

PO Box No 6
Bessemer Road
Welwyn Garden City Hertfordshire AL7 1HD

Telephone Welwyn Garden 23400 (STD Code 07073)
STD Code from London Area 96
Telex 264251 Iciplast Welwyn



Imperial
Chemical
Industries
Limited

Plastics
Division

R&S
103530

Dr T R Torkelson
Corporate Medical Department
The Dow Chemical Company
Bennett Building
2030 Dow Center
Midland
Michigan 48640
USA

Your ref.	Our ref	Tel ext	Date
	JS/MJE/DSO-107	3162	29 July 1977

Dear Dr Torkelson

Thank you very much for your letter of 6 June which reached my office on 25 July - I think it must have come by seamail. I have checked with David Duffield and find that his copy arrived on 27 July also by seamail. Hence the delay in replying to you. I am very grateful to you for sending me the NIOSH letter of 31 May plus their tables of 31 March 1977 and their 12 September 1975 table which I agree is hopelessly inappropriate on many counts.

The figures I gave in my letter of 9 May included the US as well as Europe and Canada. As I understand the situation, the angiosarcoma cases are stacking up as follows.

Table A

AS Cases (Alive & Dead) in PVC Monomer & Polymerisation Plants

Belgium	1	
Canada	10	
Czechoslovakia	2	
France	8	
Germany	8*	(a) 1 alive (b) NIOSH 08 is not known to CEFIC
Italy	2**	
Japan	1	
Norway	1	
Sweden	4	1 alive
UK	2***	
USA	21****	2 alive
Yugoslavia	2	
	62	
Alive	4	
Dead	58	

- * Excludes Ge 03 pesticide can filler
- ** Excludes It 01 bag extruder
- *** Excludes UK 02 which has been totally discounted in UK
- **** Excludes US 14 and 15 so called non polymerisation cases which I suspect are discounted in some US circles

15 Capacity v No of AS Cases

You made the point that the AS cases in Europe are more numerous than in the USA but that capacity is in step with this. I do not know about capacity but if one takes a "normal" year for consumption (ie 1974), North America looks high in AS cases.

	<u>PVC Consumption</u>	<u>AS Cases to Date</u>
North America	2.2 m te	31
Western Europe	3.4	26

The Canadian situation does however cause a heavy distortion in the North American situation - if the Canadian cases are deducted however, I still think the US incidence looks high in relation to consumption but this may not be the correct yardstick.

16 Clustering of Results

The clustering of AS cases in a few places is a remarkable feature of this whole story.

Shawinigan	10 AS cases
BFG Louisville	10
UCC S Charleston	4
Kemanord	4
Dynamit Nobel	3/4 (4 if one counts the can filling operation)
French Plant	4
German Plant	2
BFG Avon Lake	2
Goodyear Niagara	2
	42 out of a total of 62!

There may be further clusters of 2 in Europe but I am uncertain of them and will not make inspired guesses here. I suspect that the Czechoslovakian and Yugoslavian deaths are also clusters of 2. However, if we could explain the clusters of 10 and 4, we could perhaps gain a lot of useful data on VCM as a human carcinogen. Similarly we could analyse why some plants have had only 1 case so far and why many have had 0. Naturally people who have had a "cluster" will be sensitive about others probing into their affairs but I do believe that lack of such data has been a dis-service to the whole industry.

In the Du Pont epidemiological survey on acrylonitrile at their Camden SC plant, I was struck by their observation that the excess cancers occurred among employees involved in their start-up operation 1950-52. I wonder how many of our VCM clusters were among employees who were involved in start-up or pilot plant type operations. I believe Dr M N Johnson told us once that Louisville was very much a pilot plant in its early days!

17 Moving Averages of all Known AS Deaths

I thank you for your moving and cumulative averages of US deaths in PVC workers from AS of the liv r. Looking at the global picture as we see it, I hav great difficulty in knowing whether things are getting better or worse! I fear "worse" in reality.

- 11 USA I have made some minor corrections to my listings to bring them into line with NIOSH. Is your Case 18 the Charli Arthur of the Rolling Stone Magazine article which gives slightly different data from NIOSH? Is your case 22, th BFG No 10 I give in my list? Which company and factory has Case 23? Can you demolish non-polymerisation cases 14 and 15?

- 12 Yugoslavia No change for some years. No new information.

- 13 Reconciliation

	All AS cases by NIOSH	myself
NIOSH Table 1	56 cases	62 cases
NIOSH Table 2	7 "	5 non-polymerisation cases (some dubious)
	63 total	67*

* Additional to NIOSH

France	08
Sweden	03 & 04
Belgium	01
	<u>4</u>

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- 14 PVC Producing Countries without AS Cases

So far as I know, there have been no AS cases in Austria, Finland, Greece, Holland, Portugal, Spain and Switzerland which produce PVC in Europe. There have been no cases in Australia. I have no data on the USSR or any other part of the World.

It would of course be necessary to examine the "no case" countries more closely with relation to date of start-up of manufacture and also build-up of scale / numbers exposed at given dates. Looking at the European no case list I believe the start-up dates of PVC production were

Austria	1953
Spain	1953
Holland	1950
Finland	1972
Switzerland	1945
Portugal	1962
Greece	recent?

Some factories eg Switzerland and Holland have been in action longer than the latency period. There is a lot of work to be done to correlate capacity build-up, process and plant nature, plant practice in past etc with incidence of AS but regrettably we still lack data here.

Table B has some minor differences from the figures I gave you in my letter of 9 May - I think some of the dates of deaths have been altered in the latest listings and I may also have made some mistakes. I become a bit dazzled by some of the figures under study and make errors - I hope the present letter is the more accurate.

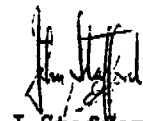
I have not done your 3 year moving average. I have given a copy of this letter to our bio-statistician Dr Paddle for his comments particularly to find out if by calculation of moving averages, weighted averages, etc, etc he can see any "peaking" of AS cases around 1975 and hopefully the start of a decrease thereafter. When I saw Dr Paddle on 14 June to review what we should be doing in the field of epidemiology etc, one thing to which he thought effort should be devoted was the keeping of a register of AS cases for analysis. I am grateful to you for all the help you have given here and I hope you may be able to encourage Rose Kaminski to continue with her efforts.

18 Assessment of Risks

At the present time I am busy trying to re-assess risks on VCM in an amateurish sort of way. I was therefore fascinated to read in European Chemical News 22 July page 22 an article on an interview with your Dr Gehring. On the basis of metabolic work, Dr Gehring suggests that 25 ppm VCM exposures would result in no greater occurrence of human angiosarcoma than would be expected to occur spontaneously. The article goes on to attribute to him a statement that 1 ppm exposure to VCM would be expected to give 1 case of AS in 100 million subjects ie lower than the spontaneous occurrence. Unfortunately I was unable to attend the Toxicology Conference at Surrey University where Dr Gehring was speaking. Do you have any papers emerging from Dow on this subject soon? They would be very timely. Any papers or calculations to back up Dr Gehring's statements would be very welcome in Europe.

With best wishes

Yours sincerely



J Stafford
Division Manager
Health & Environment Protection

TABLE B

Deaths from AS in PVC Workers in World (based on NIOSH tables 31/3/77 + CEFIC info)

<u>Case Number</u>	<u>Year of Death</u>	<u>No of Deaths</u>	<u>Cumulative Average since 1955</u>	<u>Cumulative Average since 1968</u>
Ca 1	1955	1	1	
	6	0	0.5	
Ca 2	7	1	0.67	
	8	0	0.5	
	9	0	0.4	
	60	0	0.33	
US 08	1	1	0.43	
Ca 3	2	1	0.5	
	3	0	0.55	
US 05	4	1	0.5	
	5	0	0.45	
Cz 2	6	1	0.5	
Fr 01	7	1	0.54	
Ca 4, Ca 5, US 04, US 07, US 10	8	5	0.86	5
Ge 01, US 12, US 16	9	3	1.0	4
Sw 01, US 11	70	2	1.06	3.3
Ca 6, Ge 02, US 02*	1	3	1.18	3.25
Ca 7, It 02, Nor 01, Sw 02, UK 01	2	5	1.39	3.6
Ca 8, US 01, US 03, US 23, YU 01, YU 02**	3	6	1.63	4
Ca 9, Cz 1, Ge 04, Ge 06, UK 03, US 13	4	6	1.85	4.3
Fr 02, Fr 03, Ge 05, Ge 07, Ge 08, It 03 ***	5	10	2.24	5
Jap 1, US 06, US 09, US 18				
Be 01, Fr 04, Fr 05, Fr 06, Fr 07, Sw 03, US 20	6	8	2.5	5.3
US 22				
Ca 10, Fr 08, US 21	7	3	-	-

58 ****

- * excludes It 01 (bag extruder)
 ** excludes Ge 03 (pesticide can filler)
 *** includes Ge 08 in NIOSH list about which CEFIC knows nothing
 **** UK 02, US 14 and US 15 non-polymerisation cases (so called) totally excluded

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LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

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 (cont'd) 08		19.10.17			19.04.54	1975	- (I presume 58)	22	21	25.12.75	Yes				In NIOSH list of 16.2.77 awaiting details. These details given by NIOSH on 31.3.77. Whose case is this? Why have we not heard of it?
09		13.12.34	CMH		00.02.61 (NIOSH says 2.12.59)	end '76 (NIOSH says 16.6.76)	42	15 (NIOSH says 17)	13 (NIOSH says 15)	Still alive	(NIOSH says yes)	High peaks	Autoworker & cleaner 8 yrs Next job 3 yrs Control room 1 yr		Still Alive

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Germany 01	OT	04.06.30	Dynanit		01.10.56	19.9.68	38	11	11	25.01.69	Yes (NIOSH)		Polyworker		Dates altered to fit NIOSH 31/3/77 List
02	HA	26.07.31	Dynanit		14.10.57	25.9.70	40 (397)	13	12	14.12.71	Yes (NIOSH)		Polyworker		Dates altered to fit NIOSH 31/3/77 List
03	UA	16.07.30	Dynanit?		09.06.52	00.03.73	43	21	21 (NIOSH says 14)	10.10.73	Yes (NIOSH)		Filling pesticide aerosol cans with VC		Reported under non- polymerisation workers in NIOSH list of 31/3/77. Is this correct?
04		04.09.30	Wacker		16.04.57	26.11.74	44	17	17 (NIOSH 117)	25.11.74	Yes (NIOSH - no comment)		Polyworker & temp autocleaner		
05	MV	01.01.32	Dynanit		16.12.62	00.00.75	43	13	12	10.01.75	Yes		Polyworker		
06	NH	09.05.36	Hoechst		02.04.60	00.12.73	39	13 (NIOSH says 03)	05 (NIOSH says 03)	16.12.74	Yes (NIOSH)		Polyworker (NIOSH says assistant factory chemist)		Reported under non- polymerisation workers in NIOSH list of 31/3/77
07		29.09.26	Wacker		15.04.54	12.11.75	49	21 (NIOSH says 17)	21 (NIOSH says 12)	13.11.75	Yes		Autocleaner 12 yrs Foreman Tech Dev 8 yrs		

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* UK System of dates
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USA 09	RAYMOND GETTLE- FINGER?	08-11-31	BFG	Louisville	09-09-54	01-03-74	43	19 (NIOSH says 17)	17	11-03-75	YES	2000 ppm			Ref 1 has wrong figures re first exposure. Louisville Times 29-10-74, 12-3-75, 10-3-76
10		16-08-13	Goodyear	Niagara	12-06-51	00-05-68	55	17	17	10-05-68	YES				Ref 1
11		27-05-09	Goodyear	Niagara	14-10-46	00-03-70	61	23	23	16-03-70	YES				Ref 1
12		17-11-13	Firestone	Pottstown	13-09-49	02-05-69	50	20	15	02-05-69	YES				Ref 1
13	EDWARD CLEDENIN	01-12-21	UCC	S Charle- ston	19-08-44	00-05-74	52	30	30	07-04-74	YES	2000 ppm			Charleston Daily Mail 21/7/75
14															Dubious fabrication case
15															Dubious fabrication case
16		04-11-27	BFG?		08-05-50	00-00-69	41	18 (NIOSH says 17)	4	27-03-69	YES		1951-4 VCM Polymeris- ation	From 1954 onwards in Army and other ser- vice. 46-50-Army	Table 4 in Wagoner Testimony to US Senate.
17		06-05-31	BFG?		23-06-59	11-10-74	43	19	19	ALIVE?	YES				

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USA															
01	EARL PARKS	17-10-23	BFG	Louisville	09-12-48	03-03-73	49	24 (NIOSH says 22)	16	03-03-73	YES				Rolling Stone Art Ref 1 NY Acad of Sc Symp
02		19-08-33	BFG	Louisville	15.11.55	00-05-70	37	14	13	27-09-71 (NIOSH says 28.09.71)	YES				Ref 1 Also Block JAMA 1/7/74 p53
03		25.05.15	BFG	Louisville	28.11.45	19-12-73	58	28	28	19-12-73	YES				Ref 1
04		15-01-24	BFG	Louisville	06-07-52	19-08-67	43	15	15	07-01-68	YES				Ref 1
05		25-01-12	BFG	Louisville	19-06-44	09-04-64	52	20	18	09-04-64	YES				Ref 1
06	RAY AUSTIN JONES?	00-00-29	BFG	Louisville	17-01-62	00-02-74	45	12	12	24-07-75	YES		US Air Force		Ref 1 + Louisville Time 23/7/75 Retired April 1974
07	name with- held at family request	03-05-22	UCC	S Charle- ston	00-08-44	00-00-68	45	24	18	23-03-68	YES				Ref 1
08		06-05-70	Goodyear	Niagara	07-10-46	00-08-61	41	15	15	29-08-61	YES				Ref 1

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Sheet 4

LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

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 VO 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
Is this 22?			BFG	Louisville No 10		24-01-76		28		ALIVE					Louisville Times 26-1-76. Said to be 10th AS victim at Bell: lane factory of whom 8 have died so far.

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LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

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USA															
18	Is this Charlie Arthur?	22-04-28	Is this BFG?	Is this Avon Lake	00-00-54	00-00-75	46	21	13	02-11-75	Yes				
19	VIRGIL CHRISTIAN	00-00-15	UCC	S Charles- ton	00-00-43	19-06-75	60	32	32	ALIVE?		2000 ppm			Williamsport Sun Gazette 21 June 1975 Charleston Daily Mail 21/7/75.
20		31-08-71			00-00-47	30-01-76		29	22	30-01-76	Yes				
21	CHESTER HINKLE	1910	UCC	S Charles- ton	1946	early 1977	67	30	22	02-01-77	Yes				28 yrs with UCC at SC Retired News Release 23-2-77
22		02-10-23	Is this BFG?	Is this 10th Louisville victim?	00-00-49	00-01-76	52	27	27	04-12-76	Yes				
23		00-00-23								06-04-76					
Is this 18?	CHARLIE ARTHUR	22-07-28	BFG	AVON LAKE	54	00-03-75	47	21	13	75		13 years AUTO- CLEANER — 8 yrs on ESTOL PLAST- ICISER AND CARDOSET OPERATIONS	NAVY — TYRE STORE		Rolling Stone Magazine 15/1/76

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Canada 9		19-7-21			1946	1974	53	28	26	4-9-74	Yes		Furnace op pipefitter maintenance		Worked overtime Smoker
10		16-5-15			1953	1976	61	23	14	00-04-77	Yes		Reactor Cleaner	Furnace op maintenance, packaging	Ex-smoker

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* All dates use UK system

Sheet 1

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** All this information should be held confidential until it is published by Dr Theriault of Laval University in Quebec.

*** Many of dates altered to fit NIOSH 31/3/77 list.

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CANADA 1		15-12-13	SHAWINIGAN		1944	1955	41	10	11	2-9-55	Yes		Reactor Cleaner	Operator polymeris- ation	Smoker
2		6-3-14			1943	1957	43	14	14	21-12-57	Yes		Maintenance, millwright, pipefitter	Operator,	Worked overtime Smoker
3		26-8-19			1941	1962	42	21	20	23-3-62	Yes		Operator, foreman		Worked overtime Non-smoker
4		5-4-19			1945	1967	48	22	22	21-1-68	Yes		Reactor Cleaner	Operator, foreman, intercooling unit	Worked overtime Smoker
5		7-5-11			1944	1968	57	24	5	5-7-68	Yes		Reactor Cleaner	Water cooling unit	Worked overtime Smoker
6		15-12-19			1947	1971	51	24	23	10-4-71	Yes		Reactor Cleaner	Maintenance millwright	Worked overtime Smoker
7		9-11-19			1946	1972	53	26	25	24-12-72	Yes		Reactor Cleaner	Machine Shop oper- ator and poly unit	Worked overtime Smoker
8		13-5-20			1961	1973	53	12 in plant	5	12-6-73	Yes		Reactor Cleaner	Maintenance machine shop	In plant 25 years! Smoker

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Yugoslavia 01		05.04.14			00.00.53	08.04.73	59	20	20	08.04.73	Yes				
02		15.11.31			00.00.50	12.07.73	42	23	18	12.07.73	Yes				

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

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JS 1/8/77

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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Italy 01		15.06.34			00.00.65	19.04.71	36	06	03	16.04.71	7Yes		PVC Bag Extruder		Primary tumour may have been pericardium. Not homogeneous with other cases.
02		13.11.29	Montedi- son	Porto Marghera	1957	13.12.72	43	15	06	00.12.72	Yes		Polyworker		
03		14.03.20	Solvay		00.01.53	10.07.75	55	22	21	10.07.75	Yes	High	Autocleaner 8 yrs Autoclave operator 12 yrs		

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Belgium 01		12.01.13	Solvay	Jemeppe	00.07.58	00.05.76	63	18	17	29.06.76	Yes	High	Autocleaner 14 yrs Polyworker 3 yrs	Driller in a foundry (2 yrs) Farmer (15 yrs) Work in glass ind. & chemical industry	Hepatic tests in October 1974 were normal. Retired Feb 1975 Hospitalised May 1976

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Norway 01	AH	23.12.15	Norsk Hydro		00.03.50	20.12.71	56	22	21	04.01.72	Yes		PVC worker		

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[illegible]

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BESSEMER ROAD
WELWYN GARDEN CITY

LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	COMPANY	FACTORY	FIRST VC EXPOSURE	DATE OF DIAGNOSIS	AGE AT DIAGNOSIS	YEARS OF EXPOSURE TO DIAGNOSIS	YEARS OF EXPOSURE	DATE OF DEATH	HISTOLOGICAL CONFIRMATION	ESTIMATED EXPOSURE LEVEL	OCCUPATION	OTHER CAREER HIGHLIGHTS	OTHER COMMENTS
UK 01	WJ	20.04.01	ICI	Hillhouse	00.00.44	00.12.72	71	28	22	00.12.72		500 ppm	1944-7 VCM 1947-8 Drier 1948-61 Autoclave operator 1961-66 Drier		
03	BJW	02.06.37	BP	Barry	00.02.66	00.12.74	37	09	3.5	24.12.74	Yes		Autoclave cleaner		Exposure limited to 2/66 - 9/69
															* NIOSH are still quoting Case 02 from IOCO which has been discounted in the UK. IOCO spread many polymers including PVC onto fabrics.

R&S 103550

ICI PLASTICS DIVISION
BESSEMER ROAD
WELWYN GARDEN CITY

LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

[illegible]

R&S 103551

R&S 103552

ICI PLASTICS DIVISION
DISCOVER 1049
WILMINGTON GARDEN CITY

Angiosarcoma Cases -- (Review Dates: 1 August 1977)

1	2	3	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	FIRST VS 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		15.04.24	00.01.46	10.02.67	43	21	19	19.02.67	Yes	High	Polyworker 19 years		Ref. Ravier et Al Arch. Mal. Prof. 130 n° 3 - nov 75 p. 171-177
02		03.06.11	06.07.59	15.01.75	63	16	12	24.01.75	Yes	High	Polyworker 10 years		Ref. G. Banneton et Al "Revue de la pratique medicale" 5 nov. 77 - p. 735
03		06.01.20	00.00.46	15.01.75	55	29	29	29.06.75	Yes	High	Polyworker 10 years	WCH Production 16 years Com- pounding 2 years	Ref. Rety et Al Arch. Mal. Prof. 137 n° 6 Juin 76 p. 551 - 555
04		27.01.27	19.10.49	16.01.76	49	26	26	01.01.76	Yes	High	Production worker 8 years Auto-cleaning 10 years		
05		29.01.30	10.01.65	13.05.76	30	11	11	13.05.76	Yes	High	Polyworker 11 years		
06		14.4.34	01.03.58	12.00.76	42	10	13 (HIGH says 17)	11.09.76 (HIGH says 12.02.76)	Yes	High	Polyworker 10 years		Ref P Condore et Al "Semaine des hopitaux" 10 Septembre 76 Previously had tons angiosarcoma

ICY PLASTICS DIVISION
DESHTER ROAD
WELBY GARDEN CITY

Sheet 2

LIVER Angiosarcoma Cases - (Review Date:- 1 August 1977)

1	2	3	6	7	8	9	10	11	12	13	14	15	16
COUNTRY AND REFERENCE NO	NAME OR INITIALS	DATE OF BIRTH	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
07		00.00.27	01.07.50	After death	49	26	22	02.07.70	Yes	High	Plant foreman		Died of septicaemia Small liver lesion found after autopsy
08		01.04.34	23.05.57	03.12.75	42	19	19	30.01.77	Yes	High	Packer then polyworker		

R&S 103553

TABLE 1
REPORTED CASES OF ANGIOSARCOMA OF THE LIVER AMONG
VINYL CHLORIDE POLYMERIZATION WORKERS

COUNTRY	CASE NO.	BIRTH DATE	1ST VC OR PVC EXP.	DX ANGIO-SARCOMA	AGE AT DX	YEARS TO DX	TOT. YRS. EXP.	DATE OF DEATH
BELGIUM	01*	01-12-13	07-00-58	05-00-76	63	18	17	06-29-76
CANADA	01*	12-13-13	00-00-44	00-00-55	41	11	11	09-02-55
CANADA	02*	03-06-14	00-00-43	00-00-57	43	14	14	12-21-57
CANADA	03*	08-26-19	00-00-41	00-00-62	42	21	20	03-22-62
CANADA	04*	04-03-19	00-00-45	00-00-67	48	22	22	01-21-68
CANADA	05*	05-07-11	00-00-44	00-00-68	57	24	05	07-05-68
CANADA	06*	12-15-19	00-00-47	00-00-71	51	24	23	04-10-71
CANADA	07*	11-09-19	00-00-46	00-00-72	53	26	25	12-24-72
CANADA	08*	05-13-20	00-00-61	00-00-73	53	12	05	06-12-73
CANADA	09*	07-19-21	00-00-46	00-00-74	53	28	26	09-04-74
CANADA	10*	05-16-15	00-00-53	00-00-76	61	23	14	04-00-77
CZECH.	01*	00-00-28	00-00-57	00-00-73	46	16	16	00-00-74
CZECH.	02*	00-00-26	00-00-51	00-00-66	40	15	15	00-00-66
FED.REP.GER.	01*	06-04-30	10-01-56	09-19-68	38	12	12	01-25-69
FED.REP.GER.	02*	07-26-31	10-14-57	09-25-70	39	13	12	12-14-71
FED.REP.GER.	04	09-04-30	04-16-57	11-26-74	44	17	17	11-25-74
FED.REP.GER.	05*	01-01-32	12-16-62	00-00-75	43	13	12	01-09-75
FED.REP.GER.	07*	09-29-26	04-15-54	11-12-75	49	21	12	11-13-75
FED.REP.GER.	08*	10-19-17	04-19-54	00-00-75	58	22	21	12-25-75
FED.REP.GER.	09*	12-13-34	12-02-59	06-16-76	42	17	15	03-24-78
FED.REP.GER.	10*	07-25-29	10-10-55	06-28-77	47	22	22	06-28-77
FED.REP.GER.	11*	12-29-36	01-02-61	00-00-77	41	16	10	03-07-77
FED.REP.GER.	12*	06-14-38	04-01-61	00-00-77	39	16	06	10-07-77
FRANCE	01*	04-13-24	01-00-46	02-18-67	43	21	19	02-19-67
FRANCE	02	06-03-11	07-06-59	01-08-75	63	15	12	01-24-75
FRANCE	03*	00-00-19	00-00-46	01-00-75	55	29	29	06-29-75
FRANCE	04*	01-27-27	10-19-49	01-04-76	49	26	26	01-04-76
FRANCE	05*	01-29-38	00-00-65	04-00-76	38	11	10	05-13-76
FRANCE	06*	04-14-34	00-00-58	09-00-76	42	18	17	09-12-76
FRANCE	07	00-00-27	07-01-50	07-00-76	49	26	23	07-02-76
FRANCE	08*	04-01-34	05-23-57	12-03-76	42	19	19	01-30-77
FRANCE	09*	10-08-14	01-10-48	04-26-76	62	28	28	12-16-77
FRANCE	10*	05-26-19	12-24-56	01-10-78	58	21	21	01-10-78
FRANCE	11*	02-15-12	01-00-41	08-12-78	66	37	31	11-13-78
GREAT BRIT.	01*	04-20-01	04-04-44	12-00-72	71	28	22	12-03-72
GREAT BRIT.	03*	06-02-37	02-00-66	12-00-74	37	09	04	12-24-74
ITALY	02*	11-13-29	00-00-57	12-13-72	43	15	06	12-00-72
ITALY	03*	03-14-20	00-00-53	07-10-75	55	22	21	07-10-75
JAPAN	01*	08-01-22	04-00-53	08-21-74	52	22	22	10-24-75
JAPAN	02*	08-02-39	11-00-58	08-10-76	37	18	13	08-10-76
NORWAY	01*	12-23-15	03-00-50	12-20-71	56	22	21	01-04-72
SWEDEN**	01*	06-23-27	08-14-51	08-00-74	43	19	18	10-20-70
SWEDEN	03*	06-10-10	05-00-47	03-19-76	65	29	21	03-19-76
SWEDEN	04*	11-16-14	00-00-46	05-12-77	62	31	31	05-12-77
U.S.A.	01*	10-17-23	12-09-48	03-03-73	49	24	21	03-03-73
U.S.A.	02*	08-19-33	11-15-55	05-00-70	37	14	13	09-28-71
U.S.A.	03*	05-25-15	11-28-45	12-19-73	58	28	28	12-19-73
U.S.A.	04*	01-15-24	07-06-52	08-19-67	43	15	15	01-07-68
U.S.A.	05*	01-25-12	06-19-44	04-09-64	52	20	20	04-09-64
U.S.A.	06*	11-23-28	01-17-62	02-00-74	46	12	12	07-24-75
U.S.A.	07*	05-03-22	08-27-44	00-00-68	45	24	17	03-23-68
U.S.A.	08*	05-06-20	10-07-46	08-00-61	41	15	15	08-29-61
U.S.A.	09*	11-08-31	05-28-45	03-04-74	43	29	24	03-00-75
U.S.A.	10*	08-16-13	06-12-51	05-00-68	55	17	17	05-10-68
U.S.A.	11*	05-27-09	10-14-46	03-00-70	61	23	23	03-16-70
U.S.A.	12*	11-17-18	09-13-49	05-02-69	50	20	19	05-02-69
U.S.A.	13*	12-01-21	12-11-42	05-00-74	52	32	26	07-04-74
U.S.A.	14*	11-04-27	05-08-50	00-00-69	41	19	04	03-27-69
U.S.A.	17*	05-06-31	06-23-55	10-11-74	43	19	19	ALIVE
U.S.A.	18*	04-22-28	09-15-54	00-00-75	46	21	11	11-02-75
U.S.A.	19*	00-00-15	00-00-43	06-19-75	60	32	22	04-06-76
U.S.A.	20*	08-31-17	00-00-55	01-30-76	58	21	18	01-30-77
U.S.A.	21*	09-02-09	12-00-46	00-00-77	67	30	21	01-02-77
U.S.A.	22*	10-02-23	07-11-47	01-00-76	52	29	28	12-04-76
U.S.A.	23*	00-00-23	09-08-58	04-06-73	50	15	14	04-06-73
U.S.A.+	24*	05-07-17	00-00-39	05-27-77	60	38	26	05-27-77
U.S.A.	25	08-07-10	02-00-47	03-10-77	67	30	20	03-10-77
U.S.A.	26*	07-07-23	10-03-47	00-00-77	52	28	18	02-11-75
U.S.A.	27*	05-11-16	07-01-41	11-30-78	62	37	27	11-25-78
YUGOSLAVIA	01*	04-05-14	00-00-53	04-08-73	59	20	20	04-08-73

TOTAL REPORTED CASES = 70

*--DIAGNOSIS WAS MICROSCOPICALLY CONFIRMED

**--INDICATES UNKNOWN DATA

+ THIS CASE WAS LATER DIAGNOSSED AS HAVING CHOLANGIOSARCOMA.

++THIS CASE WAS CONFIRMED 4 YEARS AFTER DEATH THROUGH A REEVALUATION OF THE MICROSCOPIC SLIDE DIAGNOSIS AT AUTOPSY WAS PRIMARY LIVER CANCER.

AUGUST 1978

TABLE 1
REPORTED CASES OF ANGIOSARCOMA OF THE LIVER AMONG
VINYL CHLORIDE POLYMERIZATION WORKERS

COUNTRY	CASE NO.	BIRTH DATE	1ST VC		DX	AGE YEARS		1ST. EXP. YRS.	DATE OF DEATH
			EXP.	SARCOMA		AT	TO DX		
BELGIUM	018	01-12-13	07-00-58	05-00-76	63	18	17	06-29-76	
CANADA	014	12-12-14	00-00-44	00-00-73	41	11	11	05-02-53	
CANADA	028	03-00-14	00-00-43	00-00-57	43	14	14	12-21-57	
CANADA	038	08-00-14	00-00-41	00-00-62	42	21	20	03-22-62	
CANADA	048	04-00-14	00-00-43	00-00-67	48	22	22	01-21-68	
CANADA	058	05-07-11	00-00-44	00-00-58	57	24	05	07-05-68	
CANADA	068	12-15-19	00-00-47	00-00-71	51	24	23	04-10-71	
CANADA	078	11-09-19	00-00-46	00-00-72	53	24	25	12-24-72	
CANADA	088	05-13-20	00-00-61	00-00-73	53	12	05	00-12-73	
CANADA	098	07-19-21	00-00-46	00-00-76	53	28	26	09-04-76	
CANADA	108	05-10-15	00-00-53	00-00-76	61	23	14	04-02-77	
CZECH.	018	00-00-28	00-00-57	00-00-73	46	16	16	00-00-76	
CZECH.	028	00-00-26	00-00-51	00-00-66	40	15	15	00-00-66	
FED. REP. GER.	018	04-08-34	10-01-56	09-14-68	38	12	12	01-25-69	
FED. REP. GER.	028	07-20-31	10-16-57	09-23-70	39	13	12	12-14-71	
FED. REP. GER.	04	09-04-30	04-16-57	11-26-74	44	17	17	11-25-74	
FED. REP. GER.	058	01-01-32	12-16-62	00-00-75	43	13	12	01-09-75	
FED. REP. GER.	078	09-29-26	04-13-64	11-12-75	49	21	12	11-13-75	
FED. REP. GER.	088	10-19-17	04-13-64	00-00-75	58	22	21	12-25-75	
FED. REP. GER.	098	12-13-34	12-02-59	00-16-76	42	17	15	03-29-78	
FED. REP. GER.	108	07-23-29	10-10-56	00-20-77	47	22	22	06-28-77	
FED. REP. GER.	118	12-29-36	01-02-61	00-00-77	41	16	10	03-07-77	
FED. REP. GER.	128	06-14-33	04-01-61	00-30-80	46	00	00	10-02-77	
FRANCE	018	04-17-24	01-00-46	02-19-67	43	21	19	02-19-67	
FRANCE	02	06-03-11	07-06-59	01-08-75	63	15	12	01-24-75	
FRANCE	038	00-00-19	00-00-46	01-00-75	55	29	29	06-29-75	
FRANCE	048	01-27-27	10-19-49	01-08-76	49	26	26	01-04-76	
FRANCE	058	01-29-38	00-00-65	04-00-76	38	11	10	05-13-76	
FRANCE	068	04-14-34	00-00-58	09-00-76	42	18	17	09-12-76	
FRANCE	07	00-00-27	07-01-50	07-00-76	49	26	23	07-02-76	
FRANCE	088	04-01-34	05-23-57	12-03-76	42	19	19	01-30-77	
FRANCE	098	10-03-14	01-10-48	04-24-76	42	23	26	12-16-77	
FRANCE	108	05-26-19	12-24-56	01-10-75	58	21	21	01-10-78	
GREAT BRIT.	018	04-20-31	04-06-44	12-03-74	71	28	22	12-03-72	
GREAT BRIT.	028	06-02-37	02-00-66	12-00-74	37	09	04	12-24-74	
ITALY	028	11-13-27	00-00-57	12-13-72	45	15	06	12-30-72	
ITALY	038	03-11-20	00-00-53	07-10-75	55	22	21	07-10-75	
JAPAN	018	08-01-22	04-00-53	08-21-74	52	22	22	10-24-75	
JAPAN	028	08-02-39	11-00-56	08-10-76	37	18	13	08-10-76	
NORWAY	018	12-23-15	01-00-50	12-20-71	56	22	21	01-04-72	
SWEDEN	018	06-23-27	08-14-51	08-00-74	43	19	10	10-20-70	
SWEDEN	038	00-10-10	05-00-47	03-19-76	65	29	21	03-19-76	
SWEDEN	048	11-10-14	00-00-46	00-12-77	62	31	31	05-12-77	
U.S.A.	018	10-17-23	12-09-48	04-03-74	69	24	21	03-03-73	
U.S.A.	028	06-11-33	11-13-55	05-00-73	37	14	13	09-28-71	
U.S.A.	038	05-25-15	11-29-45	12-16-73	58	28	28	12-16-73	
U.S.A.	048	01-15-24	07-06-52	08-17-67	43	15	15	01-07-68	
U.S.A.	058	01-25-12	06-19-44	04-04-64	52	20	20	04-04-64	
U.S.A.	068	11-23-28	01-17-62	02-03-74	46	12	12	07-24-75	
U.S.A.	078	05-23-22	09-27-44	00-00-68	45	24	17	03-23-68	
U.S.A.	088	05-06-20	10-07-46	08-00-61	41	15	15	04-24-61	
U.S.A.	098	11-03-31	05-23-43	03-31-73	43	29	24	03-00-73	
U.S.A.	108	04-16-12	00-12-51	00-00-64	54	17	17	00-10-68	
U.S.A.	118	05-27-07	10-11-46	03-00-70	61	23	23	03-16-70	
U.S.A.	128	11-17-14	04-13-49	05-02-67	50	20	19	05-02-69	
U.S.A.	138	12-31-21	12-11-42	05-00-76	52	32	26	07-04-74	
U.S.A.	148	11-04-27	05-08-50	00-00-64	41	16	16	03-27-60	
U.S.A.	158	05-15-31	00-23-53	10-11-74	43	19	19	ALIVE	
U.S.A.	168	04-22-28	04-15-54	00-00-75	46	21	11	11-02-75	
U.S.A.	178	00-00-15	00-00-43	00-19-75	60	32	22	04-00-76	
U.S.A.	188	02-11-17	00-00-55	01-30-76	58	21	18	01-30-77	
U.S.A.	198	06-07-34	12-30-44	00-00-77	47	30	21	01-22-77	
U.S.A.	208	10-02-23	07-11-47	01-30-76	52	29	28	12-04-76	
U.S.A.	218	00-00-23	00-00-58	04-00-73	60	15	14	04-00-73	
U.S.A.	228	05-07-17	00-00-39	05-27-77	60	38	26	05-27-77	
U.S.A.	238	00-07-10	02-00-47	03-10-77	67	30	20	03-10-77	
U.S.A.	248	AWAITING	DETAILS						
YUGOSLAVIA	018	04-05-14	00-00-53	04-02-73	59	20	20	04-02-73	

TOTAL REPORTED CASES = 68

*--DIAGNOSIS WAS MICROSCOPICALLY CONFIRMED

**--INDICATES UNKNOWN DATA

THIS CASE WAS CONFIRMED 4 YEARS AFTER DEATH THROUGH A REEVALUATION OF THE MICROSCOPIC SLIDES.

DIAGNOSIS AT AUTOPSY WAS PRIMARY LIVER CANCER.

R&S 103555

NIDSH
AUGUST, 1978

R&S 103556

TABLE 2

REPORTED CASES OF ANGIOSARCOMA OF THE LIVER AMONG
NON-POLYMERIZATION WORKERS EXPOSED TO VC

			1ST VC	DX	AGE	YEARS	TOT.	DATE	
	CASE	BIRTH	DR PVC	ANGIO-	AT	1ST EXP.	YRS.	OF	
COUNTRY	NO.	DATE	EXP.	SARCOMA	DX	TO DX	EXP.	DEATH	
FED. REP. GER.	03*	07-16-30	06-09-52	03-00-73	43	21	14	10-10-73	NOTE 6
FED. REP. GER.	06*	05-09-36	04-02-60	00-00-74	38	14	03	12-16-74	NOTE 9
GREAT BRIT.	02*	04-08-14	00-00-46	02-00-70	55	24	11	12-00-70	NOTE 1
ITALY	01	06-15-34	00-00-65	04-14-71	36	06	03	04-16-71	NOTE 2&7
SWEDEN	02*	11-27-11	00-00-45	08-00-74	61	27	23	08-16-72	NOTE 3&1
U.S.A.	15*	00-00-25	00-00-00	07-00-72	47	00	00	02-15-73	NOTE 5
YUGOSLAVIA	02*	11-15-31	00-00-50	07-12-73	42	23	18	07-12-73	NOTE 3
YUGOSLAVIA	03*	12-21-31	06-04-54	01-11-76	45	22	22	01-11-76	NOTE 3

NOTE 1 - POURING PVC OIL MIXTURE ONTO FABRIC BASES,

NOTE 2 - PRODUCTION OF PVC SACKS,

NOTE 3 - PRODUCTION OF VINYL CHLORIDE,

NOTE 5 - ACCOUNTANT AT PLANT MAKING PVC FABRIC,

NOTE 6 - LOADING PESTICIDE CANS WITH VC PROPELLANT,

NOTE 7 - ANGIOSARCOMA INVOLVING LIVER, LUNG AND PERICARDIUM,

ALTHOUGH DIFFICULT TO DETERMINE, PRIMARY SITE SEEMS TO BE
PERICARDIUM,

NOTE 9 - ASSISTANT FACTORY CHEMIST,

NOTE 10 - THIS MAN WAS HEAVILY EXPOSED TO VCH IN AN OIL, INDOOR PLANT

*--DIAGNOSIS WAS MICROSCOPICALLY CONFIRMED

00--INDICATES UNKNOWN DATA

R&S 103557

FED. REP. GER.	07*	09-29-26	04-15-54	11-12-75	49	21	12	01-04-75
FED. REP. GER.	08*	10-19-17	04-19-54	00-00-75	58	22	21	12-25-75
FED. REP. GER.	09*	12-13-34	12-02-58	06-16-76	42	17	15	03-24-78
FED. REP. GER.	10*	07-25-29	10-10-55	06-28-77	47	22	22	06-24-77
FED. REP. GER.	11*	12-29-36	01-02-61	00-00-77	81	16	10	03-07-77
FED. REP. GER.	12*	06-14-38	04-01-61	00-00-77	39	16	06	10-07-77
FED. REP. GER.	13*	06-03-29	10-19-53	10-09-78	49	25	20	10-23-78
FED. REP. GER.	15*	06-06-37	11-01-61	08-14-78	41	16	11	08-28-78
FED. REP. GER.	16*	00-00-33	01-10-55	08-07-78	48	23	20	08-07-78
FED. REP. GER.	17*	00-00-37	11-01-61	08-14-78	41	16	11	08-28-78
FRANCE	01*	04-15-24	01-00-46	02-18-67	43	21	19	02-19-67
FRANCE	02*	06-03-11	07-06-59	01-08-75	63	15	12	01-24-75
FRANCE	03*	00-00-19	00-00-46	01-00-75	55	29	29	06-29-75
FRANCE	04*	01-27-27	10-19-49	01-04-76	49	26	26	01-04-76
FRANCE	05*	01-29-38	00-00-65	04-00-76	38	11	10	05-13-76
FRANCE	06*	04-14-34	00-00-58	09-00-76	42	18	17	09-12-76
FRANCE	07*	00-00-27	07-01-50	07-00-76	49	26	23	07-02-76
FRANCE	08*	04-01-34	05-23-57	12-03-76	42	19	19	01-30-77
FRANCE	09*	10-08-14	01-10-48	04-26-76	62	28	28	12-16-77
FRANCE	10*	05-26-19	12-24-56	01-10-78	58	21	21	01-10-78
FRANCE	11*	02-15-12	01-00-41	08-12-78	66	37	31	11-13-78
FRANCE	12*	08-16-14	02-09-49	05-00-79	65	30	27	06-23-79
FRANCE	13	01-19-31	09-23-63	06-26-79	40	16	13	08-22-79
GREAT BRIT.	01*	04-20-01	04-04-44	12-00-72	71	28	22	12-03-72
GREAT BRIT.	03*	06-02-37	02-00-66	12-00-74	37	09	04	12-24-74
GREAT BRIT.	04*	06-23-20	04-26-54	06-00-79	59	25	18	10-12-79
GREAT BRIT.	05	03-30-14	01-08-51	10-00-79	65	28	21	11-19-79
GREAT BRIT.	06	00-00-31	00-00-62	01-09-80	49	18	12	01-09-80
ITALY	02*	11-13-29	00-00-57	12-13-72	43	15	06	12-00-72
ITALY	03*	03-14-20	00-00-53	07-10-75	55	22	21	07-10-75
JAPAN	01*	08-01-22	04-00-53	08-21-74	52	22	22	10-24-75
JAPAN	02*	08-02-39	11-00-58	08-10-76	37	18	13	08-10-76
NORWAY	01*	12-23-15	03-00-50	12-20-71	56	22	21	01-04-72
SWEDEN++	01*	06-23-27	08-14-51	08-00-74	43	19	18	10-20-70
SWEDEN	03*	06-10-10	05-00-47	03-19-76	65	29	21	03-19-76
SWEDEN	04*	11-16-14	00-00-46	05-12-77	62	31	31	05-12-77
U.S.A.	01*	10-17-23	12-09-48	03-03-73	49	24	21	03-03-73
U.S.A.	02*	08-19-33	11-15-55	05-00-70	37	14	13	09-28-71
U.S.A.	03*	05-25-15	11-28-45	12-19-73	58	28	28	12-19-73
U.S.A.	04*	01-15-24	07-06-52	09-19-67	43	15	15	01-07-68
U.S.A.	05*	01-25-12	06-19-44	04-09-64	52	20	20	04-09-64
U.S.A.	06*	11-23-28	01-17-62	02-00-74	46	12	12	07-24-75
U.S.A.	07*	05-03-22	08-27-44	00-00-68	45	20	17	03-23-68
U.S.A.	08*	05-06-20	10-07-46	08-00-61	41	15	15	08-29-61
U.S.A.	09*	11-04-31	05-26-45	03-01-78	43	20	24	03-00-75
U.S.A.	10*	08-16-13	06-12-51	05-00-68	55	17	17	05-10-68
U.S.A.	11*	05-27-09	10-14-46	03-00-70	61	23	23	03-16-70
U.S.A.	12*	11-17-18	09-13-49	05-02-69	50	20	19	05-02-69
U.S.A.	13*	12-01-21	12-11-42	05-00-74	52	32	26	07-04-74
U.S.A.	16*	11-04-27	05-08-50	00-00-69	41	19	04	03-27-69
U.S.A.	17*	05-06-31	06-23-55	10-11-74	43	19	19	00-00-80
U.S.A.	18*	04-22-28	09-15-54	00-00-75	46	21	11	11-02-75
U.S.A.	19*	00-00-15	00-00-43	00-19-75	60	32	22	04-06-76
U.S.A.	20*	08-31-17	00-00-55	01-30-76	58	21	18	01-30-77
U.S.A.	21*	09-02-09	12-00-46	00-00-77	67	30	21	01-02-77
U.S.A.	22*	10-02-23	07-11-47	01-00-76	52	29	28	12-04-76
U.S.A.	23*	00-00-23	09-04-58	04-06-73	50	15	14	04-06-73
U.S.A.+	24*	05-07-17	00-00-39	05-27-77	60	38	26	05-27-77
U.S.A.	26*	07-07-23	10-03-47	00-00-77	52	28	18	02-11-75
U.S.A.	27*	05-11-16	07-01-41	11-30-78	62	37	27	11-25-78
U.S.A.	28*	04-11-17	08-00-40	11-03-78	61	34	28	11-03-78
U.S.A.	29*	10-12-07	05-00-42	03-00-80	72	38	16	03-01-80
YUGOSLAVIA	01*	04-05-14	00-00-53	04-08-73	59	20	20	04-08-73
YUGOSLAVIA	04*	06-11-30	12-15-58	09-03-78	48	20	18	09-03-78

TOTAL REPORTED CASES = 81

*--DIAGNOSIS WAS MICROSCOPICALLY CONFIRMED

**000--INDICATES UNKNOWN DATA

+ THIS CASE WAS LATER DIAGNOSED AS HAVING CHOLANGIOSARCOMA.

+ THIS CASE WAS CONFIRMED 2 YEARS AFTER DEATH THROUGH A REEVALUATION OF THE MICROSCOPIC SLIDES. DIAGNOSIS AT AUTOPSY WAS PRIMARY LIVER CANCER.