

TECHNICAL BULLETIN
STORAGE, SHIPMENT, HANDLING, AND DISPOSITION OF
DECONTAMINATING AGENT, DS2

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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**STORAGE, SHIPMENT, HANDLING, AND DISPOSITION
 OF DECONTAMINATING AGENT, DS2**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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*This TB supersedes TB CML 113, 15 Nov 90, and Change 1, 23 Jun 92.

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**STORAGE, SHIPMENT, HANDLING, AND DISPOSITION OF
DECONTAMINATING AGENT, DS2**

SECTION I. GENERAL

1-1. Purpose and Scope. This Technical Bulletin (TB) provides information on the storage, shipment, handling, and disposition of Decontaminating Agent, DS2.

DISCLAIMER

Recommended procedures in this TB are formulated for use by elements of the Department of Defense. While the U.S. Army Edgewood Research, Development and Engineering Center (ERDEC) believes that the data contained herein are factual and the opinions expressed are those of qualified personnel, the information is not to be taken as a warranty or representation for which ERDEC assumes legal responsibility. Any person who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of these instructions for their particular situations, regardless of any similarity to a corresponding government situation.

1-2. General.

a. With stricter and changing environmental laws and the government's responsibility to protect its employees, extra care must be taken to handle, manage, transport and store DS2 properly. Disregard of the information in this TB could lead to personal injuries, hazardous waste spills, and environmental repercussions. A videocassette (709978, TVT3-81) titled DS2 Handling Procedures, which covers the information in this TB, is also available by contacting the U.S. Army Visual Information Center, Joint Visual Information Activity, ATTN: ASQNV-JVIA-T-AS, Tobyhanna Army Depot, PA 18466-5102.

b. The DS2 Material Safety Data Sheet (MSDS) is provided as Appendix C. This MSDS shall be followed when there is a conflict with this bulletin.

c. This TB covers DS2 which is stocked in the following configurations:

Item	NSN
DS2 5-Gallon Pail	6850-00-753-4870
DS2 1 1/3-Quart Can	6850-00-753-4827
M13 Portable Decon Apparatus, 14-Liter	4230-01-133-4124
DS2 Filled Fluid Container, 14-Liter	6850-01-136-8888

d. For emergencies during duty hours, 0730-1600 Eastern Time, direct questions related to DS2 to: U.S. Army Edgewood Research, Development and Engineering Center Safety Office at DSN 584-4411 or commercial (410) 671-4411/4414. For emergency information after Eastern Time Zone duty hours, contact the staff duty office at DSN 298-5201 or commercial (410) 278-5201.

e. If you think there is something wrong with this Technical Bulletin, fill out a DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to:

Technical Director
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 ATTN: SCBRD-ENL-V
 Aberdeen Proving Ground, MD 21010-5423

SECTION II. DESCRIPTION

2-1. Characteristics. DS2 is a light amber solution consisting of Diethylenetriamine (DETA) (70%), Sodium Hydroxide (NaOH) (2%), and Ethylene Glycol Monomethyl Ether (EGME)(28%).

TABLE 1. DS2 COMPONENTS NAMES AND SYNONYMS

COMPONENTS:	SYNONYMS:
Diethylenetriamine	Bis (2-Aminoethyl) Amine DETA
Ethylene Glycol Monomethyl Ether	Methyl Cellosolve 2-Methoxyethanol EGME
Sodium Hydroxide	NaOH Caustic Soda

DS2 has a slightly sweet (ammonia-like) odor. It is a reactive highly alkaline substance with a National Fire Protection Association (NFPA) code of 1 for reactivity.

2-2. Packaging and Use. DS2 is packaged in 1 1/3-quart cans for use in the MII Portable Decontaminating Apparatus; 5-gallon pails for application with brooms, swabs, or brushes; and 14-liter containers as a component of the M13 Portable Decontaminating Apparatus. It is an effective decontaminating agent against all known toxic chemical agents and biological materials (except bacterial spores). DS2 is effective at temperatures from -25°F to 125°F.

SECTION III. SAFETY

3-1. Hazards. DS2 is a class III-A combustible, alkaline, corrosive liquid with a flash point of 1680F by the closed cup method; its fumes are capable of flashing at that temperature. A fire hazard exists if DS2 is used on hot surfaces such as a running engine. DS2 by itself is not classed as a flammable liquid and is not considered a fire hazard. It has an NFPA code of 2 for flammability.

WARNING

DS2 reacts violently with acids or oxidizers such as dry STB (Supertropical Bleach) or HTH (High Test Hypochlorite) decontaminants generating enough heat to cause a fire. DS2 also reacts with battery acid and sodium bisulfate.

CAUTION

DS2 will damage some plastics such as lexan, cellulose acetate, flexible polyvinyl chloride, and mylar. DS2 corrodes tin and zinc, destroys wool, and softens leather. It may soften, remove, blister, or discolor non-Chemical Agent Resistant Coating paints.

NOTE

Water which has been used for extinguishing fires involving DS2 or in locations where DS2 is stored will be managed as hazardous waste with an Environmental Protection Agency (EPA) hazardous waste number of D002.

3-2. Physiological Action and First Aid.**WARNING**

Contact with DS2 can cause irritation to personnel with chronic pulmonary, asthmatic, renal, skin, or central nervous system conditions. Pregnant females should not be exposed to DS2 under any circumstances.

DS2 is a caustic material that is extremely irritating to the skin, eyes, and respiratory tract and with direct contact will damage these tissues. The visible effects depend on the area and duration of exposure, and on the amount of substance present. Health effects can range from mild burns and primary irritation to the cornea to severe burns to the throat and windpipe. Exposure to high vapor concentrations of DS2 can cause nausea, vomiting, and respiratory irritation as serious effects. Exposure to the EGME in DS2 may cause central nervous system depression and liver damage. Although not definitely established in humans, EGME could potentially cause adverse reproductive effects in male and female workers (including teratogenesis) and this is a major concern with EGME. Thus appropriate controls should be established to minimize worker exposure to EGME. Repeated skin and respiratory exposures to DETA can result in skin sensitization and asthma.

Based on these effects, a potential toxic hazard exists with DS2 (and its components) and protective measures to prevent inhalation of vapors and skin contact must be followed. Avoid inhaling vapors. Avoid contact with skin, eyes, or clothing. If DS2 is inhaled, remove to fresh air. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Additional supportive measures may be required. If eyes are exposed, Immediately flush the eyes with large amounts of water for at least 15 minutes. In case of skin contact, blot off DS2 and then rinse skin with water until soapiness is no longer present. If DS2 is ingested and the patient is conscious, give as much milk or water as possible. Do not induce vomiting. Seek immediate medical attention in each of the above cases. Supportive measures may be required.

3-3. Protection. Personnel performing any operations where contact with DS2 is a certainty must wear personal protection equipment (PPE). The type and level of PPE to be worn depends on where the operation is being performed and the anticipated severity of the hazard. These operations are:(1) General Inspection - Regular surveillance inspections performed in accordance with Sections 4-2 and 4-5 below where the probability of

encountering DS2 is low, (2) Handling Leaking Containers (Minor) - Situations where containers having small wet spots or small amounts of DS2 on them may be encountered, and (3) Handling Leaking Containers (Severe) - Situations where liquid is dripping from containers or where the containers are so corroded that contact with gross amounts of DS2 is certain if the containers are moved. The sections below contain the proper protection levels for operations in both depot and garrison storage.

3-3.1 Depot Storage. Types and levels of PPE for operations performed under depot storage of DS2 are shown in Table 2. A full face respirator with organic vapor cartridges which are effective against DETA and EGME and which is approved by the National Institute for Occupational Safety and Health is required. If levels of DETA and EGME in the air are unknown or are at or above the Threshold Limit Values (TLV) of one part per million for DETA and five parts per million for EGME, then a Self-Contained Breathing Apparatus (SCBA) should be worn in place of the negative pressure full facepiece respirator. (The TLV values are those set by the American Conference of Governmental Industrial Hygienists.) Gloves will be made of butyl rubber and should be long enough to protect the wrists and arms. If the splash suit does not come with integral boots, then butyl rubber boots should be worn with the splash suit.

*TABLE 2. PERSONAL PROTECTIVE EQUIPMENT
FOR DEPOT STORAGE OPERATIONS*

Operation	Clothing	Gloves	Mask
General inspection	Coverall	Available	Available
Handling leaking containers (minor)	Appropriate chemical splash suit	Worn	Worn
Handling leaking containers (severe)	Appropriate chemical splash suit	Worn	Worn; SCBA

3-3.2 Garrison Storage. Types and levels of PPE for operations performed under garrison storage of DS2 are shown in Table 3. Military personnel are required to wear long rubber gloves and a full length apron when handling open or leaking DS2 containers. Toxicological Agent Protective (TAP) gloves and aprons are appropriate. When severely leaking containers are encountered, the green vinyl overboot (GVO) will also be worn. Standard issue military protective masks provide adequate respiratory protection for all anticipated operations.

*TABLE 3. PERSONAL PROTECTIVE EQUIPMENT
FOR GARRISON STORAGE OPERATIONS*

Operation	Clothing	Gloves	Mask
General inspection	Battle Dress Uniform (BDU)	Available	Available
Handling leaking containers (minor)	BDU plus TAP apron	Worn	Worn
Handling leaking containers (severe)	BDU plus TAP apron and GVO	Worn	Worn

Equipment which will provide an equal or higher level of protection may be substituted for any operations listed in either table above. Wash protective clothing, masks, and overboots with hot soapy water as soon as possible after contact with DS2 as DS2 will cause butyl rubber to soften and deteriorate.

SECTION IV. STORAGE

4-1. General. The information presented here is provided only for guidance. Storage of DS2 is to be in accordance with requirements contained in TM 38-410, Storage and Handling of Hazardous Materials, and NFPA 30, Flammable and Combustible Liquids Code. The requirements of the uniform building code, existing fire codes, and any state and/or local regulations are also applicable for DS2 storage. In addition, DS2 storage and the

amount of DS2 that can be stored in a given facility may be further governed by local and/or state regulations. To ensure that DS2 storage facilities comply with all these requirements, guidance should be obtained from the Fire Department, Safety Office, and Environmental Office which serve the area where the DS2 is to be stored.

4-2. Receipt Inspection. Initial receipt inspection is the first opportunity to examine incoming DS2 supplies. Inspect all shipments of DS2 as per Supply Bulletin 740-94-2, Storage Serviceability Standards for AMCCOM Materiel, Decontaminating Equipment, and Decontaminating Agents, to include visually inspecting each container for advanced corrosion and leaking DS2. Any problems found should be listed on a Quality Deficiency Report, SF 368, and the form forwarded to Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAD-I, Rock Island, IL 61299-6000. If unserviceable DS2 items are uncovered during the receipt inspection, a note should be made on the receiving documentation indicating the reason for unserviceability (leak, dent, etc.), along with the type, the quantity unserviceable, and the point of contact for overpacking and disposal of the unserviceable material. If the shipment is accepted, a surveillance log must be created and maintained for all DS2 items received (see paragraph 4-5).

4-3. Storage Instructions. As long as DS2 is kept sealed in the original containers, it will last indefinitely. Once DS2 is exposed to air, it is good for only 48 hours. After this point, gelatin-like bodies will form on the surface of DS2 and its reactivity decreases. DS2 must be stored inside a cool, dry place where exposure to natural elements is prevented. Store DS2 on pallets on hardstands (concrete or blacktop). Keep the lots of each type of container together and separate from other lots. Do not stack pallets more than 20 feet high because this can lead to hidden leakers and crushed cans. Do not stack pallets of 1/3-quart cans more than two high. Keep DS2 containers away from heat (temperatures above 120 F) and open flame. No fire symbol is required for DS2.

WARNING

Do not store DS2 near acids, oxidizing agents, or battery acids. DS2 reacts violently with acids or oxidizers such as dry STB or HTH decontaminants generating enough heat to cause a fire.

Segregate DS2 from STB, HTH, and other oxidizers. However, in the event that short term depot or garrison storage or storage in field situations requires DS2 to be stored in the same area as STB, HTH, and oxidizers, separate DS2 from these materials by at least 5 feet and add a splash-proof barrier in between. Aisles, and areas between DS2 and other chemical defensive equipment must be at least 5 feet wide in order to clean up spills and to make the containers accessible for inspection.

4-4. Storage Facilities.

4-4.1 General. Depot or garrison storage of DS2 can be in a number of different types of facilities, e.g., rooms within buildings, attached buildings, general warehouses, and liquid warehouses. Requirements for each of these will be discussed separately in paragraphs below.

4-4.2 Storage Quantities. The amount of DS2 that can be stored in each facility is dependent on the type of storage area. Quantities are further governed by whether the storage area is unprotected or protected. Protected storage is that which has automatic fire suppression equipment (sprinklers) installed.

- a. Rooms within buildings. Amounts permitted in rooms within buildings are outlined in Table 4.

*TABLE 4. ALLOWABLE QUANTITIES FOR STORAGE
IN INDIVIDUAL ROOMS WITHIN BUILDINGS*

Automatic Fire Protection Provided	Fire Resistance	Maximum Floor Area	Total Allowable Quantities - Gallons Sq Ft of Floor Area
Yes	2 hr	500 sq ft	10
No	2 hr	500 sq ft	4
Yes	1 hr	150 sq ft	5
No	1 hr	150 sq ft	2

- b. Attached buildings. An attached building is one having only one common wall with another building having other types of occupants. Walls between the storage area and other areas of the building shall have a fire-resistance rating of not less than

2 hours. If the building is unprotected, then no more than 27, 500 gallons of DS2 may be placed in this type of storage and no pile may have more than 13, 750 gallons. For protected storage, the maximum amount of DS2 allowed is 55, 000 gallons and no pile may have more than 15, 000 gallons.

c. General warehouses. These are separate, detached buildings or areas separated from other types of occupancies by a standard 4-hour fire wall. No more than 2, 750 gallons of DS2 may be located in this type of storage.

d. Liquid warehouses. A liquid warehouse is a separate, detached building or area separated from other types of occupancies by a 4-hour fire wall and is specifically designed to store liquids. There are no restrictions as to the amount of material that can be stored in these warehouses. However, the amount of material that can be placed in one pile is restricted. In the case of unprotected storage, no more than 13, 750 gallons may be stored in any one pile. For protected storage, no pile may have more than 15, 000 gallons.

4-4.3 Aisles. In DS2 depot or garrison storage areas, aisles between piles of DS2 containers shall be 4 feet wide so that no container is more than 12 feet from an aisle. Main aisles shall be a minimum of 8 feet wide. Piles shall be at least 18 inches from any fire wall.

4-4.4 Lighting. Electrical wiring and lighting used in DS2 storage areas shall be that suitable for general use.

4-4.5 Ventilation. Ventilation is required only for DS2 storage rooms within buildings and should be provided by natural means. Natural ventilation inlet and outlet openings shall be arranged to provide air movement across all portions of the floor of the storage area. Exhaust air shall be discharged through a wall on one side of the room and within 12 inches of the floor with one or more make-up inlets located on the opposite side of the room within 12 inches of the floor. Exhaust from the room shall be directly to the exterior of the building without recirculation. While ventilation is not required in attached buildings or warehouses, care must be taken to ensure that DS2 vapors are not concentrated in the storage area.

4-4.6 Floors. Floors in DS2 storage areas shall be liquid tight and constructed to contain liquids by recessing the floor 4 inches, installing a liquid-tight DS2 resistant sill a minimum of 4 inches high, or installing a grating trench which drains into a collection area. For disposal of collected run-off waste, see paragraph 7-2.2.

4-5. Surveillance. After acceptance of serviceable DS2, a surveillance log must be created and maintained for all DS2 items on hand. See Appendix E for a sample log showing information that should be kept on the log. Every six months, after the date of receipt, a visual inspection shall be made of all the DS2 stock that is not crated or palletized. Each container should have its surface examined including the bottom. In addition, close attention must be paid to the chimes and side seam areas of all containers and spout areas of the 5-gallon pail. When inspecting the spout area of the 5-gallon pail, remove the screw cap to inspect the threads for corrosion and to ensure that the container's seal has not been punctured. If minor deterioration is detected on a container, it should be noted in the surveillance log with a brief explanation and the date of the inspection. The outer packaging of crated M13 Portable Decontaminating Apparatus units, 14-liter containers, and 1 1/3-quart cans should be inspected for wetness. If any are found to be showing wetness, the packaging should be opened and the DS2 containers inside should be removed and checked for leakage. All palletized pails of DS2 should also be visually inspected for evidence of leakage. Containers of DS2 are unserviceable if the surface of any container has more than 40% surface area corrosion or if the containers are leaking. Five-gallon pails and 14-liter containers are also unserviceable if they have dents longer than 8 inches; for 1 1/3-quart cans, dents should be no longer than 2 inches. If unserviceable containers are found, an entry should be made in the surveillance log, and the containers(s) must be segregated from serviceable material, overpacked, and disposed of in accordance with Section VII of this technical bulletin.

SECTION V. TRANSPORTATION

5-1. Shipping. DS2 is a hazardous material and must be handled with care. The proper shipping name of DS2 is "Caustic alkali liquids, n.o.s. (Diethylenetriamine, Ethylene Glycol Monomethyl Ether, Sodium Hydroxide) UN 1719." The Department of Transportation (DOT) hazard classification of DS2 is "corrosive material." Use a DOT "corrosive label" for shipment of DS2. This material is a packing group II material and should be annotated as PG II on all documentation. The DOT placard for carriers is "corrosive." Only DS2 which has passed the serviceability criteria stated in paragraph 4-5 will be transported. No unserviceable DS2 containers to include containers with dented seams will be shipped to any storage facility. Do not use stretch or shrink wrap to package DS2. No escort is required. Include a copy of the MSDS with the shipment. A copy of the MSDS will also be given to the operator of the mode of transportation. State governments exercise their authority to regulate intrastate

shipments of hazardous materials. For overseas shipments of DS2, international rules for air and surface movement must be followed. When DS2 is transported within a host nation, host nations rules and policies must be followed. DS2 will be packaged and shipped in accordance with Title 49 Code of Federal Regulations (CFR) part 173. AR 55-355 specifies requirements for the transportation documentation of freight for shipment. Host nations in overseas theaters of operations have similar regulations. Only the overseas command staff can advise about foreign laws concerning storage and handling of DS2.

5-2. Air Carriers. Shipments of DS2 by air are governed by Title 49 CFR and the applicable requirements of the International Air Traffic Association and the International Civil Aviation Organization (ICAO). TM 38-250 provides guidance for packaging, handling, and transporting dangerous articles by military aircraft. DS2 is limited to 5 gallons per package when shipped by military/commercial aircraft. Containers of DS2 (1 1/3-quart cans, 5-gallon pails, 14-liter containers, and M13 Portable Decontaminating Apparatus) are not authorized for shipment on passenger carrying aircraft.

5-3. Water Carriers. Shipments of DS2 by water are governed by the regulations of DOT and the U.S. Coast Guard, and by the International Maritime Dangerous Goods Code of the International Maritime Organization (IMO). AR 55-228 establishes policy and provides detailed procedures and direction governing shipments of hazardous cargo aboard vessels. Local, city, county, or state regulatory bodies in connection with the use of water terminal facilities may require additional specific precautions. Shipping DS2 "on-deck" or "under-deck" is permitted in cargo and passenger vessels subject to the requirements of Title 49 CFR, part 176.

5-4. Rail Carriers. The following DS2 containers are not authorized on passenger-carrying rail cars: 1 1/3-quart cans, 5-gallon pails, 14-liter containers, and M13 Portable Decontaminating Apparatus.

5-5. Motor Carriers. These shipments should be in accordance with AR 55-355 and Title 49 CFR.

5-6. Hazardous Waste Shipments. Any shipment of hazardous waste must be in accordance with Title 40 and 49 CFR.

SECTION VI. NEUTRALIZATION

The installation on-scene coordinator for hazardous materials spills should be informed that DS2 is in a storage facility. Per AR 200-1, if a DS2 spill occurs, notify the installation spill response team immediately. They can use sodium bisulfate solution to neutralize DS2 spills. Check the pH with a meter or pH paper. Add more sodium bisulfate solution until the pH is brought down to 9.5 or less. Spills on porous surfaces (concrete, wood, etc.) should be cleaned and neutralized immediately. Otherwise DS2 will be absorbed and become an indefinite hazard. After neutralizing a spill with sodium bisulfate, absorb it on vermiculite (NSN 5640-01-324-2664), clay, or diatomaceous earth. Scoop up all material and any contaminated soil and place in an epoxy coated drum with a fully removable head and label as "corrosive" in accordance with EPA and DOT requirements. During spills, provide adequate ventilation and remove any ignition source. Equipment, grounds, and personnel must be cleaned to the point that no DS2 will be discharged into the environment.

SECTION VII. DISPOSITION

7-1. Disposition. All existing stockpiles of DS2 will be inspected to determine the condition of the material. There will be no disposing of serviceable DS2 containers. All serviceable DS2 will be reported to HQ AMCCOM (B14) using the Materiel Returns Program (see chapter 7 of AR 725-50). Leaking or badly rusted/dented containers will be segregated from serviceable/stocks and reclassified as unserviceable. Unserviceable containers of DS2 are a hazardous waste and will be managed as such by all Department of Defense activities. Disposal methods for waste DS2 and accumulated spill cleanup residue must comply with the Resource Conservation Recovery Act, and state and local hazardous waste regulations. The wastes are corrosive, and have the EPA Hazardous Waste Number of D002. This number should be used to permit the use of off-site hazardous waste disposal facilities. For disposal of unserviceable stocks of DS2, coordinate with the Defense Reutilization Marketing Office (DRMO). Disposal methods at overseas military installations must be in accordance with host country laws. Any additional instructions required for proper disposal of DS2 will be provided by the installation or higher headquarters environmental office. Unserviceable DS2 can be reported to the servicing DRMO for inclusion in a hazardous waste disposal contract.

NOTE

Under no circumstances is DS2 or any other hazardous waste to be abandoned or illegally dumped. Persons violating environmental laws can be prosecuted and are subject to fines and/or imprisonment.

7-2. Overpacking.

7-2.1 Leaking Containers. Leaking containers of DS2 must be over packed as required by applicable environmental laws.

CAUTION

Do not use plastic containers to overpack because leakage may occur. Use epoxy-coated metal containers.

Leaking containers may be repacked in a steel removable head drum conforming to a 1A2 container of Title 49 CFR, ICAO, or IMO, as applicable. The drums in Table 5 may be used to overpack leaking cans of DS2. Other drums may also be used provided they are tested and marked in conformance with the requirements for 1A2 drums. If an old drum is used, make sure it is clean, dry, and in good condition. Pack vermiculite insulation, NSN 5640-01-324-2664, around the interior of the drums. One 1 1/3-quart can may be packed in any of these drums. A maximum of seven 1 1/3-quart cans may be packed into a 27-gallon drum, six cans along the interior periphery and one can in the center of the drum (See Appendix D). A maximum of fourteen 1 1/3-quart cans may be packed into a 57-gallon drum (packed the same way as the 27-gallon drum except with two layers). Place a minimum of 2 inches

*TABLE 5. DRUMS FOR USE IN OVERPACKING
LEAKING DS2 CONTAINERS*

Size	NSN	Notes
7 gal	8110-00-254-5714	1, 2
27 gal	8110-00-082-2625	2, 3
57 gal	8110-00-082-2626	2, 3

Notes:

1. Authorized for Military Air Shipment. In addition, when shipping by Military Air, a polyethylene (4 mil minimum) bag of sufficient size to form an interior liner for the drum shall be inserted prior to filling. After filling, the bag shall be securely closed.
2. Not authorized for Commercial Air shipment..
3. Not authorized for Military Air Shipment..

of vermiculite around the sides of the 1 1/3-quart cans and a minimum of 5 inches on top and bottom of the cans. Also, place a minimum of 5 inches of vermiculite between the layers of 1 1/3-quart cans when using the 57-gallon drum. Five gallon pails and 14-liter containers of DS2 will not fit in either the seven or 27 gallon drums. One or two 5-gallon pails or 14-liter filled fluid containers may be placed in the 57-gallon drum. For the 5-gallon pails, place a minimum of five inches of vermiculite around the sides of the pail and a minimum of 2 inches on top, bottom, and in between. Seal the drum. For the 14-liter filled fluid containers, place one container upright or two containers upright and side by side in the 57-gallon drum. Place a minimum of 5 inches of vermiculite on the top and bottom of the containers. Place a minimum of 2 inches around the sides and in between the containers. Then completely fill all the drums with vermiculite. Write on the drum's outside "HAZARDOUS WASTE" and the number and size of the leakers inside. If any DS2 has leaked out, neutralize it with sodium bisulfate, NSN 6810-00-270-9984. Soak up the DS2 with vermiculite. Put the vermiculite in a drum and write "DS2 SPILL WASTE" and "HAZARDOUS WASTE" on the outside. Seal the drum. Store the drums in a cool, dry place until your local environmental office can have them picked up.

7-2.2 Waste Water Containing DS2. Waste DS2 (which has been degraded by exposure to air or water) and waste waters containing DS2 which have a pH greater than 12.5 have an EPA hazardous waste number of D002 and must be handled and stored in accordance with federal, . state, and local hazardous waste regulations and policies. All water used for washing DS2 areas should have the pH measured to ensure it is in fact hazardous waste. The EPA requires that any runoff or waste water containing DS2 be stored in tanks or containers conforming to EPA rules. Containers of 110 gallons or less must be marked as follows: "Hazardous waste - Federal law prohibits improper disposal. If found, contact the nearest police or public safety authority, or the U.S. Environmental Protection Agency."

7-3. Demilitarization Procedures. DS2 is demil code A and should be turned in to the DRMO with a copy of the MSDS. Refer to TM 43-0003-28, Demilitarization Procedures for FSC 4230 Decontaminating and Impregnating Equipment, FSC 4410 Industrial Boilers, FSC 6810 Chemical, FSC 6850 Miscellaneous Chemical Specialities, for demilitarization procedures for the M11 and M13 Portable Decontaminating Apparatuses.

**APPENDIX A
REFERENCES**

AMCR 385-131, Safety Regulation for Chemical Agents - HD, HT, GB, and VX.

AR 55-22, Transportation by Water of Explosive and Hazardous Cargo.

AR 55-355, Defense Traffic Management Regulation.

AR 725-50, Requisitioning, Receipt, and Issue System.

NFPA 30, Flammable and Combustible Liquids Code, National Fire Protection Association.

SB 740-94-2, Storage Serviceability Standards for AMCCOM Materiel, Decontaminating Apparatus, Decontaminating Kits, and Decontaminating Agents.

TM 38-250, Preparation of Hazardous Materials for Military Air Shipments.

TM 43-0003-28, Demilitarization Procedures for FSC 4230 Decontaminating and Impregnating Equipment, FSC 4410 Industrial Boilers, FSC 6810 Chemicals, FSC 6850 Miscellaneous Chemical Specialties.

Videocassette, 709978, TVT3-81, DS2 Handling Procedures.

40 CFR et seq.

49 CFR et seq.

A-1/(A-2 blank)

**APPENDIX B
GLOSSARY/ACRONYMS**

1. BDU- Battle Dress Uniform
2. CFR- Code of Federal Regulations
3. DETA- Diethylenetriamine
4. DOT- Department of Transportation
5. DRMO- Defense Reutilization and Marketing Office
6. EGME- Ethylene Glycol Monomethyl Ether
7. EPA- Environmental Protection Agency
8. ERDEC- Edgewood Research, Development and Engineering Center
9. GVO- Green. Vinyl Overboot
10. HTH- Trademark for a high test calcium hypochlorite product commercially available as a stable water soluble material in both granular and tablet form
11. ICAO- International Civil Aviation Organization
12. IMO- International Maritime Organization
13. MSDS- Material Safety Data Sheet
14. NFPA- National Fire Protection Association
15. NSN- National Stock Number
16. PPE- Personal Protection Equipment
17. SCBA- Self-Contained Breathing Apparatus
18. STB- Supertropical Bleach
19. TAP- Toxicological Agent Protective
20. TLV- Threshold Limit Value

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U.S. ARMY EDGEWOOD
RESEARCH, DEVELOPMENT
AND ENGINEERING CENTER

HCSDS NO: 20059A
Emergency Telephone #s:
ERDEC Safety Office
410-671-4411 0800-1630
EST After normal duty
hours: 410-278-5201
Ask for ERDEC Staff
Duty Officer

APPENDIX C. MATERIAL SAFETY DATA SHEET

DS2

SECTION I - GENERAL INFORMATION

MANUFACTURER'S ADDRESS: U.S. ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND
EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 21010-5423

CAS Registry No: 111-40-0 (Diethylenetriamine)
1310-73-2 (Sodium Hydroxide)
109-86-4 (Ethylene Glycol Monomethyl Ether)

CHEMICAL NAME AND SYNONYMS:

MIXTURE OF

Diethylenetriamine (70%)

Sodium Hydroxide (2%)

Ethylene Glycol
Monomethyl Ether (28%)

SYNONYMS:

Bis (2-Aminoethyl) amine
DETA

Caustic soda

Methyl Cellosolve
2-Methoxyethanol

TRADE NAME AND SYNONYMS.

Decontaminating Agent, DS2
DS2
Decon Agent DS2C-1

CHEMICAL FAMILY: Mixture

FORMULA/CHEMICAL STRUCTURE:

Diethylenetriamine - $\text{NH}_2(\text{CH}_2)_2\text{NH}(\text{CH}_2)_2\text{NH}_2$
 Sodium Hydroxide - NaOH
 Ethylene Glycol Monomethyl Ether - $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$

NATIONAL STOCK NUMBER (NSN):

Decontaminating Agent DS2, 1-1/3 quart can, NSN: 6850-00-753-4827
 Decontaminating Agent DS2, 5 gallon pail, NSN: 6850-00-753-4870
 Decontaminating Apparatus, Portable, 14 liter, M13, NSN 4230-01-133-4124
 14 Liter Container, Fluid Filled, NSN: 6850-01-136-8888

NFPA 704 SIGNAL: Health- 3
 Flammability- 2
 Reactivity- 1

SECTION II - HAZARDOUS INGREDIENTS

Diethylenetriamine - 69-71%	TLV: 4.2 mg/m ³ (1 ppm) (skin)
Sodium Hydroxide - 1.9-2.1%	TLV: 2 mg/m ³ (ceiling)
Ethylene Glycol Monomethyl Ether - 26.9-29.1%	TLV: 16 mg/m ³ (5 ppm) (skin)

SECTION III - PHYSICAL DATA

BOILING POINT DEG F (DEG C): 380 (193.3)

SPECIFIC GRAVITY (H₂O - 1): 0.97 - 0.98

APPEARANCE AND ODOR: Clear amber solution with ammonia-like odor

VISCOSITY (centistokes): 9.9 @ 20 DEG C

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT: (Method Used). The flashpoint of the mixture has been determined to be 168 DEG F (75.5 DEG C) by the closed cup method. The lowest flashing component of the mixture (ethylene glycol monomethyl ether) has a flashpoint of 115 DEG F (46 DEG C) by the closed cup method.

EXTINGUISHING MEDIA: Carbon dioxide, alcohol foam, water

UNUSUAL FIRE AND EXPLOSION HAZARDS: Never mix or store acids, oxidizing agents, STB (Supertropical Bleach) or HTH (High Test Hypochlorite) together with DS2; fire or explosion may result.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: DS2 is made of two major components (EGME & DETA) with different toxicities and physical properties. The TLV of the mixture (calculated) is 5.2 mg/m³ as an 8 hour time weighted average (TWA). To date the Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure limit for DS2 per se nor has the value proposed been officially adopted as a part of a special occupational safety and health standard for DS2 in accordance with DOD 6055.1.

EFFECTS OF OVEREXPOSURE: No toxicity data are available on DS2 per se, however, the toxicity of each of the components has been partially determined.

(1) DS2 is an alkali and with direct contact will corrode tissue, e.g., skin, eye, respiratory mucous or gastric mucous. The effects exhibited depend on route of exposure, amount of substance present, and duration of exposure. Health effects can range from mild burns and primary irritation to corneal pacification, severe burns, and esophageal stricture.

(2) Sufficient exposure to EGME, a major component of DS2, may cause central nervous system depression and liver damage. Although not definitely established in humans, reproductive effects (including teratogenesis) are also a major concern with this substance. The National Institute for Occupational Safety and Health (NIOSH) recommends that EGME be regarded in the workplace as having the potential to cause adverse reproductive effects in male and female workers. Appropriate controls must be instituted to minimize worker exposure to EGME.

(3) Exposure to high vapor concentrations of DS2 can cause nausea, vomiting, and respiratory irritation as acute effects.

(4) Repeated skin and respiratory exposures to DETA can cause skin sensitization and asthma.

EMERGENCY AND FIRST AID PROCEDURES'

INHALATION: Remove to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Seek medical attention immediately. Additional supportive measures may be required.

EYE CONTACT: Immediately flush the eyes with copious amounts of water for at least 15 minutes. Seek medical attention immediately.

SKIN CONTACT: Flush away the DS2 from the skin with water until "soapiness" is no longer present. Seek medical attention immediately.

INGESTION: If the patient is conscious, give as much milk or water as possible. Do not induce vomiting. Seek medical attention immediately. Supportive measures may be required.

SECTION VI - REACTIVITY DATA

INCOMPATIBILITY: DS2 is a corrosive material and because of its content, it is incompatible with some metals (e.g., cadmium, tin and zinc); some plastics (e.g., Lexan, cellulose acetate, polyvinyl chloride, Mylar, and acrylic); some paints; wool; leather; oxidizing materials (e.g., Supertropical Bleach or High Test Hypochlorite); and acids.

REACTIVITY: DS2 will deteriorate in air. Exposure of 48 hours or more to open air will result in the formation of gelatin-like bodies on the surface of DS2.

SECTION VII- SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Spills on porous surfaces (concrete, wood, etc.) should be cleaned and neutralized immediately. Otherwise, the material will be absorbed and become an indefinite hazard. All spills must be contained, e.g., by covering with dry sodium bisulfate to neutralize and then absorbing them on vermiculite (NSN 5640-01-324-2664), clay or diatomaceous earth. Scoop up all this material and any contaminated soil or substrate and place in an epoxycoated drum with a fully removable head, and label as corrosive IAW EPA and DOT requirements. During spills provide adequate ventilation and remove any ignition source. During clean up, personnel should wear a full face respirator with an organic vapor cartridge effective against Diethylenetriamine and Methyl Cellosolve, rubber gloves long enough to protect hands and arms, and a full length rubber apron. Contaminated clothing and shoes should be removed immediately and washed thoroughly with water before reuse. Avoid contact with leaking liquid or vapor. All wash water should have pH measured. All material with a pH less than 2.0 or greater than 12.5 is hazardous waste with an EPA number of D002.

WASTE DISPOSAL METHOD: Waste DS2 has been tested and is a hazardous waste with an EPA waste number of D002. Disposal methods for waste DS2 and accumulated spill cleanup residues must comply with RCRA, state, and local hazardous waste regulations and procedures. If the wastes are corrosive, they have the EPA Hazardous Waste Number of D002. This number should be used when the waste is manifested, to permit the use of off-site hazardous waste disposal facilities. For disposal of excess stocks of pure DS2, coordinate with the Defense Reutilization and Marketing Office (DRMO). Disposal methods at overseas military installations must be in accordance with the laws of the host country.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

Concentration (mg/m³)
8 hour TWA _____

Respiratory Protection _____

Less than 5.2 (as mixture
i.e., 3.7 mg/m³ DETA and
1.5 mg/m³ EGME)

Escape type respirators shall be available when
necessary.

- o any NIOSH approved full facepiece respirator with an organic vapor canister.
(i.e. gas mask)

- o any NIOSH approved escape type SCBA

Greater than 5.2 or
unknown concentrations

- o any NIOSH approved full facepiece pressure demand SCBA

- o any NIOSH approved full-face piece positive pressure, supplied-air respirator
with auxiliary SCBA

NOTE: For military personnel engaged in training scenarios the M9, M17 or M40 series mask is acceptable. Filter elements and canisters should be changed after each use with DS2.

VENTILATION: Local exhaust - Necessary if TLV (TWA) exceeded.

PROTECTIVE GLOVES: Butyl Rubber

EYE PROTECTION: Splashproof chemical goggles. When there is potential for severe exposure, chemical goggles and face shield are recommended

OTHER PROTECTIVE EQUIPMENT: Hooded chemical-resistant clothing (i.e., overalls & long sleeve jacket, or one- or two-piece chemical splash suit) and chemical resistant boots. Military personnel will use standard issue equipment during training operations.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Avoid extreme temperatures (e.g. 160 Deg F or higher) during storage

SECTION X - TRANSPORTATION DATA

PROPER SHIPPING NAME: Caustic Alkali Liquids, n.o.s UN 1719

DOT HAZARD CLASSIFICATION: Corrosive Material, Class 8, Packing Group II

DOT LABEL: Corrosive with an "8"

DOT MARKING: Caustic Alkali Liquids, n.o.s. (Diethylenetriamine, Ethylene Glycol Monomethyl Ether, Sodium Hydroxide) UN 1719

DOT PLACARD: Corrosive

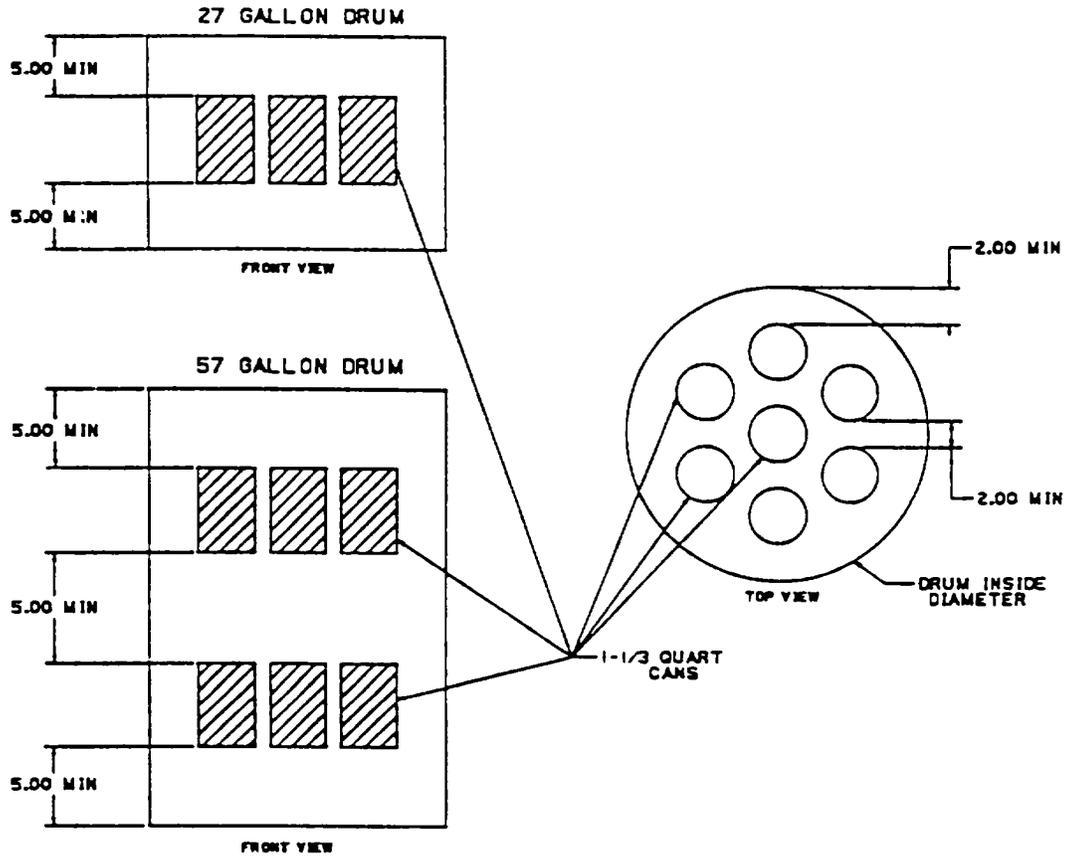
EMERGENCY ACCIDENT PRECAUTIONS & PROCEDURES: See Sections IV, VII, and VIII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Shipping "on-deck" or "under-deck" is permitted in cargo and passenger vessels subject to the requirements of 49 CFR 176.63 (b) and (c). MSDS for DS2 will be placed with all shipments. DS2 is limited to 5 gallons per package when shipped by cargo aircraft. Bulk packaging of DS2 (1 1/3 quart, 5 gallons, and M13 Portable Decontaminating Apparatus) are not authorized for shipment on passenger carrying aircraft or rail cars. Shipment on passenger carrying aircraft or railcar is permitted in 1 quart packages. DS2 will be packed and shipped in accordance with 49 CFR 173.202. Packaging exceptions can be found in 49 CFR 173.154.

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APPENDIX D

OVERPACK ARRANGEMENTS OF 27 AND 57 GALLON DRUMS



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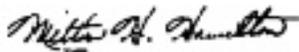
APPENDIX E
DS2 SURVEILLANCE LOG

DATE	NSN	CONTRACT NUMBER	LOT NUMBER	MFD	COMMENTS	ACTION

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By Order of the Secretary of the Army:

Official:



MILTON H. HAMILTON
*Administrative Assistant to the
Secretary of the Army*
07890

GORDON R SULLIVAN
General, United States Army
Chief of Staff

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