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Principal Investigator
Dr. J. S. S. S. S. S.

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REPORT TO THE

Evidence

Nitro

Health Survey of Dioxin-Exposed Workers at Monsanto Chemical Company in Nitro, West Virginia

Marion Moses, M.D., Ruth Lilis, M.D., Irving J. Selikoff, M.D., David Bickers, M.D.*, and Robert Lovelace, M.D.**

Problem

2,4,5-T was manufactured by the Monsanto Chemical Company at their Nitro, West Virginia plant from October 1948 to September 1969. In March, 1949 an explosion occurred in the reaction vessel where tetrachlorobenzene, methanol and caustic were being mixed to make trichlorophenol. A large amount of the reactor contents was released throughout the building as well as being dispersed to the surrounding area. It is known that such accidents release large amounts of the very toxic chemical 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). This same dioxin is also found during the manufacture of trichlorophenol and is an unwanted and undesirable contaminant of the 2,4,5-T made from it. The amounts formed during manufacture, however, are much lower than those found in an explosion as the formation of the dioxin is temperature and pressure dependent.

Workers exposed to TCDD often develop chloracne as well as other systemic manifestations of dioxin toxicity. The number of workers who suffered from chloracne and other toxic effects related to the explosion at Monsanto was reported to be 218. It is also known that chloracne had continued to be a problem among workers at the plant during the time 2,4,5-T was manufactured there.

N.B. The effects of dioxin on humans are well known because of experience with numerous accidents and other over-exposures. Systems affected are the skin, nervous system, liver, lipid metabolism, general metabolic state and most likely, the cardiovascular systems, blood-forming organs, and the immune system.

Chloracne, characterized by comedones, cysts, pustules and inflammatory skin changes of varying degrees of severity, is commonly found with exposure to TCDD. It is often very refractory to treatment and may involve almost the entire body. Hyperpigmentation and hypertrichosis may accompany the chloracne in severe cases. The chloracne usually appears within four to six weeks of exposure and in some cases may persist for many years. Chloracne can also occur in family contacts of workers exposed to the toxic agent who carry it home on their clothing.

Severe effects on the nervous system may occur with TCDD exposure. Signs and symptoms of peripheral neuropathy have often been reported. Pain and

*Case Western Reserve School of Medicine, Cleveland, Ohio

**Columbia University College of Physicians and Surgeons, New York City

weakness in the lower extremities often accompanied by difficulty in walking and coordinating the lower limbs are frequent symptoms. Objective measures of motor and sensory nerve conduction testing have confirmed that nerve damage exists. Hyperirritability, sleep disturbances, insomnia, hypersomnia, loss of vigor and drive, decreased libido and impotence are reported complaints.

Effects on the liver range from abnormalities in liver enzymes to toxic hepatitis. Porphyrria cutanea tarda has also been reported. In cases where liver biopsies have been done, results have shown abnormalities. Elevated serum lipids have been reported.

N.B. Very few toxic substances in the industrial environment have been shown to affect such a wide range of body systems and none is biologically active in animal studies at such low levels. Moreover, there are numerous experimental studies that reveal significant effects on the immune system in animals. TCDD is a teratogen and a carcinogen in experimental animals at very low doses. There are no available adequate long-term human studies that would allow quantitation of risk to humans of cancer and birth defects related to exposure to TCDD.

Monsanto has been in continuous operation at this site since 1929. The majority of the chemicals manufactured at this plant are rubber additives, accelerators, antioxidants, etc. Workers at the plant were known to be exposed to the human bladder carcinogen, para-amino-biphenyl, for several years in the 1950's. The organophosphate pesticide parathion, was also manufactured here for several years. Production was stopped when eight workers died in an explosion in the pesticide building in 1957.

N.B. In April, 1979, at the request of the United Steelworkers of America, AFL-CIO, a health survey was conducted to determine if long-term adverse health effects from exposure to dioxin could be demonstrated in the workers.

Materials and Methods

All active workers identified by union and company records as having had exposure to 2,4,5-T in manufacturing or processing were invited to participate in the survey. A sample of the remainder of the active work force not so identified as having had exposure to 2,4,5-T was also invited. All retirees, identified by union and company records, were invited to participate. Two hundred and thirty five persons participated in the survey and two hundred thirty completed it. Age distribution and work status of these 230 are shown in Tables 1 and 2. Number of years of employment at Monsanto is shown in Table 3, and the year of hire in Table 4.

Occupational, past medical, dermatological and reproductive histories as well as review of symptoms and physical examination were done. Special dermatological examination was performed on all participants by two dermatologists expert in chloracne. A special detailed neurological evaluation by a neurologist was performed of 91 (40%) of the participants. This evaluation included nerve conduction velocity measurements of motor and sensory nerves, as well as neurobehavioral performance testing.

Fatty tissue was aspirated from the upper outer quadrant of the buttocks under local anesthesia in 122 (53%) of the study participants. Laboratory tests included SMA-18 as well as GGT, triglycerides, complete urinalysis and total urinary porphyrins. All study subjects had a chest x-ray and pulmonary function testing. A small number of participants also had immunological evaluation of T and B cell function as well as antipyrine drug metabolism studies done.

Results

Amount of exposure to 2,4,5-T is shown in Table 5. Chloracne findings are presented in Table 6. Analysis of the survey data is currently being completed.

Significance

Information will be available concerning the long-term status of a group of individuals exposed to TCDD.

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Table 1. Age distribution of Nitro survey participants.

Age	Number	Percent of total
15-24	3	1.3
25-34	12	5.2
35-44	45	19.6
45-54	49	21.3
55-64	65	28.3
65-74	49	21.3
>75	7	3.0
	230	100.0

Table 2. Status of Nitro survey participants

	Number	Percent
Active	145	63.0
Retired	85	37.0
	230	100.0

Table 3. Number of years worked for Monsanto of Nitro survey participants.

Years	Number	Percent
0-9	17	7.4
10-19	63	27.4
20-29	53	23.0
30-39	90	39.1
40-49	7	3.0
	230	99.9

Table 4. Year of hire by Monsanto of Nitro survey participants.

Year	Number	Percent
1925-34	8	3.5
1935-44	61	26.5
1945-54	82	35.7
1955-64	33	14.3
1965-74	39	17.0
1975-79	7	3.0
	230	100.0

Table 5. Amount of exposure to 2,4,5-T by Nitro survey participants.

Exposure	Number	Percent
None	35	15.2
Minimal	46	20.0
Moderate	57	24.8
Heavy	92*	40.0
	230	100.0

*25 workers in this group were directly involved in 1949 explosion.

Table 6. Chloracne status of Nitro survey participants.

Status	Number	Percent
Chloracne currently present	71	31.0
Chloracne present in past	48	21.0
Never had chloracne	109	47.8
	228*	99.8

*Information unavailable for two participants.