Annex D – Hazardous Substance

Hazardous Substance Annex (from previous ACPs)

NRT CBRN CHEM UPDATE Lewisite ORG FINAL 2023 12 18 (1)

NRT CBRN CHEM UPDATE Mustard Lewisite Mixture HL ORG FINAL 2023 12 18 (1)

NRT CBRN CHEM UPDATE Sulfur Mustard HD ORG FINAL 2023 12 18 (1)

Hazardous Substance “Annex”

(From Prior ACPs)

Hazardous Substance Incident Annex – Sector Delaware Bay

Introduction

[Link to the Oil and Hazardous Materials Incident Annex in the NRF]

In accordance with the National Response Plan and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) the Coast Guard will serve as the Federal On-scene Coordinator (FOSC) for actual or potential releases of hazardous substances[1] within the coastal zone that would:

- Impact public health and safety AND
- Enter the environment and originate from:
  - Vessels or facilities [2]

Purpose

This Annex is written to provide initial response guidance upon notification of a hazardous substance release in the coastal zone which may have actual, potential, or perceived consequences to public health or the environment.

If the hazardous substance release is suspected or confirmed to be the result of a terrorist act, response to the incident should be initiated using this Annex, the Terrorism Incident Annex and the Area Maritime Security Plan.

Jurisdiction

The Coast Guard is the Federal On-scene Coordinator for any hazardous substance releases in the coastal zone that require emergency removal actions with the exception of incidents that:

- Occur from vessels or facilities owned, operated, or controlled by the Department of Defense (DOD) or Department of Energy (DOE)
- Are *non-emergency* removal actions of hazardous substance releases from vessels or facilities owned, operated, or controlled by Federal agencies *other than* the DOD or DOE

[1] The term hazardous substance is defined in CERCLA § 101. A list of hazardous substances can be found in 40 CFR 302.4

[2] The term *facility,* as defined under CERCLA Section 101(9), encompasses virtually any entity except vessels "where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise came to be located." This includes buildings, shipping containers, drums, vehicles, aircraft and drainage ditches. If hazardous substances were released from a vessel and sank to the bottom of the Delaware River, the vessel would not be considered a *facility*, but the affected area of the river bottom where the hazardous substance has accumulated would be considered as such.

Under the CERCLA the Coast Guard Incident Commander (acting under their FOSC authority) has the authority to:

- Initiate a time critical assessment of the threat
- Take the necessary steps to stabilize or control the immediately identified potential threat
- Begin activating Federal scientific support agencies necessary to conduct an assessment (air, water, soil, or specific substance sampling in accordance with the relevant published sampling protocols and guidelines)
- Initiate a response

Coast Guard Incident Commander Considerations

In most hazardous substance cases the On-scene Incident Commander will be from the local fire department or other local, county, or state agency. The Coast Guard Incident Commander's role is to:

- Determine if the incident requires the initiation of the Critical Incident Communications procedures [Link to Critical Incident Communications Procedures Section 1050]

- Determine if the response is being managed by appropriate local authorities in a timely manner (fire departments are normally lead agencies) and assess their need for Federal assistance.

If the response is being managed properly, provide Federal support as necessary to the On-scene Incident Commander through:

- Opening the CERCLA fund
- Activating Basic Ordering Agreements with contractors
- Providing technical support
- Deploying Coast Guard resources as needed (Atlantic Strike Team, vessels or aircraft)

If the response is not being managed properly by the Responsible Party[3] or is not managed in a timely manner, one of the following orders may be issued:

- An Administrative Order issued under CERCLA for "hazardous substance" releases when the FOSC has determined that there may be an imminent and substantial endangerment to the public health and welfare or the environment. The FOSC must be reasonably certain that the party to whom the Administrative Order is issued is in fact

[3] The owner and/or operator of a vessel or a facility. See 42 USC CH 103 Sec. 9607

the responsible party.[Example of a CERCLA Admin Order Section 9763]

- Captain of the Port Order[4] issued to insure the safety of vessels and waterfront facilities, and the protection of the navigable waters and the resources therein.

In the event that the Responsible Party:

- Cannot be identified, located, or contacted in a timely manner, or
- Is either unwilling or unable to take responsibility and initiate removal actions, or
- Is conducting removal actions which are inadequate, unsafe, and/or pose a hazard to public health and/or the environment, or
- Other agencies have not responded or are not available

Then: Commander Sector Delaware Bay will determine whether to federalize the removal actions. If federalized, the following actions should be taken:

- Engage in a coordinated and prompt response (The general rule for CERCLA is "First make it safe, then determine the extent of the hazard and Federal removal authorities")
- Contact the appropriate state agency
  - New Jersey Department of Environmental Protection
  - Pennsylvania Emergency Management Agency
  - Delaware Department of Natural Resources and Environmental Control
- Contact local/state authorities to secure the scene and establish exclusion zones
- Access CERCLA funding
- Consult the Base Plan Section 2000 for further Incident Commander actions [Link to Initial Considerations and Decisions of the Incident Commander/Unified Command Section 2000]
- Conduct a removal site assessment to include:
  - Identification of the source
  - Determination of the threat to public health (resources that can assist with this determination include)
    - Agency for Toxic Substance Disease Registry (ATSDR)
    - Local, County or State public health officials
  - Evaluation of the magnitude of the threat
  - Determination if actions have been taken to mitigate the release
  - Determination if there is potential of further release
- Designate the Potentially Responsible Party(s)
- Determine when removal actions are complete
- If the site requires continued cleanup under the remediation phase, AND IS NOT A VESSEL, transfer the role of OSC to EPA Region II or III as appropriate.

[4] See 33 CFR 160.101-109

Circumstances where the Coast Guard can Transfer OSC to the EPA

[Link to Guidance for Transitioning On-scene Coordinator from the Coast Guard to the EPA Section 9760]

The most common circumstances under which the Coast Guard OSC would transfer OSC responsibilities to the EPA for action are when:

- The release originates from a Hazardous Waste Management Facility.
- The release does not require an immediate removal action
- The site assessment determines that:
  - The release does not require immediate removal actions
  - Remedial actions are necessary to complete the cleanup
- The threat of further release has been eliminated, prior to the completion of the cleanup.
- Coast Guard policy requires that removal be secured when prompt action is no longer necessary and substantial remediation methods must be used to completely remove the remaining contamination.

When requesting a transfer of the OSC authority a "Statement of Agreement Transferring Federal On-Scene Coordinator Responsibility" shall document the transfer of authority. [Link to sample Statement Section 9761]

Under normal circumstances, the CG will not transfer OSC authority to the EPA whenever the source of a release is a vessel.

Notification

If the Coast Guard is receiving the initial notification:

- The information will be recorded in Sector Delaware Bay's Hazmat Incident Response Form [Link to Form Section 9762]
- Notify Tri-State Maritime Safety Association
- Contact the National Response Center (NRC)
- Contact appropriate local communications centers to activate local notification protocols

Dispatching Initial Coast Guard Response Personnel

Safety is *always* the *primary consideration* when the determination is made to dispatch response personnel.

Prior to dispatching personnel ensure that the following are completed:

- Obtain information on the hazardous substance (consider the following potential sources of information)
  - Responsible Party (RP)
  - Reference material sources (list not inclusive):

- CHRIS Manuals COMDINST 16465.12
- Material Safety Data Sheet (MSDS)
  - Supplied by PRP
  - Website http://www.cdc.gov/niosh/npg
- Department of Transportation' s Emergency Response Guidebook
- NIOSH Pocket Guide
- Atlantic Strike Team

- Collect existing and forecast environmental conditions (wind direction, speed, precipitation, temperature, inversions, etc)
- Determine nature of safety risk to responders consistent with environmental conditions. For example:
  - Inhalation hazards are directly related to wind conditions & inversions
  - Some chemicals, such as concentrated acids, react violently with water
  - Vapor pressure and off-gassing increase with temperature
- Determine, if established, the location of the Incident Command Post (ICP)
  - If there is no ICP established, contact appropriate local authorities to isolate the hazard and establish a safely located ICP
  - If locals are unable to isolate and/or control the hazardous substance release contact the Atlantic Strike Team to make entry and determine the exclusion, contamination reduction zone, and safe zone
- Get directions to the ICP that provide a safe approach to prevent inadvertent entry into a contaminated area – and check the approach against your own assessment of wind direction/speed.
- Conduct an operational risk assessment to evaluate safety concerns using either:
  - Green/Amber/Red (GAR) Model [Link to GAR form Section 9707]
  - Operational Hazard Work Sheet
    - [Link to ICS Compatible Site Safety Plan Section 9708]
    - [Link to Specific Hazard Attachments Section 9709]
- Ensure appropriate protective equipment is available
  - Emergency Escape Breathing Apparatus (EEBA)
  - Appropriate respirator and cartridge
  - Toxi-clip
  - Oxygen meter

Actions upon Arriving On-scene

- Meet with the On-scene Incident Commander at the Incident Command Post
- Determine the extent of the emergency (hazards) and actions taken to mitigate
- Determine with IC any need for Federal assistance
- Meet with PRP representative on scene and determine willingness to conduct removal actions on behalf of FOSC
- Obtain and record the following information on the unit's Hazmat Incident Response Form
  - Information on site security and control

- Availability of Emergency Response Plan
- Availability of Site Safety Plan
- Available and/or on scene Hazardous Materials response teams
- Appropriate use of personal protective equipment
- Air monitoring procedures
- Cleanup and disposal procedures

For all Federalized Removal Actions (at a facility or on a vessel)

The Unified Command should consider the following priorities, objectives and determinations when responding to a hazardous substance release.

Unified Command Priorities

- Responder safety
- Rescue of victims of the incident
- Source Control / Incident Stabilization
- Public safety and hazard mitigation
  - Protection from direct exposure, possible evacuations (evacuation determinations are generally a local government decision)
  - Protection of water intakes [Link to Water Intakes Notification List]
  - Protection of underground drinking water aquifers
  - Consider neutralizing agents prior to cleanup
- Removal, decontamination and treatment of injured or potentially exposed personnel
- Environmental cleanup/restoration
- Proper transportation, storage and disposal of contaminated debris & waste

Unified Command Considerations for an Incident Involving a Vessel

- Determine need to triage, treat, transport, decontaminate, and/or evacuate passengers and non-essential crew
- Establish a safety zone
- Vessel stability [Link to Salvage Section 3300]
- If vessel is underway, consult with states to determine whether to bring the vessel into port [Link to Port of Safe Refuge Document]
- Determine if Safe to Respond [Link to Safe to Respond]
- If vessel is on fire, consult the Marine Fire Fighting and SAR Plan [Link to Marine Fire Fighting Plan Executive Summary Section 8000]
  - Activate Tri-state Maritime Safety Association/MIRT Response Team

Unified Command Organization

The information in Figure 1 represents agencies that may support a hazardous substance release response operation and where they may potentially work in a Unified Command organization. If there is a suspected or actual terrorist threat associated with the incident, then

this information should be used in conjunction with the Unified Command organization structure outlined in the Terrorism Incident Annex.

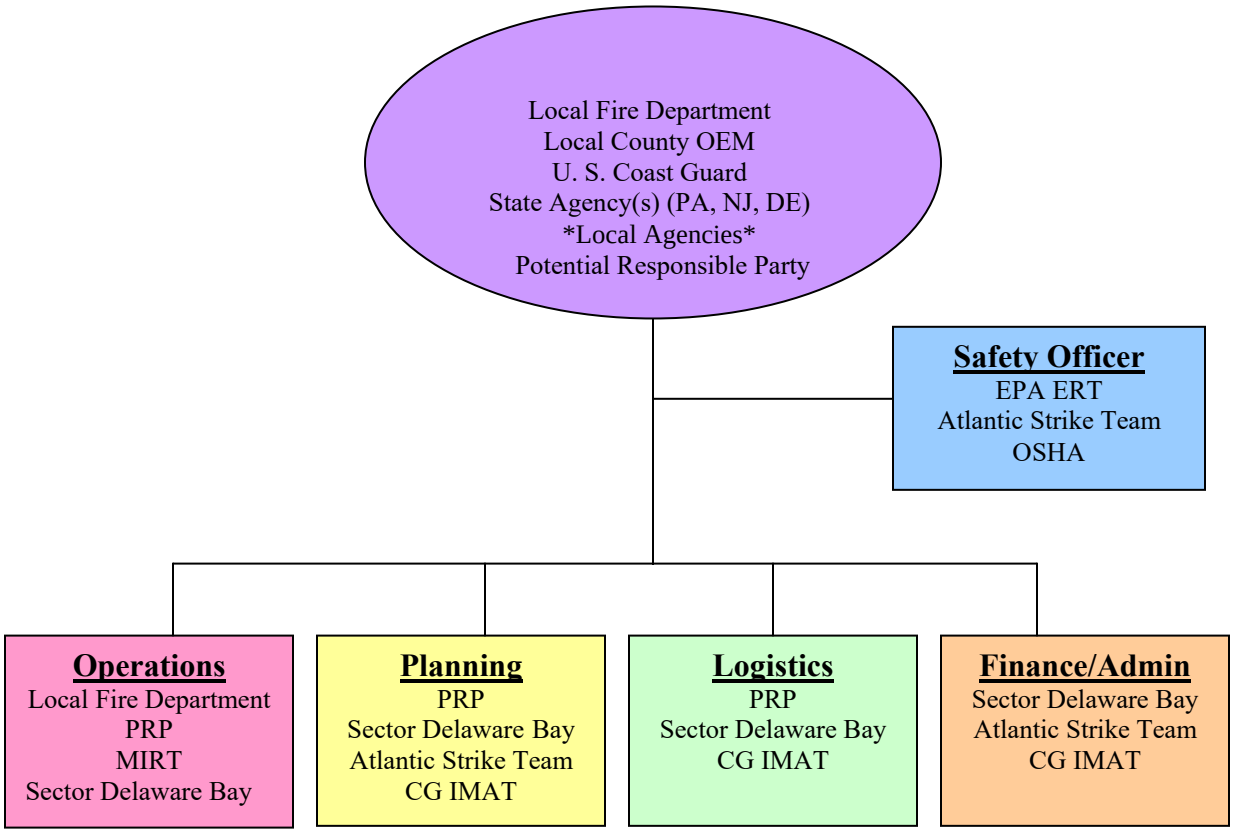

Figure 1. Depicts the potential agencies that may respond to a major hazardous substance release incident in the coastal zone. *Local governments are encouraged to contact the Unified Command through the Liaison Officer.*

Special Teams

The following special teams are equipped to respond to hazardous substance incidents, and should be considered as potential response resources:

- EPA Environmental Response Team (ERT)
- USCG Atlantic Strike Team (AST)
- OSHA (Region 2 New Jersey/Region 3 Pennsylvania and Delaware)
- ATSDR
- NOAA
- 3rd Civil Support Team (Pennsylvania)

Additional special teams can be found in the Special Teams Handbook [Link to the Handbook]
For local subject matter experts see:
[Link to Delaware Estuary Science Directory]

Hazardous Materials Response Special Teams

Hazardous Materials Response Special Teams

Capabilities and Contact Handbook

Hazardous Materials Response Special Teams Capabilities and Contact Handbook

Objective

This Handbook is intended to be used as a reference job aid for United States Coast Guard (USCG) Federal On Scene Coordinators (FOSCs) and other Federal, State and local responders and planners. It is designed to provide quick access to the capabilities of various special teams specifically related to oil, hazardous material, and Weapons of Mass Destruction (WMD) response. It is not a policy document, but rather an informational guide for response and planning personnel. The handbook is laid out to allow responders to quickly glance at each response component or category of technical expertise and ascertain which corresponding teams have the capability and resources to execute the response action(s). For planning purposes, additional narrative information is also provided to further describe the level of each team's capability in performing the necessary functions of response.

Background

The National Response System (NRS) response to the events of September 11, 2001 and subsequent anthrax cases clearly illustrated the vital role that the Special Teams and other Federal response assets play in supporting On-Scene Coordinators during oil and hazardous materials response activities.

The lessons learned from these responses afforded the NRS Special Teams and other Federal agencies with a unique opportunity to pool their collective expertise in order to conduct a comprehensive review to assess the Special Teams' individual current response assets and capabilities.

Participants of the 2002 Special Teams Capabilities Workshop concurred that Special Teams which are not listed in the NCP are still capable of responding to an incident; however, they often go unnoticed or, more specifically, their capabilities are either over- or under-estimated. The result is their capabilities being overlooked or they are relied upon for capabilities they do not have. To resolve this discrepancy, participants agreed on the need for a quick reference guide for Special Teams resources and capabilities.

In an effort to meet this need, the USCG spearheaded an effort, in coordination with numerous Federal Special Teams, to develop this Hazardous Materials Response Special Teams Capabilities and Contact Handbook.

Appendices

Appendix A, the *Hazardous Materials Team Typing* document, is a consensus product of the Hazardous Material Resource Typing Workgroup under FEMA's National Mutual Aid Initiative. The document provides guidance on the typing of hazardous materials (HAZMAT) teams. This appendix includes its own list of definitions and acronyms, which relate specifically to the typing document.
Appendix B: *Team Mission and Contact Information* provides 24-hour emergency and other contact information for each special team, in addition to a summary of each team's mission and responsibilities.
Appendix C contains a list of the terms and definitions for all response categories listed in the Handbook, and *Appendix D* is a list of acronyms.

Special Teams Included in Handbook

Background and contact information on each Special Team can be found in **Appendix B**: ***Team Mission and Contact Information.***

- Agency for Toxic Substances and Disease Registry (ATSDR) Emergency Response Teams
- U.S. Marine Corps Chemical Biological Incident Response Force (CBIRF)
- Department of Energy Nuclear Emergency Support Team (DOE NEST)
- United States Environmental Protection Agency's Environmental Response Team (EPA ERT)
- United States Environmental Protection Agency's (EPA) Office of Enforcement, Compliance, and Assurance (OECA), National Counter-terrorism Evidence Response Team (NCERT)
- United States Environmental Protection Agency's Radiological Emergency Response Team (EPA RERT)
- Federal Bureau of Investigation, Laboratory Division, Hazardous Materials Response Unit (FBI HMRU)
- National Oceanic and Atmospheric Administration Office of Response and Restoration (NOAA OR&R) Hazardous Materials Response Division (HAZMAT)
- United States Coast Guard National Pollution Funds Center (USCG NPFC)
- United States Coast Guard National Strike Force (USCG NSF)
- Occupational Safety and Health Administration Health Response Team (OSHA HRT)
- United States Navy Supervisor of Salvage and Diving (SUPSALV)
- United States Army Corps of Engineers Rapid Response Program (USACE RR)

The following Special Teams capabilities are not categorized within the Handbook; however, background and contact information for these teams may be found in **Appendix B**: ***Team Mission and Contact Information*.**

- Department of Defense Joint Director of Military Support (JDOMS)
- Department of Homeland Security, Federal Emergency Management Agency, Metropolitan Medical Response System (MMRS)
- United States Environmental Protection Agency's Diving Program
- United States Environmental Protection Agency's Emergency Communications and Outreach Team (ECOT)
- United States Environmental Protection Agency's Emergency Response Peer Support and Critical Incident Stress Management (Peer Support/CISM) Team
- United States Environmental Protection Agency's Ocean Survey Vessel, Peter W. Anderson
- United States National Guard Civil Support Teams (USNG CST)

Table of Contents

Call Down and 24-Hour Contact Information

ATSDR
ATSDR: 404-498-0120
CDC Operations: 770-488-7100
HHS Command Center: 202-358-2413

JDOMS
24 Hour Number: NMCC @ 703-697-6340 (Emergency Actions Cell) or 703-693-8196 (Senior Operations Officer)
JDOMS Main Number: 703-697-9400
Fax Number: 703-697-3147
Primary Point of Contact: CAPT Marv Heinze (703-693-8453; Marvin.Heinze@JS.Pentagon.mil)
Alternate Points of Contact: LTC Art Beasley (703-697-9408; Arthur.Beasley@JS.Pentagon.mil)
LTC Michael Avila (703-697-9415; Michael.Avila@JS.Pentagon.mil)

DOE NEST
24 Hour Contact Number: 202-586-8100 (Ask for the Emergency Response Officer)
Agency Main Number: 202-586-9892
Agency Fax Number: 202-586-3904
Primary Point of Contact: Alan Remick (202-586-8312; Alan.Remick@NNSA.doe.gov)
Alternate Point of Contact: Debbie Wilber (202-586-0592; Debbie.Wilbur@hq.doe.gov)

FEMA US&R
24 Hour Number: (202) 646-4600
Fax Number: 202-646-4684
Primary Point of Contact: Peter Smalley, WMD Program Specialist (202-646-3796; peter.smalley@dhs.gov)

FBI HMRU
Agency Main Number: 703-632-7975
Agency Fax Number: 703-632-7898
Primary Point of Contact: John Fraga, Unit Chief (703-632-7975; jmfraga@hotmail.com)
Alternate Points of Contact: ***HazMat Operations*:** Steven Patrick, Sr. Hazardous Materials Officer (703-632-7940; stevegpatrick@aol.com)
***Science Operations*:** Dr. Benjamin Garrett, Senior Scientist (703-632-7929; Dier4@aol.com)

NOAA HAZMAT
HAZMAT Duty Officer available 24/7: 206-526-4911
Agency Main Number: 206-526-6317
Fax Number: 206-526-6329
Primary Contact Person: Thomas Callahan (206-526-6326; thomas.callahan@noaa.gov)
Alternate Contact Person: Robert Pavia (206-526-6319; Robert.Pavia@noaa.gov)

OSHA HRT
Agency Main Number: 801-524-7900
Agency Fax Number: 801-524-6660
Primary Point of Contact: Bob Curtis (801-414-9371; Curtis.Bob@dol.gov)
Alternate Point of Contact: Jimmy Roberts (801-414-9372; Roberts.Jimmy@dol.gov)

USACE RR
USACE Operations Center (24/7): 202-767-1001
Agency Main Number: 402-293-2501
Agency Fax Number: 402-291-8177
Primary Point of Contact: Tim Gouger (402-216-4252; timothy.p.gouger@usace.army.mil)
Alternate Point of Contact: Mark Herse (402-293-2560; mark.r.herse@usace.army.mil)

USEPA Diving Program
24 Hour Contact Number: 703-979-4597
Main Number: 202-566-1267
Fax Number: 202-566-1337
Primary Point of Contact: Kennard W. Potts (202-566-1267; potts.kennard@epa.gov)
Alternate Point of Contact: Alan Humphrey (732-321-6748; humphrey.alan@epa.gov)

USEPA ECOT
24 Hour Number: 703-851-3873
Main Number: 703-603-8908
Fax Number: 703-603-9133
Primary Point of Contact: Virginia Coffey, ECOT Team Leader (703-603-8908; coffey.virginia@epa.gov)
Alternate Point of Contact: Virginia Narsete (312-886-4359; narsete.virginia@epa.gov)

USEPA Peer Support/CISM
24-Hour Contact Number: 202-253-4177
Team Main Number: 703-603-8737
Team Fax Number: 703-603-9100
Primary Point of Contact: Jan Shubert (703-603-8737; shubert.jan@epa.gov)
Alternate Point of Contact: Karen McCormick (214-789-2814; mccormick.karen@epa.gov)

USEPA ERT
24 Hour Contact Number: 732-321-6660 or via National Response Center (NRC) at 1-800-424-8802 or 202-267-2675
Fax Number: 732-321-6724
Primary Point of Contact: Dr. Joseph P. Lafornara (732-321-6740; lafornara.joseph@epa.gov)
Alternate Point of Contact: Dave Wright (732-321-6740; wright.dave@epa.gov)
ERT West (Las Vegas) Point of Contact: Dennisses Valdes (702-784-8003; valdes.dennisses@epa.gov)

USEPA Ocean Survey Vessel
24 hour Contact Number: 410-336-4577 (Ship Bridge Cell) or 703-979-4597 (POC Home Phone)
Main Number: 202-566-1267
Fax Number: 202-566-1337
Primary Point of Contact: Kennard W. Potts, EPA Vessel Manager (202-566-1267; potts.kennard@epa.gov)
Alternate Point of Contact: Craig Vogt (202-566-1235; vogt.craig@epa.gov)

USEPA OECA/NCERT
Agency Main Number: 703-235-1113
Agency Fax Number: 703-235-1118
Primary Point of Contact: Special Agent in Charge (SAC) Ted Stanich (703-235-1113; stanich.ted@epa.gov)
Alternate Point of Contact: Assistant Special Agent in Charge (ASAC) Stacey Noem (703-235-0317; noem.stacey@epa.gov)

USEPA RERT
24 Hour Contact Number: 1-800-424-8802 or 202-267-2675 (NRC—on-call RERT commander)
Primary Point of Contact: Gregg Dempsey (702-798-2461; Dempsey.gregg@epa.gov)
Alternate Point of Contact: Sam Poppell (334-270-3414; Poppell.sam@epa.gov)

USCG NPFC
Agency Main Number: 202-493-6700
Agency Fax Number: 202-493-6898
Primary Point of Contact: Allen R. Thuring (202-493-6801; Athuring@ballston.uscg.mil)
Alternate Point of Contact: John A. Crawford (202-493-6811; Jcrawford@ballston.uscg.mil)

USCG NSF
All teams can be requested through the NRC: 1-800-424-8802
To Request Specific National Strike Force Teams:
National Strike Force Coordination Center (NSFCC): 252–331-6000
Atlantic Strike Team: 609-724-0008
Gulf Strike Team: 251-441-6001
Pacific Strike Team: 415-883-3311
Public Information Assist Team (PIAT): 252–331-6000 (Same as NSFCC)

USMC CBIRF
Agency Main Number: 301-744-2038
Agency Fax Number: 301-744-2052
Primary Point of Contact: LtCol Scott Graham (301-744-2039; grahamsa@cbirf.usmc.mil)
Alternate Point of Contact: LCDR Jeff Betsinger (301-744-2087; betsingerjb@cbirf.usmc.mil)

USNG CST
Primary Contact: LTCOL James Kish, 703-607-1724, james.kish@ngb.army.mil

SUPSALV
Main Number: 202-781-1731, ext. 2
After Hours Number: 202-781-3889 (NAVSEA Duty Officer)
Primary Point of Contact: Mr. Thomas Salmon (202-781-0828; salmontb@navsea.navy.mil)
Alternate Point of Contact: Mr. Richard Buckingham (202-781-0465; buckinghamrt@navsea.navy.mil)

FEMA MMRS
Primary Point of Contact: Dennis Atwood (202-646-2699; dennis.atwood@dhs.gov)
See MMRS Contact List (*Appendix B*) for regional points of contact.

Emergency Response Operational Expertise

HAZMAT Teams Deployment Time

Number of hours before team is capable of departure from home unit or base. HAZMAT Response Team is defined as an organized group of individuals who are trained and equipped to perform work to control actual or potential leaks, spills, discharges or releases of hazardous materials, requiring possible close approach to the material. The team/equipment may include external or contracted resources.

Please note Appendix A, attached, which provides guidance on the typing of hazardous materials teams.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU*	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Type I		1 hr		4 hrs	6 hrs		<1 hr[1]			2 hrs			X
Type II		1 hr		4 hrs	6 hrs		<2hrs[2]			2 hrs			X
Type III		1 hr		4 hrs	6 hrs					2 hrs			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT—Capability includes immediate technical advice 24/7 via phone and ability to deploy from three locations within the US (Edison, NJ; Cincinnati, OH; and Las Vegas, NV) within four (4) hours.

EPA OECA/NCERT
Eastern Side of United States-NCERT Washington DC (6 hours)
Western Side of United States-NCERT Denver (6 hours)

FBI HMRU
*Note – FBI Teams are specifically trained and equipped for Law Enforcement Crisis Operations and Investigations only. FBI Teams do not meet TYPE I and II standards for rescue and intervention.
[1]FBI HMRU—Deployment time is less than one hour from notification.
[2]FBI HMRU Field Teams (27)—Deployment time is less than two hours from notification.

NSF—No additional information provided.

USACE
The USACE RR Program is a Center of Expertise for time-sensitive environmental actions that involve the remediation of over 450 chemically, biologically, and/or radioactively contaminated sites throughout the United States including national crisis and emergency events. RR personnel deployed to an incident follow up on the work performed by first responders including fire fighters, HAZMAT response teams, and civil support teams. The RR Center of Expertise has developed experienced "field-tested" personnel within a proven response culture and response structure. The RR Center of Expertise also has the administrative capacity to undertake cost reimbursable contracting. Technical, contractual, construction, and stakeholder needs are integrated into project execution in a timely, compliant, and cost-effective manner. The program meets the criteria under all

components for Coast Guard Special Teams Type 1 categorization. Team members can be contacted 24/7 and can be mobilized within hours for deployment.

Operational Health and Safety

Safety Plan Development and Enforcement

Ability to draft all policies and procedures for responders operating on-site to ensure a safe working environment prior to working at the site. The enforcement also includes ensuring the policies and procedures within the safety plan are adhered to during a response.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X		X	X		X	X	X	X
Chemical-Commercial	X	X		X	X		X	X		X	X		X
Chemical-Warfare Agent	X	X		X	X		X			X	X		X
Biological		X		X	X		X			X	X		X
Radiological		X		X	X	X	X			X	X		X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR

Chemical-Commercial—Currently have two (2) Site Safety Officers (SSOs) and are developing a cadre of seven (7) SSOs.

CBIRF—No additional information provided.

EPA OECA/NCERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—NCERT (30 member team)/Full health and safety plan (HASP) support.

EPA ERT

Oil—Expertise in the development of site-specific health and safety plans. ERT has been particularly active in defining levels of respiratory and skin protection at oil spills. ERT personnel have been the leaders in the development of the policies and procedures that have become the Hazardous Waste Operations and Emergency Response (HAZWOPER) Regulations. ERT has developed the Safe Operating Guide for HAZMAT responders, and can provide Safety Officer support through the OSC.

Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Expertise in the development of site-specific health and safety plans. ERT personnel have been the leaders in the development of the policies and procedures that have become the HAZWOPER Regulations. ERT has developed the Safe Operating Guide for HAZMAT responders, and can provide Safety Officer support through the OSC.

EPA RERT

Radiological—Capability for safety plan development only

FBI HRMU

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability is specific to Federal Law Enforcement Operations.

NOAA

Oil/Chemical-Commercial—Provide input to plans for safety of responders.

CG NSF

Oil/Chemical-Commercial/ Chemical-Warfare Agent—Comprehensive.
Biological/Radiological—Would need technical assistance from outside experts.

NAVY SUPSALV

Oil—Capability for all environments for SUPSALV personnel and contractor assets for Navy Occupational Safety and Health (OSH) Standards and Procedures.

OSHA HRT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—In major incidents OSHA will provide advice, assistance and technical support as needed for the Incident Commander/Unified Command and lead agency.

USACE RR

Oil/Chemical-Commercial—Experienced field, technical, project personnel, Certified Industrial Hygienists (CIH) and Certified Safety Professional (CSP) Health and Safety Managers, and Field Site Safety Officers.
Chemical-Warfare Agent—Experienced field, technical, project personnel, mobile laboratories for analytical testing, CIH Health and Safety Managers, and Field Site Safety Officers.
Biological—Experienced field, technical, project personnel; field screening instruments for detection, Senior Level Safety Microbiologists, CIH, CSP Health and Safety Managers and Site Safety Officers.
Radiological—Experienced field, technical, project personnel; field testing instruments; field monitoring instruments; certified personnel for training; certified Health Physicists, CIH, CSP Health and Safety Managers and Site Safety Officers.

Responder Health and Safety

Ability to ensure that all procedures, policies and plans are developed and followed for the health and safety of personnel during a response. This also encompasses the personnel protective equipment, air quality monitoring equipment, medical monitoring and the plans to ensure when and how any of these are used during a response.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X		X	X		X	X	X	X
Chemical-Commercial	X	X		X	X		X	X		X	X	X	X
Chemical-Warfare Agent	X	X		X	X		X	X		X	X		X
Biological		X		X	X		X			X	X		X
Radiological		X	X	X	X	X	X			X	X		X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Chemical-Commercial—Currently have two (2) SSOs and are developing a cadre of seven (7) SSOs.

CBIRF—No additional information provided.

DOE NEST
Radiological—Capability includes health physicists and radiation control technicians.

EPA OECA/NCERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—NCERT (30 member team ONLY) Level A, B, C,D Support.

EPA ERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Experts available to perform oversight on site. ERT personnel have been the leaders in the development of the policies and procedures that have become the HAZWOPER Regulations.

EPA RERT
Radiological—Capability is for advisory or assistance role; may be situation dependent.

FBI HRMU
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability specific to Federal Law Enforcement Operations.

NOAA
Oil—Provision of Industrial Hygienist advice; recommendations on safe practices, personal protective equipment (PPE), and potential site hazards. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.

Chemical-Commercial— Industrial Hygienist advice; Computer Aided Management of Emergency Operations (CAMEO) database support; recommendations on safe practices, PPE, and potential site hazards. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.
Chemical-Warfare Agent—Industrial Hygienist advice; CAMEO database support. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.

CG NSF
Oil/Chemical-Commercial/Chemical-Warfare Agent—Comprehensive, Emergency Medical Technician (EMT) basic level only for medical response.
Biological/Radiological—Would need technical assistance from outside experts.

NAVY SUPSALV
Oil/Chemical-Commercial—Capability provided for own responders only.

OSHA HRT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—In major incidents OSHA will provide advice, assistance and technical support as needed for the Incident Command/Unified Command (IC/UC) and a lead agency.

USACE RR
Oil—Experienced field, technical, project personnel; yellow iron; stock supply of treatment supplies/materials; field laboratories/chemical testing apparati; Certified Health Physicists, CIH, CSP Health and Safety Managers, and Site Safety Officers.
Chemical-Commercial—Experienced field, technical, project personnel; yellow iron; stock supply of "treatment" materials; field laboratories/chemical testing apparatus; Chemists, CIH, CSP Health and Safety Managers, and Site Safety Officers.
Chemical-Warfare Agent—Select field, technical, project personnel; exotic chemical treatment experience; Professional Chemists, CIH, CSP Health and Safety Managers and Site Safety Officers.
Biological—Experienced field, technical, project personnel; stock supply of "treatment" materials; field screening instruments for detection; Senior Level Safety Microbiologists; CIH, CSP Health and Safety Managers, and Site Safety Officers.
Radiological—Experienced field, technical, project personnel; field testing instruments; field monitoring instruments; and certified personnel for training.

Onsite Medical Monitoring

Ability to regularly evaluate response personnel and their ability to work and use different equipment, including personal protective equipment. Onsite medical monitoring typically consists of quick biological monitoring, which could include body temperature, body weight, and/or heart rate.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X		X			X		X	X
Chemical-Commercial		X		X	X		X			X		X	X
Chemical-Warfare Agent		X		X	X		X			X			X
Biological		X		X	X		X			X			X
Radiological		X	X	X	X		X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

DOE NEST
Radiological—The Radiological Emergency Advisory Center/Training Site (REAC/TS) can deploy physicians and health physicists.

EPA ERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological –Through EPA's State Hazardous Materials Enforcement Development Program (SHMED), ERT can provide on-site contractor medical monitoring support.

EPA OECA/NCERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—National First Responders/Occupational Physician.

FBI HRMU
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability specific to Federal Law Enforcement Operations.

USCG NSF
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—EMT Basic Only.

SUPSALV
Oil/Chemical-Commercial—Capability provided for own responders only.

USACE RR
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Medical Doctor (MD) resources, on-site and off-site for worker/public evaluation/monitoring.

Establishing Medical Protocol

Ability to determine the policies and procedures to be utilized for the best protection of worker health and safety.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X		X			X		X	X
Chemical-Commercial	X	X		X	X		X			X		X	X
Chemical-Warfare Agent	X	X		X	X		X						X
Biological		X		X	X		X						X
Radiological		X	X	X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR

Chemical-Commercial—ATSDR maintains a medical officer on call with other specialists in support. ATSDR also has a referral agreement with a national association of clinics.

CBIRF—No additional information provided.

DOE NEST

Radiological—Capability includes deployment of physicians, members of the World Health Organization (WHO).

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological –Through EPA's SHMED, ERT can provide on-site contractor medical monitoring support.

EPA OECA/NCERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—NCERT Personnel Only.

FBI HRMU

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability specific to Federal Law Enforcement Operations.

USCG NSF

Oil/Chemical-Commercial—EMT Basic Only.

SUPSALV

Oil/Chemical-Commercial—Capability provided for own responders only.

USACE RR

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—MD resources, on-site and off-site for worker/public evaluation/monitoring.

Salvage Capability

Vessel Fire Assessment

Ability to assess both minor and major damage to a vessel, either off-shore or on-shore, as a result of an on-board fire. The assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The assessment should include detailed damage information as well as recommended repair and salvage options. The level of PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil												X	
Chemical-Commercial												X	
Chemical-Warfare Agent												X	
Biological												X	
Radiological												X	

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

SUPSALV

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability is integral to SUPSALV response and other Navy assets.

Vessel Damage Assessment

Ability to assess both minor and major damage to a vessel as a result of a collision, grounding, explosion, or any other incident in which damage is done to the vessel. The assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The assessment should include detailed damage information as well as recommended repair and salvage options. The level of PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X						X		X	
Chemical-Commercial				X						X		X	
Chemical-Warfare Agent				X						X		X	
Biological				X								X	
Radiological				X								X	

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability to provide underwater dive capabilities for environmental/release assessments and has a tethered unmanned remote control submersible for sub-surface reconnaissance and sampling.

USCG NSF

Oil/Chemical-Commercial—Damage Assessment in accordance with Navy Salvage Manual.
Chemical-Warfare Agent—Damage Assessment in accordance with Navy Salvage Manual.

SUPSALV

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability includes use of established Navy computer programs and resources such as Program of Ship Salvage Engineering (POSSE).

Vessel Salvage

Ability to salvage a vessel that was involved in an incident such as an explosion, grounding, collision, or any other incident that puts the vessel in an unstable or unseaworthy condition. The salvage assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The salvage assessment should include detailed damage information as well as recommended salvage options. The level of PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil												X	
Chemical-Commercial												X	
Chemical-Warfare Agent												X	
Biological												X	
Radiological												X	

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

SUPSALV

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Pre-staged, rapid deployment assets positioned at different strategic locations around the US. Pre-established contracts in place to support mission.

Vessel Plugging and Patching Capability

Ability to provide necessary personnel and materials to adequately plug and patch a vessel to secure the flooding and prevent the vessel from sinking.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	X
Chemical-Commercial										X		X	X
Chemical-Warfare Agent										X			X
Radiological													X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USCG NSF

Oil/Chemical-Commercial/Chemical Warfare Agent—Limited plugging & patching capabilities. Able to employ standard Navy/Coast Guard vessel damage control techniques.

SUPSALV

Oil/Chemical Commercial—Capability includes in-house engineers and diving contractor specializing in underwater vessel repair.

USACE RR—No additional information provided.

Diving Expertise

Ability to provide diving services to meet the needs of the particular incident. Capability should include scuba diving, deep water diving, decompression capability, and any other diving related services that are required under pertinent regulations dealing with safe diving practices. Capability should also include the ability to dive into an environment contaminated with hazardous materials, such as oil, chemicals, or radiological agents.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X				X	X
Chemical-Commercial				X				X				X	X
Chemical-Warfare Agent				X								X	X
Radiological				X								X	X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Radiological—ERT has a small but well-equipped contingent of trained HAZMAT divers. Capabilities include a mini remotely operated submarine (unmanned) capable of under-water photography and side scanning radar.

NOAA

Oil/Chemical-Commercial—Provision of guidance on safe operations.

SUPSALV

Oil/Chemical-Commercial/Chemical-Warfare Agent/Radiological—Expertise includes Remotely Operated Vehicles (ROVs) to respond to NBC agents.

USACE RR

Oil/Chemical-Commercial/Radiological—Certified, trained diving personnel who also have 40 hours HAZWOPER training; stock supply of diving materials, equipment, and supplies; mobile field laboratories and screening instruments.

Chemical-Warfare Agent—Certified, trained diving personnel who also have 40 hours HAZWOPER training; stock supply of diving materials, equipment, and supplies; mobile field laboratories and screening instruments. Chemical Warfare agent detection capabilities unknown.

Spill Containment and Recovery

Search and Recovery (Nuclear Material)

Ability to provide qualified personnel, equipment and supplies to safely conduct search and rescue operations at an incident site that has been contaminated with nuclear or radiological agents.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Radiological			X	X		X	X					X	X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

DOE NEST
Capability involves large scale deployment of broad area gamma and neutron detectors.

EPA ERT
Capability includes technical expertise in both marine and fresh water oil spill containment and recovery technologies.

EPA RERT
Team has search capabilities depending upon the situation.

FBI HMRU
Specific to searching for and in an area potentially containing radiological material for the purpose of a law enforcement investigation.

SUPSALV
Capability available at sea only.

USACE RR
Field testing instruments; field monitoring instruments; extensive experience in source control, waste classification, packaging, profiling, treatment, and disposal. Infrastructure to support $140 million/year in remediation of sites contaminated with radioactivity.

Discharge/Release Containment Operations

Ability to provide qualified personnel and necessary containment equipment to respond to an oil or chemical incident, as outlined in pertinent Federal and State regulations. For biological or radiological incidents, the ability to identify, isolate and contain contaminated personnel that have been impacted by the particular agent.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X			X			X		X	X
Chemical-Commercial				X			X			X		X	X
Chemical-Warfare Agent				X			X			X			X
Biological				X			X			X			X
Radiological				X		X	X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—ERT can provide in-house and contractor experts to design and implement these operations. Actual performance would be contracted to the best available private or public sector group capable of doing the job.

EPA RERT

Radiological—Advisory role capability.

FBI HMRU

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability specific to identifying, isolating and sampling materials necessary as part of an FBI investigation.

USCG NSF

Oil—Offshore containment; special monitoring of alternative response technologies (dispersant & in-situ burning) capability; and contractor oversight.
Chemical-Commercial—Offshore containment; nearshore and inland skimming and storage capability for certain floating chemicals; and contractor oversight. May require outside expert advice.
Chemical-Warfare Agent/Biological/Radiological—May require outside expert advice on a case-by-case basis to determine if in-house chemical/agent containment capabilities will work; contractor oversight.

SUPSALV

Oil/Chemical-Commercial—Capability includes open ocean and shore seal boom with mooring systems, and related ancillaries.

USACE RR

Oil—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; stock supplies of "treatment" supplies; extensive experience in source control, waste classification,

packaging, profiling, treatment, and disposal. Considerable experience in remediating soil, sediments, and groundwater with oil pollution.

Chemical-Commercial—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; mobile field laboratories; stock supplies of "treatment" supplies, extensive experience in source control, waste classification, packaging, profiling, treatment, and disposal. Considerable experience in remediating soil, sediments, and groundwater with commercial chemical contamination.

Chemical-Warfare Agent—Some experienced field, technical, project personnel; field testing instruments; field monitoring instruments; yellow iron for removal; some experience in source control, waste classification, packaging, profiling, treatment, and disposal.

Biological—Extensive experience in assessing and decontaminating postal facilities due to the presence of anthrax; extensive experience in developing and working in a Unified Incident Command Structure and Technical Working Groups; extensive experience in presenting strategies to union officials, Executive management, employees, and the public; numerous experienced field, technical, management personnel; mobile field screening instruments; and stock supplies of some treatment materials.

Radiological—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; extensive experience in source control, waste classification, packaging, profiling, treatment, and disposal. Infrastructure to support $140 million/year in remediation of sites contaminated with radioactive.

Contaminated Debris Removal

Ability to provide personnel, equipment and certified DOT transporters to safely remove contaminated debris from the incident site to a properly designated storage facility or temporary storage location outside the impacted area. Contaminated debris may include that which has been exposed to oil, chemical, biological and/or radiological contaminants.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X			X			X		X	X
Chemical-Commercial				X			X			X		X	X
Chemical-Warfare Agent				X			X			X			X
Biological				X			X			X			X
Radiological				X		X	X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—ERT can provide in-house and contractor experts to design and implement these operations. Actual performance would be contracted to the best available private or public sector group capable of doing the job.

EPA RERT

Radiological—Advisory capability only

FBI HMRU

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability provided specific to evidence recovered in support of an FBI investigation.

USCG NSF

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability includes contractor oversight.

SUPSALV

Oil/Chemical-Commercial—Capability is contractor supported.

USACE RR

Oil/Chemical-Commercial—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; yellow iron for removal; extensive experience in source control, waste classification, packaging, profiling, treatment, and disposal.

Chemical-Warfare Agent—Some experienced field, technical, project personnel; field testing instruments; field monitoring instruments; yellow iron for removal; some experience in source control, waste classification, packaging, profiling, treatment, and disposal.

Biological—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; stock supplies of "treatment" supplies; extensive experience in source control, waste classification, packaging, profiling, treatment, and disposal.

Radiological—Numerous experienced field, technical, project personnel; field testing instruments; field monitoring instruments; extensive experience in source control; waste classification, packaging, profiling, treatment, and disposal. Infrastructure to support $140 million/year in remediation of sites contaminated with radioactive

Spill Containment and Recovery—Bulk-Liquid Off-Loading Capability

Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to another off-shore vessel, on-shore vessel, or on-shore facility. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.

On-Shore Vessel/Facility

Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to an on-shore vessel, or on-shore facility. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	X
Chemical-Commercial										X		X	X
Chemical-Warfare Agent										X*			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USCG NSF

Oil—Lightering; viscous to light product pumping/transfer compatibilities, up to 2000 gallons per minute (GPM) transfer rate; all transportation mode capability (rail, vessel, intermodal tank, tank truck).

Chemical-Commercial—Lightering; viscous to light product pumping/transfer compatibilities; temporary storage devices; up to 2000 GPM transfer capability; all transportation mode capability.

*__Chemical-Warfare Agent__—Requires outside expert advice on a case-by-case basis to determine if in-house chemical pumping capabilities will work; contractor oversight; all transportation mode capability.

SUPSALV

Oil/Chemical Commercial—Capability to offload from distressed vessel to shore or offshore storage, range of heavy to light oils.

USACE RR—No additional information provided.

Bulk-Liquid Off-Loading Capability—Off-Shore Vessel

Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to another off-shore vessel. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	X
Chemical-Commercial										X		X	X
Chemical-Warfare Agent										X*			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

*EPA Diving Program**
Dive platform is available for response.

*EPA Ocean Survey Vessel**
Vessel is capable of emergency response missions and has done so in the past (e.g.: the Delaware River oil spill—locating cargo containers of arsenic trioxide off the coast of New Jersey).

USCG NSF
Oil—Lightering; viscous to light product pumping/transfer compatibilities, up to 2000 GPM transfer rate; all transportation mode capability (rail, vessel, intermodal tank, tank truck).
Chemical-Commercial—Lightering; viscous to light product pumping/transfer compatibilities; temporary storage devices; up to 2000 GPM transfer capability; all transportation mode capability.
***Chemical-Warfare Agent**—Requires outside expert advice on a case-by-case basis to determine if in-house chemical pumping capabilities will work; contractor oversight.

SUPSALV
Oil/Chemical-Commercial—Capability to offload from distressed vessel to shore or offshore storage, both range of heavy to light oils.

USACE RR—No additional information provided.

***Team is not included in chart above; however, is capable of assisting with bulk-liquid off-loading operations for off-shore vessels.

Spill Containment and Recovery—Discharge/Release Recovery Operations

Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.

On-Shore Vessel/Facility

Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment from an on-shore vessel or facility. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	X
Chemical-Commercial										X		X	X
Chemical-Warfare Agent										X			X
Radiological										X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USCG NSF

Oil—Inland skimming capability, oil transfer capability, contractor oversight.

Chemical-Commercial—Inland skimming capability and chemical transfer capability is dependant upon chemical; contractor oversight.

Chemical-Warfare Agent/Radiological—Requires outside expert advice on a case-by-case basis to determine if in-house chemical containment/agent capabilities will work; contractor oversight.

SUPSALV

Oil/Chemical-Commercial—Capability for recovery of waterborne substances only (not contaminated soil).

USACE RR—No additional information provided.

Discharge/Release Recovery Operations—Off-Shore Vessel

Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment from an off-shore vessel. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	X
Chemical-Commercial										X		X	X
Chemical-Warfare Agent										X			X
Radiological										X			X
Ground Water													

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USCG NSF

Oil—Offshore, nearshore & inland skimming & storage capability, Special Monitoring of Advanced Response Technologies (SMART) monitoring (for in-situ burning and dispersant application), contractor oversight.
Chemical-Commercial—Offshore, nearshore & inland skimming & storage capability dependant upon chemical, contractor oversight.
Chemical-Warfare Agent/Radiological—Requires outside expert advice on a case-by-case basis to determine if in-house agent containment capabilities will work; contractor oversight.

SUPSALV

Oil/Chemical-Commercial—Capability for recovery of waterborne substances only. Multiple skimming and oil handling systems & both shallow water and open ocean capability.

USACE RR—No additional information provided.

On-Water Storage Capability

Ability to provide necessary on-water equipment, such as barges or tank vessels, and qualified personnel to operate the on-water equipment to adequately store recovered oil or chemical products from a spill incident.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil										X		X	
Chemical-Commercial										X		X	
Chemical-Warfare Agent										X		X	

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USCG NSF

Oil—Provision of temporary storage devices

Chemical-Commercial/Chemical Warfare Agent—Provision of temporary storage devices-must check compatibility.

SUPSALV

Oil/Chemical-Commercial/Chemical-Warfare Agent—Provision of large towable, shallow draft bladders & contractor barges.

Environmental Assessment and Mitigation

Wildlife Impact Assessment and Rehabilitation

The present evaluation of an ecosystem, including how that ecosystem would be affected by a change in the environment, and the steps that could be taken to restore an ecosystem to as-near-as-possible its pre-incident condition, or to a condition where it can recover on its own.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X	X				X
Chemical				X				X	X				X
Radiological				X		X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical/Radiological—ERT has a staff of in-house EPA and U.S. Fish and Wildlife Service (USFWS), and contractor experts in this area. ERT's board-certified veterinarian has assisted at several incidents.

EPA RERT

Radiological—Capable of wildlife impact assessment only.

NOAA

Oil/Chemical—Provision of natural resources at risk information; graphic environmental sensitivity index map support; coordination with Federal, state, and local natural resource agencies. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.

NPFC

Oil/Chemical—USCG/NPFC: Capability to provide three (3) individuals trained in natural resource damage assessment (NRDA) processes, available 48 hours after notification.

USACE RR

Oil/Chemical/Radiological—Experienced field resources for data collection, experienced risk assessors, and experienced ecological risk assessors.

Shoreline Impact Assessment

Ability to assess the current status of a coastal ecosystem and how that ecosystem is being affected or could be affected by change.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X	X	X			X
Chemical-Commercial				X				X	X	X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial—ERT has a staff of in-house EPA, USFWS, and contractor experts in this area.

NOAA

Oil/Chemical-Commercial—Capable of leading, conducting, and coordinating shoreline impact assessment. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.

NPFC

Oil/Chemical-Commercial—USCG/NPFC: Capability to provide three (3) individuals trained in NRDA processes, available 48 hours after notification.

USCG NSF

Oil/Chemical-Commercial—Visual assessment/shoreline cleanup assessment capability.

USACE RR

Oil/Chemical-Commercial—Experienced field resources for data collection; experienced risk assessors; and experienced ecological risk assessors.

Historical and Archeological Properties Expertise

Having the skill, knowledge, and experience to assess those landmarks, buildings, or land areas that had important impacts on the course of history, including ancient cultures. Preservation of such properties is a priority following immediate response for care of human life and health.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
General													X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

USACE RR—No additional information provided.

Overflight Assessment

Ability to evaluate an impacted area, which could include a geographical survey of the site and possible monitoring using advanced detection instruments, via means of aviation.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X		X		X	
Nighttime Capability										X		X	
Chemical-Commercial				X				X		X			
Nighttime Capability				X						X			
Chemical-Warfare Agent													
Nighttime Capability													
Radiological			X										
Nighttime Capability			X										

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

DOE NEST

Radiological/Nighttime Capability—Fixed and rotary wing detector assets; comprehensive analysis.

*EPA ASPECT**

Chemical-Commercial/Chemical-Warfare Agent/Radiological/Nighttime Capability—Capability includes infrared spectrometry; outfitted to perform real-time chemical and radiological monitoring, and visible and infrared aerial photography in conjunction with geographic data collection and mapping.

EPA ERT

Oil—ERT has in-house and contractor personnel who have experience in observing oil spills from fixed-wing and rotary-wing aircraft. ERT can also assist in forwarding requests to EPA's Environmental Monitoring Systems Labs (EMSL) in Las Vegas, NV or Reston, VA, and to EPA's Environmental Photographic Interpretation Center (EPIC) for historical aerial photo and overflight support.

Chemical-Commercial/Nighttime Capability—ERT has in-house and contractor personnel who have experience in using visual imagery to monitor releases of hazardous chemicals. ERT can also assist in forwarding requests to EPA's Environmental Monitoring Systems Labs (EMSL) in Las Vegas, NV or Reston, VA, and to EPA's Environmental Photographic Interpretation Center (EPIC) for historical aerial photo and overflight support.

NOAA

Oil/Chemical-Commercial—Provision of skilled overflight observers and observation job aids; production of aerial overflight maps. Support may be via phone within one hour; personnel may also be dispatched on-scene within 24 hours.

USCG NSF

Oil/Chemical-Commercial—Visual assessment capable with supplied commercial or government aircraft.
Nighttime Capability—Visual assessment capable with supplied commercial or government aircraft with handheld infrared (IR) camera.

SUPSALV

Oil/Nighttime Capability—Capability may be limited as certain restrictions on observers may apply on US Navy aircraft.

*Team is not included in chart above; however, is capable of overflight assessment.

Site Characterization—Monitoring

Ability to detect the presence of and regularly scrutinize levels of known or unknown liquids, solids, gases, or vapors. This can include the use of advanced detection equipment to provide standard confined space and accumulative readings in order to identify and establish the exclusion zones after contamination spread.

Oil

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X			X
Soil		X		X	X		X			X			X
Surface Water		X		X	X		X			X			X
Ground Water				X	X								X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT

Air—ERT has the experienced in-house and contractor personnel and the finest equipment and instrumentation to perform appropriate air monitoring at oil spills. ERT has the capability to rapidly design and implement air studies ranging from field screening for Health and Safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies.

Soil/Surface Water/Ground Water—ERT has the experienced in-house and contractor personnel and the finest equipment and instrumentation to perform appropriate soil/surface water/ground water monitoring at oil spills.

EPA OECA/NCERT

Air/Soil—NCERT (30 members)/Air Monitoring Detection Equipment/ Federal Law Enforcement/Levels A, B, C, and D Capable.

Surface Water/Ground Water—NCERT (30 members)/Visual Assessment Federal Law Enforcement/Levels A, B, C, and D Capable.

FBI HMRU

Air/Soil/Surface Water—Provision of standard TYPE I HAZMAT Team equipment.

USCG NSF

Air—Colorimetric, Photo Ionization Detector (PID), Flame Ionization Detector (FID), combustible gas, SKC pumps, and sample collection media.

Soil/Surface Water—Capability through visual monitoring or sampling.

USACE RR

Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources available for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Monitoring—Chemical-Commercial

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X	X		X
Soil		X		X	X		X			X			X
Surface Water		X		X	X		X			X			X
Ground Water				X	X					X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air--ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air monitoring for commercial toxic chemicals. ERT has the capability to rapidly design and implement air studies ranging from field screening for health and safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies. The ERT's mobile Trace Atmospheric Gas Analyzer (TAGA) laboratories are capable of performing real-time analysis of volatile chemicals at the sub-parts per billion level while on the move.
Soil—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate soil monitoring for commercial toxic chemicals. ERT experts have rapidly designed and implemented hundreds of extent of contamination studies involving a wide range of substances, soil types and geographical locations.
Surface Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface water monitoring for commercial toxic chemicals. ERT has performed hundreds of surface water sampling studies and has the sampling equipment and expertise to rapidly design and implement appropriate studies at both the surface and at depth.
Ground Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate ground water monitoring for commercial toxic chemicals. ERT experts have rapidly designed and implemented hundreds of ground water studies involving a wide range of substances, soil types and geographical locations. ERT has its own direct-push GEO-PROBE for shallow ground water studies and has access to qualified (40-hour trained) drillers through its Response Engineering and Analytical Contract (REAC).

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—NCERT (30 members)/Air Monitoring Detection Equipment/ Federal Law Enforcement/Levels A, B, C, and D Capable.

FBI HMRU
Air/Soil/Surface Water—Provision of standard TYPE I HAZMAT Team equipment.

USCG NSF—No additional information provided.

OSHA HRT

Air—Deployment time for air monitoring would be 18 hours.

USACE RR

Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Monitoring—Chemical-Warfare Agent

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X			X
Soil		X		X	X		X			X			X
Surface Water		X		X	X		X			X			X
Ground Water				X	X								X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air monitoring for chemical warfare agents. ERT has the capability to rapidly design and implement air studies ranging from field screening for health and safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies. The ERT's mobile TAGA laboratories are capable of performing real-time analysis of volatile warfare chemicals at the sub-parts per billion level while on the move.
Soil—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate soil monitoring for chemical warfare agents. ERT experts have rapidly designed and implemented hundreds of extent of contamination studies involving a wide range of substances, soil types and geographical locations.
Surface Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface water monitoring for chemical warfare agents. ERT has performed hundreds of surface water sampling studies and has the sampling equipment and expertise to rapidly design and implement appropriate studies at both the surface and at depth.
Ground Water--ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate ground water monitoring for chemical warfare agents. ERT experts have rapidly designed and implemented hundreds of ground water studies involving a wide range of substances, soil types and geographical locations. ERT has its own direct-push GEO-PROBE for shallow ground water studies and has access to qualified (40-hour trained) drillers through its REAC contract.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—NCERT (30 members)/Air Monitoring Detection Equipment/ Federal Law Enforcement/Levels A, B, C, and D Capable.

FBI HMRU
Air/Soil/Surface Water—Provision of standard TYPE I HAZMAT Team equipment.

USCG NSF
Air—Provision of military kits, Advanced Portable Detector (APD) 2000
Soil/Surface Water—Capability comprises sampling only.

USACE RR

Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Monitoring—Biological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X					X			X
Soil		X		X	X					X			X
Surface Water		X		X	X					X			X
Ground Water				X	X								X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air—ERT has the experienced in-house and contractor personnel and the finest equipment and instrumentation to perform appropriate air monitoring for biological agents. ERT has the capability to rapidly design and implement air studies.
Soil/Surface Water/Ground Water—ERT has the in-house and contractor personnel and the equipment and instrumentation to perform appropriate soil, surface water, and ground water monitoring for biological agents.

EPA OECA/NCERT
Air—NCERT (30 members)/ Monitoring Detection Equipment/ Federal Law Enforcement/Levels A, B, C, and D capable.
Soil/Surface Water/Ground Water—NCERT (30 members)/ Monitoring Detection Equipment/ Federal Law Enforcement/Level A capable.

USCG NSF
Air—Provision of Bioassay kits
Soil/Surface Water—Capability comprises sampling only.

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Monitoring—Radiological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X	X	X	X		X			X			X
Soil		X	X	X	X		X			X			X
Surface Water		X	X	X	X		X			X			X
Ground Water			X	X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

DOE NEST
Air/Soil/Surface Water/Ground Water—Not capable as an emergency response function.

EPA ERT
Air/Soil—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air and soil monitoring for radiological agents. While ERT has the capability to rapidly design and implement these air studies, they are usually limited to studies in support of the site safety plan. Other more in depth studies are commonly performed by the Radiological Emergency Response Teams (RERTs).
Surface Water/Ground Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface and ground water monitoring for radiological agents. While ERT has the capability to rapidly design and implement these studies, they are usually limited to screening studies. Other more in depth studies are commonly performed by the RERTs.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—NCERT (30 members)/ Monitoring Detection Equipment/ Federal Law Enforcement/Level A capable.

*EPA RERT—*No additional information provided.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capability to provide standard TYPE I HAZMAT Team, military, and DOE equipment.

USCG NSF
Air/Soil/Surface Water—Capability to provide Alpha, Beta, Gamma, Neutron survey equipment.

USACE
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Site Characterization—Sampling

Ability to conduct standard evidence collection protocols consisting of capturing and collection, containerizing and proper labeling, and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis.

Oil

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air				X	X		X			X			X
Soil				X	X		X	X		X			X
Surface Water				X	X		X	X		X			X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Air—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air sampling at oil spills. ERT has the capability to rapidly design and implement air studies ranging from field screening for Health and Safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies.

Soil/Surface Water/Ground Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate soil, surface water, and ground water sampling at oil spills.

EPA OECA/NCERT

Air/Soil/Surface Water/Ground Water—Capability provided for criminal/forensic evidence.

FBI HMRU

Air/Soil/Surface Water/Ground Water—Capable for purpose of criminal investigation.

NOAA

Soil/Surface Water—Capability to collect samples in the field for chemical analysis.

USCG NSF

Air—Provision of colorimetric, PID, FID, combustible gas, SKC pumps, and sample collection media.

Soil/Surface Water—Site characterization capability through visual/sampling.

USACE RR

Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Sampling—Chemical-Commercial

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X	X		X
Soil		X		X	X		X	X		X			X
Surface Water		X		X	X		X	X		X			X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT

Air—ERT has environmental sampling and analysis expertise and experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air sampling for commercial toxic chemicals. ERT has the capability to rapidly design and implement air studies ranging from field screening for health and safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies. The ERT's mobile TAGA laboratories are capable of performing real-time analysis of volatile chemicals at the sub-parts per billion level while on the move.

Soil—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate soil sampling for commercial toxic chemicals. ERT experts have rapidly designed and implemented hundreds of extent of contamination studies involving a wide range of substances, soil types and geographical locations.

Surface Water— ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface water sampling for chemical warfare agents. ERT has performed hundreds of surface water sampling studies and has the sampling equipment and expertise to rapidly design and implement appropriate studies at both the surface and at depth.

Ground Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate ground water sampling for commercial toxic chemicals. ERT experts have rapidly designed and implemented hundreds of ground water studies involving a wide range of substances, soil types and geographical locations. ERT has its own direct-push GEO-PROBE for shallow ground water studies and has access to qualified (40-hour trained) drillers through its REAC.

EPA OECA/NCERT

Air/Soil/Surface Water/Ground Water—Capability provided for criminal/forensic evidence.

FBI HMRU

Air/Soil/Surface Water/Ground Water—Capable for purpose of criminal investigation.

NOAA

Soil/Surface Water—Capability to collect samples in the field for chemical analysis.

USCG NSF

Air—Provision of colorimetric, PID, FID, combustible gas, SKC pumps, and sample collection media.
Soil—Soil sampling capability.
Surface Water—Water sampling capability.

OSHA HRT

Air—Deployment time for air monitoring would be 18 hours.

USACE RR

Air/Soil/Surface Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.
Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments.

Sampling—Chemical-Warfare Agent

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X			X
Soil		X		X	X		X			X			X
Surface Water		X		X	X		X			X			X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air—ERT has environmental sampling and analysis expertise experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air sampling for chemical warfare agents. ERT has the capability to rapidly design and implement air studies ranging from field screening for health and safety to full-scale sub-parts per billion level monitoring to be used for public health risk assessment studies. The ERT's mobile TAGA laboratories are capable of performing real-time analysis of volatile warfare chemicals at the sub-parts per billion level while on the move.
Soil—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate soil sampling for chemical warfare agents. ERT experts have rapidly designed and implemented hundreds of extent of contamination studies involving a wide range of substances, soil types and geographical locations.
Surface Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface water sampling for chemical warfare agents. ERT has performed hundreds of surface water sampling studies and has the sampling equipment and expertise to rapidly design and implement appropriate studies at both the surface and at depth.
Ground Water—ERT has in-house and contractor personnel and equipment and instrumentation to perform appropriate ground water sampling for chemical warfare agents.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Capability provided for criminal/forensic evidence.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capable for purpose of criminal investigation.

USCG NSF
Air—Utilization of direct reading instruments, military kits, air sample collection.
Soil—Utilization of shovels, spoons and collection bags.
Surface Water—Utilization of sample jars.

USACE RR

Air/Soil—Limited experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, and risk assessment; stock supply of screening instruments.

Surface Water/Ground Water—Limited experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Sampling—Biological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air	X	X		X	X		X			X			X
Soil	X	X		X	X		X			X			X
Surface Water	X	X		X	X		X			X			X
Ground Water	X			X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Air/Soil/Surface Water/Ground Water—ATSDR, in conjunction with CDC/National Center for Environmental Health (NCEH) and CDC/National Institute for Occupational Safety and Health (NIOSH), may provide aid in environmental sampling.

CBIRF—No additional information provided.

EPA ERT
Air—ERT has environmental sampling and analysis expertise for environmentally persistent biologicals and experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air sampling for biological agents. ERT has the capability to rapidly design and implement air studies.
Soil/Surface Water/Ground Water—ERT has in-house and contractor personnel and equipment and instrumentation to perform appropriate ground water sampling for biological agents.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Capability provided for criminal/forensic evidence.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capable for purpose of criminal investigation.

USCG NSF
Air—Utilization of bioassay tickets, sample pumps, and collection media.
Soil—Utilization of shovels, spoons and collection bags.
Surface Water—Utilization of sample jars.

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis.

Sampling—Radiological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X	X	X	X	X	X			X			X
Soil		X	X	X	X	X	X			X			X
Surface Water		X	X	X	X	X	X			X			X
Ground Water			X	X	X	X	X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

DOE NEST
Air/Soil/Surface Water/Ground Water—Not capable as an emergency response function.

EPA ERT
Air/Soil—ERT has environmental sampling and analysis expertise experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate air sampling for radiological agents. While ERT has the capability to rapidly design and implement these air studies, they are usually limited to studies in support of the site safety plan. Other more in depth studies are commonly performed by the RERTs.
Surface Water/Ground Water—ERT has experienced in-house and contractor personnel and equipment and instrumentation to perform appropriate surface and ground water sampling for radiological agents. While ERT has the capability to rapidly design and implement these studies, they are usually limited to screening studies. Other more in depth studies are commonly performed by the RERTs.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water— Capability provided for criminal/forensic evidence.

EPA RERT
Air/Soil/Surface Water—No additional information provided.
Ground Water—Well monitoring capability only; no well drilling capability.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capable for purpose of criminal investigation.

USCG NSF
Air/Soil/Surface Water—Utilization of survey meters.

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; and stock supply of screening instruments.

Site Characterization—Modeling

Ability to develop mathematical models used to predict the effects of a hazardous material release. This includes tabular and graphical summaries of the rate of release, simulated model results, and emissions and meteorological inputs and predictions.

Oil

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air				X	X		X	X		X			X
Soil				X	X		X						X
Surface Water					X		X	X		X		X	X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT
Air/Soil/Ground Water—Meteorologist and computer modelers are available via in-house experts as well as a "dedicated team" contract to provide various plume models.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Computer modeling capability.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capability available through MOU.

NOAA
Air—Capable of producing verbal and computer-based modeling products on fate and trajectories using Automated Data Injury for Oil Spills (ADIOS) and Aerial Location of Hazardous Atmospheres (ALOHA) models.
Surface Water—Capable of producing verbal and computer-based modeling products on fate and trajectories using General NOAA Oil Modeling Environment (GNOME) model.

USCG NSF
Air/Surface Water—Utilization of GNOME modeling.

SUPSALV
Surface Water—Modeling capability for free oil on open water.

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment;, stock supply of screening instruments; and mobile laboratories for GC analysis. Team has extensive experience in modeling.

Modeling—Chemical-Commercial

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air	X	X		X	X		X	X		X			X
Soil				X	X		X						X
Surface Water					X		X	X		X			X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Air—Utilization of ALOHA.

CBIRF—No additional information provided.

EPA ERT
Air/Soil/Ground Water— Meteorologist and computer modelers are available via in-house experts as well as a "dedicated team" contract to provide various plume models.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Computer modeling capability

FBI HMRU
Air—Able to provide Basic capability with Team and Advanced capability through MOU.
Soil/Surface Water/Ground Water—Capability provided through MOU.

NOAA
Air—Capable of producing verbal and computer based modeling products on fate and trajectories using ADIOS and ALOHA models.
Surface Water—Capable of producing verbal and computer based modeling products on fate and trajectories using GNOME model.

USCG NSF
Air—Utilization of CAMEO/GNOME modeling
Surface Water—Utilization of GNOME modeling

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis. Team has extensive experience in modeling.

Modeling—Chemical-Warfare Agent

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X			X			X
Soil				X	X		X						X
Surface Water					X		X			X			X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air/Soil/Ground Water— Meteorologist and computer modelers are available via in-house experts as well as a "dedicated team" contract to provide various plume models.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Computer modeling capability

FBI HMRU
Air—Can provide Basic capability with Team and Advanced capability through MOU.
Soil/Surface Water/Ground Water—Capability provided through MOU

USCG NSF
Air—Utilization of CAMEO modeling
Surface Water—Utilization of GNOME modeling

USACE RR
Air/Soil/Surface Water/Ground Water—Limited experienced field personnel for data collection and monitoring; however, numerous technical resources are available for data interpretation and modeling, regulatory understanding, and risk assessment, in addition to a stock supply of screening instruments and mobile laboratories for GC analysis. Team has extensive experience in modeling.

Modeling—Biological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air		X		X	X		X						X
Soil					X		X						X
Surface Water					X		X						X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF—No additional information provided.

EPA ERT
Air/Ground Water— Meteorologist and computer modelers are available via in-house experts as well as a "dedicated team" contract to provide various plume models.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Computer modeling capability.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capability provided through MOU.

USACE RR
Air/Soil/Surface Water/Ground Water—Numerous experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; stock supply of screening instruments; and mobile laboratories for GC analysis. Team has extensive experience in working for Federal, state, and local agencies in building consensus for strategies.

Modeling—Radiological

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air	X		X	X	X		X						X
Soil			X	X	X		X						X
Surface Water					X		X						X
Ground Water				X	X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

DOE NEST
Air/Soil—Capable of producing an internationally recognized model. Because these models serve only as a starting point, provision of source term and measurement data to DOE is critical to all modeling accuracy.

EPA ERT
Air/Soil/Ground Water— Meteorologist and computer modelers are available via in-house experts as well as a "dedicated team" contract to provide various plume models.

EPA OECA/NCERT
Air/Soil/Surface Water/Ground Water—Computer modeling capability.

FBI HMRU
Air/Soil/Surface Water/Ground Water—Capability provided through MOU.

USACE RR
Air/Soil/Surface Water/Ground Water—Experienced field personnel for data collection and monitoring; technical resources for data interpretation and modeling, regulatory understanding, risk assessment; and stock supply of screening instruments.

Site Remediation/Site Cleanup

Transportation and Disposal of Waste

Ability to provide DOT-certified hazardous waste transportation haulers to transport oil, chemical, biological, or radiological wastes to a properly designated storage and disposal facility or a temporary storage and disposal facility.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X								X	X
Chemical-Commercial				X									X
Chemical-Warfare Agent				X									X
Biological				X									X
Radiological				X		X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—ERT has experienced in-house and contractor personnel, equipment, and instrumentation to perform necessary transportation and disposal of waste.

EPA RERT

Radiological—Capable of advisory role only.

SUPSALV—No additional information provided.

USACE RR

Oil/Chemical-Commercial—Extensive experience in remediation of sites contaminated with oil and commercial chemical pollutants, including waste classification, packaging, profiling, transportation, on-site and off-site treatment, and disposal.

Chemical-Warfare Agent—Limited experience in remediation of sites contaminated with chemical warfare agents, including waste classification, packaging, profiling, transportation, on-site and off-site treatment, and disposal.

Biological/Radiological—Extensive experience in remediation of sites contaminated with biological agents (anthrax) and radiological contaminants, including assessment, monitoring, and decontamination of sites with high risks for clearance; extensive experience in waste classification, packaging, profiling, transportation, on-site and off-site treatment, and disposal.

Spill Source and Content Analysis

Product Hazards Analysis

Ability to evaluate the origin from which an oil or chemical product was derived and the content of the product released in order to obtain information regarding its components.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X			X		X			X
Chemical-Commercial	X	X		X	X			X		X			X
Chemical-Warfare Agent	X	X		X	X								X
Biological		X			X								X
Radiological		X		X	X	X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Chemical-Commercial—Consultation team available via phone 24/7 within 30 minutes of a request.
Chemical-Warfare Agent—No additional information provided.

CBIRF—No additional information provided.

EPA ERT—ERT has experienced in-house and contractor personnel, equipment, and instrumentation to perform appropriate product hazards analysis.

EPA OECA/NCERT
Oil—Provision of limited Field Support.
Chemical-Commercial/Chemical-Warfare Agent—Provision of Field/Laboratory Support/Toxicology.
Biological—Provision of Field Support/Occupational Medicine.
Radiological—Provision of Field/Laboratory Support.

EPA RERT—No additional information provided.

NOAA
Oil/Chemical-Commercial—Laboratory analysis capability.

USCG NSF
Oil—Capability available through USCG Marine Safety Lab (MSL).
Chemical-Commercial—Capability available through EPA lab.

USACE RR

Oil/Chemical-Commercial—Extensive experience with on-site Hazardous Categorization Test (HAZCAT), mobile field laboratories, field screening utilization, off-site laboratory analysis, sample collection, packaging, transport, identification of laboratories which meet stringent quality control (QC) protocols, regulatory application, waste classification, packaging, labeling, treatment, transportation, and disposal.

Chemical-Warfare Agent—Limited experience with on-site HAZCAT, mobile field laboratories, field screening utilization, off-site laboratory analysis, sample collection, packaging, transport, identification of laboratories which meet stringent QC protocols, regulatory application, waste classification, packaging, labeling, treatment, transportation, and disposal.

Biological—Extensive experience with on-site field screening, sample collection, developing sample designs for postal facilities, off-site laboratory analysis, sample collection, packaging, and transport, identification of appropriate laboratories which meet stringent QC protocols, regulatory application, waste classification, packaging, labeling, treatment, transportation, and disposal., decontamination of sites.

Radiological--Extensive experience with on-site field screening, sample collection, developing radiological surveys, radiological monitoring, off-site laboratory analysis, sample collection, packaging, and transport, identification of appropriate laboratories which meet stringent QC protocols, regulatory application, waste classification, packaging, labeling, treatment, transportation, and disposal, decontamination of sites.

Radionuclide Analysis

Ability to detect and evaluate accurately the amount of radioactivity found in the hazardous material released. Analysis would include a geographical survey search of the suspected radiological source or contamination spread and may be conducted using radiation detection devices, such as accumulative self-reading instruments (dosimeters).

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Radiological				X		X	X			X*			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT—No additional information provided.

EPA RERT
Both fixed and mobile laboratories available for use.

FBI HMRU
Provision of standard Type I HAZMAT, military, and DOE equipment; through assistance of Department of Energy National Laboratories (DOE-NLs), equipment will be covered by MOUs.

USCG NSF
*Gamma Spectrometry capability will be available early 2004.

USACE RR
Extensive experience with on-site field screening, radiological surveys, radiological monitoring, off-site laboratory analysis, identification of appropriate laboratories which meet stringent QC protocols, and regulatory application.

Public Affairs

Public Affairs Support

Ability to provide public affairs personnel, joint information center support, and any other support to adequately cover information requirements from an incident. Support can be in the form of on-scene services to the local responders or via telephone from a remote or regional location.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
On-Scene	X	X	X				X	X		X		X	X
Remotely (via telephone, radio, etc.)	X	X	X				X	X		X		X	X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
On-Scene—All ATSDR staff are cross-trained in media relations and public affairs. Emergency Response Coordinator (ERC) staff of nine (9) can be wheels-up in two (2) hours of request.
Remotely—All ATSDR staff are cross-trained in media relations and public affairs. ERC staff can be available within 10 minutes of request.

CBIRF- No additional information provided.

DOE NEST
On-Scene/Remotely—All response teams deploy with Public Affairs support.

*EPA ECOT**
On-Scene/Remotely—Capability includes community involvement and public affairs specialists who have experience in emergency and removal responses. Specialists are trained in setting up and/or functioning in a JIC and a Unified Command Structure, handling the media, public inquiries and community involvement issues, writing press releases, fact sheets, and communication strategies.

FBI HMRU
On-Scene/Remotely—FBI Public Affairs official located at FBI HQ and in all 56 FBI Field Divisions.

NOAA
On-Scene/Remotely—Agency personnel available to work with the media and in the Joint Information Center (JIC). Capable of assisting in production of material for the media and decision-makers.

USCG NSF
On-Scene—Utilization of Incident Command System (ICS); provision of Information Officer (IO); HAZWOPER qualified; capable of establishing JIC; able to provide photographic and written documentation.
Remotely—Able to provide risk communications/media relations support.

SUPSALV

On-Scene/Remotely—Capable of providing technical information for Public Assistance Officer (PAO) releases for oil spills on water surface.

USACE RR

On-Scene/Remotely—Team has extensive experience with presenting strategies to the public, union officials, and executive level management.

*Team is not included in chart above; however, is capable of public affairs support.

Risk Communication

Ability to provide appropriate risk communications to on-scene personnel responding to an incident. Risk communications can include information on risk assessments, remediation options, vulnerability assessments and consequence analysis. This information should routinely be provided to first responders and other emergency planners to assist them in developing appropriate emergency response plans and identifying pertinent remediation strategies.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X			X	X		X		X	X
Chemical-Commercial	X	X		X			X	X		X			X
Chemical-Warfare Agent	X	X		X			X			X			X
Biological		X					X			X			X
Radiological		X	X	X		X	X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR

Chemical-Commercial/Chemical Warfare Agent—All ATSDR staff are cross-trained in media relations and public affairs. ERC staff of nine (9) can be wheels-up in two (2) hours of request.

CBIRF- No additional information provided.

DOE NEST

Radiological—Capability is a key function of the Senior Energy Official.

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Radiological—ERT technical experts available to assist in risk communication. Monitoring and sampling studies can be used to support risk communications.

EPA RERT

Radiological—Capability includes provision of liaison and advisory support.

FBI HMRU

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Hazardous Materials Officer and scientist involved in all operations, either in person or via telephone.

NOAA

Oil/Chemical-Commercial—Capability to present information to decision-makers, run public meetings, and appear before the media.

USCG NSF

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capable of filling IO position, establishing JIC. Able to provide risk communication/media relations support.

SUPSALV

Oil—Provision of limited technical expertise.

USACE RR

Oil/Chemical-Commercial/Biological/Radiological—Extensive experience with understanding risk and communicating in a manner which defines expectations.

Chemical-Warfare Agent—Limited experience with understanding risk and communicating in a manner which defines expectations.

Public Health and Safety

Public Health Expertise/Assessment

Ability to evaluate overall public health response, including assessing possible toxic environmental and public health hazards to the surviving population; serve as health/medical subject matter experts; and determine specific health and medical needs and priorities, including assessment of the health system/facility infrastructure.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	limited			X					X
Chemical-Commercial	X	X		X	limited			X					X
Chemical-Warfare Agent	X	X		X	limited								X
Biological		X		X	limited								X
Radiological		X	X	X	limited	X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR

Chemical-Commercial/Chemical Warfare Agent—ATSDR has an ERC staff of nine (9) available via phone 24/7 within 10 minutes and wheels up to the site in two (2) hours. ERCs have access to all the subject matter experts of ATSDR, Centers for Disease Control (CDC), Food and Drug Administration (FDA), and all of the Department of Health and Human Services (HHS).

CBIRF- No additional information provided.

DOE NEST

Radiological—Primarily a remote capability.

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability to provide monitoring and sampling studies to support public health assessments.

EPA OECA/NCERT

Oil/Chemical-Commercial/Chemical-Warfare Agent—Capability comprises Law Enforcement-Secure Site Only; Toxicology.
Biological—Capability comprises Law Enforcement-Secure Site Only; Occupational Medicine.
Radiological—Capability comprises Law Enforcement-Secure Site Only.

EPA RERT

Radiological—Support provided through participation in the Federal Radiological Preparedness Coordinating Committee's (FRPCC) Advisory Team for Environment, Food and Health.

NOAA

Oil/Chemical-Commercial—Industrial Hygienist available to provide advice about hazards and risks; provision of CAMEO database support.

USACE RR

Oil/Chemical-Commercial/Biological/Radiological—Extensive experience working with Public Health officials concerning potential hazards to health including CDC, State Health Commissioners, and local health departments.

Chemical-Warfare Agent—Limited experience working with Public Health officials concerning potential hazards to health including CDC, State Health Commissioners, and local health departments.

On-Scene Medical Support

Ability to triage and treat casualties in the disaster area, including medical or surgical stabilization and continued monitoring and care of patients, until they can be transported or evacuated to locations where they will receive definitive medical care. This could involve provision of health and medical equipment and supplies, including pharmaceuticals, biologic products, and blood and blood products.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil		X			X		X						
Chemical-Commercial		X			X		X						
Chemical-Warfare Agent		X			X		X						
Biological		X			X		X						
Radiological		X	X		X		X						

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

DOE NEST
Radiological—Capable during large events only.

EPA OECA/NCERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—National First Responder/Occupational Physician can be deployed.

FBI HMRU
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Advanced Life Support Paramedic/HAZMAT Officer and physician deployed based on risk assessment.

First Aid/Medical Capabilities

Ability to provide emergency medical treatment for a victim of sudden illness or injury until more thorough or skillful medical treatment is available. This could include care for patients with, among other conditions, asphyxiation, cardiopulmonary arrest, minor to severe bleeding, burns, fainting, unconsciousness, and those in a state of coma.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil		X			X		X			X		X	X
Chemical-Commercial		X			X		X			X			X
Chemical-Warfare Agent		X			X		X						X
Biological		X			X		X						X
Radiological		X			X		X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

EPA OECA/NCERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—National First Responder/Occupational Physician can be deployed.

FBI HMRU
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Paramedics integrated into response teams.

USCG NSF
Oil/Chemical-Commercial—Provision of EMT-Basic only.

SUPSALV
Oil—Capability limited to emergency first aid to injured SUPSALV responders.

USACE RR
Oil/Chemical-Commercial/Biological/Radiological—Capability includes CIH, CSP Safety Managers who have access to MD consultants. The USACE Safety Manual is more stringent than other standards.
Chemical-Warfare Agent—Limited: Capability includes CIH, CSP Safety Managers who have access to MD consultants. The USACE Safety Manual is more stringent than other standards.

Mass Decontamination

Ability to decontaminate large numbers of population (civilians, first responders, medical personnel, etc.) when exposed to a particular contaminant that exceeds the designated (NIOSH, EPA, OSHA) safe limits for humans. Capability should include the ability to provide the necessary equipment, supplies and personnel to perform the work.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Chemical-Commercial		X			X								X
Chemical-Warfare Agent		X			X								X
Biological		X			X								X
Radiological		X			X	X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

EPA OECA/NCERT
Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Technical Assistance/Law Enforcement Assistance can be provided.

EPA RERT
Radiological—Capable of advisory role only.

USACE RR
Chemical-Commercial/Biological/Radiological—Extensive experience decontaminating sites, treating on-site and off-site with time-sensitive execution.
Chemical-Warfare Agent—Limited: Pyrophorics, low Immediate Danger to Life and Health (IDLH) materials.

Mortuary Capabilities

Ability to provide temporary morgue facilities; victim identification by fingerprint, forensic dental, and/or forensic pathology/anthropology methods; and the processing, preparation, and disposition of remains.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
General							X						

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

FBI HMRU

Mortuary capabilities limited only to Law Enforcement investigation including victim identification and forensic investigative tasks.

Water Decontamination and Protection

Ability to reduce and prevent the spread of contamination within drinking water, wastewater and publicly used water sources at a hazardous materials incident by physical and/or chemical processes. Emergency response personnel should implement a thorough, technically sound decontamination procedure until it is determined or judged to be no longer necessary. This also includes employing methods to ensure that water delivery facilities and structures are protected against further future decontamination.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X	X								X
Chemical-Commercial				X	X								X
Chemical-Warfare Agent				X	X								X
Biological				X	X								X
Radiological				X	X	X							X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—ERT can provide in-house and contractor experts to design and implement these operations. Actual performance would be contracted to the best available private or public sector group capable of doing the job.

EPA OECA/NCERT

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Level A, B, C, and D decontamination Support with Full Decon/ Containment/Shower.

EPA RERT

Radiological—Capable of advisory role only.

USACE RR—No additional information provided.

Legal/Investigations

Investigations

Ability to provide qualified investigative personnel to determine the probable cause of an incident. Investigators should be qualified to conduct either a civil or criminal investigation, depending on the circumstances and evidence presented at the incident.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Civil	X									X			X
Criminal	X		X		X		X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Civil—ATSDR has two (2), growing to nine (9), ERCs with incident investigation training.
Criminal—Capability to provide a joint CDC/ATSDR team which has been previously involved in evidence collection support for the FBI.

DOE NEST
Criminal—Limited to DOE facilities.

EPA OECA/NCERT
Criminal—Environmental/Title 18 Statutes, Special Agents- 1811's.

FBI HMRU
Criminal—Full capability for investigations under the responsibility of the FBI. This includes all acts of terrorism and the threatened or actual use of Weapons of Mass Destruction (WMD).

USCG NSF
Civil/Criminal—Agency support provided only for gathering of evidence.

USACE RR—No additional information provided.

Analytical Capability

Field Analytical Screening

Ability to provide real time or quick results for various hazards/chemical or classifications of hazards/chemicals, the results of which typically possess lower degrees of qualitative and quantitative accuracy than analytical methods performed by fixed laboratories, may identify a group/type of hazard rather than a specific hazard, and are often subject to false positives.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X			X	X		X		X	X
Chemical-Commercial		X		X	X		X	X		X		X	X
Chemical-Warfare Agent		X		X	X		X			X			X
Biological		X		X	X					X			X
Radiological		X	X	X	X	X	X			X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

DOE NEST
Radiological—Team has broad spectrum of capability.

EPA ERT
Oil--Fluorometers and other instruments available for field analytical screening of oil.
Chemical-Commercial—A very comprehensive capability to perform field screening of toxic commercial chemicals is available. ERT has been a leader in this area for many years.
Chemical-Warfare Agent—ERT has instruments and expertise in their use for chemical warfare agents.
Biological—ERT has several kits and instruments for field screening of biological agents.
Radiological—ERT has field screening instruments for alpha, beta, and gamma radiation.

EPA OECA/NCERT
Chemical-Commercial/Chemical-Warfare Agent—Capable of providing Field Hazcatting/Detection.
Biological—Capable of providing Field Screening/Detection.
Radiological—Capable of providing Radiological/Nuclear Detection.

EPA RERT
Radiological—Team's capability does not include alpha spectrometry

FBI HMRU
Oil/Chemical-Commercial/Chemical-Warfare Agent—Standard Type I HAZMAT and military equipment.
Radiological—Standard Type I HAZMAT and DOE equipment.

NOAA
Oil/Chemical-Commercial—Capable of field sampling and screening, fluorometry.

USCG NSF
Oil—Capable of providing visual, viscosity check only.
Chemical-Commercial— Capable of providing on-scene Hazcatting, PID, FID, IR.
Chemical-Warfare Agent— Capable of providing military kits, APD 2000.
Biological— Capable of providing bioassay tickets.
Radiological— Capable of providing survey meters (alpha/beta/gamma/neutron).

SUPSALV—No additional information provided.

USACE RR
Oil/Chemical-Commercial—Extensive experience in identification of appropriate field instruments for screening including FID, colorimetric tubes, immunoassays, etc.
Chemical-Warfare Agent—Limited experience in identification of appropriate field instruments for screening including FID, colorimetric tubes, immunoassays, etc.
Biological—Extensive experience in using PCR field instruments for screening for biological agents.
Radiological—Extensive experience in identification of appropriate field instruments for screening including pancakes, Geiger counters, dosimetry, etc.

Field Analytical Laboratory

Ability to use testing equipment which can provide quick results to accurately qualify and quantify hazards or chemicals present. In addition to using mobile equipment, field analytical methods often consist of some type of sample preparatory method and higher detection limits and lower data quality than fixed laboratory methods.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X					X
Chemical-Commercial		X		X	X		X	X					X
Chemical-Warfare Agent		X		X			X						X
Biological	X	X					X						X
Radiological			X	X		X	X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR
Biological—ATSDR has access through CDC to the CDC bio labs and the Laboratory Response Network.

CBIRF—No additional information provided.

DOE NEST
Radiological—Mobile labs available on short notice.

EPA ERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Radiological—ERT has several mobile laboratories that can be dispatched and deployed at or near a spill or site. Alternatively, instruments can be shipped and set up in a laboratory (University, health department, etc.) near the site.

EPA OECA/NCERT
Chemical-Commercial—High Capability/Low Capacity capability.

EPA RERT—No additional information provided.

FBI HMRU
Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capable of providing specialized but limited analytical equipment that might be set up and operated in the field.

NOAA
Oil/Chemical-Commercial—Capable of field sampling and screening, fluorometry.

USACE RR
Oil/Chemical-Commercial—Extensive experience in use of mobile field laboratories for detection of standard suite chemicals using GC/Mass Spectrometry screening with HAZCAT procedures.

Chemical-Warfare Agent—Limited experience in use of mobile field laboratories for detection of standard suite chemicals using GC/Mass Spectrometry screening with HAZCAT procedures.
Biological—Some experience with US Army Medical Research Institute of Infectious Diseases (USAMRIID) field laboratories.
Radiological—No additional information provided.

Fixed Analytical Laboratory

Employment of methods which require a high degree of accuracy and precision, results of which could take several days, and are performed under controlled conditions by experienced technicians.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X			X	X		X			X
Chemical-Commercial				X	X		X	X		X			X
Chemical-Warfare Agent				X	limited		X			X			X
Biological					limited		X						X
Radiological					limited	X	X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT

Oil/Chemical-Commercial/Chemical-Warfare Agent—ERT has a full service analytical laboratory on site at Edison, NJ. It is capable of performing low-level analyses of most matrices (air, water, soil, waste, oil, etc.) for a wide variety of parameters.

EPA OECA/NCERT

Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Capability includes Law Enforcement/Forensic Evidence.

EPA RERT—No additional information provided.

FBI HMRU

Oil/Chemical-Commercial—Capability available at FBI Laboratory, Quantico, and through MOU with Federal Partners.

Chemical-Warfare Agent/Biological/Radiological—Capability available through MOU with Federal Partners.

NOAA

Oil/Chemical-Commercial—Louisiana State University (LSU) contract support; NOAA National Marine Fisheries Service (NMFS) and Oceanic and Atmospheric Research (OAR) labs are located around the country.

USCG NSF

Oil—Capability available through USCG MSL.

Chemical-Commercial/Chemical-Warfare Agent—Capability available through EPA Lab.

USACE RR

Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—USACE validated laboratories are used for analysis. To be listed, these labs must pass rigorous testing procedures and maintain standards through ongoing evaluation.

Contract Analytical Laboratory

Both fixed and field laboratories, which can be contracted to analyze the presence and concentrations of hazards and chemicals.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X				X				X	X
Chemical-Commercial		X		X				X				X	X
Chemical-Warfare Agent		X		X									X
Biological		X		X									X
Radiological		X		X									X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

EPA ERT
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Available from ERT through the REAC contract and the EPA Contract Lab Program (CLP).

NOAA
Oil/Chemical-Commercial—LSU laboratory, IR spectrometry, fluorometery and GC-MS capability.

SUPSALV
Oil/Chemical-Commercial—Ability to obtain contractor resources.

USACE RR
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—USACE validated laboratories are used for analysis. To be listed, these labs must pass rigorous testing procedures and maintain standards through on going evaluation.

Data Quality Analysis

Ability to evaluate the usability of a sample's results for decision making from both a qualitative and quantitative perspective.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil		X		X	X		X	X		X		X	X
Chemical-Commercial		X		X	X		X	X				X	X
Chemical-Warfare Agent		X		X	X		X						X
Biological		X			limited		X						X
Radiological		X	X	X	limited	X	X						X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

CBIRF- No additional information provided.

DOE NEST
Radiological—Capability is an integral function of consequence management.

EPA ERT—No additional information provided.

EPA OECA/NCERT—No additional information provided.

EPA RERT—No additional information provided.

FBI HMRU
Oil/Chemical-Commercial—Capability available at FBI Laboratory, Quantico, and through MOU with Federal partners.
Chemical-Warfare Agent/Biological/Radiological—Capability available through MOU with Federal Partners.

NOAA
Oil/Chemical-Commercial—Capability available through LSU contract support. NOAA NMFS and OAR labs are located around the country.

USCG NSF
Oil—Capability available through USCG MSL.

SUPSALV—No additional information provided.

USACE RR
Oil/Chemical-Commercial/Chemical-Warfare Agent/Biological/Radiological—Extensive experience in data quality analysis, laboratory testing procedures, analytical bounds, and devising databases for storage and reporting uses.

Contractual Support

Contractor Supervising/Monitoring

Ability for the contractor to adequately supervise and monitor the activities surrounding all response operations to oil, chemical, biological or radiological incidents. These activities will be conducted in all control zones (hot, warm, cold), as outlined in NFPA standards. Must be capable of providing qualified personnel; necessary equipment and supplies; and adequate PPE to conduct the supervisory and monitoring services.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil				X						X		X	X
Chemical-Commercial				X						X		X	X
Chemical-Warfare Agent				X						X			X
Biological				X						X			X
Radiological				X		X				X			X

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

EPA ERT—No additional information provided.

EPA RERT—No additional information provided.

USCG NSF—No additional information provided.

SUPSALV—No additional information provided.

USACE RR

Oil/Chemical-Commercial/Biological/Radiological—Extensive experience in administering cost reimbursable contracting and contractors such that technical, contractual, construction, and political needs for each project are incorporated in a timely, compliant, and cost-effective manner.

Chemical-Warfare Agent—Limited experience in administering cost reimbursable contracting and contractors such that technical, contractual, construction, and political needs for each project are incorporated in a timely, compliant, and cost-effective manner.

Resource/Cost Documentation Expertise

Ability to provide cost documentation services (personnel and materials) in accordance with regulations and other requirements established by the particular statute and fund manager.

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Oil Spill Liability Trust Fund (OSLTF)				X					X	X		X	X
Federal Response Plan/ Stafford Act				X	limited				X	X		X	X
CERCLA*	X			X					X	X		X	X

*Comprehensive Environmental Response, Compensation, and Liability Act

DESCRIPTION OF THE LEVEL OF EXPERTISE/CAPABILITY FOR EACH TEAM

ATSDR

CERCLA—ATSDR is required by law to provide cost recovery records to EPA.

EPA ERT

OSLTF/FRP/Stafford/CERCLA—Provision of Removal Cost Management System (RCMS) support for on-scene cost documentation.

EPA OECA/NCERT

FRP/Stafford Act—Capability to provide EPA Office of Criminal Enforcement, Forensics, and Training (OCEFT) Homeland Security Program (HSP) only.

NPFC

OSTLF—USCG/NPFC: Three (3) expert personnel available for financial management, resource, and cost documentation under the Oil Pollution Act (OPA)/OSLTF. One available within 24 hours of notification; others available 48 hours after notification.

FRP—USCG/NPFC: Two (2) expert personnel for financial management, resource, and cost documentation under FRP and National Response Plan systems; available 48 hours after notification.

CERCLA—USCG/NPFC: Two (2) expert personnel for financial management, resource, and cost documentation under CERCLA; available 48 hours after notification.

USCG NSF

OSTLF/FRP/CERCLA—Capable with assistance from DFO/ROC; Federal Response Plan (FRP) documentation is the same as CERCLA/OSTLF without personnel support costs (standard rates).

SUPSALV—No additional information provided.

USACE RR

OSTLF/FRP/CERCLA—Extensive experience in estimating programmatic costs, tracking costs, forecasting costs, and maintaining the government's interest when performing work.

Restrictions on Availability (i.e., special circumstances where capability is not deployable):

ATSDR
Most ATSDR staff are certified for Level C or D entries only; approximately 5 staff members are certified to Level B. ATSDR staff positions are primarily funded under Superfund and cannot be deployed for non-CERLCA events. There are counterpart services offered through CDC.

CBIRF
If tasked by higher headquarters to support a national special security event, there are no restrictions.

EPA ERT
ERT is available for deployment throughout the world. Mobilization time is 4 hours for advance team personnel and equipment. Response time is dependent on travel time. ERT has major locations in Edison, NJ, Cincinnati, OH and Las Vegas, NV. The advance team will be deployed from the location which can arrive on-scene first, not necessarily the closest geographically. Note also that in non-emergency response mode ERT personnel are in the field assisting Regional EPA OSCs and Removal Program Managers (RPMs) at sites around the United States, and may be dispatched directly from those sites to the site of an emergency.

EPA RERT
Under the Homeland Security Act of 2002, EPA's radiological response resources may fall under the direction of DHS during an incident as part of the Nuclear Incident Response Team (NIRT). EPA is currently reassessing its RERT focus and capabilities and the information provided in this handbook may be subject to change.
All capabilities cannot be provided simultaneously.

USCG NSF
If deployed by air, teams can arrange USCG, DoD or commercial aircraft support, which can cause delays.
NSF does not have dedicated aircraft standing by for its exclusive use.
Funding must be provided by the requesting agency or unit.

SUPSALV
Services provided will be consistent with the operational requirements of the US Navy.

USACE RR
USACE Rapid Response capabilities provide for the mobilization of labor, materials, supply, equipment, and screening resources within hours of request.

Technical Expertise

	ATSDR	CBIRF	DOE NEST	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHA HRT	SUPSALV	USACE RR
Air Modeling Specialist	3	1		X^				5[1]					20
Air Sciences Technicians				X									
Aqua Chemist				X									
Aquatic Bioassay Specialist				X				4[1]					
Aquatic Biologist				X				4[1]					
Arborist				X									
Atmospheric Specialists		1		X				5[1]					
Bathymetric Specialist								X[2]					
Biochemist				X				X[2]					
Biologist				X	2[3]			4[1]					50
Chemical Engineer				X				2[1]			2	1	50
Chemist	2*	3		X	3[4]		5	2[1]			4	1	100
Civil Engineer				X									300
Coastal Engineer													
Computer/Network Specialist		4		X				5[1]					50
Environmental Engineer				X								3	300
Environmental Health Specialist	9*			X	1[5]			1					
Environmental Monitoring Specialist				X	30	X		4[1]					
Estuarine Biologist				X				4[1]					
Explosives Specialist													30
Fisheries Biologist				X				4[1]					25
Freshwater Biologist				X									
Geological Engineer													
Geologist				X	1								400
Geotechnical Engineer													14
GPS/GIS/Surveying and Mapping Specialist	4*			X	2[6]			3[1]				2	100
Hazardous Waste Engineer				X									51
Health Physicist	2*			X		X				1	2		25
Hydraulic Engineer													25
Hydrochemist				X									
Hydrodynamicist								6[1]					

	ATSDR	CBIRF	DOE	EPA ERT	EPA OECA/ NCERT	EPA RERT	FBI HMRU	NOAA	NPFC	NSF	OSHAH RT	SUPSALV	USACE RR
Hydrogeologist				X	1								100
Hydrographer								X[2]					
Hydrologist													50
Industrial Hygienist	2*	1		X	1[7]			1		3	7		80
Information Management/Database Specialist		1		X	1			9[1]				2	75
Marine Biologist				X				5[1]					
Marine Engineer												3	
Meteorologist		1		X				X[2]					30
Microbiologist				X	2		6						10
Natural Resource Specialist								5[1]				1	
Oceanographer								6[1]					10
Preservation Technician													
Radiation Specialist				X	1	X							200
Response Management (i.e., ICS)				X			6[#]			45		1	100
Riparian Specialist				X									14
Sedimentologist				X									
Systems Ecologist				X				5[1]					
Toxicologist	2*			X	1[5]								24
Veterinarian				X									8
Wetlands Specialist								3[1]					
Wildlife Biologist				X				3[1]					
WMD/NBC Specialist		350[WMD] 55[NBC]			3		19						100

X^ Number of experts in this field was not provided by the agency
***Technical Specialists are on call
[#]FBI HMRU: Unit Chiefs—1 Team Leaders—5
[1]Number of specialists within NOAA HAZMAT team. Others across the agency readily available.
[2]Expertise readily available across the agency.
[3]Microbiology/Physiology/Toxicology
[4]Organic/Inorganic/Biochemistry
[5]Board Certified Toxicologist
[6]Remote Sensing/GPS/Survey
[7] Certified Industrial Hygienist

Other Categories of Technical Expertise:

ATSDR
Epidemiologists—With support from CDC/Epidemiology Program Office (EPO), ATSDR can provide epidemiologist to support public health investigations of exposure and other surveillance activities. ATSDR is also developing a rapid registry response team to deploy into the field to initiate a victim registry.

EPA OECA/NCERT
Occupational Physician—1

FBI HMRU
Nuclear Specialists—4

USCG NSF
Logistics Specialist—3
Contingency Plan Exercise Specialist—8
Public Information Specialist—4

OSHA HRT
Mechanical Engineer—1

SUPSALV
Boat Operators, equipment operators, and maintenance personnel—Capable of providing multiple trades to support SUPSALV pollution and salvage response.
Environmental Response Operations Specialist
Marine Salvage Master
Marine Salvage Engineer

USACE RR
Architect—8
Construction Specialists—97
Drafting/Computer Aided Design and Drafting (CADD)—59
Economists—2
Electrical Engineers—8
Environmental Scientist—225
Estimator—58
Hazardous Waste Specialist—51
Health Specialist—74
Mechanical Engineer—21
Mining Engineer—11
Safety Engineer—10
Structural/Transportation, Sanitary Engineers and Surveyors—12
Technical Support Staff (other disciplines)—105
Technicians and Support Staff—445

Additional Capabilities Information:

ATSDR

As the lead agency for hazardous substances within HHS, ATSDR can call on resources from CDC, FDA, Substance Abuse and Mental Health Services Administration (SAMHSA), HHS, National Institutes of Health (NIH), and Health Resources and Services Administration (HRSA) to support response as needed. CDC and ATSDR are developing a computerized database of personnel with specific skill sets from within their staff that should be available within the next year [~April 2004]. Emergency Operations plans from CDC will include ATSDR resources from now on and are being modified to reflect a merger of assets.
ATSDR has response personnel to augment the HAZMAT teams of other agencies as necessary and appropriate to maximize the effectiveness of the Federal response. By and large, the Agency does not have the assets to field a self-supporting HAZMAT team as defined in this document.

DOE NEST

The DOE Nuclear Emergency Support Team encompasses all DOE/National Nuclear Security Administration (NNSA) emergency response assets. DOE/NNSA teams described in this Handbook are national and regional.

EPA ERT

ERT is a team of 45 EPA scientists, engineers, and other professionals who are dedicated to delivering the highest quality technical assistance to OSCs and other site managers. Since its establishment as a Special Team under the NCP in 1978, it has delivered that assistance at over 1900 sites and spills. Its team members have a reputation for rapidly accomplishing tasks that were considered nearly impossible.

EPA OECA/NCERT

All team members trained in ICS through the 200 level. Senior team members trained through the 400 level ICS.

FBI HMRU

- Capable of conducting confined space operations, trench and operations within collapsed structures.
- Interface with the FBI Bomb Data Center or field Special Agent Bomb Technicians for WMD/Explosive/Improvised Explosive Device (IED) operations.
- Interface with the FBI Hostage Rescue Team or field Special Weapons and Tactics (SWAT) teams for WMD Tactical Operations.
- Interface with Federal, State and local Public Health Laboratories for assistance with analysis and data interpretation.
- FBI Laboratory is American Society of Crime Laboratory Directors-Laboratory Accreditation Board (ASCLD-LAB) certified.

Total Field Hazardous Materials Response Teams: 27 field teams with minimum staffing level of eight per team.

NOAA

NOAA Scientific Support Coordinators (SSCs) are skilled at building consensus on controversial scientific issues. The NOAA SSCs are effective in communicating complex scientific information to decision makers in non-technical jargon and serve as the initial point person for accessing agency-wide assets and capabilities.
NOAA Incident News is a pre-established web-based mechanism readily available to disseminate public

information. NOAA has ships, aircraft and satellites capable of collecting a wide range of data on environmental parameters.

NPFC

USCG/NPFC also has available experts to advise the IC/UC/FOSC on third-party damage claims issues. This expertise is only for oil spill related damages. There are three (3) experts, one of which is available within 24 hours of notification; others available 48 hours after notification.

USCG NSF

- Incident Management Support: Provision of incident management team support, providing personnel to fill key ICS positions, or as coaches for existing personnel.
- Communications & Mobile Command Post Support: Access to National Interagency Fire Cache (NIFC) radio cache; the Mobile Incident Command Posts have satellite communication/computer capabilities.

OSHA HRT

The OSHA Health Response Team is a multidisciplinary team of engineers, chemists, health physicists and industrial hygienists whose main role is to support OSHA Area Offices and the OSHA National Office on technical matters in the field of occupational safety and health. The Health Response Team is based in Salt Lake City, Utah and is capable of responding to most incidents within 18-hours with onsite occupational safety and health expertise.

SUPSALV

The Emergency Ship Salvage Material (ESSM) bases located on east and west coasts, Alaska, and Hawaii have large numbers of portable generators, compressors, light towers, pumps, mobile command vans, and other all hazard support systems. SUPSALV maintains on-call world-class response contractors for diving, marine salvage, towing pollution response, and underwater search and recovery, with Navy-owned equipment. Other capabilities include:

- Cold water response capability, including spills on land;
- 20,000 feet of 6” floating hose for fuel transfer capability (4 systems);
- Access to International Bird Rescue Research Center (IBRRC) (wildlife rescue and rehabilitation center);
- Joint salvage and pollution response management capability; and
- In-house, contractor supported deep & shallow ocean side-scan search & ROV operations.

USACE RR

USACE RR personnel are “field tested” in time-sensitive, rigorous, and high profile environmental actions. Team members have extensive experience in working within a Unified Command Structure; in presenting project plans and strategies for Community Relations purposes; performing emergency response Anthrax Assessments and Decontaminations; and in advising the planning and remediation of radioactively contaminated sites.

Appendix A: Hazardous Materials Team Typing Guidance[1]

HazMat Team Type I

NOTE: HazMat teams must meet minimum criteria for **all** components under Type I to be considered a Type I team; minimum criteria for **all** components under Type II to be considered a Type II team; or minimum criteria for **all** components under Type III to be considered a Type III team.

Components	Type I	Minimum Criteria
Field Testing	Known Chemicals	The presumptive testing and identification of chemical substances using a variety of sources to be able to identify associated chemical and physical properties. Sources may include printed and electronic reference resources, safety data sheets, field testing kits, specific chemical testing kits, chemical testing strips, data derived from detection devices, and air monitoring sources.
	Unknown Chemicals	
	Known or Suspect Weapons of Mass Destruction Chemical/Biological Substances (WMD Chem/Bio)	
Air Monitoring	Basic Confined Space Monitoring	The use of advanced detection equipment to detect the presence of known or unknown gases or vapors. The basics begin with ability to provide standard confined space readings (oxygen deficiency percentage; flammable atmosphere Lower Explosive Limit (LEL); carbon monoxide; and hydrogen sulfide). Advanced detection and monitoring may incorporate more sophisticated instruments that differentiate between two or more flammable vapors, and may directly identify by name a specific flammable or toxic vapor. This includes WMD Chem/Bio detection Instruments.
	Specific Known Gas Monitoring	
	WMD Chem/Bio Aerosol Vapor and Gas	
Sampling: Capturing Labeling Evidence Collection	Known Industrial Chemicals	Known and unknown industrial chemicals' standard evidence collection protocols required for each include capturing and collection; containerizing and proper labeling; and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis. Consistent with established chain of custody protocols. Ability to sample liquids and solids. Special resources may be required for air sample collection.
	Unknown Industrial Chemicals	
	WMD Chem/Bio	
Radiation Monitoring/ Detection	Alpha Detection	The ability to accurately interpret readings from the radiation detection devices and conduct geographical survey search of suspected radiological source or contamination spread. Identify and establish the exclusion zones after contamination spread (this does include identification of some, but not all, radionuclides). Ability to conduct environmental and personnel survey. Basic criteria include detection and survey capabilities for alpha, beta, and gamma. Ensure all members of survey teams are equipped with accumulative self-reading instruments (dosimeters).
	Beta Detection	
	Gamma Detection	

Components	Type I	Minimum Criteria
Protective Clothing: Ensembles	Vapor-Protective CPC	Chemical protective clothing (CPC), which includes complete ensembles (suit, boots, gloves) and may incorporate various configurations (encapsulating, non-encapsulating, jumpsuit, multi-piece) depending upon the level of protection needed. Levels of CPC vapor protection are: Vapor-Protective, Flash Fire Protective option for Vapor-Protective, and Chemical/Biological-Protective option for Vapor-Protective, all of which must be compliant with National Fire Protection Association (NFPA) Standard # 1991, "Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies" current edition. Level of CPC liquid protection is: Liquid Splash-Protective, which must be compliant with NFPA Standard # 1992, "Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies", current edition.
	Weapons of Mass Destruction (WMD) Vapor-Protective CPC	
	Flash Fire Vapor-Protective CPC	
	Liquid Splash-Protective CPC	
	WMD Liquid Splash-Protective CPC	
Technical Reference	Printed and Electronic	Access to and use of various databases, chemical substance data depositories, and other guidelines and safety data sheets, either in print format, electronic format, stand-alone computer programs, or data available via telecommunications. The interpretation of data collected from electronic devices and chemical testing procedures. At a minimum, technical references will have the ability to outsource additional capabilities and have one source for air-modeling capability.
	Plume Air Modeling; Map Overlays	
	WMD Chem/Bio	
Special Capabilities	Gloves and Other Specialized Equipment Based on Local Risk Assessment	Additional resources that augment the capabilities of the team.
	Heat Sensing Capability	
	Light Amplification Capability	
	Digital Imaging Documentation Capability	
Intervention	Diking, Damming, Absorption; Liquid Leak Intervention	Employment of mechanical means of intervention and control such as plugging, patching, off-loading, and tank stabilization; environmental means such as absorption, dams, dikes, and booms; and chemical means such as neutralization and encapsulation of known and unknown industrial chemicals. Mechanical means include specially designed kits for controlling leaks in rail car dome assemblies and pressurized containers, to pneumatic and standard patching systems. Advanced capabilities should include ability to intervene and confine incidents involving WMD Chem/Bio substances.
	Neutralization, Plugging, Patching; Vapor Leak Intervention	
	WMD Chem/Bio Agent Confinement	

Components	Type I	Minimum Criteria
Decontamination	Known Contaminants Based on Local Risk Assessment	Must be self-sufficient to provide decontamination for members of their team. Capable of providing decontamination for known and unknown contaminants and WMD Chem/Bio.
	Unknown contaminants	
	WMD Chem/Bio	
Communications	In-Suit	Personnel utilizing CPC shall be able to communicate appropriately and safely between one another and their team leaders.
	Wireless Voice	
	Wireless Data	
	Secure Communications	
Personnel: Training & Staffing	7 Personnel	All personnel must be trained to the minimum response standards in accordance with the most current editions of NFPA Standard # 471, "Recommended Practice for Responding to Hazardous Materials Incidents", NFPA Standard # 472, "Standard for Professional Competence of Responders to Hazardous Materials Incidents", and NFPA Standard # 473, "Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents", as is appropriate for the specific team type.
Sustainability	Capability to Perform Three (3) Entries in a 24-hour Period.	Sustainability will be the capability to perform three (3) entries in a 24-hour period.

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HazMat Team Type II

Components	Type II	Minimum Criteria
Field Testing	Known Chemicals	The presumptive testing and identification of chemical substances using a variety of sources to be able to identify associated chemical and physical properties. Sources may include printed and electronic reference resources, safety data sheets, field testing kits, specific chemical testing kits, chemical testing strips, data derived from detection devices, and air monitoring sources.
	Unknown Chemicals	
Air Monitoring	Basic Confined Space Monitoring	The use of advanced detection equipment to detect the presence of known or unknown gases or vapors. The basics begin with ability to provide standard confined space readings (oxygen deficiency percentage; flammable atmosphere Lower Explosive Limit (LEL); carbon monoxide; and hydrogen sulfide). Advanced detection and monitoring may incorporate more sophisticated instruments that differentiate between two or more flammable vapors, and may directly identify by name a specific flammable or toxic vapor.
	Specific Known Gas Monitoring	
Sampling: Capturing Labeling Evidence Collection	Known Industrial Chemicals	Known and unknown industrial chemicals' standard evidence collection protocols required for each include capturing and collection; containerizing and proper labeling; and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis. Consistent with established chain of custody protocols. Ability to sample liquid and solids.
	Unknown Industrial Chemicals	
Radiation Monitoring/ Detection	Alpha Detection	The ability to accurately interpret readings from the radiation detection devices and conduct geographical survey search of suspected radiological source or contamination spread. Basic criteria include detection and survey capabilities for alpha, beta, and gamma.
	Beta Detection	
	Gamma Detection	
Protective Clothing: Ensembles	Vapor-Protective CPC	Chemical Protective Clothing (CPC), which includes complete ensembles (suit, boots, gloves) and may incorporate various configurations (encapsulating, non-encapsulating, jumpsuit, multi-piece) depending upon the level of protection needed. Levels of CPC vapor protection are: Vapor-Protective, and Flash Fire Protective option for Vapor-Protective, both of which must be compliant with NFPA Standard # 1991, "Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies", current edition. Level of CPC liquid protection is: Liquid Splash-Protective, which must be compliant with NFPA Standard # 1992, "Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies, current edition.
	Flash Fire Vapor-Protective CPC	
	Liquid Splash- Protective CPC	

Components	Type II	Minimum Criteria
Technical Reference	Printed and Electronic	Access to and use of various databases, chemical substance data depositories, and other guidelines and safety data sheets, either in print format, electronic format, stand-alone computer programs, or data available via telecommunications. The interpretation of data collected from electronic devices and chemical testing procedures. At a minimum, technical references will have the ability to outsource additional capabilities and have one source for air-modeling capability.
	Plume Air Modeling; Map Overlays	
Special Capabilities	Gloves and Other Specialized Equipment Based on Local Risk Assessment	Additional resources that augment the capabilities of the team.
	Heat Sensing Capability	
	Light Amplification Capability	
Intervention	Diking, Damming, Absorption; Liquid Leak Intervention	Employment of mechanical means of intervention and control such as plugging, patching, off-loading, and tank stabilization; environmental means such as absorption, dams, dikes, and booms; and chemical means such as neutralization and encapsulation of known and unknown chemicals. Mechanical means include specially designed kits for controlling leaks in rail car dome assemblies and pressurized containers, to pneumatic and standard patching systems.
	Neutralization, Plugging, Patching; Vapor Leak Intervention	
Decontamination	Known Contaminants Based on Local Risk Assessment	Must be self-sufficient to provide decontamination for members of their team. Capable of providing decontamination for known and unknown contaminants.
	Unknown Contaminants	
Communications	In-Suit	Personnel utilizing CPC shall be able to communicate appropriately and safely between one another and their team leaders.
	Wireless Voice	
	Wireless Data	
Personnel: Training & Staffing	5 Personnel	All personnel must be trained to the minimum response standards in accordance with the most current editions of NFPA Standard # 471, "Recommended Practice for Responding to Hazardous Materials Incidents", NFPA Standard # 472, "Standard for Professional Competence of Responders to Hazardous Materials Incidents", and NFPA Standard # 473, "Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents", as is appropriate for the specific team type.
Sustainability	Capability to Perform Three (3) Entries in a 24-hour Period	Sustainability will be capability to perform three (3) entries in a 24-hour period.

HazMat Team Type III

Components	Type III	Minimum Criteria
Field Testing	Known Chemicals	The presumptive testing and identification of chemical substances using a variety of sources to be able to identify associated chemical and physical properties. Sources may include printed and electronic reference resources, safety data sheets, field testing kits, specific chemical testing kits, chemical testing strips, data derived from detection devices, and air monitoring sources,
Air Monitoring	Basic Confined Space Monitoring	The use of devices to detect the presence of known gases or vapors. The basics begin with ability to provide standard confined space readings (oxygen deficiency percentage; flammable atmosphere Lower Explosive Limit (LEL); carbon monoxide; and hydrogen sulfide).
	Specific Known Gas Monitoring	
Sampling: Capturing Labeling Evidence Collection	Known Industrial Chemicals	Known industrial chemicals' standard evidence collection protocols required for each include capturing and collection; containerizing and proper labeling; and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis. Consistent with established chain of custody protocols.
Radiation Monitoring/ Detection	Beta Detection	The ability to accurately interpret readings from the radiation detection devices and conduct geographical survey search of suspected radiological source or contamination spread. Basic criteria include detection and survey capabilities for beta and gamma.
	Gamma Detection	
Protective Clothing: Ensembles	Liquid Splash- Protective CPC	Chemical Protective Clothing (CPC), which includes complete ensembles (suit, boots, gloves) and may incorporate various configurations (encapsulating, non-encapsulating, jumpsuit, multi-piece) depending upon the level of protection needed. Level of CPC liquid protection is: Liquid Splash-Protective, which must be compliant with NFPA Standard # 1992, "Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies", current edition.
Technical Reference	Printed and Electronic	Access to and use of various databases, chemical substance data depositories, and other guidelines and safety data sheets, either in print format, electronic format, stand-alone computer programs, or data available via telecommunications. The interpretation of data collected from electronic devices and chemical testing procedures.

Components	Type III	Minimum Criteria
Special Capabilities	Gloves and Other Specialized Equipment Based on Local Risk Assessment	Additional resources that augment the capabilities of the team.
Intervention	Diking, Damming, Absorption	Employment of mechanical means of intervention and control such as plugging, patching, off-loading, and tank stabilization; environmental means such as absorption, dams, dikes, and booms.
Decontamination	Known Contaminants Based on Local Risk Assessment	Must be self-sufficient to provide decontamination for members of their team. Capable of providing decontamination for known contaminants.
Communications	In-Suit	Personnel utilizing CPC shall be able to communicate appropriately and safely between one another and their team leaders.
	Wireless Voice	
Personnel: Training & Staffing	5 Personnel	All personnel must be trained to the minimum response standards in accordance with the most current editions of NFPA Standard # 471, "Recommended Practice for Responding to Hazardous Materials Incidents", NFPA Standard # 472, "Standard for Professional Competence of Responders to Hazardous Materials Incidents", and NFPA Standard # 473, "Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents", as is appropriate for the specific team type.
Sustainability	Capability to Perform Three (3) Entries in a 24-hour Period	Sustainability will be capability to perform three (3) entries in a 24-hour period.

TERMS AND DEFINITIONS

Teams:

Type I Team—A hazardous materials response team designated to respond to, assess, and mitigate a large-scale, complex, and sustained-duration incident that may involve multiple hazards or WMD Chem/Bio, comprised of known and/or unknown hazardous materials.

For mutual aid planning purposes, deployment time shall be within four (4) hours.

Type II Team—A hazardous materials response team designated to respond to, assess, and mitigate an incident that requires a sustained-duration effort, involving known and unknown hazardous materials.

For mutual aid planning purposes, deployment time shall be within two (2) hours.

Type III Team—A hazardous materials response team designated to respond to, assess, and mitigate an incident for specific known hazardous materials.

For mutual aid planning purposes, deployment time shall be within one (1) hour.

Other Definitions:

Biological Agent—Living organisms or the materials derived from them (such as bacteria, viruses, fungi, and toxins) that cause disease in or harm to humans, animals, or plants, or cause deterioration of material.

Capability—The ability to provide a skill or resource to meet a specific requirement.

Chemical/Biological-Protective Ensemble—A compliant vapor-protective ensemble that is also certified as being compliant with the additional requirements for protection against chemical and biological warfare agents such as vapors, gases, liquids, and particulate. *(NFPA Standard # 1991)*

Chemical Warfare Agent—A chemical substance (such as a nerve agent, blister agent, blood agent, choking agent, or irritating agent) used to kill, seriously injure, or incapacitate people through its physiological effects.

Contaminant—A hazardous material that physically remains on or in people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure. *(Clean Water Act)*

Decontamination—The physical or chemical process of reducing and preventing the spread of contaminants from persons and equipment used at a hazardous materials incident. *(NFPA Standard # 472)*

Deployment—Departure of team from home unit or base.

External Resources—Resources that fall outside of a team's particular agency, including other agency resources or commercially contracted resources.

Flash Fire Protective Ensemble—A compliant vapor-protective ensemble that is also certified as being compliant with the additional requirements for limited protection against chemical flash fire for escape only. *(NFPA Standard # 1991)*

Hazardous Material (HazMat)/(Hazardous Substance)—Any hazardous substance under the Clean Water Act, or any element, compound, mixture, solution, or substance designated under CERCLA; any hazardous waste under RCRA; any toxic pollutant listed under pretreatment provisions of the Clean Water Act; any hazardous pollutant under Section 112 of the Clean Air Act; or any imminent hazardous chemical substance for which the administrator has taken action under TSCA Section 7. *(Section 101(14) CERCLA)*

Hazardous Material Response Team—An organized group of individuals who are trained and equipped to perform work to control actual or potential leaks, spills, discharges or releases of hazardous materials, requiring possible close approach to the material. The team/equipment may include external or contracted resources.

***In-house*—**Assets or expertise specifically owned, possessed, directed and/or controlled by the responding entity.

Liquid Splash-Protective Ensemble—Multiple elements designed to provide a degree of protection for emergency response personnel from adverse exposure to the inherent risks of liquid-chemical exposure occurring during hazardous materials emergencies and similar operations. The liquid splash-protective ensemble is either an encapsulating or non-encapsulating ensemble. *(NFPA Standard # 1992)*

Mitigate—Any action to contain, reduce, or eliminate the harmful effects of a spill or release of a hazardous substance/material. (*U.S. Coast Guard Incident Management Handbook, 2001 edition)*

Personal Protective Equipment—The equipment provided to shield or isolates a person from the chemical, physical, and thermal hazards that can be encountered at a hazardous materials incident. Personal protective equipment includes both personal protective clothing and respiratory protection. Adequate personal protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. *(NFPA Standard # 472)*

Radiological Material—Any material that spontaneously emits ionizing radiation. *(NFPA Standard # 472)*

Release—Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discharging of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant). *(Section 101(22) CERCLA)*

Resources—All personnel and equipment available, or potentially available, for assignment to incident tasks on which status tracking is maintained.

Sustainability—Ability to continue response operations for the prescribed duration necessary.

Vapor Protective Ensemble—A vapor protective ensemble or garment that is intended for use in an unknown threat atmosphere or for known high health risk atmospheres is vapor tight, and is in compliance with NFPA Standard # 1991, "Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies."

Weapons of Mass Destruction (WMD)—(1) Any destructive device as defined in section 921 of this title ("destructive device" defined as any explosive, incendiary, or poison gas, bomb, grenade, rocket having a propellant charge of more than four ounces, missile having an explosive or incendiary charge of more than one-quarter ounce, mine or device similar to the above); (2) any weapon that is designed or intended to cause serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals, or their precursors; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life. *(18 USC Sec. 2332a)*

WMD Chem/Bio—A short-hand phrase for "Weapons of Mass Destruction, Chemical/Biological," and is in reference to those substances that were developed by military institutions for the purpose of creating widespread injury, illness, or death, and may be attractive to a terrorist.

Zones *(U.S. Coast Guard Incident Management Handbook, 2001 edition)*:

Exclusion Zone (Hot Zone)—The area immediately around a spill or release. That area where contamination does or could occur. The innermost of the three zones of a hazardous substances/material incident. Special protection is required for all personnel while in this zone.

Contamination Reduction Zone (Warm Zone)—That area between the Exclusion Zone and the Support Zone. This zone contains the personnel decontamination station. This zone may require a lesser degree of personnel protection than the Exclusion Zone. This separates the contaminated area from the clean area and acts as a buffer to reduce contamination of the clean area.

Support Zone (Cold Zone)—The clean area outside of the contamination control line. Equipment and personnel are not expected to become contaminated in this area. Special protective clothing is not required. This is the area where resources are assembled to support the hazardous substances/materials release operations.

ACRONYMS

CERCLA—Comprehensive Environmental Response, Compensation, and Liability Act

CPC—Chemical Protective Clothing

LEL—Lower Explosive Limit

NFPA—National Fire Protection Association

RCRA—Resource Conservation and Recovery Act

TSCA—Toxic Substances Control Act

WMD—Weapons of Mass Destruction

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[1] This document is a product of FEMA's National Mutual Aid Initiative, HazMat Resource Typing Subgroup.

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Appendix B: Team Mission and Contact Information

Agency for Toxic Substances and Disease Registry Emergency Response Teams

Contact Information

24 Hour Number:	404-498-0120
Main Number:	404-498-0100
Fax Number:	404-498-0056
Location:	1600 Clifton Rd. (E29), Atlanta, GA 30333
Primary Contact:	Duty Officer (404-498-0120; atsdrer@cdc.gov)
Alternate Contact:	CDC Duty Officer (770-488-7100; eocop@cdc.gov)

Mission

The mission of the Agency for Toxic Substances and Disease Registry (ATSDR) is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and disease related to toxic substances.

ATSDR Emergency Response Teams are available 24 hours a day, and are comprised of toxicologists, physicians, and other scientists available to assist during an emergency involving hazardous substances in the environment. Human health advice is usually provided by telephone within 30 minutes to response professionals on the scene, but on-site assistance is available upon request of the FOSC. The ATSDR Response Teams are designed to augment the HAZMAT teams of other agencies to improve and maximize the effectiveness of the Federal response.

ATSDR is directed by Congressional mandate to perform specific functions concerning the effect on public health of hazardous substances in the environment. In addition to response to emergency releases of hazardous substances, other ATSDR functions include:

- Public health assessments of waste sites;
- Health consultations concerning specific hazardous substances;
- Health surveillance and registries;
- Applied research in support of public health assessments;
- Information development and dissemination, including risk communications; and
- Education and training concerning hazardous substances.

Most of the ATSDR staff are certified for Level C or D entries only and approximately 5 staff members are certified to Level B. ATSDR staff positions are funded under Superfund and cannot be deployed for a non-CERCLA event. The CDC provides similar support for non-CERCLA events as necessary.

Designated as the lead agency for hazardous substances within HHS, ATSDR can call on resources from CDC, FDA, SAMHSA, HHS, NIH, and HRSA to support response as needed.

Department of Defense Joint Director of Military Support (JDOMS)

Contact Information

24 Hour Number:	National Military Command Center (NMCC) @ 703-697-6340 (Emergency Actions Cell) or 703-693-8196 (Senior Operations Officer)
JDOMS Main Number:	703-697-9400
Fax Number:	703-697-3147
Location:	1E1008
Primary Contact:	CAPT Marv Heinze (703-693-8453; Marvin.Heinze@JS.Pentagon.mil)
Alternate Contact:	LTC Art Beasley (703-697-9408; Arthur.Beasley@JS.Pentagon.mil)
Alternate Contact:	LTC Michael Avila (703-697-9415; Michael.Avila@JS.Pentagon.mil)

Mission

JDOMS serves as the action agent for the Secretary of Defense (SECDEF) to coordinate and direct execution of DOD assistance to civil authorities, in addition to serving as action agent for consequence management operations and plans.

JDOMS Role

The Joint Staff operates as the Joint Director of Military Support to allocate Department of Defense resources in response to requests from civil authorities—often in the form of emergency requests for assistance in responding to natural or manmade disasters. Other JDOMS functions include special event support and assisting in domestic preparedness implementation in response to weapons of mass destruction.

Department of Energy Nuclear Emergency Support Team

Contact Information

24 Hour Number:	202-586-8100
Main Number:	202-586-5892
Fax Number:	202-586-3904
Location:	1000 Independence Avenue, SW Washington, DC 20585
Primary Contact:	Alan Remick (202-586-8312; Alan.Remick@NNSA.doe.gov)
Alternate Contact:	Debbie Wilber (202-586-0592; Debbie.Wilber@hq.doe.gov)

Mission

The Nuclear Emergency Support Team (NEST) encompasses all DOE/NNSA emergency response assets. The DOE/NNSA teams described in the Handbook are national and regional. The DOE Radiological Assistance Program (RAP) is an element of the NEST. DOE created the RAP to respond to incidents involving radioactive materials. RAP provides resources, including trained personnel and equipment, to evaluate, assess, advise, and assist in the mitigation of actual or perceived radiation hazards and risks to workers, the public, and the environment. Requests for RAP assistance may pertain to any accident or incident involving radioactive materials where real or potential radiological hazards exist.

Department of Homeland Security, Federal Emergency Management Agency, National Urban Search and Rescue Response System

Contact Information

24 Hour Number:	202-646-4600
Fax Number:	202-646-4684
Location:	Office of Emergency Information and Media Affairs, Washington, D.C. 20472
Primary Contact:	Peter Smalley, WMD Program Specialist (202-646-3796; peter.smalley@dhs.gov)

Mission

The National Urban Search and Rescue (US&R) Response System, established under the authority of the Federal Emergency Management Agency (FEMA) in 1989, is a framework for structuring local emergency services personnel into integrated disaster response task forces. These task forces, replete with the necessary tools and equipment, and the requisite skills and techniques, can be deployed by FEMA for the rescue of victims of structural collapse.

When the Federal government mobilizes resources and conducts activities to support state and local response efforts to disasters, it does so under 12 Emergency Support Functions (ESFs). Each ESF is led by a primary agency, which has been selected based on its authorities, resources and capabilities in a particular functional area. FEMA is the primary agency for ESF #9—Urban Search and Rescue.

After a request for Federal assistance from a Governor is received and approved by the President, Task Forces may be activated or placed on alert when a major disaster threatens or strikes a community. The alerted Task Forces start locating personnel and organizing their mobilization. Each Task Force is charged with having all its personnel and equipment at the embarkment point within 6 hours of activation. The Task Force can be airborne and heading to its destination in a matter of hours.

Currently, there are 28 FEMA US&R Task Forces spread throughout the continental United States, trained and equipped by FEMA to handle structural collapse. They encompass local emergency services personnel from 19 states. Any operational task force can be deployed by FEMA to a major disaster and provide assistance with structural rescue. Two Task Forces have also responded to several international disasters under the auspices of the U.S. Agency for International Development (USAID), Office of Foreign Disaster Assistance.

A FEMA US&R Task Force is comprised of 70 specialists, and is divided into six major functional elements, including Search, Rescue, HAZMAT, Planning, Logistics, and Medical.

Task Force members include structural engineers, and specialists in the areas of Hazardous materials, heavy rigging, search (including highly trained search dogs), logistics, rescue and medicine. By design, there are two task force members assigned to each position to allow rotation and relief of personnel, permitting round-the-clock task force operations.

Each Task Force is supported by a comprehensive equipment cache totaling 62,000 pounds. The cache elements sent to the disaster scene include communications, locating, rope rigging, hauling, lifting and pulling equipment. In addition, shoring, structural movement sensing, victim extrication, cutting, and drilling devices are included to allow performance of the often difficult assignments encountered by a FEMA US&R Task Force.

US&R TASK FORCE MEDICAL COMPONENT

The medical team is comprised of four medical specialists and two physicians. Many of the medical specialists on US&R teams are both paramedics and firefighters, and thus have both rescue experience and extensive experience in pre-hospital medical care. Most of the physicians involved in US&R are emergency medicine specialists, and have also taken special courses in confined space medicine and crush syndrome.

The medical team is designed to bring the Emergency Department out to the field. It carries all of the advanced life support equipment available in any advanced life support ambulance. In addition to providing advanced emergency medical care in the field, the team is trained in Hazardous materials, public health issues relevant to disaster management, confined space medicine, and other issues important to the function of a US&R Team.

TASK FORCE CAPABILITIES

- Physical search and rescue operations in damaged/collapsed structures;
- Emergency medical care for entrapped victims, task force personnel and search canines;
- Reconnaissance to assess damage and needs and provide feedback to local, state and Federal officials;
- Assessment/shut off of utilities to houses and other buildings;
- Hazardous materials survey/evaluations;
- Structural/hazard evaluations of buildings needed for immediate occupancy to support disaster relief operations; and
- Stabilizing damaged structures, including shoring and cribbing operations on damaged buildings.

CURRENT US&R TASK FORCES
(as of Apr. 2003)

Arizona
AZ-TF1 Phoenix Fire Dept.

California
CA-TF1 LA City Fire Dept.
CA-TF2 LA County Fire Dept.
CA-TF3 Menlo Park Fire Dept.
CA-TF4 Oakland Fire Dept.
CA-TF5 Orange Co. Fire Authority
CA-TF6 Riverside Fire Dept.
CA-TF7 Sacramento Fire Dept.
CA-TF8 San Diego Fire Dept.

Colorado
CO-TF1 State of Colorado

Florida
FL-TF1 Metro-Dade Fire Dept.
FL-TF2 City of Miami Fire Dept.

Indiana
IN-TF1 Marion County Fire Dept.

Maryland
MD-TF1 Montgomery Co. Fire and Rescue

Massachusetts
MA-TF1 City of Beverly

Missouri
MO-TF1 Boone County Fire Protection District

Nebraska
NE-TF1 City of Lincoln

Nevada
NV-TF1 Clark County

New Mexico
NM-TF1 State of New Mexico

New York
NY-TF1 NYC Office of Emergency Management

Ohio
OH-TF1 Miami Valley Emergency Management Authority

Pennsylvania
PA-TF1 Commonwealth of Pennsylvania

Tennessee
TN-TF1 Memphis/Shelby Co. EMA

Texas
TX-TF1 Texas A&M University System/Texas Engineering Extension Service

Utah
UT-TF1 State of Utah

Virginia
VA-TF1 Fairfax Co. Fire & Rescue
VA-TF2 Virginia Beach Fire Dept.

Washington
WA-TF1 Puget Sound Task Force

For additional information, still photos, video tapes of FEMA US&R personnel and equipment contact FEMA's Office of Emergency Information and Media Affairs at **(202) 646-4600** or visit FEMA on the World Wide Web at **http://www.fema.gov/usr/**. Additional information is also available on FEMA's 24-hour fax-on-demand system by calling **(202) 646-FEMA**.

Federal Bureau of Investigation, Laboratory Division, Hazardous Materials Response Unit

Contact Information

Main Number: 703-632-7975
Fax Number: 703-632-7898
Location: 2501 Investigation Parkway, Quantico, Virginia 22135
Primary Contact: John Fraga, Unit Chief (703-632-7975; jmfraga@hotmail.com)
Alternate Contacts:

HAZMAT Operations: Steven Patrick, Sr. Hazardous materials Officer (703-632-7940; stevegpatrick@aol.com)
Science Operations: Dr. Benjamin Garrett, Sr. Scientist (703-632-7929; Dier4@aol.com)

Mission

The FBI's Hazardous Materials Response Unit (HMRU) responds to criminal acts and incidents involving the use of Hazardous materials, and develops the FBI's technical proficiency and readiness for crime scene and evidence-related operations in cases involving chemical, biological, and radiological materials and wastes.

FBI HMRU fulfills its mission through an integrated effort involving specialized response teams, a national training program, interagency liaison, technical assistance to FBI field and Headquarters divisions, and the development of field response programs. The Unit also trains, equips, and certifies FBI field office personnel for Hazardous materials operations.

National Oceanic and Atmospheric Administration, Office of Response and Restoration, Hazardous Materials Response Division

Contact Information

24 Hour Number:	206-526-4911
Main Number:	206-526-6317
Fax Number:	206-526-6329
Location:	7600 Sand Point Way NE, Seattle, WA 98115
Primary Contact:	Thomas Callahan (206-526-6326; thomas.callahan@noaa.gov)
Alternate Contact:	Robert Pavia (206-526-6319; Robert.Pavia@noaa.gov)

Mission

The National Oceanic and Atmospheric Administration's Office of Response and Restoration (OR&R) is responsible for providing scientific support for oil and hazardous material spills. OR&R responds to dozens of spills of oil and other hazardous materials each year; helps emergency planners prepare for potential accidents; creates software, databases, and other tools to help people respond to hazardous materials accidents; works to find remedies for environmental damage caused by hazardous waste sites in coastal areas; and assesses injury to coastal resources from releases of oil, other hazardous materials, vessel groundings, and abandoned vessels, and pursue restoration from those responsible for the harm.

The OR&R Hazardous Materials Response Division (HAZMAT) provides 24-hour support to spill events. HAZMAT provides scientific expertise for incident response in order to reduce harm to people, the economy, and the environment.

HAZMAT facilitates spill prevention, preparedness, response, and restoration at national and local levels, and its area of responsibility encompasses the entire U.S. coastline, including the Great Lakes, the Gulf of Mexico, Alaska, and Hawaii. HAZMAT expertise is also frequently sought internationally. While oil and chemical spills are the major focus, the Division also provides support for incidents such as downed aircraft, search and rescue, and tracking of floating objects.

Department of Labor, Occupational Safety and Health Administration, Health Response Team

Contact Information

Main Number: 801-524-7900
Fax Number: 801-524-6660
Location: 1781 South 300 West, Salt Lake City, UT 84115
Primary Contact: Bob Curtis (801-414-9371; Curtis.Bob@dol.gov)
Alternate Contact: Jimmy Roberts (801-414-9372; Roberts.Jimmy@dol.gov)

Mission

The Health Response Team (HRT) of the Occupational Safety and Health Administration (OSHA) is available to provide technical assistance in the areas of industrial hygiene and specialized engineering. The HRT is designed for and serves to conduct the following:

- Respond to occupationally related emergencies which may involve potentially catastrophic releases of Hazardous materials;
- Provide technical expertise in recognizing and evaluating health and safety hazards associated with a wide range of complex industrial operations;
- Evaluate and recommend appropriate engineering controls, provide onsite technical expertise for complex, unusual, and high priority occupational hazard investigations;
- Work with the Directorates of Health and Safety Standards in developing new standards, and design and conduct studies to obtain data which the standards development organizations can use to form the basis for making decisions;
- Maintain current national and international safety and health awareness and technological advances involving industry practices and specific work processes to advise OSHA program offices of their potential impact on existing OSHA programs;
- Provide national technical experts for SARA hazardous waste site activities; and
- Provide testimony as needed in contested cases, or for the standards setting process.

U.S. Army Corps of Engineers, Rapid Response Program

Contact Information

Main Number: 402-293-2501
Fax Number: 402-291-8177
Location: Offutt AFB, NE
Primary Contact: Tim Gouger (402-216-4252; timothy.p.gouger@usace.army.mil)
Alternate Contact: Mark Herse (402-293- 2560; mark.r.herse@usace.army.mil)

Mission

The U.S. Army Corps of Engineers (USACE) Rapid Response Program (RR) is designed to support the Nation and other agencies during times of crises by providing "All Hazards Response" while maintaining a high level of preparedness. This requires that the RR attain a high, consistent state of preparedness and provide rapid, efficient all hazards response. When a disaster exceeds the state and local capabilities to respond, RR teams are prepared to help save human life, prevent immediate human suffering, and minimize property damage.

As a Center for Expertise for time-sensitive hazardous, infectious, and/or radioactive actions, the USACE RR works with numerous Federal customers, including the Department of State, U.S. Postal Service, Department of the Interior, Department of Energy, Department of Justice, U.S. Environmental Protection Agency, and the Department of Defense. USACE supports the Federal Emergency Management Agency in carrying out the Federal Response Plan. Under this plan, USACE has the lead responsibility for public works and engineering missions.

U.S. Environmental Protection Agency's Diving Program

Contact Information

Main Number:	202-566-1267
Fax Number:	202-566-1337
Location:	Office of Water, Office of Wetlands, Oceans and Watersheds Oceans and Coastal Protection Division (4504T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460 *(for program management)*
Primary Contact:	Kennard W. Potts, Chairman, EPA Diving Safety Board (202-566-1267; potts.kennard@epa.gov)
Alternate contact:	Alan Humphrey, OSWER (732-321-6748; humphrey.alan@epa.gov)

Mission

EPA programs have required the support of specially trained and certified divers to conduct a variety of underwater operations. The agency maintains a Diving Safety Management Program which establishes the organizational structure, managerial functions, technical framework and training, and safe diving protocols for EPA employees to conduct dive operations. This program incorporates national accepted and consistent methods for planning and implementing underwater activities. EPA's Dive Safety Policy is directed toward minimizing the occupational hazards due to working in an underwater environment. All EPA employees who wish to conduct dive operations must do so in accordance with EPA's Dive Safety Policy and the associated Standard Operating Practices. EPA operates its program under the "Scientific Diving Exemption" maintained through the Occupational Safety and Health Administration. EPA divers are trained as "Scientific Divers". All EPA divers are trained in variable volume dry suits, full face masks, polluted water diving concepts, diving accident management, oxygen administration, and NITROX.

The EPA Dive Program supports a wide range of EPA offices: Superfund, Office of Water, Enforcement, regional field activity support, and Office of Research and Development (ORD), to name a few. EPA divers often work with other Federal and State programs through reciprocity agreements with each agency. Many EPA dive activities are scientifically based monitoring and assessment, and hazardous water diving is often a component of the operational aspects.

Nationally, EPA dive units have a wide range of assets which include surface supplied operational capabilities, underwater and surface communications, remotely operated vehicles, hand held video, dry suits, full face masks, and numerous small vessel support. While the program has the ability to support a varied EPA program need it is also capable of responding to large national events and disasters. The EPA Dive Program supported the national emergency response for the space shuttle "Columbia" recovery operations in Texas. This recovery operation demonstrated EPA's capacity to support a national response effort.

U.S. Environmental Protection Agency's Emergency Communications and Outreach Team

Contact Information

24 Hour Number:	(703) 851-3873
Main Number:	(703) 603-8908
Fax Number:	(703) 603-9133
Location:	Crystal Gateway Bldg 1, 1235 Jefferson Davis Hwy, Arlington, VA
Primary Contact:	Virginia Coffey, ECOT Team Leader (703-603-8908; coffey.virginia@epa.gov)
Alternate Contact:	Virginia Narsete (312-886-4359; 77 West Jackson Blvd, Chicago, IL; narsete.virginia@epa.gov)

Mission

The Emergency Communications and Outreach Team (ECOT) is a support team for regional removal and emergency responses, specifically during national disasters and other significant response efforts, requiring public outreach for extended periods of time.

ECOT comprises community involvement and public affairs specialists from EPA regions and headquarters who have experience in emergency and removal responses. Specifically, they are trained in setting up and/or functioning in a JIC and a Unified Command Structure, handling the media, public inquiries and community involvement issues, writing press releases, fact sheets, and communication strategies. They are also experienced in working on teams and coordinating with multiple agencies in stressful environments, and possess a sound understanding of the National Response System.

U.S. Environmental Protection Agency's Emergency Response Peer Support & Critical Incident Stress Management Team

Contact Information

24 hour number:	202-253-4177
Main number:	703-603-8737
Fax number:	703-603-9100
Location:	EPA Headquarters, 1200 Pennsylvania Avenue, Washington, DC 20460
Primary Contact:	Jan Shubert, L.C.S.W., Clinical Director (703-603-8737; shubert.jan@epa.gov)
Alternate contact:	Karen McCormick, Operations Coordinator (214-789-2814; mccormick.karen@epa.gov)

Mission

The mission of the Emergency Response Peer Support and Critical Incident Stress Management (Peer Support/CISM) Team is to provide support and assistance to EPA's Regional OSCs for stress experienced in the day-to-day performance of their jobs as well as in the event of major emergencies or disasters. The program is an organized approach to help OSCs prevent, reduce, and/or control potentially harmful stress symptoms caused by the nature of their jobs. The Team offers a national network of trained peers and other EPA staff with whom OSCs can talk on a confidential basis either in person or by telephone. Team members are available during regular business hours, after hours by special arrangement, and at disasters. Services include preparedness training for new OSCs, confidential peer support, on-going stress management education, critical incident stress management assistance at emergency/disaster sites, and special outreach for OSC families and other special needs.

U.S. Environmental Protection Agency's Environmental Response Team

Contact Information
24 Hour Number: 732-321-6660
Fax Number: 732-321-6724
Major Locations: Edison, NJ, Cincinnati, OH, and Las Vegas, NV
Primary Contact: Dr. Joseph P. Lafornara (732-321-6740; lafornara.joseph@epa.gov)
Alternate Contact: Dave Wright (732-321-6740; wright.dave@epa.gov)

Mission
The U.S. EPA Environmental Response Team (ERT) is involved in response to oil spills, hazardous emergencies, potentially hazardous situations, and long-term remedial activities. The goals of the ERT are to:

- Provide high quality service and consultation to those requiring assistance around the world;
- Promote the development of technology and procedure in relevant science and engineering areas; and
- Disseminate information.

ERT is comprised 45 scientists, engineers, and experts in environmental emergencies who provide on-scene assistance in managing environmental disasters. The ERT is also supported by the Environmental Response Center (ERC), an information center that assists with reference and research needs. The ERT is available for deployment throughout the world. Mobilization time is 4 hours for advance team personnel and equipment. Response time is dependent on travel time. The advance team will be deployed from the location that can arrive on scene first, not necessarily the closest location geographically.

U.S. Environmental Protection Agency's Ocean Survey Vessel, Peter W. Anderson

Contact Information

24 hour number:	Potts Home Phone (703-979-4597) Ship Bridge Cell (410-336-4577)
Main number:	202-566-1267
Fax number:	202-566-133
Location:	Office of Water, Office of Wetlands, Oceans and Watersheds Oceans and Coastal Protection Division (4504T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460 *(for vessel management)*
Primary Contact:	Kennard W. Potts, EPA Vessel Manager (202-566-1267; potts.kennard@epa.gov)
Alternate Contact:	Craig Vogt (202-566-1235; vogt.craig@epa.gov)

Mission

The Ocean Survey Vessel, Peter W. Anderson (OSV Anderson) is the EPA's only ocean survey vessel. The ship's primary mission is monitoring and assessment of coastal waters, particularly with regard to waste disposal sites and ocean outfalls. The ship also is ready for emergency response missions and has done so in the past (e.g., the Delaware River oil spill; locating cargo containers of arsenic trioxide off the coast of New Jersey). The OSV Anderson is equipped and manned to conduct offshore data collection. The vessel was formerly the Navy Patrol Gunboat (USS Antelope PG - 86), and extensively modified and refitted in 1979, as a survey vessel.

Ship Specifications: OSV Peter W. Anderson

Launched:	1966
Length:	165'
Width:	24'
Draft:	11'
Displacement:	250 metric tons
Engines:	2 Cummins Diesel
Ship Crew:	15
Scientific Crew:	15

The OSV Anderson has Side scan sonar capability for benthic searches, a NITROX membrane system to produce enhanced oxygen breathing gas to support dive teams, and a variety of benthic and water column sampling equipment. The vessel supports small boat operations and ship assets include two 21' and one 17' Rigid hull inflatable boat.

The OSV Anderson conducts operations in the Gulf of Mexico, Caribbean, and the East coast. Endurance is six days in transit and ten days.

U.S. Environmental Protection Agency Office of Enforcement, Compliance, and Assurance (OECA) National Counter-Terrorism Evidence Response Team (NCERT)

Contact Information

Main Number: 703-235-1113
Fax Number: 703-235-1118
Location: 1100 Wilson Blvd. Suite 950, Arlington, VA 22209
Primary Contact: SAC Ted Stanich (703-235-1113; stanich.ted@epa.gov)
Alternate Contact: ASAC Stacey Noem (703-235-0317, noem.stacey@epa.gov)

Mission

The efforts of the Office of Enforcement, Compliance and Assurance (OECA) are to maximize compliance and reduce threats to public health and the environment by employing an integrated approach of compliance assistance, compliance incentives, and innovative civil and criminal enforcement.

The National Counter-Terrorism Evidence Response Team (NCERT) is comprised of expert technical and investigative personnel, engineers, analysts, computer specialists and environmental specialists, who participate in the detection of terrorist activities, evaluation of terrorist and counter-terrorism activities, and investigation of and safe operations at crime scenes involving chemicals, toxic substances, hazardous substances and toxic materials. They also provide resources to respond to terrorist attacks involving chemical and biological weapons of mass destruction.

U.S. Environmental Protection Agency Radiological Emergency Response Team

Contact Information

24 Hour Number: 800-424-8802 (On-call commander via NRC)
Location: 1200 Pennsylvania Avenue, Washington, DC 20460
Primary Contact: Gregg Dempsey (702-798-2461; Dempsey.gregg@epa.gov)
Alternate Contact: Sam Poppell (334-270-3414; Poppell.sam@epa.gov)

Mission

The Radiological Emergency Response Team (RERT) responds to emergencies involving releases of radioactive materials. RERT works closely with Federal, state, and local agencies to respond to emergencies that can range from accidents at nuclear power plants, to transportation accidents involving shipments of radioactive materials, to deliberate acts of nuclear terrorism.

RERTs are on standby alert at all times and are available for deployment six hours after notification. RERT on-scene operations include: monitoring, sampling, and laboratory activities, in addition to providing state and local authorities with advice on protecting local residents from exposure to harmful radiation levels.

There are approximately 75 team members stationed at EPA's two national radiation laboratories and EPA Headquarters in Washington, DC. EPA can send just a few specialists or all team members to the emergency site. Headquarters RERT members support field operations activities from the agency's Emergency Operations Center (EOC).

U.S. Coast Guard National Pollution Funds Center

Contact Information

Main Number: 202-493-6700
Fax Number: 202-493-6898
Location: 4200 Wilson Blvd. Suite 1000, Arlington, VA 22203
Primary Contact: Allen R. Thuring (202-493-6801; Athuring@ballston.uscg.mil)
Alternate Contact: John A. Crawford (202-493-6811; Jcrawford@ballston.uscg.mil)

Mission

The National Pollution Funds Center (NPFC) is responsible for administering the OSLTF, managing the portion of Superfund that the U.S. Coast Guard uses, and overseeing the vessel financial responsibility provisions of the OPA. The NPFC aims to:

- Provide funding for Federal removal actions in response to a discharge or a substantial threat of discharge of oil to navigable waters of the United States;
- Compensate claimants for OPA removal costs or damages;
- Provide funding to Natural Resource Trustees for natural resource damage assessment and restoration;
- Recover OPA removal costs and damages from responsible parties;
- Certify financial responsibility for vessels; and
- Provide funding for U.S. Coast Guard responses to discharges or the substantial threat of a discharge of hazardous substances.

U.S. Coast Guard National Strike Force

Contact Information

National Response Center
24 Hour Number: 1-800-424-8802

National Strike Force Coordination Center
Main Number: 252-331-6000
Fax Number: 252-331-6012
Location: 1461 N. Road, Elizabeth City, NC
Primary Contact: LCDR Chip Lopez (252-331-6000 x 3005; Jlopez@nsfcc.uscg.mil)
Alternate Contact: CDR James Hanzalik (252-331-6000x3009; Jhanzalik@nsfcc.uscg.mil)

Mission

The National Strike Force (NSF) is comprised of highly trained U.S. Coast Guard professionals who maintain and rapidly deploy with specialized equipment and incident management skills. The NSF is mandated to assist and support FOSCs in their response and preparedness activities. In this way, the NSF supports the entire NRS by minimizing the adverse impact to the public and reducing environmental damage from oil discharges and hazardous substance releases.

The NSF will continue to function as part of an effective NRS and be recognized worldwide as experts in preparedness and response and will remain a vital national asset, essential to the nation's ability to prepare for and respond to oil discharges, hazardous substance releases, and other emergencies on behalf of the American public.

The NSF is currently comprised of three strike teams, including the Atlantic Strike Team in New Jersey, the Gulf Strike Team in Alabama, and the Pacific Strike Team in California.

U.S. Marine Corps Chemical Biological Incident Response Force

Contact Information

24 Hour Number:	301-744-2038
Fax Number:	301-744-2052
Location:	101Strauss Ave Bldg 901, Indian Head, MD 20640
Primary Contact:	LtCol Scott Graham (301-744-2039; grahamsa@cbirf.usmc.mil)
Alternate Contact:	LCDR Jeff Betsinger (301-744-2087; betsingerjb@cbirf.usmc.mil)

Mission

The Chemical Biological Incident Response Force (CBIRF) is designed to deploy immediately in the event of a credible threat of a Chemical, Biological, Radiological, Nuclear, or High Yield explosive (CBRNE) incident in order to assist local, state, or Federal agencies. CBIRF assistance would include coordinating initial relief efforts, security, detection, identification, expert medical advice, and limited decontamination of personnel and equipment. CBIRF consists of specially trained personnel and specialized equipment suited for operations in a wide range of contingencies. Through detection, decontamination and emergency medical services, the CBIRF capabilities are intended to minimize the effects of a chemical or biological incident.
CBIRF is prepared to respond on short notice to chemical or biological incidents worldwide in assisting the on-scene commander in providing initial post-incident consequence management. CBIRF responders have been trained to deal with "G-series" nerve agents, like sarin gas; "H-series" blister agents, such as mustard gas and other chemical-burn causing materials; and some 25 biological threats, such as anthrax and typhoid.

There are five functional elements within CBIRF which deploy in an emergency situation to assist in the response. These include the Nuclear, Biological, Chemical (NBC) reconnaissance element, decontamination, medical, security, and service support operations. CBIRF's NBC reconnaissance element is responsible for detecting the location of an incident site. The decontamination element decontaminates personnel and equipment exposed to any chemical or biological agents, and the medical element is capable of providing triage support to casualties during and after decontamination. The security element provides security for the contaminated site as well as assets operating within the area. Finally, the service support element provides shelter, food and water so CBIRF can operate in a contaminated site.

U.S. National Guard Civil Support Team

Contact Information
Primary Contact: LTCOL James Kish, 703-607-1724, james.kish@ngb.army.mil

Mission
The National Guard consists of citizen-soldiers and airmen who serve our nation and States. The Army National Guard has units in 2,700 communities in all 50 States, the District of Columbia, Guam, Puerto Rico and the U.S. Virgin Islands. The Air National Guard has 88 flying units at more than 170 installations nationwide. National Guard units are organized, trained, and equipped to the same standards as the U.S. Army and the U.S. Air Force. The National Guard has two roles—one as part of the nation's entire military force and the other to the respective States for emergency response and community support missions. Serving these roles creates three missions: to participate in global security for the United States, to provide emergency response at the State level, and to give support to local community needs.

The Weapons of Mass Destruction Civil Support Team (CST) is designed to augment terrorism response capabilities in events known or suspected to involve WMD. CST will assess a suspected CBRNE event in support of a local Incident Commander; advise civilian responders regarding appropriate response actions; and assist in expediting arrival of additional state and Federal assets to help save lives, prevent human suffering, and mitigate property damage.

CST is a full time, Federally funded National Guard unit. The team is made up of a 22 Person National Guard Unit, with 14 Military Specialties, Commercial and Military Equipment, Sophisticated Reachback System, and Interoperable with Civil Responders. There are a total of 32 active CSTs in the nation, organized under the ten FEMA regions. The team integrates into the ICS in support of the local Incident Commander. CST has the capability to provide rapid detection and analysis of chemical, biological, and radiological hazard agents at WMD incident scenes.

U.S. Navy Supervisor of Salvage and Diving

Contact Information

Main Number: 202-781-1731
After Hours Number: 202-781-3889 (NAVSEA Duty Officer)
Fax Number: 202-781-4588
Location: Commander Naval Sea Systems Command (Code 00C),
1333 Isaac Hull Ave, SE, Washington DC 20376-1070
Primary Contact: William Walker (202-781-0469; walkerwa@navsea.navy.mil)
Alternate Contact: Richard Buckingham (202-781-0465; buckinghamrt@navsea.navy.mil)

Mission

The Supervisor of Salvage and Diving (SUPSALV) is designed to provide technical, operational, and emergency support to the Navy, Department of Defense, and other Federal agencies, in the ocean engineering disciplines of marine salvage, pollution abatement, diving, diving system certification, and underwater ship husbandry. SUPSALV prevents, responds to, and minimizes the effects of catastrophes and other national emergencies.

SUPSALV reports to the Surface Ship Directorate of the Naval Sea Systems Command. Located in Washington, D.C. in the Washington Navy Yard, SUPSALV is responsible for all aspects of ocean engineering, including salvage, in-water ship repair, contracting, towing, diving safety, and equipment maintenance and procurement.

SUPSALV consists of 10-12 military personnel, 30 civilian personnel and one Royal Navy Exchange Officer. The five divisions that support SUPSALV are:

- The Management Support Division - prepares and tracks contractual and financial documents and provides logistic support to the other divisions in SEA 00C;
- The Salvage Operations Division - handles salvage and recovery and oil spill control operations;
- The Diving Program Division - responsible for setting diving policy and approving U.S. Navy Diving Equipment;
- The Diving Certification Division - serves as the System Certification Authority for shipboard and portable hyperbaric systems; and
- The Underwater Ship Husbandry Division (UWSH) - develops techniques, procedures, and equipment to perform ship repairs waterborne.

SUPSALV is working to increase its technical expertise, exploit state-of-the-art technologies, improve procedures, and develop new technologies while remaining committed to safety.

Metropolitan Medical Response System

Contact Information

Primary Contact: Dennis Atwood (202-646-2699; dennis.atwood@dhs.gov)
Regional Contacts: See attached regional point of contact listings.

Mission

The Metropolitan Medical Response System (MMRS) program assists highly populated jurisdictions (125 through FY 2003) in developing plans, conducting training and exercises, and acquiring pharmaceuticals and personal protective equipment. The purpose of the MMRS is to achieve the capabilities necessary to respond to a mass casualty event, caused by a WMD terrorist act, during the first hours crucial to lifesaving and population protection, until significant external assistance can arrive. This capability is all possible using their own resources.

The approach requires teamwork among first responders, medical treatment resources, public health, emergency management, volunteer organizations, and other local elements, working together to reduce the effects resulting from horrific terrorist acts. It also requires planning integration with neighboring jurisdictions, state and Federal agencies, and enhanced mutual aid. Gaining the mentioned capability increases the preparedness of the jurisdictions for a mass casualty event caused by an incident involving Hazardous materials, an epidemic disease outbreak, or a natural disaster.

The Federal government does not possess operational control over MMRS jurisdictions' response operations. Federal assets may supplement/augment local response operations under immediate response procedures or as the result of a request for assistance from duly authorized state officials. In doing so, they must work with the local incident command/unified command leadership. Federal elements seeking to coordinate mass casualty preparedness, planning or response operations with MMRS jurisdictions should contact the designated MMRS POCs (see attached).

MMRS funding is provided via a contract with the local jurisdiction. Jurisdictions entered the program in various fiscal year groups (refer to MMRS map): 27 in FYs 96-97; 20 in FY 99; 25 each in FYs 00, 01, and 02, and 4 in FY 03 (includes Atlanta's upgrade from a Metropolitan Medical Strike Team (MMST) to a MMRS).

The MMRS contracts contain statements of work which require specified deliverables and deliverable time-lines. These initial MMRS contracts have provided $600,000 to the jurisdiction, with payments based on the approved completion of groups of deliverables. Key deliverables in the contract for enhanced capabilities for system development include:

- Establishment of a broad-based Steering Committee, with members from all jurisdictional elements relevant to MMRS development;
- MMRS Development Plan;
- Primary MMRS Plan;
- Component plans, including managing the medical and public health consequences of a WMD event (chemical, biological, radiological, or explosive device);

- Component plan for local hospital and healthcare system;
- Plan component for the forward movement of patients;
- Mass fatality management;
- Training Plan;
- Pharmaceutical and Equipment Plan;
- List of pharmaceutical and equipment acquisitions; and
- Final Report including a statement that the MMRS is operational.

The five-year strategic plan for MMRS emphasizes:

1. Establishing an Operational Readiness Assessment component evaluating the capabilities gained by the jurisdictions to provide a basis for targeting future funding;
2. Sustainment, which reflects the dynamics of mass casualty preparedness—taking into account changes in: the terrorist threat, evolving and new epidemic disease threats, pharmaceuticals anticipated through the Project BIOSHIELD, opportunities in applied technology including interoperable communications, medical treatment infrastructure, and demographics in the MMRS service areas.
3. The program also offers the advantages of the MMRS program to states and territories which do not currently have MMRS jurisdictions.

MMRS capacity requirements include:

- Pharmaceuticals sufficient to provide care for at least 1,000 victims of a chemical incident and for 10,000 victims for the first 48 hours of response to a biological event;
- Biological agent response, determined by the specific agent (Anthrax, Botulism, Hemorrhagic Fever, Plague, Smallpox, and Tularemia) for up to 100 victims, from 100 to 10,000 victims, and more than 10,000 victims; and
- The local hospital and healthcare system plan must ensure surge capacity to accommodate 500 critically ill patients

To date, 55 MMRS jurisdictions have completed their baseline capability enhancement and an additional 25 are nearly complete.

The MMRS program is funded at $50M for FY04 and received $50M in FY03. In FY03 the first funding for sustainment was provided via a Program Support contract, which made available $280,000 for capability maintenance and optional operational area expansion. Jurisdictions are eligible for sustainment funding only upon completion of their baseline enhanced capability development.

The MMRS program was transferred to the Department of Homeland Security, Emergency Preparedness and Response Directorate/Federal Emergency Management Agency, from the Department of Health and Human Services on March 1, 2003.

For additional information, visit http://mmrs.fema.gov/
(DHS/FEMA/EPR/Preparedness/MMRS 031126)

MMRS Points of Contact (by region)

Region 1

Boston, MA

Primary POC

Richard Serino
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Secondary POC

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Hartford, CT

Primary POC

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Health Dept: (860) 543-8800
24-hour Emergency: (860) 842-7578
Residence: (860) 249-0305
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Secondary POC

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Capital Region MMRS
Senior Project Manager
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Providence, RI

Primary POC

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Springfield, MA

Primary POC

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Worcester, MA

Primary POC

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Secondary POC

Tom Connell

Region 2

Buffalo, NY

Primary POC

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Primary POC

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New York, NY

Primary POC

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Secondary POC

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Newark, NJ

Primary POC

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Rochester, NY

Primary POC

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Fire Chief
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Secondary POC

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Syracuse, NY

Primary POC

Jean Smiley
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Yonkers, NY

Primary POC

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Secondary POC

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Region 3

Allegheny County, PA

Primary POC

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Co-Primary POC

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Arlington, VA

Primary POC

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Secondary

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Baltimore, MD

Primary POC

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Hampton Roads, VA

Primary POC

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Hampton Roads Planning Commission
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Philadelphia, PA

Primary POC

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Richmond, VA

Primary POC

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Secondary POC

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Washington Metro (DC, MD, VA)

Primary POC

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Region 4

Atlanta, GA

Primary POC

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Birmingham, AL

Primary POC

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Charlotte, NC

Primary POC

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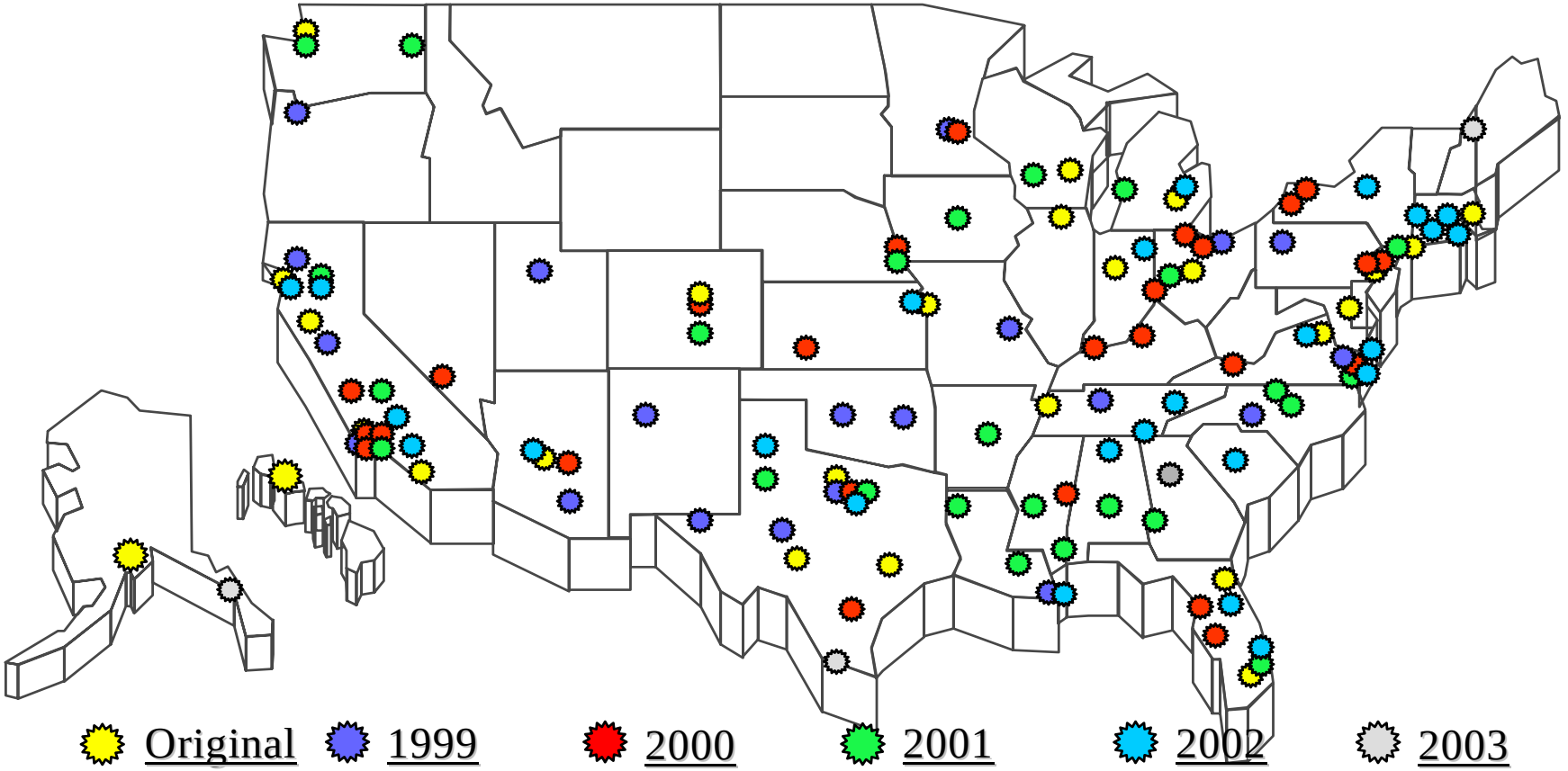
Metropolitan Medical Response Systems



Original

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2003

Atlanta Regional Coalition, Northern New England Region (New Hampshire, Maine, Vermont), Southern Rio Grande Region (TX), Southeast Alaska Region

As of October 2003

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Appendix C: Terms and Definitions

Emergency Response Operational Expertise

HAZMAT Teams Deployment Time – Number of hours before team is capable of departure from home unit or base**.** HAZMAT Response Team is defined ***as*** an organized group of individuals who are trained and equipped to perform work to control actual or potential leaks, spills, discharges or releases of hazardous materials, requiring possible close approach to the material. The team/equipment may include external or contracted resources.

Operational Health and Safety

Safety Plan Development and Enforcement - Ability to draft all policies and procedures for responders operating on-site to ensure a safe working environment prior to working at the site. The enforcement also includes ensuring the policies and procedures within the safety plan are adhered to during a response.

Responder Health and Safety – Ability to ensure that all procedures, policies and plans are developed and followed for the health and safety of personnel during a response. This also encompasses the personnel protective equipment, air quality monitoring equipment, medical monitoring and the plans to ensure when and how any of these are used during a response.

Onsite Medical Monitoring – Ability to regularly evaluate response personnel and their ability to work and use different equipment, including personal protective equipment. Onsite medical monitoring typically consists of quick biological monitoring, which could include body temperature, body weight, and/or heart rate.

Establishing Medical Protocol – Ability to determine the policies and procedures to be utilized for the best protection of worker health and safety.

Salvage Capability

Vessel Fire Assessment – Ability to assess both minor and major damage to a vessel, either off-shore or on-shore, as a result of an on-board fire. The assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The assessment should include detailed damage information as well as recommended repair and salvage options. The level of PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

Vessel Damage Assessment – Ability to assess both minor and major damage to a vessel as a result of a collision, grounding, explosion, or any other incident in which damage is done to the vessel. The assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The assessment should include detailed damage information as well as recommended repair and salvage options. The level of

PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

Vessel Salvage– Ability to salvage a vessel that was involved in an incident such as an explosion, grounding, collision, or any other incident that puts the vessel in an unstable or unseaworthy condition. The salvage assessment may have to take place with the vessel and surrounding environment being contaminated with hazardous materials, such as oil, chemicals, biological or radiological agents. The salvage assessment should include detailed damage information as well as recommended salvage options. The level of PPE for the assessment team should meet all NFPA and OSHA requirements for the incident and surrounding contamination.

Vessel Plugging and Patching Capability – Ability to provide necessary personnel and materials to adequately plug and patch a vessel to secure the flooding and prevent the vessel from sinking.

Diving Expertisee – Ability to provide diving services to meet the needs of the particular incident. Capability should include scuba diving, deep water diving, decompression capability, and any other diving related services that are required under pertinent regulations dealing with safe diving practices. Capability should also include the ability to dive into an environment contaminated with hazardous materials, such as oil, chemicals, or radiological agents.

Spill Containment and Recovery

Search and Recovery (Nuclear Material) – Ability to provide qualified personnel, equipment and supplies to safely conduct search and rescue operations at an incident site that has been contaminated with nuclear or radiological agents.

Discharge/Release Containment Operations – Ability to provide qualified personnel and necessary containment equipment to respond to an oil or chemical incident, as outlined in pertinent Federal and State regulations. For biological or radiological incidents, the ability to identify, isolate and contain contaminated personnel that have been impacted by the particular agent.

Debris Removal – Ability to provide personnel, equipment and certified DOT transporters to safely remove debris from the incident site to a properly designated storage facility or temporary storage location outside the impacted area.

Contaminated Debris Removal – Ability to provide personnel, equipment and certified DOT transporters to safely remove contaminated debris from the incident site to a properly designated storage facility or temporary storage location outside the impacted area. Contaminated debris may include that which has been exposed to oil, chemical, biological and/or radiological contaminants.

Bulk Liquid Off-Loading Capability – Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to another off-shore vessel, on-shore vessel, or on-shore facility. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.

> ***On-Shore Vessel/Facility*** – Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to an on-shore vessel, or on-shore facility. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.
>
> ***Off-Shore Vessel*** – Ability to provide necessary personnel and equipment to off-load or discharge the bulk liquid cargo or fuel oil from a vessel to another off-shore vessel. Operation must be conducted in accordance with pertinent Federal and State regulations surrounding bulk liquid transfers.

Discharge/Release Recovery Operations – Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.

> ***On-Shore Vessel/Facility*** – Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment from an on-shore vessel or facility. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.
>
> ***Off-Shore Vessel*** – Ability to provide necessary personnel, equipment and supplies to respond to and recover the spilled product and associated wastes from an oil discharge into a navigable water or chemical release into the environment from an off-shore vessel. Response and recovery operations must be conducted in accordance with pertinent Federal and State regulations.

On-Water Storage Capability – Ability to provide necessary on-water equipment, such as barges or tank vessels, and qualified personnel to operate the on-water equipment to adequately store recovered oil or chemical products from a spill incident.

Environmental Assessment and Mitigation

Wildlife Impact Assessment and Rehabilitation – The present evaluation of an ecosystem, including how that ecosystem would be affected by a change in the environment, and the steps that could be taken to restore an ecosystem to as-near-as-possible its pre-incident condition, or to a condition where it can recover on its own.

Shoreline Impact Assessment – Ability to assess the current status of a coastal ecosystem and how that ecosystem is being affected or could be affected by change.

Historical and Archeological Properties Expertise – Having the skill, knowledge, and experience to assess those landmarks, buildings, or land areas that had important impacts on the course of history, including ancient cultures. Preservation of such properties is a priority following immediate response for care of human life and health.

Overflight Assessment – Ability to evaluate an impacted area, which could include a geographical survey of the site and possible monitoring using advanced detection instruments, via means of aviation.

Site Characterization

Monitoring – Ability to detect the presence of and regularly scrutinize levels of known or unknown liquids, solids, gases, or vapors. This can include the use of advanced detection equipment to provide standard confined space and accumulative readings in order to identify and establish the exclusion zones after contamination spread.

Sampling – Ability to conduct standard evidence collection protocols consisting of capturing and collection, containerizing and proper labeling, and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis.

Modeling – Ability to develop mathematical models used to predict the effects of a hazardous material release. This includes tabular and graphical summaries of the rate of release, simulated model results, and emissions and meteorological inputs and predictions.

Site Remediation/Site Cleanup

Transportation and Disposal of Waste – Ability to provide DOT-certified hazardous waste transportation haulers to transport oil, chemical, biological, or radiological wastes to a properly designated storage and disposal facility or a temporary storage and disposal facility.

Spill Source and Content Analysis

Product Hazards Analysis – Ability to evaluate the origin from which an oil or chemical product was derived and the content of the product released in order to obtain information regarding its components**.**

Radionuclide Analysis – Ability to detect and evaluate accurately the amount of radioactivity found in the hazardous material released. Analysis would include a geographical survey search of the suspected radiological source or contamination spread and may be conducted using radiation detection devices, such as accumulative self-reading instruments (dosimeters).

Public Affairs

Public Affairs Support – Ability to provide public affairs personnel, joint information center support, and any other support to adequately cover information requirements from an incident. Support can be in the form of on-scene services to the local responders or via telephone from a remote or regional location.

Risk Communication – Ability to provide appropriate risk communications to on-scene personnel responding to an incident. Risk communications can include information on risk assessments, remediation options, vulnerability assessments and consequence analysis. This information should routinely be provided to first responders and other emergency planners to assist them in developing appropriate emergency response plans and identifying pertinent remediation strategies.

Public Health and Safety

Public Health Expertise/Assessment – Ability to evaluate overall public health response, including assessing possible toxic environmental and public health hazards to the surviving population; serve as health/medical subject matter experts; and determine specific health and medical needs and priorities, including assessment of the health system/facility infrastructure.

On-Scene Medical Support – Ability to triage and treat casualties in the disaster area, including medical or surgical stabilization and continued monitoring and care of patients, until they can be transported or evacuated to locations where they will receive definitive medical care. This could involve provision of health and medical equipment and supplies, including pharmaceuticals, biologic products, and blood and blood products.

First Aid/Medical Capabilities – Ability to provide emergency medical treatment for a victim of sudden illness or injury until more thorough or skillful medical treatment is available. This could include care for patients with, among other conditions, asphyxiation, cardiopulmonary arrest, minor to severe bleeding, burns, fainting, unconsciousness, and those in a state of coma.

Mass Decontamination – Ability to decontaminate large numbers of population (civilians, first responders, medical personnel, etc.) when exposed to a particular contaminant that exceeds the designated (NIOSH, EPA, OSHA) safe limits for humans. Capability should include the ability to provide the necessary equipment, supplies and personnel to perform the work.

Mortuary Capabilities – Ability to provide temporary morgue facilities; victim identification by fingerprint, forensic dental, and/or forensic pathology/anthropology methods; and the processing, preparation, and disposition of remains.

Water Decontamination and Protection – Ability to reduce and prevent the spread of contamination within drinking water, wastewater and publicly used water sources at a hazardous materials incident by physical and/or chemical processes. Emergency response personnel should implement a thorough, technically sound decontamination procedure

until it is determined or judged to be no longer necessary. This also includes employing methods to ensure that water delivery facilities and structures are protected against further future decontamination.

Legal/Investigations

Investigations – Ability to provide qualified investigative personnel to determine the probable cause of an incident. Investigators should be qualified to conduct either a civil or criminal investigation, depending on the circumstances and evidence presented at the incident.

Analytical Capability

Field Analytical Screening – Ability to provide real time or quick results for various hazards/chemical or classifications of hazards/chemicals, the results of which typically possess lower degrees of qualitative and quantitative accuracy than analytical methods performed by fixed laboratories, may identify a group/type of hazard rather than a specific hazard, and are often subject to false positives.

Field Analytical Laboratory – Ability to use testing equipment which can provide quick results to accurately qualify and quantify hazards or chemicals present. In addition to using mobile equipment, field analytical methods often consist of some type of sample preparatory method and higher detection limits and lower data quality than fixed laboratory methods.

Fixed Analytical Laboratory – Employment of methods which require a high degree of accuracy and precision, results of which could take several days, and are performed under controlled conditions by experienced technicians.

Contract Analytical Laboratory – Both fixed and field laboratories, which can be contracted to analyze the presence and concentrations of hazards and chemicals.

Data Quality Analysis – Ability to evaluate the usability of a sample's results for decision making from both a qualitative and quantitative perspective.

Contractual Support

Contractor Supervising/Monitoring – Ability for the contractor to adequately supervise and monitor the activities surrounding all response operations to oil, chemical, biological or radiological incidents. These activities will be conducted in all control zones (hot, warm, cold), as outlined in NFPA standards. Must be capable of providing qualified personnel; necessary equipment and supplies; and adequate PPE to conduct the supervisory and monitoring services.

Resource/Cost Documentation Expertise – Ability to provide cost documentation services (personnel and materials) in accordance with regulations and other requirements established by the particular statute and fund manager.

Additional Definitions

Chemical-Commercial – A chemical substance used in industry that, if released from proper storage and containers, can kill, seriously injure, or incapacitate people through its physiological effects, and/or may have negative effects on the health of an environment or ecosystem.

Chemical-Warfare Agent – A chemical substance (such as nerve agent, blister agent, blood agent, choking agent, or irritating agent) often used in military operations to kill, seriously injure, or incapacitate people through its physiological effects.

Biological – Living organisms or the materials derived from them (such as bacteria, viruses, fungi, and toxins) that cause disease in or harm to humans, animals, or plants, or cause deterioration of material.

Radiological – Any material that spontaneously emits ionizing radiation.

Nighttime Capability – Use of equipment to increase optical capability in the dark. Such equipment can range from high-powered flashlights to night vision goggles, scopes, binoculars, monoculars and other such devices.

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Appendix D: Acronyms

A

ALOHA	Arial Location of Hazardous Atmospheres
ADIOS	Automated Data Injury for Oil Spills
APD 2000	Advanced Portable Detector
ASAC	Assistant Special Agent in Charge
ASCLD/LAB	American Society of Crime Laboratory Directors/Laboratory Accreditation Board
ATSDR	Agency for Toxic Substances and Disease Registry (HHS)

C

CADD	Computer Aided Design and Drafting
CAMEO	Computer-Aided Management of Emergency Operations (EPA)
CBIRF	Chemical Biological Incident Response Force (USMC)
CBRNE	Chemical, Biological, Radiological, Nuclear, or High Yield Explosive
CDC	Centers for Disease Control and Prevention (HHS)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CLP	Contract Lab Program
CSP	Certified Safety Professional
CST	Civil Support Teams (National Guard)

D

DoD	Department of Defense
DOE	Department of Energy
DOE NEST	Department of Energy Nuclear Emergency Support Team
DOE-NLs	Department of Energy National Laboratories
DOE RAP	Department of Energy Radiological Assistance Program

E

ECOT	Emergency Communications and Outreach Team (EPA)
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
EPA ERT	U.S. Environmental Protection Agency Environmental Response Team
EPA OECA/NCERT	U.S. Environmental Protection Agency Office of Enforcement, Compliance, and Assurance, National Counter-terrorism Evidence Response Team

EMSL	Environmental Monitoring Systems Laboratory (EPA)
EPIC	Environmental Photographic Interpretation Center (EPA)
EPO	Epidemiology Program Office (CDC)
ERC	Environmental Response Center (EPA)
ERC	Emergency Response Coordinator (ATSDR)
ERT	Environmental Response Team (EPA)
ESF	Emergency Support Function

F

FBI	Federal Bureau of Investigation
FBI HMRU	Federal Bureau of Investigation, Laboratory Division Hazardous Materials Response Unit
FDA	Food and Drug Administration
FID	Flame Ionization Detector
FOSC	Federal On-Scene Coordinator
FRP	Federal Response Plan
FRPCC	Federal Radiological Preparedness Coordinating Committee

G

GC	Gas Chromatography
GCMS	General Circulation Models
GEO-PROBE	Hydraulically-powered percussion/probing machine designed specifically for use in the environmental industry
GNOME	General NOAA Oil Modeling Environment
GPM	Gallons per minute

H

HASP	Health and Safety Plans
HAZCAT	Hazard Categorization Test
HAZMAT	Hazardous Materials
HAZMAT	Hazardous Materials Response Division (NOAA OR&R)
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHS	Department of Health and Human Services
HMRU	Hazardous Materials Response Unit (FBI)
HRSA	Health Resources and Services Administration (HHS)
HRT	Health Response Team (OSHA)
HSP	Homeland Security Program

I

IBRRC	International Bird Rescue Research Center
ICS/UC	Incident Command System/Unified Command
IDLH	Immediate Danger to Life and Health
IED	Improvised Explosive Device
IO	Information Officer
IR	Infrared

J

JDOMS	Joint Directorate of Military Support
JIC	Joint Information Center

L

LSU	Louisiana State University
LAB	Laboratory Accreditation Board (ASCLD)

M

MD	Medical Doctor
MMRS	Metropolitan Medical Response System (DHS/FEMA)
MMST	Metropolitan Medical Strike Team
MSL	Marine Safety Lab

N

NBC	Nuclear, Biological, Chemical
NCEH	National Center for Environmental Health
NCERT	National Counter-Terrorism Evidence Response Team (EPA)
NCP	National Contingency Plan
NEST	Nuclear Emergency Support Team (DOE)
NIFC	National Interagency Fire Cache
NIOSH	National Institute for Occupational Safety and Health (CDC)
NIRT	Nuclear Incident Response Team
NMCC	National Military Command Center
NMFS	National Marine Fisheries Service (NOAA)
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NPFC	National Pollution Funds Center (USCG)
NRDA	Natural Resource Damage Assessment
NRS	National Response System
NSF	National Strike Force (USCG)

O

OAR	Oceanic and Atmospheric Research
OCEFT	Office of Criminal Enforcement, Forensics, and Training (EPA)
OECA	Office of Enforcement, Compliance, and Assurance (EPA)
OPA	Oil Pollution Act
ORD	Office of Research and Development (EPA)
OR&R	Office of Response and Restoration (NOAA)
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSHA HRT	Occupational Safety and Health Administration Health Response Team
OSTLF	Oil Spill Liability Trust Fund

P

PAO	Public Assistance Officer
PCR	Polymerase Chain Reaction
Peer Support/CISM	Emergency Response Peer Support and Critical Incident Stress Management Team (EPA)
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
POC	Point of Contact
POSSE	Program of Ship Salvage Engineering

Q

QC	Quality Control

R

RAP	Radiological Assistance Program (DOE)
RCMS	Removal Cost Management System
REAC	Response Engineering and Analytical Contract
RERT	Radiological Emergency Response Team (EPA)
ROV	Remotely Operated Vehicle
RPM	Removal Program Manager
RR	Rapid Response Program (USACE)

S

SAC	Special Agent in Charge
SAMHSA	Substance Abuse and Mental Health Services Administration (HHS)
SARA	Superfund Amendments and Reauthorization Act

SECDEF	Secretary of Defense
SHMED	State Hazardous Materials Enforcement Development Program (DOT)
SMART	Special Monitoring of Advanced Response Technologies
SSC	Scientific Support Coordinator
SSO	Site Safety Officer
SUPSALV	Supervisor of Salvage and Diving (U.S. Navy)
SWAT	Special Weapons and Tactics

T

TAGA	Trace Atmospheric Gas Analyzer

U

UOC	USACE Operations Center
USACE	U.S Army Corps of Engineers
USAID	U.S. Agency for International Development
USMC	U.S. Marine Corps
USAMRIID	U.S. Army Medical Research Institute of Infectious Diseases
USCG	U.S. Coast Guard
USCG NSF	U.S. Coast Guard National Strike Force
US&R	Urban Search and Rescue
USFWS	U.S. Fish and Wildlife Service (DOI)
UWSH	Underwater Ship Husbandry Division (SUPSALV)

W

WHO	World Health Organization
WMD	Weapons of Mass Destruction

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NRT Quick Reference Guide: Lewisite (L-1)

NRT Quick Reference Guide: Lewisite (L-1)

GHS: Acute Toxicity, Category 1
H310 – Fatal in contact with skin
H330 – Fatal if inhaled

GHS: Eye Damage/Irritation, Category 1
H318 – Causes serious eye damage

1. Agent Characteristics

Agent Characteristics

Agent Classification: Schedule 1 Chemical Warfare Blister (Vesicant) Agent; Lewisite (L); **CAS:** 541-25-3

Description: Lewisite (L) is referred to as L-1 and is an oily, colorless, and odorless liquid. When impure, it is a yellow brown through violet-black liquid with a strong penetrating geranium odor. The manufacturing process affects physical properties, appearance, persistence, and analytical detection limits. Lewisite is often referred to as L-1, and with common impurities includes two related compounds, lewisite 2 (L-2) and lewisite 3 (L-3). This QRG is based on L-1 but includes aspects of L-2 and L-3 and will use "L-1" as the collective abbreviation.

L-1 is a blister (vesicant) agent that produces immediate burning pain with blistering starting within a few hours. L-1 is less volatile than Sarin (GB); it is much more volatile than persistent agents VX or HD. Environmental breakdown of L-1 is primarily due to hydrolysis, which is pH dependent, with hydrolysis products of L-1 easily formed. These include hydrochloric acid (HCl) and highly toxic arsenic (III) compounds, such as 2-chlorovinyl arsenous acid (CVAA), 2-chlorovinylarsenious oxide (lewisite oxide), and arsenites; some of which cause blistering similar to L-1. Oxidative decontamination byproducts of L-1 include arsenic (V) compounds, which are generally less toxic than arsenic (III) compounds but may still be considered hazardous.

Persistence: L-1 is considered a "low to moderate persistent" chemical warfare agent. Vapor: minutes to hours; liquid: hours to days. Persistence will depend upon the amount and purity of the agent, method of release, environmental conditions, and the types of surfaces and materials impacted. L-1 remains a liquid at low temperatures and is persistent in colder climates. **Many vesicant and toxic environmental breakdown products and decontamination byproducts are persistent.** Under certain environmental conditions, when protected from environmental degradation processes, L-1 breakdown products may persist in soils for decades. Porous, permeable, organic, or polymeric materials such as carpets, vinyl tiles, and painted surfaces can accumulate L-1 vapors and liquids, acting as "sinks," thereby prolonging persistence.

2. Physical Properties

Physical Properties

Molecular Weight: 207.32 g/mol	**Formula:** $C_2H_2AsCl_3$
Vapor Density: 7.1 (air = 1)	**Flash Point:** Not established
Vapor Pressure: 0.58 mm Hg (77°F/25°C)	**Liquid Density:** 1.89 g/mL (77°F/25°C)
Volatility: 4,480 mg/m^3 (68°F/20°C)	**Melting/Freezing Point:** 32.2°F/0.1°C
Boiling Point: 374-378°F/190-192°C	**Non-aqueous Solubility:** Common organic solvents, alcohols, gasoline, oils, fats
Hydrolysis ($t_{1/2}$): Rapid for vapors or dissolved L-1 but limited by low aqueous solubility	**Aqueous Solubility:** 0.5 g/L (temperature not reported), to slightly soluble

Note: physical properties are listed at/near STP unless otherwise indicated.
Conversion Factors for L-1: ppm = mg/m^3 x 0.1179; mg/m^3 = ppm x 8.481

3. Release Scenarios

Release Scenarios

AIR RELEASE SCENARIOS ARE ASSUMED MOST PROBABLE; HOWEVER, OTHER RELEASE SCENARIOS AND EXPOSURE ROUTES SHOULD BE CONSIDERED.

Open Areas: Due to its volatility, L-1 could be dispersed as a vapor or liquid spray (aerosol), and the primary release/attack scenario is an airborne release. L-1 is expected to degrade in the environment fairly rapidly; however, liquid L-1 on surfaces generally persists for hours to days. Environmental conditions will affect the degradation and evaporation rates of L-1 with cooler and drier conditions enhancing persistence. **L-1 has a melting/freezing point at 0.1°C (32.2°F), so the reaerosolization of liquids and solids, as ambient temperatures rise, may present an inhalation hazard.** L-1 vapors are heavier than air, so vapors can accumulate in lower terrains.

Water/Water Systems: L-1 released into water will likely hydrolyze within a few hours into vesicant and toxic compounds, which may persist for days to weeks. If released into water systems such as reservoirs, treatment plants, distribution systems, public fountains or pools, their treatment processes may result in further reaction with L-1. Water systems, plumbing, surfaces, and equipment that have contacted contaminated water must be evaluated for decontamination along with the bulk water.

Indoor Facility: Due to its volatility, L-1 could potentially be dispersed as a vapor or liquid spray (aerosol), inside a building or facility; HVAC systems could be impacted. L-1 vapors are heavier than air so vapors can accumulate in lower levels, basements, floor drains, or utility corridors inside the buildings.

Other: L-1 is combustible; agent may burn but does not ignite readily. Fire may produce irritating, corrosive, and/or toxic gases. When heated, vapors may form explosive mixtures with air, presenting an explosion hazard indoors, outdoors, and in sewers. Containers may explode when heated. If L-1 is released into the air as a liquid spray (aerosol), it has the potential to contaminate agricultural products. If L-1 is released as a vapor, it is highly unlikely to contaminate agricultural products.

4. Health Effects

Health Effects

4.1. Onset: Onset of symptoms is rapid. Severity of effects depends on dose, duration, and route of exposure (not all signs/symptoms may develop). The effects caused by L-1 are immediate but are not typically fatal; however, secondary infections from blisters/tissue damage may be fatal and can require substantial supportive medical care. L-1 can cause immediate eye pain and eye/skin/respiratory tract irritation. L-1 can cause skin redness within 15-30 minutes. Blister formation and deep skin burns are approximately 12 hours post-exposure. Eye lesions are very serious resulting in blindness unless decontamination is very prompt.

4.2. Signs/Symptoms: Initial symptoms will vary depending on dose and exposure route (see EXPOSURE ROUTES section below). The following is a general list of possible symptoms. The severity of effects depends upon the dosage.

Mild to Moderate: Immediate stinging and burning pain and strong irritation of eyes, tear production, spasmodic blinking, swelling and fluid accumulation in the eye membranes and eyelids, and inflammation of the cornea. Irritation of mucous membranes in the nose and lower airways, immediate burning nasal pain, violent sneezing, nosebleed, sinus pain, inflammation of the voice box, cough, and difficulty breathing or shortness of breath. Immediate stinging and burning pain or irritation of skin, redness, delayed blistering with pain, and itching.

Severe: Blistering and scarring of the cornea, rupture of the eye, and blindness. Inflammation of the lungs, accumulation of fluid in the lungs, respiratory failure, and death. Severe blistering and severe burns on skin.

4.3. Exposure Routes:

Inhalation: Vapor is absorbed through mucous membranes (mouth, nose, throat, lungs).

Skin: Direct contact with liquid or vapor causes immediate effects.

Eyes: Eyes are the most sensitive to L-1 vapors. Vapors are absorbed through mucous membranes. Symptoms occur immediately. Rapid decontamination (within minutes of exposure) using copious amounts of water is the only way to limit eye injury.

Ingestion: Consumption of contaminated food or drink could cause burning, nausea, and vomiting.

5. Effect Levels

Effect Levels

Air (inhalation vapor hazard): Acute Exposure Guideline Levels (AEGLs) for general population one-time exposure emergency scenarios for L-1 (complete definitions are available at: https://www.epa.gov/aegl). NA = Not available.

AEGL Level in mg/m^3, at various exposure durations for L-1	**10 min.**	**30 min.**	**1 hr.**	**4 hr.**	**8 hr.**
AEGL 1: Threshold mild effects	NA	NA	NA	NA	NA
AEGL 2: Potentially irreversible effects or impaired ability to escape	1.3	0.47	0.25	0.070	0.037
AEGL 3: Threshold for severe effects/medical needs/increasing potential for lethality	3.9	1.4	0.74	0.21	0.11

American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPG™) are not established/determined for L-1.

6. Exposure Guidelines

Exposure Guidelines

6.1. Airborne Exposure Limits (AELs): CDC has issued recommendations for protecting human health from potential adverse effects of exposure to this agent. (NA = not available)
(refer to: NIOSH ERSH-DB, https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750006.html)

CDC/National Center for Environmental Health (NCEH) IDLH = NA
DOD/Army IDLH Equivalent = 0.36 mg/m^3; proposed value for Pine Bluff but considered a safe estimate for other IDLH applications. Workers should remove themselves immediately from exposure if the concentration is reached at any point in time. [original source: Army OTSG memorandum, New Immediately Dangerous to Life and Health (IDLH) Concentration Level for Lewisite (August 24, 2009)]

CDC/NCEH STEL = NA

CDC/NCEH Worker Population Limit (WPL) = 0.003 mg/m^3 **

CDC/NCEH General Population Limit (GPL) = 0.003 mg/m^3 **
** the value 0.003 mg/m^3 is a detection value that can be used as safe level for all civilian worker and general population exposures including long term. These L-1 values for WPL and GPL are based on detection limit and are not health-based. [original source: NCEH, Final Recommendations for Protecting Human Health and Safety against Potential Adverse Effects of Long-term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, T), and Lewisite (L-1); 53 FR 8504-8507 (March 15, 1988); (corrected in 53 FR 11002 (April 4, 1988))]

6.2. Occupational: (NA = not available)

NIOSH IDLH = NA	**OSHA PEL** = NA
NIOSH REL-TWA = NA	**ACGIH TLV-TWA** = NA
NIOSH REL-STEL = NA	**ACGIH TLV-STEL** = NA

Arsenic: Refer to site-specific HASP for any occupational exposure guidelines for arsenic relevant to response activities. (for more information on arsenic, see NIOSH Pocket Guide to Chemical Hazards: Arsenic, inorganic compounds (as As), https://www.cdc.gov/niosh/npg/npgd0038.html).

6.3. Population:

Soil: USAPHC Health Based Environmental Screening Levels (HBESL) = 3.7 mg/kg over work life for Industrial Soil; 0.3 mg/kg over lifetime for Residential Soil.

Drinking Water: EPA Provisional Advisory Levels (PALs): see below for more information.

EPA Provisional Advisory Level (PAL): PALs represent chemical concentrations in air or drinking water above which varying health effects (PAL1, PAL2, PAL3) are expected. They are developed for 24-hour, 30-day, and 90-day exposure durations. In the event of a nationally significant or large-scale chemical release, EPA can provide PALs, if available, to appropriate end-users and stakeholders as needed (PALs are not currently available to the public) to assist in response decision-making. Contact: PALs@epa.gov, for information on and access to the PALs. (Note: PALs are not intended to define cleanup levels.)

7. Personnel Safety

Personnel Safety

Note: Personal Protective Equipment (PPE) selection (Levels A-D), medical surveillance requirements, First Aid options, and personnel decontamination may vary depending upon the amount and purity of agent, site conditions, and the release scenario. Additional information on personnel safety and PPE selection criteria can be found at: www.cdc.gov/niosh/ershdb. We also recommend that responders check their own internal procedures (i.e., SOPs), if applicable.

7.1. Medical:

Pre-incident: Must have current medical and respiratory clearances as part of an Occupational Medical Surveillance Program according to OSHA HAZWOPER and Respiratory Protection Program, as per 29 CFR 1910.

During Incident: Conduct periodic on-site medical monitoring, observe for any signs and symptoms as per HEALTH EFFECTS section above and treat accordingly as per First Aid section below.

Post-incident: Perform post-incident medical surveillance, as per 29 CFR 1910. Because health effects may not occur until several hours after exposure, patients/victims should be under medical surveillance for at least 24-48 hours.

7.2. First Aid: Immediately remove person from affected area and remove contaminated clothing and articles. Wash bare skin immediately with water, or warm, soapy water if available, at normal household pressures (~50-60 psi) for three minutes, ensure thorough soaking. Rinse eyes exposed to agent (liquid or vapor; eyes are especially sensitive to L-1) with potable water for at least 15 minutes. If irritation or pain is severe or persists, prolonged eye washing is advised. Do not cover eyes with bandages. Seek immediate medical attention.

Antidote: Dimercaprol (a.k.a. British Anti-Lewisite (BAL)). Dimercaprol is currently used in hospital settings for arsenic poisoning. Antidote should only be administered in a hospital setting. Dimercaprol is given by intramuscular injection as an antidote for whole body (systemic) health effects of arsenic/L-1 poisoning but has no effect on local blisters or lesions of the skin, eyes, or airways**.**

Other: RSDL (Reactive Skin Decontamination Lotion), an FDA-cleared kit with a sponge impregnated with a lotion to remove or neutralize chemical warfare agents from contaminated skin. Apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits. **NOTE: no citations were currently found for the efficacy of RSDL specifically for L-1, but the application methods and decontamination materials present in RSDL may be useful to neutralize L-1 exposure on skin.**

After administering first aid, send person for follow-up medical attention and evaluation. If cleared to resume work, continue to monitor for signs/symptoms and treat accordingly.

7.3. Personal Protective Equipment (PPE):

GENERAL INFORMATION: NIOSH Approved® Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA), NIOSH Approved Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR), full-face masks, and protective clothing should be used. Level A protection should be used until monitoring

results confirm identity and concentration of contaminant. Pre-incident training and exercises on the proper use of PPE are recommended.

Per NIOSH guidance –

LEVEL A: Recommended for the initial response to an L-1 incident. NIOSH Approved CBRN full-face-piece SCBA operated in pressure-demand mode with Level A suit that provides protection against CBRN agents. Level A provides the greatest level of skin (totally encapsulating chemical protective suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank), respiratory (SCBA), and eye protection when the contaminant identity or concentration is unknown. Select Level A when the L-1 concentration is unknown or above the IDLH or AEGL-2, and when there is a potential of ocular or dermal exposure.

LEVEL B: Pressure-demand SCBA (NIOSH Approved CBRN full-face-piece SCBA) with Level B protective suit that provides protection against CBRN agents. Level B provides the highest level of respiratory protection (SCBA) when a lesser level of skin protection is required. Select Level B when the L-1 concentration is unknown or above the IDLH or AEGL-2, and when dermal exposure is less of a risk. Level B differs from Level A in that it typically incorporates a non-encapsulating, splash-protective, chemical-resistant outer suit that provides protection against most liquids but is not vapor tight (hooded chemical-resistant outer suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank). **The Level B PPE dress-out for L-1 should be modified to ensure there is no exposed skin or potential for ocular exposure.**

LEVEL C: May be selected when the contaminant identity and concentration are known and the respiratory protection criteria factors for the use of APR or PAPR (i.e., < IDLH, warning properties) are met. Level C may be appropriate when decontaminating personnel or equipment. Level C still incorporates hooded chemical-resistant outer suit that provides protection against CBRN agents, chemical-resistant inner and outer gloves, and chemical-resistant boots with steel toe and shank.

- For air levels greater than AEGL-2: NIOSH Approved CBRN tight-fitting PAPR with a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator.
- For air levels greater than AEGL-1: NIOSH Approved CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR.

LEVEL D: Select Level D when the contaminant is known, and the concentration is below the appropriate occupational exposure limits or less than AEGL-1 for the stated duration times. PPE includes coveralls or other work clothes, boots, and gloves.

Downgrading PPE levels can be considered only by the site Health and Safety Officer when the identity and concentration of the contaminant and the risks of dermal exposure are known and must be accompanied by on-site monitoring. The on-site availability of any applicable medical countermeasures should also be considered when deciding to downgrade PPE during a CBRN response.

8. Personnel Decontamination

Personnel Decontamination

8.1. Personnel Decontamination Procedure:

Tents, berms, and collection vessels should be able to maintain copious amounts of wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decontamination process as well as replace necessary chemicals and decontamination solutions.

Prior to entering the hot zone, all personnel are required to familiarize themselves with the site-specific personnel decontamination procedures.

Personnel decontamination should take place in a decontamination area comprised of two decontamination corridors (one for entering and one for exiting). Position corridors upwind and uphill of release area; exit should be upwind and uphill of entrance. Detergent and water solution (pH>8, but <10.5), soft brushes, and durable 6-mil polyethylene bags should be provided.

Personnel decontamination area workers need to wear appropriate PPE as indicated below. Be aware that absorbed agent can be released from clothing and skin as a vapor. Decontamination wash water (effluent) will contain arsenic. Do not release the wash water (effluent) to the environment. See Section 15.2 below for additional guidance on waste management. Arsenic may be toxic to wastewater treatment plant (WWTP) microorganisms. Only discharge non-RCRA hazardous effluent to a WWTP after approval by the WWTP owner/manager.

Conduct personnel decontamination per NIOSH ERSH-DB:
https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750006.html

- Emergency Responders: Use soft brush to wash PPE with soap and detergent solution in a downward motion, getting into all folds. Repeat washing and rinsing until thoroughly clean. Remove PPE by rolling downward from head; avoid pulling PPE over the head. Remove SCBA last, and place all PPE in polyethylene bags.
- Patient/victim: Remove all clothing down to at least undergarments, and place in polyethylene bags. Thoroughly wash and rinse skin with soap and water solution, taking care not to break the skin and covering all open wounds. Cover patient/victim (e.g., blanket, towels, Tyvek) and move to treatment area. If available in decontamination kit, apply

RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

8.2. Personnel Decontamination Procedures by Zone/Step: (attendants will verbally direct personnel through each step)

Conducted in Hot Zone (exclusion zone)

1	Equipment Drop	Place equipment taken into the Hot Zone on a plastic covered table or container provided prior to entering the contamination reduction corridor. Equipment will either be reused if more than one entry is planned or will be decontaminated later.

Conducted in Warm Zone (contamination reduction zone)

2	Sample Drop	Place samples in a container provided for sample decontamination. Care needs to be taken to ensure that workers maintain chain-of-custody of samples. It is recommended that samples are decontaminated in a separate decontamination line.
3	Outer Boot and Glove Wash	The purpose of this step is to enable physical removal of gross contamination if contamination is visible. If gross contamination is not visible, this step may be skipped. Wash outer boots and then outer gloves using designated decontaminating agents as specified in HASP (e.g., soap and water, trisodium phosphate substitute, or diluted bleach).
4	Glove, Boot, and Suit Wash	Wash all outer surfaces in a contained area (e.g., kiddie pool) using a pressurized spray with designated decontamination solution. Start with decontaminating boots and gloves, then work on suit from the top down, including SCBA/PAPR casing. Decontamination personnel should conduct this step. Care should be taken to ensure that all areas are decontaminated, including around zipper, arms, front torso, and any other area that could have come in contact with contamination. The solution used for decontamination should be contained, collected, and disposed of properly from the decontamination line.
5	Outer Glove, Boot, and Suit Removal	While sitting on a stool, remove outer boots and outer gloves. Undo the SCBA/PAPR belt and hold in hand. While touching only the inside of suit, carefully roll suit in an outward motion from shoulders down to feet. Dispose of boots, gloves, and suit in a designated container. This step may require decontamination personnel to assist either by holding SCBA/PAPR unit or assisting in suit removal.
6	Mask Removal	With inner gloves, remove the mask. Remove cartridge filters and place into designated container. Put mask into mask wash. Decontamination personnel will clean each mask and SCBA/PAPR assembly prior to return to service.
7	Inner Glove Removal	Remove inner gloves by only touching outside of first glove and then only inside of second glove. Place gloves into designated container.

Conducted in Cold Zone (support zone)

8	Quadrant Monitoring	Using appropriate L-1 air monitoring equipment, screen personnel for residual contamination by dividing body into 4 sections: upper right and left sides of the body, and lower left and right sides. If positive, perform spot decontamination immediately and direct person to showers.
9	Personal Shower	Personnel should shower using copious quantities of soap and water for a minimum of 5 minutes and change into clean clothes. If a personal shower is not immediately available then, at the minimum, hands and face should be washed thoroughly.
10	Medical Monitoring	Report to medical monitoring station for post-entry monitoring and report to appropriate personnel for debriefing. Observe for any obvious sign of L-1 exposure. Using criteria listed above in PERSONNEL SAFETY section of this QRG, administer RSDL and notify site Health and Safety officer.

Emergency Egress Corridor: Establish an emergency egress line to use for quickly decontaminating personnel who have medical emergencies while in the hot zone. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital.

Hand-Wash Station: A hand-wash station with soap and water should be available for personnel to clean up or physically remove any residual decontaminant following entry. If a hand-wash station is not initially available or weather conditions prohibit its use, personnel should wash their hands and face as soon as possible.

Caution: Avoid waterless hand cleaners, which contain solvents (alcohols) that could increase risk of dermal exposure to L-1.

9. Field Detection

Field Detection

Real-time field screening tools (results not confirmatory or quantitative): Caution should be given to equipment that has not been properly evaluated. False positive and false negatives may occur in the presence of interferents common in the environment. The following is a summary of minimum screening concentration ranges or levels for equipment procured by many EPA and HAZMAT response teams. Other screening tools may be used by these teams and other agencies and responders, some with similar capabilities and limitations.

9.1. Minimum Screening Ranges/Levels for Air/(Vapor):

Field Equipment:	ppm	mg/m^3
JCAD M4A1, at 10 secs [30 mins/pre-concentrator]	0.23-5.9	2-50
AP2C / AP4C (AP2C does not detect As or L-1)	ND / 0.15-1.5 (as Arsenic)	ND / 0.5-13 (as Arsenic)
MX-908 Vapor Mode	NA	NA
Dräger (CDS Kit) / CDS I as Arsine or organic Arsenic	0.1 Arsine / 0.35 organic Arsenic	0.35 Arsine / 3.0 organic Arsenic

MINICAMS™ (Near real-time; at 5 minutes)	0.00035	0.003

Note: ND = not detectable; NA = not available

9.2. Minimum Screening Ranges/Levels for Vapor/Liquid:

Field Equipment:	**ppm** (vapor)	**mg/m^3** (vapor)	**mL** (liquid)
M256 / M256A1 (as blister only, up to 6 mins below 50° F)	1.1	9-14	0.020 (via M8 paper)
M8 (as blister only)	NA	NA	0.020

Note: M256 is combined 2 kits with 12 disposable sampler/detectors for vapors and a booklet of M8 paper for liquids.
NA = not applicable

9.3. Minimum Screening Ranges/Levels for Water:

Field Equipment:	**mg/L**
M272	0.1-2

10. Environmental Sampling

Environmental Sampling

Note: This section on sampling contains general guidelines and does not replace the need for a site-specific sampling plan

10.1. Sampling Concerns: Detection, sampling equipment and procedures, and analytical techniques will be site-specific and depend on: 1) physical state of the agent; 2) type of surfaces contaminated (e.g., porous vs. non-porous); 3) the purpose of sampling (e.g., characterization, decontamination efficacy, and clearance); and 4) specific laboratory requirements. The U.S. Environmental Protection Agency (EPA) has set up mobile and fixed labs and analytical assets for chemical agent analysis of environmental samples under their Environmental Response Laboratory Network (ERLN), see ANALYSIS section below, (https://www.epa.gov/emergency-response/environmental-response-laboratory-network). For questions on environmental sampling for L-1 call EPA/HQ-EOC at 202-564-3850.

10.2. Sample Locations and Planning: Initially consider air monitoring to ensure worker safety and to determine if there is a vapor plume that could impact other areas. Characterization sampling is initiated by targeted or judgmental sampling to identify "hot spots," potential agent flow paths, and media or objects potentially acting as sinks. Additional biased or random sampling can be used to determine the extent of potential contamination or to verify the efficacy of decontamination. More thorough probabilistic sampling (e.g., grid, statistical approach) may be required for the clearance phase or if there are large uncertainties about the area impacted or the amount released. Because L-1 has low to moderate persistence on surfaces, ambient air sampling to help to "clear areas" should be included in the sampling plan.

Note: L-1 breaks down in most environmental and decontamination conditions to numerous persistent toxic products, such as arsenites, lewisite oxide, and CVAA; some cause blistering similar to L-1. Because of low capacity for analysis that is specific for L-1 and L-1-related compounds, total arsenic (As) may be used as a marker to determine the extent of contamination of the parent L-1. Arsenic is prevalent in many environments; therefore, determining background As levels is recommended. See ANALYSIS section below to ensure sampling procedures are compatible with all analytes. Some preparation techniques for both L-1 and its breakdown products are available in EPA's Sample Information Collection Documents (https://www.epa.gov/esam/sample-collection-information-documents-scids). These provide general information regarding sampling procedures for different media, sampling supplies, sample size, container, holding time, preservation, packaging, and shipping, supporting collection of samples.

10.3. Types of Samples:

Air (Vapors are heavier than air): Samples are collected using appropriate solid phase absorbent media (tubes) or air sampler (e.g., SUMMA canister) at breathing zone level (~5 ft.) to assess inhalation exposure. To assess off gassing from surfaces and at ground levels, collect air samples at ~6 in. above the ground. Concurrent air sampling and monitoring of air and air particulates during response activities is recommended for both total As and L-1, using high-volume samplers or other appropriate equipment.

Water: Water should be collected in appropriate containers with addition of appropriate de-chlorinating agents and preservatives to minimize L-1 degradation and hydrolysis prior to analysis. Concurrent air monitoring for L-1 and total As is recommended.

Soil: For localized "hot spot" areas where soil deposition may occur (i.e., neat liquid, aerosol, or liquid droplets), surface soil samples should be taken from a non-vegetated area to a depth of less than one inch. Sub-surface soil samples are typically not necessary unless a large amount of liquid was poured on the ground, or if an underlying aquifer is endangered. Concurrent air monitoring for L-1 and total As is recommended.

Surface Wipes: Wipe samples are often desired to indicate absence of L-1 or total As on non-porous surfaces. Concurrent air monitoring for L-1 and total As is recommended.

Bulk: For hot spot areas where liquid L-1 deposition may occur on porous surfaces (e.g., concrete, asphalt), actual pieces (chips) or cores of contaminated surface may be obtained using appropriate tools (scabbling, coring, or drills) for subsequent laboratory extraction analysis for L-1 and total As. Bulk samples of suspected sink materials may be recommended to rule out secondary vapor phase disposition or absorption of L-1 and total As into these materials. Concurrent air monitoring for L-1 and total As is recommended.

Other Sample Matrices: Contact EPA/HQ-EOC at 202-564-3850 for sampling instructions.

11. Packaging/Shipping: CWA Environmental Samples for Site Characterization

Packaging and Shipping: CWA Environmental Samples For Site Characterization

The packaging and shipping of environmental samples potentially contaminated with a chemical warfare agent (CWA) would be subject to complex and restrictive regulations established primarily by DOT for ground transportation (49 CFR Parts 171-180), and by DOT, ICAO, and IATA for air transportation (in addition to other regulations by CDC, USPS, OSHA). Transportation of L-1-contaminated waste for treatment and disposal is covered under the WASTE MANAGEMENT section below.

Samples can be collected from environmental media that include surface and subsurface soil, groundwater, surface water, drinking water, dust, air, and solids other than soil (e.g., building materials). Given the wide range of potential environmental media and complex regulatory requirements, the approach would likely be situationally dependent.

CAUTION: Environmental samples potentially contaminated with CWA should not be introduced into commercial transportation as an undeclared hazardous material. Hazard classification, packaging, and hazard communication are the shipper's responsibility under DOT's Hazardous Materials Regulations (49 CFR Parts 171-180).

A summary of key packaging and shipping considerations for environmental samples with unknown concentrations of a potential unknown CWA is:

- Transport of pure L-1 is forbidden other than via military (Technical Escort Unit) transport in accordance with 49 CFR §173.7.
- If the collected sample contains or is suspected to contain hazardous materials, as defined in 49 CFR §171.8, the shipper must determine the appropriate UN ID Number, the Proper Shipping Name (PSN), and the Packing Group (PG) from the Hazardous Materials Table in 49 CFR §107.101. The table will then direct the shipper to the type of hazard and handling labels needed, the appropriate packaging (inner and outer packaging), and any special provisions.
- The designated shipper (EPA personnel or contractors) must be trained and certified according to the requirements found in 49 CFR §172.704 (a)(2) and/or by IATA Dangerous Goods (DG) 1.5 requirements for shipments by air.
- Contact the sample-receiving laboratory to determine if they have additional packaging, shipping, or labeling requirements.

Note that there is no UN ID for L-1 listed in the Hazardous Materials Table (49 CFR §172.101). Therefore, the most likely classification would be UN3381, Toxic by inhalation liquid, n.o.s. with an LC50 lower than or equal to 200 mL/m^3 and saturated vapor concentration greater than or equal to 500 LC50, PG I. In the US, non-bulk packaging would then be in accordance with 49 CFR §173.226.

Use of Mobile labs: Another consideration would be use of an on-site mobile laboratory for CWA analysis. This could eliminate the shipper's responsibility for transporting the collected samples containing a substance that might be considered forbidden for transport by air or a hazardous material or DG by ground or air transport to an off-site laboratory. In addition, there may be public concern about shipping samples off-site, or reluctance of commercial shipping companies to accept and transport samples from a known CWA-contaminated site. EPA maintains mobile laboratory assets (PHILIS mobile laboratories: https://www.epa.gov/emergency-response/philis-portable-high-throughput-integrated-laboratory-identification-system) in NJ and CO that are capable of analyzing CWAs, including L-1, in environmental matrices, down to health-based risk clearance levels. Access to the PHILIS mobile labs for a CWA incident can be obtained from EPA HQ/EOC at 202-564-3850. EPA also has access to the US Army CBRNE assets, including shipping and analysis, through inter-agency agreements as described in the COORDINATION WITH OTHER AGENCIES section below.

12. Analysis

Analysis

CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes and soil). Few laboratories currently have the capability to determine L-1, particularly for large numbers of samples and for the various types of environmental media. EPA's ERLN labs (https://www.epa.gov/emergency-response/environmental-response-laboratory-network) that are specially trained and equipped for the analysis of L-1, will use sample prep and analytical methods from EPA's Environmental Sampling and Analytical Methods (ESAM) Programs (https://www.epa.gov/esam). For access to the nearest ERLN laboratory specially trained and equipped for L-1 analysis, and methods provided in EPA's ESAM, contact EPA/HQ-EOC at 202-564-3850. The ERLN also maintains EPA's Compendium of Environmental Testing Laboratories (CETL), a database of commercial, federal, state, and academic laboratories, which can be queried for specific analyses and matrices. Analysis on environmental matrices for toxic organics, metals, biological and radiological agents, as well as several of the CWAs, including L-1 and its breakdown products, can be obtained by querying the database of laboratories listed in EPA's CETL (https://cfext.epa.gov/cetl/lblogin.cfm?action=None); prior registration for access to CETL website is necessary.

13. Coordination with Other Agencies: CWA Field Activities

Coordination With Other Agencies: CWA Field Activities

Numerous agencies other than EPA may be involved in a chemical agent response incident. Every attempt should be made to integrate assets and design a uniform approach to sampling procedures, quality assurance, and data sharing. Every

attempt should be made to coordinate activities, share data, and maintain chain-of-custody integrity throughout all phases of the response, amongst all agencies involved.

Civilian: The National Guard Civil Support Team (CST) and the U.S. Coast Guard "Strike Teams" deploy survey teams, response vehicles, and mobile labs to hazardous chemical incidents throughout the United States. Many CSTs and Strike Teams have the capabilities to sample, prepare, and analyze certain types of environmental samples for CWA analysis. CSTs have analytical equipment that can provide screening or presumptive data results for CWAs. The OSC should discuss site-specific types of samples, data quality, and chain-of-custody requirements with Strike Teams and CSTs before integrating their capabilities into the overall CWA response. Other agencies, such as the FBI, may be present on-site performing tasks, such as evidence retrieval, which are specific for their agency.

Military: EPA's Special Teams (ERT and CMAD) have access to Department of Defense (DOD) assets through Inter-Agency Agreements (IAA) with the US Army's Combat Capabilities Development Command, Chemical Biological Center (CBC) at Aberdeen Proving Ground, MD. The CBC has expertise and deployable assets for CWA air monitoring (i.e., MINICAMS™), sampling, analysis, decontamination, and waste transport and disposal through their ongoing demilitarization activities at former chemical agent munitions facilities in the US and abroad.

Access to EPA's IAA for support to Federal OSCs at a CBRN response or incident can be arranged through EPA/HQ-EOC at 202-564-3850. Consultation or training for EPA personnel and partners that do not need to go through EPA/HQ-EOC can be arranged via the IAA with EPA's ERT-Special Team at 732-321-6660. Additional CBRNE support can be obtained via the IAA with EPA's CMAD-Special Team, including support for chemical, biological, and radiological agent response through EPA/HQ-EOC at 202-564-3850.

14. Environmental Decontamination/Cleanup

Environmental Decontamination/Cleanup

14.1. Decontamination/Cleanup Planning:

Once site controls are in place, develop a site-specific decontamination/cleanup plan. Environmental decontamination may require a "tiered approach" using a variety of techniques and products. Call EPA/HQ-EOC at 202-564-3850 for more information.

General Considerations: A cost vs. benefit evaluation should be undertaken for each decontamination strategy and approach that considers public safety, total cost, impact on the area, wastes generated, time the area or item will be inaccessible and/or out of service, as well as any socio-economic, public health, and/or security impacts that may result. Large volumes of decontamination wastes may be generated that will need to be collected, treated, and disposed of properly. Waste handling and disposal must be addressed as early in the decontamination and cleanup process as possible (see WASTE MANAGEMENT section below).

Disposal Option: The urgency to restore an area or item as quickly as possible may result in the outright and timely removal and disposal of contaminated materials. Certain materials may be impacted by the decontamination products, and/or may be cheaper to discard and replace than to decontaminate and restore.

Monitored Natural Attenuation: L-1 degrades via natural processes. Environmental monitoring must be maintained during decontamination and recovery phases. Monitored natural attenuation may require institutional controls (e.g., access restriction and contaminant containment measures). The time to achieve clearance must be considered in the overall cost/benefit evaluation. This option is more passive than other options but is non-destructive to materials. Porous or permeable materials can absorb L-1 thereby prolonging persistence.

Fix-in-Place Option: The contaminated area may be resistant to decontamination products or may be unable or impractical to be treated. Physical barriers can be used to immobilize the contamination and prevent it from coming into contact with the environment or the public. This can be a temporary or permanent solution.

14.2. Decontamination Strategy:

A decontamination strategy can be developed by designating contaminated areas into five broad categories: 1) surfaces or hot spots, 2) large volumetric spaces, 3) sensitive equipment or items, 4) aqueous solutions, and 5) water systems. Areas in each category may be treated using one or more unique decontamination processes in a tiered approach to the overall site-specific decontamination strategy.

Cautions:

- Hydrolysis of L-1 is rapid and produces compounds containing As (III), the more toxic oxidation state of arsenic, such as lewisite oxide and most significantly CVAA, which has similar vesicant properties as L-1. In basic solutions, acutely toxic inorganic arsenite (AsO_3) may also be formed. HCl may also be produced, so situation-specific tolerance to potentially altered pH and corrosiveness should be evaluated when developing a decontamination strategy.
- Under oxidizing conditions (e.g., for household chlorine bleach or other hypochlorite-containing solutions), the hydrolysis products of L-1 mentioned above are converted to compounds containing As (V), which are generally less toxic but still can be of concern. The conversion is rapid even under mild conditions, but complete conversion should not be assumed because of the toxicity of CVAA. Decontamination formulations and conditions should be chosen to minimize or eliminate the formation of these toxic breakdown products.

- Decontamination products may have unique safety/PPE requirements due to their own toxicity or that of breakdown products during use (e.g., use of bleach results in release of chlorine vapors). Strong oxidizers, such as hypochlorite, may react violently with organics.
- Dirt, grime, and other coatings (organic load) can reduce the efficacy of decontamination; pre-cleaning surfaces with soap and water may be needed before the application of decontamination formulations. However, the resulting pre-cleaning rinsates require containment to avoid spread of the L-1 degradation products including CVAA, which will be formed as a result of pre-cleaning with aqueous solutions.
- Even under ideal decontamination conditions using oxidizers, residual arsenic compounds including arsenate will be present and should be considered in site-specific goals.

For additional information, contact the EPA/HQ-EOC at 202-564-3850.

Surfaces/Hot Spots: This category is for areas smaller in size but with higher levels of agent contamination. They may require more rigorous decontamination products and methods. Excess L-1 liquid should be absorbed using, e.g., vermiculite or dry sand, and transferred into a sealed container and disposed of according to WASTE MANAGEMENT section below. In contrast to the rapid hydrolysis when L-1 is dissolved in water, the hydrolysis of L-1 on surfaces is limited by the amount of available moisture. Regardless of hydrolysis rate, hydrolysis products such as CVAA should be avoided. Thus, application of the following oxidative decontamination solutions and formulations may be efficacious by following applicable manufacturers' directions.

1) Hypochlorite-containing solutions: Hypochlorite can be corrosive to certain surfaces and materials and should be rinsed thoroughly afterwards. Household bleach solutions (≥5% sodium hypochlorite) are effective for decontamination of surfaces with L-1 with efficacy expected to be achieved with contact time of 30-60 minutes depending on surface material. Calcium hypochlorite, present in commercial products, such as HTH (10% hypochlorite solution), is better for surfaces with high concentrations of liquids in localized areas. Note that lowering the pH of hypochlorite solutions is not required and may be counterproductive. If inadequate amount of oxidant is used, highly toxic byproducts will likely accumulate.
2) The decontamination technology EasyDecon DF-200® (or equivalent Decon7 (D7)), which is expected to be less corrosive than hypochlorite-containing solution, is effective against surfaces contaminated with L-1 and CVAA with a contact time of at least 30 minutes. Other proprietary decontamination technologies such as Dahlgren Decon®, CASCAD®, Decon Green®, or L-Gel® have not been tested for decontamination of surfaces with L-1. Availability, cost, and the need for specialized equipment to apply the decontaminant may limit their use early in the response.

Large Volumetric Spaces: This category is for areas larger in size but with lower levels of agent contamination. These areas may require less aggressive, but more broadly applied, decontamination products and methods.

1) Monitored Natural Attenuation is more passive than other decontamination options and is non-destructive to materials. This option may be preferable depending on the scope and severity of contamination.
2) Forced or Hot Air ventilation methods are recommended for vapor plume contamination or low surface concentration of L-1 in large volumetric spaces, including HVAC systems, or open areas; efficacy may be typically achieved in hours to days based on the low to moderate persistence of L-1 with less waste and adverse impacts to materials. Hydrolysis and vesicant byproduct CVAA may be formed and stay on surfaces longer than L-1. Capture technologies, such as activated carbon-containing air filters, would be required to prevent transfer of the L-1 vapor to the outside environment or prevent recirculation into other surrounding spaces.
3) Other approaches such as modified vaporous hydrogen peroxide (mVHP®; a combination of ammonia and hydrogen peroxide vapor), or chlorine dioxide have not been tested for decontamination of surfaces with L-1. These oxidants may be theoretically effective and advantageous based on expected formation of less toxic arsenic-containing byproducts. Steam has not been tested for L-1 and may lead to L-1 hydrolysis and formation of vesicant byproduct CVAA.

Sensitive Equipment or Items: Forced or Hot Air ventilation may be used for L-1 and can be used either in-situ or ex-situ to decontaminate these items. Capture technologies using activated carbon air filters would be required to prevent transfer of the L-1 vapor to the outside environment or prevent recirculation into other surrounding spaces. Although testing has not been performed, fumigation with mVHP® is another option that could be efficacious aside from formation of less toxic arsenic-containing byproducts, with no or minimal impact on materials.

Aqueous Solutions: L-1 degrades rapidly via hydrolysis but forms other toxic compounds and vesicants, such as CVAA and arsenite, as well as HCl. Decontamination operations involving bleach or other oxidants may yield aqueous solutions containing arsenic compounds that may have been converted to less toxic forms. Some toxicity will still be retained (see toxic byproducts statement under Cautions above). Avoid any additional release and/or inappropriate disposal to water systems, drains, or sewers. Contain or transfer liquid to appropriate containers and dispose of according to WASTE MANAGEMENT section below.

Water Systems: Removal of contaminated water will lessen L-1 and its breakdown products' contamination in water systems, but they may persist in hydraulic dead ends and via sorption to system components (e.g., plastics) that act as sinks. It may be necessary to isolate potentially affected portions of the system to evaluate them and implement decontamination. A contaminated water system may transfer L-1 and its breakdown products to building and premise plumbing, which then may also require decontamination. As L-1 is denser than water, it may sink and accumulate in low lying areas, such as the bottom of pipes and tanks.

Verification of Decontamination: Site and situation specific. Please contact EPA/HQ-EOC at 202-564-3850 for further assistance.

15. Waste Management

Waste Management

15.1. Transportation:

Federal requirements for the commercial transport of hazardous materials and procedures for exemptions are specified in How to Comply with Federal Hazardous Materials Regulations, available at: https://www.fmcsa.dot.gov/regulations/hazardous-materials/how-comply-federal-hazardous-materials-regulations.

Lewisite (L-1) should not be offered for commercial transportation without being rendered safe by neutralization. Contact the PHMSA Hazardous Materials Information Center at 1-800-467-4922 or infocntr@dot.gov to discuss specific cases.

Additional resources on packaging, labeling, and shipping are available at: https://www.phmsa.dot.gov/standards-rulemaking/hazmat/hazardous-materials-regulations. Detailed state regulations can be found at www.envcap.org/.

This QRG is intended to apply to Federal OSCs in the first 24-48 hours of a response. Once determined, the concentrations of L-1 in individual waste streams should be used to determine which transportation requirements apply. For instance, certain requirements may apply to waste streams with concentrated agent but may not apply to waste streams such as soil containing dilute concentrations of agent.

15.2. Waste Management:

Under the Resource Conservation and Recovery Act (RCRA), waste is classified as hazardous waste (subtitle C) or solid waste (subtitle D). The RCRA regulations generally define a waste to be hazardous if it is: (1) a listed waste (40 CFR §261.31-§261.32); (2) exhibits specific characteristics (40 CFR §261.21-§261.24); or (3) is a discarded commercial chemical product, off specification species, container residue, or spill residue listed in 40 CFR §261.33. Lewisite (L-1) is not listed under 40 CFR §261.31-33, but L-1-contaminated waste may be considered toxic hazardous waste, chemical code D004, if it contains arsenic (As) above the regulatory level of 5.0 mg/L when tested according to the specifications in 40 CFR §261.24. It is the responsibility of the waste generator to make a hazardous waste determination (40 CFR §262.11).

The states (except for Alaska and Iowa) have the primary responsibility to implement the hazardous waste regulations and can impose more stringent requirements or requirements broader in scope than the federal program. Because L-1 contains As, the state may have specific regulations regarding disposal of As-contaminated wastes. Several states, including CO, IN, KY, MD, OR, and UT, have their own waste designations for chemical agents, which may be applicable for the cleanup of L-1-contaminated residues, decomposition products, soils, and debris. It is critical to open a dialogue with state regulators as early as possible.

Management of toxic decomposition products, associated residual decontamination solutions, local waste acceptance criteria, and transportation and handling requirements should be considered. High pH aqueous decontamination solution waste may be considered corrosive hazardous waste, chemical code D002, if it has a pH greater than or equal to 12.5 (40 CFR §261.22).

EPA/CMAD can provide Federal OSCs with information and support to address knowledge gaps for dealing with wastes contaminated with dilute concentrations of CWA; contact EPA/HQ-EOC at 202-564-3850.

EPA also recommends the creation of pre-incident waste management plans as a preparedness measure for chemical agent releases, and has created an **All-Hazards Waste Management Planning Tool** to help state, local, territorial, and tribal waste management officials coordinate and prepare these plans. Access to the All-Hazards Waste Management Planning Tool requires pre-registration (https://wasteplan.epa.gov/).

NRT Quick Reference Guide: Mustard-Lewisite Mixture (HL)

NRT Quick Reference Guide: Mustard-Lewisite Mixture (HL)

GHS: Acute Toxicity, Category 1
H310 – Fatal in contact with skin
H330 – Fatal if inhaled

GHS: Eye Damage/Irritation, Category 1
H318 – Causes serious eye damage

1. Agent Characteristics

Agent Characteristics

Agent Classification (HL): Schedule 1 Chemical Warfare Blister (Vesicant) Agent. HL is mixture of Sulfur Mustard (HD; CAS: 505-60-2) and Lewisite (L-1; CAS: 541-25-3) and has some properties of both. Its properties are related to the exact composition, and the composition will vary with manufacturing process and changes after dispersion.
HL CAS: Not available (NA). Given that the composition of HL in an actual incident may be unknown, the user should refer to QRGs for L-1 and HD. Decontamination verification must include both L-1 and HD.

Description: HL is a dark, oily liquid. HL may have a geranium, garlic, onion, horseradish, or mustard-like odor, depending on the amounts of L-1 and HD present. However, odor should not be depended on to detect HL (see Caution under Section 7.3 below).
This QRG is based on munitions-grade HL, which has a composition of 63/37% by bulk weight of L-1/HD respectively. This HL mixture requires lower ambient temperatures before it will freeze; this property allows for improved ground dispersal and aerial spraying.
HL is both a blister agent (vesicant) and an alkylating agent (causes damage to the DNA of rapidly dividing cells). Exposure to large amounts of HL may be fatal. HL as a blister (vesicant) agent has both immediate effects and delayed health effects on the order of hours, and contains a reported, known human carcinogen. It can be manufactured at different concentrations; with impurities, additives, or thickening materials that will all affect physical properties, appearance, persistence, and analytical detection limits.
Environmental breakdown (hydrolysis) products of HL are easily formed and include both relatively non-toxic compounds, such as thiodiglycol (TDG) [CAS 111-48-8] and hydrochloric acid (HCl), and highly toxic arsenic (III) compounds, such as 2-chlorovinyl arsenous acid (CVAA), 2-chlorovinylarsenious oxide (lewisite oxide), and arsenites; some of which cause blistering similar to L-1. Due to its low freezing point, HL remains a liquid in cold weather and at high altitudes. Decontamination byproducts of HL include toxic mustard sulfone/sulfoxide, as well as arsenic (V) compounds that are generally less toxic than arsenic (III) compounds, but may be considered hazardous.

Persistence: HL may be considered a "semi-persistent" chemical warfare agent with liquid deposition on surfaces lasting for hours to days, with the liquid composition changing over time. Persistence will depend upon amount and purity of the agent, method of release, environmental conditions, and the types of surfaces and materials impacted. HL remains a liquid at low temperatures and is persistent in colder climates. **Many vesicant and toxic environmental breakdown products and decontamination byproducts are persistent.** Under certain environmental conditions, when protected from environmental degradation processes, HL breakdown products may persist in soils for decades. Porous, permeable, organic, or polymeric materials such as carpets, vinyl tiles, and painted surfaces can accumulate HL vapors and liquids, acting as "sinks," thereby prolonging persistence.

Note: Under certain environmental conditions, Sulfur Mustard (HD) liquid may go through a partial hydrolysis that results in an outer protective coating around "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed (see HD QRG). It is unknown if this occurs for HL.

2. Physical Properties

Physical Properties

Molecular Weight: 186.4 g/mol based on eutectic mixture of 63/37% weight L-1 and HD • Lewisite (L-1): 207.32 g/mol • Sulfur Mustard (HD): 159.08 g/mol	**Formula:** NA (mixture of L-1 and HD) • L-1: $C_2H_2AsCl_3$ • HD: $C_4H_8Cl_2S$
Vapor Density: 6.5 (air = 1)	**Flash Point:** Not established; assume 219-221°F/104-105°C (HD)
Vapor Pressure: 0.248 mm Hg (68°F/20°C)	**Liquid Density:** 1.66 g/mL at (68°F/20°C)
Volatility: 2,730 mg/m^3 (68°F/20°C)	**Melting/Freezing Point:** Purified mix: 13°F (-25.4°C) Typical production batch: -43.6°F (-42°C)
Boiling Point: Indefinite, but below 374-378°F/190-192°C	**Non-aqueous Solubility:** Common organic solvents, alcohols, gasoline, oils, fats

Hydrolysis ($t_{1/2}$): **L-1:** Rapid for vapors or dissolved L-1 but limited by low aqueous solubility **HD:** The rate of HD hydrolysis is controlled by the speed of dissolution of the HD into water. Once HD is dissolved in bulk water, hydrolysis proceeds rapidly. (See HD QRG)	**Aqueous Solubility:** Slightly soluble based on solubilities of L-1 and HD individually (See L-1 and HD QRGs)

Note: physical properties are listed at/near STP unless otherwise indicated. Properties are for the munitions-grade HL mixture (63/37% L-1/HD, w/w). Other HL mixtures will have different properties.
Conversion Factors for HL: ppm = mg/m^3 x 0.122; mg/m^3 = ppm x 8.21 (assuming MW = 186.4). Also see L-1 and HD QRGs.

3. Release Scenarios

Release Scenarios

AIR RELEASE SCENARIOS ARE ASSUMED MOST PROBABLE; HOWEVER, OTHER RELEASE SCENARIOS AND EXPOSURE ROUTES SHOULD BE CONSIDERED.

Open Areas: HL has moderate volatility, and could be dispersed as a vapor or a liquid spray (aerosol), depending upon the percentages of L-1 and HD within the HL mixture. The primary release/attack scenarios are cold weather operations and airborne releases. HL is expected to degrade in the environment fairly rapidly; however, liquid HL on surfaces could persist for days. Environmental conditions will affect the degradation and evaporation rates of HL with cooler and drier conditions enhancing persistence. **HL has a melting/freezing point at -25.4°C (-13°F), so the reaerosolization of liquids and solids, as ambient temperatures rise, may present an inhalation hazard.** HL vapors are heavier than air, so vapors can accumulate in lower terrains.

Water/Water Systems: HL released into water will likely hydrolyze within a few hours into vesicant and toxic compounds, which may persist for days to weeks. In sufficient amounts (relative to water volume). HD may form HD "globules" surrounded by an outer protective coating resistant to further hydrolysis. These HD globules may settle out or be entrapped, and can persist for considerable periods of time (years, decades), while retaining vesicant properties, posing a contact hazard to anyone disturbing them. Areas in which the globules may persist include stagnant volumes of water as small as puddles formed by precipitation events. It is unknown if this occurs for HL. If released into water systems such as reservoirs, treatment plants, distribution systems, public fountains or pools, their treatment processes may result in further reaction with HL. Water systems, plumbing, surfaces and equipment that have contacted contaminated water, including potential HD globules, must be evaluated for decontamination along with the bulk water.

Indoor Facility: HL may be considered as a semi-persistent agent with moderate volatility, and could potentially be distributed inside a building or facility; HVAC systems could potentially be impacted. Liquid HL may result in localized areas of surface contamination. HVAC system intakes near to liquid HL should be investigated for contamination from HL vapors and aerosols. HL vapors are heavier than air so vapors can accumulate in lower levels, basements, floor drains, or utility corridors inside the buildings.

Other: HL is combustible; agent may burn but does not ignite readily. Fire may produce irritating, corrosive, and/or toxic gases. When heated, vapors may form explosive mixtures with air, presenting an explosion hazard indoors, outdoors, and in sewers. Containers may explode when heated. If HL is released into the air as a liquid spray (aerosol), it has the potential to contaminate agricultural products. If HL is released as a vapor, it is highly unlikely to contaminate agricultural products.

4. Health Effects

Health Effects

4.1. Onset: Following exposure to HL, onset of symptoms from L-1 is rapid (within seconds to minutes); the effects of HD are more delayed. Severity of effects depends on dose, duration, and route of exposure (not all signs/symptoms may develop). The effects caused by L-1 or HD are not typically fatal immediately, but can require substantial supportive medical care, and secondary infections from blisters/tissue damage may also be fatal.

- L-1 can cause immediate eye pain and eye/skin/respiratory tract irritation. L-1 can cause skin redness within 15-30 minutes. Blister formation and deep skin burns are approximately 12 hours post-exposure. Eye lesions are very serious resulting in blindness unless decontamination is very prompt
- Following HD exposure, actual signs/symptoms (eye irritation, coughing, reddening and burning of skin) are **delayed 1-48 hours after exposure**, so those exposed may not be aware.

4.2. Signs/Symptoms: Symptoms will vary depending on dose and exposure route (see EXPOSURE ROUTES section below). The following is a general list of possible symptoms. The severity of effects depends upon the dosage.

Mild to Moderate: Immediate stinging and burning pain and strong irritation of eyes, tear production, spasmodic blinking, swelling and fluid accumulation in the eye membranes and eyelids, and inflammation of the cornea. Irritation of mucous membranes in the nose and lower airways, immediate burning nasal pain, violent sneezing, nosebleed, sinus

pain, inflammation of the voice box, cough, and difficulty breathing or shortness of breath. Immediate stinging and burning pain or irritation of skin, redness, delayed blistering with pain, and itching.

Severe: Blistering and scarring of the cornea, rupture of the eye, and blindness. Inflammation of the lungs, accumulation of fluid in the lungs, respiratory failure, and death. Severe blistering and severe burns on skin.

Cumulative: HL has properties of both L-1 and HD. It causes blisters (is a vesicant) and binds to DNA and damages rapidly dividing cells (is an alkylating agent). The alkylating properties of HL make it particularly toxic to the blood-forming tissues (e.g., the bone marrow). Whole-body (systemic) absorption of HL may result in bone marrow suppression and an increased risk for fatal complicating infections. The rate of detoxification of HL in the body is very slow, and repeated exposure is likely to cause a build-up of the agent in the body.

4.3. Exposure Routes:

Inhalation: Vapor is absorbed through mucous membranes (mouth, nose, throat, lungs). Respiratory exposure to vapor produces immediate irritation of the upper, then the lower, respiratory tract; with increasing doses, inflammation is more severe and progresses deeper into the respiratory tract.

Skin: Direct contact with liquid or vapor from the HL mixture can cause stinging and burning pain and redness immediately. Blistering can be delayed for hours, but it appears earlier than with exposure to pure HD. Warm and sweaty skin areas (underarms, groin) are most susceptible to exposure.

Eyes: Eyes are the most sensitive to L-1 and HD vapors. Vapors are absorbed through mucous membranes. Symptoms occur immediately; irritation, burning, gritty feeling, itching, weeping, reddening, lid swelling, light sensitivity, pain, and corneal injury. High concentration effects are extremely painful and generally require extended medical treatment. Rapid decontamination (within minutes of exposure) using copious amounts of water is the only way to limit eye injury.

Ingestion: Consumption of contaminated food or drink could cause burning, nausea, and vomiting.

5. Effect Levels

Effect Levels

Air (inhalation vapor hazard): Acute Exposure Guideline Levels (AEGLs) for general population one-time exposure emergency scenarios are not available for HL. However, AEGLs are available for L-1 and HD (complete definitions are available at: https://www.epa.gov/aegl). Because AEGLs are not available for HL, use the lower of L-1 or HD values from tables below. NA = Not available.

AEGL Level in mg/m^3, at various exposure durations for L-1	**10 min.**	**30 min.**	**1 hr.**	**4 hr.**	**8 hr.**
AEGL 1: Threshold mild effects	NA	NA	NA	NA	NA
AEGL 2: Potentially irreversible effects or impaired ability to escape	1.3	0.47	0.25	0.070	0.037
AEGL 3: Threshold for severe effects/medical needs/increasing potential for lethality	3.9	1.4	0.74	0.21	0.11

AEGL Level in mg/m^3, at various exposure durations for HD	**10 min.**	**30 min.**	**1 hr.**	**4 hr.**	**8 hr.**
AEGL 1: Threshold mild effects	0.40	0.13	0.067	0.017	0.008
AEGL 2: Potentially irreversible effects or impaired ability to escape	0.60	0.20	0.10	0.025	0.013
AEGL 3: Threshold for severe effects/medical needs/increasing potential for lethality	3.9	2.7	2.1	0.53	0.27

American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPG™) are not established/determined for L-1 or HD.

6. Exposure Guidelines

Exposure Guidelines

6.1. Airborne Exposure Limits (AELs): Exposure Guidelines are not available for HL directly. See below for L-1 and HD values.

CDC has issued recommendations for protecting human health from potential adverse effects of exposure to L-1 and HD. (refer to: NIOSH ERSH-DB, for L-1: https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750006.html, and for HD: https://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750008.html)

(NA = not available)

Lewisite (L-1) Exposure Guidelines:

CDC/National Center for Environmental Health (NCEH) IDLH = NA

DOD/Army IDLH Equivalent = 0.36 mg/m^3; proposed value for Pine Bluff but considered a safe estimate for other IDLH applications. Workers should remove themselves immediately from exposure if the concentration is reached at any point in time. [original source: Army OTSG memorandum, New Immediately Dangerous to Life and Health (IDLH) Concentration Level for Lewisite (August 24, 2009)]

CDC/NCEH STEL = NA
CDC/NCEH Worker Population Limit (WPL) = 0.003 mg/m^3 **
CDC/NCEH General Population Limit (GPL) = 0.003 mg/m^3 **
** the value 0.003 mg/m^3 is a detection value that can be used as safe level for all civilian worker and general population exposures including long term. These L-1 values for WPL and GPL are based on detection limit and are not health-based. [original source: NCEH, Final Recommendations for Protecting Human Health and Safety against Potential Adverse Effects of Long-term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, T), and Lewisite (L-1); 53 FR 8504-8507 (March 15, 1988); (corrected in 53 FR 11002 (April 4, 1988))]

Sulfur Mustard (HD) Exposure Guidelines:
CDC/NCEH IDLH = 0.7 mg/m^3; workers should remove themselves immediately from exposure if the concentration is reached at any point in time
CDC/NCEH STEL = 0.003 mg/m^3 (3×10^{-3}); exposure at the STEL should be as short as practical (but no longer than 15 minutes) and should not occur more than once per day
CDC/NCEH Worker Population Limit (WPL) = 0.0004 mg/m^3 (4×10^{-4})
CDC/NCEH General Population Limit (GPL) = 0.00002 mg/m^3 (2×10^{-5})
[original source: CDC, National Center for Environmental Health (NCEH), Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard), 69 FR 24164-24168 (May 3, 2004).]

6.2. Occupational: (NA = not available)

Lewisite (L-1):

NIOSH IDLH = NA	**OSHA PEL** = NA
NIOSH REL-TWA = NA	**ACGIH TLV-TWA** = NA
NIOSH REL-STEL = NA	**ACGIH TLV-STEL** = NA

Sulfur Mustard (HD):

NIOSH IDLH = NA	**OSHA PEL** = NA
NIOSH REL-TWA = NA	**ACGIH TLV-TWA** = NA
NIOSH REL-STEL = NA	**ACGIH TLV-STEL** = NA

Arsenic: Refer to site-specific HASP for any occupational exposure guidelines for Arsenic relevant to response activities. (for more information on arsenic, see NIOSH Pocket Guide to Chemical Hazards: Arsenic, inorganic compounds (as As), https://www.cdc.gov/niosh/npg/npgd0038.html).

6.3. Population:

Soil: USAPHC Health Based Environmental Screening Levels (HBESL) =

- **L-1:** 3.7 mg/kg over work life for Industrial Soil; 0.3 mg/kg over lifetime for Residential Soil.
- **HD:** TBD. The US Department of Defense (DOD) will be issuing new HBESL values for both industrial and residential soil after DOD completes a reevaluation of toxicological information related to liquid mustard skin exposure and vesication (blistering). Until DOD releases these new HBESL values to the public, DO NOT use current values available from websites and other resources.

Drinking Water: EPA Provisional Advisory Levels (PALs): see below for more information.

EPA Provisional Advisory Level (PAL): PALs represent chemical concentrations in air or drinking water above which varying health effects (PAL1, PAL2, PAL3) are expected. They are developed for 24-hour, 30-day, and 90-day exposure durations. In the event of a nationally significant or large-scale chemical release, EPA can provide PALs, if available, to appropriate end-users and stakeholders as needed (PALs are not currently available to the public) to assist in response decision-making. Contact: PALs@epa.gov, for information on and access to the PALs. (Note: PALs are not intended to define cleanup levels.)

7. Personnel Safety

Personnel Safety
Note: Personal Protective Equipment (PPE) selection (Levels A-D), medical surveillance requirements, First Aid options, and personnel decontamination may vary depending upon the amount and purity of agent, site conditions, and the release scenario. Additional information on personnel safety and PPE selection criteria can be found at: www.cdc.gov/niosh/ershdb. We also recommend that responders check their own internal procedures (i.e., SOPs), if applicable.

7.1. Medical:

Pre-incident: Must have current medical and respiratory clearances as part of an Occupational Medical Surveillance Program according to OSHA HAZWOPER and Respiratory Protection Program, as per 29 CFR 1910.

During Incident: Conduct periodic on-site medical monitoring, observe for any signs and symptoms as per HEALTH EFFECTS section above and treat accordingly as per First Aid section below.

Post-incident: Perform post-incident medical surveillance, as per 29 CFR 1910. Because health effects may not occur until several hours after exposure, patients/victims should be under medical surveillance for at least 24-48 hours.

7.2. First Aid: Immediately remove person from affected area and remove contaminated clothing and articles. Wash bare skin immediately with water, or warm, soapy water if available, at normal household pressures (~50-60 psi) for three minutes, ensure thorough soaking. Rinse eyes exposed to agent (liquid or vapor; eyes are especially sensitive to L-1 and HD) with potable water for at least 15 minutes. If irritation or pain is severe or persists, prolonged eye washing is advised. Do not cover eyes with bandages. Seek immediate medical attention.

Antidote: Dimercaprol (a.k.a. British Anti-Lewisite (BAL)). Dimercaprol is currently used in hospital settings for arsenic poisoning. Antidote should only be administered in a hospital setting. Dimercaprol is given by intramuscular injection as an antidote for whole body (systemic) health effects of arsenic/L-1 poisoning but has no effect on local blisters or lesions of the skin, eyes, or airways**. NO ANTIDOTE AVAILABLE FOR HD; be aware effects of HD are delayed 1-48 hours.**

Other: RSDL (Reactive Skin Decontamination Lotion), an FDA-cleared kit with a sponge impregnated with a lotion to remove or neutralize chemical warfare agents from contaminated skin. Apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits. **NOTE: no citations were currently found for the efficacy of RSDL specifically for HL or L-1, but the application methods and decontamination materials present in RSDL may be useful to neutralize HL or L-1 exposure on skin.**

After administering first aid, send person for follow-up medical attention and evaluation. If cleared to resume work, continue to monitor for signs/symptoms and treat accordingly.

7.3. Personal Protective Equipment (PPE):

GENERAL INFORMATION: NIOSH Approved® Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA), NIOSH Approved Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR), full-face masks, and protective clothing should be used. Level A protection should be used until monitoring results confirm identity and concentration of contaminant. Pre-incident training and exercises on the proper use of PPE are recommended.

Currently no inhalation exposure guidelines exist for the HL mixture. Use L-1 and HD exposure guidelines. Caution: The L-1 component of HL mixture does NOT provide sufficient warning properties (see AGENT CHARACTERISTICS section above) that would allow appropriate use of APR/PAPR in most contamination scenarios (see Level C).

Per NIOSH guidance –

LEVEL A: Recommended for the initial response to an HL incident. NIOSH Approved CBRN full-face-piece SCBA operated in pressure-demand mode with Level A suit that provides protection against CBRN agents. Level A provides the greatest level of skin (totally encapsulating chemical protective suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank), respiratory (SCBA), and eye protection when the contaminant identity or concentration is unknown. Select Level A when the HL concentration is unknown or above the IDLH or AEGL-2 for either L-1 or HD, and when there is a potential of ocular or dermal exposure.

LEVEL B: Pressure-demand SCBA (NIOSH Approved CBRN full-face-piece SCBA) with Level B protective suit that provides protection against CBRN agents. Level B provides the highest level of respiratory protection (SCBA) when a lesser level of skin protection is required. Select Level B when the HL concentration is unknown or above the IDLH or AEGL-2 for either L-1 or HD, and when dermal exposure is less of a risk. Level B differs from Level A in that it typically incorporates a non-encapsulating, splash-protective, chemical-resistant outer suit that provides protection against most liquids but is not vapor tight (hooded chemical-resistant outer suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank). **The Level B PPE dress-out for HL should be modified to ensure there is no exposed skin or potential for ocular exposure.**

LEVEL C: May be selected when the contaminant identity and concentration are known and the respiratory protection criteria factors for the use of APR or PAPR (i.e., < IDLH, warning properties) are met. Level C may be appropriate when decontaminating personnel or equipment. Level C still incorporates hooded chemical-resistant outer suit that provides protection against CBRN agents, chemical-resistant inner and outer gloves, and chemical-resistant boots with steel toe and shank.

- For air levels greater than AEGL-2: NIOSH Approved CBRN tight-fitting PAPR with a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator. Since no such values exist for the HL mixture, AEGL-2 values for both L-1 and HD may have to be used.
- For air levels greater than AEGL-1: NIOSH Approved CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR. Since no such values exist for the HL mixture, AEGL-1 values for both L-1 and HD may have to be used.

LEVEL D: Select Level D when the contaminant is known, and the concentration is below the appropriate occupational exposure limits or less than AEGL-1 for the stated duration times. Since no such values exist for the HL mixture, AEGL-1 values for both L-1 and HD may have to be used. PPE includes coveralls or other work clothes, boots, and gloves.

Downgrading PPE levels can be considered only by the site Health and Safety Officer when the identity and concentration of the contaminant and the risks of dermal exposure are known and must be accompanied by on-site monitoring. Monitoring for L-1 and HD is required during an HL response to ensure that exposure guidelines for

either have not been exceeded. The on-site availability of any applicable medical countermeasures should also be considered when deciding to downgrade PPE during a CBRN response.

8. Personnel Decontamination

Personnel Decontamination

8.1. Personnel Decontamination Procedure:

Tents, berms, and collection vessels should be able to maintain copious amounts of wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decontamination process as well as replace necessary chemicals and decontamination solutions.
Prior to entering the hot zone, all personnel are required to familiarize themselves with the site-specific personnel decontamination procedures.

Personnel decontamination should take place in a decontamination area comprised of two decontamination corridors (one for entering and one for exiting). Position corridors upwind and uphill of release area; exit should be upwind and uphill of entrance. Detergent and water solution (pH>8, but <10.5), soft brushes, and durable 6-mil polyethylene bags should be provided.

Personnel decontamination area workers need to wear appropriate PPE as indicated below. Be aware that absorbed agent can be released from clothing and skin as a vapor. Decontamination wash water (effluent) will contain toxic arsenic. Do not release the wash water (effluent) to the environment. See Section 15.2 below for additional guidance on waste management. Arsenic may be toxic to wastewater treatment plant (WWTP) microorganisms. Only discharge non-RCRA hazardous effluent to a WWTP after approval by the WWTP owner/manager.

Conduct personnel decontamination per NIOSH ERSH-DB:
https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750007.html

- Emergency Responders: Use soft brush to wash PPE with soap and detergent solution in a downward motion, getting into all folds. Repeat washing and rinsing until thoroughly clean. Remove PPE by rolling downward from head; avoid pulling PPE over the head. Remove SCBA last and place all PPE in polyethylene bags.
- Patient/victim: Remove all clothing down to at least undergarments, and place in polyethylene bags. Thoroughly wash and rinse skin with soap and water solution, taking care not to break the skin and covering all open wounds. Cover patient/victim (e.g., blanket, towels, Tyvek) and move to treatment area. If available in decontamination kit, apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

8.2. Personnel Decontamination Procedures by Zone/Step: (attendants will verbally direct personnel through each step)

Conducted in Hot Zone (exclusion zone)

1	Equipment Drop	Place equipment taken into the Hot Zone on a plastic covered table or container provided prior to entering the contamination reduction corridor. Equipment will either be reused if more than one entry is planned or will be decontaminated later.

Conducted in Warm Zone (contamination reduction zone)

2	Sample Drop	Place samples in a container provided for sample decontamination. Care needs to be taken to ensure that workers maintain chain-of-custody of samples. It is recommended that samples are decontaminated in a separate decontamination line.
3	Outer Boot and Glove Wash	The purpose of this step is to enable physical removal of gross contamination if contamination is visible. If gross contamination is not visible, this step may be skipped. Wash outer boots and then outer gloves using designated decontaminating agents as specified in HASP (e.g., soap and water, trisodium phosphate substitute, or diluted bleach).
4	Glove, Boot, and Suit Wash	Wash all outer surfaces in a contained area (e.g., kiddie pool) using a pressurized spray with designated decontamination solution. Start with decontaminating boots and gloves, then work on suit from the top down, including SCBA/PAPR casing. Decontamination personnel should conduct this step. Care should be taken to ensure that all areas are decontaminated, including around zipper, arms, front torso, and any other area that could have come in contact with contamination. The solution used for decontamination should be contained, collected, and disposed of properly from the decontamination line.
5	Outer Glove, Boot, and Suit Removal	While sitting on a stool, remove outer boots and outer gloves. Undo the SCBA/PAPR belt and hold in hand. While touching only the inside of suit, carefully roll suit in an outward motion from shoulders down to feet. Dispose of boots, gloves, and suit in a designated container. This step may require decontamination personnel to assist either by holding SCBA/PAPR unit or assisting in suit removal.
6	Mask Removal	With inner gloves, remove the mask. Remove cartridge filters and place into designated container. Put mask into mask wash. Decontamination personnel will clean each mask and SCBA/PAPR assembly prior to return to service.
7	Inner Glove Removal	Remove inner gloves by only touching outside of first glove and then only inside of second glove. Place gloves into designated container.

Conducted in Cold Zone (support zone)

8	Quadrant Monitoring	Using appropriate HL, L-1, and HD air monitoring equipment, screen personnel for residual contamination by dividing body into 4 sections: upper right and left sides of the body, and lower left and right sides. If positive, perform spot decontamination immediately and direct person to showers.
9	Personal Shower	Personnel should shower using copious quantities of soap and water for a minimum of 5 minutes and change into clean clothes. If a personal shower is not immediately available then, at the minimum, hands and face should be washed thoroughly.
10	Medical Monitoring	Report to medical monitoring station for post-entry monitoring and report to appropriate personnel for debriefing. Observe for any obvious sign of HL exposure. Using criteria listed above in PERSONNEL SAFETY section of this QRG, administer RSDL and notify site Health and Safety officer.

Emergency Egress Corridor: Establish an emergency egress line to use for quickly decontaminating personnel who have medical emergencies while in the hot zone. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital.
Hand-Wash Station: A hand-wash station with soap and water should be available for personnel to clean up or physically remove any residual decontaminant following entry. If a hand-wash station is not initially available or weather conditions prohibit its use, personnel should wash their hands and face as soon as possible.
Caution: Avoid waterless hand cleaners, which contain solvents (alcohols) that could increase risk of dermal exposure to HL.

9. Field Detection

Field Detection

Real-time field screening tools (results not confirmatory or quantitative): Caution should be given to equipment that has not been properly evaluated. False positive and false negatives may occur in the presence of interferents common in the environment. The following is a summary of minimum screening concentration ranges or levels for equipment procured by many EPA and HAZMAT response teams. Other screening tools may be used by these teams and other agencies and responders, some with similar capabilities and limitations.

Currently no instruments measure HL directly; see below for separate tables for field detection of L-1 and HD:

9.1. Minimum Screening Ranges/Levels for Air/(Vapor):

Field Equipment (L-1):	**ppm (L-1)**	**mg/m^3 (L-1)**
JCAD M4A1, at 10 secs [30 mins/pre-concentrator]	0.23-5.9	2-50
AP2C / AP4C (AP2C does not detect As or L-1)	ND / 0.15-1.5 (as Arsenic)	ND / 0.5-13 (as Arsenic)
MX-908 Vapor Mode	NA	NA
Dräger (CDS Kit) / CDS I as Arsine or organic Arsenic	0.1 Arsine / 0.35 organic Arsenic	0.35 Arsine / 3.0 organic Arsenic
MINICAMS™ (Near real-time; at 5 minutes)	0.00035	0.003

Note: ND = not detectable; NA = not available

Field Equipment (HD):	**ppm (HD)**	**mg/m^3 (HD)**
JCAD M4A1, at 10 secs [30 mins/pre-concentrator]	8 [0.003]	50 [0.02]
AP2C / AP4C	0.08	0.5
MX-908 Vapor Mode	1.2	7.8
Dräger (CDS Kit)	0.15	1.0
MINICAMS™ (Near real-time; at 5 minutes)	0.0005	0.003

9.2. Minimum Screening Ranges/Levels for Vapor/Liquid:

Field Equipment (L-1):	**ppm** (vapor) **(L-1)**	**mg/m^3** (vapor) **(L-1)**	**mL** (liquid) **(L-1)**
M256 / M256A1 (as blister only, up to 6 mins below 50° F)	1.1	9-14	0.020 (via M8 paper)
M8 (as blister only)	NA	NA	0.020

Note: M256 is combined 2 kits with 12 disposable sampler/detectors for vapors and a booklet of M8 paper for liquids.
NA = not applicable

Field Equipment (HD):	**ppm** (vapor) **(HD)**	**mg/m^3** (vapor) **(HD)**	**mL** (liquid) **(HD)**
M256 / M256A1 (13 mins)	0.46	3.0	0.02 (via M8 paper)
M8	NA	NA	0.02

Note: M256 is combined 2 kits with 12 disposable sampler/detectors for vapors and a booklet of M8 paper for liquids.
NA = not applicable

9.3. Minimum Screening Ranges/Levels for Water:

Field Equipment (L-1):	**mg/L (L-1)**
M272	0.1-2

Field Equipment (HD):	**mg/L (HD)**
M272	0.02

10. Environmental Sampling

Environmental Sampling

Note: This section on sampling contains general guidelines and does not replace the need for a site-specific sampling plan

10.1. Sampling Concerns: Detection, sampling equipment and procedures, and analytical techniques will be site-specific and depend on: 1) physical state of the agent; 2) type of surfaces contaminated (e.g., porous vs. non-porous); 3) the purpose of sampling (e.g., characterization, decontamination efficacy, and clearance); and 4) specific laboratory requirements. The U.S. Environmental Protection Agency (EPA) has set up mobile and fixed labs and analytical assets for chemical agent analysis of environmental samples under their Environmental Response Laboratory Network (ERLN), see ANALYSIS section below, (https://www.epa.gov/emergency-response/environmental-response-laboratory-network). For questions on environmental sampling for HL call EPA/HQ-EOC at 202-564-3850.

10.2. Sample Locations and Planning: Initially consider air monitoring to ensure worker safety and to determine if there is a vapor plume that could impact other areas. Characterization sampling is initiated by targeted or judgmental sampling to identify "hot spots," potential agent flow paths, and media or objects potentially acting as sinks. Additional biased or random sampling can be used to determine the extent of potential contamination or to verify the efficacy of decontamination. More thorough probabilistic sampling (e.g., grid, statistical approach) may be required for the clearance phase or if there are large uncertainties about the area impacted or the amount released. Because HL may be considered a semi-persistent liquid, sample priorities should include surfaces that are potentially contaminated with liquid (e.g., release site, low lying areas, HVAC, utility corridors) and areas that people are likely to contact or where food or agricultural products are present.

Note: There are no sampling and analytical methods specific for HL. Samples should be analyzed for presence of both L-1 and HD agent and their breakdown products. See ANALYSIS section below to ensure sampling procedures are compatible with all analytes. Some preparation techniques for both L-1 and HD and their breakdown products are available in EPA's Sample Information Collection Documents (https://www.epa.gov/esam/sample-collection-information-documents-scids). These provide general information regarding sampling procedures for different media, sampling supplies, sample size, container, holding time, preservation, packaging, and shipping, supporting collection of samples.

[**Additional note specifically for L-1:** L-1 breaks down in most environmental and decontamination conditions to numerous persistent toxic products, such as arsenites, lewisite oxide, and CVAA; some cause blistering similar to L-1. Because of low capacity for analysis that is specific for L-1 and L-1-related compounds, total arsenic (As) may be used as a marker to determine the extent of contamination of the parent L-1. Arsenic is prevalent in many environments; therefore, determining background As levels is recommended.]

[**Additional note specifically for HD:** HD breaks down in most environmental conditions to numerous breakdown products, especially TDG, which may be used as a marker to determine the extent of contamination of the parent HD.]

10.3. Types of Samples:

Air (Vapors are heavier than air): Samples are collected using appropriate solid phase absorbent media (tubes) or air sampler (e.g., SUMMA canister) at breathing zone level (~5 ft.) to assess inhalation exposure. To assess off gassing from surfaces and at ground levels, collect air samples at ~6 in. above the ground. Concurrent air sampling and monitoring of air and air particulates during response activities is recommended for both total As and L-1, using high-volume samplers or other appropriate equipment. Concurrent air monitoring for HD is also recommended.

Water: Water should be collected in appropriate containers with addition of appropriate de-chlorinating agents and preservatives to minimize HL degradation and hydrolysis prior to analysis. Concurrent air monitoring for L-1, total As, and HD is recommended.

Soil: For localized "hot spot" areas where soil deposition may occur (i.e., neat liquid, aerosol or liquid droplets), surface soil samples should be taken from a non-vegetated area to a depth of less than one inch. Sub-surface soil samples are typically not necessary unless a large amount of liquid was poured on the ground, or if an underlying aquifer is endangered. Concurrent air monitoring for L-1, total As, and HD is recommended.

Surface Wipes: Wipe samples are often desired to indicate absence of HL (as L-1, total As, and HD) on non-porous surfaces. Concurrent air monitoring for L-1, total As, and HD is recommended.

Bulk: For hot spot areas where liquid HL deposition may occur on porous surfaces (e.g., concrete, asphalt), actual pieces (chips) or cores of contaminated surface may be obtained using appropriate tools (scabbling, coring, or drills) for subsequent laboratory extraction analysis for L-1, total As, and HD. Bulk samples of suspected sink materials may be recommended to rule out secondary vapor phase disposition or absorption of L-1, total As, and HD into these materials. Concurrent air monitoring for L-1, total As, and HD is recommended.

Other Sample Matrices: Contact EPA/HQ-EOC at 202-564-3850 for sampling instructions.

11. Packaging/Shipping: CWA Environmental Samples for Site Characterization

Packaging and Shipping: CWA Environmental Samples For Site Characterization

The packaging and shipping of environmental samples potentially contaminated with a chemical warfare agent (CWA) would be subject to complex and restrictive regulations established primarily by DOT for ground transportation (49 CFR Parts 171-180), and by DOT, ICAO, and IATA for air transportation (in addition to other regulations by CDC, USPS,

OSHA). Transportation of HL-contaminated waste for treatment and disposal is covered under the WASTE MANAGEMENT section below.

Samples can be collected from environmental media that include surface and subsurface soil, groundwater, surface water, drinking water, dust, air, and solids other than soil (e.g., building materials). Given the wide range of potential environmental media and complex regulatory requirements, the approach would likely be situationally dependent.

CAUTION: Environmental samples potentially contaminated with CWA should not be introduced into commercial transportation as an undeclared hazardous material. Hazard classification, packaging, and hazard communication are the shipper's responsibility under DOT's Hazardous Materials Regulations (49 CFR Parts 171-180).

A summary of key packaging and shipping considerations for environmental samples with unknown concentrations of a potential unknown CWA is:

- Transport of pure HL, L-1, or HD is forbidden other than via military (Technical Escort Unit) transport in accordance with 49 CFR §173.7.
- If the collected sample contains or is suspected to contain hazardous materials, as defined in 49 CFR §171.8, the shipper must determine the appropriate UN ID Number, the Proper Shipping Name (PSN), and the Packing Group (PG) from the Hazardous Materials Table in 49 CFR §107.101. The table will then direct the shipper to the type of hazard and handling labels needed, the appropriate packaging (inner and outer packaging), and any special provisions.
- The designated shipper (EPA personnel or contractors) must be trained and certified according to the requirements found in 49 CFR §172.704 (a)(2) and/or by IATA Dangerous Goods (DG) 1.5 requirements for shipments by air.
- Contact the sample-receiving laboratory to determine if they have additional packaging, shipping, or labeling requirements.

Note that there is no UN ID for HL, L-1, or HD listed in the Hazardous Materials Table (49 CFR §172.101). Therefore, the most likely classification would be UN3381, Toxic by inhalation liquid, n.o.s. with an LC50 lower than or equal to 200 mL/m^3 and saturated vapor concentration greater than or equal to 500 LC50, PG I. In the US, non-bulk packaging would then be in accordance with 49 CFR §173.226.

Use of Mobile labs: Another consideration would be use of an on-site mobile laboratory for CWA analysis. This could eliminate the shipper's responsibility for transporting the collected samples containing a substance that might be considered forbidden for transport by air or a hazardous material or DG by ground or air transport to an off-site laboratory. In addition, there may be public concern about shipping samples off-site, or reluctance of commercial shipping companies to accept and transport samples from a known CWA-contaminated site. EPA maintains mobile laboratory assets (PHILIS mobile laboratories: https://www.epa.gov/emergency-response/philis-portable-high-throughput-integrated-laboratory-identification-system) in NJ and CO that are capable of analyzing CWAs, including HL, L-1, or HD, in environmental matrices, down to health-based risk clearance levels. Access to the PHILIS mobile labs for a CWA incident can be obtained from EPA HQ/EOC at 202-564-3850. EPA also has access to the US Army CBRNE assets, including shipping and analysis, through inter-agency agreements as described in the COORDINATION WITH OTHER AGENCIES section below.

12. Analysis

Analysis

CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes and soil). Few laboratories currently have the capability to determine HL, L-1, or HD, particularly for large numbers of samples and for the various types of environmental media. EPA's ERLN labs (https://www.epa.gov/emergency-response/environmental-response-laboratory-network) that are specially trained and equipped for the analysis of HL, L-1, or HD, will use sample prep and analytical methods from EPA's Environmental Sampling and Analytical Methods (ESAM) Programs (https://www.epa.gov/esam). For access to the nearest ERLN laboratory specially trained and equipped for HL, L-1, or HD analysis, and methods provided in EPA's ESAM, contact EPA/HQ-EOC at 202-564-3850. The ERLN also maintains EPA's Compendium of Environmental Testing Laboratories (CETL), a database of commercial, federal, state, and academic laboratories, which can be queried for specific analyses and matrices. Analysis on environmental matrices for toxic organics, metals, biological and radiological agents, as well as several of the CWAs, including HL, L-1, or HD and their breakdown products, can be obtained by querying the database of laboratories listed in EPA's CETL (https://cfext.epa.gov/cetl/lblogin.cfm?action=None); prior registration for access to CETL website is necessary.

13. Coordination with Other Agencies: CWA Field Activities

Coordination With Other Agencies: CWA Field Activities

Numerous agencies other than EPA may be involved in a chemical agent response incident. Every attempt should be made to integrate assets and design a uniform approach to sampling procedures, quality assurance, and data sharing. Every attempt should be made to coordinate activities, share data, and maintain chain-of-custody integrity throughout all phases of the response, amongst all agencies involved.

Civilian: The National Guard Civil Support Team (CST) and the U.S. Coast Guard "Strike Teams" deploy survey teams, response vehicles, and mobile labs to hazardous chemical incidents throughout the United States. Many CSTs and Strike Teams have the capabilities to sample, prepare, and analyze certain types of environmental samples for CWA analysis. CSTs have analytical equipment that can provide screening or presumptive data results for CWAs. The OSC should

discuss site-specific types of samples, data quality, and chain-of-custody requirements with Strike Teams and CSTs before integrating their capabilities into the overall CWA response. Other agencies, such as the FBI, may be present on-site performing tasks, such as evidence retrieval, which are specific for their agency.

Military: EPA's Special Teams (ERT and CMAD) have access to Department of Defense (DOD) assets through Inter-Agency Agreements (IAA) with the US Army's Combat Capabilities Development Command, Chemical Biological Center (CBC) at Aberdeen Proving Ground, MD. The CBC has expertise and deployable assets for CWA air monitoring (i.e., MINICAMS™), sampling, analysis, decontamination, and waste transport and disposal through their ongoing demilitarization activities at former chemical agent munitions facilities in the US and abroad.

Access to EPA's IAA for support to Federal OSCs at a CBRN response or incident can be arranged through EPA/HQ-EOC at 202-564-3850. Consultation or training for EPA personnel and partners that do not need to go through EPA/HQ-EOC can be arranged via the IAA with EPA's ERT-Special Team at 732-321-6660. Additional CBRNE support can be obtained via the IAA with EPA's CMAD-Special Team, including support for chemical, biological, and radiological agent response through EPA/HQ-EOC at 202-564-3850.

14. Environmental Decontamination/Cleanup

Environmental Decontamination/Cleanup

14.1. Decontamination/Cleanup Planning:

Once site controls are in place, develop a site-specific decontamination/cleanup plan. Environmental decontamination may require a "tiered approach" using a variety of techniques and products. Call EPA/HQ-EOC at 202-564-3850 for more information.

General Considerations: A cost vs. benefit evaluation should be undertaken for each decontamination strategy and approach that considers public safety, total cost, impact on the area, wastes generated, time the area or item will be inaccessible and/or out of service, as well as any socio-economic, public health, and/or security impacts that may result. Large volumes of decontamination wastes may be generated that will need to be collected, treated, and disposed of properly. Waste handling and disposal must be addressed as early in the decontamination and cleanup process as possible (see WASTE MANAGEMENT section below).

Disposal Option: The urgency to restore an area or item as quickly as possible may result in the outright and timely removal and disposal of contaminated materials. Certain materials may be impacted by the decontamination products, and/or may be cheaper to discard and replace than to decontaminate and restore.

Monitored Natural Attenuation: HL degrades via natural processes. Environmental monitoring must be maintained during decontamination and recovery phases. Monitored natural attenuation may require institutional controls (e.g., access restriction and contaminant containment measures). The time to achieve clearance must be considered in the overall cost/benefit evaluation. This option is more passive than other options but is non-destructive to materials. Porous or permeable materials can absorb HL thereby prolonging persistence.

Fix-in-Place Option: The contaminated area may be resistant to decontamination products or may be unable or impractical to be treated. Physical barriers can be used to immobilize the contamination and prevent it from coming into contact with the environment or the public. This can be a temporary or permanent solution.

14.2. Decontamination Strategy:

A decontamination strategy can be developed by designating contaminated areas into five broad categories: 1) surfaces or hot spots, 2) large volumetric spaces, 3) sensitive equipment or items, 4) aqueous solutions, and 5) water systems. Areas in each category may be treated using one or more unique decontamination processes in a tiered approach to the overall site-specific decontamination strategy.

Decontamination of HL as a mixture faces the same challenges as the individual components, HD and L-1.The decontamination of HL as a mixture has been studied and has been reported as efficacy against HD on surfaces in the presence of residual L-1 and efficacy against L-1 on surfaces in the presence of residual HD. Hence, strategies presented below are based on the individual components, HD and L-1.

Cautions:

Presence of Lewisite in HL:

- Hydrolysis of L-1 is rapid and produces compounds containing As (III), the more toxic oxidation state of arsenic, such as lewisite oxide and most significantly CVAA, which has similar vesicant properties as L-1. In basic solutions, acutely toxic inorganic arsenite (AsO_3) may also be formed. HCl may also be produced, so situation-specific tolerance to potentially altered pH and corrosiveness should be evaluated when developing a decontamination strategy.
- Under oxidizing conditions (e.g., for household chlorine bleach or other hypochlorite-containing solutions), the hydrolysis products of L-1 mentioned above are converted to compounds containing As (V), which are generally less toxic but still can be of concern. The conversion is rapid even under mild conditions, but complete conversion should not be assumed because of the toxicity of CVAA. Decontamination formulations and conditions should be chosen to minimize or eliminate the formation of these toxic breakdown products.

Presence of HD in HL:

- Under oxidizing conditions (particularly for household chlorine bleach or other hypochlorite-containing solutions), HD can break down into several toxic byproducts, such as mustard and vinyl sulfones. Decontamination formulations and conditions should be chosen as to minimize or eliminate the formation of these toxic breakdown products.
- Hydrolysis of HD produces HCl. Situation-specific tolerance to potentially altered pH and corrosiveness should be evaluated when developing a decontamination strategy.

Decontamination:

- Decontamination products may have unique safety/PPE requirements due to their own toxicity or that of breakdown products during use (e.g., use of bleach results in release of chlorine vapors). Strong oxidizers, such as hypochlorite, may react violently with organics.
- Dirt, grime, and other coatings (organic load) can reduce the efficacy of decontamination; pre-cleaning surfaces with soap and water may be needed before the application of decontamination formulations. However, the resulting pre-cleaning rinsates require containment to avoid spread of HL including the L-1 degradation products CVAA which will be formed as a result of pre-cleaning with aqueous solutions.
- Even under ideal decontamination conditions using oxidizers, residual arsenic compounds including arsenate will be present and should be considered in site-specific goals.

For additional information, contact the EPA/HQ-EOC at 202-564-3850.

Surfaces/Hot Spots: This category is for areas smaller in size but with higher levels of agent contamination. They may require more rigorous decontamination products and methods. Excess HL liquid should be absorbed using, e.g., vermiculite or dry sand, and transferred into a sealed container and disposed of according to WASTE MANAGEMENT section below. In contrast to the rapid hydrolysis when HD and L-1 are dissolved in water, the hydrolysis of both HD and L-1 on surfaces is generally slower since it is limited by the amount of available moisture. Regardless of hydrolysis rate, hydrolysis products such as CVAA should be avoided. Thus, application of the following oxidative decontamination solutions and formulations may be efficacious by following applicable manufacturers' directions.

1) Hypochlorite-containing solutions: Hypochlorite can be corrosive to certain surfaces and materials and should be rinsed thoroughly afterwards.
   - Household bleach solutions (≥5% sodium hypochlorite) are effective for decontamination of surfaces contaminated with HL with high efficacy expected to be achieved with contact time of 30-60 minutes depending on surface material. Diluted bleach (<0.5% sodium hypochlorite) has been shown to be less effective for these contact times. Note that lowering the pH of hypochlorite solutions is not required and may be counterproductive. If inadequate amount of oxidant is used, highly toxic byproducts will likely accumulate calcium hypochlorite, present in commercial products, such as HTH (10% hypochlorite solution), is better for surfaces with high concentrations of liquids in localized areas.
   - The decontamination technology EasyDecon DF-200® (or equivalent Decon7 (D7)), which is expected to be less corrosive than hypochlorite-containing solutions, is generally effective against surfaces contaminated with HL with a contact time of at least 30 minutes although residual HD may remain and would require additional decontamination. Other proprietary decontamination technologies such as Dahlgren Decon®, CASCAD®, Decon Green®, or L-Gel® have not been tested for decontamination of surfaces with HL. More specifically, all of these technologies have been shown to be effective against HD alone on the order of minutes to hours, but not all have been thoroughly tested against L-1. Availability, cost, and the need for specialized equipment to apply the decontaminant may limit their use early in the response.

Large Volumetric Spaces: This category is for areas larger in size but with lower levels of agent contamination. These areas may require less aggressive, but more broadly applied, decontamination products and methods. The described approaches are based on studies of HD or L-1; there are no testing data available for HL mixture.

1) Monitored Natural Attenuation is more passive than other decontamination options and is non-destructive to materials. This option may be preferable depending on the scope and severity of contamination.
2) Forced or Hot Air ventilation methods are recommended for vapor plume contamination or low surface concentration of HD and L-1 in large volumetric spaces, including HVAC systems, or open areas; efficacy may be typically achieved in hours to days with less waste and adverse impacts to materials. L-1 hydrolysis and vesicant byproduct CVAA may be formed and would stay on surfaces longer than L-1. Capture technologies, such as activated carbon-containing air filters, would be required to prevent transfer of the HD and L-1 vapors to the outside environment or prevent recirculation into other surrounding spaces.
3) Fumigations with modified vaporous hydrogen peroxide (mVHP®; a combination of ammonia and hydrogen peroxide vapor) or chlorine dioxide (ClO_2) have been reported to be effective against HD. mVHP® and ClO_2 have not been tested for decontamination of surfaces with L-1. These oxidants may be theoretically effective and advantageous based on expected formation of less toxic arsenic-containing byproducts.
4) Steam application has been reported to effectively degrade HD on surfaces with no HD found in the condensate. Steam has not been tested for L-1 and may lead to L-1 hydrolysis and formation of vesicant byproduct CVAA.

Sensitive Equipment or Items: Forced or Hot Air ventilation may be used for HL and can be used either in-situ or ex-situ to decontaminate these items. Capture technologies using activated carbon air filters would be required to prevent transfer of the L-1 and HD vapor to the outside environment or prevent recirculation into other surrounding spaces. Although testing has not been performed, fumigation with mVHP® is another option that could be efficacious aside from formation of less toxic arsenic-containing byproducts, with no or minimal impact on materials.

Aqueous Solutions:
L-1 component of HL degrades rapidly via hydrolysis but forms other toxic compounds and vesicants, such as CVAA and arsenite, as well as HCl. Decontamination operations involving bleach or other oxidants may yield aqueous solutions containing arsenic compounds that may have been converted to less toxic forms. Some toxicity will still be retained (see toxic byproducts statement under Cautions above). The HD component of HL degrades via hydrolysis but may persist in aqueous solutions, depending on initial concentration and environmental conditions. Also contributing to persistence is that hydrolysis products of HD may accumulate at the interface between the HD liquid and the water, forming a protective coating around HD "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed. It is unknown if this occurs for HL. The amount of disturbance required is unknown, so simple mixing of containerized HL solution may not suffice. Hydrolysis of HD produces HCl. If the aqueous solutions result from decontamination operations involving bleach or other high pH conditions, significant HD degradation into toxic byproducts may occur (see toxic byproducts statement under Cautions above).Avoid any additional release and/or inappropriate disposal to water systems, drains, or sewers. Contain or transfer liquid to appropriate containers and dispose of according to WASTE MANAGEMENT section below.

Water Systems: Hydrolysis and removal of contaminated water will lessen HD, L-1 and its breakdown products (e.g., CVAA) contamination in water systems, but they may persist in hydraulic dead ends and via sorption to system components (e.g., plastics) that act as sinks. It may be necessary to isolate potentially affected portions of the system to evaluate them and implement decontamination. A contaminated water system may transfer HD, L-1 and its breakdown products (e.g., CVAA) to building and premise plumbing, which then may also require decontamination. As HL mixture is denser than water, it may sink and accumulate in low lying areas, such as the bottom of pipes and tanks. Hydrolysis of HD in water produces HCl.

Verification of Decontamination: Site and situation specific. Please contact EPA/HQ-EOC at 202-564-3850 for further assistance.

15. Waste Management

Waste Management

15.1. Transportation:

Federal requirements for the commercial transport of hazardous materials and procedures for exemptions are specified in How to Comply with Federal Hazardous Materials Regulations, available at: https://www.fmcsa.dot.gov/regulations/hazardous-materials/how-comply-federal-hazardous-materials-regulations.

Mustard-Lewisite Mixture (HL), Lewisite (L-1), or Sulfur Mustard (HD) should not be offered for commercial transportation without being rendered safe by neutralization. Contact the PHMSA Hazardous Materials Information Center at 1-800-467-4922 or infocntr@dot.gov to discuss specific cases.

Additional resources on packaging, labeling, and shipping are available at: https://www.phmsa.dot.gov/standards-rulemaking/hazmat/hazardous-materials-regulations. Detailed state regulations can be found at www.envcap.org/.

This QRG is intended to apply to Federal OSCs in the first 24-48 hours of a response. Once determined, the concentrations of HL, L-1, or HD in individual waste streams should be used to determine which transportation requirements apply. For instance, certain requirements may apply to waste streams with concentrated agent but may not apply to waste streams such as soil containing dilute concentrations of agent.

15.2. Waste Management:

Under the Resource Conservation and Recovery Act (RCRA), waste is classified as hazardous waste (subtitle C) or solid waste (subtitle D). The RCRA regulations generally define a waste to be hazardous if it is: (1) a listed waste (40 CFR §261.31-§261.32); (2) exhibits specific characteristics (40 CFR §261.21-§261.24); or (3) is a discarded commercial chemical product, off specification species, container residue, or spill residue listed in 40 CFR §261.33.

- Lewisite (L-1) is not listed under 40 CFR §261.31-33, but L-1-contaminated waste may be considered toxic hazardous waste, chemical code D004, if it contains arsenic (As) above the regulatory level of 5.0 mg/L when tested according to the specifications in 40 CFR §261.24.
- Sulfur Mustard (HD) is not listed under 40 CFR §261.31-33, but HD-contaminated waste may be considered reactive hazardous waste, D003, if, when mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(4)) or if it is a sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(5)).

It is the responsibility of the waste generator to make a hazardous waste determination (40 CFR §262.11).

The states (except for Alaska and Iowa) have the primary responsibility to implement the hazardous waste regulations and can impose more stringent requirements or requirements broader in scope than the federal program. Because L-1 contains As, the state may have specific regulations regarding disposal of As-contaminated wastes. Several states, including CO, IN, KY, MD, OR, and UT, have their own waste designations for chemical agents, which may be applicable for the cleanup of HL-, HD-, or L-1-contaminated residues, decomposition products, soils, and debris. It is critical to open a dialogue with state regulators as early as possible.

Management of toxic decomposition products, associated residual decontamination solutions, local waste acceptance criteria, and transportation and handling requirements should be considered. High pH aqueous decontamination solution waste may be considered corrosive hazardous waste, chemical code D002, if it has a pH greater than or equal to 12.5 (40 CFR §261.22).

EPA/CMAD can provide Federal OSCs with information and support to address knowledge gaps for dealing with wastes contaminated with dilute concentrations of CWA; contact EPA/HQ-EOC at 202-564-3850.

EPA also recommends the creation of pre-incident waste management plans as a preparedness measure for chemical agent releases, and has created an **All-Hazards Waste Management Planning Tool** to help state, local, territorial, and tribal waste management officials coordinate and prepare these plans. Access to the All-Hazards Waste Management Planning Tool requires pre-registration (https://wasteplan.epa.gov/).

NRT Quick Reference Guide: Sulfur Mustard (HD)

NRT Quick Reference Guide: Sulfur Mustard (HD)

GHS: Acute Toxicity, Category 1
H310 – Fatal in contact with skin
H330 – Fatal if inhaled

GHS: Eye Damage/Irritation, Category 1
H318 – Causes serious eye damage

1. Agent Characteristics

Agent Characteristics

Agent Classification: Schedule 1 Chemical Warfare Blister (Vesicant) Agent; Sulfur Mustard (HD); CAS 505-60-2

Description: Sulfur mustard, Bis-(2-chloroethyl) sulfide, is sometimes called "mustard gas" but is actually a yellow to brown oily liquid with a garlic, onion, horseradish, or mustard-like odor. It is a blister (vesicant) agent that will have delayed health effects on the order of hours, and is reported to be a known human carcinogen. It can be manufactured at different concentrations; with impurities, additives, or thickening materials that will all affect physical properties, appearance, persistence, and analytical detection limits. Distilled mustard (HD) is considered the most toxic form and is the basis of this QRG. Because HD evaporates slowly, HD is primarily a liquid hazard − or dermal (contact) hazard − under temperate conditions, although aerosols and vapors can be generated under proper conditions and would present an ocular or inhalation hazard. Environmental breakdown (hydrolysis) products of HD, including thiodiglycol (TDG) [CAS 111-48-8] and hydrochloric acid (HCl), are relatively non-toxic, but some combustion and decontamination byproducts can be toxic (e.g., sulfur oxides, sulfones).

Other Sulfur Mustard Agents:

- **Agent H** (CAS 505-60-2): H is Levinstein mustard, from a production process that originated during WWI and contains about 30% impurities. The reported physical and chemical properties, and toxicity, are essentially the same as those reported for HD.
- **Agent HT** (CAS: 101-77-9): HT is a mixture of 60% Agent HD and 40% Agent T ((bis (2-chloroethylthio) diethyl ether)), a vesicant that is a byproduct of certain methods of manufacturing mustard. Agent T is intentionally included to lower the freezing point of HT (32-34.3°F (0-1.3°C)), lower the volatility, and increase the persistence of sulfur mustard. The reported toxicity and remaining physical and chemical properties of HT are similar to those of HD.

Persistence: HD is considered a "persistent or semi-persistent" chemical warfare agent with liquid deposition on surfaces lasting for hours to days. Persistence will depend upon the amount and purity of the agent, method of release, environmental conditions, and the types of surfaces and materials impacted. HD can be 2 to 5 times more persistent in winter than in summer due to lower winter temperatures. Under certain environmental conditions, HD liquid may go through a partial hydrolysis that results in an outer protective coating around "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed. This is often the case in aqueous systems where HD, with a liquid density greater than water (>1), will sink to the bottom of water systems, and persist for considerable periods of time (years, decades), while retaining its vesicant properties. Porous, permeable, organic, or polymeric materials such as carpets, vinyl tiles, and painted surfaces can accumulate HD vapors and liquids, acting as "sinks," thereby prolonging persistence.

2. Physical Properties

Physical Properties

Molecular Weight: 159.08 g/mol	**Formula:** $C_4H_8Cl_2S$
Vapor Density: 5.4 (air = 1)	**Flash Point:** 219-221°F/104-105°C
Vapor Pressure: 0.072 mm Hg (68°F/20°C)	**Liquid Density:** 1.27 g/mL (68°F/20°C)
Volatility: 610 mg/m^3 (68°F/20°C)	**Melting/Freezing Point:** 55-57°F/13-14°C
Boiling Point: 419-423°F/215-217°C	**Non-aqueous Solubility:** Common organic solvents, alcohols, gasoline, oils, fats
Hydrolysis ($t_{1/2}$): The rate of HD hydrolysis is controlled by the speed of dissolution of the HD into water, which is typically very slow especially if "globules" are formed (see Aqueous Solubility). Once HD is dissolved in bulk water, hydrolysis proceeds rapidly. In distilled water, $t_{1/2}$ = 5-8.5 minutes (77°F/25°C). In salt water, $t_{1/2}$ = 60 minutes (77°F/25°C).	**Aqueous Solubility:** HD is practically insoluble in water and is limited by the rate of dissolution (mass transfer) of HD into the bulk water. After HD is dissolved, the solubility of HD in distilled water is 0.92 g/L (72°F/22°C). HD is heavier than water (Liquid density > 1) and if released in or on top of the water, will sink to the bottom of waterbodies where it can form a protective coating around "globules" (see Persistence in AGENT CHARACTERISTICS section above) and resist further dissolution and persist for considerable periods of time (years, decades) while retaining its vesicant properties.

Note: physical properties are listed at/near STP unless otherwise indicated. The reported Physical Properties for H and HT are similar to the reported physical properties for HD.

Conversion Factors for HD: ppm = mg/m^3 x 0.1538; mg/m^3 = ppm x 6.503

3. Release Scenarios

Release Scenarios

AIR RELEASE SCENARIOS ARE ASSUMED MOST PROBABLE; HOWEVER, OTHER RELEASE SCENARIOS AND EXPOSURE ROUTES SHOULD BE CONSIDERED.

Open Areas: HD is difficult to disperse in air due to low volatility; however, it may be possible to disperse HD as a vapor/aerosol plume or liquid droplets if an appropriate heat/explosive device is employed. The low volatility of HD would limit the size and extent of plume dissipation, posing localized hazards. **HD has a melting/freezing point at 55-57°F/13-14°C. Frozen HD can easily melt as ambient temperatures rise, and may present a continued dermal (contact) hazard. The vapor hazard of HD increases with increasing temperature; HD is a definite vapor hazard (i.e., ocular or inhalation hazard) at temperatures above 100°F (38°C).** HD vapors are heavier than air, so vapors can accumulate in lower terrains.

Water/Water Systems: If released into natural waters or water systems, HD may sink to the bottom, then slowly dissolve. Some release conditions may be conducive for enhancing the dissolution rate, such as agitation and dispersion as fine droplets. Once dissolved, the HD hydrolyzes with a half-life dependent on the composition of the water, ranging from 5-8.5 minutes (at 77°F/25°C in distilled water) to 60 minutes (at 77°F/25°C in high chloride waters, such as seawater). In sufficient amounts (relative to water volume) and under certain environmental conditions (low temperature and oxygen levels), HD may also form globules surrounded by a protective outer layer resistant to hydrolysis. These globules may settle out or be entrapped, persisting for decades, and posing a contact hazard to anyone disturbing them. Areas in which the globules may persist include stagnant volumes of water as small as puddles formed by precipitation events. Water systems, plumbing, surfaces, and equipment that have contacted HD globules should be evaluated for decontamination.

Indoor Facility: HD is a semi-persistent agent with low to moderate volatility and would be difficult to distribute effectively throughout a building or facility from a point source. Liquid HD will result in localized areas of surface contamination. However, HD vapors can be generated if conditions are right. HD vapors are heavier than air so vapors can accumulate in lower levels, basements, floor drains, or utility corridors inside the buildings.

Other: HD will decompose when heated or when combusted in a fire to form highly toxic fumes of sulfur oxides and hydrochloric acid. If HD is released into the air as a liquid spray (aerosol), it has the potential to contaminate agricultural products. If HD is released as a vapor, it is unlikely to contaminate agricultural products, since it will likely recondense as a liquid soon after release, presenting a potentially short- or long-term secondary dermal (contact) hazard.

Military Munitions: Information for OSCs on military munitions found in the civilian sector (e.g., recovery of sea-disposed discarded HD munitions during diving or commercial fishing, clamming, and dredging) is available on nrt.org (scroll to or click on military munitions hazards).

4. Health Effects

Health Effects

4.1. Onset: Onset of symptoms is dose and route dependent. Onset and severity of effects depend on dose, duration, and route of exposure (not all signs/symptoms may develop). The effects caused by HD are not typically fatal immediately, but can require substantial supportive medical care as there is no antidote, and secondary infections from blisters/tissue damage may also be fatal. HD produces effects by causing DNA damage/cell death in seconds (this is not like an acid burn). Despite the immediate DNA damage actual **signs/symptoms may be delayed 1-48 hours** after exposure, so those exposed may not be aware.

4.2. Signs/Symptoms: Initial symptoms will vary depending on dose and exposure route (see EXPOSURE ROUTES section below). The following is a general list of possible symptoms. The severity of effects depends upon the dosage.

Mild: Effects delayed 1-48 hours (severity depends on dose): Eye irritation (tearing, grittiness), runny nose, sneezing, nosebleed, hoarseness, hacking cough.

Moderate: Effects delayed 1-24 hours: Mild effects plus reddening and swelling of eyelids, severe cough, shortness of breath, reddening of skin.

Severe: Effects delayed 1-24 hours: Upper respiratory/lung damage may occur at high concentrations and longer exposure durations.

4.3. Exposure Routes:

Inhalation: Airway injury develops slowly, within 2-6 hours after severe exposure or within 12-24 hours after mild exposure and intensifies over several days. Airway injury begins with the upper airways and descends to the lower airways. Vapor exposure is absorbed in mucous membranes (e.g., mouth, throat, lungs).

- **Mild exposure:** Runny nose, sneezing, nosebleed, hoarseness, hacking cough, wheezing, and difficulty breathing.
- **Severe exposure:** Same as above, plus acute inflammation of upper and lower airways, tissue death of airway lining, airway blockage from inflamed and dead (necrotic) cells, and death due to lung inflammation (pneumonia).

Skin: Direct contact with HD liquid can cause redness or blisters in 2-24 hours. Some skin injury may appear as late as 48 hours after exposure. Warm and sweaty skin areas (e.g., underarms, groin) are most susceptible to exposure. Skin effects of HD liquid occur sooner than skin effects of HD vapor.

- **Mild exposure:** Redness (erythema) within 1-24 hours, blistering (vesication) within 2-18 hours after onset of redness, itching, and burning pain.

- **Severe exposure:** All of the above, with more severe blistering (vesication) with areas of tissue death (necrosis) along with whole-body (systemic) effects including weakness, vomiting (emesis), fever, exhaustion. Skin exposure to HD can be fatal: an area of redness (erythema), with or without blistering (vesication), which covers 25% or more of the body's surface area, suggests a lethal exposure.

Eyes: Eyes are the most sensitive to HD vapors; effects occur after 1-2 hours after severe exposure or within 3-12 hours after a mild to moderate exposure.

- **Mild/Moderate exposure:** Lacrimation (tear production), irritation, burning, dryness or gritty feeling, itching, weeping, reddening, lid swelling (edema in eyelids), and moderate pain.
- **Severe exposure:** Severe pain and additional effects include increased lid swelling (edema in eyelids), light sensitivity, corneal injury, and blindness and generally require extended medical treatment.

Ingestion: Consumption of contaminated food or drink could cause nausea, vomiting (emesis), pain, and possible chemical burns of gastrointestinal (GI) tract.

5. Effect Levels

Effect Levels

Air (inhalation vapor hazard): Acute Exposure Guideline Levels (AEGLs) for general population one-time exposure emergency scenarios for HD (complete definitions are available at: https://www.epa.gov/aegl).

AEGL Level in mg/m^3, at various exposure durations for HD. (Note: AEGL values for H and HT are not available)	**10 min.**	**30 min.**	**1 hr.**	**4 hr.**	**8 hr.**
AEGL 1: Threshold mild effects	0.40	0.13	0.067	0.017	0.008
AEGL 2: Potentially irreversible effects or impaired ability to escape	0.60	0.20	0.10	0.025	0.013
AEGL 3: Threshold for severe effects/medical needs/increasing potential for lethality	3.9	2.7	2.1	0.53	0.27

American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPG™) are not established/determined for HD.

6. Exposure Guidelines

Exposure Guidelines

6.1. Airborne Exposure Limits (AELs): CDC has issued recommendations for protecting human health from potential adverse effects of exposure to this agent. The reported AELs for H and HT are the same as those for HD.
(refer to: NIOSH ERSH-DB, https://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750008.html)
[original source: CDC, National Center for Environmental Health (NCEH), Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard), 69 FR 24164-24168 (May 3, 2004)]

CDC/National Center for Environmental Health (NCEH) IDLH = 0.7 mg/m^3; workers should remove themselves immediately from exposure if the concentration is reached at any point in time
CDC/NCEH STEL = 0.003 mg/m^3 (3×10^{-3}); exposure at the STEL should be as short as practical (but no longer than 15 minutes) and should not occur more than once per day
CDC/NCEH Worker Population Limit (WPL) = 0.0004 mg/m^3 (4×10^{-4})
CDC/NCEH General Population Limit (GPL) = 0.00002 mg/m^3 (2×10^{-5})

6.2. Occupational: (NA = not available)

NIOSH IDLH = NA	**OSHA PEL** = NA
NIOSH REL-TWA = NA	**ACGIH TLV-TWA** = NA
NIOSH REL-STEL = NA	**ACGIH TLV-STEL** = NA

6.3. Population:

Soil: USAPHC Health Based Environmental Screening Levels (HBESL) = TBD. The US Department of Defense (DOD) will be issuing new HBESL values for both industrial and residential soil after DOD completes a reevaluation of toxicological information related to liquid mustard skin exposure and vesication (blistering). Until DOD releases these new HBESL values to the public, DO NOT use current values available from websites and other resources.

Drinking Water: EPA Provisional Advisory Levels (PALs): see below for more information.

EPA Provisional Advisory Level (PAL): PALs represent chemical concentrations in air or drinking water above which varying health effects (PAL1, PAL2, PAL3) are expected. They are developed for 24-hour, 30-day, and 90-day exposure durations. In the event of a nationally significant or large-scale chemical release, EPA can provide PALs, if available, to appropriate end-users and stakeholders as needed (PALs are not currently available to the public) to assist in response decision-making. Contact: PALs@epa.gov, for information on and access to the PALs. (Note: PALs are not intended to define cleanup levels.)

7. Personnel Safety

Personnel Safety

Note: Personal Protective Equipment (PPE) selection (Levels A-D), medical surveillance requirements, First Aid options, and personnel decontamination may vary depending upon the amount and purity of agent, site conditions, and the release scenario. Additional information on personnel safety and PPE selection criteria can be found at: www.cdc.gov/niosh/ershdb. We also recommend that responders check their own internal procedures (i.e., SOPs), if applicable.

7.1. Medical:

Pre-incident: Must have current medical and respiratory clearances as part of an Occupational Medical Surveillance Program according to OSHA HAZWOPER and Respiratory Protection Program, as per 29 CFR 1910.
During Incident: Conduct periodic on-site medical monitoring, observe for any signs and symptoms as per HEALTH EFFECTS section above and treat accordingly as per First Aid section below.
Post-incident: Perform post-incident medical surveillance, as per 29 CFR 1910. Because health effects may not occur until several hours after exposure, patients/victims should be under medical surveillance for at least 24-48 hours.

7.2. First Aid: Immediately remove person from affected area and remove contaminated clothing and articles. Wash bare skin immediately with water, or warm, soapy water if available, at normal household pressures (~50-60 psi) for three minutes, ensure thorough soaking. Rinse eyes exposed to agent (liquid or vapor; eyes are especially sensitive to HD) with potable water for at least 15 minutes. If irritation or pain is severe or persists, prolonged eye washing is advised. Do not cover eyes with bandages. Seek immediate medical attention.

Antidote: NO ANTIDOTE AVAILABLE.

Other: RSDL (Reactive Skin Decontamination Lotion), an FDA-cleared kit with a sponge impregnated with a lotion to remove or neutralize chemical warfare agents from contaminated skin. Apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

After administering first aid, send person for follow-up medical attention and evaluation. If cleared to resume work, continue to monitor for signs/symptoms and treat accordingly.

7.3. Personal Protective Equipment (PPE):

GENERAL INFORMATION: NIOSH Approved® Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA), NIOSH Approved Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR), full-face masks, and protective clothing should be used. Level A protection should be used until monitoring results confirm identity and concentration of contaminant. Pre-incident training and exercises on the proper use of PPE are recommended.

Per NIOSH guidance –

LEVEL A: Recommended for the initial response to an HD incident. NIOSH Approved CBRN full-face-piece SCBA operated in pressure-demand mode with Level A suit that provides protection against CBRN agents. Level A provides the greatest level of skin (totally-encapsulating chemical protective suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank), respiratory (SCBA), and eye protection when the contaminant identity or concentration is unknown. Select Level A when the HD concentration is unknown or above the IDLH or AEGL-2, and when there is a potential of ocular or dermal exposure.

LEVEL B: Pressure-demand SCBA (NIOSH Approved CBRN full-face-piece SCBA) with Level B protective suit that provides protection against CBRN agents. Level B provides the highest level of respiratory protection (SCBA) when a lesser level of skin protection is required. Select Level B when the HD concentration is unknown or above the IDLH or AEGL-2, and when dermal exposure is less of a risk. Level B differs from Level A in that it typically incorporates a non-encapsulating, splash-protective, chemical-resistant outer suit that provides protection against most liquids but is not vapor tight (hooded chemical-resistant outer suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank).

LEVEL C: May be selected when the contaminant identity and concentration are known and the respiratory protection criteria factors for the use of APR or PAPR (i.e., < IDLH, warning properties) are met. Level C may be appropriate when decontaminating personnel or equipment. Level C still incorporates hooded chemical-resistant outer suit that provides protection against CBRN agents, chemical-resistant inner and outer gloves, and chemical-resistant boots with steel toe and shank.

- For air levels greater than AEGL-2: NIOSH Approved CBRN tight-fitting PAPR with a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator.
- For air levels greater than AEGL-1: NIOSH Approved CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR.

LEVEL D: Select Level D when the contaminant is known and the concentration is below the appropriate occupational exposure limits or less than AEGL-1 for the stated duration times. PPE includes coveralls or other work clothes, boots, and gloves.

Downgrading PPE levels can be considered only by the site Health and Safety Officer when the identity and concentration of the contaminant and the risks of dermal exposure are known, and must be accompanied by on-site

monitoring. The on-site availability of any applicable medical countermeasures should also be considered when deciding to downgrade PPE during a CBRN response.

8. Personnel Decontamination

Personnel Decontamination

8.1. Personnel Decontamination Procedure:

Tents, berms, and collection vessels should be able to maintain copious amounts of wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decontamination process as well as replace necessary chemicals and decontamination solutions.
Prior to entering the hot zone, all personnel are required to familiarize themselves with the site-specific personnel decontamination procedures.

Personnel decontamination should take place in a decontamination area comprised of two decontamination corridors (one for entering and one for exiting). Position corridors upwind and uphill of release area; exit should be upwind and uphill of entrance. Detergent and water solution (pH>8, but <10.5), soft brushes, and durable 6-mil polyethylene bags should be provided.

Personnel decontamination area workers need to wear appropriate PPE as indicated below. Be aware that absorbed agent can be released from clothing and skin as a vapor.

Conduct personnel decontamination per NIOSH ERSH-DB:
https://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750008.html

- Emergency Responders: Use soft brush to wash PPE with soap and detergent solution in a downward motion, getting into all folds. Repeat washing and rinsing until thoroughly clean. Remove PPE by rolling downward from head; avoid pulling PPE over the head. Remove SCBA last, and place all PPE in polyethylene bags.
- Patient/victim: Remove all clothing down to at least undergarments, and place in polyethylene bags. Thoroughly wash and rinse skin with soap and water solution, taking care not to break the skin and covering all open wounds. Cover patient/victim (e.g., blanket, towels, Tyvek) and move to treatment area. If available in decontamination kit, apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

8.2. Personnel Decontamination Procedures by Zone/Step: (attendants will verbally direct personnel through each step)

Conducted in Hot Zone (exclusion zone)

1	Equipment Drop	Place equipment taken into the Hot Zone on a plastic covered table or container provided prior to entering the contamination reduction corridor. Equipment will either be reused if more than one entry is planned or will be decontaminated later.

Conducted in Warm Zone (contamination reduction zone)

2	Sample Drop	Place samples in a container provided for sample decontamination. Care needs to be taken to ensure that workers maintain chain-of-custody of samples. It is recommended that samples are decontaminated in a separate decontamination line.
3	Outer Boot and Glove Wash	The purpose of this step is to enable physical removal of gross contamination if contamination is visible. If gross contamination is not visible, this step may be skipped. Wash outer boots and then outer gloves using designated decontaminating agents as specified in HASP (e.g., soap and water, trisodium phosphate substitute, or diluted bleach).
4	Glove, Boot, and Suit Wash	Wash all outer surfaces in a contained area (e.g., kiddie pool) using a pressurized spray with designated decontamination solution. Start with decontaminating boots and gloves, then work on suit from the top down, including SCBA/PAPR casing. Decontamination personnel should conduct this step. Care should be taken to ensure that all areas are decontaminated, including around zipper, arms, front torso, and any other area that could have come in contact with contamination. The solution used for decontamination should be contained, collected, and disposed of properly from the decontamination line.
5	Outer Glove, Boot, and Suit Removal	While sitting on a stool, remove outer boots and outer gloves. Undo the SCBA/PAPR belt and hold in hand. While touching only the inside of suit, carefully roll suit in an outward motion from shoulders down to feet. Dispose of boots, gloves, and suit in a designated container. This step may require decontamination personnel to assist either by holding SCBA/PAPR unit or assisting in suit removal.
6	Mask Removal	With inner gloves, remove the mask. Remove cartridge filters and place into designated container. Put mask into mask wash. Decontamination personnel will clean each mask and SCBA/PAPR assembly prior to return to service.
7	Inner Glove Removal	Remove inner gloves by only touching outside of first glove and then only inside of second glove. Place gloves into designated container.

Conducted in Cold Zone (support zone)

8	Quadrant Monitoring	Using appropriate HD air monitoring equipment, screen personnel for residual contamination by dividing body into 4 sections: upper right and left sides of the body, and lower left and right sides. If positive, perform spot decontamination immediately and direct person to showers.

9	Personal Shower	Personnel should shower using copious quantities of soap and water for a minimum of 5 minutes and change into clean clothes. If a personal shower is not immediately available then, at the minimum, hands and face should be washed thoroughly.
10	Medical Monitoring	Report to medical monitoring station for post-entry monitoring and report to appropriate personnel for debriefing. Observe for any obvious sign of HD exposure. Using criteria listed above in PERSONNEL SAFETY section of this QRG, administer RSDL and notify site Health and Safety officer.

Emergency Egress Corridor: Establish an emergency egress line to use for quickly decontaminating personnel who have medical emergencies while in the hot zone. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital.
Hand-Wash Station: A hand-wash station with soap and water should be available for personnel to clean up or physically remove any residual decontaminant following entry. If a hand-wash station is not initially available or weather conditions prohibit its use, personnel should wash their hands and face as soon as possible.
Caution: Avoid waterless hand cleaners, which contain solvents (alcohols) that could increase risk of dermal exposure to HD.

9. Field Detection

Field Detection

Real-time field screening tools (results not confirmatory or quantitative): Caution should be given to equipment that has not been properly evaluated. False positive and false negatives may occur in the presence of interferents common in the environment. The following is a summary of minimum screening concentration ranges or levels for equipment procured by many EPA and HAZMAT response teams. Other screening tools may be used by these teams and other agencies and responders, some with similar capabilities and limitations.

9.1. Minimum Screening Ranges/Levels for Air/(Vapor):

Field Equipment:	ppm	mg/m^3
JCAD M4A1, at 10 secs [30 mins/pre-concentrator]	8 [0.003]	50 [0.02]
AP2C / AP4C	0.08	0.5
MX-908 Vapor Mode	1.2	7.8
Dräger (CDS Kit)	0.15	1.0
MINICAMS™ (Near real-time; at 5 minutes)	0.0005	0.003

9.2. Minimum Screening Ranges/Levels for Vapor/Liquid:

Field Equipment:	**ppm** (vapor)	**mg/m^3** (vapor)	**mL** (liquid)
M256 / M256A1 (13 mins)	0.46	3.0	0.02 (via M8 paper)
M8	NA	NA	0.02

Note: M256 is combined 2 kits with 12 disposable sampler/detectors for vapors and a booklet of M8 paper for liquids.
NA = not applicable

9.3. Minimum Screening Ranges/Levels for Water:

Field Equipment:	mg/L
M272	0.02

10. Environmental Sampling

Environmental Sampling

Note: This section on sampling contains general guidelines and does not replace the need for a site-specific sampling plan

10.1. Sampling Concerns: Detection, sampling equipment and procedures, and analytical techniques will be site-specific and depend on: 1) physical state of the agent; 2) type of surfaces contaminated (e.g., porous vs. non-porous); 3) the purpose of sampling (e.g., characterization, decontamination efficacy, and clearance); and 4) specific laboratory requirements. The U.S. Environmental Protection Agency (EPA) has set up mobile and fixed labs and analytical assets for chemical agent analysis of environmental samples under their Environmental Response Laboratory Network (ERLN), see ANALYSIS section below, (https://www.epa.gov/emergency-response/environmental-response-laboratory-network). For questions on environmental sampling for HD call EPA/HQ-EOC at 202-564-3850.

10.2. Sample Locations and Planning: Initially consider air monitoring to ensure worker safety and to determine if there is a vapor plume that could impact other areas. Characterization sampling is initiated by targeted or judgmental sampling to identify "hot spots," potential agent flow paths, and media or objects potentially acting as sinks. Additional biased or random sampling can be used to determine the extent of potential contamination or to verify the efficacy of decontamination. More thorough probabilistic sampling (e.g., grid, statistical approach) may be required for the clearance phase or if there are large uncertainties about the area impacted or the amount released. Because HD is a semi-persistent liquid, sample priorities should include surfaces that are potentially contaminated with liquid (e.g., release site, low lying areas, HVAC, utility corridors) and areas that people are likely to contact or where food or agricultural products are present.

Note: HD breaks down in most environmental and decontamination conditions to numerous breakdown products, especially TDG, which may be used as a marker to determine the extent of contamination of the parent HD. See

ANALYSIS section below to ensure sampling procedures are compatible with all analytes. Some preparation techniques for both HD and its breakdown products are available in EPA's Sample Information Collection Documents (https://www.epa.gov/esam/sample-collection-information-documents-scids). These provide general information regarding sampling procedures for different media, sampling supplies, sample size, container, holding time, preservation, packaging, and shipping, supporting collection of samples.

10.3. Types of Samples:

Air (Vapors are heavier than air): Samples are collected using appropriate solid phase absorbent media (tubes) or air sampler (e.g., SUMMA canister) at breathing zone level (~5 ft.) to assess inhalation exposure. To assess off gassing from surfaces and at ground levels, collect air samples at ~6 in. above the ground. Concurrent air monitoring for HD is recommended.

Water: Water should be collected in appropriate containers with addition of appropriate de-chlorinating agents and preservatives to minimize HD degradation and hydrolysis prior to analysis. Concurrent air monitoring for HD is recommended.

Soil: For localized "hot spot" areas where soil deposition may occur (i.e., neat liquid, aerosol or liquid droplets), surface soil samples should be taken from a non-vegetated area to a depth of less than one inch. Sub-surface soil samples are typically not necessary unless a large amount of liquid was poured on the ground, or if an underlying aquifer is endangered. Concurrent air monitoring for HD is recommended.

Surface Wipes: Wipe samples are often desired to indicate absence of HD on non-porous surfaces. Concurrent air monitoring for HD is recommended.

Bulk: For hot spot areas where liquid HD deposition may occur on porous surfaces (e.g., concrete, asphalt), actual pieces (chips) or cores of contaminated surface may be obtained using appropriate tools (scabbling, coring, or drills) for subsequent laboratory extraction analysis. Bulk samples of suspected sink materials may be recommended to rule out secondary vapor phase disposition or absorption of HD into these materials. Concurrent air monitoring for HD is recommended.

Other Sample Matrices: Contact EPA/HQ-EOC at 202-564-3850 for sampling instructions.

11. Packaging/Shipping: CWA Environmental Samples for Site Characterization

Packaging and Shipping: CWA Environmental Samples For Site Characterization

The packaging and shipping of environmental samples potentially contaminated with a chemical warfare agent (CWA) would be subject to complex and restrictive regulations established primarily by DOT for ground transportation (49 CFR Parts 171-180), and by DOT, ICAO, and IATA for air transportation (in addition to other regulations by CDC, USPS, OSHA). Transportation of HD-contaminated waste for treatment and disposal is covered under the WASTE MANAGEMENT section below.

Samples can be collected from environmental media that include surface and subsurface soil, groundwater, surface water, drinking water, dust, air, and solids other than soil (e.g., building materials). Given the wide range of potential environmental media and complex regulatory requirements, the approach would likely be situationally dependent.

CAUTION: Environmental samples potentially contaminated with CWA should not be introduced into commercial transportation as an undeclared hazardous material. Hazard classification, packaging, and hazard communication are the shipper's responsibility under DOT's Hazardous Materials Regulations (49 CFR Parts 171-180).

A summary of key packaging and shipping considerations for environmental samples with unknown concentrations of a potential unknown CWA is:

- Transport of pure HD is forbidden other than via military (Technical Escort Unit) transport in accordance with 49 CFR §173.7.
- If the collected sample contains or is suspected to contain hazardous materials, as defined in 49 CFR §171.8, the shipper must determine the appropriate UN ID Number, the Proper Shipping Name (PSN), and the Packing Group (PG) from the Hazardous Materials Table in 49 CFR §107.101. The table will then direct the shipper to the type of hazard and handling labels needed, the appropriate packaging (inner and outer packaging), and any special provisions.
- The designated shipper (EPA personnel or contractors) must be trained and certified according to the requirements found in 49 CFR §172.704 (a)(2) and/or by IATA Dangerous Goods (DG) 1.5 requirements for shipments by air.
- Contact the sample-receiving laboratory to determine if they have additional packaging, shipping, or labeling requirements.

Note that there is no UN ID for HD listed in the Hazardous Materials Table (49 CFR §172.101). Therefore, the most likely classification would be UN3381, Toxic by inhalation liquid, n.o.s. with an LC50 lower than or equal to 200 mL/m^3 and saturated vapor concentration greater than or equal to 500 LC50, PG I. In the US, non-bulk packaging would then be in accordance with 49 CFR §173.226.

Use of Mobile labs: Another consideration would be use of an on-site mobile laboratory for CWA analysis. This could eliminate the shipper's responsibility for transporting the collected samples containing a substance that might be considered forbidden for transport by air or a hazardous material or DG by ground or air transport to an off-site laboratory. In addition, there may be public concern about shipping samples off-site, or reluctance of commercial shipping companies to accept and transport samples from a known CWA-contaminated site. EPA maintains mobile laboratory assets (PHILIS mobile laboratories: https://www.epa.gov/emergency-response/philis-portable-high-

throughput-integrated-laboratory-identification-system) in NJ and CO that are capable of analyzing CWAs, including HD, in environmental matrices, down to health-based risk clearance levels. Access to the PHILIS mobile labs for a CWA incident can be obtained from EPA HQ/EOC at 202-564-3850. EPA also has access to the US Army CBRNE assets, including shipping and analysis, through inter-agency agreements as described in the COORDINATION WITH OTHER AGENCIES section below.

12. Analysis

Analysis

CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes and soil). Few laboratories currently have the capability to determine HD, particularly for large numbers of samples and for the various types of environmental media. EPA's ERLN labs (https://www.epa.gov/emergency-response/environmental-response-laboratory-network) that are specially trained and equipped for the analysis of HD, will use sample prep and analytical methods from EPA's Environmental Sampling and Analytical Methods (ESAM) Programs (https://www.epa.gov/esam). For access to the nearest ERLN laboratory specially trained and equipped for HD analysis, and methods provided in EPA's ESAM, contact EPA/HQ-EOC at 202-564-3850. The ERLN also maintains EPA's Compendium of Environmental Testing Laboratories (CETL), a database of commercial, federal, state, and academic laboratories, which can be queried for specific analyses and matrices. Analysis on environmental matrices for toxic organics, metals, biological and radiological agents, as well as several of the CWAs, including HD and its breakdown products, can be obtained by querying the database of laboratories listed in EPA's CETL (https://cfext.epa.gov/cetl/lblogin.cfm?action=None); prior registration for access to CETL website is necessary.

13. Coordination with Other Agencies: CWA Field Activities

Coordination With Other Agencies: CWA Field Activities

Numerous agencies other than EPA may be involved in a chemical agent response incident. Every attempt should be made to integrate assets and design a uniform approach to sampling procedures, quality assurance, and data sharing. Every attempt should be made to coordinate activities, share data, and maintain chain-of-custody integrity throughout all phases of the response, amongst all agencies involved.

Civilian: The National Guard Civil Support Team (CST) and the U.S. Coast Guard "Strike Teams" deploy survey teams, response vehicles, and mobile labs to hazardous chemical incidents throughout the United States. Many CSTs and Strike Teams have the capabilities to sample, prepare, and analyze certain types of environmental samples for CWA analysis. CSTs have analytical equipment that can provide screening or presumptive data results for CWAs. The OSC should discuss site-specific types of samples, data quality, and chain-of-custody requirements with Strike Teams and CSTs before integrating their capabilities into the overall CWA response. Other agencies, such as the FBI, may be present on-site performing tasks, such as evidence retrieval, which are specific for their agency.

Military: EPA's Special Teams (ERT and CMAD) have access to Department of Defense (DOD) assets through Inter-Agency Agreements (IAA) with the US Army's Combat Capabilities Development Command, Chemical Biological Center (CBC) at Aberdeen Proving Ground, MD. The CBC has expertise and deployable assets for CWA air monitoring (i.e., MINICAMS™), sampling, analysis, decontamination, and waste transport and disposal through their ongoing demilitarization activities at former chemical agent munitions facilities in the US and abroad.

Access to EPA's IAA for support to Federal OSCs at a CBRN response or incident can be arranged through EPA/HQ-EOC at 202-564-3850. Consultation or training for EPA personnel and partners that do not need to go through EPA/HQ-EOC can be arranged via the IAA with EPA's ERT-Special Team at 732-321-6660. Additional CBRNE support can be obtained via the IAA with EPA's CMAD-Special Team, including support for chemical, biological, and radiological agent response through EPA/HQ-EOC at 202-564-3850.

14. Environmental Decontamination/Cleanup

Environmental Decontamination/Cleanup

14.1. Decontamination/Cleanup Planning:

Once site controls are in place, develop a site-specific decontamination/cleanup plan. Environmental decontamination may require a "tiered approach" using a variety of techniques and products. Call EPA/HQ-EOC at 202-564-3850 for more information.

General Considerations: A cost vs. benefit evaluation should be undertaken for each decontamination strategy and approach that considers public safety, total cost, impact on the area, wastes generated, time the area or item will be inaccessible and/or out of service, as well as any socio-economic, public health, and/or security impacts that may result. Large volumes of decontamination wastes may be generated that will need to be collected, treated, and disposed of properly. Waste handling and disposal must be addressed as early in the decontamination and cleanup process as possible (see WASTE MANAGEMENT section below).

Disposal Option: The urgency to restore an area or item as quickly as possible may result in the outright and timely removal and disposal of contaminated materials. Certain materials may be impacted by the decontamination products, and/or may be cheaper to discard and replace than to decontaminate and restore.

Monitored Natural Attenuation: HD degrades via natural processes. Environmental monitoring must be maintained during decontamination and recovery phases. Monitored natural attenuation may require institutional controls (e.g., access restriction and contaminant containment measures). The time to achieve clearance must be considered in the overall cost/benefit evaluation. This option is more passive than other options but is non-destructive to materials.

Fix-in-Place Option: The contaminated area may be resistant to decontamination products or may be unable or impractical to be treated. Physical barriers can be used to immobilize the contamination and prevent it from coming into contact with the environment or the public. This can be a temporary or permanent solution.

14.2. Decontamination Strategy:

A decontamination strategy can be developed by designating contaminated areas into five broad categories: 1) surfaces or hot spots, 2) large volumetric spaces, 3) sensitive equipment or items, 4) aqueous solutions, and 5) water systems. Areas in each category may be treated using one or more unique decontamination processes in a tiered approach to the overall site-specific decontamination strategy. The described strategy is for HD; strategies for other sulfur mustard agents (H, HT; see AGENT CHARACTERISTICS section) are expected to be similar.

Cautions:

- Decontamination products may have unique safety/PPE requirements due to their own toxicity or that of breakdown products during use (e.g., use of bleach results in release of chlorine vapors). Strong oxidizers, such as hypochlorite, may react violently with organics.
- Under oxidizing conditions (particularly for household chlorine bleach or other hypochlorite-containing solutions), **HD can break down into several toxic byproducts, such as mustard and vinyl sulfones.** Decontamination formulations and conditions should be chosen as to minimize or eliminate the formation of these toxic breakdown products.
- Hydrolysis of HD produces HCl. Situation-specific tolerance to potentially altered pH and corrosiveness should be evaluated when developing a decontamination strategy.
- Dirt, grime, and other coatings (organic load) can reduce the efficacy of decontamination; pre-cleaning surfaces with soap and water may be needed before the application of decontamination formulations, but resulting pre-cleaning rinsates require containment to avoid agent spread.

For additional information, contact the EPA/HQ-EOC at 202-564-3850.

Surfaces/Hot Spots: This category is for areas smaller in size but with higher levels of agent contamination. They may require more rigorous decontamination products and methods. Excess HD liquid should be absorbed using, e.g., vermiculite or dry sand, and transferred into a sealed container and disposed of according to WASTE MANAGEMENT section below. In contrast to the rapid hydrolysis when HD is dissolved in water, **the hydrolysis of HD on surfaces is generally slower since it is limited by the amount of available moisture**. Application of the following oxidative decontamination solutions and formulations may be efficacious by following applicable manufacturers' directions.

1) Hypochlorite-containing solutions: Hypochlorite can be corrosive to certain surfaces and materials and should be rinsed thoroughly afterwards. Household bleach solutions (≥5% sodium hypochlorite) are effective for HD with efficacy achieved with contact time of 15-60 minutes depending on surface material. Calcium hypochlorite, present in commercial products, such as HTH (10% hypochlorite solution), is better for surfaces with high concentrations of liquids in localized areas. Note that lowering the pH of hypochlorite solutions is not required and may be counterproductive. If inadequate amount of oxidant is used, toxic byproducts will likely accumulate.
2) Proprietary decontamination technologies such as EasyDecon DF-200®, Decon7 (D7), Dahlgren Decon®, CASCAD®, Decon Green®, or L-Gel® have been shown to be effective against HD (and may be less corrosive than hypochlorite-containing solutions) on the order of minutes to hours, but not all have been thoroughly tested. Availability, cost, and the need for specialized equipment to apply the decontaminant may limit their use early in the response.

Large Volumetric Spaces: This category is for areas larger in size but with lower levels of agent contamination. These areas may require less aggressive, but more broadly applied, decontamination products and methods.

1) Monitored Natural Attenuation is more passive than other decontamination options and is non-destructive to materials. This option may be preferable depending on the scope and severity of contamination.
2) Forced or Hot Air ventilation methods are recommended for vapor plume contamination or low surface concentration of HD in large volumetric spaces, including HVAC systems, or open areas; efficacy may be typically achieved in hours to days with less waste and adverse impacts to materials. Capture technologies, such as activated carbon-containing air filters, would be required to prevent transfer of the HD vapor to the outside environment or prevent recirculation into other surrounding spaces.
3) Fumigations with modified vaporous hydrogen peroxide (mVHP®; a combination of ammonia and hydrogen peroxide vapor) or chlorine dioxide (ClO_2) have been reported to be effective against HD. Prolonged hydrogen peroxide fumigation (up to 24 hours) at lower vapor concentrations (≤75 ppmv) was found to be non-efficacious.
4) Steam application has been reported to effectively degrade HD on surfaces with no HD found in the condensate. Condensate may contain HCl.

Sensitive Equipment or Items: Forced or Hot Air ventilation may be used for HD and can be used either in-situ or ex-situ to decontaminate these items. Capture technologies using activated carbon air filters would be required to prevent transfer of the HD vapor to the outside environment or prevent recirculation into other surrounding spaces. Fumigation

with mVHP® is another option that could be efficacious with no or minimal impact on materials. Use of steam can be considered if presence of condensate (likely containing HCl) is not detrimental to the equipment or item.

Aqueous Solutions: HD degrades via hydrolysis but may persist in aqueous solutions, depending on initial concentration and environmental conditions, such as pH and temperature. Also contributing to persistence is that hydrolysis products of HD may accumulate at the interface between the HD liquid and the water, forming a protective coating around HD "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed. The amount of disturbance required is unknown, so simple mixing of containerized HD solution may not suffice. Hydrolysis of HD produces HCl. If the aqueous solutions result from decontamination operations involving bleach or other high pH conditions, significant HD degradation into toxic byproducts may occur (see toxic byproducts statement under Cautions above). Avoid any additional release and/or inappropriate disposal to water systems, drains, or sewers. Contain or transfer liquid to appropriate containers and dispose of according to WASTE MANAGEMENT section below.

Water Systems: Hydrolysis and removal of contaminated water will lessen HD contamination in water systems, but HD may persist in hydraulic dead ends and via sorption to system components (e.g., plastics) that act as sinks for HD. It may be necessary to isolate potentially affected portions of the system to evaluate them and implement decontamination. A contaminated water system may transfer HD to building and premise plumbing, which then may also require decontamination. As HD is denser than water, it may sink and accumulate in low lying areas, such as the bottom of pipes and tanks. Hydrolysis of HD in water produces HCl.

Verification of Decontamination: Site and situation specific. Please contact EPA/HQ-EOC at 202-564-3850 for further assistance.

15. Waste Management

Waste Management

15.1. Transportation:

Federal requirements for the commercial transport of hazardous materials and procedures for exemptions are specified in How to Comply with Federal Hazardous Materials Regulations, available at: https://www.fmcsa.dot.gov/regulations/hazardous-materials/how-comply-federal-hazardous-materials-regulations.

Sulfur Mustard (HD) should not be offered for commercial transportation without being rendered safe by neutralization. Contact the PHMSA Hazardous Materials Information Center at 1-800-467-4922 or infocntr@dot.gov to discuss specific cases. Additional resources on packaging, labeling, and shipping are available at: https://www.phmsa.dot.gov/standards-rulemaking/hazmat/hazardous-materials-regulations. Detailed state regulations can be found at www.envcap.org/.

This QRG is intended to apply to Federal OSCs in the first 24-48 hours of a response. Once determined, the concentrations of HD in individual waste streams should be used to determine which transportation requirements apply. For instance, certain requirements may apply to waste streams with concentrated agent, but may not apply to waste streams such as soil containing dilute concentrations of agent.

15.2. Waste Management:

Under the Resource Conservation and Recovery Act (RCRA), waste is classified as hazardous waste (subtitle C) or solid waste (subtitle D). The RCRA regulations generally define a waste to be hazardous if it is: (1) a listed waste (40 CFR §261.31-§261.32); (2) exhibits specific characteristics (40 CFR §261.21-§261.24); or (3) is a discarded commercial chemical product, off specification species, container residue, or spill residue listed in 40 CFR §261.33. Sulfur Mustard (HD) is not listed under 40 CFR §261.31-33, but HD-contaminated waste may be considered reactive hazardous waste, D003, if, when mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(4)) or if it is a sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(5)). It is the responsibility of the waste generator to make a hazardous waste determination (40 CFR §262.11).

The states (except for Alaska and Iowa) have the primary responsibility to implement the hazardous waste regulations and can impose more stringent requirements or requirements broader in scope than the federal program. Several states, including CO, IN, KY, MD, OR, and UT, have their own waste designations for chemical agents, which may be applicable for the cleanup of HD-contaminated residues, decomposition products, soils, and debris. It is critical to open a dialogue with state regulators as early as possible.

Management of toxic decomposition products, associated residual decontamination solutions, local waste acceptance criteria, and transportation and handling requirements should be considered. High pH aqueous decontamination solution waste may be considered corrosive hazardous waste, chemical code D002, if it has a pH greater than or equal to 12.5 (40 CFR §261.22).

EPA/CMAD can provide Federal OSCs with information and support to address knowledge gaps for dealing with wastes contaminated with dilute concentrations of CWA; contact EPA/HQ-EOC at 202-564-3850.

EPA also recommends the creation of pre-incident waste management plans as a preparedness measure for chemical agent releases, and has created an **All-Hazards Waste Management Planning Tool** to help state, local, territorial, and tribal

7. Personnel Safety

Personnel Safety

Note: Personal Protective Equipment (PPE) selection (Levels A-D), medical surveillance requirements, First Aid options, and personnel decontamination may vary depending upon the amount and purity of agent, site conditions, and the release scenario. Additional information on personnel safety and PPE selection criteria can be found at: www.cdc.gov/niosh/ershdb. We also recommend that responders check their own internal procedures (i.e., SOPs), if applicable.

7.1. Medical:

Pre-incident: Must have current medical and respiratory clearances as part of an Occupational Medical Surveillance Program according to OSHA HAZWOPER and Respiratory Protection Program, as per 29 CFR 1910.
During Incident: Conduct periodic on-site medical monitoring, observe for any signs and symptoms as per HEALTH EFFECTS section above and treat accordingly as per First Aid section below.
Post-incident: Perform post-incident medical surveillance, as per 29 CFR 1910. Because health effects may not occur until several hours after exposure, patients/victims should be under medical surveillance for at least 24-48 hours.

7.2. First Aid: Immediately remove person from affected area and remove contaminated clothing and articles. Wash bare skin immediately with water, or warm, soapy water if available, at normal household pressures (~50-60 psi) for three minutes, ensure thorough soaking. Rinse eyes exposed to agent (liquid or vapor; eyes are especially sensitive to HD) with potable water for at least 15 minutes. If irritation or pain is severe or persists, prolonged eye washing is advised. Do not cover eyes with bandages. Seek immediate medical attention.

Antidote: NO ANTIDOTE AVAILABLE.

Other: RSDL (Reactive Skin Decontamination Lotion), an FDA-cleared kit with a sponge impregnated with a lotion to remove or neutralize chemical warfare agents from contaminated skin. Apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

After administering first aid, send person for follow-up medical attention and evaluation. If cleared to resume work, continue to monitor for signs/symptoms and treat accordingly.

7.3. Personal Protective Equipment (PPE):

GENERAL INFORMATION: NIOSH Approved® Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA), NIOSH Approved Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR), full-face masks, and protective clothing should be used. Level A protection should be used until monitoring results confirm identity and concentration of contaminant. Pre-incident training and exercises on the proper use of PPE are recommended.

Per NIOSH guidance –

LEVEL A: Recommended for the initial response to an HD incident. NIOSH Approved CBRN full-face-piece SCBA operated in pressure-demand mode with Level A suit that provides protection against CBRN agents. Level A provides the greatest level of skin (totally-encapsulating chemical protective suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank), respiratory (SCBA), and eye protection when the contaminant identity or concentration is unknown. Select Level A when the HD concentration is unknown or above the IDLH or AEGL-2, and when there is a potential of ocular or dermal exposure.

LEVEL B: Pressure-demand SCBA (NIOSH Approved CBRN full-face-piece SCBA) with Level B protective suit that provides protection against CBRN agents. Level B provides the highest level of respiratory protection (SCBA) when a lesser level of skin protection is required. Select Level B when the HD concentration is unknown or above the IDLH or AEGL-2, and when dermal exposure is less of a risk. Level B differs from Level A in that it typically incorporates a non-encapsulating, splash-protective, chemical-resistant outer suit that provides protection against most liquids but is not vapor tight (hooded chemical-resistant outer suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank).

LEVEL C: May be selected when the contaminant identity and concentration are known and the respiratory protection criteria factors for the use of APR or PAPR (i.e., < IDLH, warning properties) are met. Level C may be appropriate when decontaminating personnel or equipment. Level C still incorporates hooded chemical-resistant outer suit that provides protection against CBRN agents, chemical-resistant inner and outer gloves, and chemical-resistant boots with steel toe and shank.

- For air levels greater than AEGL-2: NIOSH Approved CBRN tight-fitting PAPR with a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator.
- For air levels greater than AEGL-1: NIOSH Approved CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR.

LEVEL D: Select Level D when the contaminant is known and the concentration is below the appropriate occupational exposure limits or less than AEGL-1 for the stated duration times. PPE includes coveralls or other work clothes, boots, and gloves.

Downgrading PPE levels can be considered only by the site Health and Safety Officer when the identity and concentration of the contaminant and the risks of dermal exposure are known, and must be accompanied by on-site

throughput-integrated-laboratory-identification-system) in NJ and CO that are capable of analyzing CWAs, including HD, in environmental matrices, down to health-based risk clearance levels. Access to the PHILIS mobile labs for a CWA incident can be obtained from EPA HQ/EOC at 202-564-3850. EPA also has access to the US Army CBRNE assets, including shipping and analysis, through inter-agency agreements as described in the COORDINATION WITH OTHER AGENCIES section below.

12. Analysis

Analysis

CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes and soil). Few laboratories currently have the capability to determine HD, particularly for large numbers of samples and for the various types of environmental media. EPA's ERLN labs (https://www.epa.gov/emergency-response/environmental-response-laboratory-network) that are specially trained and equipped for the analysis of HD, will use sample prep and analytical methods from EPA's Environmental Sampling and Analytical Methods (ESAM) Programs (https://www.epa.gov/esam). For access to the nearest ERLN laboratory specially trained and equipped for HD analysis, and methods provided in EPA's ESAM, contact EPA/HQ-EOC at 202-564-3850. The ERLN also maintains EPA's Compendium of Environmental Testing Laboratories (CETL), a database of commercial, federal, state, and academic laboratories, which can be queried for specific analyses and matrices. Analysis on environmental matrices for toxic organics, metals, biological and radiological agents, as well as several of the CWAs, including HD and its breakdown products, can be obtained by querying the database of laboratories listed in EPA's CETL (https://cfext.epa.gov/cetl/lblogin.cfm?action=None); prior registration for access to CETL website is necessary.

13. Coordination with Other Agencies: CWA Field Activities

Coordination With Other Agencies: CWA Field Activities

Numerous agencies other than EPA may be involved in a chemical agent response incident. Every attempt should be made to integrate assets and design a uniform approach to sampling procedures, quality assurance, and data sharing. Every attempt should be made to coordinate activities, share data, and maintain chain-of-custody integrity throughout all phases of the response, amongst all agencies involved.

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14. Environmental Decontamination/Cleanup

Environmental Decontamination/Cleanup

14.1. Decontamination/Cleanup Planning:

Once site controls are in place, develop a site-specific decontamination/cleanup plan. Environmental decontamination may require a "tiered approach" using a variety of techniques and products. Call EPA/HQ-EOC at 202-564-3850 for more information.

General Considerations: A cost vs. benefit evaluation should be undertaken for each decontamination strategy and approach that considers public safety, total cost, impact on the area, wastes generated, time the area or item will be inaccessible and/or out of service, as well as any socio-economic, public health, and/or security impacts that may result. Large volumes of decontamination wastes may be generated that will need to be collected, treated, and disposed of properly. Waste handling and disposal must be addressed as early in the decontamination and cleanup process as possible (see WASTE MANAGEMENT section below).

Disposal Option: The urgency to restore an area or item as quickly as possible may result in the outright and timely removal and disposal of contaminated materials. Certain materials may be impacted by the decontamination products, and/or may be cheaper to discard and replace than to decontaminate and restore.

waste management officials coordinate and prepare these plans. Access to the All-Hazards Waste Management Planning Tool requires pre-registration (https://wasteplan.epa.gov/).

NRT Quick Reference Guide: Sulfur Mustard (HD)

GHS: Acute Toxicity, Category 1
H310 – Fatal in contact with skin
H330 – Fatal if inhaled

GHS: Eye Damage/Irritation, Category 1
H318 – Causes serious eye damage

1. Agent Characteristics

Agent Characteristics

Agent Classification: Schedule 1 Chemical Warfare Blister (Vesicant) Agent; Sulfur Mustard (HD); CAS 505-60-2

Description: Sulfur mustard, Bis-(2-chloroethyl) sulfide, is sometimes called "mustard gas" but is actually a yellow to brown oily liquid with a garlic, onion, horseradish, or mustard-like odor. It is a blister (vesicant) agent that will have delayed health effects on the order of hours, and is reported to be a known human carcinogen. It can be manufactured at different concentrations; with impurities, additives, or thickening materials that will all affect physical properties, appearance, persistence, and analytical detection limits. Distilled mustard (HD) is considered the most toxic form and is the basis of this QRG. Because HD evaporates slowly, HD is primarily a liquid hazard − or dermal (contact) hazard − under temperate conditions, although aerosols and vapors can be generated under proper conditions and would present an ocular or inhalation hazard. Environmental breakdown (hydrolysis) products of HD, including thiodiglycol (TDG) [CAS 111-48-8] and hydrochloric acid (HCl), are relatively non-toxic, but some combustion and decontamination byproducts can be toxic (e.g., sulfur oxides, sulfones).

Other Sulfur Mustard Agents:

- **Agent H** (CAS 505-60-2): H is Levinstein mustard, from a production process that originated during WWI and contains about 30% impurities. The reported physical and chemical properties, and toxicity, are essentially the same as those reported for HD.
- **Agent HT** (CAS: 101-77-9): HT is a mixture of 60% Agent HD and 40% Agent T ((bis (2-chloroethylthio) diethyl ether)), a vesicant that is a byproduct of certain methods of manufacturing mustard. Agent T is intentionally included to lower the freezing point of HT (32-34.3°F (0-1.3°C)), lower the volatility, and increase the persistence of sulfur mustard. The reported toxicity and remaining physical and chemical properties of HT are similar to those of HD.

Persistence: HD is considered a "persistent or semi-persistent" chemical warfare agent with liquid deposition on surfaces lasting for hours to days. Persistence will depend upon the amount and purity of the agent, method of release, environmental conditions, and the types of surfaces and materials impacted. HD can be 2 to 5 times more persistent in winter than in summer due to lower winter temperatures. Under certain environmental conditions, HD liquid may go through a partial hydrolysis that results in an outer protective coating around "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed. This is often the case in aqueous systems where HD, with a liquid density greater than water (>1), will sink to the bottom of water systems, and persist for considerable periods of time (years, decades), while retaining its vesicant properties. Porous, permeable, organic, or polymeric materials such as carpets, vinyl tiles, and painted surfaces can accumulate HD vapors and liquids, acting as "sinks," thereby prolonging persistence.

2. Physical Properties

Physical Properties

Molecular Weight: 159.08 g/mol	**Formula:** $C_4H_8Cl_2S$
Vapor Density: 5.4 (air = 1)	**Flash Point:** 219-221°F/104-105°C
Vapor Pressure: 0.072 mm Hg (68°F/20°C)	**Liquid Density:** 1.27 g/mL (68°F/20°C)
Volatility: 610 mg/m^3 (68°F/20°C)	**Melting/Freezing Point:** 55-57°F/13-14°C
Boiling Point: 419-423°F/215-217°C	**Non-aqueous Solubility:** Common organic solvents, alcohols, gasoline, oils, fats
Hydrolysis ($t_{1/2}$): The rate of HD hydrolysis is controlled by the speed of dissolution of the HD into water, which is typically very slow especially if "globules" are formed (see Aqueous Solubility). Once HD is dissolved in bulk water, hydrolysis proceeds rapidly. In distilled water, $t_{1/2}$ = 5-8.5 minutes (77°F/25°C). In salt water, $t_{1/2}$ = 60 minutes (77°F/25°C).	**Aqueous Solubility:** HD is practically insoluble in water and is limited by the rate of dissolution (mass transfer) of HD into the bulk water. After HD is dissolved, the solubility of HD in distilled water is 0.92 g/L (72°F/22°C). HD is heavier than water (Liquid density > 1) and if released in or on top of the water, will sink to the bottom of waterbodies where it can form a protective coating around "globules" (see Persistence in AGENT CHARACTERISTICS section above) and resist further dissolution and persist for considerable periods of time (years, decades) while retaining its vesicant properties.

Note: physical properties are listed at/near STP unless otherwise indicated. The reported Physical Properties for H and HT are similar to the reported physical properties for HD.

Conversion Factors for HD: ppm = mg/m^3 x 0.1538; mg/m^3 = ppm x 6.503

3. Release Scenarios

Release Scenarios

AIR RELEASE SCENARIOS ARE ASSUMED MOST PROBABLE; HOWEVER, OTHER RELEASE SCENARIOS AND EXPOSURE ROUTES SHOULD BE CONSIDERED.

Open Areas: HD is difficult to disperse in air due to low volatility; however, it may be possible to disperse HD as a vapor/aerosol plume or liquid droplets if an appropriate heat/explosive device is employed. The low volatility of HD would limit the size and extent of plume dissipation, posing localized hazards. **HD has a melting/freezing point at 55-57°F/13-14°C. Frozen HD can easily melt as ambient temperatures rise, and may present a continued dermal (contact) hazard. The vapor hazard of HD increases with increasing temperature; HD is a definite vapor hazard (i.e., ocular or inhalation hazard) at temperatures above 100°F (38°C).** HD vapors are heavier than air, so vapors can accumulate in lower terrains.

Water/Water Systems: If released into natural waters or water systems, HD may sink to the bottom, then slowly dissolve. Some release conditions may be conducive for enhancing the dissolution rate, such as agitation and dispersion as fine droplets. Once dissolved, the HD hydrolyzes with a half-life dependent on the composition of the water, ranging from 5-8.5 minutes (at 77°F/25°C in distilled water) to 60 minutes (at 77°F/25°C in high chloride waters, such as seawater). In sufficient amounts (relative to water volume) and under certain environmental conditions (low temperature and oxygen levels), HD may also form globules surrounded by a protective outer layer resistant to hydrolysis. These globules may settle out or be entrapped, persisting for decades, and posing a contact hazard to anyone disturbing them. Areas in which the globules may persist include stagnant volumes of water as small as puddles formed by precipitation events. Water systems, plumbing, surfaces, and equipment that have contacted HD globules should be evaluated for decontamination.

Indoor Facility: HD is a semi-persistent agent with low to moderate volatility and would be difficult to distribute effectively throughout a building or facility from a point source. Liquid HD will result in localized areas of surface contamination. However, HD vapors can be generated if conditions are right. HD vapors are heavier than air so vapors can accumulate in lower levels, basements, floor drains, or utility corridors inside the buildings.

Other: HD will decompose when heated or when combusted in a fire to form highly toxic fumes of sulfur oxides and hydrochloric acid. If HD is released into the air as a liquid spray (aerosol), it has the potential to contaminate agricultural products. If HD is released as a vapor, it is unlikely to contaminate agricultural products, since it will likely recondense as a liquid soon after release, presenting a potentially short- or long-term secondary dermal (contact) hazard.

Military Munitions: Information for OSCs on military munitions found in the civilian sector (e.g., recovery of sea-disposed discarded HD munitions during diving or commercial fishing, clamming, and dredging) is available on nrt.org (scroll to or click on military munitions hazards).

4. Health Effects

Health Effects

4.1. Onset: Onset of symptoms is dose and route dependent. Onset and severity of effects depend on dose, duration, and route of exposure (not all signs/symptoms may develop). The effects caused by HD are not typically fatal immediately, but can require substantial supportive medical care as there is no antidote, and secondary infections from blisters/tissue damage may also be fatal. HD produces effects by causing DNA damage/cell death in seconds (this is not like an acid burn). Despite the immediate DNA damage actual **signs/symptoms may be delayed 1-48 hours** after exposure, so those exposed may not be aware.

4.2. Signs/Symptoms: Initial symptoms will vary depending on dose and exposure route (see EXPOSURE ROUTES section below). The following is a general list of possible symptoms. The severity of effects depends upon the dosage.

Mild: Effects delayed 1-48 hours (severity depends on dose): Eye irritation (tearing, grittiness), runny nose, sneezing, nosebleed, hoarseness, hacking cough.

Moderate: Effects delayed 1-24 hours: Mild effects plus reddening and swelling of eyelids, severe cough, shortness of breath, reddening of skin.

Severe: Effects delayed 1-24 hours: Upper respiratory/lung damage may occur at high concentrations and longer exposure durations.

4.3. Exposure Routes:

Inhalation: Airway injury develops slowly, within 2-6 hours after severe exposure or within 12-24 hours after mild exposure and intensifies over several days. Airway injury begins with the upper airways and descends to the lower airways. Vapor exposure is absorbed in mucous membranes (e.g., mouth, throat, lungs).

- **Mild exposure:** Runny nose, sneezing, nosebleed, hoarseness, hacking cough, wheezing, and difficulty breathing.
- **Severe exposure:** Same as above, plus acute inflammation of upper and lower airways, tissue death of airway lining, airway blockage from inflamed and dead (necrotic) cells, and death due to lung inflammation (pneumonia).

Skin: Direct contact with HD liquid can cause redness or blisters in 2-24 hours. Some skin injury may appear as late as 48 hours after exposure. Warm and sweaty skin areas (e.g., underarms, groin) are most susceptible to exposure. Skin effects of HD liquid occur sooner than skin effects of HD vapor.

- **Mild exposure:** Redness (erythema) within 1-24 hours, blistering (vesication) within 2-18 hours after onset of redness, itching, and burning pain.

- **Severe exposure:** All of the above, with more severe blistering (vesication) with areas of tissue death (necrosis) along with whole-body (systemic) effects including weakness, vomiting (emesis), fever, exhaustion. Skin exposure to HD can be fatal: an area of redness (erythema), with or without blistering (vesication), which covers 25% or more of the body's surface area, suggests a lethal exposure.

Eyes: Eyes are the most sensitive to HD vapors; effects occur after 1-2 hours after severe exposure or within 3-12 hours after a mild to moderate exposure.

- **Mild/Moderate exposure:** Lacrimation (tear production), irritation, burning, dryness or gritty feeling, itching, weeping, reddening, lid swelling (edema in eyelids), and moderate pain.
- **Severe exposure:** Severe pain and additional effects include increased lid swelling (edema in eyelids), light sensitivity, corneal injury, and blindness and generally require extended medical treatment.

Ingestion: Consumption of contaminated food or drink could cause nausea, vomiting (emesis), pain, and possible chemical burns of gastrointestinal (GI) tract.

5. Effect Levels

Effect Levels

Air (inhalation vapor hazard): Acute Exposure Guideline Levels (AEGLs) for general population one-time exposure emergency scenarios for HD (complete definitions are available at: https://www.epa.gov/aegl).

AEGL Level in mg/m^3, at various exposure durations for HD. (Note: AEGL values for H and HT are not available)	**10 min.**	**30 min.**	**1 hr.**	**4 hr.**	**8 hr.**
AEGL 1: Threshold mild effects	0.40	0.13	0.067	0.017	0.008
AEGL 2: Potentially irreversible effects or impaired ability to escape	0.60	0.20	0.10	0.025	0.013
AEGL 3: Threshold for severe effects/medical needs/increasing potential for lethality	3.9	2.7	2.1	0.53	0.27

American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPG™) are not established/determined for HD.

6. Exposure Guidelines

Exposure Guidelines

6.1. Airborne Exposure Limits (AELs): CDC has issued recommendations for protecting human health from potential adverse effects of exposure to this agent. The reported AELs for H and HT are the same as those for HD.
(refer to: NIOSH ERSH-DB, https://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750008.html)
[original source: CDC, National Center for Environmental Health (NCEH), Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard), 69 FR 24164-24168 (May 3, 2004)]

CDC/National Center for Environmental Health (NCEH) IDLH = 0.7 mg/m^3; workers should remove themselves immediately from exposure if the concentration is reached at any point in time
CDC/NCEH STEL = 0.003 mg/m^3 (3×10^{-3}); exposure at the STEL should be as short as practical (but no longer than 15 minutes) and should not occur more than once per day
CDC/NCEH Worker Population Limit (WPL) = 0.0004 mg/m^3 (4×10^{-4})
CDC/NCEH General Population Limit (GPL) = 0.00002 mg/m^3 (2×10^{-5})

6.2. Occupational: (NA = not available)

NIOSH IDLH = NA	**OSHA PEL** = NA
NIOSH REL-TWA = NA	**ACGIH TLV-TWA** = NA
NIOSH REL-STEL = NA	**ACGIH TLV-STEL** = NA

6.3. Population:

Soil: USAPHC Health Based Environmental Screening Levels (HBESL) = TBD. The US Department of Defense (DOD) will be issuing new HBESL values for both industrial and residential soil after DOD completes a reevaluation of toxicological information related to liquid mustard skin exposure and vesication (blistering). Until DOD releases these new HBESL values to the public, DO NOT use current values available from websites and other resources.

Drinking Water: EPA Provisional Advisory Levels (PALs): see below for more information.

EPA Provisional Advisory Level (PAL): PALs represent chemical concentrations in air or drinking water above which varying health effects (PAL1, PAL2, PAL3) are expected. They are developed for 24-hour, 30-day, and 90-day exposure durations. In the event of a nationally significant or large-scale chemical release, EPA can provide PALs, if available, to appropriate end-users and stakeholders as needed (PALs are not currently available to the public) to assist in response decision-making. Contact: PALs@epa.gov, for information on and access to the PALs. (Note: PALs are not intended to define cleanup levels.)

7. Personnel Safety

Personnel Safety

Note: Personal Protective Equipment (PPE) selection (Levels A-D), medical surveillance requirements, First Aid options, and personnel decontamination may vary depending upon the amount and purity of agent, site conditions, and the release scenario. Additional information on personnel safety and PPE selection criteria can be found at: www.cdc.gov/niosh/ershdb. We also recommend that responders check their own internal procedures (i.e., SOPs), if applicable.

7.1. Medical:

Pre-incident: Must have current medical and respiratory clearances as part of an Occupational Medical Surveillance Program according to OSHA HAZWOPER and Respiratory Protection Program, as per 29 CFR 1910.
During Incident: Conduct periodic on-site medical monitoring, observe for any signs and symptoms as per HEALTH EFFECTS section above and treat accordingly as per First Aid section below.
Post-incident: Perform post-incident medical surveillance, as per 29 CFR 1910. Because health effects may not occur until several hours after exposure, patients/victims should be under medical surveillance for at least 24-48 hours.

7.2. First Aid: Immediately remove person from affected area and remove contaminated clothing and articles. Wash bare skin immediately with water, or warm, soapy water if available, at normal household pressures (~50-60 psi) for three minutes, ensure thorough soaking. Rinse eyes exposed to agent (liquid or vapor; eyes are especially sensitive to HD) with potable water for at least 15 minutes. If irritation or pain is severe or persists, prolonged eye washing is advised. Do not cover eyes with bandages. Seek immediate medical attention.

Antidote: NO ANTIDOTE AVAILABLE.

Other: RSDL (Reactive Skin Decontamination Lotion), an FDA-cleared kit with a sponge impregnated with a lotion to remove or neutralize chemical warfare agents from contaminated skin. Apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

After administering first aid, send person for follow-up medical attention and evaluation. If cleared to resume work, continue to monitor for signs/symptoms and treat accordingly.

7.3. Personal Protective Equipment (PPE):

GENERAL INFORMATION: NIOSH Approved® Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA), NIOSH Approved Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR), full-face masks, and protective clothing should be used. Level A protection should be used until monitoring results confirm identity and concentration of contaminant. Pre-incident training and exercises on the proper use of PPE are recommended.

Per NIOSH guidance –

LEVEL A: Recommended for the initial response to an HD incident. NIOSH Approved CBRN full-face-piece SCBA operated in pressure-demand mode with Level A suit that provides protection against CBRN agents. Level A provides the greatest level of skin (totally-encapsulating chemical protective suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank), respiratory (SCBA), and eye protection when the contaminant identity or concentration is unknown. Select Level A when the HD concentration is unknown or above the IDLH or AEGL-2, and when there is a potential of ocular or dermal exposure.

LEVEL B: Pressure-demand SCBA (NIOSH Approved CBRN full-face-piece SCBA) with Level B protective suit that provides protection against CBRN agents. Level B provides the highest level of respiratory protection (SCBA) when a lesser level of skin protection is required. Select Level B when the HD concentration is unknown or above the IDLH or AEGL-2, and when dermal exposure is less of a risk. Level B differs from Level A in that it typically incorporates a non-encapsulating, splash-protective, chemical-resistant outer suit that provides protection against most liquids but is not vapor tight (hooded chemical-resistant outer suit and chemical-resistant inner and outer gloves, along with chemical-resistant boots with steel toe and shank).

LEVEL C: May be selected when the contaminant identity and concentration are known and the respiratory protection criteria factors for the use of APR or PAPR (i.e., < IDLH, warning properties) are met. Level C may be appropriate when decontaminating personnel or equipment. Level C still incorporates hooded chemical-resistant outer suit that provides protection against CBRN agents, chemical-resistant inner and outer gloves, and chemical-resistant boots with steel toe and shank.

- For air levels greater than AEGL-2: NIOSH Approved CBRN tight-fitting PAPR with a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator.
- For air levels greater than AEGL-1: NIOSH Approved CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR.

LEVEL D: Select Level D when the contaminant is known and the concentration is below the appropriate occupational exposure limits or less than AEGL-1 for the stated duration times. PPE includes coveralls or other work clothes, boots, and gloves.

Downgrading PPE levels can be considered only by the site Health and Safety Officer when the identity and concentration of the contaminant and the risks of dermal exposure are known, and must be accompanied by on-site

monitoring. The on-site availability of any applicable medical countermeasures should also be considered when deciding to downgrade PPE during a CBRN response.

8. Personnel Decontamination

Personnel Decontamination

8.1. Personnel Decontamination Procedure:

Tents, berms, and collection vessels should be able to maintain copious amounts of wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decontamination process as well as replace necessary chemicals and decontamination solutions.
Prior to entering the hot zone, all personnel are required to familiarize themselves with the site-specific personnel decontamination procedures.

Personnel decontamination should take place in a decontamination area comprised of two decontamination corridors (one for entering and one for exiting). Position corridors upwind and uphill of release area; exit should be upwind and uphill of entrance. Detergent and water solution (pH>8, but <10.5), soft brushes, and durable 6-mil polyethylene bags should be provided.

Personnel decontamination area workers need to wear appropriate PPE as indicated below. Be aware that absorbed agent can be released from clothing and skin as a vapor.

Conduct personnel decontamination per NIOSH ERSH-DB:
https://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750008.html

- Emergency Responders: Use soft brush to wash PPE with soap and detergent solution in a downward motion, getting into all folds. Repeat washing and rinsing until thoroughly clean. Remove PPE by rolling downward from head; avoid pulling PPE over the head. Remove SCBA last, and place all PPE in polyethylene bags.
- Patient/victim: Remove all clothing down to at least undergarments, and place in polyethylene bags. Thoroughly wash and rinse skin with soap and water solution, taking care not to break the skin and covering all open wounds. Cover patient/victim (e.g., blanket, towels, Tyvek) and move to treatment area. If available in decontamination kit, apply RSDL immediately to area of skin with suspected exposure to a chemical warfare agent (do not wait for symptoms) and wipe affected area using a scrubbing action, rinse with water when time permits.

8.2. Personnel Decontamination Procedures by Zone/Step: (attendants will verbally direct personnel through each step)

Conducted in Hot Zone (exclusion zone)

1	Equipment Drop	Place equipment taken into the Hot Zone on a plastic covered table or container provided prior to entering the contamination reduction corridor. Equipment will either be reused if more than one entry is planned or will be decontaminated later.

Conducted in Warm Zone (contamination reduction zone)

2	Sample Drop	Place samples in a container provided for sample decontamination. Care needs to be taken to ensure that workers maintain chain-of-custody of samples. It is recommended that samples are decontaminated in a separate decontamination line.
3	Outer Boot and Glove Wash	The purpose of this step is to enable physical removal of gross contamination if contamination is visible. If gross contamination is not visible, this step may be skipped. Wash outer boots and then outer gloves using designated decontaminating agents as specified in HASP (e.g., soap and water, trisodium phosphate substitute, or diluted bleach).
4	Glove, Boot, and Suit Wash	Wash all outer surfaces in a contained area (e.g., kiddie pool) using a pressurized spray with designated decontamination solution. Start with decontaminating boots and gloves, then work on suit from the top down, including SCBA/PAPR casing. Decontamination personnel should conduct this step. Care should be taken to ensure that all areas are decontaminated, including around zipper, arms, front torso, and any other area that could have come in contact with contamination. The solution used for decontamination should be contained, collected, and disposed of properly from the decontamination line.
5	Outer Glove, Boot, and Suit Removal	While sitting on a stool, remove outer boots and outer gloves. Undo the SCBA/PAPR belt and hold in hand. While touching only the inside of suit, carefully roll suit in an outward motion from shoulders down to feet. Dispose of boots, gloves, and suit in a designated container. This step may require decontamination personnel to assist either by holding SCBA/PAPR unit or assisting in suit removal.
6	Mask Removal	With inner gloves, remove the mask. Remove cartridge filters and place into designated container. Put mask into mask wash. Decontamination personnel will clean each mask and SCBA/PAPR assembly prior to return to service.
7	Inner Glove Removal	Remove inner gloves by only touching outside of first glove and then only inside of second glove. Place gloves into designated container.

Conducted in Cold Zone (support zone)

8	Quadrant Monitoring	Using appropriate HD air monitoring equipment, screen personnel for residual contamination by dividing body into 4 sections: upper right and left sides of the body, and lower left and right sides. If positive, perform spot decontamination immediately and direct person to showers.

9	Personal Shower	Personnel should shower using copious quantities of soap and water for a minimum of 5 minutes and change into clean clothes. If a personal shower is not immediately available then, at the minimum, hands and face should be washed thoroughly.
10	Medical Monitoring	Report to medical monitoring station for post-entry monitoring and report to appropriate personnel for debriefing. Observe for any obvious sign of HD exposure. Using criteria listed above in PERSONNEL SAFETY section of this QRG, administer RSDL and notify site Health and Safety officer.

Emergency Egress Corridor: Establish an emergency egress line to use for quickly decontaminating personnel who have medical emergencies while in the hot zone. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital.
Hand-Wash Station: A hand-wash station with soap and water should be available for personnel to clean up or physically remove any residual decontaminant following entry. If a hand-wash station is not initially available or weather conditions prohibit its use, personnel should wash their hands and face as soon as possible.
Caution: Avoid waterless hand cleaners, which contain solvents (alcohols) that could increase risk of dermal exposure to HD.

9. Field Detection

Field Detection

Real-time field screening tools (results not confirmatory or quantitative): Caution should be given to equipment that has not been properly evaluated. False positive and false negatives may occur in the presence of interferents common in the environment. The following is a summary of minimum screening concentration ranges or levels for equipment procured by many EPA and HAZMAT response teams. Other screening tools may be used by these teams and other agencies and responders, some with similar capabilities and limitations.

9.1. Minimum Screening Ranges/Levels for Air/(Vapor):

Field Equipment:	ppm	mg/m^3
JCAD M4A1, at 10 secs [30 mins/pre-concentrator]	8 [0.003]	50 [0.02]
AP2C / AP4C	0.08	0.5
MX-908 Vapor Mode	1.2	7.8
Dräger (CDS Kit)	0.15	1.0
MINICAMS™ (Near real-time; at 5 minutes)	0.0005	0.003

9.2. Minimum Screening Ranges/Levels for Vapor/Liquid:

Field Equipment:	**ppm** (vapor)	**mg/m^3** (vapor)	**mL** (liquid)
M256 / M256A1 (13 mins)	0.46	3.0	0.02 (via M8 paper)
M8	NA	NA	0.02

Note: M256 is combined 2 kits with 12 disposable sampler/detectors for vapors and a booklet of M8 paper for liquids.
NA = not applicable

9.3. Minimum Screening Ranges/Levels for Water:

Field Equipment:	mg/L
M272	0.02

10. Environmental Sampling

Environmental Sampling

Note: This section on sampling contains general guidelines and does not replace the need for a site-specific sampling plan

10.1. Sampling Concerns: Detection, sampling equipment and procedures, and analytical techniques will be site-specific and depend on: 1) physical state of the agent; 2) type of surfaces contaminated (e.g., porous vs. non-porous); 3) the purpose of sampling (e.g., characterization, decontamination efficacy, and clearance); and 4) specific laboratory requirements. The U.S. Environmental Protection Agency (EPA) has set up mobile and fixed labs and analytical assets for chemical agent analysis of environmental samples under their Environmental Response Laboratory Network (ERLN), see ANALYSIS section below, (https://www.epa.gov/emergency-response/environmental-response-laboratory-network). For questions on environmental sampling for HD call EPA/HQ-EOC at 202-564-3850.

10.2. Sample Locations and Planning: Initially consider air monitoring to ensure worker safety and to determine if there is a vapor plume that could impact other areas. Characterization sampling is initiated by targeted or judgmental sampling to identify "hot spots," potential agent flow paths, and media or objects potentially acting as sinks. Additional biased or random sampling can be used to determine the extent of potential contamination or to verify the efficacy of decontamination. More thorough probabilistic sampling (e.g., grid, statistical approach) may be required for the clearance phase or if there are large uncertainties about the area impacted or the amount released. Because HD is a semi-persistent liquid, sample priorities should include surfaces that are potentially contaminated with liquid (e.g., release site, low lying areas, HVAC, utility corridors) and areas that people are likely to contact or where food or agricultural products are present.

Note: HD breaks down in most environmental and decontamination conditions to numerous breakdown products, especially TDG, which may be used as a marker to determine the extent of contamination of the parent HD. See

ANALYSIS section below to ensure sampling procedures are compatible with all analytes. Some preparation techniques for both HD and its breakdown products are available in EPA's Sample Information Collection Documents (https://www.epa.gov/esam/sample-collection-information-documents-scids). These provide general information regarding sampling procedures for different media, sampling supplies, sample size, container, holding time, preservation, packaging, and shipping, supporting collection of samples.

10.3. Types of Samples:

Air (Vapors are heavier than air): Samples are collected using appropriate solid phase absorbent media (tubes) or air sampler (e.g., SUMMA canister) at breathing zone level (~5 ft.) to assess inhalation exposure. To assess off gassing from surfaces and at ground levels, collect air samples at ~6 in. above the ground. Concurrent air monitoring for HD is recommended.

Water: Water should be collected in appropriate containers with addition of appropriate de-chlorinating agents and preservatives to minimize HD degradation and hydrolysis prior to analysis. Concurrent air monitoring for HD is recommended.

Soil: For localized "hot spot" areas where soil deposition may occur (i.e., neat liquid, aerosol or liquid droplets), surface soil samples should be taken from a non-vegetated area to a depth of less than one inch. Sub-surface soil samples are typically not necessary unless a large amount of liquid was poured on the ground, or if an underlying aquifer is endangered. Concurrent air monitoring for HD is recommended.

Surface Wipes: Wipe samples are often desired to indicate absence of HD on non-porous surfaces. Concurrent air monitoring for HD is recommended.

Bulk: For hot spot areas where liquid HD deposition may occur on porous surfaces (e.g., concrete, asphalt), actual pieces (chips) or cores of contaminated surface may be obtained using appropriate tools (scabbling, coring, or drills) for subsequent laboratory extraction analysis. Bulk samples of suspected sink materials may be recommended to rule out secondary vapor phase disposition or absorption of HD into these materials. Concurrent air monitoring for HD is recommended.

Other Sample Matrices: Contact EPA/HQ-EOC at 202-564-3850 for sampling instructions.

11. Packaging/Shipping: CWA Environmental Samples for Site Characterization

Packaging and Shipping: CWA Environmental Samples For Site Characterization

The packaging and shipping of environmental samples potentially contaminated with a chemical warfare agent (CWA) would be subject to complex and restrictive regulations established primarily by DOT for ground transportation (49 CFR Parts 171-180), and by DOT, ICAO, and IATA for air transportation (in addition to other regulations by CDC, USPS, OSHA). Transportation of HD-contaminated waste for treatment and disposal is covered under the WASTE MANAGEMENT section below.

Samples can be collected from environmental media that include surface and subsurface soil, groundwater, surface water, drinking water, dust, air, and solids other than soil (e.g., building materials). Given the wide range of potential environmental media and complex regulatory requirements, the approach would likely be situationally dependent.

CAUTION: Environmental samples potentially contaminated with CWA should not be introduced into commercial transportation as an undeclared hazardous material. Hazard classification, packaging, and hazard communication are the shipper's responsibility under DOT's Hazardous Materials Regulations (49 CFR Parts 171-180).

A summary of key packaging and shipping considerations for environmental samples with unknown concentrations of a potential unknown CWA is:

- Transport of pure HD is forbidden other than via military (Technical Escort Unit) transport in accordance with 49 CFR §173.7.
- If the collected sample contains or is suspected to contain hazardous materials, as defined in 49 CFR §171.8, the shipper must determine the appropriate UN ID Number, the Proper Shipping Name (PSN), and the Packing Group (PG) from the Hazardous Materials Table in 49 CFR §107.101. The table will then direct the shipper to the type of hazard and handling labels needed, the appropriate packaging (inner and outer packaging), and any special provisions.
- The designated shipper (EPA personnel or contractors) must be trained and certified according to the requirements found in 49 CFR §172.704 (a)(2) and/or by IATA Dangerous Goods (DG) 1.5 requirements for shipments by air.
- Contact the sample-receiving laboratory to determine if they have additional packaging, shipping, or labeling requirements.

Note that there is no UN ID for HD listed in the Hazardous Materials Table (49 CFR §172.101). Therefore, the most likely classification would be UN3381, Toxic by inhalation liquid, n.o.s. with an LC50 lower than or equal to 200 mL/m^3 and saturated vapor concentration greater than or equal to 500 LC50, PG I. In the US, non-bulk packaging would then be in accordance with 49 CFR §173.226.

Use of Mobile labs: Another consideration would be use of an on-site mobile laboratory for CWA analysis. This could eliminate the shipper's responsibility for transporting the collected samples containing a substance that might be considered forbidden for transport by air or a hazardous material or DG by ground or air transport to an off-site laboratory. In addition, there may be public concern about shipping samples off-site, or reluctance of commercial shipping companies to accept and transport samples from a known CWA-contaminated site. EPA maintains mobile laboratory assets (PHILIS mobile laboratories: https://www.epa.gov/emergency-response/philis-portable-high-

throughput-integrated-laboratory-identification-system) in NJ and CO that are capable of analyzing CWAs, including HD, in environmental matrices, down to health-based risk clearance levels. Access to the PHILIS mobile labs for a CWA incident can be obtained from EPA HQ/EOC at 202-564-3850. EPA also has access to the US Army CBRNE assets, including shipping and analysis, through inter-agency agreements as described in the COORDINATION WITH OTHER AGENCIES section below.

12. Analysis

Analysis

CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes and soil). Few laboratories currently have the capability to determine HD, particularly for large numbers of samples and for the various types of environmental media. EPA's ERLN labs (https://www.epa.gov/emergency-response/environmental-response-laboratory-network) that are specially trained and equipped for the analysis of HD, will use sample prep and analytical methods from EPA's Environmental Sampling and Analytical Methods (ESAM) Programs (https://www.epa.gov/esam). For access to the nearest ERLN laboratory specially trained and equipped for HD analysis, and methods provided in EPA's ESAM, contact EPA/HQ-EOC at 202-564-3850. The ERLN also maintains EPA's Compendium of Environmental Testing Laboratories (CETL), a database of commercial, federal, state, and academic laboratories, which can be queried for specific analyses and matrices. Analysis on environmental matrices for toxic organics, metals, biological and radiological agents, as well as several of the CWAs, including HD and its breakdown products, can be obtained by querying the database of laboratories listed in EPA's CETL (https://cfext.epa.gov/cetl/lblogin.cfm?action=None); prior registration for access to CETL website is necessary.

13. Coordination with Other Agencies: CWA Field Activities

Coordination With Other Agencies: CWA Field Activities

Numerous agencies other than EPA may be involved in a chemical agent response incident. Every attempt should be made to integrate assets and design a uniform approach to sampling procedures, quality assurance, and data sharing. Every attempt should be made to coordinate activities, share data, and maintain chain-of-custody integrity throughout all phases of the response, amongst all agencies involved.

Civilian: The National Guard Civil Support Team (CST) and the U.S. Coast Guard "Strike Teams" deploy survey teams, response vehicles, and mobile labs to hazardous chemical incidents throughout the United States. Many CSTs and Strike Teams have the capabilities to sample, prepare, and analyze certain types of environmental samples for CWA analysis. CSTs have analytical equipment that can provide screening or presumptive data results for CWAs. The OSC should discuss site-specific types of samples, data quality, and chain-of-custody requirements with Strike Teams and CSTs before integrating their capabilities into the overall CWA response. Other agencies, such as the FBI, may be present on-site performing tasks, such as evidence retrieval, which are specific for their agency.

Military: EPA's Special Teams (ERT and CMAD) have access to Department of Defense (DOD) assets through Inter-Agency Agreements (IAA) with the US Army's Combat Capabilities Development Command, Chemical Biological Center (CBC) at Aberdeen Proving Ground, MD. The CBC has expertise and deployable assets for CWA air monitoring (i.e., MINICAMS™), sampling, analysis, decontamination, and waste transport and disposal through their ongoing demilitarization activities at former chemical agent munitions facilities in the US and abroad.

Access to EPA's IAA for support to Federal OSCs at a CBRN response or incident can be arranged through EPA/HQ-EOC at 202-564-3850. Consultation or training for EPA personnel and partners that do not need to go through EPA/HQ-EOC can be arranged via the IAA with EPA's ERT-Special Team at 732-321-6660. Additional CBRNE support can be obtained via the IAA with EPA's CMAD-Special Team, including support for chemical, biological, and radiological agent response through EPA/HQ-EOC at 202-564-3850.

14. Environmental Decontamination/Cleanup

Environmental Decontamination/Cleanup

14.1. Decontamination/Cleanup Planning:

Once site controls are in place, develop a site-specific decontamination/cleanup plan. Environmental decontamination may require a "tiered approach" using a variety of techniques and products. Call EPA/HQ-EOC at 202-564-3850 for more information.

General Considerations: A cost vs. benefit evaluation should be undertaken for each decontamination strategy and approach that considers public safety, total cost, impact on the area, wastes generated, time the area or item will be inaccessible and/or out of service, as well as any socio-economic, public health, and/or security impacts that may result. Large volumes of decontamination wastes may be generated that will need to be collected, treated, and disposed of properly. Waste handling and disposal must be addressed as early in the decontamination and cleanup process as possible (see WASTE MANAGEMENT section below).

Disposal Option: The urgency to restore an area or item as quickly as possible may result in the outright and timely removal and disposal of contaminated materials. Certain materials may be impacted by the decontamination products, and/or may be cheaper to discard and replace than to decontaminate and restore.

Monitored Natural Attenuation: HD degrades via natural processes. Environmental monitoring must be maintained during decontamination and recovery phases. Monitored natural attenuation may require institutional controls (e.g., access restriction and contaminant containment measures). The time to achieve clearance must be considered in the overall cost/benefit evaluation. This option is more passive than other options but is non-destructive to materials.

Fix-in-Place Option: The contaminated area may be resistant to decontamination products or may be unable or impractical to be treated. Physical barriers can be used to immobilize the contamination and prevent it from coming into contact with the environment or the public. This can be a temporary or permanent solution.

14.2. Decontamination Strategy:

A decontamination strategy can be developed by designating contaminated areas into five broad categories: 1) surfaces or hot spots, 2) large volumetric spaces, 3) sensitive equipment or items, 4) aqueous solutions, and 5) water systems. Areas in each category may be treated using one or more unique decontamination processes in a tiered approach to the overall site-specific decontamination strategy. The described strategy is for HD; strategies for other sulfur mustard agents (H, HT; see AGENT CHARACTERISTICS section) are expected to be similar.

Cautions:

- Decontamination products may have unique safety/PPE requirements due to their own toxicity or that of breakdown products during use (e.g., use of bleach results in release of chlorine vapors). Strong oxidizers, such as hypochlorite, may react violently with organics.
- Under oxidizing conditions (particularly for household chlorine bleach or other hypochlorite-containing solutions), **HD can break down into several toxic byproducts, such as mustard and vinyl sulfones.** Decontamination formulations and conditions should be chosen as to minimize or eliminate the formation of these toxic breakdown products.
- Hydrolysis of HD produces HCl. Situation-specific tolerance to potentially altered pH and corrosiveness should be evaluated when developing a decontamination strategy.
- Dirt, grime, and other coatings (organic load) can reduce the efficacy of decontamination; pre-cleaning surfaces with soap and water may be needed before the application of decontamination formulations, but resulting pre-cleaning rinsates require containment to avoid agent spread.

For additional information, contact the EPA/HQ-EOC at 202-564-3850.

Surfaces/Hot Spots: This category is for areas smaller in size but with higher levels of agent contamination. They may require more rigorous decontamination products and methods. Excess HD liquid should be absorbed using, e.g., vermiculite or dry sand, and transferred into a sealed container and disposed of according to WASTE MANAGEMENT section below. In contrast to the rapid hydrolysis when HD is dissolved in water, **the hydrolysis of HD on surfaces is generally slower since it is limited by the amount of available moisture**. Application of the following oxidative decontamination solutions and formulations may be efficacious by following applicable manufacturers' directions.

1) Hypochlorite-containing solutions: Hypochlorite can be corrosive to certain surfaces and materials and should be rinsed thoroughly afterwards. Household bleach solutions (≥5% sodium hypochlorite) are effective for HD with efficacy achieved with contact time of 15-60 minutes depending on surface material. Calcium hypochlorite, present in commercial products, such as HTH (10% hypochlorite solution), is better for surfaces with high concentrations of liquids in localized areas. Note that lowering the pH of hypochlorite solutions is not required and may be counterproductive. If inadequate amount of oxidant is used, toxic byproducts will likely accumulate.
2) Proprietary decontamination technologies such as EasyDecon DF-200®, Decon7 (D7), Dahlgren Decon®, CASCAD®, Decon Green®, or L-Gel® have been shown to be effective against HD (and may be less corrosive than hypochlorite-containing solutions) on the order of minutes to hours, but not all have been thoroughly tested. Availability, cost, and the need for specialized equipment to apply the decontaminant may limit their use early in the response.

Large Volumetric Spaces: This category is for areas larger in size but with lower levels of agent contamination. These areas may require less aggressive, but more broadly applied, decontamination products and methods.

1) Monitored Natural Attenuation is more passive than other decontamination options and is non-destructive to materials. This option may be preferable depending on the scope and severity of contamination.
2) Forced or Hot Air ventilation methods are recommended for vapor plume contamination or low surface concentration of HD in large volumetric spaces, including HVAC systems, or open areas; efficacy may be typically achieved in hours to days with less waste and adverse impacts to materials. Capture technologies, such as activated carbon-containing air filters, would be required to prevent transfer of the HD vapor to the outside environment or prevent recirculation into other surrounding spaces.
3) Fumigations with modified vaporous hydrogen peroxide (mVHP®; a combination of ammonia and hydrogen peroxide vapor) or chlorine dioxide (ClO_2) have been reported to be effective against HD. Prolonged hydrogen peroxide fumigation (up to 24 hours) at lower vapor concentrations (≤75 ppmv) was found to be non-efficacious.
4) Steam application has been reported to effectively degrade HD on surfaces with no HD found in the condensate. Condensate may contain HCl.

Sensitive Equipment or Items: Forced or Hot Air ventilation may be used for HD and can be used either in-situ or ex-situ to decontaminate these items. Capture technologies using activated carbon air filters would be required to prevent transfer of the HD vapor to the outside environment or prevent recirculation into other surrounding spaces. Fumigation

with mVHP® is another option that could be efficacious with no or minimal impact on materials. Use of steam can be considered if presence of condensate (likely containing HCl) is not detrimental to the equipment or item.

Aqueous Solutions: HD degrades via hydrolysis but may persist in aqueous solutions, depending on initial concentration and environmental conditions, such as pH and temperature. Also contributing to persistence is that hydrolysis products of HD may accumulate at the interface between the HD liquid and the water, forming a protective coating around HD "globules" that are resistant to further hydrolysis and can persist for decades if not physically disturbed. The amount of disturbance required is unknown, so simple mixing of containerized HD solution may not suffice. Hydrolysis of HD produces HCl. If the aqueous solutions result from decontamination operations involving bleach or other high pH conditions, significant HD degradation into toxic byproducts may occur (see toxic byproducts statement under Cautions above). Avoid any additional release and/or inappropriate disposal to water systems, drains, or sewers. Contain or transfer liquid to appropriate containers and dispose of according to WASTE MANAGEMENT section below.

Water Systems: Hydrolysis and removal of contaminated water will lessen HD contamination in water systems, but HD may persist in hydraulic dead ends and via sorption to system components (e.g., plastics) that act as sinks for HD. It may be necessary to isolate potentially affected portions of the system to evaluate them and implement decontamination. A contaminated water system may transfer HD to building and premise plumbing, which then may also require decontamination. As HD is denser than water, it may sink and accumulate in low lying areas, such as the bottom of pipes and tanks. Hydrolysis of HD in water produces HCl.

Verification of Decontamination: Site and situation specific. Please contact EPA/HQ-EOC at 202-564-3850 for further assistance.

15. Waste Management

Waste Management

15.1. Transportation:

Federal requirements for the commercial transport of hazardous materials and procedures for exemptions are specified in How to Comply with Federal Hazardous Materials Regulations, available at: https://www.fmcsa.dot.gov/regulations/hazardous-materials/how-comply-federal-hazardous-materials-regulations.

Sulfur Mustard (HD) should not be offered for commercial transportation without being rendered safe by neutralization. Contact the PHMSA Hazardous Materials Information Center at 1-800-467-4922 or infocntr@dot.gov to discuss specific cases. Additional resources on packaging, labeling, and shipping are available at: https://www.phmsa.dot.gov/standards-rulemaking/hazmat/hazardous-materials-regulations. Detailed state regulations can be found at www.envcap.org/.

This QRG is intended to apply to Federal OSCs in the first 24-48 hours of a response. Once determined, the concentrations of HD in individual waste streams should be used to determine which transportation requirements apply. For instance, certain requirements may apply to waste streams with concentrated agent, but may not apply to waste streams such as soil containing dilute concentrations of agent.

15.2. Waste Management:

Under the Resource Conservation and Recovery Act (RCRA), waste is classified as hazardous waste (subtitle C) or solid waste (subtitle D). The RCRA regulations generally define a waste to be hazardous if it is: (1) a listed waste (40 CFR §261.31-§261.32); (2) exhibits specific characteristics (40 CFR §261.21-§261.24); or (3) is a discarded commercial chemical product, off specification species, container residue, or spill residue listed in 40 CFR §261.33. Sulfur Mustard (HD) is not listed under 40 CFR §261.31-33, but HD-contaminated waste may be considered reactive hazardous waste, D003, if, when mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(4)) or if it is a sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (40 CFR §261.23(a)(5)). It is the responsibility of the waste generator to make a hazardous waste determination (40 CFR §262.11).

The states (except for Alaska and Iowa) have the primary responsibility to implement the hazardous waste regulations and can impose more stringent requirements or requirements broader in scope than the federal program. Several states, including CO, IN, KY, MD, OR, and UT, have their own waste designations for chemical agents, which may be applicable for the cleanup of HD-contaminated residues, decomposition products, soils, and debris. It is critical to open a dialogue with state regulators as early as possible.

Management of toxic decomposition products, associated residual decontamination solutions, local waste acceptance criteria, and transportation and handling requirements should be considered. High pH aqueous decontamination solution waste may be considered corrosive hazardous waste, chemical code D002, if it has a pH greater than or equal to 12.5 (40 CFR §261.22).

EPA/CMAD can provide Federal OSCs with information and support to address knowledge gaps for dealing with wastes contaminated with dilute concentrations of CWA; contact EPA/HQ-EOC at 202-564-3850.

EPA also recommends the creation of pre-incident waste management plans as a preparedness measure for chemical agent releases, and has created an **All-Hazards Waste Management Planning Tool** to help state, local, territorial, and tribal

ANALYSIS section below to ensure sampling procedures are compatible with all analytes. Some preparation techniques for both HD and its breakdown products are available in EPA's Sample Information Collection Documents (https://www.epa.gov/esam/sample-collection-information-documents-scids). These provide general information regarding sampling procedures for different media, sampling supplies, sample size, container, holding time, preservation, packaging, and shipping, supporting collection of samples.

10.3. Types of Samples:

Air (Vapors are heavier than air): Samples are collected using appropriate solid phase absorbent media (tubes) or air sampler (e.g., SUMMA canister) at breathing zone level (~5 ft.) to assess inhalation exposure. To assess off gassing from surfaces and at ground levels, collect air samples at ~6 in. above the ground. Concurrent air monitoring for HD is recommended.

Water: Water should be collected in appropriate containers with addition of appropriate de-chlorinating agents and preservatives to minimize HD degradation and hydrolysis prior to analysis. Concurrent air monitoring for HD is recommended.

Soil: For localized "hot spot" areas where soil deposition may occur (i.e., neat liquid, aerosol or liquid droplets), surface soil samples should be taken from a non-vegetated area to a depth of less than one inch. Sub-surface soil samples are typically not necessary unless a large amount of liquid was poured on the ground, or if an underlying aquifer is endangered. Concurrent air monitoring for HD is recommended.

Surface Wipes: Wipe samples are often desired to indicate absence of HD on non-porous surfaces. Concurrent air monitoring for HD is recommended.

Bulk: For hot spot areas where liquid HD deposition may occur on porous surfaces (e.g., concrete, asphalt), actual pieces (chips) or cores of contaminated surface may be obtained using appropriate tools (scabbling, coring, or drills) for subsequent laboratory extraction analysis. Bulk samples of suspected sink materials may be recommended to rule out secondary vapor phase disposition or absorption of HD into these materials. Concurrent air monitoring for HD is recommended.

Other Sample Matrices: Contact EPA/HQ-EOC at 202-564-3850 for sampling instructions.

11. Packaging/Shipping: CWA Environmental Samples for Site Characterization

Packaging and Shipping: CWA Environmental Samples For Site Characterization

The packaging and shipping of environmental samples potentially contaminated with a chemical warfare agent (CWA) would be subject to complex and restrictive regulations established primarily by DOT for ground transportation (49 CFR Parts 171-180), and by DOT, ICAO, and IATA for air transportation (in addition to other regulations by CDC, USPS, OSHA). Transportation of HD-contaminated waste for treatment and disposal is covered under the WASTE MANAGEMENT section below.

Samples can be collected from environmental media that include surface and subsurface soil, groundwater, surface water, drinking water, dust, air, and solids other than soil (e.g., building materials). Given the wide range of potential environmental media and complex regulatory requirements, the approach would likely be situationally dependent.

CAUTION: Environmental samples potentially contaminated with CWA should not be introduced into commercial transportation as an undeclared hazardous material. Hazard classification, packaging, and hazard communication are the shipper's responsibility under DOT's Hazardous Materials Regulations (49 CFR Parts 171-180).

A summary of key packaging and shipping considerations for environmental samples with unknown concentrations of a potential unknown CWA is:

- Transport of pure HD is forbidden other than via military (Technical Escort Unit) transport in accordance with 49 CFR §173.7.
- If the collected sample contains or is suspected to contain hazardous materials, as defined in 49 CFR §171.8, the shipper must determine the appropriate UN ID Number, the Proper Shipping Name (PSN), and the Packing Group (PG) from the Hazardous Materials Table in 49 CFR §107.101. The table will then direct the shipper to the type of hazard and handling labels needed, the appropriate packaging (inner and outer packaging), and any special provisions.
- The designated shipper (EPA personnel or contractors) must be trained and certified according to the requirements found in 49 CFR §172.704 (a)(2) and/or by IATA Dangerous Goods (DG) 1.5 requirements for shipments by air.
- Contact the sample-receiving laboratory to determine if they have additional packaging, shipping, or labeling requirements.

Note that there is no UN ID for HD listed in the Hazardous Materials Table (49 CFR §172.101). Therefore, the most likely classification would be UN3381, Toxic by inhalation liquid, n.o.s. with an LC50 lower than or equal to 200 mL/m^3 and saturated vapor concentration greater than or equal to 500 LC50, PG I. In the US, non-bulk packaging would then be in accordance with 49 CFR §173.226.

Use of Mobile labs: Another consideration would be use of an on-site mobile laboratory for CWA analysis. This could eliminate the shipper's responsibility for transporting the collected samples containing a substance that might be considered forbidden for transport by air or a hazardous material or DG by ground or air transport to an off-site laboratory. In addition, there may be public concern about shipping samples off-site, or reluctance of commercial shipping companies to accept and transport samples from a known CWA-contaminated site. EPA maintains mobile laboratory assets (PHILIS mobile laboratories: https://www.epa.gov/emergency-response/philis-portable-high-