

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTER FOR DISEASE CONTROL  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT  
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TA 78-65

Stauffer Chemical Company  
Chicago Heights, Illinois

June 1980

I. SUMMARY

Following an explosion involving the EPN manufacturing operation at the Stauffer Chemical Company's Chicago Heights, Illinois facility, NIOSH received a request from the company to evaluate the possibility of delayed neurotoxic effects among its employees. Subsequently, the Illinois Department of Health requested an evaluation of such effects among other persons who were in the area during and shortly after the explosion. NIOSH initiated a questionnaire survey of some 240 persons and selected 115 of them, as well as 30 Stauffer employees, for a comprehensive neurological evaluation. Among the 53 participants in the neurological evaluations, eight cases of definite or possible peripheral neuropathy were detected, but none were typical of a toxic neuropathy.

Low participation rates and methodologic problems with the study precluded a meaningful epidemiologic analysis of the data, so NIOSH was unable to determine whether there were any delayed neurologic effects resulting from working in or around the EPN production facility or otherwise being in the vicinity of the explosion.

II. INTRODUCTION

At about 7:45 a.m. on August 18, 1978 there was an explosion at the Stauffer Chemical Company's Chicago Heights, Illinois facility, where EPN (O-Ethyl O-p-nitrophenyl phenylphosphonothioate) was being manufactured. A plume of smoke, possibly indicating the dispersal pattern of EPN and other chemicals, spread to the northeast. In addition to Stauffer employees, police and firefighting personnel were soon working at or near the site. Also potentially "exposed" were news crews and others at the site, and possibly other persons in the area covered by the plume, mostly employees of other businesses.

EPN<sup>1</sup> is an organophosphate insecticide. It inactivates the enzyme cholinesterase, causing chest tightness, wheezing, difficulty breathing, constriction of the pupils, blurred vision, excessive production of

tears, runny nose, excessive diarrhea, headache, weakness, paleness or blue discoloration of the skin, muscle twitching, slurred speech, incoordination, paralysis, confusion, convulsions, and loss of consciousness. Whether respiratory or intestinal symptoms occur first depends on whether the exposure is by breathing or swallowing the chemical. It is also absorbed through the skin, and in this case sweating and muscle twitching at the site of absorption may be the first signs. Although, to the best of our knowledge, delayed toxicity due to EPN alone has not been described in humans, delayed neurological effects have been reported in birds<sup>2,3</sup> and mice,<sup>4</sup> and other organophosphate compounds have been associated with peripheral neuropathies in humans.<sup>5,6</sup>

### III. METHODS

Thirty Stauffer employees who were exposed regularly or sporadically to EPN as part of their usual work activities, who were present at the time of the explosion, or who were involved in cleanup activities were invited to participate in the neurological evaluation. The 44 police and firefighting personnel identified as being at the site after the explosion were also invited to participate. Finally, additional potential participants were selected from the approximately 200 people who completed a screening questionnaire. (All persons in the area covered by the plume, an estimated 300-500, were invited by means of various public and employer-distributed notices to contact NIOSH or local authorities.) Forty-one of them reported symptoms consistent with organophosphate toxicity, although not necessarily temporally related to the explosion. These, plus an additional 30, matched for sex and age to Stauffer employees and among matches selected according to greatest distance from the explosion and least time in the area, were invited to participate.

The neurological evaluation included a medical history, clinical neurological examination, electromyography, and nerve conduction studies. The findings were interpreted by the neurologists performing the examinations and later by another neurologist.

### IV. RESULTS

Fourteen (47%) of the 30 eligible Stauffer employees participated in the neurological evaluation, as did 15 (34%) of the 44 police and firefighting personnel, and 24 of the other persons in the area (18 [44%] of the 41 "symptomatic" persons and 6 [20%] of the 30 "matched" persons).

In all, 22 of the 53 persons examined had symptoms or physical examination abnormalities possibly relevant to peripheral neuropathy. While 15 had symptoms possibly relevant to peripheral neuropathy, only two had symptoms characteristic of it. One of these two, a fire investigator, had an L-5 radiculopathy (that is, his neuropathy was due to a lower back problem). The other, a sanitary district supervisor, had normal electrodiagnostic studies. He and 15 others (7 of whom had possibly

relevant symptoms) had physical examination abnormalities, primarily loss of pinprick sensation in the hands or feet. One symptomatic person had electrodiagnostic findings of carpal tunnel syndrome (compression of a nerve in the wrist, not due to toxic chemicals). Thus, in only two of the 22 cases of possibly relevant symptoms or physical examination abnormalities were the findings readily attributable to a musculoskeletal etiology.

On the basis of the electrodiagnostic studies, eight cases of definite or possible peripheral neuropathy were detected, two among Stauffer employees, one among police and firefighting personnel, and five among the other persons (Table 1). Four cases were unilateral, demyelinating, or hypertrophic neuropathies. The other four could have been toxic neuropathies, they but lacked either the usually associated clinical findings (other than sensory loss) or the typical axonal pattern.<sup>7,8</sup>

In summary, of the 20 persons who had symptoms or physical examination abnormalities not readily attributable to a musculoskeletal etiology, four had electrodiagnostic abnormalities. Of the 31 persons who had no relevant symptoms or physical examination abnormalities, four had electrodiagnostic abnormalities not readily attributable to a musculoskeletal etiology, although one of these four was a unilateral single-nerve neuropathy.

#### V. DISCUSSION

Many of the study's limitations are the result of factors extraneous to the design. These include the lack of nearby clinical facilities adequate for a study of this size, which - along with the severe weather conditions - undoubtedly adversely affected participation; the ill-defined target population, which was difficult to identify and locate; and the involvement of various governmental agencies with differing views concerning the study design. There were also intrinsic methodologic problems with the study. These included deficiencies in the design and, more importantly, in the use of the screening questionnaire; the lack of a clearly unexposed comparison group; the dependence on a self-selection process to recruit potential participants from among those people who were not Stauffer employees, police, or firefighting personnel; and the use of two different, analytically incompatible processes to determine which of these potential participants were eligible for the neurological evaluation.

Because of these methodologic and administrative problems, and because of the relatively low participation rates in all groups, a detailed epidemiologic analysis of the neurologic findings would be inappropriate since neither "positive" nor "negative" findings could validly be interpreted as the presence or absence, respectively, or a delayed neurotoxic effect from exposure to EPN (or other substances generated by the explosion). Furthermore, because of the participants may not have been adequately representative of the community, and because the

prevalence of peripheral neuropathies in the population is not known, it cannot be determined whether the eight detected cases reflect an excess occurrence of peripheral neuropathies in the community.

#### VI. RECOMMENDATIONS

1. The EPN manufacturing facility was destroyed by the explosion, and Stauffer is not planning to resume EPN reduction at the Chicago Heights plant. Therefore, there are no specific recommendations concerning minimizing employee exposures at the facility. For operations elsewhere involving EPN or related substances Stauffer should follow the pertinent industrial hygiene practices and medical surveillance recommendations described in the NIOSH criteria document for pesticide manufacturing.<sup>9</sup>
2. The EPN-contaminated building and production facilities have been disassembled. Workers involved in further demolition operations and removal of materials should be protected from exposure in accordance with the recommendations mentioned above.
3. Continued medical follow-up should be made available to workers who were exposed to EPN during ordinary production or maintenance operations or as a result of the explosion. Workers with symptoms or signs of neurologic dysfunction (such as loss of sensation, muscle weakness, impaired coordination) should have a neurological evaluation. Specific screening of EPN-exposed workers for such symptoms and signs could be done as part of a general medical surveillance program.
4. Firefighting and rescue workers responding to a chemical fire should be adequately protected from skin and respiratory exposure to toxic substances. The company manufacturing or using such substances should provide the fire department with accurate information concerning their identity, safety and health hazards. (Ideally, the fire department should systematically collect this information from businesses in its service area.) Fire departments should not rely solely on verbal assurances from company personnel that protective equipment isn't needed. Protective clothing and respirators should be used unless the fire department determines, from reliable documents or consultants, that such equipment is not necessary.

#### VII. DISTRIBUTION AND AVAILABILITY

For the purpose of informing the "affected employees" the employer should post this report at least 30 days in a prominent place(s) near where employees work.

Copies of this report will be available from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226 for 90 days. Thereafter, copies will be available from the National Technical Information Service



(NTIS), Springfield, Virginia. Information concerning its availability through NTIS can be obtained from the NIOSH Publications Office at the above Cincinnati address.

#### External Distribution

Stauffer Chemical Company  
Oil, Chemical and Atomic Workers Union Local 7765  
Illinois Department of Health  
Illinois Department of Labor  
U.S. Department of Labor, OSHA, Region V  
Study Participants

#### VIII. REFERENCES

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Table 1  
Electrodiagnostically Defined Cases of Definite  
or Possible Peripheral Neuropathy  
Chicago Heights, Illinois

	<u>Exposure Category</u>	<u>Possibly Relevant Symptoms</u>	<u>Neurological Examination Abnormalities</u>	<u>Electrodiagnostic Findings</u>
1.	Stauffer employee	None	None	Peripheral neuropathy
2.	Stauffer employee	Numbness and tingling in legs	None	Demyelinating neuropathy
3.	Police/fire-fighting personnel	None	None	Demyelinating neuropathy
4.	Other (see text)	Tingling in hands and arms	Stocking-glove sensory impairment in all 4 limbs; decreased ankle reflexes	Possible mild sensory neuropathy
5.	Other	None	Slightly decreased lower limb reflexes; mild static tremor of hands	Possible axonal neuropathy
6.	Other	None	None	Right peroneal neuropathy
7.	Other	Numbness and tingling in fingertips	Stocking-glove sensory impairment in all 4 limbs; ataxic gait	Mild sensory neuropathy
8.	Other	None	None	Hypertrophic neuropathy