EPA Office of Pollution Prevention and Toxics

Occupational Safety and Health Administration

February 15, 2000

CHEMICAL ADVISORY AND NOTICE OF POTENTIAL RISK: Skin exposure to molten 2,4-Dichlorophenol (2,4-DCP) can cause rapid death.

SUMMARY

Based on information obtained from recent worker fatality cases, skin exposure to relatively small amounts of molten 2,4-Dichlorophenol (as little as 1% of body surface - about the size of your hand) may lead to death.

2,4-DCP is a high production volume feedstock chemical used to produce some herbicides and pharmaceuticals. It is not believed to be used outside of the chemical industry. A 1998 worker fatality at a herbicide manufacturing operation was reported to EPA under Section 8(e) of the Toxic Substances Control Act (TSCA). Case evaluation and additional research revealed the following:

- Three other fatalities have occurred since 1980 in operations where 2,4-DCP is handled.
- The fatalities involve rapid death after accidental skin exposure.
- Molten (i.e. heated and liquified) 2,4-DCP is more quickly absorbed through the skin than the solid crystalline form.
- Amounts of molten 2,4-Dichlorophenol that cover as little as 1% of body surface area (hand-sized) are of concern.
- Current toxicology literature does not sufficiently describe the potential for the molten form of 2,4-DCP to cause death via skin absorption.
- No common occupational exposure limits exist for this chemical.
- There is a need to increase awareness about this risk and the steps needed to reduce risks to workers.

If you are involved with operations where 2,4-DCP is manufactured, imported, processed, used, or handled as a waste, then you need to read this advisory. It provides both general and specific recommendations based on a review of available information by EPA and the Occupational Safety and Health Administration (OSHA). It is not intended to serve as an exhaustive source of all technical information on 2,4-DCP, and the agencies did not independently verify all of the recommendations developed by others that are contained in the advisory. Additional information on the fatality cases is available in TSCA docket #8EHQ-14302. Specific details and a description of the four cases (in the order in which they

were identified) are provided below.

SUBSTANCE IDENTIFICATION AND REGULATORY STATUS

2,4-Dichlorophenol: (CAS 120-83-2 , EINECS 204-429-6)
Crystalline needles at room temperature, colorless liquid when melted.
Melting Point is 43-45° C (111-116° F): freezing point is 42° C (108° F)
Strong odor described as pungent, medicinal, similar to phenol.
EC # 604-011-00-7, UN# 2020,
International Chemical Safety Card # 0438
Reportable chemical under EPCRA Section 313 (Toxics Release Inventory)
Reportable waste (U081) under Resource Conservation and Recovery Act (RCRA)
Reportable quantity under EPCRA Section 304 - 100 pound threshold
Subject to TSCA Testing requirements under 40CFR 766
2,4- DCP is a "hazardous chemical" as defined by the OSHA Hazard Communication Standard
No OSHA PEL, NIOSH REL, or ACGIH TLV®

DESCRIPTION OF KNOWN FATALITIES

CASE #1.
A 29 year old man was sprayed with 2,4-DCP while working on a tubing leak in October of 1998. While there were no witnesses, available information indicates that the worker was apparently trying to clean a shut down pump by passing hot pressurized steam condensate through the pump to thaw frozen 2,4-DCP inside. It is believed that pressurized material sprayed out of a hole in the tubing connected to the pump. The hole had previously been hidden and sealed by solid 2,4-DCP but had been subsequently washed off. The sprayed worker bypassed the nearest safety shower to use the locker room shower where he fell unconscious. Immediate first-aid and resuscitation was unsuccessful and the worker was pronounced dead at the hospital one hour later. Skin contamination with 2,4-DCP involved his forearms, knee, thigh, and face. Death was attributed to acute dichlorophenol intoxication, and 2,4-DCP was found in the victim's blood (7.2 ug/ml free 2,4-DCP, 13.1 ug/ml total 2,4-DCP), and urine (4.8 ug/ml free 2,4-DCP, 6.2 ug/ml total 2,4-DCP). The employer, Dow Chemical Company, reported the fatality to the EPA under Section 8(e) of the Toxic Substances Control Act on October 19, 1998. 2,4-DCP was being used as a feedstock for production of herbicides.

CASE #2
Additional evaluation of 2,4-DCP led to a finding of a second case published in the Archives of Toxicology in 1992. The report, "Accidental death caused by the absorption of 2,4-dichlorophenol through the skin", described a fatality that occurred when a 33 year old man was splattered over portions of his right thigh and arm with a pure solution of 2,4-DCP. Less than 10% of his body surface was contaminated. He walked away from the scene and washed himself with water without undressing. He experienced a seizure and collapsed within 20 minutes of the contamination episode, and died after unsuccessful attempts at resuscitation and cardiac massage.

The authors reported finding 2, 4-dichlorophenol in the blood (24.3 mg/l); urine (5.3 mg/l); bile (18.7 mg/l); and stomach (1.2 mg/l).[1] The authors commented that the low stomach concentration suggested that absorption via the skin had occurred. While the name and location of the facility were not provided, the authors who performed the post-mortem tests were based in Strasbourg, France. The facility was described as a factory, and the task being performed at the time of the accident was disposal of industrial waste.

CASE #3

EPA's request to the Section 8(e) submitter (Dow Chemical Company) for additional information revealed a previous fatality involving 2,4-DCP exposure at the same facility and operation as Case #1. The fatality occurred in September of 1980 and involved a 45 year old man. Accidental introduction of water into a high temperature system resulted in violent vaporization and steam formation. It is believed that the worker was sprayed by steam containing 2,4-DCP resulting in skin and inhalation exposure. The worker bypassed the nearest safety shower and initiated decontamination in a dressing area with an unalarmed shower. He then left that shower and went to an alarmed shower which set off an alarm to bring personnel and an ambulance. He received various thermal burns to his skin and mouth, lost consciousness and died despite immediate resuscitation attempts. The final pathologic diagnosis was "acute steam and dichlorophenol exposure". Post-mortem testing of serum for 2,4-DCP was negative. While steam was considered to have been the primary cause of this fatality at the time of the accident, the TSCA 8(e) submitter now believes, based on awareness of limitations in the 1980 serum testing and additional experience and findings from the more recent case, that the death was likely to have been due to 2,4-DCP.

CASE #4

EPA found reference to a 1992 case that occurred at an A.H. Marks chemical facility in Bradford, England. According to a report on the incident prepared by the Pesticide Action Network North America Updates Service (PANUPS) a 64 year old man died after being sprayed with 2,4-DCP. He was reportedly attempting to unblock a clogged pump carrying 2,4-DCP in an operation where it was being used as a feedstock for herbicide manufacture. The PANUPS report was based on a British newspaper investigation and article. Additional details obtained from a report in the magazine Health and Safety at Work indicate that steam was being used to clear the blockage, that a pump seal gave way, that steam and 2,4-DCP spurted out onto the worker's face and neck, and that death occurred twenty minutes later.

In summary, 2,4-DCP has been linked by various investigators with at least four worker fatality cases. The agencies were unable to obtain all of the underlying data needed to independently verify the linkage in each case, but believe that the available information is of

[1] Note - the units used in Case #2 (mg/l - milligrams per liter) are equivalent to the units used for Case #1 (ug/ml - micrograms per milliliter)

sufficient value to merit a high level of concern. It is prudent to consider 2,4-DCP as capable of causing rapid death after skin exposure to the heated form, and steps should be taken to examine and control worker exposures.

IDENTIFICATION OF BEST PRACTICES TO PROTECT WORKERS

EPA reviewed and discussed existing information with OSHA, NIOSH, and the Section 8(e) submitter. Because few guidelines for handling 2,4-DCP exist, the following list of work practices was developed based on available information to assist facilities and operations handling the substance.

1) CREATE A HIGH LEVEL OF HAZARD AWARENESS

1a) Toxicity awareness It is imperative that all jobs with potential exposure to 2,4-DCP be identified, and that workers, supervisors, and health and safety staff be made fully aware of the possible dangers associated with skin exposure to 2,4-DCP, especially as a solution or in a molten state. Existing Material Safety Data Sheets (MSDSs) and training materials need to be updated to provide an explicit warning about the skin absorption hazard. For example, the TSCA Section 8(e) submitter revised their MSDS for 2,4-DCP to include these statements:
"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."

> NOTE: While the 1% figure reported on the MSDS is useful because it helps to convey the serious nature of the skin absorption hazard, EPA does not have sufficient information to judge whether it can be used as a strict limit for judging smaller skin exposures to be "safe" or not. Another factor is that some references consider hand-sized (front and back) to represent approximately 3% of body surface. Therefore, the Agency recommends that extreme caution and action be taken for **any** skin contact with molten 2,4-DCP, even if it is less than hand-sized or 1% (e.g. even a finger or part of a hand).

2,4-DCP can also cause other types of adverse health effects. Exposure to the eye can cause severe irritation and corneal injury which can result in permanent impairment of vision or blindness. Inhalation of dusts can cause severe irritation to the upper respiratory tract. Elevated temperatures can generate vapor levels sufficient to cause eye and respiratory irritation. In animal tests, it has been associated with effects on the blood forming organs, kidney, and liver.
Lastly, 2,4-DCP is one of a number of organic chemical substances covered under current EPA

testing requirements[2] to analyze for possible contamination by certain polyhalogenated dibenzo-p-dioxins and polyhalogenated dibenzofurans. Polyhalogenated dioxins and furans are of concern because of their potential to cause adverse health and environmental effects at very low doses.

1b) Temperature awareness 2,4-DCP is a white solid at room temperature, but it melts at the relatively low temperature of 43-45 degrees C (111-116 degrees F). Heating it above this temperature creates a slurry or liquid that is much more quickly absorbed through the skin than the solid crystals. Workers and supervisors need to understand that the hot liquid or molten form of 2,4-DCP is much more hazardous than the solid form, and all tasks involving the molten form should be targeted for special review to minimize the chance of splashing exposures.

1c) Time awareness (related to decontamination) Workers and supervisors need to know that if skin exposure does occur, that speed is critical. In Case #1, the worker for some reason bypassed the nearest emergency shower to go to locker room showers and this delay may have contributed to death. Rapid effective decontamination is critical to surviving a skin exposure episode.

2) REVIEW PROCEDURES AND EQUIPMENT TO INSURE THAT THEY ARE EFFECTIVE FOR PREVENTING EXPOSURES

2a) Use of safe work permits for specific tasks Safe work permits are recommended to help insure that proper procedures are consistently used for tasks involving potential skin exposure to molten 2,4-DCP. Permits and standard procedures should be developed for tasks such as line and equipment openings for routine maintenance, tasks involving high temperatures and pressure, and tasks that address known or suspected leaks or blocked lines. The unplugging of blocked lines was involved in two of the fatality cases. The ability of solid 2,4-DCP to plug up leaks can lead to spray exposures to workers when the solid residue is washed off and hot pressurized 2,4-DCP escapes.

2b) Selection of material for pipes and equipment in 2,4-DCP service The investigation in Case #1 revealed that copper tubing was being used for 2,4-DCP lines and that copper is degraded by 2,4-DCP at a rate of 20 mils per year. Such degradation can increase the likelihood of leaks and subsequent exposures. Facilities using 2,4-DCP need to review process and equipment specifications to assure that appropriate materials are being used. Copper should be

[2] 2,4-DCP is subject to EPA's TSCA Section 4 Polyhalogenated Dioxin/Furan (D/F) Test Rule found at 40 CFR 766. In general, the D/F Test Rule requires each individual producer or importer of a chemical substance listed at 40 CFR 766.25 to submit to EPA either: 1) a letter of intent to analyze and then (following the Agency's approval of submitted sampling plans and analytical protocols) analyze their listed chemical for possible contamination by certain polyhalogenated dibenzo-p-dioxins and polyhalogenated dibenzofurans; or 2) a letter requesting either an exclusion or waiver (see 40 CFR 766.32) or exemption (see 40 CFR 766.35) from testing that chemical.

excluded from 2,4-DCP service (e.g. seal flushes/pots, instrument connections, drains, sample lines) in favor of other more resistant materials such as nickel based alloys (e.g. monel and hastelloy). Schedules for routine maintenance and replacement of 2,4-DCP service should take degradation factors into account.

2c) Use of engineering controls and exposure guidelines Facilities using 2,4-DCP should develop a comprehensive list of all job tasks and operations with potential airborne exposures (e.g. dust, vapor, aerosol) and/or potential skin or splash exposures. Additional evaluation of this exposure inventory should be performed to determine where engineering and source reduction methods can be employed to eliminate or reduce the source of exposures. Local exhaust and general ventilation may be needed to control airborne levels if source reduction is not possible. Dow has established an Industrial Hygiene Guideline of 1 ppm (with a "Skin" notation[3]) for evaluation of 2,4-DCP levels. Samples are collected on 800 mg. silica gel tubes and analyzed by liquid chromatography with UV detection. EPA was unable to obtain documentation for this limit, or additional details on the air sampling method. There are no OSHA, NIOSH, or ACGIH exposure limits.

2d) Selection and use of protective equipment The exposure inventory described above should also be used to create a list describing the type of respirator, protective suit, glove, and eye protection needed for each task or operation. Guidance on when to discard and dispose of protective gear is also important and should be included. Types of protective clothing reported to be used for protection from 2,4-DCP include the following:

GLOVES: Nitrile or Neoprene
BOOTS: Neoprene
PROTECTIVE SUITS: Saranex(TM), Neoprene, or Kapler CPF3(TM)

> NOTE: The agencies were not able to examine the documentation for these selections to verify them. Facility-specific chemical resistance testing is recommended using candidate protective clothing materials and the actual industrial chemicals and conditions (e.g. temperatures, immersion vs splash) to be protected against to insure confidence in the protection provided. Other materials may also provide protection - check with equipment providers for additional information.

RESPIRATORS: Because exposure to 2,4-DCP in dust or vapor form may also cause corneal injury and permanent impairment of vision, *full face* masks are recommended as the minimum level of protection. NIOSH-approved full face air purifying masks are typically allowed when exposure levels are known to be within 50 times an exposure guideline. In theory, full face masks using combination organic vapor and dust and mist particulate filter cartridge/canisters (along with protective cartridge changeout schedules) could be used to protect against 2,4-DCP exposures. However the lack of a fully documented exposure guideline presents an obstacle to

[3] A"Skin" notation indicates that absorption of the substance through the skin can contribute significantly to overall exposure.

this approach. Instead, NIOSH-approved supplied air respirators operated in a pressure-demand or other positive pressure mode are recommended for protection from inhalation exposures until such time that a documented exposure guideline becomes available.

> NOTE: NIOSH reports that they are not aware of any standards for gas-tight goggles that would permit them to recommend such goggles as providing reliable eye protection as an alternative to full face masks. This is why half face masks are not recommended for use with lower exposure levels.

3) REVIEW PROCEDURES AND EQUIPMENT TO INSURE THAT THEY WILL BE EFFECTIVE SHOULD EXPOSURES OCCUR

3a) Selection and placement of emergency showers for decontamination Safety showers need to be located in the immediate vicinity of areas involving 2,4-DCP tasks, and they should have alarms to summon help. They should be inspected regularly to insure that they are in working order.

3b) First aid and decontamination procedures Existing recommendations currently state that in case of skin contact, exposed employees should immediately flush the skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

> NOTE: Some information suggests that fluids such as soap solution, mild alkaline solutions, or vegetable oil might be more effective than water for skin decontamination. However, there are no definitive data. This issue is described as a short term research need in a later section of this advisory and in Appendix B.

In order to be effective, decontamination requires removal of all potentially contaminated clothing. In Case #2 the exposed worker washed without undressing and this probably served to prolong exposure. Exposed workers should receive immediate medical attention, even if no symptoms (such as redness or irritation) develop. The "Note to Physician" on the TSCA Section 8(e) submitter MSDS states:

> "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 judgement of the physician in response to reactions of the patient."

NOTE: No other medical management information specific to 2,4-DCP was found. Information on the related substances phenol and 2,4-Dichlorophenoxyacetic acid (2,4-D) may be helpful to those seeking additional information. Note also that the advisability of lavage is a controversial subject, and recent guidance suggests that there are a number of

important issues related to the risks and benefits associated with the procedure.[4] The term "endotracheal control" refers to use of a cuffed endotracheal tube; the term "esophageal control" refers to use of an esophageal obturator tube (not as commonly used). One of these devices would be placed prior to placing an esophagogastric tube for stomach lavage, so as to protect the trachea and lungs from accidental aspiration of material.

Contaminated clothing should be laundered before reuse, and items which cannot be decontaminated, such as belts, shoes, and watchbands, should be removed, destroyed and disposed of.

3c) Training and emergency drills to insure familiarity with decontamination procedures. Given the contribution of decontamination errors to three of the four known fatalities, the agencies strongly recommend that workers and supervisors be trained in the importance and proper use of emergency showers. In addition, decontamination drills should be performed to increase confidence that workers and emergency response personnel are proficient in proper decontamination and first aid procedures. Emergency personnel and coworkers need to be informed in advance about the hazards of 2,4-DCP, the potential for their own dermal exposures when assisting with decontamination procedures, and the availability and need for donning appropriate personal protective equipment.

INFORMATION ON CURRENT USE OF 2,4-DCP

Based on information currently available to EPA, 2,4-Dichlorophenol is not expected to be in wide use. Appendix A lists the five facilities known to be using 2,4-DCP as of 1997 (the most recently available data). Known potential uses and exposure scenarios include the following:

1) Chemical manufacturing

2,4-DCP's primary use is as a feedstock for manufacture of agricultural chemicals - especially herbicides such as 2,4-D (2,4-Dichlorophenoxyacetic acid). It is also reported to be used in the manufacture of pharmaceuticals. It can also be formed as an impurity from some chemical operations. Production, maintenance, and waste handling and treatment workers are those who might have potential exposures to 2,4-DCP.

2) Hazardous waste handling

The most recent data from EPA's Biennial Reporting System (BRS) indicates that 52 sites reported generating 2,4-DCP wastes (as RCRA waste code U081) in 1995. An additional 32 hazardous waste treatment facilities reported receiving 2,4-DCP as a waste. This indicates that

[4] For additional information, see the position statement on gastric lavage jointly issued by the American Academy of Clinical Toxicology and the European Association of Poison Centres and Clinical Toxicologists. See Reference section for the citation.

hazardous waste workers might come across it as well. A review of some of the BRS records indicated that typical reports were for discarded or old laboratory materials.

3) Formation in effluent

2,4-DCP may be formed in effluents from wood pulp bleaching, and from chlorination involving water treatment. While this has raised drinking water issues, the low detected concentrations are not expected to be relevant for the skin absorption/fatality concern that is the subject of this advisory.

SHORT TERM RESEARCH NEEDS

Additional information is needed to address a variety of toxicity, first aid/ medical management, protective equipment selection, and occupational exposure guideline issues associated with 2,4-DCP. However, one very basic issue directly related to the skin absorption fatality risk is the need for additional information on how to best remove 2,4-DCP from the skin should exposure occur. A review of 2,4-DCP's physical and chemical properties, combined with information on the related chemical phenol, suggests that water flushing might not be very effective for removing 2,4-DCP from the skin. A number of other skin decontamination agents appear likely to be more effective and deserve additional consideration. This issue is described in greater detail in Appendix B. Specific experimentally verified procedures for rapid and effective decontamination need to be developed and disseminated by manufacturers of 2,4-DCP.

FOR FURTHER INFORMATION

Contact Terry O'Bryan (202-260-3483, obryan.terry@epa.gov) or Matt Gillen (202-260-1801, gillen.matthew@epa.gov) at EPA with with any additional inquiries on this advisory. The OSHA contact is Adam Finkel at OSHA (202-693-2256, adam.finkel@osha.gov).

APPENDIX A

Facilities reporting 2,4-DCP releases and wastes to the EPA Toxics Release Inventory in 1997.

BASF Corporation, W. Port Arthur Road, Beaumont, Texas, 77705.
SIC 2879 Pesticides and Agricultural Chemicals Not Elsewhere Classified.
Manufacturing use: Produce, as an impurity.
Maximum amount on site: 10,000 to 99,000 pounds
Summary of all releases: 19120 pounds.
Air releases: 3100 pounds,
Underground Injection 16,020 pounds.
Onsite recycling:1450 pounds
Onsite treatment: 115 pounds

Bayer Corp. 8400 Hawthorne Rd, PO Box 4913, Kansas City, Mo 64120
SIC 2879 - Pesticides and Agricultural Chemicals Not Elsewhere Classified
Form A certification: material was not manufactured, processed, or used in amounts exceeding 1 million pounds, and annual releases did not exceed 500 pounds.

Catalytica Bay View Inc, 1990 Bay Road, East Palo Alto, California, 94303
SIC 2833 Medicinal Chemicals and Botanical Products
Processing use: as a reactant
Maximum amount on site: 10,000 to 99,000 pounds
Summary of all releases: 10 pounds
Air releases : 10 pounds

Dow Chemical Co., Midland Operations, Midland, Michigan 48667
SIC 2800 Chemicals and Allied Products
Manufacturing use: produce, import, for on site use and processing, and for sale/distribution, and as an impurity.
Processing use: as a reactant.
Maximum amount on site: 1,000,000 - 9,999,999 pounds
Summary of all releases: 320 pounds
Air releases: 186 pounds
Water releases: 134 pounds
Onsite energy recovery: 3 pounds
Onsite treatment: 315,710 pounds

Helena Chemical Co, 3525 Vandalia Rd, Des Moines, Iowa, 50317
SIC 2879 Pesticides and Agricultural Chemicals Not Elsewhere Classified
Form A certification: material was not manufactured, processed, or used in amounts exceeding 1 million pounds, and annual releases did not exceed 500 pounds.

APPENDIX B
2,4-DCP skin decontamination research needs

While toxicity levels for 2,4-dichlorophenol and phenol are similar, certain physical and chemical properties predict that 2,4-DCP will pose a greater overall hazard to workers and that simple flushing of skin with water may not be sufficient for decontamination.

First, the solubility of 2,4-DCP in water is about fourteen times less than that of phenol (5 g/L vs. 70 g/L). While it is the rate of dissolution rather than solubility that is more relevant, in general the dissolution rate generally decreases with decreasing solubility. This predicts that decontamination by flushing the skin with water will tend to be slower for 2,4-DCP than for phenol.

Second, the octanol-water partition coefficient for 2,4-DCP is greater than that for phenol (log POW of 3.06 vs.1.46 for phenol). As shown by Lopez et al (1998), octanol-water partition coefficients are indicative of lipophilicity, which is often observed to correlate strongly with toxicity and skin penetration. These researchers studied two homologous series, phenyl alcohols and p-alkylanilines, and found that the optimal lipophilicity for skin penetration, expressed as log P (n-octanol), was 3.1, which is very similar to 2,4-DCP's score of 3.06. Thus once 2,4-DCP gets on the skin, the potential for skin penetration may be forty times greater than that for phenol, thus increasing the potential danger associated with skin contact.

Third, there is evidence that extended contact and incomplete decontamination of skin may result in a reservoir effect leading to slow and prolonged release into the body over time. Bentur et al (1998) reported a case where a worker exposed for 41/2 hours to phenol on his left foot and shoe (3% of body surface) suffered a variety of health effects and survived despite peak serum levels in the range associated with fatalities. Decontamination was then performed with copious amounts of water along with supportive medical treatment. The resulting half life for urinary phenol was 13.86 hours, considerably longer than previously reported. This indicated that prolonged contact had led to major skin absorption that was not reduced by water flushing, and that the skin had acted as a reservoir for slow release into the serum. The authors concluded that "immediate removal from exposure and aggressive decontamination of the skin are essential". Lessons learned from this case would be expected to apply for 2,4-DCP.

The Agency for Toxic Substances and Disease Registry (ATSDR) guidelines for managing acute phenol exposure do recommend the use of other materials more effective than water for rinsing if available. For example, the use of polyvinyl pyrrolidone (PVP) is suggested because it can form a complex with phenol to help remove it from the skin. Additional substances are also mentioned. Given the properties of 2,4-DCP, it is prudent to question whether water should be relied upon as the primary means for decontamination. Use of other solutions for flushing might be more effective and deserve evaluation. For example, the dissolution rate can be influenced by adjusting the pH of the wash solution. Because 2,4-DCP is a weak acid, flushing the skin with an alkaline solution would convert 2,4-DCP to its ionized (salt) form, which will be more rapidly dissolved (Soap solutions, e.g., sodium stearate, are alkaline and may be expected to promote more rapid decontamination; alternatively, solutions of sodium bicarbonate, sodium carbonate, or phosphate buffers might be considered.). A secondary benefit to using an alkaline solution is that the ionized form of 2,4-DCP will be much less lipophilic, therefore less readily absorbed into the skin.

In summary, given the fatalities that have occurred, and the potentially life-saving benefits that could accrue from a relatively modest research effort, it is recommended that companies involved with manufacture and processing of 2,4-DCP collaborate to examine this issue as a near term project.

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Phone discussion with Mike Mason, Michigan OSHA, on September 9, 1999.

TSCA Docket # 8EHQ-14302
(NOTE: Requests for information in the docket should be sent to: Document Control Office (7407), Room G99, East Tower, ATTN: Section 8(e), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, 401 M St. S.W. Washington, DC 20460-0001. Email requests can be sent to oppt.ncic@epa.gov, or faxed to 202-260-5069)

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ACKNOWLEDGMENTS:

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Ira Wainless, P.E.

The authors are grateful to the following NIOSH scientists for their valuable assistance:
Alan Lunsford, Ph.D.; Geoff Calvert, M.D., Marie Haring Sweeney, Ph.D.; Stephen Berardinelli, M.S.; Leroy Michelsen, M.S., P.E.; Mark Boeniger, M.S., CIH; Ralph Zumwalde, M.S.