WILLARD MACHLE, M. D.
610 PARK AVENUE
NEW YORK 21, N. Y.

16 August 1946

Dr. Robert A. Kehoe
Kettering Laboratory
College of Medicine
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Cincinnati 19, Ohio

Dear Bob:

Herewith report on Scientific Products Company, Beacon Falls, Connecticut. Slides are being forwarded under separate cover.

Cordially,

Bill

WM/rl

Willard Machle, M.D.

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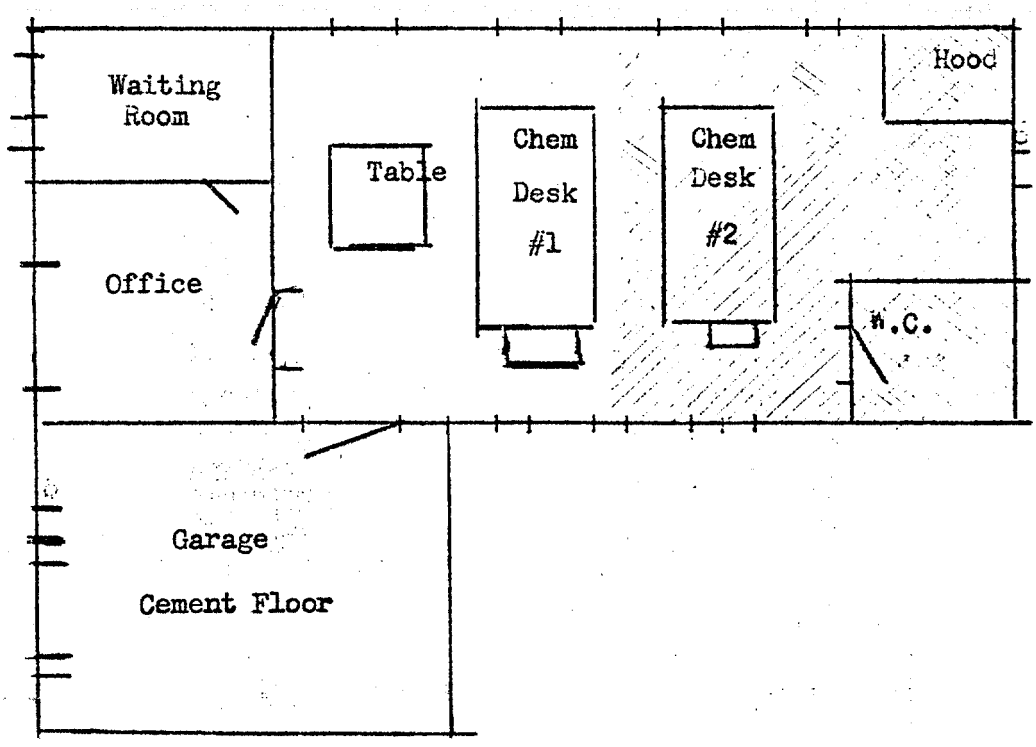
SCIENTIFIC PRODUCTS COMPANY
Beacon Falls
Connecticut

1. Description of Plant

The above company, owned by Dr. [redacted], is a small chemical company employing four men. Since its beginnings in December 1945, they have been engaged in the manufacture of small lots of specia chemicals, among which have been organic mercurials (for antiseptics and fungicides), Cresol derivatives phenyl esters etc.. The plant occupies a former police barracks of fair quality construction, situated about fifty feet from Highway 8, in the village of Beacon Falls, Connecticut (near Waterbury). The inside working space is about fifty by one hundred twenty-five feet with attached garage per rough sketch below. Floors of building of pine - concrete in garage. There is a dwelling (Dr. Bowles') above the main structure.



Ventilation is limited to that from windows and such air as is moved by a 300 cfm fan in the chemical hood. There is an additional portable 300 cfm fan which is installed at times before an opened window. Entire system is haphazard and unrelated to any local needs. The chemical hood in the corner of the building is about three by six feet in table area, is provided with windows and updraft only, and flow pattern is such that heavy vapors will escape into the room. Vent from hood fan is in side of building and effluent freely enters the residence apartment on the second floor.

Sewage disposal is direct to the Naugatuck River, a small stream of variable or stagnant flow, about one hundred fifty feet away. There is no preliminary treatment of wastes.

Cleansing facilities are limited to the sinks at the ends of the chemical tables and to a basin the W.C. enclosure, this room also being used for storage of rubber aprons, soiled clothing, gloves, shoes and towels.

2. Character of Exposure

The following materials were involved and are listed in the probable order of importance:

a. Mercury diethyl and its degradation products
b. Mercuric, and mercurous mercury alkyl salts (Ac., CO_3, etc.)
c. Mercurous and mercuric salts including Ac. CO_2, Oxides
d. Degradation products of TEL.
e. Benzol
f. Mercury
g. Other compounds which may result from reactions in the following procedure: (The presence of gummy oily mass at the end of the reaction suggests the presence of polymerization products of alkyl mercury compounds).

About May 1946, one case of 12 cases of pure TEL was acquired from Ethyl Corp. to be used as an alkyl carrier in the reaction for preparation of ethylmercuric acetate in syntheses of 3-Me, 6-alkyl, ethylmercuric, thiosodiumbenzoate. In the preparation of this antiseptic, one gm mol TEL and 1.1 gm mol HgAc are reacted in anhydrous benzene. The first operation was begun on 3 August 1946. Working outdoors, 400ml TEL were transferred from the can to a beaker, gloves and apron only being worn. There was no detectable odor or spillage. The TEL was taken into the laboratory and added to 6L anhydrous benzene (under hood) and reaction started by addition of Hg Ac. The reaction went poorly at low reflux temperature of 80 °C and crystallization did not occur in four hours. Mixture was then filtered on laboratory table near open window and allowed to stand 36 hrs till 5 August, at which time it was noted that the filtrate had turned salmon-red. The filtrate and ppt were then mixed and the benzene distilled off (at 200mm Hg) and the residue taken up in absolute EtOH (6L) and refluxed vigorously for 6 hours. On cooling, a small yield of needles was gotten. The mixture was then distilled to half (3L) volume when evidence of decomposition appeared in the shape of free mercury; mixture was then filtered hot and again concentrated by distillation to one-fourth original volume (1½L). There was further decomposition with more free mercury appearing. Mixture was then filtered and cooled with separation of a pasty, oily mass with the characteries of a super-cooled solid. Above procedure was carried out during 5th and 6th August. On 7th August, oily mass was subjected to numerous tests for identity - procedures occupying entire day - work stopping in evening because of pain from burns of hands of operators.

Direct exposure was limited to 3 employees in laboratory, Dr. [redacted] and [redacted] Most severe exposure was that of [redacted] who toil-

owed operations throughout, did the filtrations and tests of residue and was most careless in handling. He did not wear gloves at all times, and there is good presumption that he handled soiled flasks and later put hands in thiokol gloves in carrying out other operations.

Next in severity of exposure was [redacted] whose work was like that of [redacted] but who was careful to avoid contact and inhalation and who has a considerable respect for the dangers of chemicals in general.

[redacted] had the least exposure of the lot - he measured out the TEL and initiated the reaction - then departed.

Peak exposure of [redacted] and [redacted] Wednesday 7 August 1500-1930 hrs.

Sources of exposure were:

a. Vapors of reaction mixture - especially during decanting and filtration
b. Skin contact with material that had penetrated (perhaps) or been carried into gloves
   (1) Distribution and discrete character of lesions suggests carriage of material into gloves.
c. Dusts from spillage on floors and equipment
   (1) This spillage was much in evidence
d. Vapors and dusts from open Buchner funnels, beakers, and the evident gross deposits on outer surfaces of glassware from sloppage.
e. Owing to the course of the effluent vapors from the hood, there was secondary exposure of the occupants of the apartment on the upper story. This was limited to Mrs. [redacted] (including 3/9 of a child), two infants ages 20 and 8 months respectively, and to Dr. Bowles when 'at home'. Feed-back into the main laboratory space was also possible - this point was, however, not checked. The pollution of the general air of the residence was serious, however, since during our visit there was pronounced odor at various time in most of the rooms near the side of the hood and in the corridor.

   In the main laboratory space, the odors were quite strong and persistent - their pattern of distribution is indicated by the hatching in the sketch of the structure. (Cross-hatching = very strong) Odors were not like those of TEL or degradation products, but strongly suggestive of alkyl mercury salts - no sneezing was produced. Mustiness predominated.

3. Protective Measures

a. Technique of handling was poor and housekeeping worse. Material was left standing open on Chem desk #2 and spills of mixture on floors and equipment not wiped or cleansed. Dirty towels, aprons and clothing were responsible for the odor in the washroom.
b. Gloves and aprons were in good condition but dirty
c. No respirators are provided
d. Washing facilities (noted above)

4. Recommendations

a. Removal of residence from apartment and immediate cleanup of all product - to be buried.

b. Purchase, rather than manufacture, of the intermediate, ethyl mercury acetate or:
c. Isolation of operation - a separate building with concrete floor, ventilation and change room with shower.
d. Redesign of chemical hood with baffle and extension of vent pipe. Hood to be cleansed statim.
e. Provision of cleansing material - kerosene, sulphuryl chloride, bleach etc.
f. Coating of floors
g. Treatment of wastes in sump - with proper trapping and dilution.
h. Provision of baths for treatment of glassware prior to washing.
i. Construction of showers and separate lockers for clean and dirty clothing.
j. Procedure re impervious gloves
k. Canister masks in general laboratory - airline and canister in new building.
l. Sampling control of air.
m. Routine medical check.

CLINICAL DATA

A. [redacted] 13 August 1946

Owner - manager - chemist
Age 56 MSWD (4x) PROGENY 2 L&W

PI See joint history of exposure. General symptoms began nite of 7 August, with insomnia, chills and weakness and have persisted with slight increase in severity. Cutaneous lesions began with severe burning of fingers, nite of 7 August, causing stoppage of work. This was followed by deep pain in 48 hrs when a white, cooked appearance of skin of terminal phalanges, both hands was noted. Initially applied heat, then sodium bicarbonate for 3 hrs, then ethyl alcohol, then diethyl ether, then potassium iodide solution and finally ice water soaks which have been continued since. The insomnia is attributed to the pain which has been continuous. Since 8 August, there has been polyuria and frequency - q 2h day and nite. Appetite has been fair in past week - no nervousness, bad dreams, weight loss, etc. No fever, or sweats with chills. There were stabbing pains over spleen at times in past week.

IH Three years + 7 months medicine, PhD in chemistry, has done organic synthesis since age 25 with all types exposure. Was poisoned by phenyl bromide in 1924 - mainly pulmonary symptoms. No unusual exposure to any series - has done considerable work with organometallic compounds.

PMH Usual childhood diseases including scarlatina and diptheria. Shrapnel wound of face, head and neck in 1917, Hernioplasty 1928. Pneumonia 1943 - 4 days abed.

FH Father died 58 Apoplexy. Mother died 73 Nephritis. 2 sibs L&W

SYSTEMIC REVIEW

Gen	Health always good - a very active worker
C.R.	NR
GE	Appetite generally good - little breakfast - fair intake past week. constipation noted since 7 August 46
GU	Nycturia and polyuria since 8 August, very cloudy urine noted on 9 August
CNS	Blind right eye since birth. Glasses all times. Questionable

	irritability past five days.
Skin	NR till PI
Habits	Very irregular - works long hours with no relaxation, sport or diversion
Social	Activity limited to business and technical societies.
Diet	Home foods - well balanced - 1 pt milk daily. Occas alcohol. Heavy smoker - prefers coffee to water.
Pers Hyg	Good but careless.
Vacc	Smallpox
Allergy	Benzol vapors cause prompt headache. Sensitive to tomatoes.

PHYSICAL EXAMINATION

Ht 70½" Wt 131 (last record prior to PI) T 98.0 P 78 R 22
BP 125/76 (last record 15 June 46 - 136/84

GA	Emaciated, pale, hyperactive - aggressive rather than anxious.
Skin	General pallor. Severe corrosive burns volar aspect all fingers right hand and volar aspect first and second finger and thumb of left hand to level 3 and 2 phalanges - with slight involvement dorsal surfaces. (Distribution like that which would occur from the handling of glassware). The skin has a white, cooked appearance with a few blebs which contain bloody plasma. Lesions extend thru entire dermis in most of affected areas and red inflamed tissue is exposed beneath opened bleb. There is slight local swelling and little area redness. Local circulation appears unimpaired at this time.
Nodes	NR
Ears	NR
Eyes	R=L miosis. Reflexes and EOM OK. Fundus examination unsatisfactory.
Nose	NR
Mouth	Gums NR. Pallor m.m. Teeth fair with many large fillings and two permanent bridges.
Throat	Slight redness anterior pillars
Neck	NR
Thorax	Summetrical - good expansion
Heart	Tones soft but clear, regular
Lungs	B. S. inc vesicular - normal
Abdomen	NR Spleen not palpable, no tenderness, much gas in enteric tract.
Pelvis	NR
Joints	NR
Cr Nerv	Normal - no tremor
Reflexes	Normal activity - equal
Sensor	Normal
Muscul	Symmetrical, good strength, marked myotatic irritability.
Mental	Coherent, well oriented, normal. Is alert hypomanic type.

LABORATORY

Hb	80%
Diff	Poly 61 Non-Seg 4 Lg Lymph 20.5 Sm Lymph 13.5 Mono 3 Eo 0 Baso 1 Myelo 3 Myeloblasts 2
Urine	Neg for Albumin and Sugar. pH 6.0

IMPRESSION

1. Severe corrosive burns of fingers from mercury salts
2. Mild intoxication from organic mercury compounds

RECOMMENDATIONS

1. To call in from time to time re progress
2. Recheck in two weeks if indicated
3. General therapy - soporific, high fluid intake, rest, full diet, etc.
4. Therapy for hands - Advised Dr. Russell - procaine injection for pain, aspiration remainder of blebs, debridement as indicated, control of infection. Discontinue soaking and treat dry or with ointment.
5. Samples blood and urine taken. Several blebs on fingers were aspirated and 0.3ml bloody plasma obtained for analysis

B. [redacted]

Age 39 SEX Male

PI See joint history of exposure. Has had no general symptoms and has slept well except for nite of 7 August when was kept awake by pain from burns. Skin lesions started with intense pain in hands and fingers which lasted for thirty-six hours only. Twelve hours after onset, a few small vesicles appeared on hands - these were opened, leaving raw flesh beneath - most have epithelialized or crusted over.

LOCAL EXAMINATION

There are several 1 x 2cm opened blebs and numerous small (few mm) lesions on skin of both hands. A few are deep - most superficial and healing well with minimal areas of reaction.

On right forearm are several superficial reddened areas (1 x 3cm) with no gross destruction of skin or bleb formation. These suggest bromine or acid burns rather than lesions from metallic salts.

RECOMMENDATION

None - Samples blood and urine taken.

C. [redacted]

Salesman
Age 58

PI See joint history of exposure. There have been no general symptoms except anorexia, which has been an occasional occurrence. No insomnia etc.

LOCAL EXAMINATION

There is one healed burn of skin of index finger and base of thumb of left hand from contact with neck of flask. Initial symptom in few hours, as burning sensation - pain in 24 hrs and bleb in 36 hrs. This was left alone and dried and peeled in six days leaving dusky erythematous area.

RECOMMENDATION None - Blood and urine samples taken.