

## CODING FORMS FOR SRC INDEXING

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		TSCA Section	9E
Submitting Organization	DOW CHEMICAL CO		
Contractor			
Document Title	SUPPORT: LETTER FROM DOW CHEM CO RESPONDING TO USEPA REQUEST FOR ADD INFOR RE ACCIDENTAL EMPLOYEE LETHALITY FLLWNG DERMAL EXPOSURE TO 2,4-DICHLOROPHENOL, W/ATTCHMTS & DATED 062499		
Chemical Category	2,4-DICHLOROPHENOL		

A 03

OFFICE OF TOXIC SUBSTANCES  
CODING FORM FOR GLOBAL INDEXING

REV. 7/27/82

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A 04



8EHQ-0799-14302

RECEIVED  
OPPT CBIC

The Dow Chemical Company  
Midland, Michigan 48674

1999 JUL -1 AM 11:47

2030 DOW CENTER  
June 24, 1999



8EHQ-98-14302

CERTIFIED MAIL

ea

24009

Document Control Office (7407)  
Room G99 East Tower  
Attn: Section 8(e)  
Office of Pollution Prevention and Toxics  
US Environmental Protection Agency  
401 M Street, SW  
Washington, DC 20460-0001

CONTAINS NO CBI

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OPPT CBIC  
99 JUL 13 PM 1:43

Re: 8EHQ-1098-14302  
Response to EPA Letter Dated April 12, 1999

Dear Sir or Madam:

The Dow Chemical Company acknowledges receipt of your letter dated April 12, 1999, and signed by Richard H. Hefter, Chief, High Production Volume Chemicals Branch of the US Environmental Protection Agency (EPA). In that letter, EPA requested that Dow provide additional information related to the submission made by Dow under the Toxic Substances Control Act Section 8(e) on October 19, 1998. That submission related to a fatality suffered at a facility when a worker was over-exposed to 2,4-dichlorophenol. That incident has been fully investigated by Dow and the Michigan Occupational Safety & Health Administration (MIOSHA).

In response to requests 1 through 5 and request 6, the following documents from that investigation are enclosed:

- (1) Root Cause Investigation Summary
- (2) Material Safety Data Sheet dated 9/4/99
- (3) Material Safety Data Sheet dated 2/1/99
- (4) Standard Operating Procedure for Pump Preparation for Maintenance (SAFE9002)
- (5) Plant Treatment of Chemical Exposure - Safety Showers and Eye Baths
- (6) Personal Protective Equipment (PPE) Grid for the plant
- (7) Safe Work Permit (blank form)



89990000234

US Environmental Protection Agency

Attn: Section 8(e)

June 24, 1999

Page 2

- (8) Industrial Hygiene Report dated September 27, 1989: Comprehensive Industrial Hygiene Survey, Michigan Division Herbicides Plant, 948, 949, 1076 Buildings, February through August, 1989.

Regarding request 5, you will note in the enclosed materials, that dermal exposure was the sole route of exposure in this incident. A summary of Dow's findings are reiterated in the following enclosed document:

- (9) Dow Releases Formal Incident Findings

As to previous incidents at the same plant, I have enclosed the following document related to a 1980 fatality:

- (10) Midland Hospital Center Pathology Department Autopsy Examination of Victor Kniffen dated September 17, 1980.

In response to request 7, the answer is yes, Dow has notified its customers of this incident.

If you have additional questions regarding this matter, please direct them to the undersigned.

Sincerely,



Paul A. Wright  
Counsel  
Legal Department  
517/636-1853

Enclosures (1-10)

Exhibit 2-2  
**Root Cause Investigation Summary**

Dow Chem  
114532187 (W)  
11-12-98

THE DOW CHEMICAL COMPANY

**1. General Information (Shaded areas to be completed by Safety Department)**

<b>1.1 Report #</b>	<b>1.2 Date of Incident</b> 12/10/98	<b>1.3 Time of Incident</b> approximately 03:00	<b>1.4 Shift</b> Weekend 12-hour night shift
<b>1.5 # of days worked in shift</b> 02	<b>1.6 # of hours worked in shift</b> 09	<b>1.7 Date of Report</b> 19/10/98	<b>1.13 Dow Area</b> North America
<b>1.14 Region/Country</b> U.S.	<b>1.15 Site/Location</b> Michigan Operations	<b>1.16 Plant/Building</b> 948 Building	<b>1.17 Function/Business/ Technology Operations</b>
<b>1.18 Place</b> Process area	<b>1.21 Contractor Firm</b> N/A	<b>1.23 Type of Incident (check all that apply)</b> <input checked="" type="checkbox"/> DAWC <input type="checkbox"/> Loss* <input type="checkbox"/> MVA <input type="checkbox"/> PSA <input type="checkbox"/> RWC <input type="checkbox"/> RC* <input type="checkbox"/> Security <input type="checkbox"/> LE <input type="checkbox"/> RMTc <input type="checkbox"/> PSCMS* <input type="checkbox"/> Environmental <input type="checkbox"/> FAC <input type="checkbox"/> RMP* <input type="checkbox"/> Transportation	
<b>1.19 System Status</b> Shut down	<b>1.22 Type of Contractor</b> <input type="checkbox"/> Construction <input type="checkbox"/> Service <input type="checkbox"/> Maintenance <input type="checkbox"/> Operations		
<b>1.20</b> <input checked="" type="checkbox"/> Dow <input type="checkbox"/> Contractor			

<b>1.24 For: DAWC/RWC/RMTC/FAC</b>	<b>1.24.1 # Days Away from Work</b>
Name: <u>(Signature)</u> Function Years: <u>07</u>	Property Damage _____ Environmental Cleanup _____ Product Loss _____
Age: <u>29</u> Dow Years: <u>09</u>	<b>1.24.2 # Days Restricted Work</b>
Department: <u>Phenoxy Herbicides</u> ID #: <u>(Signature)</u>	Business Interruption _____ Other Loss _____ Days Outage (estimate) _____
Function: <u>Manufacturing</u> Business: <u>Dow Agro Sciences</u>	<b>Total</b> _____
<b>1.25 Investigation Team</b> Mark Cassells, Ryan Delcambre, Steve Eymann (Chairperson), Jeffrey Feerer, Bill Laney, Mark Neil, Mike Rio, Jim Semanco, Toby Threet, Lynne Warner	

**1.27 Description (Use additional sheet if necessary)**  
The 12 hour shift started at 6:30 pm. (Signature) was the Head Operator for the shift. Several equipment preparation jobs were verbally passed on from the previous shift. One of these tasks was to prepare the accumulator pump (P-3403 North) for maintenance. The plant was entering a planned maintenance shutdown, but this task had not been part of the shutdown plan. The previous shift noticed an accumulation of solid material, believed to be 2,4-DichloroPhenol on the pump at the seal area. This was believed to be indicative of a pump seal leak.

The shift took a break at 2:15 am. About 2:30 am the DCP Operator and Head Operator pumped the vessel that accumulates the distillation overhead product empty by starting and stopping the pump while monitoring the flow meter from the control room. The head operator then went out to the pump with a radio. It is believed that he was going to prepare the pump for maintenance. Plant policies require a safe work permit and special protective equipment, including a rubber suit, to prep a DCP pump. The Head Operator did not prepare a safe work permit and was not wearing a rubber suit. He asked the DCP Operator to close the pump outlet valves from the control room. He then shut off the pump using the field switch at 2:45 am.

It is believed that the head operator closed the pump suction and discharge valves, washed the solid accumulated DCP from the seal area using a plant condensate system hose and then connected the condensate hose to the pump suction drain valve using a double block and bleed assembly.

Apparently the Head Operator then opened the condensate supply and double block valves on the block and bleed, and then opened the pump drain valve to allow hot condensate to thaw any material that could be frozen in the drain. It is believed that condensate at up to 100 psi then entered the pump and sprayed DCP onto the operator through a hole in the pump seal flush tubing. This hole is believed to have been hidden and sealed by solid DCP until the solid material was washed off.

It is believed that the Head Operator went around the pump to close the double block valves. He then bypassed the nearest process safety shower and entered the control room, and went to the locker room shower at approximately 3:03 am.

At 3:05 the plant operators called 1-2-3. Security arrived at 3:07 to find the head operator unconscious and administered CPR. EMTs arrived and attempted Heart Start at 3:12 am. The hospital ambulance arrived and transported the head operator to the hospital. He was pronounced dead at 4:01 am.

Supervisor Signature: \_\_\_\_\_

**2. Incident Information - Only to be completed for Injury/Illness Incidents (Use Checklist of Choices (page 2) for each category below)**

<b>2.1 Type of Contact</b> Contact with hazardous chemical	<b>2.2 Nature of Injury/Illness</b> Death	<b>2.3 Affected Body Part</b> Forearms, knee, thigh and face
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**3. Incident Information - Only to be completed for Security Incidents (Use Checklist of Choices (page 3) for each category below)**

<b>3.1 Type of Incident</b>	<b>3.2 Perpetrator</b>	<b>3.3 Reported to Police</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>3.4 Amount Recovered</b>
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**4. Incident Information - Only to be completed for Loss Incidents (Use Checklist of Choices (pages 3 & 4) for each category below)**

<b>4.1 Type of Loss</b>	<b>4.2 Incident Classification</b>	<b>4.3 Component Involved</b>	<b>4.4 Loss Minimized by the Following Loss Control Factors</b>
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**4.5 Learning Experience (Use additional sheet if necessary)**

The information on this form has been collected from available sources and is reported in good faith. However, accuracy cannot be guaranteed in all instances nor are the conclusions necessarily based on any professional expertise. (This record's retention time is one year plus current.)

5. Incident Information - Only to be completed for Environmental Incidents (i.e. Chemical Releases, Spills, Leaks, etc.)				
5.1 Location where Initiated	5.2 Loss of Containment To	5.3 Physical Property	5.4 Chemical	
5.5 Quantity Released	5.6 CAS Number	5.7 Impact on Environment or Community		
5.8 Reported to Government Agency				
6. Incident Information - Complete sections 2, 4, and 5 for Transportation Incidents				
7. Recommendations				
List all recommendations along with the person responsible for the follow-up actions and the completion dates. Every immediate and/or root cause requires an action. Use checklists on pages 4, 5, and 6 of this form.				
Identified Root/Immediate Causes (each)	For Each Underlying Cause, List Actions to Prevent Recurrence	Person Responsible for Action	Scheduled Completion Date	Completion Date
Employee chose to initially pressurize pump in the immediate vicinity vs. remotely.	Evaluate and modify procedures to reflect this issue as appropriate with special emphasis on: - equipment prep - unplugging - hazardous materials etc. (948, Global Tech Centers) Train employees on the changed procedures, using the Management of Change procedure. (948, Global Tech Center)	Paul Vammer/Mark Neil (948) Global Tech Center Managers  Paul Vammer/Mark Neil (948) Global Tech Center Managers	12/1/98 3/1/99  12/18/98 3/22/99	
Tubing was copper, which has an estimated corrosion rate of 20 mils per year in DCP service and is not listed in the process piping and equipment specifications for this plant.	Inspect process fluid contacting lines to assure proper material of construction (948), emphasis: - seal flushes/pots - instrument connections - drains - sample lines Re-do/evaluate piping, equipment and instrumentation specs to assure proper materials. Specifically exclude the use of copper in DCP service and common materials in DCP service as appropriate. (948) Do the evaluation as described above, with emphasis on seal flushes, instrument lines, drains, sample lines (global tech centers)	Paul Vammer (948)  Paul Vammer (948)  Tech Center Managers	10/23/98  11/1/98  3/1/99	
Employee presumably didn't anticipate exposure, and employee did not take action to protect himself with the proper protective equipment as prescribed in this plant's procedures.	Establish a policy that anytime there is a known or suspected leak, the clearing and maintenance procedures must be considered as a line and equipment opening, with respect to PPE (948, global)	Paul Vammer (948) Business and Functional Leaders	11/1/98 3/1/99	
Employee didn't have a safe work permit to do job as prescribed by this plant's procedures.	Visibly communicate and post a statement of clear management expectation policy that we will follow and use procedures 100% of the time in running our plants, or change them using MOC, and that we will enforce this policy. (948, global, site)	Paul Vammer (948) Vince Smith (Site) Arnold Allemang (Global)	11/1/98 11/1/98 12/1/98	
Possibly insufficient employee understanding of hazard of molten DCP.	Communicate to employees, customers, other producers, users of DCP the new understanding of the hazards believed to be associated with dermal absorption of molten DCP. (948, DAS) Include a description of this incident in the plant archives (948, DAS) Update annual hazard review training (948, DAS) Review entire HazCom training package for effectiveness (948, DAS)	Paul Vammer (948) Garry Hamlin (DAS)  Paul Vammer/Mark Neil (948) Mark Cassells (DAS) Paul Vammer/Mark Neil (948) Mark Cassells (DAS) Paul Vammer/Mark Neil (948) Mark Cassells (DAS)	10/23/98 11/1/98  11/1/98 11/1/98 12/1/98 12/1/98 12/1/98 12/1/98	
MSDS does not expressly address possible difference in response time and effect of molten as compared to solid DCP.	Update MSDS with new understanding of the hazards believed to be associated with molten DCP. (Global, 948, DAS) Evaluate the need for possible changes to hazard information on the hazards of dermal absorption of other room temperature solids handled in a molten state (DAS)	Cathy Baase (Global) Mark Neil (948) Mark Cassells (DAS) Mark Cassells (DAS)	12/1/98 12/1/98 12/1/98 12/1/98	

The information on this form has been collected from available sources and is reported in good faith. However, accuracy cannot be guaranteed in all instances nor are the conclusions necessarily based on any professional expertise. (This record's retention time is one year plus current.)

	Submit this case history for publication in medical literature. (DAS, global)	Cathy Baase (Global) Mark Cassells (DAS)	12/1/98 12/1/98	
Possible inadequacy of or failure to follow procedure to periodically review MSDS or add new data	Review and modify as appropriate, the procedures for routine and event triggered updates of MSDS (Global) Assure adequate procedure exists for notifying and incorporating MSDS changes in plant operating discipline (948, global EH&S Delivery)	Greg Bona (Global) Cathy Baase (Global)  Mark Neil (948) Mike Rio (Global EH&S Delivery)	1/1/99  1/1/99 1/1/99	
Possible lack of intervention	Broadly communicate any roles that positive intervention could have played in avoiding this fatality. Do this in a general way, not specific to individuals. (global, site) - Global corporate communication - Global Operations communication - Site safety program communications Global Responsible Care* structure develop an intervention program intended to substantially improve intervention across the company. (global)	Bill Stavropoulos (Global) Arnold Altemang (Global) Jeff Feerer/Bill Laney (Site)  Mike Rio (Global)	11/1/98 11/15/98 11/1/98  3/1/99	
Employee bypassed nearest safety shower.	Publicize the impact of our new understanding of the possibly higher dermal absorption rate for molten DCP on the need for rapid decontamination. (948, DAS) Develop training aids that clearly demonstrate the possible impact of exposure time on severity of dermal exposure to molten DCP and emphasize existing safety shower policies. (948, DAS)	Paul Vammer (948) Mark Cassells (DAS)  Mark Neil (948) Mark Cassells (DAS)	11/1/98 11/1/98  1/1/98 1/1/99	

**Checklist of Choices for Sections 2.1, 2.2 and 2.3 Incident Information**

<p><b>2.1 Type of Contact</b></p> <input type="checkbox"/> Struck against <input type="checkbox"/> Struck by <input type="checkbox"/> Caught in/on/between <input type="checkbox"/> Fall on same level Specify: _____ <input type="checkbox"/> Fall to lower level Specify: _____ <input type="checkbox"/> Contact with or exposure to: <input type="checkbox"/> Welding light <input type="checkbox"/> Explosion <input type="checkbox"/> Surface area <input type="checkbox"/> Steam <input type="checkbox"/> Hot condensate <input type="checkbox"/> Radiation <input type="checkbox"/> Extreme noise <input type="checkbox"/> Particle or sliver <input type="checkbox"/> Electricity <input type="checkbox"/> Arc flash <input type="checkbox"/> Current <input checked="" type="checkbox"/> Chemicals <input type="checkbox"/> Flammable <input checked="" type="checkbox"/> Poisonous <input checked="" type="checkbox"/> Corrosive <input type="checkbox"/> Irritating <input type="checkbox"/> Bodily reaction	<p><b>2.2 Nature of Injury/Illness</b></p> <input checked="" type="checkbox"/> Injury <input checked="" type="checkbox"/> Death <input type="checkbox"/> Amputation <input type="checkbox"/> Thermal burns <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input checked="" type="checkbox"/> Chemical burns <input type="checkbox"/> Crushed body part <input type="checkbox"/> Fracture <input type="checkbox"/> Torn ligaments/sprain/strain <input type="checkbox"/> Bruise <input type="checkbox"/> Concussion <input type="checkbox"/> Cut/abrasion/puncture <input type="checkbox"/> Inhalation (one time) <input type="checkbox"/> Dislocation of joint <input type="checkbox"/> Hernia <input checked="" type="checkbox"/> Poisoning (one exposure) <input type="checkbox"/> Infection <input type="checkbox"/> Electric shock <input type="checkbox"/> Illness <input type="checkbox"/> Repeated trauma disorder <input type="checkbox"/> Disorder due to repeated exposure to physical agents <input type="checkbox"/> Skin diseases or disorders <input type="checkbox"/> Dust disease <input type="checkbox"/> Respiratory disease due to toxic agents <input type="checkbox"/> Poisoning due to repeated exposure	<p><b>2.3 Affected Body Part</b></p> <input checked="" type="checkbox"/> Head <input type="checkbox"/> Scalp <input checked="" type="checkbox"/> Face <input type="checkbox"/> Eye <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Ear <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Nose <input type="checkbox"/> Mouth <input type="checkbox"/> Neck <input type="checkbox"/> Chest/ribs <input type="checkbox"/> Back <input checked="" type="checkbox"/> Internal organs <input type="checkbox"/> Lungs <input type="checkbox"/> Kidney <input checked="" type="checkbox"/> Heart <input type="checkbox"/> Liver <input type="checkbox"/> Other <input checked="" type="checkbox"/> Arm <input type="checkbox"/> Shoulder <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Elbow <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Wrist <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Hand <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Finger <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> r <input type="checkbox"/> l <input checked="" type="checkbox"/> Other forearm <input checked="" type="checkbox"/> Leg <input type="checkbox"/> Hip <input type="checkbox"/> r <input type="checkbox"/> l <input checked="" type="checkbox"/> Knee <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Ankle <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Foot <input type="checkbox"/> r <input type="checkbox"/> l <input type="checkbox"/> Toe <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> r <input type="checkbox"/> l <input checked="" type="checkbox"/> Other Thigh <input type="checkbox"/> Abdomen <input checked="" type="checkbox"/> Multiple
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The information on this form has been collected from available sources and is reported in good faith. However, accuracy cannot be guaranteed in all instances nor are the conclusions necessarily based on any professional expertise. (This record's retention time is one year plus current.)

A 10

DowElanco  
 Law Department  
 9130 Zionsville Road  
 Indianapolis, IN 46268-1053 U.S.A.  
**M A T E R I A L S S A F E T Y D A T A S H E E T**  
 -----  
 DowElanco Indianapolis, IN 46268 Emergency Phone: 517-636-4400

Product Code: 20626  
 Product: 2,4-DICHLOROPHENOL

Page: 1

Effective Date: 09/04/96

Date Printed: 10/22/96

MSD: 000715



1. INGREDIENTS: (% w/w, unless otherwise noted)

2,4-DICHLOROPHENOL, MIN. CAS# 000120-83-2 97.0% 97.5  
 OTHER PHENOLIC COMPOUNDS  
 (PHENOL, PARACHLOROPHENOL, ORTHOCHLOROPHENOL,  
 2,6-DICHLOROPHENOL, 2,4,6-TRICHLOROPHENOL)  
 WATER 0.1%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 419F, 215C  
 VAP PRESS: (mmHg at 20C) 0.10  
 VAP DENSITY (Air = 1): 5.6  
 SOL. IN WATER: 0.45 g/100g  
 SP. GRAVITY: 1.382 (60C/4C)  
 FREEZE POINT: 108F, 42C  
 APPEARANCE: Crystalline needles. Colorless liquid when melted.  
 ODOR: Strong phenolic-type odor

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: 219F, 104C  
 METHOD USED: TCC

FLAMMABLE LIMITS

LFL: Not determined.  
 UFL: Not determined.

EXTINGUISHING MEDIA: Water fog, CO2, dry chemical.

Use water only after other alternative extinguishing media are exhausted.

FIRE & EXPLOSION HAZARDS: Toxic, irritating gases may be formed under fire conditions. Contain water from fire-

(Continued on Page 2)

(\*) Indicates a Trademark of DowElanco

**A 11**

DowElanco  
Law Department  
9330 Zionsville Road  
Indpls., IN 46268-1054 U.S.A.  
DowElanco Indianapolis, IN 46268 Emergency Phone: 517-636-4400

Product Code: 20636  
Product: 2,4-DICHLOROPHENOL

Page: 2

Effective Date: 09/04/96 Date Printed: 10/22/96 MSD: 000715



**3. FIRE AND EXPLOSION HAZARD DATA: (CONTINUED)**

fighting to prevent entry to water supplies.

**FIRE-FIGHTING EQUIPMENT:** Wear positive-pressure, self-contained breathing apparatus and full protective equipment.

**4. REACTIVITY DATA:**

**STABILITY: (CONDITIONS TO AVOID)** Stable at normal handling and storage conditions.

**INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID)** Moderately corrosive to steel if wet. Consult DowElanco if more information is required.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Hydrochloric acid and other toxic, irritating products may be produced if product is involved in fire.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**5. ENVIRONMENTAL AND DISPOSAL INFORMATION:**

**ACTION TO TAKE FOR SPILLS/LEAKS:** In case of spill in confined area, use respiratory protection as indicated in Handling Precautions Section. Also wear protective clothing as indicated in Handling Precautions Section. Contain and sweep up small spills. Do not use water to wash down spill area. For large spills, consult DowElanco.

**DISPOSAL METHOD:** Contaminated runoff water can be toxic to fish. Bury unsalvageable material in area away from domestic water supplies in accordance with applicable federal, state and local regulations. For help in disposal of large amounts, contact DowElanco.

**6. HEALTH HAZARD DATA:**

**EYE:** MAY CAUSE SEVERE IRRITATION WITH CORNEAL INJURY WHICH MAY RESULT IN PERMANENT IMPAIRMENT OF VISION, EVEN BLINDNESS.  
MATERIAL MAY BE HANDLED AT ELEVATED TEMPERATURES; CONTACT WITH

(Continued on Page 3)

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DowElanco  
Law Department  
9330 Zionsville Road  
Indpls., IN 46268-1054 U.S.A.

DowElanco Indianapolis, IN 46268 Emergency Phone: 517-636-4400

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6. HEALTH HAZARD DATA: (CONTINUED)

HEATED MATERIAL MAY CAUSE THERMAL BURNS. ELEVATED TEMPERATURES MAY GENERATE VAPOR LEVELS SUFFICIENT TO CAUSE EYE IRRITATION.

SKIN CONTACT: SHORT SINGLE EXPOSURE MAY CAUSE SKIN BURNS. A SINGLE PROLONGED EXPOSURE MAY RESULT IN THE MATERIAL BEING ABSORBED IN AMOUNTS WHICH COULD CAUSE DEATH. THE LD50 FOR SKIN ABSORPTION IN RABBITS IS 1400 (5% SOLUTION)-4000 (SOLID) MG/KG. MATERIAL MAY BE HANDLED AT ELEVATED TEMPERATURES; CONTACT WITH HEATED MATERIAL MAY CAUSE THERMAL BURNS. 2,4-DCP IS ABSORBED MORE READILY THROUGH SKIN WHEN IN SOLUTION THAN AS SOLID.

INGESTION: Single dose oral toxicity is considered to be low. The oral LD50 for rats is 2000-5000 mg/kg. Small amounts that might be swallowed incidental to normal handling operations are not likely to cause injury; swallowing larger amounts may cause injury. Ingestion may cause burns of mouth and throat.

INHALATION: DUSTS MAY CAUSE SEVERE IRRITATION OF THE UPPER RESPIRATORY TRACT (NOSE AND THROAT). ELEVATED TEMPERATURES MAY GENERATE VAPOR LEVELS SUFFICIENT TO CAUSE RESPIRATORY IRRITATION.

SYSTEMIC & OTHER EFFECTS: Excessive exposure may cause hemopoietic injury (damage to blood forming organs). Repeated excessive exposures may cause liver and kidney effects. In laboratory animals, 2,4-dichlorophenol had some effect on various immune responses, effects not directly applicable to humans.

CANCER INFORMATION: 2,4-Dichlorophenol did not cause cancer in long-term animal studies. 2,4,6-Trichlorophenol, a suspect carcinogen under OSHA (listed by IARC), may be present at 0.1% in current samples. This impurity may have also been present when 2,4-dichlorophenol was tested for carcinogenicity and produced inconclusive results.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no adverse effects on the mother should have no effect on the fetus.

(Continued on Page 4)

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DowElanco Indianapolis, IN 46268

Emergency Phone: 517-636-4400

Product Code: 20636  
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Page: 4

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6. HEALTH HAZARD DATA: (CONTINUED)

REPRODUCTIVE EFFECTS. No relevant information found.

MUTAGENICITY: In vitro mutagenicity studies were negative in some cases and positive in other cases.

7. FIRST AID:

EYES: Immediately flush eyes with plenty of water for at least 30 minutes. Prompt medical consultation is essential.

SKIN: IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING.

INGESTION: Do not induce vomiting. Give large amounts of water or milk if available and transport to a medical facility.

INHALATION: Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN: May cause tissue destruction leading to stricture. If lavage is performed, suggest endotracheal and/or esophageal control. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): Dow Industrial Hygiene Guide is 1 ppm for 2,4-dichlorophenol.

VENTILATION: PROVIDE GENERAL AND/OR LOCAL EXHAUST VENTILATION TO CONTROL AIRBORNE LEVELS BELOW THE EXPOSURE GUIDELINES.

RESPIRATORY PROTECTION: ATMOSPHERIC LEVELS SHOULD BE MAINTAINED BELOW THE EXPOSURE GUIDELINE. FOR MOST CONDITIONS, NO RESPIRATORY PROTECTION SHOULD BE NEEDED; HOWEVER, IF HANDLING AT ELEVATED TEMPERATURES WITHOUT SUFFICIENT VENTILATION, USE AN APPROVED AIR-PURIFYING RESPIRATOR. IF RESPIRATORY IRRITATION IS EXPERIENCED, USE AN APPROVED AIR-PURIFYING RESPIRATOR.

(Continued on Page 5)

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Product Code: 20636  
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8. HANDLING PRECAUTIONS: (CONTINUED)

**SKIN PROTECTION:** Use protective clothing impervious to this material. Selection of specific items such as face shield, gloves, boots, apron, or full body suit will depend on OPERATION. SAFETY SHOWER SHOULD BE LOCATED IN IMMEDIATE WORK AREA. REMOVE CONTAMINATED CLOTHING IMMEDIATELY, WASH SKIN AREA WITH SOAP AND WATER, AND LAUNDER CLOTHING BEFORE REUSE. CONTAMINATED LEATHER ITEMS, SUCH AS SHOES, BELTS AND WATCHBANDS SHOULD BE REMOVED AND DESTROYED. USE GLOVES WITH INSULATION FOR THERMAL PROTECTION, WHEN NEEDED.

**EYE PROTECTION:** USE CHEMICAL GOGGLES. EYE WASH FOUNTAIN SHOULD BE LOCATED IN IMMEDIATE WORK AREA. IF VAPOR EXPOSURE CAUSES EYE DISCOMFORT, USE A FULL-FACE RESPIRATOR.

9. ADDITIONAL INFORMATION:

**SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Do not get in eyes, on skin or clothing. Avoid breathing dusts or vapors. Do not take internally.

**MSDS STATUS:** Revised section 6.

For information regarding state/provincial and federal regulations see the Regulatory Information Section.

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**B 01**

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MSD: 000715



**REGULATORY INFORMATION:** (Not meant to be all-inclusive-- selected regulations represented.)

**NOTICE:** The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

**U.S. REGULATIONS**

**SARA 313 INFORMATION:** This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
2,4,6-TRICHLOROPHENOL	000088-06-2	0.1 *
2,4-DICHLOROPHENOL	000120-83-2	97 *

**SARA HAZARD CATEGORY:** This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

- An immediate health hazard
- A delayed health hazard

(Continued on Page R-2)

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**B 02**

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Product Code: 20636 Page: R-2  
Product: 2,4-DICHLOROPHENOL

Effective Date: 09/04/96 Date Printed: 10/22/96 MSD: 000715



REGULATORY INFORMATION: (CONTINUED)

CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986:

This product contains a chemical(s) known to the State of California to cause cancer.  
(See Section 3 or 11 of the MSDS for details on carcinogenicity.)

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

If you export this product, verify that the ingredients meet the inventory listing requirements of the receiving country or contact DowElanco.

OSHA HAZARD COMMUNICATION STANDARD:

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Health	3
Flammability	1
Reactivity	1

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The Information Herein Is Given In Good Faith, But No Warranty, Express Or Implied, Is Made. Consult The DowElanco Company For Further Information.

# MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994  
 Dow AgroSciences LLC  
 Indianapolis, IN 46268

## 2,4-DICHLOROPHENOL

Effective Date: 2/1/99  
 Product Code: 20636  
 MSDS Number: 000715

### 1. PRODUCT AND COMPANY IDENTIFICATION:

**PRODUCT:** 2,4-Dichlorophenol

**COMPANY IDENTIFICATION:**

Dow AgroSciences  
 9390 Zionsville Road  
 Indianapolis, IN 46268-1189

**EYE:** May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Material may be handled at elevated temperatures; contact with heated material may cause thermal burns. Elevated temperatures may generate vapor levels sufficient to cause eye irritation.

### 2. COMPOSITION/INFORMATION ON INGREDIENTS:

2,4-Dichlorophenol	CAS # 000120-83-2	97.5%
Phenolic compounds, including:		2.5%
2,6-Dichlorophenol	CAS # 000087-65-0	
2,4,6-Trichlorophenol	CAS # 000088-06-2	

**SKIN:** Brief single exposure may cause skin burns. Molten or hot 2,4-dichlorophenol is immediately absorbed through the skin in amounts which have caused death in humans. Rapid death in humans has been caused by skin exposure without immediate decontamination. Amounts of molten 2,4-dichlorophenol that may cover as little as 1% body surface area (hand-sized) may cause death. The LD<sub>50</sub> for skin absorption in rabbits is 1400 mg/kg (50% solution) and 4000 (solid) mg/kg. Material may be handled at elevated temperatures; contact with heated material may cause thermal burns. 2,4-Dichlorophenol is absorbed more readily through the skin when in a solution or molten than as a solid. DOT CLASSIFICATION: CORROSIVE SOLID, TOXIC, N.O.S.

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not "Hazardous" per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

### 3. HAZARDOUS IDENTIFICATIONS:

#### EMERGENCY OVERVIEW

Hazardous chemical. Product form is crystalline needles with strong phenolic-type odor. **MOLTEN OR HOT 2,4-DICHLOROPHENOL IS IMMEDIATELY ABSORBED THROUGH THE SKIN IN AMOUNTS WHICH HAVE CAUSED DEATH IN HUMANS. RAPID DEATH IN HUMANS HAS BEEN CAUSED BY SKIN EXPOSURE WITHOUT IMMEDIATE DECONTAMINATION. AMOUNTS OF MOLTEN 2,4-DICHLOROPHENOL THAT MAY COVER AS LITTLE AS 1% BODY SURFACE AREA (HAND-SIZED) MAY CAUSE DEATH.** May cause severe eye irritation with corneal injury which may result in permanent impairment of vision, even blindness. Brief single exposure may cause skin burns. Contact with heated material may cause thermal burns. LD<sub>50</sub> for skin absorption in rabbits is 1400 (50% solution) - 4000 (solid) mg/kg. Oral LD<sub>50</sub> for rats is 2000-5000 mg/kg. DOT CLASSIFICATION: CORROSIVE SOLID, TOXIC, N.O.S. Flash point is 219°F (104°C). Freeze point is 108°F (42°C). Toxic to aquatic organisms.  
**EMERGENCY PHONE NUMBER: (U.S.) 800-992-5994**

**INGESTION:** Single dose oral toxicity is low. The oral LD<sub>50</sub> for rats is 2000-5700 mg/kg. Small amounts that might be swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing large amounts may cause injury. Ingestion may cause burns of the mouth and throat.

**INHALATION:** Dusts may cause severe irritation of the upper respiratory tract (nose and throat). Elevated temperatures may generate vapor levels sufficient to cause respiratory irritation.

**SYSTEMIC & OTHER EFFECTS:** In animals, effects have been reported on the following organs: blood forming organs, kidney and liver.

**CANCER INFORMATION:** 2,4-Dichlorophenol did not cause cancer in laboratory animals. This mixture contains 2,4,6-Trichlorophenol which is listed as a potential carcinogen for hazard communication purposes under OSHA Standard 29 CFR 1910.1200. 2,4,6-Trichlorophenol may be present as an impurity at 0.1% in current samples. This material may also have been present when 2,4-dichlorophenol was tested for carcinogenicity and produced inconclusive results.

**POTENTIAL HEALTH EFFECTS:** This section includes possible adverse effects which could occur if this material is not handled in the recommended manner.

# MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994  
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 Indianapolis, IN 46268

## 2,4-DICHLOROPHENOL

Effective Date: 2/1/99  
 Product Code: 20636  
 MSDS Number: 000715

**TERATOLOGY (BIRTH DEFECTS):** Birth defects are unlikely. Exposures having no adverse effects on the mother should have no effect on the fetus.

**REPRODUCTIVE EFFECTS:** No relevant information found.

### 4. FIRST AID:

**EYES:** Immediate and continuous irrigation with flowing water for at least 30 minutes is imperative. Prompt medical consultation is essential.

**SKIN:** In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoe. Destroy and dispose of items which cannot be decontaminated, such as shoes. Seek medical attention.

**INGESTION:** Do not induce vomiting. Give large amounts of water or milk if available and transport to a medical facility. Do not give anything by mouth to an unconscious person.

**INHALATION:** Remove to fresh air if effects occur. Consult a physician.

**NOTE TO PHYSICIAN:** This material causes hypokalemia and compromises kidney function. Electrolytes and fluid balance should be closely monitored. May cause tissue destruction leading to stricture. If lavage is performed, suggest endotracheal and/or esophageal control. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

### 5. FIRE FIGHTING MEASURES:

**FLASH POINT:** 219°F (104°C)  
**METHOD USED:** TCC

**FLAMMABLE LIMITS**  
**LFL:** Not determined  
**UFL:** Not determined

**EXTINGUISHING MEDIA:** Water fog, CO<sub>2</sub>, dry chemical. Use water only after other alternative extinguishing media are exhausted.

**FIRE & EXPLOSION HAZARDS:** Toxic, irritating gases are formed under fire conditions. Contain water from fire-fighting to prevent entry to surface or groundwater.

**FIRE-FIGHTING EQUIPMENT:** Wear positive-pressure, self-contained breathing apparatus and full protective equipment. See Section 8 for additional personal protective equipment (PPE) recommendations.

### 6. ACCIDENTAL RELEASE MEASURES:

**ACTION TO TAKE FOR SPILLS/LEAKS:** Contain and sweep up small spills of flaked 2,4-dichlorophenol. Do not use water to wash down spill area. For molten 2,4-dichlorophenol, wear full PPE, dike the area, and allow the material to solidify and follow the above procedures for flaked material. If a large spill occurs, immediately notify Dow AgroSciences at 800-992-5994.

### 7. HANDLING AND STORAGE:

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:**

**HANDLING OF FLAKED 2,4-DICHLOROPHENOL:**  
**DANGER.** Keep out of reach of children. Causes severe eye burns. Causes severe skin burns. May be fatal if absorbed through the skin. Causes severe burns of the mouth and throat. Dust and vapors are extremely irritating if inhaled. May cause liver, kidney and blood effects. See Section 3, 4, & 8 for additional information.

**HANDLING OF MOLTEN 2,4-DICHLOROPHENOL:**  
 Molten or hot 2,4-dichlorophenol is immediately absorbed through the skin in amounts which have caused death in humans. Rapid death in humans has been caused by skin exposure without immediate decontamination. Amounts of molten 2,4-dichlorophenol that may cover as little as 1% body surface area (hand-sized) may cause death. Brief contact with heated material may cause thermal burns. See Section 3, 4, & 8 for additional information.

**STORAGE:** Stable at normal handling and storage conditions. Store in original container.

# MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994  
Dow AgroSciences LLC  
Indianapolis, IN 46268

## 2,4-DICHLOROPHENOL

Effective Date: 2/1/99  
Product Code: 20636  
MSDS Number: 000715

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where a potential for exposure exists. Emergency conditions may require additional precautions.

**EXPOSURE GUIDELINE(S):** 2,4-Dichlorophenol: Dow AgroSciences Industrial Hygiene Guideline is 1 ppm, skin. (Molten or hot 2,4-dichlorophenol is immediately absorbed through the skin in amounts which have caused death in humans. Rapid death in humans has been caused by skin exposure without immediate decontamination. Amounts of molten 2,4-dichlorophenol that may cover as little as 1% body surface area (hand-sized) may cause death).

A "skin" notation following the exposure guideline refers to the potential for dermal absorption of the material. It is intended to alert the reader that inhalation may not be the only route of exposure and that measures to minimize dermal exposures should be considered.

**ENGINEERING CONTROLS:** Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

**RESPIRATORY PROTECTION:** Atmospheric levels should be maintained below the exposure guideline. For most conditions, no respiratory protection should be needed; however, if handling at elevated temperatures without sufficient ventilation, or respiratory irritation is experienced, use a NIOSH approved air-purifying respirator for organic vapors.

**SKIN PROTECTION:** Use protective clothing impervious to this material. Selection of specific items such as face shield, gloves, boots, apron, or full body suit will depend on operation. Use gloves, impervious to this material, at all times. Safety shower should be located in immediate work area. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse. Items which cannot be decontaminated, such as shoes, belts, and watchbands, should be removed, destroyed, and disposed. Use gloves with insulation for thermal protection, when needed. The following personal protective clothing is recommended: gloves: nitrile or neoprene; boots: neoprene; suit: Saranex, neoprene, or Kapler CPF3.

**EYE PROTECTION:** Use chemical goggles. Eye wash fountain should be located in immediate work area. If vapor exposure causes eye discomfort, use a NIOSH approved full-face respirator for organic vapors.

### 9. PHYSICAL AND CHEMICAL PROPERTIES:

**BOILING POINT:** 419°F (215°C)  
**VAPOR PRESSURE:** (mmHg @ 20°C) 0.10  
**VAPOR DENSITY (Air=1)** 5.6  
**SOLUBILITY IN WATER:** 0.45g/100g  
**SPECIFIC GRAVITY:** 1.382 (60°C/4°C)  
**FREEZE POINT:** 108°F, 42°C  
**APPEARANCE:** Crystalline needles. Colorless liquid (melted)  
**ODOR:** Strong phenolic-type

### 10. STABILITY AND REACTIVITY:

**STABILITY: (CONDITIONS TO AVOID)** Stable at normal handling and storage conditions.

**INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID)** Moderately corrosive to steel if wet. Consult Dow AgroSciences for additional information.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Hydrochloric acid and other toxic, irritating products may be produced if product is involved in fire.

**HAZARDOUS POLYMERIZATION:** Not known to occur.

### 11. TOXICOLOGICAL INFORMATION:

**MUTAGENICITY (EFFECTS ON GENETIC MATERIAL):** In vitro mutagenicity studies were negative in some cases and positive in other cases.

### 12. ECOLOGICAL INFORMATION:

#### ENVIRONMENTAL FATE:

**MOVEMENT AND PARTITIONING:** Bioconcentration potential is moderate (BCF between 100 and 3000 or Log Pow between 3 and 5). Potential for mobility in soil is low (Koc between 500 and 2000). Measured log octanol/water partition coefficient (log Pow) is 3.06. Log soil organic carbon partition coefficient (Log Koc) is 2.74. Bioconcentration factor (BCF) in fish is 34.

# MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994  
Dow AgroSciences LLC  
Indianapolis, IN 46268

## 2,4-DICHLOROPHENOL

Effective Date: 2/1/95  
Product Code: 20636  
MSDS Number: 000715

**DEGRADATION AND PERSISTENCE:** Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD greater than 40%).

5-Day biochemical oxygen demand (BOD5) is 0.90 p/p.  
10-Day biochemical oxygen demand (BOD10) is 0.92 p/p.  
20-Day biochemical oxygen demand (BOD20) is 0.92 p/p.  
Theoretical oxygen demand (ThOD) is calculated to be 1.18 p/p.

Inhibitory concentration (IC50) in OECD Activated Sludge Respiration Inhibition Test (OECD Test No. 209) is 52.5 mg/L.

**ECOTOXICOLOGY:** Material is moderately toxic to aquatic organisms on an acute basis (LC<sub>50</sub>/EC<sub>50</sub> between 1 and 10 mg/L in most sensitive species).

Acute LC<sub>50</sub> for fathead minnow (*Pimephales promelas*) is 6.9 mg/L.

Acute LC<sub>50</sub> for goldfish (*Carassius auratus*) is 7.8 mg/L.

Acute LC<sub>50</sub> for guppy (*Poecilia reticulata*) is 4.2 mg/L.

Acute LC<sub>50</sub> for water flea (*Daphnia magna*) is 3.9 mg/L.

Maximum acceptable toxicant concentration (MATC) in fathead minnow (*Pimephales promelas*) is 0.795 mg/L.

Maximum acceptable toxicant concentration (MATC) in water flea (*Daphnia magna*) is 0.44 mg/L.

Acute LC<sub>50</sub> for rainbow trout (*Oncorhynchus mykiss*) is 2.6 mg/L.

Acute LC<sub>50</sub> for rainbow trout (*Oncorhynchus mykiss*) is 2.6 mg/L.

### 13. DISPOSAL CONSIDERATIONS:

**DISPOSAL METHOD:** Wastes are toxic. Improper disposal of excess material is a violation of Federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your state agency or environmental control agency, or the hazardous waste representative at the nearest EPA regional office for guidance.

### 14. TRANSPORT INFORMATION:

For DOT regulatory information, consult transportation regulations, product shipping papers, or contact your Dow AgroSciences representative. DOT CLASSIFICATION: CORROSIVE SOLID, TOXIC, N.O.S.

### 15. REGULATORY INFORMATION NOTICE:

The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

#### U.S. REGULATIONS

**SARA 313 INFORMATION:** This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
2,4,6-Trichlorophenol	000088-06-2	0.1%
2,4-Dichlorophenol	000120-83-2	97.5%

**SARA HAZARD CATEGORY:** This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard  
A delayed health hazard

**CALIFORNIA PROPOSITION 65:** The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer. (See Section 3 or 11 of the MSDS for details on carcinogenicity.)

#### TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory. If you export this product, verify that the ingredients meet the inventory listing requirements of the receiving country or contact Dow AgroSciences.

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# MATERIAL SAFETY DATA SHEET



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Dow AgroSciences LLC  
Indianapolis, IN 46268

## 2,4-DICHLOROPHENOL

Effective Date: 2/1/99  
Product Code: 20636  
MSDS Number: 000715

**STATE RIGHT-TO-KNOW:** The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

### RCRA Categorization Hazardous Code:

2,4-Dichlorophenol = U081  
2,4,6-Trichlorophenol = F027  
2,6-Dichlorophenol = U082

CHEMICAL NAME	CAS NUMBER	LIST
2,6-Dichlorophenol	000087-65-0	NJ3 PA1 PA3
2,4,6-Trichlorophenol	000088-06-2	PA2 NJ1
2,4-Dichlorophenol	000120-83-2	NJ2 NJ3 PA1

### 16. OTHER INFORMATION:

**MSDS STATUS:** Revised sections 3,7, & 8  
Reference: DR-0002-6288  
Replaces MSDS dated: 1/7/99

NJ1=New Jersey Special Health Hazard Substance (present at > or = to 0.1%).  
 NJ2=New Jersey Environmental Hazardous Substance (present at > or = to 1.0%).  
 NJ3=New Jersey Workplace Hazardous Substance (present at > or = to 1.0%).  
 PA1=Pennsylvania Hazardous Substance (present at > or = to 1.0%).  
 PA2=Pennsylvania Special Hazardous Substance (present at > or = to 0.01%).  
 PA3=Pennsylvania Environmental Hazardous Substance (present at > or = to 1.0%).

### OSHA HAZARD COMMUNICATION STANDARD:

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

CATEGORY	RATING
Health	3
Flammability	1
Reactivity	1

### COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND):

This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases:

Chemical Name	CAS Number	RQ	% in Product
2,4-Dichlorophenol	000120-83-2	100	97.5%
2,4,6-Trichlorophenol	000088-06-2	10	0.1%
2,6-Dichlorophenol	000087-65-0	100	1.0%

The Information Herein Is Given In Good Faith, But No Warranty, Express Or Implied, Is Made. Consult Dow AgroSciences For Further Information.



**Safety & Quality Considerations**

**Safety Equipment Required**

Refer to protective equipment policy (POL10070) for protective equipment requirements for a specific chemical.

→ Attached mrm

**Exposure Hazards**

Potential hazards due to exposure are as follows:

Splash hazard of chemical you may be working with.

**Safe Work Permit Required**

Is a safe work permit required?

YES  NO

→ Attached mrm

**Applicable Safety, Industrial Hygiene or Environmental Standards**

Reference the following standards for more information concerning this procedure:

Standard	Description
S-775	Line and Equipment Opening

→ Attached mrm

**Quality Considerations**

The following issues need to be considered for their impact on product quality:

## Site Preparation Procedures

### Plant Preparation

The following steps should be performed at the job site prior to performing this task:

<u>Step</u>	<u>Requirement</u>

### MOD Preparation

The following steps should be followed to prepare the MOD prior to performing this task:

<u>Step</u>	<u>MOD Requirement</u>
Step 1	Examine actions required based on specific pump isolation.

### Equipment Required

The following equipment may be used to perform this procedure:

- tools
- fittings
- air/N2 hose
- lance

### Special Equipment Set-up

The following describes any special equipment or set-up that is required:

<u>Step</u>	<u>Set-up Procedure</u>

**Procedure and Hazards of Deviation**

**Procedure Overview**

Main topics of the procedure:

**Diagrams**

This procedure contains the following diagram(s) listed below which can be found at the end of this procedure.

<u>Diagram #</u>	<u>Name</u>	<u>Location of Electronic copy</u>
None		

**How To Prep a Pump**

The following steps describe how to perform this task:

<u>Step</u>	<u>Action</u>
Step 1	Lock pump out and check start switch. (Red tag both switches)
Step 2	On pumps with double seals, valve off and red tag line from seal pot. In addition, red tag and lockout auxillary seal pot pump if one exists.
Step 3	Barricade area.
Step 4	Adjust or shut tracing off to minimize hydraulic or vapor pressure, but still keep material liquid.
Step 5	Examine specific pump job to determine if Steps 6 and 7, introduction of inert gas, is acceptable.
Step 6	Shut either suction or discharge valve and blow material clear from pump. Switch valve positions to repeat for other side.
Step 7	Use air or nitrogen (one may be more appropriate to use than the other for the specific application) to blow material clear from pump.
Step 8	Relieve pressure through process piping as much as possible.
Step 9	Shut and red tag inlet and outlet valves.
Step 10	Drain residual liquid from pump into drain bucket or trench. <b>Hazard: Think through the potential splashing that may occur while draining and protect yourself with splash panels or by piping the discharge in an opposite direction.</b>  Anticipate a plugged drain line especially if dealing with solids or material with freezing point above ambient temperature. A steam lance may be necessary to unplug drain.

# B. 12

## Procedure and Hazards of Deviation (continued)

### How To Prep a Pump (continued)

Step 11	Tag drain valve open. The tag will insure that the valve will be closed before returning pump back to service.
Step 12	Flush pump with appropriate fluid or purge with N2. Minimize condensate pressure to prevent damaging the pump seal.  Hazard: SO2CL2 and water react violently.

**Follow-up**

**Waste Disposal**

The following describes how to properly dispose of waste generated from this procedure:

<u>Step</u>	<u>Action</u>
1	Appropriate disposal of drained material.

**Housekeeping**

The following describes appropriate housekeeping measures to perform after the task has been completed:

<u>Step</u>	<u>Action</u>
1	Wash down any spilled material.

**MOD Follow-up**

The following describes what steps need to be taken with the MOD after performing the task:

<u>Step</u>	<u>Action</u>
1	Dependent on specific pump isolation.

**Completion of Paperwork**

The following describes the paperwork that must be completed after performing the task:

<u>Step</u>	<u>Action</u>
1	Note that pump was prepped in the shift summary book.

**Document History****Creation Date**

March, 1982

**Created By****List of Qualified Approvers**

The following table lists qualified approvers for this procedure.

<u>Approver</u>	<u>Title</u>
Paul Vammer	Superintendent

**Location of Controlled Copies**

The following table lists the location of controlled copies:

<u>Copy</u>	<u>Location</u>
1	Plant Library
2	Control Room

**Supporting Documentation**

The following table lists any required supporting documentation:

<u>Document</u>	<u>Title</u>

**Applicable Cross-References**

The following table lists applicable cross-references that apply to this procedure:

<u>Program</u>	<u>Section/Reference Number</u>

**Revision History**

The following table lists the key changes of the latest revision for this procedure:

<u>Date</u>	<u>Description of key changes</u>
May 1998	

**PLANT TREATMENT OF CHEMICAL EXPOSURES**  
**SAFETY SHOWERS AND EYE BATHS**

**I. POLICY**

Wherever the eyes or body of any person may be exposed to injurious chemicals or other foreign materials, suitable facilities for immediate drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. After use, the employee shall report to the Medical Department. All other potential exposures shall be treated as determined by the Medical Department utilizing all available resources, which may include on-site consultation. (See Appendix B.)

**II. SCOPE**

This standard provides for plant practices regarding treatment of chemical exposures and covers minimum design criteria and inspection of safety showers, eye baths, and body washes.

**III. RESPONSIBILITY**

- A. Every employee shall know the location of the nearest eye bath and safety shower in their immediate work area, and shall use them in the case of chemical exposure. After facilities use, the employee shall report to the Medical Department. All employees shall report suspected chemical exposures immediately to their supervisor.
- B. The supervisor shall supply all necessary information to the Medical Department in the case of a chemical exposure, such as the chemicals involved, and will ensure that the incident is thoroughly investigated, if necessary. The supervisor shall ensure that all employees know how to obtain medical assistance. (See Appendix B.)
- C. The plant superintendent (owner) shall be responsible for determination of the need for safety showers, eye baths, and body washes within his/her plant and to ensure that they are tested weekly. The owner will define the installation Area Electrical Classification.
- D. The designer and/or installer of the safety shower and eye bath shall be responsible to design the installation to meet the owner's requirements and at least the minimum design criteria as established by this Safety Standard (Appendix A) and Engineering Practices M4A-5400-00.
- E. The owner is responsible for ensuring that the installations are in compliance with ANSI 2358.1-1981, Area Electrical Classification, and Engineering Practices M4A-5400-00.

IV. APPROPRIATE RESPONSE/ACTION TO CHEMICAL EXPOSURE

- A. When a chemical exposure has occurred to the eyes or skin **ONLY WATER** must be used to flush the contaminant away. No material is to be used as a neutralizing agent. Soap may be used if it is readily available.
- B. If any chemical comes in contact with the eyes, thoroughly wash the eyes with flowing water - **SPEED IS ESSENTIAL**. If a spray of chemical occurs to the face or head while goggles are being worn - they should not be removed until the chemical has been removed in the shower. Continue washing for 15 minutes or until the ambulance arrives to take the patient to the site medical facility.
- C. If a questionable material or a material that is known to cause a rash or burn comes in contact with the skin, the skin shall be washed with large amounts of flowing water and contaminated shoes and clothing shall be removed while showering - **SPEED IS ESSENTIAL**. Soap may be used if it is readily available. The exposed employee shall report to the site medical facility. Contaminated clothing and shoes shall be handled by following the procedure in Appendix C.
- D. Report to the site medical facility upon the first indication of a rash or burn if exposure to a chemical is suspected.
- E. When skin contact occurs with a material that can be absorbed through the skin, any contaminated shoes or clothing shall be removed while showering and the skin shall be washed with large amounts of flowing water - **SPEED IS ESSENTIAL**. Soap may be used if it is readily available. The exposed employee shall report to the site medical facility.
- F. If illness from inhalation occurs, remove the person at once to fresh air and call the site medical facility. If breathing has stopped, begin CPR at once.
- G. Any person who does not feel well for an unknown reason should report to the site medical facility at once. The site medical facility should be made aware of any possible chemical exposures that may have occurred.
- H. When a chemical exposure results in the employee reporting to the site medical facility and the material is unknown to the employee, it is essential that supervision immediately notify the site medical facility regarding the incident.
- I. All initial medical visits for chemical exposures, shall occur via ambulance. (See Appendix B.)

V. DESIGN AND INSTALLATION

- A. The design of each installation shall make use of equipment which meets or exceeds the minimum requirements of ANSI Z358.1-1981. (See Appendix A of this standard and Engineering Practices M4A-5400-00.)

**B. Each installation should consider the following:**

1. Safety shower.
2. Eye bath.
3. Face wash.
4. Body wash.
5. Tempered water tank (300 gallon minimum).
6. Tempered water supply (85° to 90° F).
7. Pressure, temperature and flow monitoring and alarm system.
8. Booth (mandatory for outdoor installations).
9. Thermometer to measure booth temperature.
10. Materials of construction - should be compatible with chemicals used in the area.

C. It is recommended that electrical heating be used to maintain the booth temperature, due to unreliable past history of temperature control with steam.

D. It is recommended that steam or thermal liquid tracing not be used on tank or piping downstream of the tempering tank because of possible uncontrolled temperature rise. If steam or thermal liquid tracing is used, appropriate alarms and high temperature cut-offs must be in place.

**VI. TESTING**

Safety showers and eye baths shall be tested weekly, using the following criteria:

**A. Safety Showers and Eye Baths - Outdoor System.**

1. Verify booth temperature is between 75° and 95° F.
2. Verify that pressure, temperature and flow monitoring is operational and that alarms will sound, so that at least one other person hears the alarm.
3. Verify that there is a legible sign on the booth identifying it as a safety shower.
4. Verify that the shower, eye bath and body wash have clear access.
5. Verify that the tempered water temperature is between 75° and 95° F.

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## B. Safety Showers and Eye Baths - Inside Systems.

1. Verify space temperature is between 60° and 95° F and that the tempering tank is located in an area with a temperature between 75° and 95° F.
2. Verify that pressure, temperature and flow monitoring is operational and that alarms will sound, so that at least one other person hears the alarm.
3. Verify that there is a legible sign adjacent to each safety shower and eye bath identifying its safety function.
4. Verify that the shower, eye bath, and body wash have clear access.

## C. Safety Showers.

Verify that flow and flow distribution appear normal.

## D. Eye Baths.

1. Verify that the differential between highest stream level and lowest stream level is less than 1 ¼ inches and that the height of the lowest stream is at least 2 inches high.
2. Verify that the unit is clean.
3. Verify that the eye bath nozzles have a good cover that is free to come off under water flow conditions.

## E. Body Washes.

Verify that flow appears normal.

**Note:** A testing checklist is also provided in Safety Standard S-710, Emergency Equipment.

SAFE WORK PERMIT

EMERGENCY NUMBER



PLANT/DEPARTMENT	ISSUED BY	DATE	TIME FROM	<input type="checkbox"/> a.m. <input type="checkbox"/> p.m. TO	<input type="checkbox"/> a.m. <input type="checkbox"/> p.m.
ACCEPTED BY	COMPANY/DEPARTMENT				
RESPONSIBILITY TRANSFERRED TO (NAME)	GO-SIGNATURE (IF REQUIRED)				
LIST ALL WORKERS - SEE ATTACH ROSTER					

**AS ALL OTHER WORKERS ARE BEING EVACUATED SUSPENDS THIS PERMIT. (Permits may be issued only if authorized)**  
**COMPLETE SECTION I AND SECTION IV ON ALL PERMITS. SECTION I IS FOR GENERAL WORK ONLY. ALL PERMITTED JOBS REQUIRE AN ON-SITE INSPECTION.**

**SECTION I (GENERAL AREA WORK PERMIT)**

- Work limited to the following: (Description & Area/Equipment)
- On-site inspection Conducted / All Locks or Tags Attached, if Required / Environmental Impact of Job Considered Permit Issuer Initials Permit Receiver Initials
- Red Tag Master Number or Number of Red Tags Underground Reference Drawing Number
- Special Hazards to Protect Against  None Chemicals (Name)
  - Flammable  Noise  Hot water/steam  Thermal Burn  Falls  Pinch Pts./Strp. edges
  - Toxic  Corrosive  Heat Stress  Electrical/High Voltage Line  Asbestos  Other
  - Skin Contact  Reactive  Pressure Extreme  Inert Atmosphere  Radiation
- Safety Equipment: (Other than area requirements)  None
  - Rain Suit  Gloves  Face Shield  Ground Fault Circuit Int.  Air Pack (SCBA)  Flash Suit
  - Chemical Suit  Hearing Protection  Hood  Barricades/warning signs  Supplied Air  Long Sleeves
  - Rubber Boots  Chemical Goggles  Fall Restraint Device  Communications Eqpt. (list)  Respirator  Other
- The person receiving the permit verifies that all workers:
  - A. Have been through the Plant Safety Orientation  Yes  No
  - B. Understand Applicable HAZCOM requirements  Yes  No
  - C. Have discussed hazards of the job and area  Yes  No
  - D. Know the location/use of safety showers/eye wash stations  Yes  No
  - E. Know the location of the phone or intercom  Yes  No
  - F. Know emergency alarms, evacuation, assembly points  Yes  No
  - G. Know the Procedures for Safe Job Completion  Yes  No
  - H. Have inspected all tools/equipment/scaffolding  Yes  No
  - I. Understand the Housekeeping Requirements  Yes  No
- Potentially Affected Area Personnel and Workers Notified of Work to be Done  Yes  N/A
- For demolition or renovation jobs, has the work area been inspected for asbestos?  Yes  N/A  
If asbestos is present, is the asbestos going to be disturbed?  Yes  No If yes, refer to Division Guidelines for special instructions.
- The following responsibilities have been communicated to the person receiving this permit:
  - Performing the Work Safety  Reporting Changes that Affect Job Safety  Conditions for Work Stoppage  Crew Accountability
  - Completion of Section IV and Permit Return
- Additional Permits/Checklists Required (Attach)  See Sections Below  Electrical Hot Work  Railroad Right-of-Way  
 Confined Space Entry  Excavation  Power Line Clearance  Critical lift  Other (Identify)  
 Equipment Integrity

**SECTION II LINE AND/OR EQUIPMENT OPENINGS**

Complete this Section & Section I for Opening Lines & Equipment

	Yes	No	N.A.
1. Line Positively Identified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Line/Equip. Drained/Depressured, Piping Properly Supported	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Line/Equipment Cleaned and Purged	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Blinds and/or Block and Bleed in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Fuses Removed / Switches Open	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Lock(s) Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Field Switches Tested	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Splash Guards Considered	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Adjacent Area Safe. (If limited, describe below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Area Roped/Taped Off	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are all automatic valves secured in a safe position?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DOESNT APPLY

**SECTION III HOT WORK**

Complete this Section & Sections I & II for Hot Work

	Yes	No	N.A.
1. Safety Observer/Fire Watch Name	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Fire Extinguishers Type Is it full?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Survey Area for Combustibles and Openings, Holes, Trenches and Cracks as Routes of Contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Combustible Materials Removed or Protected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Heat/Spark Control - Tarps, Covers, Water, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Considered Hidden Combustibles and Take Precautions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Purge Gas Used. Type	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Heat Exposure to gasket, seals, liners (Describe Precautions)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Other Work in area which should be stopped (Describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Material present which emits vapor when heated (Describe)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Pipe Stoppers/Plumbers Plugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Equipment Operating or Contains Original Contents. (If yes, written procedures are required & Supt/Dept. Head must Co-sign Permit)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Adjacent Areas Safe (If limited, describe below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Explosimeter Tests Acceptable (LEL=0%) Reading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Oxygen Tests Acceptable Reading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Describe below specific locations where LEL and O2 tests are to be conducted and the test frequency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Person who made LEL, O2 Check Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Ground Lead Attached to Work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DOESNT APPLY

**SECTION IV Questions to be Completed on Permit Expiration or Job Completion**

Worker Closeout Signature

X \_\_\_\_\_

Time: a.m./p.m.

	Yes	No	N.A.
1. Has the job been completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Has the area been cleaned of work material?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have Department personnel been informed job is done?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Have all locks and/or tags been removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Has everyone signed off Tags/Red Tag Master/Roster?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Have safety devices been reinstalled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Special precautions or remarks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Has hot work area been surveyed for smoldering materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Have supplemental Permits been returned?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SPECIAL INSTRUCTIONS \_\_\_\_\_

PRECAUTIONS \_\_\_\_\_

LIMITATIONS, REMARKS \_\_\_\_\_

C. 12

MICHIGAN DIVISION INDUSTRIAL HYGIENE REPORT

114532187 (10)

DOW CHEMICAL U.S.A.  
AN OPERATING UNIT OF THE DOW CHEMICAL COMPANY

10-13-98

LABORATORY REPORT CODE	
HEH23.14-11-2(22)	
DATE ISSUED	
September 27, 1989	
ACCOUNT NO	PROBLEM NUMBER

Exhibit 14 - 29 CFR  
1910.1000

COMPREHENSIVE INDUSTRIAL HYGIENE  
HERBICIDES PLANT, 948, 949, 10  
THROUGH AUGUST, 1989

Air contaminants

MICHIGAN DIVISION  
BUILDINGS, FEBRUARY

AUTHOR(S) SIGNATURE(S)

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DESCRIPTIVE SUMMARY WITH CONCLUSIONS

A comprehensive industrial hygiene survey was conducted in the Michigan Division Herbicides Plant based on a protocol [HEH23.14-11-2(22)] issued May 19, 1989. Employees' 8-hour time-weighted average (TWA) exposures to methylene chloride, perchloroethylene, diethylbenzene (DOWTHERM\* J), phenol, 2,4-dichlorophenol (2,4-DCP), 2,4-dichlorophenoxyacetic acid (2,4-D) and noise were evaluated and found to be well within the current guidelines. Specific task excursion (short-term) exposures to methylene chloride, perchloroethylene, diethylbenzene, phenol, 2,4-DCP, 2,4-D, ferric chloride, diphenyl sulfide, sulfur dioxide, hydrogen chloride and oil mist were also evaluated and found to be within current guidelines.

A sound level survey was conducted and three areas were identified with levels greater than or equal to 90 dBA: both mechanical refrigeration units and the cooling tower. Several shop instruments generated noise levels greater than 90 dBA when in use. Levels greater than 85 dBA were found in the shop, the cooling tower pump room and around the Howden oil compressor.

A heat stress survey in the center wing of the 2,4-D process in 949 Building indicated a potential for overexposure to heat during the summer months. A heat stress program consisting of training, acclimatization, a work/rest regimen and use of personal protective equipment is planned to prevent heat-related incidents.

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## PURPOSE

As part of an ongoing effort to maintain a healthful work environment, a comprehensive industrial hygiene survey was conducted in the Michigan Division Herbicides Plant, Buildings 948, 949, 1068 and 1164. Employee exposures to methylene chloride, perchloroethylene, diethylbenzene (DOWTHERM J), 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4-dichlorophenol (2,4-DCP), phenol, diphenyl sulfide, sulfur dioxide, ferric chloride, hydrochloric acid (HCl), oil mist, noise and heat were evaluated.

## CONCLUSIONS AND RECOMMENDATIONS

1. Employees' time-weighted (TWA) average exposures to methylene chloride, perchloroethylene, diethylbenzene (DOWTHERM J), phenol, 2,4-dichlorophenol and 2,4-D were found to be within the established guidelines.
2. Excursion monitoring for methylene chloride, perchloroethylene and diethylbenzene during specific short-term tasks indicated acceptable exposures for each chemical. While no specific short-term exposure limits have been set for these chemicals, the exposures measured are less than three times the TWA guideline for a period of 30-minutes or less during the workday. The exposures during the methylene chloride filter changes were potential, not actual, since respiratory protection was worn during both operations. It is recommended that respirator usage continue during these filter changes.
3. Short-term exposures to phenol, 2,4-DCP and 2,4-D during specific tasks were judged to be acceptable based on the levels of chemical measured and the duration of the exposure.
4. Based on the results of area monitoring for methylene chloride, perchloroethylene, diethylbenzene, phenol, 2,4-DCP and 2,4-D, airborne concentrations of these chemicals were judged to be acceptable.
5. Short-term exposures to sulfur dioxide (SO<sub>2</sub>) and hydrochloric acid (HCl) were evaluated with detector tubes during the sampling of the dichlorophenol reactor and were found to be within the established guidelines.
6. A potential short-term exposure to SO<sub>2</sub> of 36 parts per million (ppm) was measured during the unloading of a tank truck of incoming material. A half-face air-purifying respirator was worn during the operation; however, a half mask provides no protection against the eye irritation caused by SO<sub>2</sub>. Full-face respiratory protection is recommended for the unloading of SO<sub>2</sub>.
7. Procedures for unloading tank trucks should be re-evaluated to ensure that employee exposures and environmental releases are minimized.

9. Short-term exposures to ferric chloride during the dumping of drums, and oil mist and HCl during the changing of the Howden oil filter were within established guidelines. The length of the purge prior to the filter change can significantly affect the exposures during this type of operation.
10. A short-term exposure of 0.14 ppm measured during the loading of diphenyl sulfide was judged to be acceptable. No exposure guideline has been established for diphenyl sulfide.
11. Due to the lack of a specific monitoring method, potential exposures to sulfuryl chloride during the dumping of the sulfuryl chloride reactors were assessed subjectively by observation. There were no apparent fumes released when the reactor was opened. It is recommended that current work practices, including a thorough purge and use of slicker suits and respiratory protection, be continued.
12. Noise levels greater than 90 dBA were measured during the changing of the carbon beds in the sulfuryl chloride reactor. The operating procedures for this operation should be changed to require hearing protection during the use of the high impact hammers.
13. Noise levels greater than 90 dBA were measured in the plant maintenance shop, 1076 Building, during the operation of the following shop tools:
  - a. 2-Wheel grinder
  - b. Tool grinder
  - c. Hand-held grinder
  - d. Vertical band saw
  - e. Sander
  - f. Plasma arc
  - g. Rigid pipe threaderOperators should wear hearing protection during operation and these tools should be posted accordingly.
14. Persons working at the table just outside the welding curtain in the shop can be exposed to noise levels greater than 90 dBA when grinders or the plasma arc are in operation. Transmission of noise from the welding area to the general shop area should be reduced. A more effective noise barrier, sound proofing on ceiling or walls, or relocation of the welding area would be options to investigate.
15. An area sound level survey indicated that the noise levels in the methylene chloride and perchloroethylene refrigeration rooms and along the east and west sides of the cooling towers are greater than 90 dBA and should be posted for mandatory hearing protection.

16. The following locations have been identified as high noise areas (noise levels greater than or equal to 85 dBA) and posted with warning signs:
  - a. Entrances to the maintenance shop
  - b. Cooling tower pump room
  - c. Howden oil compressor
17. Evaluation of personal TWA noise exposures indicated that exposures for all job classifications monitored were within the established guideline of 85 dBA as an 8-hour Time-weighted average.
18. A heat stress survey indicated a high potential for heat stress in the 2,4-D center wing of 949 Building during the summer months. In order to reduce the risk of heat-related incidents, a written program should be established addressing heat stress and should consist of training, acclimatization, a work/rest regimen and personal protective equipment.
19. Fume hoods in the laboratory were evaluated for adequacy of air flow. The auxiliary and sample fume hoods met the recommended face velocities with the fans on the high settings. The new fume hood met the recommended face velocity with the far left sash closed and a sash opening of 23 inches for the remaining four sashes. The new hood should be operated in this configuration to provide adequate capture of contaminants.

#### TOXICOLOGY SUMMARY

The toxicological properties of the significant chemicals used in the Herbicides Plant are summarized below.

##### 2,4-Dichlorophenoxyacetic Acid (2,4-D Acid)

2,4-D is moderate in acute oral toxicity. Contact with the skin may cause dermatitis, and prolonged or repeated contact with highly concentrated solutions or the wetted material may cause burns. Repeated skin exposure may result in absorption of harmful amounts. 2,4-D is not considered to be a significant inhalation problem due to its physical state and low vapor pressure. Dusts from the acid may cause irritation of the eyes.

Ingestion of large amounts, though unlikely in an industrial situation, may cause liver, kidney, gastrointestinal and muscular effects, with symptoms such as nausea, vomiting, abdominal cramps and diarrhea. The current Threshold Limit Value (TLV) for 2,4-D acid is 10 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).

##### Phenol

Phenol is a white crystalline solid with a distinctive odor. It has an odor threshold of about 0.05 ppm for most individuals.

Phenol is moderate in acute oral toxicity and ingestion of even small amounts could cause serious effects. The most significant health concern of phenol is absorption through the skin. Phenol is rapidly absorbed through the skin in amounts which could be lethal. Short, single exposures may result in severe burns; since phenol has an anesthetic effect, the seriousness of a skin exposure or burn may not be obvious. Excessive exposure may result in central nervous system effects.

Excessive exposures to vapors or aerosols may cause irritation of the upper respiratory tract as well as serious adverse effects. The recommended TLV for an 8-hour TWA exposure is 5 ppm.

#### 2,4-Dichlorophenol (2,4-DCP)

The acute oral toxicity of 2,4-DCP is low; however, ingestion may cause burns of the mouth and throat. Eye contact with the material may result in severe irritation and corneal injury, with permanent impairment of vision, even blindness.

Short, single skin exposures to 2,4-DCP may cause burns. Repeated dermal exposures may result in the absorption of harmful amounts; skin absorption is more rapid when the material is in solution.

Excessive exposures to dusts and vapors, generated at elevated temperatures, can cause eye and respiratory irritation. The Dow Industrial Hygiene Guide (IHG) for 2,4-DCP is 1 ppm as an 8-hour TWA.

#### DOWTHERM J (Diethylbenzene, mixed isomers)

DOWTHERM J is a mixture of diethylbenzene isomers. The material is low in acute oral toxicity. Prolonged or repeated skin exposure may cause irritation or even a burn. Exposures to 100 ppm in air for short periods may cause eye irritation. Excessive inhalation exposures may cause dizziness and affect the liver and kidneys. DOWTHERM J has poor warning properties; the exposure guideline is 10 ppm, the same as the odor threshold for most people.

#### Perchloroethylene

Perchloroethylene is a colorless liquid with an ether-like odor which can be detected by most people at 100 ppm. It is low in acute oral and dermal toxicity. Prolonged or repeated skin exposure may cause drying or flaking of the skin, irritation or even a burn.

Perchloroethylene vapors may irritate the eyes at about 100 ppm, the odor threshold. Inhalation exposures of 200 ppm perchloroethylene may cause dizziness; higher levels may also cause nasal irritation, nausea, incoordination, drunkenness, and above 1000 ppm, unconsciousness and death. Based on animal data, excessive exposures may lead to irregular heartbeats. Alcohol consumption either before or after exposure may increase the adverse effects.

Chronic excessive exposures may result in central nervous system, liver and kidney effects. Perchloroethylene has caused tumors in mice at extremely high oral doses. The Permissible Exposure Limit (PEL) for perchloroethylene is 25 ppm.

#### Methylene Chloride

Methylene chloride is a mild central nervous system depressant and an eye, skin and respiratory tract irritant. It is metabolized to carbon monoxide and exposure will increase carboxyhemoglobin levels, causing a decrease in the oxygen-carrying ability of the blood. Carboxyhemoglobin values level off at relatively low values, even with high methylene chloride exposures.

Methylene chloride has a sweetish odor, detectable at about 300 ppm. Anesthetic effects begin to occur at about 1000 ppm for most people. The TLV for methylene chloride is 50 ppm. Methylene chloride is a suspected human carcinogen based on studies in rats and mice.

#### Sulfur Dioxide (SO<sub>2</sub>)

Sulfur dioxide is a gas which irritates the eyes, mucous membranes and skin by the formation of sulfurous acid upon contact with moisture. In addition to irritation, short-term exposures may cause choking, coughing and bronchioconstriction. The magnitude of the effect is related to dose, not duration of exposure. Mouth breathing increases the effects. The TLV of 2 ppm, with a short-term exposure limit (STEL) of 5 ppm, was set to prevent respiratory irritation.

### EXPOSURE EVALUATION CRITERIA

Industrial Hygiene Guides (IHGs) are concentrations of airborne substances to which it is believed nearly all employees may be repeatedly exposed throughout a working lifetime without known adverse health effects. IHGs are established by health professionals of the Dow Health and Environmental Management Team for chemicals (raw materials, intermediates, by-products, wastes, and products) handled within Dow Chemical. Published exposure criteria are available for many industrial chemicals; examples include the Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists (ACGIH), the ANSI standards of the American National Standards Institute, and the Permissible Exposure Limits (PELs) set by the Occupational Safety and Health Administration (OSHA). For most of these chemicals, the Health and Environmental Management Team has adopted the published exposure criteria as the Dow IHGs. In a few instances, the Dow IHGs differ from the published exposure criteria. In establishing IHGs for chemicals which lack published exposure criteria, the Health and Environmental Management Team considers toxicological information, occupational exposure data, and medical experience.

IHG's do not represent fine lines between safe and dangerous exposures. As the name indicates, IHG's are properly used as guides for plant design and for evaluation of occupational exposures. IHG's for gases and vapors are usually expressed in parts per million (ppm, volume/volume); for dusts, mists, fumes and aerosols, IHG's are usually expressed in milligrams of contaminant per cubic meter of air (mg/m<sup>3</sup>).

Most IHG's are time-weighted average (TWA) concentrations for an 8-12 hour workday and a 40 hour work week. Limited excursion exposures to concentrations exceeding the IHG are permitted, provided that the TWA exposure for the entire workday is acceptable and the consequences of exposure, within the excursion limits are minimal and reversible. For most chemicals, excursion limits are calculated from the IHG's or TLV's and the excursion factors recommended by the ACGIH. Ceiling IHG's are assigned to those materials which cause significant or irreversible effects at concentrations exceeding the IHG. These chemicals are not to exceed exposures above these ceiling values.

The following exposure criteria currently apply to the agents - sampled in this survey.

<u>Compound</u>	<u>TWA</u>	<u>Excursion Limit</u>	<u>Source</u>
2,4-Dichloro- phenoxyacetic acid	10 mg/m <sup>3</sup>	NE	ACGIH/OSHA
2,4-Dichlorophenol	1 ppm	NE	Dow
Phenol	5 ppm(s)	NE	ACGIH/OSHA
DOWTHERM J (diethylbenzene)	10 ppm	NE	Dow
Methylene chloride	50 ppm	NE	ACGIH
Perchloroethylene	100 ppm	1000 ppm (C)	OSHA
	50	200 ppm	ACGIH
	25 ppm	NE	OSHA
Sulfur dioxide	2 ppm	5 ppm	ACGIH/OSHA
Ferric chloride (as soluble iron salts)	1 mg/m <sup>3</sup>	NE	ACGIH/OSHA
Hydrochloric acid	5 ppm (C)	NE	ACGIH/OSHA

NE-None established

C-Ceiling limit which may not be exceeded at any time during the work day.

S-"Skin" notation refers to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye either by airborne, or more particularly, by direct contact with the substance.

When the results of an industrial hygiene survey indicate a need to reduce exposure, control measures should be implemented. Traditional engineering control methods include containment, isolation, substitution, local exhaust ventilation, general ventilation, sound enclosures, and change of operating procedures. Administrative control, limiting exposure time through remote control or job rotation, may also be effective. Personal protective equipment may be used to protect employees only as a last alternative when none of the preceding control measures are feasible or until control measures can be effective.

A thorough explanation of the chemical exposure criteria is contained in report number HEH2.1-1-58(10) and is available upon request.

#### SAMPLING AND ANALYTICAL

Methylene chloride, diethylbenzene and perchloroethylene were collected on 1 gram Pittsburg Coconut Base (PCB) charcoal tubes and analyzed by gas chromatography with flame ionization detection (GC/FID). Phenol, 2,4-D and 2,4-DCP were collected on 800 mg silica gel tubes and analyzed by liquid chromatography with UV detection. Diphenyl sulfide was collected on 800 mg silica gel tubes and analyzed by GC/FID. Analyses were performed by C. D. Jenkins, J. M. Hugo and K. A. Charron of the H&ES Analytical Chemistry Laboratory and are reported in IHAL-89-0117, 0165, 0166 and 0167.

Sulfur dioxide was collected in an impinger containing a solution of 0.3% hydrogen peroxide. The solutions were analyzed for sulfate using ion chromatography with conductivity detection. Analyses were performed by V. T. Turkelson of the Midland Analytical Laboratory and are reported in AL-89-040641.

Ferric chloride was collected on 37 mm, 0.8 micron pore size, mixed cellulose ester filters and measured spectrophotometrically. Analysis was performed by H. W. Emmel of the Midland Analytical Laboratory and is reported in AL-89-040943. Hydrochloric acid was collected on 500 mg Chromosorb B coated with sodium carbonate (Supelco ORBO 70) and analyzed by ion chromatography with conductivity detection. The analysis, conducted by J. Healey of the Midland Analytical Laboratory, is reported in AL-89-060334. Oil mist was collected on 37 mm glass fiber filters, solvent extracted and analyzed by infrared spectroscopy. The analysis was performed by C. Putzig of the Midland Analytical Laboratory and is reported in AL-89-051199.

Personal noise doses were measured with DuPont Mark MK-1 noise dosimeters, calibrated before and after each monitoring period with a DuPont AC-1 acoustical calibrator. Area noise measurements were obtained with a GenRad sound level meter and analyzer on the A-weighted scale with a slow response. The meter was calibrated before and after each survey with a GenRad Type 1565-A calibrator.

## RESULTS AND DISCUSSION

Employees' TWA exposures to methylene chloride, perchloroethylene, diethylbenzene, phenol, 2,4-DCP and 2,4-D (Tables 1A and B) were all within the established guidelines for each chemical. The sample collected for the Millwright on 6-19-89 showed breakthrough of phenol into the backup section of the silica gel tube, indicating possible loss of some of the sample. During that sampling period, the Millwright had spent a significant amount of time cleaning some equipment with hot water. It is suspected that the phenol was carried through with water vapor. Based on the small amount of phenol detected in this and other personal samples, there is little probability that a significant amount of phenol was lost from the sample, and re-sampling is not recommended.

The results of excursion monitoring for methylene chloride, perchloroethylene and diethylbenzene exposures during specific short-term tasks are shown in Table 2A. All excursion exposures were judged to be acceptable for those chemicals. Where an excursion guideline is not established, short-term exposures should exceed three times the 8-hour TWA guideline for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed five times that guideline. The exposures during the methylene chloride filter changes were potential exposures, as respiratory protection was worn during both operations. It is recommended that respirator usage continue during these filter changes. The diethylbenzene exposure during the DOWTHERM J filter change on 4-19-89 was measured to be 27 ppm. During the operation that day, the basket which holds the filter was found to be corroded and had to be replaced, creating an unusually long exposure period of 35 minutes. Sampling was conducted during a subsequent filter change (6-27-89) to document the exposures during a more typical operation. The filter change on 6-27 required only 10 minutes, and the diethylbenzene exposure was 3.5 ppm, well within the short-term exposure guideline.

Short-term exposures to phenol, 2,4-DCP and 2,4-D during specific tasks are shown in Table 2B. All exposures were judged to be acceptable. Again, some breakthrough of phenol was seen in the sample collected during the dumping of the steam stripper on 6-20-89. This operation also involved a significant amount of water vapor. Due to the short duration of the operation (3 minutes) and the small amount of phenol detected in the sample (0.067 ppm), the exposure was judged to be acceptable and re-sampling is not recommended.

Area monitoring for methylene chloride, perchloroethylene, diethylbenzene, phenol, 2,4-DCP and 2,4-D was conducted at several sites throughout the Herbicides plant (Table 3). Samples were collected at points approximately 3 to 5 feet above the floor, primarily to document ambient airborne concentrations in the plant. All concentrations were judged to be acceptable.

air temperature outdoors was 86 °F. These measurements indicated that employees working in this area during warm weather months could be overexposed to heat, especially when wearing slicker suits.

In order to reduce the risk of heat-related incidents, particularly during the summer months, a policy should be established addressing heat stress and work practices in the 2,4-D center wing of 949 Building. The program should consist of training, acclimatization, a work/rest regimen and personal protective equipment.

Training should be conducted in the early spring as the weather begins to warm to raise the employees' awareness of heat stress, symptoms, treatment and prevention. Workers should become accustomed to a hot environment by short periods of exposure, gradually building to longer periods. This is particularly important for new employees and those returning from a vacation. Replacement of body fluids is essential. Employees must learn to drink more fluids at regular intervals when working in hot environments, even if they do not feel thirsty.

Work periods should be alternated with rest periods in a cool area. The hotter the environment, the shorter the work period. Likewise, the heavier the work load, the shorter the work period. The length of the work period will vary with the temperature, the exertion required for the job, and the protective equipment required. Some recommendations for work-rest periods are found in Table 10. Based on the temperatures measured on the third floor of the 2,4-D center wing on July 5, 1989, an acclimatized operator could work in that area for approximately 25 minutes, followed by a one-hour rest period in a cooler area. The time would be shorter when wearing a rubber suit.

Other administrative controls include scheduling work during the cooler parts of the day and job sharing. When rubber suits are required, ice vests should also be worn.

Monitoring of temperature and humidity in the hot areas should be continued to characterize seasonal temperature fluctuations. These data will also be used to determine the work/rest regimen and other necessary work practices.

The face velocities of the three laboratory fume hoods in the herbicide plant laboratory, 948 Building, were evaluated, using a TSI Model 1650 thermo-anemometer. The fume hoods were identified as the "sample hood," "auxiliary hood," and "new hood". The sample and auxiliary fume hoods were evaluated on March 17, 1989, and the new hood was evaluated on April 4, 1989. Fume hood face velocity data was evaluated based on recommendations found in HEH2.16-1-1(1) on improved laboratory fume hood performance criteria. Evaluations were based on the relative toxicity and volatility of materials used in fume hoods, and turbulence created by items stored in the hood as well as by external (room) air flow.

The auxiliary and sample fume hoods were evaluated with the fan speed settings on high and sash openings of 30 inches. The recommended minimum face velocity for each of these hoods under current conditions of use is 90 feet per minute (fpm). The average face velocity measured was 93 fpm for the auxiliary hood and 89 fpm for the sample fume hood. The face velocities were judged to be adequate, when the fans were on the highest setting. This setting should be used when chemicals are being handled in these hoods.

The new fume hood has five sashes that open vertically to a maximum of 29 inches. When evaluated, this hood had a wider range of face velocities resulting in the need for increased average face velocity. The recommended face velocity for the new hood is 95 fpm. The average face velocity was 106 fpm with the left-most sash fully closed and all other sashes lowered such to provide a face opening 23 inches from the counter top level. Opening sashes to a greater extent resulted in insufficient minimum face velocities in certain areas of the hood's face, in some instances less than 70 fpm. This point was further illustrated by evaluation of hood face turbulence with smoke tubes which indicated the potential for contaminated air to escape from the hood when the hood sashes were wide open. Therefore, in order to meet the recommended face velocity, the new hood should be operated with the left sash fully closed and the remaining sash openings no greater than 23 inches.

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TABLE 1A. RESULTS OF PERSONAL SAMPLING FOR METHYLENE CHLORIDE, PERCHLOROETHYLENE AND DIETHYL BENZENE AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL THROUGH JULY, 1989.

MASTER NUMBER	DATE 1989	JOB DESCRIPTION	SAMPLING TIME (min)	CONCENTRATION, PPM		
				MeCl <sub>2</sub>	PERC	DIETHYL-BENZENE
033505	4-21	Herbicide Operator	451	ND*(0.2)	1.1	0.069
074748	4-20	Head Operator	451	0.21	1.0	0.055
069424	4-21	Alternate	450	0.23	0.43	0.41
063333	6-19	Spare	416	ND(0.4)	ND(0.1)	ND(0.05)
079609	4-21	Process Engineer	452	0.39	0.12	0.032
062881	6-19	Operations Supervisor	460	ND(0.3)	0.15	0.11
078198	6-19	Laboratory Technician	399	ND(0.4)	ND(0.1)	ND(0.06)
075090	6-19	Maintenance Foreman	452	ND(0.4)	ND(0.1)	ND(0.05)
052229	6-19	Millwright	461	ND(0.3)	0.24	0.094
053615	4-20	Pipefitter	492	0.43	3.1	0.41
065506	4-21	Pipefitter	484	0.94	0.52	0.055
090668	6-19	Service Operator	457	ND(0.3)	ND(0.09)	ND(0.04)
060529	6-20	Instrument Apprentice	461	ND(0.3)	ND(0.1)	ND(0.05)
Exposure Guidelines (8-Hr.TWA)				50	25	10

\*ND denotes nondetectable at the lower analytical detection limit shown in parentheses.

TABLE 1B. RESULTS OF PERSONAL SAMPLING FOR PHENOL, 2,4-DICHLOROPHENOL (2,4-DCP) AND 2,4-D AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL THROUGH JULY, 1989. HEH23.14-11-2(22)

MASTER NUMBER	DATE 1989	JOB DESCRIPTION	SAMPLING TIME (min)	CONCENTRATION		
				PHENOL (ppm)	2,4-DCP (ppm)	2,4-D (mg/m <sup>3</sup> )
033505	4-21	Herbicide Operator	451	0.02	ND*(0.01)	ND(0.09)
074748	4-20	Head Operator	451	0.06	ND(0.009)	ND(0.08)
069424	4-21	Alternate	450	ND(0.01)	ND(0.009)	ND(0.08)
063333	6-19	Spare	416	ND(0.02)	ND(0.006)	ND(0.04)
079609	4-21	Process Engineer	452	ND(0.01)	ND(0.01)	ND(0.09)
062881	6-19	Operations Supervisor	460	0.015	0.0058	ND(0.03)
078198	6-19	Laboratory Technician	399	0.039	ND(0.007)	ND(0.05)
075090	6-19	Maintenance Foreman	452	ND(0.01)	ND(0.005)	ND(0.03)
052229	6-19	Millwright	461	0.02**	0.017	ND(0.03)
065506	4-21	Pipefitter	484	0.01	ND(0.01)	ND(0.09)
053615	4-20	Pipefitter	492	ND(0.01)	ND(0.008)	ND(0.07)
090668	6-19	Service Operator	457	0.016	0.0054	ND(0.03)
060529	6-20	Instrument Apprentice	461	0.023	0.0059	ND(0.04)
Exposure Guidelines (8-hr. TWA)			5	1	10	

\*ND denotes nondetectable at the lower analytical detection limit shown in parentheses.  
 \*\*Sample breakthrough into backup section greater than 10%.

TABLE 2A. RESULTS OF EXCURSION MONITORING FOR METHYLENE CHLORIDE, PERCHLOROETHYLENE AND DIETHYL BENZENE AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL THROUGH AUGUST, 1989  
HEH23.14-11-2(22)

MASTER NUMBER	DATE	DESCRIPTION (JOB DESCRIPTION)	SAMPLING TIME (min)	CONCENTRATION, PPM		
				MeCl <sub>2</sub>	PERC	DIETHYL-BENZENE
075619	4-13	Filter Change on Perc Still Feed (Alternate)	14	ND*(0.4)	11	4.7
075619	4-13	Perchloroethylene Rag Filter Change (Alternate)	9	ND(0.5)	21	8.8
081184	4-14	Filter Change, Methylene Chloride Refrigerant Filter (Head Operator)**	26	110	0.18	0.055
041680	4-19	Methylene Chloride Bag Filter Change (Herbicide Operator)**	21	120	ND(0.1)	ND(0.025)
041680	4-19	DOWTHERM* J Filter Change (Herbicide Operator)	36	ND(0.1)	1.5	27.4
033505	4-21	Changing 10° and 50°C Perc Filters (Herbicide Operator)	10	ND(0.4)	28	ND(0.055)
062881	5-23	Dumping Perchloroethylene Tars (T-31) (Spare)	15	ND(0.03)	0.45	0.16
063333	6-27	DOWTHERM J Filter Change (Spare)	10	ND(0.4)	0.39	3.5
063333	8-18	Unloading Perchloroethylene Truck	34	--	8.8	--
		Exposure Guidelines (8-hr. TWA) (Excursion)	50	25	10	
			1000(C)	NE	NE	

\*ND denotes nondetectable at the lower analytical detection limit shown in parentheses.

\*\*Respiratory Protection Worn

NE - Not Established

TABLE 2B. RESULTS OF EXCURSION MONITORING FOR PHENOL, 2,4-DICHLOROPHENOL (2,4-DCP) AND 2,4-D AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL HEH23.14-11-2(22) THROUGH JULY, 1989

MASTER NUMBER	DATE	DESCRIPTION (JOB DESCRIPTION)	SAMPLING TIME (min)	CONCENTRATION		
				PHENOL (ppm)	2,4-DCP (ppm)	2,4-D (mg/m <sup>3</sup> )
075619	4-13	Perchloroethylene Rag Filter Change (Alternate)	9	ND*(0.03)	ND(0.03)	ND(0.2)
063333	4-13	Sampling Dichlorophenol Reactor (Spare)	3	ND(0.1)	0.1	ND(0.7)
087428	6-20	Dumping Steam Stripper (Herbicide Operator)	3	0.067**	0.088	ND(0.1)
063333	6-21	Sampling and Unloading Phenol Tank Car (Spare)	18	0.18	0.0038	ND(0.02)
063333	6-21	Disconnect Phenol Tank Car After Unloading (Spare)	20	0.07	ND(0.003)	ND(0.02)
063333	7-5	Dumping Dichlorophenol Tars (T-20)	4	0.31	0.047	ND(0.1)
		Exposure Guidelines (8-hr. TWA) (Excursion)		5 NE	1 NE	10 NE

\*ND denotes nondetectable at the lower analytical detection limit shown in parentheses.  
 \*\*Sample breakthrough into back-up section of tube greater than 10%.  
 NE - Not Established

TABLE 3. RESULTS OF AREA MONITORING FOR METHYLENE CHLORIDE, PERCHLOROETHYLENE, DIETHYL BENZENE, PHENOL, 2,4-DICHLOROPHENOL (2,4-DCP) AND 2,4-D AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL 14, 1989 HEH23.14-11-2(22)

DATE 1989	SAMPLE DESCRIPTION	SAMPLING TIME (min)	CONCENTRATION, ppm					
			MeCl <sub>2</sub>	PERC	DIETHYL- BENZENE	PHENOL	2,4-DCP	2,4-D (mg/m <sup>3</sup> )
4-14	South Wing, 2nd Floor, Tracing Station Between V301 and V201	338/332*	ND(0.2)	0.85	3.7	ND(0.02)	0.04	ND(0.1)
4-14	Sump South Wing, 1st Floor of 949	330/300	ND(0.2)	1.2	4.3	ND(0.02)	0.05	ND(0.1)
4-14	2nd Level Catalyst Mix Tank	333/333	0.79	0.6	3.5	0.25	0.01	0.17
4-14	Perchloroethylene Compressor Room	336	ND(0.2)	0.29	ND(0.026)	---	---	---
	Exposure Guidelines (8-hr. TWA)		50	25	10	5	1	10

\*The first sampling time is for methylene chloride, perchloroethylene and diethylbenzene; the second sampling time is for phenol, 2,4-DCP and 2,4-D.

ND denotes nondetectable at the lower analytical detection limit shown in parentheses.

TABLE 4. RESULTS OF EXCURSION AND AREA MONITORING FOR SULFUR DIOXIDE AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, APRIL 21, 1989  
HEH23.14-11-2 (22)

MASTER NUMBER	DATE 1989	SAMPLE DESCRIPTION	CONCENTRATION, PPM		
			SAMPLE TIME (min)	SO <sub>2</sub>	HCl
062881	4-21	Sulfur Dioxide Unloading; Connection and Material Verification Sample*	8.5	2.1	--
062881	4-21	Same as Above; Duplicate Sample*	8.5	1.5	--
062881	4-21	Flow From Truck Started*	15	1.9	--
---	4-21	Area Sample 15 Feet North of the SO <sub>2</sub> Connection	15	3.5	--
062881	4-21	During Disconnect and Hose Bleed Off After Unloading SO <sub>2</sub> *	5.8	36	--
062881	4-14	Dichlorophenol Reactor Sampling	< 1	40**	3**
		Exposure Guideline (8-hr. TWA)			5(C)
					2 5

\*Respiratory protection worn  
 \*\*Sampling conducted with detector tubes for an instantaneous reading. Exposure was approximately a 10-second duration. Assuming a 1-minute exposure to SO<sub>2</sub>, the 15-minute TWA would be 2.7 ppm.

TABLE 5. RESULTS OF EXCURSION MONITORING FOR AIRBORNE CONTAMINANTS DURING SHORT-TERM TASKS AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, JUNE AND JULY, 1989  
HEH23.14-11-2 (22)

MASTER NUMBER	DATE 1989	SAMPLE DESCRIPTION (SAMPLE TIME, min)	CONTAMINANT SAMPLED	CONCENTRATION MEASURED	EXPOSURE GUIDELINE
053164	6-19	Loading Ferric Chloride Drums (9)	Ferric chloride	0.083 mg/m <sup>3</sup>	1 mg/m <sup>3</sup>
063333	6-21	Loading Diphenyl sulfide Drums (12)	Diphenyl sulfide	0.14 ppm	NE
063333	7-19	Changing Howden Oil Filter (27)	Oil Mist Hydrochloric acid	ND(0.15) mg/m <sup>3</sup> 0.06 ppm	5 mg/m <sup>3</sup> 5 ppm(C)

ND denotes nondetectable at the lower analytical detection limit shown in parentheses.

TABLE 6. SOUND PRESSURE LEVELS IN THE CONTROL ROOM AND LABORATORY OF THE MICHIGAN DIVISION HERBICIDES PLANT, 948 BUILDING, FEBRUARY 28, 1989. HEH23.14-11-2(22)

<u>LOCATION</u>	<u>SOUND LEVEL, dBA</u>
Control Room	70
Break Room	60
Men's Locker room	55
Hallway to men's locker room	60
Hallway by TRANE air handling unit	72
Outside door #3, 948 Bldg.	80
Lab, North end	60
Lab, East fume hood	65
Terminal Room	59
Behind the Mod IV "cans"	68
Exposure Guideline	90(C)

TABLE 7. SOUND PRESSURE LEVELS IN THE MICHIGAN DIVISION  
HERBICIDE PLANT MAINTENANCE SHOP, 1076 BUILDING, MARCH  
15, 1989 HEH23.14-11-2(22)

<u>LOCATION*</u>	<u>SOUND LEVEL, dBA</u>
<b>Background levels:</b>	
South end of shop, hand grinder in use behind welding curtain.	76
At second table S. of break- room, west of the welding curtain (no tools in use)	65
<b>Levels with equipment running:</b>	
At bench west of welding curtain; hand grinder used on sheet metal inside welding curtain	86
Repeat of previous event, 30 seconds later	89
<b>Inside welding curtain of plasma arc area:</b>	
2-wheel grinder running, work being performed with a 4" section of 6" diam. pipe; 3' from source	80-89
2-wheel grinder; grinding a flat piece of metal	105-110
Plasma arc in use (4' from source)	95-103
<b>Hand grinder in use:</b>	
(1) 3' from grinder	102
(2) Immediately inside welding curtain	98
(3) Outside of welding curtain, at the bench west of the curtain	90

\*All measurements made with the plasma arc area local exhaust  
ventilation on.

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TABLE 7 (CONT). SOUND PRESSURE LEVELS IN THE MICHIGAN DIVISION  
HERBICIDE PLANT MAINTENANCE SHOP, 1076 BUILDING,  
MARCH 15, 1989 HEH23.14-11-2(22)

<u>LOCATION*</u>	<u>SOUND LEVEL, dBA</u>
Other shop power tools:	
Horizontal band saw	82
Vertical band saw	85-94
Sander	
87-93	
Tool grinder	96-98
Rigid pipe threader (not threading pipe)	93
RAX pipe threader (not threading pipe)	70

\*All measurements made with the plasma arc area local exhaust ventilation on.

TABLE 8. EMPLOYEE TIME-WEIGHTED AVERAGE NOISE EXPOSURES AT THE MICHIGAN DIVISION HERBICIDES PLANT, 948, 949 AND 1076 BUILDINGS, MARCH 28 - APRIL 7, 1989  
HEH23.14-11-2(22)

JOB CLASSIFICATION	MASTER NUMBER	DATE 1989	SAMPLING TIME (min)	Lavg dbA	% DOSE CORRECTED TO FULL SHIFT
Head Operator	064826	3-30	461	82	62
	072333	4-7	448	69	13
Herbicide Operator	087428	3-30	466	63	5.3
	053164	4-4	398	79	50
Spare	063333	3-30	466	77	35
	062881	4-4	463	81	60
Alternate	075619	4-4	460	83	79
	069424	4-7	417	77	31
Operations Supervisor	066267	4-4	453	67	10
Production Supervisor	078233	4-7	470	54	1.3
Pipefitter	063392	3-28	463	73	19
	064250	4-5	481	75	27
Fitter-Welder	062834	3-28	470	81	56
Millwright	052229	3-28	472	78	43
	052229	4-7	435	73	22
Instrument Man	060529	4-5	471	75	28
Service Operator	090668	4-5	480	74	21
Maintenance Foreman	075090	4-5	467	71	15
Exposure Guideline				85	100
		(8-hour TWA) (Ceiling)		90	

TABLE 9. RESULTS OF A HEAT STRESS SURVEY CONDUCTED IN THE 2,4-D CENTER WING, 949 BUILDING, MICHIGAN DIVISION HERBICIDES PLANT, JULY 5, 1989  
HEH23.14-11-2(22)

LOCATION	TEMPERATURE, OF				WBGT*	Relative Humidity (%)
	Dry Bulb	Wet Bulb	Globe	Globe		
Outside	85.9	73.0	88.7	88.7	77.8	54
1st Floor	97.8	80.7	98.8	98.8	86.1	49
2nd Floor	110.8	84.3	112.8	112.8	92.9	32
3rd Floor	120.5	87.2	121.9	121.9	97.7	28

\*WBGT(Wet Bulb Globe Temperature)=0.7(Natural Wet Bulb Temperature) + 0.3(Globe Temperature)

Table 10. INDUSTRIAL HEAT EXPOSURE LIMITS<sup>a</sup>

Work Category	Maximum WBGT			
	Continuous <sup>c</sup>	3 hours <sup>e</sup>	2 hours <sup>e</sup>	Intermittent Work-Rest <sup>b</sup> 1 hour 30 min 20 min
Light <sup>d</sup>	90	94	96	100 107 112
Moderate	86	89	91	95 101 106
Heavy <sup>f</sup>	80	84	86	90 95 100

<sup>a</sup>From Basic Industrial Hygiene, R.S. Brief, published by the American Industrial Hygiene Association

<sup>b</sup>Length of work period alternated with one-hour rest periods under cooler conditions

<sup>c</sup>Eight hours per day with ten minutes rest per hour

<sup>d</sup>Sitting, desk work

<sup>e</sup>Standing, light or moderate work at machine or bench

<sup>f</sup>Intermittent heavy lifting, pushing, pulling, climbing





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FIGURE 3. AREA NOISE LEVEL MEASUREMENTS IN 949 BUILDING; 3RD FLOOR, SOUTH AND WEST WINGS, AT THE MICHIGAN DIVISION HERBICIDES PLANT, MARCH, 1989.  
HEH23.14-11-2(22)

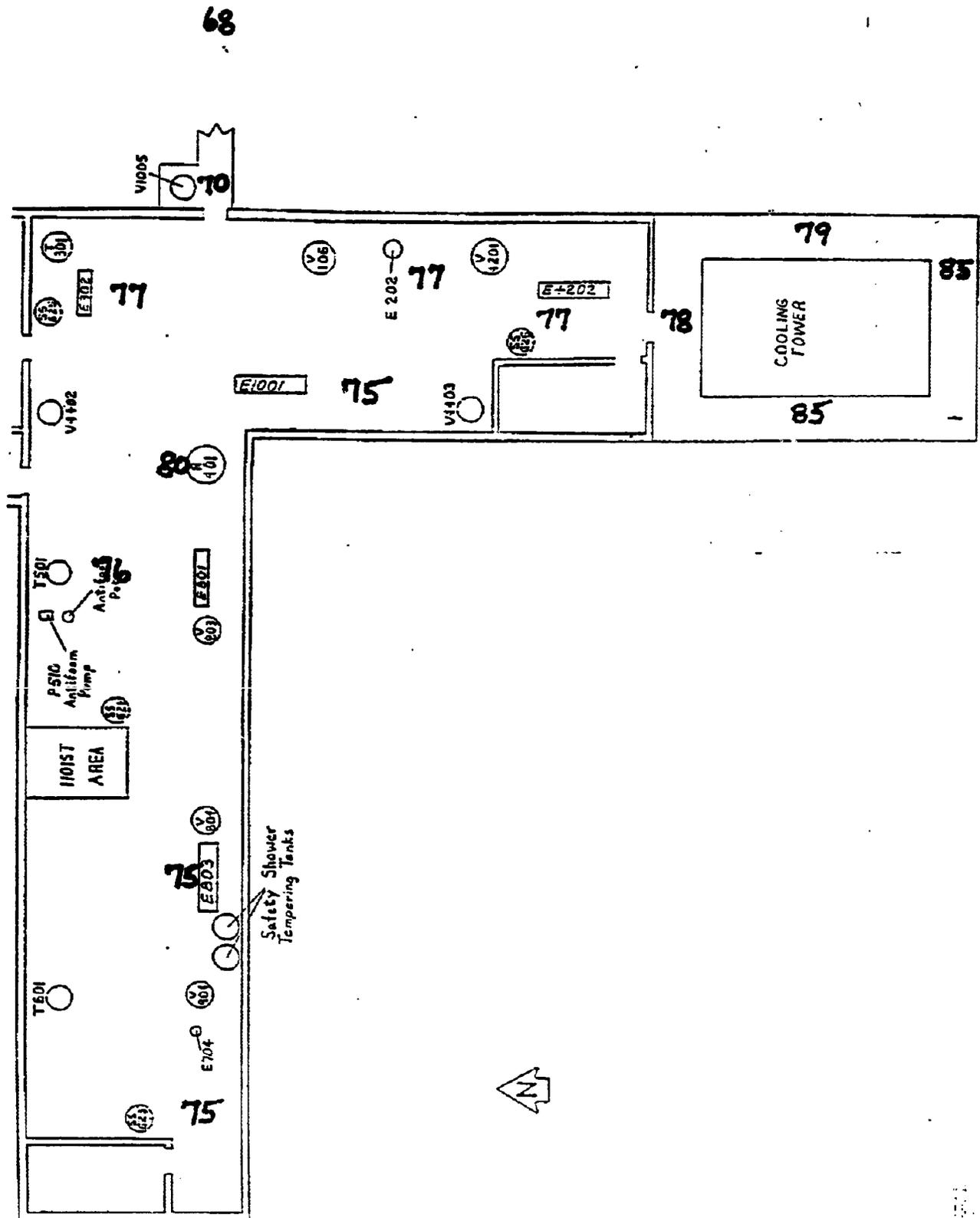


FIGURE 4. AREA NOISE LEVEL MEASUREMENTS 949 BUILDING, SOUTH WING ROOF, MICHIGAN DIVISION HERBICIDES PLANT, MARCH, 1989.

HEH23.14-11-2(22)

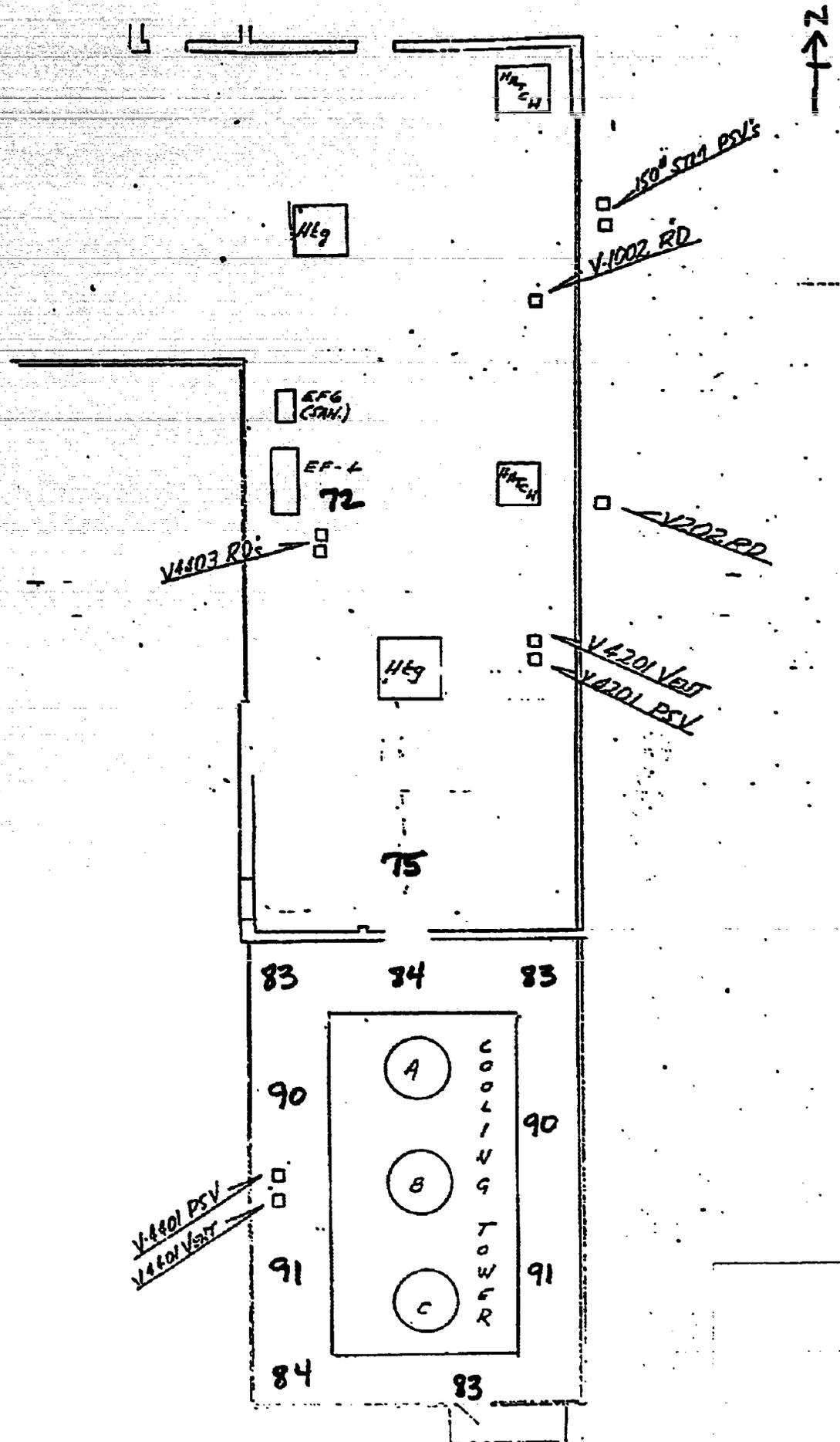


FIGURE 5. AREA NOISE LEVEL MEASUREMENTS, BUILDING, WEST WING ROOF, MICHIGAN DIVISION HERBICIDES PLANT, MARCH, 1989. HEH23.14-11-2(22)

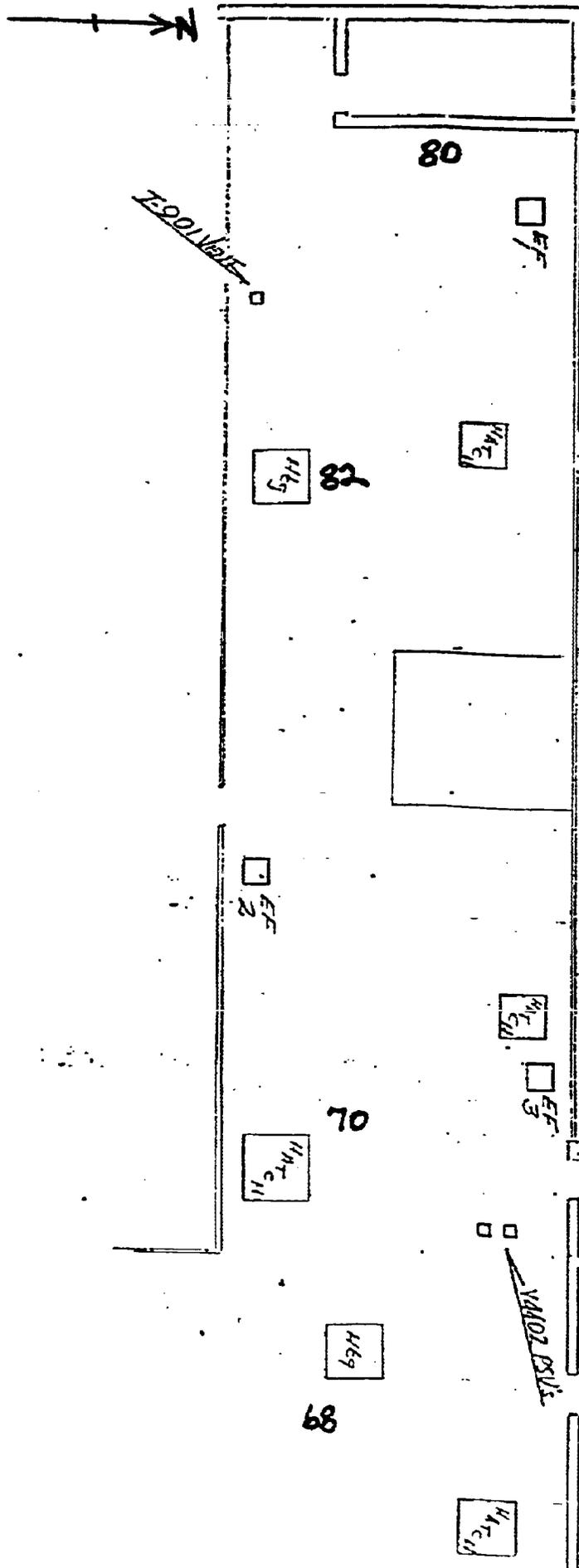
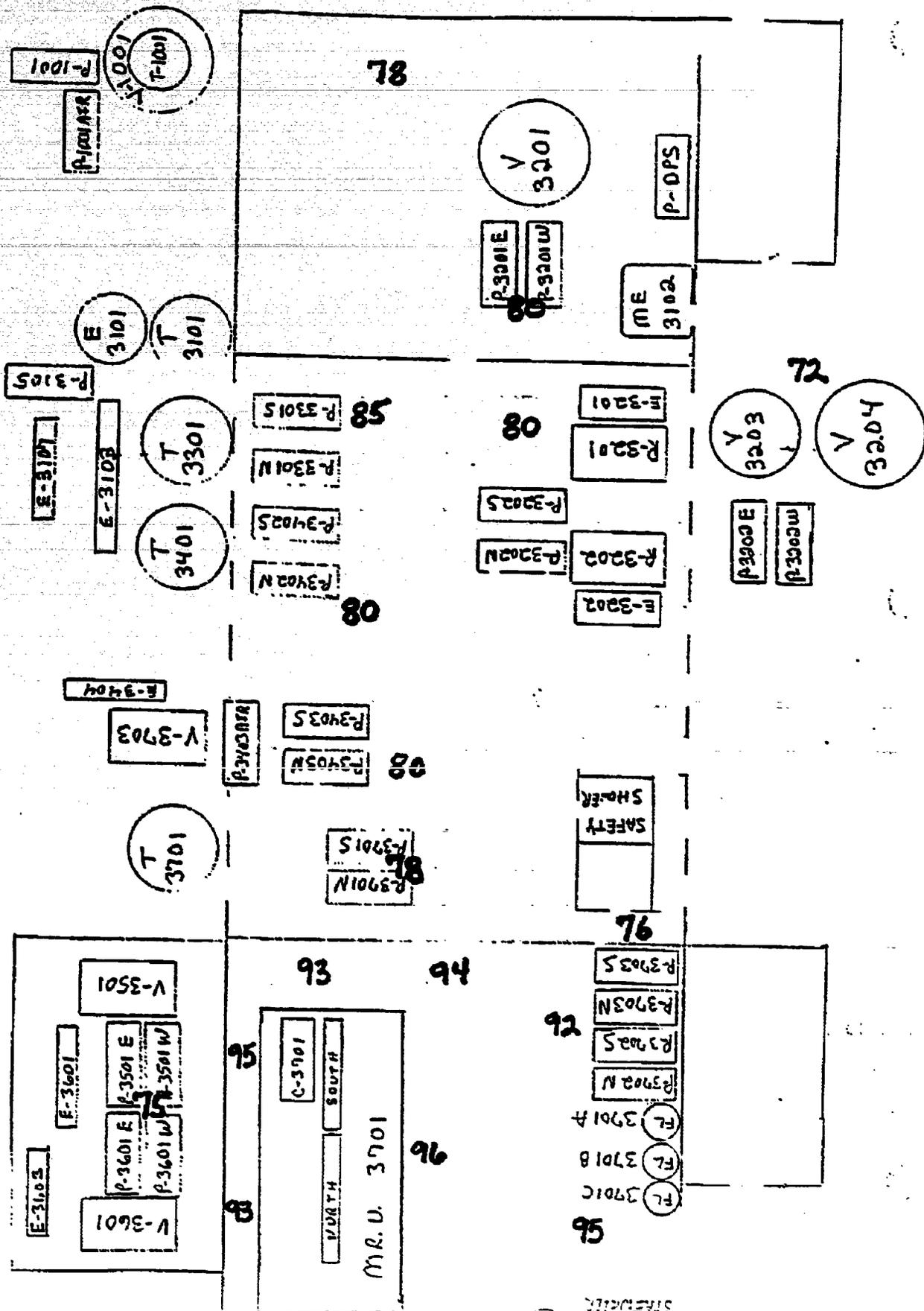


FIGURE 6. AREA NOISE LEVEL MEASUREMENTS, 949 BUILDING, NORTH WING, 1ST FLOOR, MICHIGAN DIVISION HERBICIDES PLANT, MARCH, 1989.

HEH23.14-11-2(22)





## Dow Releases Formal Incident Findings

The Dow incident investigation team has reached its conclusions about the death of a Dow Chemical Company employee which occurred at the plant site in Midland on October 12. Learnings from the incident will be applied to the site, as well as to plant locations globally, in an effort to prevent such a tragedy from occurring again, according to Vince Smith, director of Michigan Operations.

A 29-year-old head operator at a herbicide plant, was accidentally exposed to an herbicide intermediate chemical at his worksite in the early morning hours. He was pronounced dead shortly afterwards at MidMichigan Regional Medical Center. Since there were no witnesses to the actual incident, the Dow investigation team members conducted a simulation exercise to attempt to determine what happened. For the past two weeks, they have focused on establishing what they believe to be the root causes of the incident, including examination of the appropriateness of job procedures and use of personal protective equipment. Further efforts by them and by all employees at the Michigan Operations site, according to Smith, will include incorporation of learnings into plant operating procedures and standards.

His last known task before the accident was to clean a pump that was shut down for maintenance. He was exposed on his leg and arms to dichlorophenol, apparently from a leak which developed in a piece of tubing connected to the pump. The protective gear the employee was wearing at the time he was sprayed was not sufficient to protect him from the exposure he experienced, according to the investigation team. The team made the following conclusions as a result of their investigation:

- A Dow safe work permit was not issued which would have been required for this task;
- The employee was not wearing a rubber suit and boots, chemical-resistant gloves, and a face shield which would have been the personal protective equipment required by the permit for this task;
- The employee bypassed the nearest safety shower for unknown reasons and entered a more distant locker room shower instead; and
- Specifications for the tubing material on the pump were not found in plant documents. The tubing was made of copper which is susceptible to corrosion when it comes in contact with this chemical.

Representatives of Dow AgroSciences, who are the owners of the manufacturing facility where the accident occurred, participated in the investigation and will continue to coordinate with Dow and with their customers and other producers on communications of incident learnings.

"First and foremost, we need to institutionalize the concept of adherence to best practices and of expecting the unexpected," said John Tomke, vice president and global leader for Operations, Dow AgroSciences. "Best practices clearly are the collective intelligence of the entire organization. Secondly, we need to assure that all team members understand the positive actions of intervention. This is a responsibility and an opportunity for each and every one of us. We also need to emphasize the importance of time. The time to decontaminate in this situation may have had an impact on the final outcome.

"Finally, we've challenged our investigation team to look at innovative and effective ways to not only communicate the results of this event and the outcomes inside of our organization globally, but to also enhance learnings from it so we can really learn from this very tragic event," said Tomke.

Corrective actions have already been taken, including:

- Emphasizing with employees the importance of following the existing work procedures and safe work permit requirements;
- Emphasizing with employees the proper use of personal protective equipment and safety equipment; and
- Replacement of the tubing with another material and review of other pipe and tubing connections throughout the process for use of appropriate materials.

Now that the investigation is completed, the plant process has been restarted.

"We have lost a friend and a co-worker," said Smith. "A father at our site has lost a son. We all continue to feel great sadness over this. It is a lesson for us all—and a distinct challenge to us all—that we will elevate our safety performance."

"From this incident, we've been reminded of how tragic putting our guard down for safety can be," said William L. Laney Jr., President of Local 12075, United Steelworkers of America. "We must take the time to look at all jobs, second guess what we are doing, and intervene with other employees if need be to ensure our safety at Dow Michigan Operations."

As is standard procedure in industrial accidents, MIOSHA continues to investigate the accident in a parallel investigation. Dow is cooperating fully with the organization's representatives and hopes to gain further learnings from their investigation, said Smith.

An official autopsy report is still pending from the Midland County Medical Examiner's office.

Dichlorophenol is an intermediate material used in the production of some herbicides, insecticides, and pharmaceuticals. The chemical is hazardous. It can cause severe burns upon skin contact, and if absorbed through the skin, it can affect internal organ function and cause death. Workers who deal with this chemical routinely receive specialized safety training and have guidelines for wearing the appropriate personal protective equipment.

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F-05

*Medical Records*

MIDLAND HOSPITAL CENTER  
PATHOLOGY DEPARTMENT  
AUTOPSY EXAMINATION

NAME: \_\_\_\_\_  
AGE: 45  
RACE: Caucasian  
SEX: Male  
HOSPITAL NO.: D.O.A.  
DATE OF ADMISSION: \_\_\_\_\_  
DATE OF COMPLETION: Oct. 30, 1980

AUTOPSY NO.: 80A77  
DEATH: Sept. 16, 1980  
DATE TIME  
AUTOPSY: Sept. 17, 1980  
DATE TIME  
PROSECTOR: John W. Hysell, M.D.  
PHYSICIAN: James Frye, M.D.,  
Deputy Medical Examiner

FINAL PATHOLOGIC DIAGNOSIS:

"Acute steam and dichlorophenol exposure." Superficial cutaneous burns involving neck, back, and thighs. Acute mucosal congestion of epiglottis and pyriform sinuses. Petechial laryngeal mucosal hemorrhage. Marked pulmonary congestion with extensive alveolar hemorrhage. Hyperkalemia (9.1 mM). Slight acute congestion of kidneys. Bilateral adrenal cortical hyperplasia. Small posterior intramural left ventricular myocardial scar. Hepatomegaly (fatty liver).

CAUSE OF DEATH:

- I A) Cardiac arrhythmia
- B) Hyperkalemia (9.1 mM)
- C) Acute severe pulmonary thermal injury.

*John W. Hysell*  
John W. Hysell, M.D.,  
Pathologist

JWH/cm

CC: Dr. Frye  
Dr. J. Eline  
Dr. Kolesar  
Lab File

**F.06**

80A77

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CLINICAL SUMMARY

The decedent, a 45 year old white male, was involved in an industrial accident involving dichlorophenol exposure. He suffered superficial cutaneous burns over his neck, back, and thighs. He reportedly immediately went into a decontamination shower during which time he reported that he felt poorly. He suffered a syncopal episode at which time he was noted to have no pulse or respiration. Cardiopulmonary resuscitation efforts were immediately initiated and the Dow Ambulance Service was summoned. The decedent was transported to the Dow Medical Emergency Area where he was dead on arrival. Postmortem examination was requested by Dr. James Frye, Deputy Medical Examiner for Midland County.

## CLINICAL PATHOLOGIC CORRELATION

The decedent, a 45 year old white male was involved in an industrial accident which initially was believed to involve only dichlorophenol exposure. Subsequent industrial safety investigation of the accident by The Dow Chemical Company and the Michigan Occupational Safety and Health Agency revealed that the decedent had in fact introduced steam condensate into the system without having notified the appropriate personnel to have the system turned off. The water was therefore introduced into a system which was being maintained well in excess of 100°C. The resulting violent vaporization resulted in the decedent being sprayed by steam which may have contained a dichlorophenol aerosol. The industrial investigation of the accident also revealed that the victim then bypassed the nearest safety shower and initiated decontamination in a dressing area in an unalarmed shower. He subsequently left that shower and used an alarmed shower which initiated the ambulance dispatch procedure and set-off other alarms to obtain immediate aid from nearby personnel. He suffered a syncopal episode, the description of which lead the Deputy Medical Examiner to make a provisional diagnosis of cardiac arrhythmia. Resuscitation efforts were unsuccessful even though immediately initiated.

Postmortem examination revealed grossly obvious superficial cutaneous burns over the neck, back, and thighs. Extensive oral burns were reported at the scene and postmortem examination confirmed the presence of extensive acute burns involving the epiglottis and pyriform sinuses. Petechial hemorrhages were observed in the larynx and trachea. Microscopic examination revealed severe pulmonary congestion and extensive alveolar hemorrhage. Because of the very brief interval between thermal injury and death, no microscopic inflammatory changes other than vascular congestion were apparent in any of these locations. No other significant changes were noted grossly or microscopically.

No dichlorophenol or acetate derivatives were detectable in serum, gastric contents, or urine. The serum, which was obtained shortly after death had a potassium concentration of 9.1 mM. This observation is somewhat difficult to access since increasing potassium concentration is a normal postmortem finding. In this instance, since the specimen was obtained essentially immediately postmortem, it may be significant. If this is a premortem change, it could be explained on the basis of acute severe thermal injury of the pulmonary tissue and blood within the pulmonary vascular bed due to steam inhalation. The extent of observed pulmonary changes could also account for death on the basis of acute respiratory failure. In either event, the ultimate cause of death is acute pulmonary thermal injury due to steam inhalation, either due to respiratory compromise and respiratory arrest or due to cardiac arrhythmia secondary to the extensive tissue destruction with consequent hyperkalemia.

EXTERNAL EXAMINATION:

**BODY LENGTH:** Approximately 69 inches.  
**WEIGHT:** Approximately 220 pounds.  
**NUTRITION:** Slightly excessive.  
**HEAD:** Normocephalic.  
**NECK:** No abnormal mobility or masses.  
**CHEST:** No osseous deformity.  
**ABDOMEN:** Slightly protuberant.  
**EXTREMITIES:** Unremarkable except for cutaneous burns.  
**SKIN:** There are superficial cutaneous burns involving neck, upper chest, back, and thighs. The anterior thighs appear to have sustained somewhat deeper injury.

INTERNAL EXAMINATION:

**MAIN INCISION:** The panniculus is moderately thickened.  
**BODY CAVITIES:** No abnormal fluid or adhesions.  
**LUNGS:** The right lung weighs 630 grams and the left 520 grams. The pleural surfaces are smooth. The parenchyma is of normal crepittance. The cut surface reveals moderate acute congestion but no other abnormality.  
**HEART:** Weight 420 grams. The epicardial surface is smooth and glistening. Examination of the coronary arteries reveals slight atherosclerotic change but no significant stenosis and no occlusion. Multiple sections through the myocardium reveals a single small scar approximately 1 cm. in maximum dimension within the posterior portion of the left ventricular wall. The cardiac valves are unremarkable.  
**LARYNX:** The epiglottic and pyriform sinus mucosa is markedly congested suggesting acute chemical burn. In addition, there are occasional petechial hemorrhages within the laryngeal mucosa below the vocal cords.  
**TRACHEA:** Rare petechial changes. Otherwise unremarkable.  
**THYROID:** Unremarkable.  
**ESOPHAGUS:** Unremarkable.  
**STOMACH:** Unremarkable.  
**DUODENUM:** Unremarkable.  
**SMALL INTESTINE:** Unremarkable.  
**COLON:** Unremarkable.  
**LIVER:** Weight 2310 grams. The liver margins are somewhat blunted. Cut surface reveals the parenchyma is slightly softer than usual and has a somewhat yellowish-tan coloration suggesting fatty change.  
**PANCREAS:** Unremarkable.  
**SPLEEN:** Weight 130 grams. Unremarkable.  
**KIDNEYS:** Each kidney weighs 210 grams. The capsules strip with ease revealing a smooth cortical surface. Cut surface reveals slight passive congestion but no other abnormality.  
**ADRENAL GLANDS:** Each adrenal gland contains cortical nodules up to 1.5 cm. in diameter each. The medullary portion appears to be unremarkable.  
**PELVIS:** Not examined.  
**BRAIN:** The skull is intact. The meninges are smooth and glistening. The brain weighs 1570 grams. The cerebral hemispheres are symmetrical and normally developed. The base of the brain is unremarkable. The cerebellum has its usual foliate configuration. The brain stem is unremarkable. Cut surface reveals no abnormality. The ventricles are of normal size having no abnormal contents.

## TOXICOLOGIC EVALUATION

Blood, urine, and gastric contents are submitted to the Dow Chemical Company for analysis. The urinary bladder is essentially empty and only approximately 3 ml could be aspirated.

These samples were then forwarded to Dr. Daniel Couri, Professor of Pharmacology and Director of Toxicology, at Ohio State University. The serum specimen which was submitted for evaluation was one which was obtained immediately postmortem at the Dow Medical Facility. No 2,4-dichlorophenol, monochloroacetic acid, or 2,4-dichlorophenoxyacetic acid were detectable in the gastric fluid, serum, or urine. Evaluation of the serum electrolytes revealed a potassium concentration of 9.1 mM. A copy of the complete toxicology report is appended to this autopsy report.

MICROSCOPIC EXAMINATION

LUNGS: Severe congestion and extensive alveolar hemorrhage.

HEART: Occasional foci of interstitial fibrosis with myocardial hypertrophy of the adjacent fibers.

CORONARY ARTERY: Moderate atherosclerosis with approximately 50% luminal stenosis.

TRACHEA: Postmortem change. Congestion of the blood vessels of the substantia propria.

ESOPHAGUS: Unremarkable.

STOMACH: Postmortem change.

SMALL INTESTINE: Postmortem change.

LIVER: Moderately severe hepatocellular fatty change. Slight passive congestion.

PANCREAS: Postmortem change.

SPLEEN: Unremarkable.

KIDNEYS: Unremarkable.

ADRENAL GLAND: Cortical adenoma.

SKIN: Unremarkable.

BRAIN: Unremarkable.

F:11



The Ohio State University

Department of Pharmacology

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Phone 614 422-8608

October 27, 1980

Dr. John Hyse  
Pathology Department  
Midland Community Hospital  
Midland, Michigan 48640

Re:  serum, urine, gastric

The specimens submitted by Dr. Kolesar were subjected to a comprehensive toxicology examination. Serum, gastric and urine samples were utilized for analysis in a manner yielding the most information possible regarding the presence or absence of exogenous agents of acidic, neutral, basic and volatile chemical characteristics.

RESULTS OF TOXICOLOGY EXAMINATION:

Gastric Fluid:

Acid, basic and neutral drugs were not detected in the gastric sample. Also, 2,4-dichlorophenol<sup>a</sup>, monochloroacetic acid<sup>a</sup>, and 2,4-dichlorophenoxyacetic<sup>b</sup> acid were not detected in the gastric sample. (Detection limits: <sup>a</sup> 1 ug/ml; <sup>b</sup> 5 ug/ml.)

Serum:

Samples of serum were analyzed for acidic, neutral and volatile drugs and agents. Analyses included at least: barbiturates, methaqualone, glutethimide, methyprylon, benzodiazepines, acetaminophen, ethchlorvynol, salicylates, alcohols, acetone and phenol. Serum was further analyzed for the presence of 2,4-dichlorophenol, monochloroacetic acid, and 2,4-dichlorophenoxyacetic acid. None were detected in the serum.

Urine:

Urine was analyzed for the presence of 2,4-dichlorophenoxyacetic acid. None was present in urine.

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OTHER DETERMINATIONS:

Serum Electrolytes:

Potassium - 9.1 mM  
Sodium - 137.5 mM

Urine:

Creatinine - 30 mg/100 ml  
\*Protein - Approximately 100 mg%  
\*Glucose - Approximately 100 mg%  
\*Ketones - Negative  
\*Blood (presence) - Positive  
Total catecholamines in urine - None detected (Limit of detection:  
25 ng/ml)

\*Limited amounts of urine necessitated use of Ames Labstix for estimation.

Sincerely,

A handwritten signature in cursive script that reads 'Daniel Couri'.

Daniel Couri, Ph.D.  
Professor of Pharmacology  
Director of Toxicology