesman
The Vinyl Institute
Wayne Interchange
Plaza II
155 Route 46 West
Wayne, NJ 07470

Sirs:

You may wish to bring the attached paper to the attention of your various committees interested in vinyl chloride health effects. It describes VC as the only recognized central nervous system carcinogen.

Very truly yours,


John T. Barr, Manager
Regulatory Response

JTB:pbr
0608c

Enclosure: Moss, J. Toxicol. Environ. H. 16 703-711 (1985)

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OCCUPATIONAL EXPOSURE AND BRAIN TUMORS

Andrew R. Moss

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Epidemiological evidence of an occupational risk of brain cancer has been reported in four industries where chemical exposures are likely, most recently in a series of prospective studies in the petrochemical industry. However, only in the case of vinyl chloride exposure has an occupational central nervous system carcinogen been identified. This report reviews the convergence of epidemiological and laboratory evidence that established the occupational carcinogenicity of vinyl chloride, and discusses in detail the current evidence for an occupational risk of brain tumors in the petrochemical industry.

INTRODUCTION

Primary brain tumors of the glioma series, which make up about half of all brain tumors, show a male-to-female ratio of about 1.5 to 1. Brain tumors in general appear to be increasing in incidence among older cohorts (Waxweiler et al., 1983). Thus brain tumors in general, and glioma series tumors in particular, are sometimes considered as a priori likely suspects in the search for occupationally related tumors. Furthermore, gliomas can be produced experimentally in rats by at least four groups of experimental chemicals: aromatic hydrocarbons, *N*-nitroso compounds, triazenes, and hydrazines. More recently, brain tumors including gliomas have been shown to be produced by inhalation in rats by three industrial chemicals, bis(chloromethyl) ether, vinyl chloride, and acrylonitrile (Maltoni et al., 1982). These experimental results, together with the established history of brain-tumor carcinogenesis in vinyl chloride workers, have led many researchers to lend at least preliminary credence to reports of brain tumors occurring in other industries where there are chemical exposures. Most recently, a series of studies have suggested excess risk of brain tumors in the petrochemical industry.

Evidence suggesting an excess of brain tumors has now been reported for at least four occupational groups: rubber workers (beginning with Mancuso's investigations in the 1950s), chemists, vinyl chlo-

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ride workers, and petrochemical workers. However, the convergence of epidemiological and laboratory investigations that is usually accepted as the informal criterion of proof in such situations has been hard to demonstrate (see, e.g., Cole and Merletti, 1980; Doll and Peto, 1981). Thus, Mancuso's original observations in the rubber industry were not followed by the identification of any specific carcinogen, and the existence of an occupational risk of brain tumors in rubber workers is currently open to doubt (Mancuso, 1982; Symons et al., 1982). Brain-tumor risk in chemists has been shown only in a series of Swedish studies, and as yet no likely carcinogen has been identified (Olin and Ahlbom, 1982). The convergence of an epidemiologically identified risk and a suspected carcinogen has been demonstrated only among vinyl chloride workers. Thus Cole, in his surveys of occupational carcinogenesis, recognizes only vinyl chloride as an established industrial brain carcinogen (Cole and Merletti, 1980). Doll and Peto, more conservatively, admit the brain only as a "possible" site of occupational carcinogenesis (Doll and Peto, 1981). The history of vinyl chloride as a central nervous system (CNS) carcinogen is discussed in the next section.

Historically, the establishing of occupational or environmental risks has often been a complex and drawn-out process, sometimes requiring decades for the development of a consensus on a particular exposure. Thus although the issue of excess risks of brain tumors in rubber workers is currently in debate, the persistence of reports of brain tumor excesses in this and other industries has, as it were, promoted brain tumors to the top of the list of tumors that may be associated with important occupational risk (along with lung cancer, leukemias and lymphomas, primary liver cancer, and, more recently, melanoma). This was the situation in 1978 when a cluster of brain tumors was reported in petrochemical workers in Texas, initiating a major wave of research into the subject. The petrochemical research is also reviewed in this article.

VINYL CHLORIDE AS A BRAIN CARCINOGEN

Cole observes that occupational carcinogens are usually recognized because they generate an unusually high rate among a small exposed population, and because they produce tumors that are otherwise unusual (Cole and Goldman, 1975). Vinyl chloride (VC) is the classic case of a carcinogen that has such an effect, producing in workers exposed to high levels of the gas the very rare angiosarcoma of the liver (ASL). The first reported case of ASL in a vinyl chloride worker was diagnosed at the B. F. Goodrich company in Louisville, Kentucky, in May, 1970; the second in March, 1973; and the third, at autopsy, in December, 1973 (Heath et al., 1976). Since the incidence of ASL in the United States

was then 20–25 cases/yr, the appearance of 3 cases among a small group of workers prompted considerable concern. Furthermore, concurrent studies by Viola (1971) had shown skin, lung, and bone tumors in rats exposed to VC by inhalation. [Viola's carcinogenesis studies were reportedly an outgrowth of his work on acroosteolysis in VC-exposed workers. Hepatitis-like liver changes had been reported as early as 1949 (Nicholson, 1977).]

Following Viola, Maltoni demonstrated angiosarcomas in rats exposed to VC in 1972 (Maltoni et al., 1982). This result was communicated to the Manufacturing Chemists Association, which following the discovery of the third case at B. F. Goodrich, made public the finding of three cases of angiosarcoma in VC-exposed workers in the *Wall Street Journal*. With this announcement, a major effort began to study vinyl chloride workers, including a National Institute of Occupational Safety and Health (NIOSH) follow-up study of 1294 workers with extensive VC exposure in four plants. A concurrent histopathology study reviewed tumors reported on death certificates of all workers in the four plants.

The NIOSH study, published in 1976, showed very high relative risks in the category "biliary and liver cancer." The relative risk was 11 for workers with 10 or more years of exposure and 16 for workers with 15 or more years of exposure. Furthermore in the concurrent histopathology study, 11 of 14 reported liver and biliary cancer cases on death certificates were ASL (Waxweiler et al., 1976). These observations have remained the primary epidemiological basis for the assertion of the carcinogenicity of vinyl chloride.

However the study also observed a significantly increased relative risk for brain tumors, with 3 observed and 0.6 expected among workers exposed more than 15 years. At the same time Maltoni (1976a) reported that brain tumors as well as ASL could be produced in rats exposed to VC by inhalation. Furthermore the NIOSH histological study showed that 9 of 10 brain-cancer deaths in the VC worker cohort were glioblastoma multiformes (the most commonly occurring tumor in the glioma series). This proportion was thought to be unusually high. [However, it has been shown that the expected proportion of glioma-series tumors in such a series depends heavily on the number diagnosed at autopsy (Schoenberg et al., 1978)]. These results were sufficient for the development of a reasonable consensus that brain tumors as well as ASL were associated with VC exposure. The primary evidence in the development of the consensus was the correspondence between the human data and the laboratory inhalation studies, in which the exposure levels were thought to be close to human occupational exposures. (see, e.g., Wagoner and Infante, 1977). Vinyl chloride is the only occupational chemical carcinogen for which a correspondence exists.

Waxweiler et al. (1983) also note that in the 9 glioblastoma multiforme cases identified in the VC workers histology study, the average

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time since first exposure to vinyl chloride was 21 yr. Thus the epidemiological observation of risk may have followed the oncogenic exposure by a generation, and the circumstance of exposure could well have changed by the time the risk was recognized. This long latency period is characteristic of occupational carcinogenesis. The excess risk of mesothelioma in asbestos workers, for example is not generally observable until 20 yr after exposure (Selikoff, 1977). The long latency period has important consequences in the case of brain tumors, which are not rare tumors.

The identification of VC-produced brain tumors, currently the only accepted example of occupational CNS carcinogenesis, offers some important lessons for studies of other industries. First, vinyl chloride was identified as a CNS carcinogen because it produces, as its primary effect, the extremely rare ASL. The excess risk of brain tumors would probably not have been recognized if it had not "piggybacked" on the rarer tumor. Second, the brain was only recognized as an additional site of carcinogenesis because comparable ranges of tumors were seen in human and animal inhalation studies. There is no other occupational carcinogen for which such a correspondence is currently known. Third, the number of tumors reported in the primary study was very small: there were 3 cases in the high-exposure cohort, and 10 in the concurrent histopathology study. Fourth, the period between initial exposure and observation was so long that observed effects may in fact have been archaeology rather than epidemiology—the carcinogenic situation may well have no longer existed when the excess risk was observed.

BRAIN TUMORS AND PETROCHEMICAL EXPOSURE

The intensive study of brain tumors in the petrochemical industry began in 1978 when an employee at the Union Carbide plant in Texas City, Texas, reported a newly diagnosed brain tumor to the local office of the Occupational Safety and Health Administration (OSHA). A joint study with the Oil, Chemical and Atomic Workers union (OCAW) and company representatives identified a total of 10 brain-tumor deaths and cases among workers at the plant (not including the original complainant, whose tumor proved to be metastatic). This number was sufficient for the OSHA office to request a formal study by NIOSH. A joint study, with Union Carbide researchers, was initiated. A proportional mortality study of OCAW members in South Texas was already in progress, and additional studies in other refineries and chemical plants were initiated over the next year.

However, in 1979 both the Three Mile Island incident and the Federal declaration of emergency status for the Love Canal area took place,

and in the ensuing controversies over environmental carcinogenesis the atmosphere became polarized between industry and governmental-union forces. As a result, competing industry and governmental-union studies were set up in several of the exposed petrochemical cohorts in Texas and Louisiana. When a meeting was convened at the New York Academy of Sciences in 1980 to review the studies, a total of eight were presented, four from each group. The four governmental-union studies uniformly indicated a twofold risk of brain cancer among petrochemical workers; the four industry studies uniformly failed to detect any excess risk. "To the innocent observer," *Science* reported, "the crisp pattern of falling chips appeared at first sight to display blatant gerrymandering" (Lewin, 1980). It was also true, however, that the range of methods and cohorts involved was considerable and that there was extensive methodological disagreement. Reeve et al. (1985) reviewed the issues. The primary methodological questions were (1) the tendency of proportional mortality studies, as carried out by NIOSH, to inflate cancer risk, and (2) the tendency of industry-wide cohort studies, as carried out by the industry groups, to bury small groups of at-risk workers in very large cohorts. These issues were not resolved as, with the new Federal administration in 1981, NIOSH capacity to continue the epidemiology studies was lost. With no pressure from the regulatory side, the industry studies appear to have slowed down also.

However, most of the proportional mortality studies were eventually converted to standardized mortality form, and a review of these studies is now possible. Savitz and Moure (1984) have recently reviewed the six prospective studies of refinery workers that were initiated by labor-governmental and industry groups in 1979-1980. Table 1 is adapted from Savitz and Moure, with the addition of results from two studies of petrochemical plant workers, those of Waxweiler et al. (1983) and Reeve et al. (1983). [One study, that of Thomas et al. (1982); remains a proportional mortality rate study (PMR): the others use standardized mortality ratios.]

All cohorts of petrochemical workers had low overall mortality, as is generally the case in studies of "healthy workers," and six of the seven for which all-site cancer mortality or incidence were reported showed lowered total cancer rates. [The exception was the PMR study of Thomas et al. (1982).] However, brain-tumor rates were elevated in all but two of the studies, the exceptions being the refinery-wide study of Wen et al. (1983), which included salaried workers, and the industry-wide study of the British petrochemical industry by Rushton and Alderson (1981). There was additional evidence of an association in more detailed substudies. Thus Savitz and Moure (1984) note that while Hanis et al. (1982) report an overall relative risk of 1.02 for brain tumors in their study of the Baton Rouge Exxon refineries, a more highly exposed

TABLE 1. Relative Risk for Brain Cancer and Melanoma in Prospective Epidemiological Studies of Refinery and Petrochemical Workers^{a,b}

Study	All cancers		Brain		Melanoma	
	RR	N	RR	N	RR	N
Theriault and Goulet, (1979)	0.89	25	3.90	3	—	—
Rushton and Alderson, (1981)	0.89	1147	0.80	36	2.16	14
Schottenfeld et al. (1981) (mortality)	0.76	127	1.63	8	—	—
Schottenfeld et al. (1981) (incidence)	0.86	240	1.29	9	1.32	13
Thomas et al. (1982) (PMR)	1.19	474	2.28	27	1.61	11
Hanis et al. (1982)	0.92	249	1.02	5	—	—
Wen et al. (1983)	0.96	839	0.99	30	1.22	16
Waxweiler et al. (1983)	0.81	131	1.81	13	—	—
Reeve et al. (1983)	N/A	N/A	1.09	25	—	—

^a Adapted from Savitz and Moore (1984).^b RR, relative risk; N, number.

subgroup had a higher risk. In the Reeve et al. study of Dow chemical workers, while the overall relative risk was 1.09, the risk among workers hired before 1945 was 1.83 (Reeve et al., 1983).

On the basis of the first six studies, Savitz and Moore comment that there was reasonably consistent evidence of a potential association between petrochemical exposure and brain cancer. The two chemical-plant studies appear to strengthen the association.

In an independent review of all NIOSH investigations in eight individual refineries and chemical plants in Texas, Reeve et al. (1983) note that inconsistencies remain in the plant-by-plant results, and that case-control studies within the studied cohorts show no consistent patterns of exposure. However the consistently elevated brain-tumor risk in the prospective studies appears sufficient at least for this line of research to continue.

Savitz and Moore note that melanoma risk is rather consistently elevated in the studies of petrochemical cohorts, as well as brain-tumor risk. This result is of interest because of an emerging pattern in recent studies of nuclear fabrication workers. Hadjimichael et al. (1983), in their study of the United Nuclear facility in Connecticut, observed relative risks of 2.40 for brain tumors and 2.12 for melanoma, against an

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all-sites relative risk of 0.88. Furthermore, Wilkinson et al. (1983) observed a tripled risk of brain tumors at the Rocky Flats nuclear plant, and Austin (1981) observed a tripled risk of melanoma at the Lawrence Livermore laboratory. Attempts to explain these risks by radiation exposures have proved generally unsuccessful; the similarity with the pattern of risk among petrochemical workers suggests that perhaps the cause is in some other aspect of the fabrication process.

CONCLUSION

Although this review suggests that the issue of brain tumors in petrochemical workers is at least worth further study, most of the prospective studies appear to have been dropped. However, a second wave of large case-control studies of occupational exposure in brain tumors has now been set in motion (see Table 2). In these studies, all brain-tumor cases or deaths in a specific case-finding area over a specific period are interviewed, either in person or by proxy. These large studies may eventually resolve the issue of whether there is a genuine

TABLE 2. Case-Control Studies Currently in Progress of Occupational Exposure in Glioma Patients

Investigator	Site	Number of cases	Number of controls	Source of cases	Location
Thomas, T. L., NCI Environmental Epidemiology Branch	CNS	600	600	Death certificate	New Jersey/Louisiana
Preston-Martin, S., University of Southern California	CNS	300	300	Incidence	Los Angeles County
Moss, A. R., University of California, San Francisco	Glioma	500	500	UCSF clinical cases and death certificates	Northern California
Buffler, P., University of Texas	Glioma	650	870	Incidence	Coastal Texas and Louisiana
Ahlbom, A., Huddinge University Hospital, Sweden	Brain	150	300	Clinical cases in 2 hospitals	Huddinge
Musico, M., Neurological Institute C. Besta, Milan	Meningioma/glioma	800	1,600	Hospital cases	Milan

* From Muir and Wagner (1982) and P. Buffler, personal communication

excess risk in petrochemical workers. [However, Cole notes that such large case-control studies are only effective when the exposed group makes up at least 2-3% of the population studied (Cole and Goldman, 1975).] It should also be noted that while large case-control studies of brain tumors may identify industry-wide risk, they cannot, by their nature, identify the pattern of tumor sites associated with a specific exposure. This latter information is generally accepted as important in establishing risk.

In conclusion, the prospective studies of petrochemical worker cohorts reviewed here suggest that there is an increased risk of brain tumors associated with petrochemical exposure, possibly accompanied by an increased risk of melanoma. No evidence of a specific carcinogen has been established, and while the current generation of large case-control studies will probably identify any overall risk in the industry, these studies will not identify the pattern of sites at risk. In the light of the consistency between the petrochemical worker studies and the recent nuclear-fabrication worker studies, there is an argument for a coherent program of prospective research in these cohorts. Other studies that could usefully be coordinated with such a program include a review of the specific-exposure inquiries in the petrochemical worker cohorts, an examination of the change in the incidence of glioma series tumors among all brain tumors, and an exploration of other associations between brain tumors and melanoma.

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CONFIDENTIAL

LIVER ANGIOSARCOMA CASES

WPK/ASL - ASL ADDRESS

CIRCULATION OF REGISTER

ADAMS Dr A Ross Air Products, Allentown, Pa, USA
 BAGSHAW Dr I M M Norsk Hydro, Newton Aycliffe, UK
 BAND Dr P R Cancer Control Agency of British Columbia, Vancouver, Canada
 BARNES Jnr W C Monsanto, St Louis, Missouri, USA
 BARR Dr J T Air Products, Allentown, Pa, USA
 BARRAT Dr G AECRP, Commeny, France
 BAXTER Dr Peter EMAS, London, UK
 BEAUFRE M Government of Quebec Cancer Registry, Canada
 BENECH Dr M Naphtachimie, Lavern, France
 BENNETT Dr B ICI Millhouse, UK
 BERTAZZI Dr P Inst of Occupational Health, Milan University, Italy
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 BISHOP Dr C EMAS, Bootle, UK
 BORRELLI F E Georgia Gulf, Delaware City, USA
 BOYER R W Formosa Plastics, Delaware City, USA
 BURGESS Mr David ICI Americas, Wilmington, Delaware USA
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 CELLA Mr C Enichen Polimeri, Milan, Italy
 CHANCE Mr M ICI Runcorn, UK
 CLAUS Mr P G APME, Brussels, Belgium
 CLAYTON Mr H Norsk Hydro, Newton Aycliffe, UK
 CONTASSOT Dr J C Chloé Chimie, Saint-Fons, France
 DAVIES Mr J G ICI, Everberg, Belgium (2)
 DE SLOOVER Dr Solvay & Cie, Brussels, Belgium
 DE VOS Mr A J ICI Everberg, Belgium
 DIETZ Dr H W B F Goodrich, Akron, Ohio, USA
 DOLL Sir Richard Imperial Cancer Research Fund, Oxford University, UK
 DOMEROWSKI S L Dow Chemical, Midland, Michigan, USA
 DUPONT Mr G APME, Brussels, Belgium
 EMMINGER Mr H VKE, Frankfurt, Germany
 ERNST Dr W Berufsgenossenschaft der Chemischen Industrien, Nurnberg, Germany
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 HARRIS Dr W D Uniroyal Inc, Middlebury, Connecticut, USA
 HILL Dr G B Alberta Cancer Board, Edmonton, Canada
 HILLMAN Dr D W Diamond Shamrock Corp, Dallas, Texas, USA
 KINDERER Dr R K B F Goodrich, Cleveland, Ohio, USA
 HOLGSON Mr J EMAS, Bootle, UK
 HOGG Dr W A Imperial Oil Ltd, Sarnia, Ontario, Canada
 HOWARD Dr J K University of Otago School of Medicine, Wellington, New Zealand
 HUMPHRY Dr N F ICI Australia, Melbourne, Australia
 JALVERT Mr J Chloé Chimie, Paris, France
 JERVIS Mr H R ICI Millbank, London UK
 KARRH Dr Bruce Dupont, Wilmington, Delaware USA
 KREUGER Dr R A B F Goodrich, Akron, Ohio, USA
 LAJOINE Dr J P Solvay, Brussels, Belgium
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 LAWRENCE-JONES Sir Christopher, Chief Medical Officer, ICI, London UK
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 MOTTI Dr A A Duperial SAIC, Buenos Aires, Argentina
 MNN Dr A Montanto, Brussels, Belgium
 MUNOZ MOUTON Dr M Rio Rodano, Madrid, Spain
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 O'SULLIVAN Dr JJ ICI Runcorn, UK
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 PAGLIAIUNGA Dr S Montedison, Milan, Italy
 POPPER Dr Hans Mount Sinai Medical Center, New York, USA
 POSSBERG Dr J Wacker-Chemie, Munich, Germany
 PUECH Dr A M Atochem, Brignoud, France
 PURDHAM Dr J Canadian Centre for Occupational Health & Safety, Hamilton, Canada
 RAMBAUD Dr J RP Recherches, Antony, France
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 RICHARD Dr P Rhone Poulenc, Rousaillon, France
 ROBSON Mrs D Saskatchewan Cancer Foundation, Regina, Canada
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 ROUSH Dr G Monsanto, St Louis, Missouri, USA
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 SALG Dr J NIOSH, Cincinnati, USA
 SARACCI Dr R IARC, Lyons, France
 SCHEFFERS Dr M L DSM/CVMD, Geleen, Holland
 SCHIPPER Dr H University of Manitoba, Winnipeg, Canada
 SERONNE Dr D Diamond Shamrock, Dallas, USA
 SHAH Dr Has CMA, Washington DC, USA
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 THEISS Prof Dr AM BASF, Ludwigshafen, Germany
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 WALDMATE H BF Goodrich, Cleveland, Ohio, Usa
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 WHEELER Dr D J ICI Hillhouse, UK
 WHEELER R N Union Carbide, South Charleston, USA
 WHISTON Dr J ICI Hillhouse, UK
 WHITE K H Duperial, Buenos Aires, Argentina
 WILNSKI O Electrochemical Industries, Acre, Israel
 WILLIAMS Dr DMJ BP Chemicals, Penarth, UK
 WILSON Prof R Harvard University, Cambridge, Massachusetts, USA
 WRIGHT Dr A P ICI Wilton, UK
 YORK J ICI Everberg, Belgium
 From: Dr B Bennett, Medical Department, Imperial Chemical Industries Plc
 Hillhouse Site, PO Box 4, Thornton-Cleveleys, Blackpool FY5 4QD, UK.

February 1986

URL 13774

C O N F I D E N T I A L

REGISTER OF CASES OF ANGIOSARCOMA OF THE LIVER DUE TO EXPOSURE TO VINYL CHLORIDE - REVIEW DATE 1 JANUARY 1986

P R E F A C E : Acknowledgments, significant changes and comments

1. The new cases in the Register are the following :

France	18
Germany	23, 24, 25, 26, 27
UK	11, 12
2. There are amendments from the previous Register against the following cases: Germany 21, 22 US 36, 38
3. I would like to thank Dr De Sloover, Dr D M J Williams and Dr Friedel for informing me of new cases.
4. For the case corrections I would like to thank Dr Friedel, Mr J T Barr and Mr R W Frase.
5. For other corrections and information, thanks to Dr D Forman, Mr J T Barr, Mr T H Sutherland and Mr N F Humphry.
6. I should be very grateful if all recipients of the Register could continue to keep me fully informed of any new cases, or, if they should hear of other Companies who have acquired a case of ASL, it would be much appreciated if I could be notified by the appropriate person.

It is extremely helpful if new information is supplied in tabulated form, using the headings in the Register as far as possible.
7. I would like to thank the many people who have suggested research topics, and should be grateful if I could be kept up to date.
8. I shall be happy to supply to any recipient of the Register a copy of the Paper "Exposure to Vinyl Chloride and Angiosarcoma of the Liver: a report of the Register of cases" by Dr David Forman, myself, Dr John Stafford and Sir Richard Doll, published in the British Journal of Industrial Medicine, November 1985 (42: 750-753)

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February 1986

UPL 13775

LIVER ANGIOSARCOMA CASES (REVIEW DATE - 1 JANUARY 1986)

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LIVER Angiosarcoma Cases - (Review Date 1 January 1986)

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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
<u>BELGIUM</u> 01		12.01.13	Solvay	Janssoppe	06.07.36	00.03.76	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 autoclave 1968-1972 exposed to 50-200 ppm 8 hrs per day in 25m autoclave 1972-1974 exposed to 50-200 ppm in auto- clave room 1974-1980 1975- 30 ppm REVISED 1 Feb 1975	Autoclave 14 yrs Polymer 1 yrs Work in glass ind. & chemi- cal industry	Driller in a foundry (2 yrs) Power (13 yrs) Work in glass ind. & chemi- cal industry	Magnetic tests in Oct 1974 were normal. Mediated Feb 1975 Hospitalized May 1976 Complete Clinical and carcino detail are given in a paper by Munblat et al in Arch. Belg. Med. Soc., 1978. Med. Trav. Med. Leg. 1977 pages 601-621
02	BB	27.09.40	Solvay	Janssoppe	20.08.62	00.10.79	39	17	9	23.10.83	Yes	08.62-03. 63 01.67 -10.71 + 200 ppm 8h/day 04.63-12. 66 + 200 ppm	Autoclave 3 yrs 3 mths Operator 3 yrs 3 mths.	Firmness since 10.71.	1st sign July 79. Thoracic pain 07.79. Magnetic tests altered 10.79. Positive echography 11.79. Hepa- tectomy 01.80. Chemotherapy. Information given in letter 12 Nov 1984 from Dr De Sloover.

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CANADA
Sheet 1

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 01		15.12.13	SHAWINIGAN		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		07.03.11			1944	1968	57	24	03	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			1944	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	1976	53	28	26	06.09.74	Yes		Furnace op. pipefitter maintenance		Worked overtime Smoker

* Paper by Dr F DELORME in Annales d'Anatomie pathologique Paris, 1970 Vol 23 No 2 pp105-114 claims this case had both a hepatoma and ASL simultaneously.

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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		16.03.15			1953	1976	61	23	14	00.04.77	Yes		Reactor cleaner	Permanence op. maintenance, packaging	Ex-smoker

CZECHOSLOVAKIA

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 86)

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 CASES HIGHLIGHTS	OTHER COMMENTS
CZECHOSLO- VAKIA 01		28.06.28	State Co	Novaký	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 for Hygiene and Occ diseases.	
02		06.07.27	State Co	Novaký	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.	

UPL 13780

FRANCE
Sheet 1

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 86)

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	13.04.26	RP	Reun- illon	00.01.46	10.02.67	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 171-172
02	SEN	03.06.11	PCWE	Brignoud	06.07.59	15.01.75	63	16	12	26.01.75	Yes (NIOH no comment)	High	2 yrs on monomer 10 yrs on polymer- isation	Italian origin	Ref. C Bonneton et al Nouvelles pratiques medicales 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	Polymworker 10 yrs as autoclave cleaner Compounding 3 yrs	VCM production 16 yrs Italian POW Shepherd, Savoyet, Mason	Ref. Rety et al Arch. Mal. Prof. 1 17 n° 6 June 77 p 551-555
04	MOB	27.01.27	PCWE	Brignoud	19.10.49	16.01.76	49	26	26	04.01.76	Yes	High	Monomer production worker 8 yrs PVC filtration 10 yrs		
05	B	29.01.30	PCWE	Brignoud	18.01.65	13.05.76	30	11	11	13.05.76	Yes	High	Polyworker 11 yrs	1)Theracotomy 9th Feb 1976 causal angiosarcoma 2)Isotagigraphy found ABL 3)Haemorrhage from ABL 4)Right Hepatectomy	Ref. P Coudane et al Semaine des Hospitaux 10 Septembre 1976 Previously had bone angiosarcoma Also Pillchowski et al La Nouvelle Pratique Medicate 7th July 1979 Page 248

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WPI/ASL 2 - LANGUAGES, 11

FRANCE
Sheet 2

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 CASES HIGHLIGHTS	OTHER COMMENTS
FRANCE															
06	Pa	14.04.34	PCHE	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 polymer and works lab?		This man had AOL prior to ASL. Ann. de Mal. Prof. July '77 p 643 & 6. AOL was found in 1971 five yrs before ASL.
07	GIR	24.04.27	BP	St Auban	01.07.50	After death NIOSH says 06.07.76	49	16	22	02.07.76	Yes (NIOSH no comment)	High	Plant form- er in polymer- isation	1972-6 admin section in St Auban	Died of septicemia Small liver lesion found after autopsy
08	B	01.04.34	Solvay	Tavern	23.05.57	03.12.75	42	19	19	30.01.77	Yes	Moderate	6 yrs pecker & autoclave cler 14 yrs autoclave worker		Had been tunnel worker previously
09	RPZ	08.10.14	BP	St Paul	10.01.48	26.04.76	63	28	28	25.12.77	Yes	Very High 1948-1966 Lanner Exposure 1966-1976	Polymer- isation operator, autoclave, autoclave maintenance	10 yrs in sulphuric acid factory, storekeeper & general servicing	Operated 4.76 for removal of tumour from liver and died after second surgical operation for bilio bronchial tuberculosis Paper by Dr Baty et al in Archives de Maladies Professionnelles Vol 40 No 6 1979 pages 741-3.

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IMPERIAL CHEMICAL INDUSTRIES PLC

WFX/ASL 2 - LANGLOMBARD, 12

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FRANCE
Sheet 3

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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
<u>France</u>															
10	VP	24.05.19	BP	St Pons	00.12.54	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	15.08.12	BP	St Pons	00.01.41	12.08.78	66	37	31	13.11.78	Yes	High	1941-1946 polymer- isation general purpose worker 1946-1972 VCH synthetic (MCI 4 Acetylene) Foreman (agent de migration) 1972 retired		
12		16.08.14	PCBR	Brignoud	09.02.49	00.05.79	65	30	27	23.06.79	Yes	High	Monomer production and polymer- isation operator		
13		19.01.31	Solvay	Taverny	23.09.63	26.06.79	48	16	13	22.08.79	Yes		Autoclave 2 yrs, Auto- operator 5 yrs, Copolymers 4 yrs	2 yrs as cycle mechanic. 10 yrs as mechanic 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	Chico Chino (Formerly BP)	St Pons	1943	00.07.81	57	38	36	29.07.81	Yes	Very High	1943-1975 All types of jobs on manufacture A maintenance in VCH Poly Process	1975-1979 maintenance work	

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FRANCE
Sheet 4

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 Chino (formerly BP)	St Pons	07.07.55	28.09.82	45	27	27	Alive	Yes	High-20 yrs Moderate 7 yrs	Autoclave cleaner 1955-1962 autoclave operator 1962-1982		J C Contassot Letter of 5 10 1983
16	GIN	13.07.22	Chloe Chino (formerly BP)	St Pons	17.10.41	05.01.83	61	41	38	03.04.83	Yes	High-33 yrs Moderate- Low - 5 yrs	Polymeriza- tion Process Man Maintenance Worker Health & Safety Agent		Retired Jan 1979. J C Contassot Letters of 5 10 1983 and 25 7 84.
17	BAR	22.02.23	Chloe Chino (formerly BP)	St Pons	17.06.48	03.04.83	60	34	28	03.04.83	Yes	High - 23 yrs	Autoclave Cleaner 1948-1971	Other sectors of St Pons Factory 1971- 1978	Retired 01.01.79 J C Contassot Letter of 5 10 1983
18	B	14.07.42	Solvay	Yverdon	09.09.63	21.03.84	42	21	21	27.12.84	21.03.84	High-12 yrs Low - 9 yrs	Autoclave Cleaner		09.03.84 Right Hepatectomy 05.05.84- 24.09.84 chemotherapy for lung- metastasis : partial remission. 08.84 - liver recurrence. 10.84 - lung: evolution of the disease

URL 13784

GERMANY
Sheet 1

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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
<u>GERMANY</u>															
01		00.00.30	Dynamic	Trotelorf	01.10.56	19.09.68	38	12	12	25.01.69	Yes (NIOSH)		Polyworker		
02		00.00.31	Dynamic	Trotelorf	14.10.57	25.09.70	39	13	11	14.12.73	Yes (NIOSH)		Polyworker		
03		00.00.30	Dynamic	Rheinfel- den	09.06.52	00.03.73	43	21	14	10.10.73	Yes (NIOSH)		Filling pesticide aerosol cans with VC		Reported under non polymer- isation workers in NIOSH list of 31.3.77. This of course is strictly correct. However I wonder whether this man had high exposure to VC in his can filling operation
04		00.00.30	Hocher	Burg- hausen	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 Göbel et al Virchows Arch A Path 1976 172 p 195-203

URL 13785

IMPERIAL CHEMICAL INDUSTRIES PLC

LIVER Angliomarcous Cases - (Review Date: 1 Jan 1986)

MPX/ASL 2 - LAMCLOCASES, 15

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	DAYS OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
05 (NICHOL gives as Case 06)		00.00.30	Becher	Frankfurt	02.04.60	10.12.73	38	13	05	16.12.74	Yes (NICHOL)		80 Chemie soys Chemistry Laboratory in the NICHOL list of Techno- logical Research Department (NICHOL says assistant factory chemist which may be wrong translation)		Confirmed Reported under non-polymer- fection workers in NICHOL list of 11.3.77 and 1.78. 1.80.14 think this is a correct classification by NICHOL. The man may have been involved in VCH polymerization in pilot plant or in main plant.
06 (NICHOL gives as Case 05)		00.00.32	Leuna	Meißen	16.12.62	00.00.75	43	13	12	09.01.75	Yes		PVC - Mann- facture Shift Leader		
07		00.00.26	Wacker	Burg- Lauen	15.04.54	12.11.73	49	21	21 (NICHOL says 12)	13.11.75	Yes		PVC Mann- facture and all work incl. auto- cleaning 12 yrs (1954-66) Research Tech Rep. 8 yrs (1967-1973)		
08		00.00.17	Dynalac	Treleford	19.07.54	08.04.75	58	20	20	25.12.75	Yes	1	Polymer	1	

URL 13786

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 PC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIACHOLOL	YEARS OF REPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER REMARKS	OTHER COMMENTS
GERMANY 09		00.00.34	OMI	Mari	20.02.70	16.06.91	19	15	13	24.03.78	Yes	High peaks	12 yrs poly- worker incl 17% auto- cleaning Control room 1 yr		10/78 Confirmed Average exposure first 9 yrs 150 ppm, occ 1000 ppm. Max 3 yrs av. 75 ppm. Last yr av 35 ppm
10 (NICKEL gloves see Case 11)		00.00.34	OMI	Mari	01.01.41	00.01.00	40	19	10	07.03.77	Yes	High peaks	10 yrs poly- worker incl 17% auto- cleaning		Average exposure first 9 yrs 150 ppm, occ 1000 ppm. Last yr av 75 ppm. OMI factor of 21.04.78
11 (NICKEL gloves see Case 10)		02.00.00	Hecker	Mari- hausen	15.01.91	04.00.92	49	12	22	28.06.77	Yes	High	3 yrs auto- cleaning 19 yrs filter operator		
21		03.00.00	Dynamit	Treilacker	19.00.00	07.01.00	63	01	9	07.10.77	Yes	4	PVC New- factory associated worker for 6 yrs		

GERMANY
Sheet 4

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 13		00.00.14	Lenze	Waldshut	00.00.60	08.04.78	63	18	14	19.05.78	Yes				P U West letter of 30th June 1980 enclosing data from Mr H F Friedel of BG Chemie
14											Not an Angiosarcoma in his letter of 21.12.81. Mr Friedel said this was a Pilonuspl- theliosis Der Epithelioma (a carcinoma of the oesophagus) not attribut- able to VCM & not recognized as an indust- rial disease				P U West letter of 30th June 1980 enclosing data from H F Friedel of BG Chemie withdrawing this case
15 (HIGGS given this as Case 13)		00.00.29	Wacker	Burghausen	19.10.55	09.10.78	49	23	25	21.10.78	Yes	1	Autoclave cleaner and worker. Dryer operator. Later shift leader		Angiosarcoma confirmed 09/79. Some detail of this & also cases 9, 13, 15, 16 & 17 given in HEM Report for 1978
16		00.00.23	Dynamic	Friedrich	10.01.55	07.08.78 (Lalbach suspected ASL at Feb 1975 laparotomy)	55	23	20	07.08.78	Yes ASL and Hepatocellular Carcinoma	High	Autoclave worker till 1966. Lander and master		Angiosarcoma confirmed. Full details of illness since March 1973 given in HEM Med Insp Rep for 1978. Different details given in VC Associated Disease by Lalbach and Marschall (1981) p71.

URL 13788

GERMANY
Sheet 5

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 (HIGSON gives as Case 15)		00.00.37	Dynamic	Trolendorf	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 02-02-75. Oesophageal varices. Radiologically confirmed acro osteolysis.
18		00.08.13	Beecham	Gendorf	00.08.53	23.12.79	46	24	21	25.12.79	Yes		Autoclave Worker		
19		00.08.23	Dynamic	Trolendorf	18.10.54	00.08.79	54	25	18	22.02.80	Yes Histotoxic ABL	High	Autoclave Worker		Dr Beeche letter of 13-04-82 to Dr V G F Adams
20		00.08.13	Dynamic	Trolendorf	14.02.61	00.04.80	65	19	13	19.10.80	Yes Haemangio endothelioma of liver with histiocytosis	High	Autoclave Worker		Dr Beeche letter of 13-04-82 to Dr V G F Adams
21		00.08.13	Dynamic	Trolendorf	01.01.62	00.09.79 (pronounced clinical liver symptoms)	66	18	13	19.04.80	Yes Haemangio endothelioma of liver with histiocytosis	High	Autoclave Worker and worked in drying shop		Dr Beeche letter of 13-04-82 to Dr V G F Adams
22		00.08.21	Dynamic	Trolendorf	15.10.61	28.08.80	59	19	11	06.12.81	Yes Histotoxic ABL	High	Autoclave Worker	Chargehand, subsequently Foreman	Dr Beeche letter of 13-04-82 to Dr V G F Adams

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GERMANY
Sheet 5

LIVER Angiosarcoma Cases (Rev Date: 1 Jan 1986)

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 23	HF	00.00.27	Wacker	Burg- hausen	1955	26.03.79	53	24	21	29.09.81	Yes	High (~300 ppm)	Chemistry Worker	-	Prof Gadighi states metastasized. Friedel letter 19.04.85
24	HL	00.00.28	Wacker	Burg- hausen	1969	11.10.82	54	13	12	28.05.83	Yes	High (~300 ppm)	Autoclave Cleaner	-	Prof Eder (Munich) letter 22.08.83. Friedel letter 19.04.85
25	B.Sch	00.00.27	Wacker	Burg- hausen	1960	28.09.81	58	21	13	14.01.83	Yes	High	Polycrystalline Worker and Autoclave Cleaner	-	Prof Seimair (Munich) Friedel letter 19.04.85
26	PH	00.00.22	OMI	Merl	1953	14.06.76	54	22	22	22.11.82	Yes	High	Polyworker	-	Chronic Hepatitis (Lelbach). Friedel letter 19.04.85
27	MM	00.00.28	Dynamit	Trolanderf	1955	18.01.83	55	28	18	02.01.84	Yes	High	Autoclave Cleaner till 1972	-	Lelbach. Friedel letter 19.04.85

URL 13790

INDUSTRIAL CHEMICAL INDUSTRIES PLC

LIVER Angiosarcoma Cases - (Review Report 1 Jan 1986)

WFE/ASL 2 - LANCIOCLASZB

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 WC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO PULMONIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED RESPONSE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
TOTAL															
01 (On Wilson supplier- memory list)	LC	15.06.34	PAMAC	Mira Venice	00.00.65	19.04.71	36	06	03	16.04.71	Yes		WVC Bag extruder		Primary tumour may have been pericardium. Met bone- sarcoma with other cases. a
02	SE	13.11.29	Montedison	Ponte Marghera	00.00.57	13.12.72	43	15	06	27.12.72	Yes		Polymerizer		a
03	NC	14.03.28	Solvay	Porraro	00.01.53	18.07.75	53	22	21	10.07.75	Yes	High	Autoclave operator 1972-5 did a variety of jobs 61) Autoclave operator 12 yrs (1961- 72)		a
04	PS	20.07.37	ARIC	Savona	00.04.59	00.10.80	43	12	12	30.03.81	Yes	12 yrs - Very High 3 yrs - Medium 4 yrs - Low	1 yr - Hammer operator 20 yrs - Autoclave operator & other duties in suspension for polymer- ization. Acted Foreman in same Dept since 1975.	Never cleaned autoclaves. See paper by CHIAPPINO at AI Med Lavoro Vol 6 (1982) pp 555-563	a
05	D	03.07.60	PAMAC	Mira Venice	02.00.00	03.07.70	59	91	8	03.04.80	Yes	Medium-H High	Bag extruder 1967-1975 Commercial Dept 1976- 1981		a Paglia- Lange (also of 2 Aug 1983)

* See Milioni Mod 10 Lavers 65 p445, 1976. Further details in letter from Dr Montanaro of IARC on April 1st 1988.
** Also see Milioni Lavers 65 p445, 1976. Further details in letter from Dr Montanaro of IARC on April 1st 1988.

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 CASEFILE HIGHLIGHTS	OTHER COMMENTS
JAPAN 01	Tanaka Hori	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 work since exposures often at 3000 ppm up to 1974	13 yrs auto- clave cleaner 1964 - assigned to different work since had ill health		Japan Times 25.10.75 Japanese PVC Assoc letter of 31.03.78
02	50	02.08.39			06.11.58	10.08.76	77	17	11	10.08.76	Yes	Not known	In polymer- isation work including autoclave cleaning		Japanese PVC Association letter of 31.03.78

* In his letter of 1st April 1985, Dr Montanaro of IMC says Japanese Ministry of Labour give

Date of diagnosis - 21-08-76
Age at diagnosis - 53
Years of exposure - 22

JPL 13792

UHL 13793

SUDEN

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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
SUDEN															
01	WU	23.06.27	Komanord	Sundevall	14.08.51	20.10.70 ^a	43	19	18	20.10.70	Yes		Polyworker		
02	BL	27.11.11	Komanord	Sundevall	00.01.65	00.08.72 ^a	61	27	27	16.08.72	Yes	High	VCN production		Mr Bjorling's letter of 28 March 1978 confirms BL was a summer worker who was heavily exposed, probably even more so than a normal reactor cleaner
03	HE	10.06.10	Komanord	Sundevall	00.05.47	18.03.76	63	29	21	19.03.76	Yes	High	Polyworker		
04	AL	16.11.14	Komanord	Sundevall	00.08.46	12.05.77	62	31	31	12.05.77	Yes	High	1946-1958 polymer- isation 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. Data confirmed in Dr D Byron letter 15.0.77 to CEFIC
05		12.03.19	Komanord	Sundevall	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 Byron

^a In his letter of 1st April 1982, Dr Montusani of IARC says in Sunden's National Board of OH Health gives 20-02-70 as date of diagnosis for Case 01 and 15-05-72 for Case 02.

JK
Sheet 1

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 CASES HIGHLIGHTS	OTHER COMMENTS
01	WJ	20.04.01	ICI	Millhouse	04.04.44	03.12.72 (Fox & Collier paper says 23.12.72)	71	28	21	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		See end Harry Lancet 29-06074 pages 1314-8
02															Dubious fabrication case
03	BJW	02.06.37	BP	Barry	00.02.66	00.12.74	37	09	3.5	24.12.74	Yes	High	Autoclave operator		Exposure limited to 2.66 - 9.69
04	JSR	23.06.29	ICI	Millhouse	24.04.34	06.06.79	59	25	10	12.10.79	Yes	Medium- high	54-5 Bagging Plant 55-6 Drier Plant 56-58 Autoclave operator 58-61 Chargehand Drier Plant 61-72 Vacuum & 2/3 Plant	Pre-war fish packer 1939-45 army vehicle maintenance 1945-54 fish packer	

URL 13795

URL 13796

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	FACILITY	FIRST NO EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF BIRTH	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
UK	03	JK			08.01.51	00.10.79	65	28	21	19.11.79			1931-52 Polytechnic 1952-55 Lancaster 1955-60 Polytechnic 1960-64 Charterhouse 1964-70 Charterhouse operator 1970-72 operator operator		
	02	02P			1951			18/9	12	08.01.80			7 yrs operator Poly 7100 operator on 5 yrs operator on Poly 7100		
	07	02B			1953	00.00.80	50	17	8.2	13.06.80			1963-75 Polytechnic 1963-75 operator		
	08	02B							24	25.12.81			1950-51 operator 1951-55 operator 1955-57 operator 1957-59 operator 1959-64 operator 1964-70 operator 1970-72 operator operator		

LIVER AND PANCREAS CANCER - (Review Date: 1 Jan 1986)

IMPERIAL CHEMICAL INDUSTRIES PLC

WPX/ADL 2 - LANCLOGAS89.25

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UK

Sheet 2

UK

Sheet 3

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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
09	RIG	07.05.25	BP	Barry	15.02.50	02.03.63	58	33	29	24.02.63	Yes	Medium	Polyworker	2 years on Acrylonitrile Basin Plant. Also prior to 1950. 4 years RAF maintenance. 3 years motor car paintshop. 2 years in Graving Dock.	
10	GJT	04.04.47	BP	Barry	27.04.66	01.05.84	37	18	4.2	16.05.84	Yes	High - 11 months (500 ppm). Low - 18 months (50 ppm). Medium - 21 months (200 ppm)	Polycleaner 1966-67. Spraydrier bagger 1967- 68. Slow- down stripper operator 1968-70.	Heavy goods vehicle driver until final illness.	Information given in letter 18.06.84 from Dr R H J Williams
11	GLP	08.05.28	BP	Barry	10.12.65	02.06.85	37	19	18	02.06.85	Yes	High 1965-69 Med 69-79 Low 79-82	Polycleaner 1965-68. Service operator 68-69. Poly Operator 69-79. Loading Hand 79-82.	-	Letter of 04.06.85 Dr Paul Smith and letter of 04.06.85 Dr R H J Evans Oesophageal haemorrhage due to oesophageal varices due to Angiosarcoma of liver
12	JT	24.01.37	ICI	Millhouse	16.09.57	03.06.85	48	28	28	06.12.85	Yes	Low 1957-59 High 59-74 Low 74-85	Spore man, bagging floor 1957-59. Autoclave Operator 1959-85	-	Letter 26.06.85 Dr F I Lea

URL 13797

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	BPO	Louis- ville	09.12.44	03.03.73	49	24	21	03.03.73	Yes		Pat Cleaner (Black Jans 1974) p 53	Victory given in Annapolis ACAD SCIENCES Vol 329 (1979) page 190 is Paper by B B Cottrell of OSMA	Rolling Stone Art Ref 1 NY Acad of Sc Symp 1974 Also Black Jans 1.7.74 p 53
02		19.00.33	BPO	Louis- ville	15.11.55	00.05.70	37	14	13	27.09.71 (N1000 says 28.09.71)	Yes		Pat Cleaner (CF Block)		Ref 1 Also Black JAMA 1.7.74 p 53
03	Edward Blouiddie	25.05.15	BPO	Louis- ville	18.11.45	19.12.73	50	28	28	19.12.73	Yes		Pat Cleaner (CF Block)	Louisville Courier Journal 02-09-80	Ref 1 Also Black
04		15.01.24	BPO	Louis- ville	06.07.52	19.08.67	43	15	15	07.01.68	Yes		Pat Cleaner (CF Block)		Ref 1 Also Black
05		25.04.12	BPO	Louis- ville	19.06.44	09.04.64	52	20	20	09.04.64	Yes		Pat Cleaner (CF Block)		Ref 1 Also Black
06	Ray Austin Jensen?	23.11.20	BPO	Louis- ville	17.04.62	00.02.74	45	12	12	24.07.75	Yes		US Air Force Pat Cleaner (CF Block)		Ref 1 + Louisville Times 23.7.75 Retired April 1974 Also Black
07	Charles T Smart	03.05.22	VCC	B Charle- ston	27.08.44	00.00.60	45	24	17	23.03.68	Yes				Ref 1
08		06.05.20	Goodyear	Hingora	07.10.46	00.08.61	41	15	15	29.08.61	Yes				Ref 1

JRL 13798

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 Gottle- Finger?	08.11.31	BFG	Louis- ville	28.03.43	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	Wingara	12.06.51	00.03.68	55	17	17	10.05.68	Yes				Ref 1
11		27.05.09	Goodyear	Wingara	14.10.46	00.03.70	61	23	23	16.03.70	Yes				Ref 1
12	Francis A Bachman	17.11.18	Pirestone	Pittston 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 lyrm plant	Ref 1 + letter of 26 April 1978 from Russell A Park to J T Seawell of NCA
13	Richard Edward Clements	01.12.21	BCC	S Charler- aton	11.12.42	00.05.74	52	32	26	07.04.74	Yes	1000 ppm			Charleston Daily Mail 21.7.75
14															Never diag- nosed as ang- iosarcoma of liver. Inform- ation given in letter 22 May 1984 from J A Salg.
15															Accountant; ABL - No evi- dence of VCN exposure.

USA
Sheet 3

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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	BPG	Louis- ville	08.05.50	00.00.69	41	19	04	27.03.69	Yes		1951-4 VCM polymer- isation	From 1954 onwards in Army and other service. 46-50 Army	Table 4 in Magnum Testimony to US Senate Confirmed in N H Johnson ltr 07.08.78
17	Fearnham	06.05.31	BPG	Louis- ville	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 N H Johnson letter of 24.2.81 con- firmed death 6 years after diagnosis
18	Charlie Arthur	22.04.28	BPG	Aven Lake	15.09.54	00.00.75	46	21	13	02.11.75	Yes	13 yrs auto-cleaner 8 yrs on Katal plasticiser & Carbonyl operation	Navy Tyre Store		Confirmed in N H Johnson ltr 07.08.78 Also Rolling Stone Mag. 15.01.76
19	Virgil Christie	00.00.13	BCC	8 Charle- ston	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		31.00.17	Goodyear	Wingars	00.00.55	30.01.76	58	21	18	30.01.76	Yes				NIOSH letter of 23.10.79
21	Chester Hipple	02.09.09	BCC	8 Charle- ston	00.12.46	Early 77	67	30 "	22	02.01.77	Yes				28 yrs with VCC at BC Retired News release 23.2.77

URL 13800

USA
Sheet 4

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 22		02.10.23	MPG	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 Halls Lane of whom 8 had died by 26.1.76 In his letter of 16.09.81 Dr M H Johnson confirms this is the case described by Dunnaher Tanburro & Tan in Feb 1980 Am J Medicine Vol 70 p280
23		00.00.23	Great American Chemical Company	Fitchburg Mass.	08.09.58	04.04.73	50	13	14	04.04.73	Yes				
24	Charles Edward Moore	17.05.17	ICC	2 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 resin unit first as fitter helper, then shift utility man	(1937-39 van 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	R H Wheeler letter of 18.6.77 to J Stafford gives details Reese Kaminski letter of 26/2/79 R Kaminski (5 Nov 1980) suggests that NIOSH will revisit on register since this neoplasm may be associ- ated with ARL.
(25)															R H Wheeler letter of 20/2/79 and Reese Kaminski letters of 26/2/79 and 5/1/80

Removal from register confirmed in R Kaminski letter of 5 November 1980

UPL 13801

USA
Sheet 6

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 CASES HIGHLIGHTS	OTHER COMMENTS
US 32	C W Giron	22-02-08	Monanto	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 Giron's usual occupation as bottle operator in 'chemicals industry'	1940-1951 Various jobs in polymer manufacture MUTUAL LUSTREK 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 Monanto Springfield to Dr A Mann of Monanto Europe.
US 33	E Ferguson Jr	08-10-17	BPC	Louisville	09-09-54	11-05-82	54	28	28	Alive	Yes		Multiple jobs including Poly Operator + Polycleaner.		Prof Tombarro letter of 12 Aug 1982 + Dr H N Johnson letter of 28 Feb 1983.
US 34	Mr Byrum	29-01-34	BPC	Louisville	1953	03-11-82	48	27	10	04.08.83	Yes		Poly Operator + Autoclave Cleaner 1955-65.	1965 left BPC to become a Clergyman.	Dr H N Johnson letter of 3 Nov 1982, 28 Feb 1983 and 9 Aug 1984.
US 35		09-03-12	WCC	Charlotte	23-07-44	18-07-83	71	39	14	18-07-83	Yes	High from 1944 to 1955. Medium from 1955-1958			Dr Decey letter of 5 Sept 1983.
US 36		27-08-32	The General Tire and Rubber Co	Ashtab Ohio	11-06-56	21-08-83	58	27	27	Alive	Yes	Moderate	1956-56 labourer 1956-57 prod helper 1957-70 operator 1970-75 electrician 1975-present operator		Dr W Landrie letter of 12 Sept 1983; spotted at medical May 1983. Testing commenced May 1983

URL 13803

USA
Sheet 7

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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 37	Mr J Payton	29 08 29	BPG	Louis- ville	1953	06 08 84	54	31	22	06.08.84	Yes	High	Worked regularly in PVC area. In the early days was a reactor cleaner 1953-75.		Information given in letter 09.08.84 from Dr M H Johnson
US 38	JUB	28 08 22	Air Products	Colvert City	08.02.63	19.01.84	61	20	20	28.10.83	Yes	High 1963-1982	Normal pro- gression from helper to senior operator, cleaned reactors, stripping and recovery areas as well as charging operator.		Thrombo- cytopenia and leukopenia since 1978. Cold treatment for arthritis 1976. Under Dr's care about 6 months before death, had passed standard physical exam- ination 3 months earlier. J Barr letters of 22.10.84 & 23/01/85.

URL 13804

YUGOSLAVIA

LIVER Angiosarcoma Cases - (Review Date: 1 Jan 1986)

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		15.11.33	Jugo Vinil	Split	00.00.50	12.07.73	42	23	10	12.07.73	Yes*		VCH Production		*In his letter of 3 Oct 1978, Dr Spirtno of NIOSH changed the status of Case 02 to VCH production employee. Dr Spirtno also notified a new Case 03 also a VCH production worker
03		21.12.31	Jugo Vinil	Split	04.06.54	11.01.76	45	22	22	11.01.76	Yes*		VCH Production		
04		11.06.30	Jugo Vinil	Split	15.12.50	03.09.78	48	20	18	03.09.78	Yes				Rose Kantoski Letter of 19th June 1980 and IARC letter of 1 April 1982

URL 13805

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	.....	8
4	.....	5
5	.....	11
6	.....	11
7	.....	9
8	.....	10
9	.....	5
1980	.....	40
1	.....	5
2	.....	2
3	.....	9
4	.....	5
5	.....	2
Total		117

- 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 F 15 who are alive.
- 4 The 1983 total does not include US 36 who is alive.

Distribution of ASL Cases by Country

USA	35 ***
W Germany	26 **
France	18 ***
UK	11
Canada	10
Sweden	5 ****
Yugoslavia	4 *****
Italy	4 *
Czechoslovakia	2
Japan	2
Belgium	2
Norway	1
Total	120

* Omit It01 - atypical case of PVC bag extruder.

** Includes GE03 aerosol can filler.

*** Includes case US 24 which was diagnosed as Cholangiosarcoma & US 33, and 36; and P 15 who are alive.

**** Includes one monomer worker.

***** Includes two monomer workers.

1.a Western Europe	67
North America	45
Rest of World	8

Total 120

TABLE 3Pattern of ASL Cases by Factory(a) W Europe

Of the 67 cases in W Europe, 57 have occurred in clusters at 11 factories. Of the 26 German cases, 23 have occurred in clusters at 4 factories.

	<u>ASL Cases</u>
Dynalit, Troisdorf, Germany	11
Chios Chimie (Formerly RP), St Fons, France	8
BP, Barry, UK	8
Wacker, Burghausen, Germany	7
Kemanord, Sundsvall, Sweden	5
PCUK, Brignoud, France	5
CWH, Marl, Germany	3
ICI, Hillhouse, UK	3
Solvay, Tavaux, France	3
Lonza, Waldshut, Germany	2
Solvay, Jemeppe, Belgium	2
	<u>57</u>

NB: There are 32 pre 1962 PVC plants in W Europe; 18 of these have had ASL cases (Ref Table 8)

(b) N America

Of the 45 cases in N America, 38 have occurred at four factories out of a total of 54 factories:- In N America 43 plants have not had ASL cases.

	<u>ASL Cases</u>
BFG, Louisville, US	14
BFG, Shawinigan, Canada	10
UCC, S Charleston	10
Goodyear, Niagara	4
	<u>38</u>

NB: There are 28 pre 1962 PVC plants in N America; 11 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.

TABLE 4A

Latency Periods (Years from first Exposure to Diagnosis)

	<u>Country</u>	<u>No of Cases</u>	<u>Total Years</u>	<u>Average</u>
<u>W Europe</u>	Belgium	2	35	17.5
	France	18	459	25.5 *
	Germany	26	495	19.04 *
	Italy	4	74	18.5
	Norway	1	22	22
	Sweden	5	122	24.5
	UK	<u>11</u>	<u>254</u>	23.09 *
		<u>67</u>	<u>1461</u>	21.80
<u>N America</u>				
	US	35	886	25.31 *
	Canada	<u>10</u>	<u>204</u>	20.4 *
		<u>45</u>	<u>1090</u>	24.22
<u>Rest of World</u>				
	Czechoslovakia	2	30	15.0
	Japan	2	39	19.5
	Yugoslavia	<u>4</u>	<u>85</u>	21.2
		<u>8</u>	<u>154</u>	19.2
<u>Summary</u>				
	W Europe	67	1461	21.80
	N America	45	1090	24.22
	Rest of World	<u>8</u>	<u>154</u>	19.2
		<u>120</u>	<u>2705</u>	22.54

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

(Review Date - 1 Jan 1986)

DISTRIBUTION OF LATENCY PERIODS TABLE 4B

	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			2					2	17.5
Canada		3		5	2			10	20.4
Czechoslovakia		1	1					2	15.0
France		1	4	3	5	2	3	18	25.5
Germany		5	9	9*	3			26	19.04
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		4		4	2		11	23.09
USA		2	7	8	8	5	5	35	25.31
Yugoslavia				4				4	21.2
TOTAL	1	12	32	33	24	10	8	120	22.54

* Includes G 03 aerosol can filler

(Review date 1 January 1986)

TABLE 4C
LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE

MAX POSSIBLE LATENCY PERIOD	YEAR OF FIRST EXPOSURE	LATENCY PERIOD (NO OF YEARS)	ARITHMETIC MEAN OF LATENCY PERIODS	
47	1939	38*		
46	1940		$\frac{244}{7} = 34.86$	
45	1	37,21,37,41		
44	2	32,38		
43	3	38,14,32		
	4	28,11,24,20,24,34,39	$\frac{718}{27} = 26.59$	
	5	27,22,28,29		
	6	21,29,31,26,28,15,23, 30,35		
39	7	29,24,29,28		
38	8	28,24,34		
	9	30,26,20	$\frac{458}{19} = 24.11$	
	1950	26,22,31,19,23,14,33		
	1	19,28,17,28		
34	2	21**,15		
33	3	25,22,23,22,20,31,22		
	4	21,21,25,25,21,28***, 22	$\frac{725}{33} = 21.97$	
	5	22,23,24,14,19,21,27 27*** 24,28		
	6	21,12,27***		
29	7	19,17,15,13,16,28		
28	8	18,18,15,17,20		
	9	16,21	$\frac{368}{22} = 16.73$	
	1960	13,18,21		
	1	15,16,16,16,19,19,12		
24	2	13,18,17,12,18		
23	3	16,17,20,21		
	4	16,17	$\frac{180}{11} = 16.36$	
	5	11,19		
	6	9,18		
19	7	16		
18	8			
	9	13	13	
	1970			VIOLA
	1			
14	2			
13	3			MALTONI
	4			GOODRICH
	TOTAL	120 CASES	$\frac{2706}{120} = 22.55$	

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

URL 13811

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
47	1939		38*	
46	1940			
45	1	37,41	21,37	
44	2		32,38	
43	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	
39	7	29	24,29,28	
38	8	28,34	24	
	9	30,26	20	
	1950	26,22,31	19	23,14
	1	19,28	17,28	
34	2	21**	15	
33	3	25,22,22	23,31	22,20
	4	21,21,25,25	21,28***	22
	5	22,23,24,27***24,28	14,19,21,27	
	6	21,12	27***	
29	7	19,17,15,13,28		16
28	8	18,18	15	17,20
	9	16,21		
	1960	13,18,21		
	1	15,16,16,16,19,19	12	
24	2	13,18,17,18	12	
23	3	16,17,21	20	
	4	16	17	
	5	11,19		
	6	9,18		
19	7	16		
18	8			
	9	13		
	VIOLA 1970			
	1			
	2			
	MALTONI 3			
	TOTAL CASES	67	45	8

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

URL 13812

(Review date 1 January 1986)

TABLE 4E

PLANT	START UP DATE	LATENCY PERIODS OF ASL CASES IN SPECIFIC PLANTS (10 OR MORE CASES)	NO OF CASES	AVERAGE LATENCY PERIOD
LOUISVILLE USA	1940?	12,14,15,19,19,20,24,27,28,28,28,29,29 31	14	23.07
SHAWINIGAN CANADA	1941?	11,12,14,21,22,23,24,24,26,28	10	20.5
S CHARLESTON USA	1939?	24,30,32,32,34,35,37,38,38,39	10	33.9
TROISDORF W GERMANY	1954	12,13,16,16,18,19,19,21,23,25,28	11	19.09

UPL 13813

TABLE 4F
LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE
AND SPECIFIC PLANT (10 OR MORE CASES)

YEAR OF FIRST EXPOSURE	S CHARLESTON USA	LOUISVILLE USA	SHAWINIGAN CANADA	TROISDORF W GERMANY
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		31	23	
4		28		21,25
5		14,19		23,28
6				12
7				13
8				
9				
1960				
1			12	16,16,19,19,
2		12		18

URL 13814

(Review date 1 January 1986)

TABLE 4G

PLANT	START-UP DATE	LATENCY PERIOD OF ASL CASES IN SPECIFIC PLANTS(4-9 CASES)	NO OF CASES	AVERAGE PERIOD
SUNDSVALL SWEDEN	1945	16,19,27,29,31	5	24.4 years
BRIGNOUD FRANCE	1950	11,16,18,26,30	5	20.2
ST FONS FRANCE	1939	21,28,29,37,38,27,41,35	8	31.88
BARRY UK	1948	9,17,18,28,31,33,18,19	8	21.62
BURGHUSEN W GERMANY	1933	17,21,22,25,24,13,21	7	20.43
NIAGARA USA	1947	15,17,21,23	4	19
SPLIT YUGOSLAVIA	1941	20,20,22,23	4	21.25

URL 13815

TABLE 4H
LATENCY PERIOD OF ASL CASES TABULATED BY YEAR OF FIRST EXPOSURE AND SPECIFIC PLANT
(4-9 CASES)

YEAR OF FIRST EXPOSURE	SUNDSVALL SWEDEN	BRIGNOUD FRANCE	ST FONS FRANCE	BARRY UK	BURGHAUSEN W GERMANY	NIAGARA USA	SPLIT YUGO- SLAVIA
1939							
1940							
1			37				
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					22,24	21	
6			21				
7					17		
8		18					20
9		16					
1960					21		
1							
2				18			
3				17			
4	16						
5		11		19			
6				18			
7							
8					13		
9							
1970							
1							
2							

* Monomer workers

UJRL 13816

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	5	0	-	5	99	
2	1	1		2	101	
1983	6	3		9	110	
1984	4	1		5	115	
1985	2			2	117	
TOTAL	66* **	43**	8	117		

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

** Does not include US33, and 36; and F 15. 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,G23		
	2	G26	US31	
	3	UK09,It5,F17,B2,G24,G25	US35, US34, US38	
	4	UK10, F16, F18, G27	US37	
	5	UK11, UK12		
	Total	66	43***	8

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

URL 13818

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,G26	C10, US37	Jap1,Y1
	4	G7,G8,UK4,G19	US18,US33***	Y3
	5	G11,G16,G18, Fr15***	US2,US17,US20,US34	
		G23,G28		
	6	FR10,G1	US36***	
	7	Fr8,G4,It2,G2,UK12		Cz1
	8	Fr6,B1	US23	Jap2,Y4
	9	Fr2,It4		
	60	G5,G13,G25		
	1	G9,G10,G12,G17,G20,G22	C8	
	2	G6,UK6,G21,B2	US6	
	3	Fr13, UK7,Fr18	US38	
	4	Sw5	US30	
	5	Fr5,UK11		
	6	UK3, UK10		
	7	It5		
	8			
	9	G24		
Viola	70			
	1			
	- 2			
Maltoni	3			
	Total	67	45	8

* Cholangiosarcoma (US24)
** Aerosol can filler (G3)
*** US33 and 36; and Fr 15 are still alive.

URL 13819

(Review date 9 January 1986)

TABLE 8

WESTERN EUROPE PVC PRODUCERS - START-UP DATES vs ASL CASES (OMITTING G03 & It.01)

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	04,07,11,15,23,24	25,57,54,55,53,55,69,60
1938	Italy	Montecatini	Acna		
1939	France	Rhone Poulenc	St Fons	03,09,10,11,14,15,16,17	46,48,56,41,43,55,41,48
1940	United Kingdom	ICI	Runcorn		
1940	United Kingdom	ICI	Hillhouse	01,04,12	44,54,57
1945	Sweden	Kemnord	Sundsvall(Stockvik)	01,02,03,04,05	51,43,47,46,64
	Switzerland	Lonza	Sins		
1946	France	Rhone-Poulenc	Rousillon	01	46
1947	Italy	Montedison	Porto Marghera	02	57
1948	United Kingdom	BP Chem	Barry	03,05,06,07,08,09,10,11	66,51,62,63,50,50,66,65
	West Germany	Huls	Merl	09,10,26	61,61,53
1949	Belgium	Solvay	Jenepps	01,02	58,62
1950	France	Puk	Brignoud	02,04,05,06,12	59,49,63,58,49
	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	Solvay	Tavaux	08,13,18	57,63,63
	Italy	Solvay	Ferrara	03	53
	Spain	Rio Rodano	Hernani		
	United Kingdom	BIP	Aycliffe		
	West Germany	Hoechst	Gendorf	18	55
1954	West Germany	Dynasit	Troisdorf	01,02,08,12,16,17,19,20,21,22,27	56,57,54,61,55,61,54,61,62,61,55
1955	Spain	Monsanto Iberia	Monzon		
1956	Spain	Calqsa	Sabinanigo		
		Hispanvic	Torrealevega		
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	Knapack(Frankfurt)	05*	60
1967	France	ATO Chimie	Balan		
	Spain	Rio Rodano	Miranda de Ebro		
	Greece	Esso Pappas	Diavata Salonika		
1968	Belgium	Bediphil	Antwerp		
1969	United Kingdom	Vinater	Staveley		
	Italy	Rumancia	Cagliari Sardinia		
1970	Italy	SIR	Porto Torres Sar		
	United Kingdom	ICI	Runcorn		
1971	Italy	S C Ravenna	Ravenna		
	Spain	Hispanvic	Martorell		
	Sweden	Kemnord	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 Venica, case not included (It 05), due not knowing start up date of the Plant.

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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, 26,33,34,37	48,55,45,52,44, 62,45,50,55,47, 47,54,55,53
1946?	*UCC	Texas City (Partially closed 1977)		
1947	Goodyear	Niagara Falls	08,10,11,20	46,51,46,55
1948	Firestone	Pottstown	12	49
	Uniroyal	Painesville (closed 1975)		
1950	Monsanto	Springfield (Closed 1975)	32	51
1952	Dow	Midland (No PVC since c 1975)		
	BFG	Avon Lake	18	54
1953	BFG	Deer Park (Formerly Diamond)		
1954	General Tire	Ashtabula (Closed 1984)	36	56
1956	Air Products	Pensacola		
	Atlantic Refining	Brooklyn (Closed late 1960s)		
	Borden	Leominster (Closed 1984)		
	Conoco	Hebronville (Closed 1975)		
	BFG	Niagara		
	Great American Plastics	Fitchburg (Closed 1983)	23	58
	Hooker	Hicksville (Closed 1980-81)		
	Pantosoto	Pasniac (Closed 1984)		
1957	Atlantic Tubing	Cranston (Closed 1967)		
	Terneco	Flemington NJ	30	59
1958	Keyser Century	Saugus, Cal		
1960	BFG	Watson, Cal		
	Air Products	Calvert City (closed March 1982 Re-opened October 1983)	38	63
	Borden	Illioopolis		
1962	Terneco	Burlington NJ		
1963	Conoco	Aberdeen, Miss		
	Stauffer	Long Beach, Cal (Closed 1982)		
1965	Conoco	** Assonet, Mass (Closed by Olin 1975, see below)		
	Ethyl	Baton Rouge (Closed 1984)		
1966	Georgia Gulf	Delaware City (Formerly Diamond)		
	General Tire/Pantas	Mt Pleasant W Va (Closed 1983)		
	BFG	Henry, Ill		
	Stauffer	Delaware City (Sold to Formosa 1983)		
1967	Allied	*** Painesville, O (sold to Robintech)		
	Hooker	Burlington NJ		
1968	Firestone	Perryville (Closed 1982)		
1969	BFG	Pedrickton NJ		
	Goodyear	Flaquemine		
	Olin	** Assonet, Mass (Closed 1975) (See above) (Formerly Conoco)		
1971	Conoco	Oklahoma City		

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TABLE 9 (Continued)

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/ Tallyrand	Cranston RI (Closed 1982)		
	Shintech	Freeport, Tex		
1975	Certain-teed	Lake Charles		
	Georgia Pacific	Plaquemine, La		
	Tenneco	Pasadena, Tex		
1979	Firestone	Plaquemine		
1983	Formosa	Point Comfort, Tex		

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

** Refers to same plant at Assonet

***Refer to same plant at Painesville. Allied plant never operated again for PVC after it was sold to Robintech.

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

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TABLE 10CANADIAN 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 (Closed 1975)		
1957	Goodrich	Welland		
1966	Esso	Sarnia		
1979	Diamond Shamrock Alb	Fort Saskatchewan		

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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	Oswiecim (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	Neratovica		
	Russia	State Comps	Kalush Area		
1976	Yugoslavia	Hip	Pancevo		
1977	Rumania	State Comps	Rimnicu Vilcea		

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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 Kanegafuchi Kag Tekkosha	Minamata Osaka Sakata		
1951	Mitsui Toatsu	Nagoya	01, 02	53, 58
1952	Mitsubishi Mon Sumitomo Kag	Yokkaichi Kikumoto		
1951	Denki Kagaku Nippon Zeon Toa Gosei	Shibukawa Kambara Tckushima		
1955	Ryo-Nichi	Uozu		
1956	Nippon Zeon Nisshin Kagaku	Takoaka Takeo		
1957	Kureha Kasei Shinetsu Kag	Nishiki Naoetsu		
1960	Denki Kagaku Kanegafuchi Kag	Ohmi Takasago		
1964	Chisso Corp	Chiba		
1966	Tokuyama Seksui	Tokuyama		
1967	San Arrow Kagak Sumitomo Kag	Tokuyama Chiba		
1968	Ryo-Nichi Shinetsu Kag	Mizushima Tokuyama		
1970	Chisso Corp Denki Kagaku Kanegafuchi Kag Kawasaki Yuki Mitsui Toatsu Nissan Kagaku Shinetsu Kag	Mizushima Goi (Chiba) Kashima Kawasaki Sakai Chiba Kashima		
1971	Tekkosha	Yokkaichi		
1973	Asahi Glass	Hayatsuki		
1974	Toyo Soda	Sakata Yokkaishi		
1975	Central Kagaku Toyo Soda	Kawasaki Yokkaichi		
1977	Unknown	Kashima		

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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 (1967 start up PET Columbiana	Paramonga (Peru) 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	Tlaxcala (Mexico)		
1978	Huls Brasil	Cubato (Brazil)		
	Polychem	El Salvador		
	Policyd	Coatzacoalcos (Mexico)		
1979	PET Camacari	Camacari Bahia (Brazil)		

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TABLE 14
AUSTRALASIAN PVC PRODUCERS

START-UP YEAR	COMPANY NAME	LOCATION	ASL CASE NUMBER	YEAR OF 1st EXPOSURE
Mid 1950s	ICI Australia	Botany, Sydney		
1960s	B F Goodrich	Melbourne		
Late 1970s	ICI Australia	Laverton Melbourne		

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