U.S. Environmental Protection Agency

Emergency Prevention, Preparedness, and Response Program

Chemical Warfare Agent Response

Standard Operating Guidance

USEPA - Emergency Prevention, Preparedness, and Response Program
Chemical Warfare Agent (CWA) Response Standard Operating Guidance (SOG)

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PRE-ENTRY PROCEDURES:	✓
1.0 Initial Response Management	
a. Complete U.S. Environmental Protection Agency (EPA) emergency response notification procedures.	
b. Mobilize critical EPA, Response Engineering and Analytical Contract *(*REAC), Superfund Technical Assessment and Response Team (START), and Emergency and Rapid Response Services *(*ERRS) assets to the scene.	
c. Establish or integrate EPA into Incident Command System (ICS) and/or Unified Command (UC) once on-scene.	
d. Initiate planning by completing the ICS Form 201 (Incident Briefing), and establish the EPA as the lead federal agency at the scene.	
1.1 Initial Site Characterization and Operational Planning	
a. Gather intelligence and conduct research about the scene and the incident.	
b. Rapidly assess hazards, then establish and secure conservative site boundaries.	
c. Assign a Site Safety Officer (SSO) to initiate health and safety planning.	
d. Synchronize the EPA and the Unified Command (UC) incident objectives.	
e. As qualified personnel arrive, rapidly expand the ICS structure to include an Operations Section Chief (OpsSC) and a Planning Section Chief (PSC) at a minimum; give both section chiefs the authority to expand their sections as required.	
1.2 Establish Work Zones	
a. Remotely establish the Exclusion Zone; include areas of interest and tentatively identify areas of responsibility for initial reconnaissance efforts.	
b. Establish the Contamination Reduction Zone (CRZ); include the Contamination Reduction Corridor (CRC), the entry access control point, and the egress control point.	
c. Establish the Support Zone; include the locations of the incident command post (ICP), staging areas, the medical monitoring area, and the triage area. Prevailing wind direction and a "reasonable" distance from the hazard must be considered (as close as possible without putting ICP in jeopardy).	
d. Reinforce site security; request law enforcement support to restrict access to the site, contain and direct victims, and harden the perimeter.	
1.3 Organize and Prepare Assets for Initial Assessment	
a. Appoint an On-scene Coordinator (OSC) or qualified START member as the HazMat Group Supervisor, **who will**:	
I. Appoint an OSC or qualified START as the HazMat Entry Team Leader.	
II. Appoint a Decontamination Team Leader (START or ERRS).	
III. Appoint a qualified START as the Site Access Control Team Leader.	
IV. Establish entry, decontamination, backup, and site access control teams to support the initial entry by establishing the decontamination line, monitoring personnel and equipment as they enter and exit the site, and providing technical expertise during the initial assessment of the Exclusion Zone.	
V. Appoint an Analytical Laboratory Coordinator (technical specialist).	
b. Appoint a Law Enforcement Group Supervisor, **who will**:	
I. Appoint a Site Security Team Leader.	
II. Appoint an Evidence Collection (EC) Team Leader.	
III. Appoint an Explosive Ordnance Disposal (EOD) Team Leader.	
IV. Establish site security, evidence preservation, and EOD teams to support the response by limiting unauthorized access to the site and support areas, preventing the loss of evidence, and providing technical expertise to neutralize any explosive devices prior to entries by other teams.	
c. Appoint a Medical Group Supervisor, **who will**:	
I. Appoint a Triage Unit Leader.	
II. Appoint a Treatment Unit Leader.	
III. Appoint a Hospital Coordination and Transport Unit Leader.	
IV. Appoint a Medical Information and Research Technical Specialist.	
V. Direct on-scene medical care, casualty decontamination, casualty transportation, and technical medical research teams to assist civilian victims and responder casualties, while providing technical	

support to the UC.	
d. Appoint a START to serve as the Documentation Unit Leader.	
e. Appoint an Information Officer to address media concerns and control the message.	
f. Conduct an initial action briefing using ICS Form 201 (Initial Briefing) as an outline, with the Group Supervisors, the SSO, the OpsSC, the PSC, and available Team Leaders. Brief all personnel on the required tasks for the initial assessment:	
I. Complete preparations of a secure, functional Support Zone with HazMat, Law Enforcement and Medical staging areas, an ICP, medical triage and treatment areas, a joint information center (JIC), and a debriefing area.	
II. Complete preparations of a CRC for entry personnel and equipment with entry and egress control points inside the CRZ and upwind/upslope of the exclusion zone.	
III. Initial Assessment.	
A. EOD Team - Sweep scene to secure or destroy any explosive devices.	
B. Evidence Collection (EC) Team - Identify and secure evidence areas.	
C. HazMat Group - Conduct an assessment to ensure any CWA or HazMat is contained in the Exclusion Zone, provide technical assistance in hazard assessment to EOD and Evidence Collection Teams during their entries, control site access, and provide decontamination support to responders.	
D. Medical Group - Provide casualty decontamination, triage and treatment support to victims and response personnel, and coordinate casualty transportation to local hospitals and clinics.	
g. Immediately following the initial briefing, conduct a site safety meeting where the SSO should address the hazards expected during the initial assessment.	
h. Prior to dismissing briefing participants, provide an estimated time for completion of the initial assessment, defining the incident objectives, and implementing the incident management cycle, as outlined in ICS.	
1.4 Conduct Pre-Entry Medical Monitoring	
a. All personnel entering the Exclusion Zone and supporting the initial assessment effort from the Contamination Reduction Zone must undergo medical monitoring.	
b. Medical monitoring should be performed by qualified individuals from either the Medical Group, if available, or respective agencies, which will complete the required medical documentation for entry personnel, which must be given to the Site Access Control Team at the entry access control point prior to entry.	
c. Any individuals deemed unfit for entry per medical monitoring criteria will be barred from entry by the Site Access Control Team, and they must be immediately replaced with qualified personnel, as designated by their respective Team Leaders.	
d. Once medical monitoring is completed and entry personnel have been identified and deemed fit for entry, the respective teams should be task-organized, i.e. Decontamination Team, EOD Team, etc., to complete preparations.	
1.5 Equipment Calibration and Functions Checks *(***** - section applies to HazMat Entry Team only)*	
a. Inspect the personal protective equipment (PPE) for signs of cracks, rips, tears or other visible defects.	
b. Ensure all SCBA tanks are filled, masks and regulators are serviceable, air supply valves are operational, and, if applicable, Level-A personal communications equipment is working properly.	
c. Ensure functional lines of communications by conducting radio checks between all entry teams, the backup team, the decontamination team, the medical teams, and the incident command post (ICP), and review emergency hand and arm signals.	
*d. Conduct calibration and functions checks on hazard detection equipment:	
I. Radiation meter or electronic personal dosimeter (operating range in µR/hr).	
II. Multiple-gas monitor, i.e. MultiRAE or TMX-412 (must have O_2 and LEL; should have H2S and CO unless site history suggests other inorganic contaminants may be present.	
III. Toxic vapor analyzer with PID, FID, or both, i.e. MultiRAE or TVA-1000.	
*e. Conduct CWA detection equipment function checks.	
I. Nerve and blister agent vapor detection system, i.e. APD 2000, SAW MiniCAD, AP2Ce, AP4C, HAPSITE GC/MS, and M256A1 Kits.	
II. Blood and choking agent vapor detection equipment, i.e. HAPSITE GC/MS, AP4C, M256A1 Kits, and Draeger CDS Kits.	

III. Nerve and blister agent liquid detection equipment, i.e. HAPSITE GC/MS, AP2Ce, AP4C, and M8 Paper.	
f. Assemble and check serviceability of required site documentation equipment.	
I. Digital camera or video camera to collect photographic documentation for UC.	
II. GPS unit or site map to record the locations of instrument/detection kit readings.	
III. Clipboard, logbook, and pens to document site activities.	
IV. Limited sampling equipment for sample collection and submittal to analytical laboratories.	
1.6 Donning Personal Protective Equipment	
a. Gather required PPE.	
I. Fully-encapsulating, level-A suit (must have passed testing within last year).	
II. A towel to clear condensation from the suit window should be placed at an accessible location inside the suit.	
III. Multiple pairs of protective gloves will be worn to protect the worker from the hazard. The gloves will be selected based on the compatibility with the CWA(s) involved and any other chemicals which the gloves may also come in contact with. Typically there will be gloves on the Level A suit, over which a pair of solvex, Teflon, or the like will be used. Nitriles can be used over gloves with minimal dexterity to increase the user's ability to perform assigned tasks.	
IV. 1 pair of chemical resistant steel-toe boots and 1 pair of rubber overboots.	
V. SCBA pack, regulator, and mask, with communications equipment.	
b. Available support zone personnel should assist entry personnel in donning all required PPE (except for the mask and the suit sealing) while in the staging area, to expedite the process and to provide a thorough check.	
c. When all personnel and equipment are ready for entry, move to the entry access control point to await entry clearance.	
1.7 Entry Clearance	
a. Upon arrival of entry personnel at the entry access control point, the Site Access Control Team will collect medical monitoring documentation, record all personnel and equipment on the Site Entry/Egress Log, and request permission from the ICP for the team to enter the Exclusion Zone.	
b. The ICP should then contact the team leader by radio, confirm the tasks to be accomplished by the team, provide a situation and weather update, contact the Decontamination and Backup Teams to confirm they are ready, and then give permission for the team to enter the Exclusion Zone.	
c. The Team Leader will order his team to mask and seal suits, then the Team Leader should conduct a final inspection of personnel and equipment, verifying proper PPE serviceability, and ensuring accountability of all required equipment.	
d. The Site Access Control Team will record the time "on air" for the team, and conduct a "buddy-team" headcount to confirm accountability as the team enters the site.	
e. Once the team has entered the site, the Site Access Control Team will give the entry team's medical monitoring documents and entry log to the egress control point.	
INITIAL ASSESSMENT PROCEDURES:	✓
2.1 EOD Team (Law Enforcement Group - Local or Federal Asset, i.e. Bomb Squad or Alcohol, Tobacco and Firearms (ATF)	
a. Responsible for declaring areas of the Exclusion Zone safe from explosives hazards.	
b. Will use agency-specific operating procedures, equipment, and personnel to systematically locate, neutralize or destroy unexploded ordnance or secondary devices designed to injure or kill civilians and emergency responders.	
c. Should be the first team to enter the Exclusion Zone, concurrent with or immediately following lifesaving efforts made by local EMS, police, and fire during their response.	
d. Will advise the ICP when explosive devices are found, neutralized, or destroyed, when sectors of the site have been cleared, and when other teams can occupy cleared sectors.	
e. A technical specialist from the HazMat Group should be provided to the EOD Team to ensure the safety of response personnel from ionizing radiation and chemical hazards, but this assistance should in no way interfere with or supersede the actions of the team in accomplishing its assigned duties unless the safety of the team members are at risk.	
f. Depending on the size of the site and the presence of explosives on the site, the EOD Team may require	

several SCBA bottle changes and/or shift changes to complete their task; the ICP should be provided situation reports (SITREPs) frequently to assist the Incident Commanders (ICs) or the (UC) in managing concurrent operations efficiently.	
g. Once the EOD Team has notified the ICP that other teams may occupy clear sectors, or that the site is clear, the UC should order the EC Team into those sectors.	
h. Upon completion of the explosives sweep of the site and a declaration of "all-safe", the EOD Team should conduct egress procedures as outlined below.	
2.2 EC Team (Law Enforcement Group - Federal Asset, i.e. FBI or ATF)	
a. Initially responsible for identifying and securing areas of possible criminal evidence to prevent the destruction or loss of evidence until collection can occur.	
b. Will use agency-specific operating procedures, equipment, and personnel to systematically locate, mark, and secure possible evidence areas, permitting other teams to immediately begin operating around these "off-limits areas" during the initial assessment and subsequent response activities.	
c. Should be the second team to enter the Exclusion Zone, concurrent with or following the EOD Team explosives sweep, depending on agency-specific protocols.	
d. Will rapidly assess the scene and advise the ICP when evidence has been found, marked, and secured, when sectors of the site have been completed, and when other teams can occupy completed sectors.	
e. A technical specialist from the HazMat Group should be provided to the EC Team to ensure the safety of response personnel from ionizing radiation and chemical hazards, but this assistance should in no way interfere with or supersede the actions of the team in accomplishing its assigned duties unless the safety of the team members are at risk.	
f. The ICP should be provided SITREPs frequently to assist the IC(s) / UC in managing concurrent operations. The EC Team should be directed to expedite their initial evidence security activities to permit a rapid assessment of the site by the HazMat Entry Team, thereby preventing additional casualties from potential contamination migration off-site.	
g. Once the EC Team has notified the ICP that other teams may occupy completed sectors, the HazMat Entry Team should be sent into those sectors.	
h. Upon completion of the evidence sweep of the site and a declaration of "all-secure", the EC Team may conduct egress procedures as outlined below, or may be directed by the IC(s) / UC to begin formal evidence collection on the site. This may require multiple entries.	
2.3 HazMat Group (Federal, State, and Local Assets, i.e. EPA, Weapons of Mass Destruction-Civil Support Teams (WMD-CST), or Fire HAZMAT)	
a. HazMat Entry Team	
I. Initially responsible for determining whether the established site boundaries adequately contain the hazard area, thereby preventing off-site contamination. This action occurs concurrently while the EOD Team and EC Team are conducting their tasks inside the Exclusion Zone.	
II. Will use EPA protocols, equipment, and personnel to systematically assess hazardous vapor concentrations along the boundary between the Exclusion Zone and the CRZ, to ensure site containment.	
III. Conduct air monitoring with organic, inorganic, and CWA vapor detection equipment around the perimeter of the Exclusion Zone, with particular emphasis on the downwind side, to ensure the boundaries include any contamination migration.	
IV. If airborne contamination is detected along the established boundary of the Exclusion Zone, notify the ICP immediately, attempt to identify the extent of any migration, and do not proceed until the Exclusion Zone boundaries have been adjusted by the ICP to include an 800m buffer, as recommended by the Emergency Response Guidebook (ERG).	
V. Ensure that the existing/adjusted perimeter has been secured and marked to prevent access by unauthorized personnel.	
VI. Once the perimeter is determined to have a negligible airborne hazard, notify the ICP and request permission to proceed to an open sector of the site that the EOD Team and EC Team have cleared.	
VII. In each sector, collect the following information and report it to the ICP:	
A. Detection and presumptive identification of CWAs, chemical, radiological, and physical hazards within instrument capabilities.	
B. Location of hazard areas, documented in the logbook and with photos.	

C. Air monitoring that identifies any atmospheres that are oxygen-deficient, combustible, corrosive, or toxic.	
D. If visual observations, instruments, or detection kits indicate the presence of product liquid CWA, notify the ICP, and collect a sample of the material for confirmatory analysis in a 2 oz glass jar labeled with the sample number, date, time, location, sampler identification, instrument reading, and then seal with a custody seal.	
E. Place samples in a re-sealable plastic bag for immediate transfer to the Decontamination Team for decontamination and shipment to an analytical laboratory, or later technical decontamination during egress.	
VIII. Depending on the size of the site to be characterized, the HazMat Entry Team may require several SCBA bottle changes and/or shift changes to complete the initial assessment; the ICP should be provided frequent SITREPs to assist the IC(s) / UC in managing concurrent operations.	
IX. Once the HazMat Entry Team has completed the initial assessment of the site, they should confirm there are no additional tasks from the ICP prior to proceeding to the decontamination line for egress procedures.	
b. Decontamination Team and Backup Team	
I. Responsible for manning the decontamination stations while entry personnel are inside the Exclusion Zone, providing additional resources to the entry teams upon request, monitoring the condition of entry personnel during SCBA bottle changes and decontamination, and providing emergency personnel support to entry teams, as needed.	
II. Will utilize EPA protocols, personnel, and equipment to conduct decontamination operations in the CRC for the duration of the site assessment.	
III. Team should be positioned and ready to conduct decontamination prior to any entry into the Exclusion Zone. Depending on the location of the CRC, weather conditions, and air monitoring capabilities at the CRC, the team may be permitted to be "off-air," with suits opened until needed; this requires UC/SSO approval and additional site coordination by teams requesting or requiring decontamination support.	
IV. At a minimum, the Decontamination Team should be equipped with a SAW MiniCAD (or similar CWA area sensor) to be placed at the contamination control line, and an APD 2000, AP2Ce or a PID (organic or CWA vapor sensor) to be used to confirm decontamination efficiency on personnel and equipment. If contaminant is known the detection equipment should be able to detect the known contaminants. In appropriate instances surface detection methods may be employed.	
V. The Backup Team should not assist in decontamination, but should be awaiting requests for support just outside the CRZ in the Support Zone, however, they may be used to provide rest and relief to decontamination personnel who will then assume roles on the Backup Team; both teams must be fully manned at all times during the initial assessment.	
VI. Both the Decontamination Team and the Backup Team are required to monitor the radio at all times to receive SITREPs and information related to the presumptive identification of hazards, which may be used to adjust the decontaminating solution used.	
VII. A combination of soapy water and 0.5% bleach solution should initially be used on the decontamination line until or unless site characterization reveals possible incompatibilities or hazards with the decontaminating solution and the known or suspected contaminants.	
VIII. The Decontamination Team is required to monitor the effectiveness of the decontamination solution throughout the initial assessment, disposal of used PPE, spent decontaminating solution, and other investigation-derived waste (IDW), and to replenish CRC stations with supplies and fresh solutions.	
IX. The Decontamination Team is also responsible for conducting technical decontamination of samples and equipment during egress operations; this process ensures that all items brought into or returned to the Support Zone are free of hazardous contamination.	
X. Once the initial assessment is complete and all entry personnel have processed through the decontamination line, the Decontamination Team is required to close the decontamination line and process team members through the decontamination sequence to the Support Zone; during this process, all IDW should be packaged for disposal and new decontamination solutions should be prepared so that the CRC is prepared to support future operations if future operations are expected.	
2.4 Medical Group (Federal, State, and Local Assets, i.e. FEMA, State DOH, or City EMS)	

a. Units from the Medical Group may include the local fire and EMS teams that may have been the first on the scene after the incident occurred; as such, the UC may be organized around these assets to allow their critical work to continue uninterrupted.	
b. Medical group units will use agency-specific operating procedures, equipment and personnel to locate, recover, and treat casualties at the scene, as needed, as well as providing support to any casualties among incident response personnel.	
c. Triage Unit	
I. Responsible for decontaminating, evaluating, and prioritizing civilian casualties recovered from the scene prior to and during the initial assessment.	
d. Treatment Unit	
I. Responsible for providing first aid and medical treatment to prioritized casualties and stabilizing them for onward transport to medical facilities.	
e. Hospital Coordination and Transport Unit	
I. Responsible for coordinating the transport of casualties to local hospitals.	
2.5 Unified Command / ICP (Federal, State, and Local Assets - i.e. Above)	
a. Responsible for managing all assets and activities on the incident, maintaining all lines of communications, maintaining documentation of site activities, maintaining site facilities and boundaries, and maintaining site security.	
b. During the initial assessment, the ICP should be fully manned and focused on organizing and building the framework for the appropriate response to the incident; if the UC is not fully formed and resourced, the objective must be to get it operating efficiently by delegating critical tasks to capable personnel to ensure success ~~d~~o not hesitate to replace less qualified individuals as more experienced personnel arrive, as soon as it is reasonable.	
c. While the focus should be on characterizing the hazards in the Exclusion Zone, this responsibility should be placed on the Group Supervisors, freeing the UC and the general staff to track and request resources, anticipate and plan for future events, and get ahead of the management cycle before the assessment is completed.	
d. Remember to establish lines of communication with the city, county, and state emergency management agencies, which can assist in providing local resources during the initial operational periods of the incident before federal assistance arrives. Designate a liaison officer.	
EGRESS PROCEDURES:	✓
3.1 Sample Transfer Procedures	
a. Any samples to be processed through the CRC must be sealed in a labeled, custody-sealed sample jar, and an external re-sealable plastic bag that will be decontaminated.	
b. The samples will be given to the technical decontamination specialist at the CRC control point when the entry team is finally ready to egress from the Exclusion Zone.	
c. As the sampler processes through the decontamination line, he/she should maintain “visual custody” of the samples as they are processed through technical decontamination, which is parallel to the personnel decontamination line.	
d. Once the samples have been decontaminated and confirmed to be externally “clean”, they will be sealed inside a new clear re-sealable bag and placed on a clean equipment table near the egress control point, where the sampler will retrieve them.	
e. The sampler retains custody of the samples until a complete chain of custody can be prepared using the logbook and the information recorded on the sample labels.	
f. Once the sample documentation is complete, the sampler will transfer custody to the Analytical Laboratory Coordinator until the final transfer to the selected analytical laboratory for confirmatory testing.	
3.2 Personnel Decontamination	
a. Entry team personnel that have completed operations in the Exclusion Zone will report to the CRC control point to meet the Decontamination Team Leader, who is responsible for directing them through the personnel decontamination sequence.	
b. Contaminated response personnel must take direction from the Decontamination Team as they complete the decontamination process to ensure the most efficient and complete removal and neutralization of contamination.	
c. After the removal of tape, outer gloves, and boot covers, contaminated personnel will cross the	

	"HOTLINE," which marks the boundary between the Exclusion Zone and the CRZ. If good field practices are employed by entry personnel, a removal of up to 95% of gross (liquid) contamination should be realized.	
d.	The remaining steps in the decontamination sequence are designed to remove and neutralize the residual contamination on the suits and safety boots; the decontamination team should be checking the efficiency of their procedures with CWA or organic vapor detection instruments after Suit/Safety Boot Rinse (CRC Station 8) to confirm that the decontamination solution is working and that procedures are sufficient to remove residual contamination; "dirty" personnel (defined by detectable organic or CWA vapor concentrations using a PID/FID) must be processed again.	
e.	Wash stations (CRC stations 2, 8, and 13) should be initially resourced with two separate decontaminant containers, one containing a warm soapy water solution, and the other containing a 0.5% bleach solution, applied in this sequence to all surfaces; this may be revised by the Decontamination Team Leader and SSO as more information is collected about the chemical hazards on the scene.	
f.	The Decontamination Team is responsible for decontaminating and cleaning reusable PPE, SCBA packs, and masks by processing them through technical decontamination during periods of lower throughput.	
g.	The decontamination team will also dispose of IDW and replenish decontamination solutions in accordance with procedures outlined in this SOG.	
h.	Once the entry team members have completed the decontamination sequence, they will redress and proceed to the egress control point for out-processing.	
3.3	Technical Decontamination	
a.	Samples and equipment will be left at the Segregated Equipment Drop (CRC station 1) for technical decontamination specialists to process.	
b.	Technical decontamination line will consist of cleaning apparatus (i.e. brushes, sponges, mops, and cloths) and three large immersion bins, containing warm soapy water, a 0.5 - 5.0% bleach solution, and clean rinse water, respectively. Contents of the first two bins may be changed by the first two bins by the decontamination Team Leader and SSO as more information is collected about the chemical hazards on the scene.	
c.	The technical decontamination specialists will, when possible, immerse contaminated equipment in these three bins, in the sequence outlined above, brushing or wiping the equipment thoroughly after each bin, to remove gross and residual contamination.	
d.	When it is not possible to immerse equipment, the technical decontamination specialist will thoroughly decontaminate each piece using cleaning apparatus to apply each of the decontamination solutions in sequence, then wipe items clean with rinse water.	
e.	Decontaminated equipment will be placed on a table, where it will be monitored for residual vapor concentrations and allowed to air-dry; "dirty" equipment must be processed until vapor contamination can no longer be detected.	
f.	There must be an equipment transfer area at the end of the technical decontamination line where equipment that could not be processed in time to be recovered by the entry personnel prior to egress, medical monitoring, and debriefing, can be transferred to the Site Access Control Team at the egress control point for pick-up.	
3.4	Egress Control Point	
a.	Once response personnel and samples have arrived at the egress control point, they will be marked off the entry/egress log, given a receipt for any equipment that has not yet processed through technical decontamination, and handed their medical monitoring documentation.	
b.	Once all team members have processed through the egress control point, the Team Leader must get a copy of the entry/egress log, his equipment receipt, and the team vital signs sheet for use at the post-decontamination medical monitoring station.	
3.5	Post-Decontamination Medical Monitoring	
a.	All personnel exiting the Exclusion Zone or the CRZ must undergo medical monitoring.	
b.	Medical monitoring should be performed by EMT qualified individuals from either the Medical Group, if available, or respective agencies, who will complete the required post-decontamination medical evaluation and monitoring documentation.	
c.	Any individuals identified by the medical monitoring team for further observation or treatment due to abnormalities in vital signs or symptom presentment should immediately be taken to the treatment area in the support zone, where they will remain until released by medical personnel or transported to local	

hospitals, as necessary; team leaders are responsible for documenting this in the logbook.	
d. Once medical monitoring is completed and entry personnel have been medically released, the team leader will be given the completed medical monitoring documents and sent to the debriefing area where the entry team should be waiting.	
3.6 Debriefing	
a. In the debriefing area, the entry Team Leaders should review the actions conducted in the Exclusion Zone with the entire entry team, and collect all required site documentation from team members, to include logbooks, medical monitoring data sheets, entry/egress logs, and photographic and video equipment for the ICP.	
b. Once the team debriefing is complete, the entry Team leader may release the team, or request that select team members with unique observations accompany him to the IC/UC debriefing.	
c. The team leader and any select team members will then proceed to the ICP to be debriefed by the IC/UC, or a designated representative, using their photographic documentation, logbooks, and site documents.	
CONTINGENCY PROCEDURES:	✓
C.1 Heat/Cold Casualties	
a. If signs and symptoms of heat exhaustion, heat stroke, dehydration, frostbite, or hypothermia are observed among response personnel, notify the ICP immediately.	
b. ICP should contact the Medical Group to inform them of the situation and have them prepare to receive a heat/cold casualty at the egress control point.	
c. The Backup Team should be ordered into the Exclusion Zone to meet the entry team and the casualty, and escort/assist the casualty back to the CRC control point for emergency decontamination.	
d. After decontamination, members of the Medical Treatment Team will receive and assess the casualty, providing any treatment required.	
e. The entry team leader should conduct a brief "safety-halt" to assess other team members for similar symptoms, if none are found, contact the ICP and request permission to continue operations.	
C.2 Toxic Exposure Casualties	
a. If signs and symptoms of agent exposure are observed among response personnel, notify the ICP immediately.	
b. The ICP should give the order to evacuate the Exclusion Zone and contact the Medical Group to inform them of the situation and have them prepare to receive a toxic exposure casualty at the egress control point.	
c. The entry Team Leader should immediately ensure full accountability of all entry team personnel and order the entire team to move the casualty to CRC control point for emergency decontamination, followed by team decontamination.	
d. The Backup Team should be alerted and be prepared to move to the CRC control point to provide assistance with casualty evacuation or decontamination, if needed.	
e. After decontamination, members of the Medical Treatment Team will receive and assess the casualty and the entry team members, providing any treatment required.	
f. The Exclusion Zone and CRZ should be closed until the SSO can conduct an investigation to determine the cause of the exposure(s).	
g. Once the SSO determines the cause and implements strategies to mitigate the risk of further casualties, the Exclusion Zone will be re-opened and operations can continue.	
C.3 Low SCBA Air Alarm or SCBA Equipment Failure	
a. If any entry team member has a low SCBA air alarm activate or their SCBA pack fail, they must contact the entry team leader and the ICP immediately to request a bottle or SCBA pack change.	
b. The ICP should contact the Decontamination Team to confirm receipt of the request.	
c. The team member should proceed to the CRC control point with his/her "buddy" to execute the decontamination sequence for a tank or SCBA pack change together, if they intend to return to the Exclusion Zone.	
d. Once both entry team members have completed the sequence, they should return to the Exclusion Zone, notifying the entry team leader and ICP of their return.	
C.4 Non-Emergency Equipment Failure	
a. If critical detection, sampling, or documentation equipment fails and they must be replaced during the entry to accomplish critical tasks, notify the team leader and contact the ICP to request replacements from the	

HazMat Group.	
b. The faulty equipment should be given to the technical decontamination specialist at the CRC control point by an entry team member and his/her "buddy" for processing.	
c. Once an operational replacement item has been brought to the egress control point, the Decontamination Team will pass it through the CRC to the waiting entry team members at the CRC control point.	
d. Once the replacement item has been received, the entry team members should return to their assigned tasks, notifying the entry Team Leader and ICP of their return.	
C.5 Explosives, Suspicious Devices, or Booby-traps	
a. If explosives, suspicious devices (i.e. Improvised Explosive Devices (IEDs), pipe bombs, etc.), or booby-traps are found by entry team members, they should immediately move away from the device and inform the ICP.	
b. The ICP should give the order to evacuate the Exclusion Zone and contact the EOD Team to inform them of the situation and have them assess the device.	
c. The entry Team Leader should immediately ensure full accountability of all entry team personnel and order the entire team to move to the CRC control point for team decontamination and egress.	
d. Depending upon the severity of the threat posed by the device and the time required to neutralize it, the SSO may restrict access to the Exclusion Zone or close it altogether until the EOD Team declares it safe for re-entry and continued operations.	
C.6 Civilian Casualties	
a. In the event civilian casualties are found during operations in the Exclusion Zone, the entry team will cease operations and notify the ICP immediately.	
b. The entry team personnel will assess the casualty and attempt to determine vital signs and visible symptoms, then report the casualty's location and status to the ICP.	
c. The ICP should inform the Medical Group that a civilian casualty is enroute to the Triage Team at the casualty decontamination line.	
d. The Backup Team will enter the Exclusion Zone to evacuate the casualty to the casualty decontamination line and transfer custody of the patient to the Triage Team. An EMT should be part of this Team.	
e. Once the casualty has been transferred to the Triage Team, the entry team can continue operations, while the Backup Team proceeds to the CRC control point for decontamination, unless further assistance is required.	
POST-ASSESSMENT INCIDENT COMMAND SYSTEM MANAGEMENT CYCLE:	✓
The procedures and steps outlined above are the initial response and assessment phase of a generic CWA incident from the perspective of the EPA OSC. By the time the initial assessment is completed, the framework for the basic ICS structure for Unified Command should be established. Once established, it will be time to formally begin the ICS management cycle, outlined below and discussed in detail in the corresponding sections at the end of this SOG.	
4.1 Initial Unified Command Meeting	
4.2 UC Set Incident Objectives	
4.3 Tactics Meeting	
4.4 Preparation for Planning Meeting	
4.5 Planning Meeting	
4.6 Incident Action Plan Preparation and Approval	
4.7 Operations Briefing	
4.8 Execute Plan and Assess Progress	

USEPA - Emergency Prevention, Preparedness, and Response Program
Chemical Warfare Agent (CWA) Response Standard Operating Guidance (SOG)

INTRODUCTION

Key elements in any chemical warfare agent (CWA) site investigation are site entry and egress. Safe and proper entry/egress requires a careful and coordinated team effort. The focus of this document is entry/egress procedures to and from the Exclusion Zone during CWA incidents.

The entry team must complete a reconnaissance of the site, and undertake other tasks in unfamiliar surroundings, in a variety of situations and with unknown hazards. The goal of all site personnel is to complete their work while maintaining and protecting the health and safety of themselves and other site personnel.

0.1 Purpose

The primary objective of this document is to provide operating guidelines and establish procedures for entry/egress procedures and the initial assessment process at CWA incidents. This document includes pre-planning, site safety considerations, entry/egress procedures, on-site operations guidelines, and decontamination procedures. This document is not designed to present site-specific procedures or detailed sampling and site characterization protocols, rather it describes general procedures applicable to a variety of CWA agent sites.

0.2 Scope

This standard operating guideline shall apply to the Environmental Protection Agency (EPA) Office of Emergency Prevention, Preparedness, and Response, including the Environmental Response Team (ERT), all regional Federal On-Scene Coordinators (OSCs), and all EPA response contractors. Steps and procedures outlined in this document are intended to serve as the minimum standard of acceptability. Modifications to this protocol may be directed or required due to incident conditions.

0.3 Limitations

This Standard Operating Guidance (SOG) assumes that all persons responding to the scene of a chemical agent attack on behalf of the EPA possess the requisite Occupational Safety & Health Administration (OSHA) hazardous material training required by their duty position. These individuals should be trained to achieve individual competencies in weapons of mass destruction (WMD) agent characteristics, operation of specialized detection equipment, and knowledge of hazardous waste operations. Each member of the EPA response team maintains individual certifications and qualifications for HazMat technician training (29 CFR 1910.120). The procedures outlined in this document are applicable to all personnel who participate in investigations of sites where CWA contamination is known or suspected. This document is applicable only to the conditions specified herein and does not address operations where other potential hazards may apply, e.g., flooding, elevated workspaces, and confined spaces.

0.4 References

Department of Homeland Security (DHS) - Initial National Response Plan (www.dhs.gov/interweb/inrp.pdf)

Federal Emergency Management Agency (FEMA) - Federal Response Plan (www.fema.gov/rrr/frp)

SBCCOM - Guidelines for Responding to a Chemical Weapons Incident

United States Coast Guard (USCG) - Incident Management Handbook

Center for Disease Control (CDC) - Emergency Response Guides for Chemical Warfare Agents

Agency for Toxic Substances and Disease Registry (ATSDR) - Medical Management Guidelines for Chemical Warfare Agents

EPA - Environmental Response Team Instrument QuickStart Guides

EPA - Environmental Response Team Sampling SOG

0.5 Information Resources

- U.S. Soldier and Biological Chemical Command (SBCCOM) - Edgewood Research Development and Engineering Center. Contact SBCCOM Staff Duty Officer from 0700-1630 EST at 410-671-4411 and from 1630-0700 EST at 410-278-5201.
- CDC Emergency Response Hotline. 24-hours a day at 770-488-7100.
- ATSDR Emergency Response Hotline. 24-hours a day at 404-498-0120.

PRE-ENTRY PROCEDURES

1.0 Initial Response Management

Initial response management will be conducted by first-responders, i.e. local police and fire units. These units will request additional support when they determine that the available personnel and resources are insufficient to handle the incident, or that a federal crime has been committed, as is the case in a suspected CWA incident.

Per the Initial National Response Plan, the EPA will serve as the lead federal agency for hazardous materials events, such as CWAs or biological agents. It is critical that the lead OSC establish this role, federalize the scene, and implement the Incident Command System (ICS) as quickly as possible upon arrival. It is also critical that the lead OSC complete notification procedures, to include mobilizing Superfund Technical Assessment and Response Team (START) and Emergency & Rapid Response Services (ERRS) to the scene, as required.

1.1 Initial Site Characterization and Operational Planning

During the initial moments after arriving on the scene, EPA personnel should attempt to gather as much of the information below as possible. This information will assist the lead OSC in determining what has occurred on the scene, which resources are immediately available, and to what extent ICS has been implemented. With this information, the lead OSC can begin to develop the ICS structure toward the goal of implementing Unified Command, and immediately address critical hazards, containment issues, and resource shortages that may be addressed before continuing to develop the scene. A checklist for the initial critical information requirements for a CWA response is provided on page 14.

Initial Critical Information Requirements for a CWA Response					
SITE SPECIFIC INFO	✓	**ICS INFO**	✓	**OPERATIONAL INFO**	✓
What is the incident location? (street address and longitude/latitude)		Has ICS been implemented and, if so, who is/are the incident commanders, and where is the ICP located?		Who has information about on-site organization and coordination plans, site survey plans, local emergency planning committee (LEPC) data sheets of adjacent buildings, site maps, emergency response plans, very important person (VIP) coordination, public affairs (PA) liaison, Point of Contact (POC), and current maps of the area?	
Does the incident have an operational name?		Has a list of response assets and agency (POCs) present been assembled for the IC?		What are the weather and environmental conditions on scene (such as relative humidity; wind speed and direction; status of heating, ventilation, and air conditioning [HVAC] systems; available daylight)?	
Is the incident a suspected terrorist/criminal act or perceived to be just an accident?		What are the telephone numbers and radio frequencies for the ICP and IC liaisons?		Has a decontamination line been established for responders and/or civilian casualties?	
What is/are the suspected agent(s)?		Who are the senior medical/EMS POCs, and where are they located?		What is the status of light and electricity on site (generators, extension cords, and light sets)?	
How many victims are there (if any)?		What is the status of EMS (such as paramedics on site, transport capability, triage plan, triage location, antidotes)?		What is the status of water on the site (hydrants, hoses, and drainage)?	
What are the signs and symptoms of the victims?		Who is/are the senior fire personnel on scene, and where are they located?		What is the status of public works, and who is the POC for public works?	
Have EMS units already transported the victims to hospitals?		Who is the HAZMAT team leader, and where is he located?		What is the terrain at and around the source area?	
Which hospitals were victims transported to?		Who is/are the senior law enforcement personnel on-scene, and where are they located?		What is the forecast weather for the next 12-24 hours, and are conditions expected to change?	
Have response personnel cleared the scene of secondary devices?		What is the status of law enforcement around the site, and has the site been secured?		Is the site secure and adequately marked to prevent access by bystanders?	
Has/have the source(s) been identified and secured?		Has an evidence collection plan been developed, or is it being developed?		Are there buildings or facilities near the scene that could be used to support ICS operations?	
Was there a visible cloud or plume sighted moving off-site?		Has the FBI been contacted, and if so, are they on scene, and where are they located?		Have tentative site and zone boundaries been established, and are they sufficient?	
If so, have casualties been reported downwind of the site?		Who or what authorities or response elements have been notified and/or requested (such as Center for Disease Control and Prevention [CDC], United States Public Health Service [USPHS], morgues, and health care facilities)?		How much time has elapsed since the incident took place? Is the source still emitting contaminants? If so what is the state of matter (gas, liquid, aerosol, etc)?	

In addition to gathering the above information from personnel at the scene, the lead OSC should select qualified individuals to begin expanding the ICS structure. A Site Safety Officer, Planning Section Chief, and Operations Section Chief are critical to incident management. The appointed Planning Section Chief should begin completing the ICS Form 201 (Incident Briefing) immediately, if one has not already been drafted. The appointed command and general staffs should be given delegated authority to expand the ICS structure within their sections. Also, until a complete site assessment is done, there should not be a Unified Command meeting to set objectives, since the UC may not have all critical information.

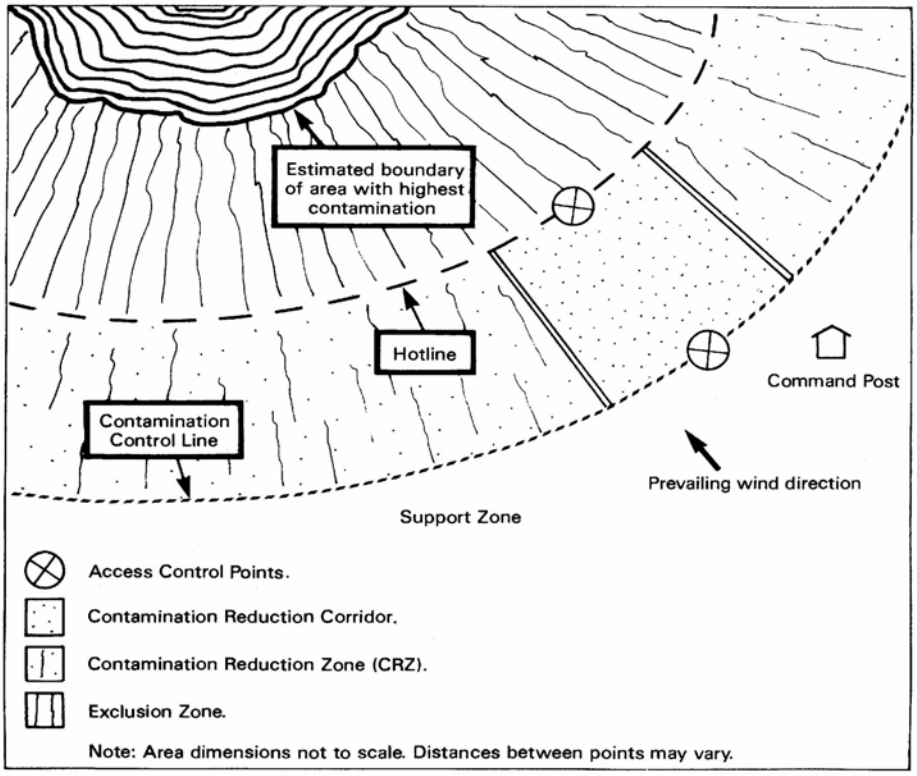
1.2 Establish Work Zones

To reduce risk to workers and the accidental spread of hazardous substances from the contaminated area to the clean area, zones shall be delineated where different types of operations will occur, and the flow of personnel among the zones will be controlled. The establishment of work zones will help ensure that: personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency. The site shall be organized into a minimum of three work zones: *Exclusion Zone*, *Contamination Reduction Zone* (CRZ), and the *Support Zone*. The Exclusion Zone is the area where contamination has occurred or could occur. The CRZ is the transition area between the contaminated area and the clean area. The Support Zone is the location of the administrative and other support functions. Movement of personnel and equipment between these zones will be minimized and restricted through *access control points*. The figure on page 16 illustrates the relationships between work zones.

Establishing the Exclusion Zone

The Exclusion Zone should be established immediately upon arriving on the scene. To adequately locate the Exclusion Zone, data should be collected about meteorology, agent physical and chemical properties (if agent is known), agent location, type of containers, and victim signs/symptoms. Access control points shall be located at the periphery of the Exclusion Zone to regulate the flow of personnel and equipment into and out of the zone and to help verify that proper procedures for entering and exiting are followed. The Exclusion Zone shall be clearly marked with lines, placards, caution tape, and/or signs; or enclosed by physical barriers such as chains, fences, ropes, or building walls. The following information is used to determine the Exclusion Zone:

A. Evaluate indicators at the incident.
   Symptoms of victims;
   Casualty patterns;
   Odor described by victims;
   Suspicious substance, solid or liquid, description provided by victim; and
   Location of the incident.



Site Work Zones (note that decontamination facilities are located in the CRZ). (Reproduced from NIOSH/OSHA/USCG/EPA, 1985, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, DHHS [NIOSH] Publication 85-115)

B. Evaluate the toxicity of the agent including rate of action and quantity.

Chemical agents;
Biological agents, if any; and
Radiological isotopes, if any.

Physical properties:
Vapor pressure;
Vapor density;
Boiling point;
Freezing point;
Specific gravity;
Water solubility; and
Persistency.

Physical state:
Gas;
Liquid;
Solid (fine particles or other); and
Color.

Chemical properties:
Rate of hydrolysis; and
Reactions with metals, corrosive or damaging.

C. Determine if agent is or was in a dissemination device and the type of device.

- **Direct deposit.** A mechanical device that contains the agent and is executed on a specific target. Direct deposit poses the least downwind hazard.
- **Breaking device.** A mechanical device that contains an agent which is released when broken. Point dissemination of agent creates moderate downwind hazard.
- **Bursting/exploding device.** A mechanical device which employs an explosion to disseminate the agent. Bursting/exploding devices pose a significant downwind hazard.
- **Aerosol device.** A mechanical device that employs a supplied pressure to release a reservoir of agent. Spraying devices can be point sources such as an aerosol sprayer or a line source. Aerosol devices pose a substantial downwind hazard.

D. Visually survey the topography.

- The contamination reduction corridor will be located upwind from the Exclusion Zone;
- The contamination reduction corridor should be located at an elevation above that of the Exclusion Zone, if possible; and
- Barriers may enhance or retard a cloud or plume and attenuate a blast.

E. Obtain and observe meteorological conditions.

- Wind speed;
- Wind direction;
- Precipitation;
- Relative humidity;
- Atmospheric stability; and
- Ambient temperature.

F. Establish emergency egress routes from the site.

<u>Establishing the Contamination Reduction Zone (CRZ)</u>

The contamination reduction zone is the transition area between the contaminated area and the clean area. This zone is designed to reduce the probability that the clean support zone will become contaminated or otherwise affected by other site hazards. The CRZ exists between the hot line and the contamination control line. Access to the CRZ from the support zone is through access control points, if feasible. A deliberate attempt should be made to minimize the size of the CRZ; however, the CRZ should allow personnel to perform effective decontamination. The degree of contamination in the CRZ decreases as one moves from the hot line to the support zone, due both to the distance and the decontamination procedures. All potentially contaminated personal protective equipment (PPE), field equipment, and samples must remain in the CRZ until adequately decontaminated. The CRZ must be designed to facilitate:

- Decontamination of equipment, personnel, and samples;

- Emergency response: transport for injured personnel, first-aid equipment, and containment equipment;
- Equipment resupply: self contained breathing apparatus (SCBA) air tank changes, PPE, sampling equipment, and tools; and
- Drainage of water and other liquids that are used during decontamination.

Personnel within the CRZ will be required to maintain internal communications, line-of-sight contact with the entry teams, and entry team monitoring, and participate in site security activities.

Establishing the Support Zone

The Support Zone shall contain administrative and support functions that need not or cannot be performed in a hazardous or potentially hazardous area. At a minimum, the support zone shall have the following services available: command post, medical station, equipment, supply center, and administrative facilities. The support zone may also provide a field laboratory. Support zone personnel are responsible for alerting the proper officials in the event of an emergency.

Command Post

- Supervision of all field operations and field teams;
- Maintenance of communications, including emergency lines of communications;
- Record-keeping, including:
- Logbooks,
- Chain-of-custody records,
- Accident reports,
- Manifest records,
- Personnel training records (as needed),
- Health Status Reports (HSR),
- Site maps,
- Site inventories, and
- SHASP;
- Provide access to up-to-date safety and health manuals and other reference material;
- Monitor work schedules and weather variations;
- Maintain site security; and
- Provide sanitation.

Medical Station

- First-aid administration;
- Medical emergency response;
- Medical monitoring activities; and
- Sanitation.

Equipment and Supply Centers

- Supply, maintenance, and repair of communications, PPE, and sampling equipment;
- Maintenance and repair of vehicles;
- Storage of monitoring equipment and supplies; and

- Replacement of expendable supplies.

Administration

- Communicate with necessary office personnel;
- Maintain emergency telephone numbers, evacuation route maps, and vehicle keys; and
- Coordinate with laboratories, transporters, and disposal and other agencies.

1.3 Organize and Prepare Assets for Initial Assessment

Once the Lead OSC / IC(s) / UC develop the situation sufficiently, response personnel should be task-organized to accomplish the initial assessment of the scene. This ensures that all critical aspects of the initial response are managed and that the Lead OSC is available to supervise the entire scene and serve a role in ICS. The Lead OSC / IC(s) / UC should then direct the Group Supervisors to execute the tasks agreed upon during the initial briefing meeting with the IC(s) / UC. A description of the ICS organization for the initial assessment is provided on page 20.

1.4 Conduct Pre-Entry Medical Screening.

The Site Safety Officer should develop the site-specific health and safety plan (SHASP) for all site personnel. This can be done from a standard boilerplate, but it must address site-specific hazards and all personnel on scene must be briefed on it during the safety meetings prior to their first entry. While the Site Safety Officer completes the SHASP, emergency medical technicians (EMTs) or trained personnel should conduct medical screening and record the vital statistics for all personnel on the entry, backup and decontamination teams. If any personnel are deemed unfit to conduct entry operations, they should be replaced by a member of the backup team or another qualified individual.

Personnel involved in Level A situations must implement pre- and post-entry medical monitoring. Monitoring procedures shall include collecting and recording baseline vitals (i.e. blood pressure, respiration rate, temperature, pulse, weight) and completing medical monitoring worksheets which will accompany teams through the pre-entry sequence. Personnel re-entering the Exclusion Zone must also undergo medical monitoring as well as fluid replenishment prior to re-entry.

Medical monitoring documentation should accompany the entry team to the entry access control point, and be given to the Site Access Control Team. Once the Site Access Control Team has reviewed the medical monitoring documentation and allowed the entry team into the Exclusion Zone, the documentation will be given to the egress control point for use in post-decontamination medical monitoring. The medical monitoring vital signs sheet is provided on page 21. The pre-entry medical monitoring worksheet is provided on pages 22 and 23.

ICS ORGANIZATION FOR THE INITIAL ASSESSMENT		
Role	**Personnel Required**	**Responsibility**
Lead OSC / Unified Command Principals	Up to 4	Manage the overall incident response, direct assets toward accomplishing shared goals of protecting lives, property and the environment.
Site Safety Officer	1	Ensures safety of all personnel on the scene, manages medical monitoring and ensures required safety measures are enforced.
Information Officer	1	Manages the Joint Information Center *(*JIC), if activated, presents media messages at media briefings, and drafts all press releases.
Operations Section Chief (OpsSC)	1	Manages the ICP and site operations, monitors entry teams, interprets field analytical results, and serves as the liaison between the UC and the entry, backup, and decon teams.
Planning Section Chief (PSC)	1	Plans upcoming operational periods, drafts the Incident Action Plan (IAP), maintains current situational awareness, requests and tracks resources to support future operations, coordinates technical specialists, and manages documentation.
Documentation Unit Leader	1	Documents all aspects of the scene, to include sample documentation, POLREPS, UC decisions and meetings, actions taken on the scene, entry/egress logs, chains of custody, IAPs, and Site Health and Safety Plans *(*SHASPs). Works for PSC.
Analytical Laboratory Coordinator	1	Coordinates with analytical laboratories for the confirmatory analyses of suspected CWA samples collected from the site.
EOD Team	2+ (even number)	Enters the Exclusion zone to locate, secure, and/or destroy unexploded munitions, IEDs, and source dispersion devices.
Evidence Collection Team	2+ (even number)	Enters the Exclusion zone to develop the situation, locate and secure possible evidence areas, and document the scene.
HazMat Entry Team	4+ (even number)	Enters the Exclusion Zone to assess physical and chemical hazards, ensure that the source material is contained to the site, and document the scene.
Backup Team	2+ (even number)	Assist or replace entry team personnel in the event of an emergency in the Exclusion Zone
Decontamination Team	5 (may be manned by first-responders)	Establish and operate the CRC for response personnel and equipment.

MEDICAL MONITORING VITAL SIGNS SHEET

Date	Time (Before) / After Entry	Name	Blood Pressure (Before) / After Entry	Pulse (Before) / After Entry	Respiration (Before) / After Entry	Temperature (Before) / After Entry	Weight (Before) / After Entry

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PRE-ENTRY MEDICAL MONITORING WORKSHEET

Date:_____ INCIDENT NAME:_____

Name:_____

Last 4 of SSN:_____

Gender: Male☐Female☐Age:_____DOB:_____

Any known allergies:_____Blood Type:_____

Category: Entry Team ☐Decontamination Team ☐Backup Team ☐

Pre - Entry Questionnaire (Check one)

(Y)(N)

☐ ☐ Major surgery in last 4 months?

☐ ☐ Headache?

☐ ☐ Diarrhea within last 24 hours?

☐ ☐ Vomiting within last 24 hours?

☐ ☐ Currently experiencing shortness of breath?

☐ ☐ Currently experiencing weakness?

☐ ☐ Prehydrated with 16 oz. of water in last 30 mins?

☐ ☐ Seizures in the past 6 months?

☐ ☐ Alcohol intake within last 6 hrs.? How much?_____

☐ ☐ Taking any medication or other drugs that may cause drowsiness?

☐ ☐ Heart attack (within last 6 months)?

☐ ☐ Chest pain? This needs to be evaluated and documented as non-cardiac.

☐ ☐ Do you feel like making this entry?

Reason (if applicable):

List current medications:

How do you feel right now?

MEDICAL EXCLUSION CRITERIA FOR ENTRY INTO THE EXCLUSION ZONE

Reactive Airway Disease (wheezing, rales, bronchi, or active upper respiratory infection)

Nausea/Vomiting/Diarrhea

Open Skin Sores (watch for shaving nicks), large rash, and significant sun burns

Altered Mental Status (slurred speech, unsteady gait, and weakness)

Blood Pressure: Systolic > 160mm Hg or Diastolic > 100mm Hg

Heart Rate: HR > 120 bpm (after 5 minutes rest)

Irregular Pulse (without previous or prior history)

Pulse > 70% of maximum heart rate (220 - age x 0.7 = Max HR)

AGE	70% of Max HR
20-25	140
26-30	136
31-35	132
36-40	128
41-45	125
46-50	122
51-55	116

Respiration > 24 breaths per minute

New prescriptions not reviewed by medical personnel must be approved prior to entry.

Oral temp > 100.5 F or are symptomatic of elevated temperature

(chills, body aches, alt. mental status)

Any alcohol intake within past 6 hours

1.5 Equipment Checks

The following equipment should be utilized by the entry team to detect and monitor for the presence of chemical warfare agents on the site:

	Physical and Chemical Properties								Chemical Warfare Agent Detection Instrumentation										
AGENT TYPE	Chemical Agent, Symbol & Chemical Structure	Odor	Vapor Density (Air = 1)	Vapor Pressure (mm Hg)	Boiling Point (°C)	Volatility (mg/m3)	Flash Point (° C)	State @ 20 °C	M8 Paper	M256 Kit	APD 2000	SAW Mini-CAD	HAPSITE	AP2C	Drager CDS Tubes	PID	Drager CMS Chips	FID	PID Lamp Use (eV)
Nerve	**Tabun (GA)**, C2H5OPO(CN)N(CH3)2	**Fruit, none if pure**	**5.63**	**0.037 @ 20 °C**	**240**	**610 @ 25 °C**	**78**	**Brown-clear liquid**	**x**	**x**	**x**	**x**	**x**	**x**		**x***		**x****	10.6
Nerve	Sarin (GB), CH3PO(F)OCH(CH3)2	**None**	**4.86**	**2.10 @ 20 °C**	**158**	**22,000 @ 25 °C**	**Non-flam.**	**Clear liquid**	**x**	**x**	**x**	**x**	**x**	**x**		**x***		**x****	10.6
Nerve	Soman (GD), CH3 PO(F)OCH(CH3)C(CH3)3	**Fruit or camphor**	**6.33**	**0.4 @ 25 °C**	**198**	**3,900 @ 25 °C**	**Non-flam.**	**Clear liquid**	**x**	**x**	**x**	**x**	**x**	**x**		**x***		**x****	10.6
Nerve	Cyclo-sarin (GF), CH3PO(F)OC6H11	**Musty, peaches**	**6.2**	**0.044 @ 20 °C**	**239**	**438 @ 20 °C**	**94**	**Clear liquid**	**x**	**x**	**x**	**x**	**x**	**x**		**x***		**x****	NA
Nerve	VX, (C2H5O)(CH3O)P(O)S(C2H4)N[C2H2(CH3)2]2	**None**	**9.2**	**0.0007 @ 20 °C**	**298**	**10.5 @ 25 °C**	**159**	**Amber-clear liquid**	**x**	**x**	**x**	**x**	**x***	**x**		**x***		**x****	10.6
**PID will detect organic and inorganic vapors with an ionization potential less than or equal to that of the PID's lamp.*																			
Blister	**Distilled Mustard (HD)**, (ClCH2CH2)2S	**Garlic**	**5.4**	**0.072 @ 20 °C**	**217**	**610 @ 20 °C**	**105**	**Yellow liquid**	**x**	**x**	**x**	**x**	**x**	**x**		**x***		**x****	10.6
Blister	Nitrogen Mustard (HN), N(CH2CH2Cl)3	**Fishy, soapy**	**7.1**	**0.0109 @ 25 °C**	**256**	**121 @ 25 °C**	**Non-flam.**	**Dark liquid**	**x**	**x**	**x**	**x**	**x**			**x***		**x****	10.6
Blister	Lewisite (L), CLCHCHAsCl2	**Geraniums**	**7.1**	**0.394 @ 20 °C**	**190**	**4,480 @ 20 °C**	**Non-flam.**	**Brown gas**	**x**	**x**			**x**			**x***		**x****	10.6
Blister	Phosgene Oxime (CX), CCl2NOH	**Sharp**	**3.9**	**13 @ 40 °C**	**54**	**1,800 @ 20 °C**	**N/A**	**Colorless solid/gas**	**x**	**x**			**x**			**x***		**x****	NA
*** FID will detect organic vapors with ionization potentials less than 15.4*																			
Blood	**Hydrogen Cyanide (AC)**, HCN	**Bitter Almonds**	**0.990 (20 °C)**	**612 @ 20 °C**	**25.7**	**1,080,000 @ 25 °C**	**Non-flam.**	**Colorless gas**		**x**					**x**		**x**		ND
Blood	Cyanogen Chloride (CK), CNCl	**Pungent, biting**	**2.1**	**1,000 @ 20 °C**	**12.8**	**2,600,000 @ 20 °C**	**Non-flam.**	**Colorless gas**		**x**					**x**				**ND**
Blood	**Arsine (SA),** AsH3	**Mild garlic**	**2.69**	**11,100 @ 20 °C**	**-62.5**	**30,900,000 @ 20 °C**	**Unk.**	**Colorless gas**							**x**				**10.6**
NA = Information Not Available, ND = Not Detectable by PID																			
Choking	**Phosgene (CG), COCl2**	**New mown hay, grass**	**3.4**	**1.173 @ 20 °C**	**7.6**	**4,300,000 @ 7.6 °C**	**Non-flam.**	**Colorless gas**							**x**				**11.7**

See CDC-NIOSH Chemical Warfare Agent Response Cards for additional information on physical and chemical properties of CWAs.

See instrument manuals for further information on detection limits, interferences, and instrument limitations.

In addition to the chemical warfare agent detection and monitoring equipment listed above, the following equipment should also be taken into the Exclusion Zone during the initial entry to determine whether any additional hazards are present and to document site conditions:

- TLD Badge or Electronic Personal Dosimeter
- Radiation Survey Meter
- PID / FID
- 4-Gas Monitor (to include O_2 and LEL sensors)
- GPS
- Site Sketch or Map With Sectors
- Radios
- Digital Camera or Video Camera

In addition to the hazard detection equipment listed above, the UC or ICP may require entry teams to collect samples for immediate evacuation and confirmatory analyses. The protocols for regional laboratories should dictate the selection of sample containers, but a minimal sample collection kit for an initial assessment entry should contain the following equipment:

- 2-oz Glass Sample Jars with Labels Affixed
- Pipettes
- Spoons
- Re-sealable Plastic Bags
- Custody Seals
- Sharpies

1.6 Donning Personal Protective Equipment

The only PPE authorized for an unknown agent is LEVEL-A. Until an analytical laboratory can independently verify the chemical warfare agent used on the scene, no PPE downgrades are permitted. Generally, hazardous routes of exposure for nerve and blister agents can include inhalation, dermal, and ocular, which requires full encapsulation and supplied air. Blood agents and choking agents are generally considered extremely hazardous via inhalation, but exposure to these agents may require only respiratory protection. Any requests to modify PPE on any area of the site must be approved by the SSO.

1.7 Entry Clearance

In order to prevent conflicts and maintain control of the access points into the Exclusion Zone, the entry team must request clearance to enter at the entry access control point. While this is done, the entry team leader should confirm the details of the assigned tasks with the ICP to ensure that his plan meets the intent of the UC. The Site Access Control Team will record the names of the personnel, their assigned equipment, and the time the entry team goes “on-air” on the Site Entry/Egress Log (page 26). Final approval for entry will be given by the ICP once the decontamination team has reported that the CRC is established and ready for customers. Once the entry team

enters the Exclusion Zone, their entry/egress log and medical monitoring documents will be given to the egress control point to await the team's return.

SITE ENTRY/EGRESS LOG **ENTRY TEAM: _____**				**Time**	
Name	**Agency**	**Assigned Equipment**	**Work Zone**	**In**	**Out**

Chain-of-Command

Team Leader:_____

Site Safety Officer: _____

Decontamination Team Leader: _____

INITIAL ASSESSMENT PROCEDURES

2.1 EOD Team

In addition to hazards associated with hazardous materials incidents, CWA terrorism incidents may include secondary devices designed to maim or kill emergency response personnel. In a potential CWA terrorism incident, always consider that a secondary device is present. In order to determine the presence of secondary devices, it is necessary to involve properly trained EOD or similarly trained personnel capable of identifying and securing these devices, as well as undetonated CWA sources. EOD teams, such as police bomb squads, are prevalent in most major metropolitan areas, but it is imperative that their skill and experience level be established prior to allowing teams to support the incident.

When the EOD team is operating inside the Exclusion Zone, it is critical for the ICP to monitor all actions taken by the team, especially when explosives are encountered. The ICP may need to order the evacuation of surrounding areas and the support zone, depending upon what types of devices are encountered. Until the EOD team has declared the site secure, no other assets should be allowed into the Exclusion Zone, unless, as may be the case with Evidence Collection Teams, agency-specific training or protocols permit it. This does not preclude the HazMat Entry Team from confirming that the perimeter is secure.

2.2 Evidence Collection Team

The use or release of CWAs is considered a federal crime, thus the entire incident site is a potential crime scene that falls under the authority of the FBI. As such, all potential evidence found on the site must be preserved for collection by FBI and law enforcement crime scene investigators. The role of the evidence collection team in the initial assessment of a site is to isolate areas of the scene where there may be potential evidence. The quicker the Evidence Collection Team can secure evidence areas, the faster the HazMat Entry Team can complete hazard assessment. The Evidence Collection Team can return to secured areas to begin collecting evidence with crime scene investigators only when all areas of the Exclusion Zone have been searched and potential evidence areas have been secured.

2.3 HazMat Entry Group

Air monitoring with detection equipment should be conducted downwind of the suspected source area to ensure that no contamination is migrating off the site. If contaminants are migrating outside of the established Exclusion Zone, the IC must be notified and the boundaries must be adjusted immediately. A detection should be considered anything above twice background on the most sensitive instrument. Once the perimeter has been confirmed free of contamination, the entry team can proceed on their reconnaissance of the cleared sectors of the

Exclusion Zone. Particular care must be taken when the detectors used are not sensitive enough to see the CWAs of interest at a detection limit that would provide an acceptable risk.

Prior to entry, the team should develop survey and sampling plans using information from ICP intelligence and the initial reconnaissance done by first-responders and the EOD Team. They should use the reconnaissance techniques of search, survey, and/or sampling. Initially, search techniques are used to find the contamination. Once the contamination is detected and identified, a survey of the area can be performed to determine the size and extent of the contamination. Sampling is conducted after the search or survey is completed and only if samples of the contamination are required by the ICP. Sampling is required when the agent identity cannot be determined or confirmed, biological agents are suspected, or proof of use is needed.

Direct-reading instruments, chemical detector chips and tubes, and air monitors should be used to determine whether chemical agent vapors are present anywhere on the site. Readings above background on these instruments should be reported to the operations manager and recorded in conjunction with a GPS location to provide a detailed map of the extent of contamination on the site.

The collection of air, vapor, liquid, soil, and other solid samples is an integral part of initial and presumptive identification of known and/or unknown agents. During reconnaissance and sample collection operations, the entry team establishes the required protective procedures to fit the situation. Entry teams should expected to be able to collect samples under varying circumstances while maintaining a chain of custody, understanding that all CWA samples will be turned in to the laboratory for use in the identification process.

Control or background samples should be collected from clean areas upwind and/or near the incident site as baseline data. The control samples must be identical to the samples collected from the contaminated areas (such as liquid, soil, vegetation). The contaminated samples are compared to the baseline data (control samples). This is especially true if unknown or non-standard chemical warfare agents are employed. Control samples generally are the same as those collected in an alleged attack area. The size of an environmental control sample should be about the same as the suspected contaminated sample collected from the attack area. The EPA uses the control samples to compare with a similar contaminated item during the analysis process.

During the initial entry, the entry team will be required to document all aspects of the site, including photographs, GPS locations for critical features, detector readings and screening test results for later analysis in the support zone. Emphasis should be placed on gathering as much information about the site as possible during the initial reconnaissance efforts so that the OSC and IC can decide how to proceed in developing the site. It is critical that the entry team maintain radio contact with the ICP to relay time-critical information.

Prior to site entry, documentation shall be completed to address the legal, health, and safety issues of the team. The TL and SSO will be responsible for maintaining all records, logs, and reports required for, or generated by, on-site activities. The following records will be recorded in the field activity logbook:

- All information and data from monitoring devices and instruments;

- Weather conditions, progress of each activity, field data from each sample collected, tracking numbers, and other pertinent information; and
- All personnel, safety activities, site entries, PPE usage, decontamination procedures, and deviations from the original safety plan.
- Entry team observations are to be recorded in the field logbook, and should include observed hazards, identified container labels, container condition, instrument readings, and apparent spilled agent areas. Under certain conditions, entry team personnel may take notes in a logbook kept inside their suit, or personnel may take notes using a laminated logbook and permanent marker suitable to maintain integrity during decontamination activities.

All relevant field activities should be photographed to confirm the presence or absence of contaminants and for evidence. All information concerning each photograph must be recorded in the field activity logbook. Digital cameras are permissible for legal documentation of the site and they may also be a useful tool in transmitting electronic photographs off site.

2.4 Medical Group

The role of the medical group during the response and the initial assessment that follows is constant, to provide medical support and treatment to incident victims and casualties. The medical group will consist of local fire and EMS teams initially, and it will grow as regional medical support arrives to assist, if victims exceed the local medical capacity. Due to the possibility that local medical capacity may be overwhelmed during the initial response, the Triage Teams will perform the critical function of determining which victims should receive care with the limited available resources.

Due to its critical role in the incident response, the ICS structure will evolve around the medical group as it functions. Ensure that the lines of communication are established between the ICP and the medical group supervisor early in the initial response to facilitate more responsive support with medical needs.

2.5 Unified Command / Incident Command Post

The ICP will be the information and activity hub at the incident. It is critical to establish an organized information and resource tracking system early on in the incident. Since police and fire are well versed in managing scenes and conducting ICP operations, it may be advantageous to utilize their incident management tools during the initial assessment until a more permanent ICP can be established and organized. This is also beneficial when establishing the Unified Command, as response agencies can quickly begin to work together to develop incident objectives, strategies, and tactics.

Delegation to the Planning Section Chief and Operations Section Chief during the initial stages of the response are critical to getting ahead of the incident. As the command and general staff grow the organization to manage the incident, it is critical to maintain visibility on the structure of the ICS and the locations of critical assets

and incident area. The Situation Unit and Resource Unit should be an integral part of the ICP to ensure the greatest situational awareness by commanders and staff.

EGRESS PROCEDURES

The entry team leader advises the ICP that they are departing the incident site, or the ICP orders the entry team to depart the incident site. After concluding all testing/sampling operations, the entry team will collect equipment and samples for removal from the Exclusion Zone and will report items that were not removed. They will generally depart the incident site via the same route used to enter the site. Entry and decontamination teams will link up at the CRC control point (informing the ICP, if necessary) and receive instructions on the decontamination procedures at the incident site. The priority for decontamination goes to downed/injured/distressed team members, personnel lowest on air, remaining entry personnel, samples, video records, evidence, and equipment.

Egress from the Exclusion Zone must be pre-planned and carried out as such. No team member may exit alone, and no team member may remain alone in the Exclusion Zone or CRZ. When using SCBA, egress procedures must provide for adequate time in the CRZ.

If gamma radiation is detected above 2mR/hr, immediate exit from the Exclusion Zone shall be initiated until the situation can be assessed further by the ICP and SSO. The entry team will immediately withdraw and the SSO will be informed of the conditions. The SHASP will be modified before re-entry is permitted.

3.1 Sample Transfer Procedures

Samples, consisting of labeled sample jars inside a re-sealable plastic bag, should be given to the technical decontamination specialist at the decon line for external decontamination and packaging in a clean external container with the chains of custody. These samples should follow the entry team through the decontamination line and the sampler should maintain visual contact with them during decontamination. Once personnel and technical decontamination is complete, the samples should be returned to the sampler for chain of custody documentation and transfer to the Analytical Laboratory Coordinator, who will select an appropriate laboratory for the analyses to be performed, and send the samples to the lab.

The Analytical Laboratory Coordinator should also develop a complete record for each sample using Forms II Lite or SCRIBE. The completed record can be made available to the requesting agencies receiving and analyzing the sample(s). Critical information includes—

- **Circumstances of acquisition.** Describe how the sample was obtained. Note where it was found, what time it was obtained, and who collected the sample.
- **Physical description.** List the physical state (solid, liquid, powder, apparent viscosity), color, approximate size, and identity (such as military nomenclature) of the specimen, dirt, leaves, and so forth.

- **Circumstances of agent deposition.** If known, note the type of delivery system; describe how the weapon functioned; how the agent acted on release; sounds heard during dissemination; any craters or shrapnel found associated with a burst; and colors of smoke, flames, or mist that may be associated with the attack.
- **Agent effects on vegetation.** Describe the general area (urban, jungle, mountain, grassland) and changes in the vegetation after agent deposition (color change, wilting, drying, dead) in the main attack and fringe areas.
- **Agent effects on humans.** Describe how the agent affected personnel in the main attack area versus fringe areas. Note the duration of agent effects, peculiar odors that may have been noticed in the area prior to, during, and/or after an attack; measures taken that alleviated or deteriorated the effects; and the approximate number of victims and survivors, to include their age and gender.
- **Agent effects on animals.** Note the types of animals that were or were not affected by an attack and a description of how they were affected.

3.2 Personnel Decontamination

Decontamination is defined as the removal of hazardous materials from personnel and their equipment to the extent necessary to prevent foreseeable adverse health effects. A decontamination plan shall be developed and set up before Exclusion Zone entries. The decontamination plan shall be included in the health and safety plan. The decontamination plan should establish the following:

- Number and layout of decontamination stations;
- Decontamination equipment needed;
- Appropriate decontamination methods;
- Methods and procedures to minimize worker contact with contaminants during removal of PPE and equipment; and
- Methods for disposing of PPE and equipment that is not completely decontaminated.

The plan should be revised whenever the type of PPE or equipment changes, the site conditions change, or the site hazards are reassessed based on new information.

<u>Decontamination Procedures</u>

Before any personnel enter an area where contamination of their PPE or equipment may occur, an adequate decontamination method will be identified and implemented per the SHASP. Decontamination methods will conform to the EPA Standard Operating Safety Guides and other applicable guidance. Disposable PPE will be used whenever possible. All personnel leaving a potentially contaminated area will be decontaminated.

Monitoring equipment used in the contamination reduction corridor (CRC) should be protected from contamination. If practical, protect monitoring and sampling instruments by bagging. Make openings in the bags for sample ports and sensors that may contact site materials.

Location of the Contamination Reduction Corridor (CRC)

The CRC is established upwind of the incident location, within plus or minus 20 degree wind direction. The CRC will be set up in a manner that will minimize contamination of the ground surface. Plastic sheeting will be used, and the sides and ends should be diked to a level that will retain the decontamination fluids. The boundaries of the CRC should be clearly marked using rope, tape, or flags.

Specifications of the CRC

Each CRC shall be designed taking the following into account:

- Physical site characteristics (e.g., trees, buildings, topography);
- Associated hazards;
- Number of personnel entering the Exclusion Zone;
- Weather conditions;
- Number of CRC personnel needed; and
- The amount of incident-derived waste (IDW) that may be produced.

CRC Design/Layout

The CRC will be designed so that personnel proceed through all stations in a deliberate and methodical manner. Stations should be separated physically to prevent cross-contamination and should be arranged in order of decreasing contamination, preferably in a straight line. Signs with arrows, ropes, and/or markers delineating the proper avenue for decontamination procedures will be visible to personnel. The entry point of the CRC from the hot line should be well-defined and easily identified.

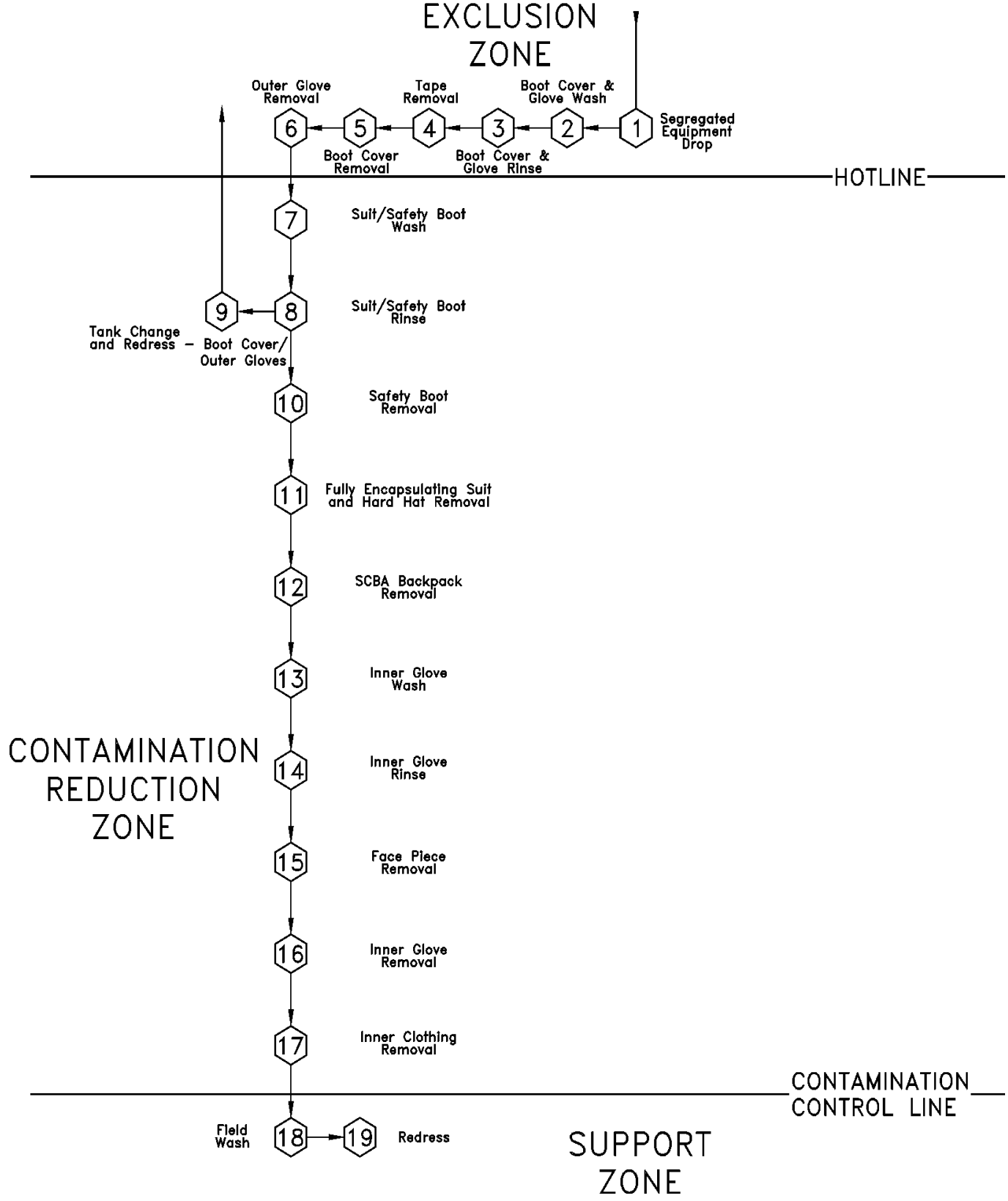
CRC Personnel

Personnel working in the CRC will be required to be dressed in the same PPE level or one level below the level worn by the personnel being decontaminated as deemed appropriate by the SSO. However, upon the removal of the SCBA/air purifying respirator (APR), the CRC personnel may be dressed in Level C or D, depending on the hazards.

An adequate number of CRC personnel should be available and familiar with their assigned tasks. The number of attendants on the CRC depends on the experience of the entry personnel with the decontamination procedure, the required throughout of the CRC, and the availability of site personnel.

The illustration on page 33 describes the CRC for Level A PPE. The recommended minimum number of attendants for the CRC on page 33 is 5, however additional personnel will provide greater decontamination efficiency and overall site safety. A description for each CRC station is provided on page 34. Equipment requirements are provided on page 35.

MAXIMUM DECONTAMINATION LAYOUT
LEVEL A PROTECTION



Level A - Contamination Reduction Corridor Stations

The CRC should consist of up to 19 stations through which personnel egress from the Exclusion Zone (see figure on page 33). Depending on the hazards, the following steps to the basic CRC layout may be deleted or expanded as necessary per SSO approval.

1. **Segregated Equipment/Sample Drop.** The equipment drop is situated on the Exclusion Zone side of the hot line. Deposit equipment and samples into separate containers with plastic liners. Chain-of-custody of collected samples will be maintained either by visual or possession methods.
2. **Boot Cover and Glove Wash.** Scrub outer boot covers and gloves with decontamination solutions.
3. **Boot Cover and Glove Rinse.** Rinse decontamination solutions from Station 2 using copious amounts of water.
4. **Tape Removal.** Remove tape from boots and gloves and deposit in container with plastic liner.
5. **Boot Cover Removal.** Remove boot covers and deposit in container with plastic liner.
6. **Outer Glove Removal.** Remove outer gloves and deposit in container with plastic liner.
7. **Suit and Boot Wash.** Wash encapsulating suit and boots using brushes and decontamination solutions. Repeat as many times as necessary.
8. **Suit and Boot Rinse.** Rinse decontamination solutions using copious amounts of water. Repeat as many times as necessary.
9. **Tank Change.** If an SCBA air tank change is desired, this is the last step in the decontamination procedure. Air tank is exchanged, new outer gloves and boot covers donned, and joints taped. Personnel return to duty in Exclusion Zone.
10. **Safety Boot Removal.** Remove safety boots and deposit in container with plastic liner.
11. **Fully Encapsulating Suit and Hard Hat Removal.** Fully encapsulating suit is removed with assistance of a helper and laid out on plastic sheeting or deposited in a container with a plastic liner. Hard hat is removed.
12. **SCBA Removal.** While wearing face piece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.
13. **Inner Glove Wash.** Wash with decontamination solution.
14. **Inner Glove Rinse.** Rinse with water. Repeat as many times as necessary.
15. **Face Piece Removal.** Remove face piece. Deposit into container with plastic liner. Avoid touching face with gloved hands.
16. **Inner Glove Removal.** Remove inner gloves and deposit in container with plastic liner.
17. **Inner Clothing Removal.** Remove clothing and place in container with plastic liner. Do not wear inner clothing off site.
18. **Field Wash.** Shower if highly toxic agent is suspected, or if skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
19. **Re-dress.** Put on clean clothing.

Equipment Requirements

EQUIPMENT REQUIRED FOR LEVEL-A DECONTAMINATION MEASURES			
Station 1:	Various Size Containers Plastic Liners Plastic Drop Cloths	Station 10:	Containers (20-30 Gallons) Plastic Liners Bench or Stools Boot Jack
Station 2:	Containers (20-30 Gallons) Decontamination Solution or Detergent Water 2-3 Long-Handled, Soft Bristled Scrub Brushes	Station 11:	Rack Drop Cloths Bench or Stools
Station 3:	Containers (20-30 Gallons) OR High-Pressure Spray Unit Water 2-3 Long-Handled, Soft Bristled Scrub B	Station 12:	Table
Station 4:	Containers (20-30 Gallons) Plastic Liners	Station 13:	Basin or Bucket Decontamination Solution Small Table
Station 5:	Containers (20-30 Gallons) Plastic Liners Bench or Stools	Station 14:	Water Basin or Bucket Small Table
Station 6:	Containers (20-30 Gallons) Plastic Liners	Station 15:	Containers (20-30 Gallons) Plastic Liners
Station 7:	Containers (20-30 Gallons) Decontamination Solution or Detergent Water 2-3 Long-Handled, Soft-Bristled Scrub Brushes	Station 16:	Containers (20-30 Gallons) Plastic Liners
Station 8:	Containers (20-30 Gallons) OR High-Pressure Spray Unit Water 2-3 Long-Handled, Soft Bristled Scrub Brushes	Station 17:	Containers (20-30 Gallons) Plastic Liners
Station 9:	Air Tanks or Face Masks and Cartridge Depending on Level Tape Boot Covers Gloves	Station 18:	Water Soap Small Table Basin or Bucket Field Showers Towels
		Station 19:	Dressing Trailer is Needed in Inclement Weather Tables Chairs Lockers Cloths

Source: EPA Office of Emergency and Remedial Response, Hazardous Support Division, *Field SOP for the Decontamination of Response Personnel.*

Decontamination Solutions

Proper decontamination solutions must be used to ensure that all contamination has been removed from personnel, sample containers, and equipment used on site. Suggested decontamination solutions are provided on page 36. The initial background study and site entry survey should provide information on selection of proper solutions. All decontamination solutions must be properly labeled and identifiable. Decontamination solutions shall be prepared daily or more frequently, as deemed necessary through monitoring.

Decontamination Solutions For Responders					
Agent	**Symbol**	**Decontamination Solution**	**Methods**	**Preparation**	**Cautions**
Chemical Unknown	? 	Soap and water, followed by a bleach solution		1.Wash with soap and water. 2.Wash with a 1:10 dilution of household bleach (1 part bleach, 9 parts water) (0.5% hypochlorite). 3.Rinse with water.	Use: For skin. Undiluted bleach: harmful to skin and clothing. Remove from skin and clothing by flushing with water. Keep out of victim's eyes and mouth, do not use if victims have any abdominal wounds. Corrosive to metals. Use: 5% hypochlorite (undiluted household bleach) for equipment, PPE.
NERVE Tabun Sarin Soman V Agent	 GA GB GD VX	Soap and water, followed by a bleach solution Soap and Water Only	Removes and Neutralizes Physical Removal	1.Wash with soap and water. 2.Wash with a 1:10 dilution of household bleach (1 part bleach, 9 parts water) (0.5% hypochlorite). 3.Rinse with water. 1.Wash with soap and water. 2.Flush with water.	 Using bleach solutions on V-agents may cause emission of toxic vapors and the formation of toxic byproducts in solution.
BLISTER Mustard Distilled Mustard Lewisite Phosgene Oxime	 H HD L CX	Bleach or Soap and Water	Physical Removal	1.Wash with soap and water. 2.Wash with a 1:10 dilution of household bleach (1 part bleach, 9 parts water) (0.5% hypochlorite). 3.Rinse with water.	Use: For skin. Undiluted bleach: harmful to skin and clothing. Remove from skin and clothing by flushing with water. Keep out of victim's eyes and mouth, do not use if victims have any exposed wounds. Corrosive to metals. Use: 5% hypochlorite (undiluted household bleach) for equipment, PPE. Soap and detergents may decrease the hydrolyzation rate of these agents.
BLOOD Cyanogen Chloride Hydrogen Cyanide	 CK AC	Water	Removes	Flush with copious amounts of water.	Effective in physically removing the agent, but may not neutralize the agent.
CHOKING Chlorine Phosgene	 CL CG	Water	Removes	Flush with copious amounts of water.	Effective in physically removing the agent, but may not neutralize the agent.

Emergency Gross Decontamination

In life-saving situations, the CRC will also be utilized for performing emergency gross decontamination. At this time, routine operations of the CRC will cease and the focus will be on the emergency situation. Emergency gross decontamination is defined as the immediate removal of large amounts of contamination to a level that should not contaminate the victim or personnel performing emergency rescue. Personnel performing emergency gross decontamination will be dressed in PPE that is at the same level or one step lower than that of the victim. Note that in the event of injuries, only water will be used for decontamination.

CRC Disassembly

The disassembly of the CRC shall be accomplished with a minimal amount of contact to personnel. Possible upgrading of PPE should be evaluated depending on hazards. All non-expendable equipment used within the CRC must be decontaminated and moved to the support zone. All expendable items and decontamination solutions shall be rendered non-usable and double-bagged and/or drummed according to the incident-derived waste (IDW) protocol. These items may also be considered as crime scene evidence. The CRC area should be inspected to ensure all materials have been collected prior to demobilization.

CRC personnel will perform self-decontamination procedures in accordance with the decontamination plan prior to egress from the CRC area.

Management of Hazardous Incident-Derived Waste (IDW)

The minimum requirements during management are:

- Liquid and soil/sediment IDW must be containerized and analyzed before disposal; and
- The collection, handling, and proposed disposal method must be specified in the approved site safety plan.

Disposal of hazardous or suspected hazardous IDW must be specified in the approved site safety plan. Hazardous IDW must be disposed as specified in EPA regulations. If appropriate, these wastes may be placed back in an active waste treatment facility. These wastes may also be disposed of in the source area from which they originated, if doing so does not endanger human health and the environment.

If on-site disposal is not feasible, and if the wastes are suspected to be hazardous, appropriate tests must be conducted to make that determination. If the wastes are determined to be hazardous, they must be properly contained and labeled. They may be stored on the site for a maximum of 90 days before they must be manifested and shipped to a permitted treatment or disposal facility. Generation of hazardous IDW must be anticipated, if possible, to permit arrangements for proper containerization, labeling, transportation, and disposal/treatment in accordance with EPA regulations.

The generation of hazardous IDW should be minimized to conserve resources. Care should be taken to keep non-hazardous materials segregated from hazardous waste-contaminated materials. The volume of spent solvents

produced during equipment decontamination should be controlled by applying only the minimum amount of solvent necessary, and capturing it separately from the wastewater. The table describing the IDW protocol is provided below.

DISPOSAL OF INVESTIGATION-DERIVED WASTE		
TYPE	**HAZARDOUS**	**NON-HAZARDOUS**
PPE-Disposable*	Containerize in plastic 5-gallon bucket with tight-fitting lid. Identify and leave on site with permission of site operator, preferably in writing.	Double bag waste. Place in dumpster with permission of site operator, preferably in writing.
PPE-Reusable	Perform technical decontamination, if possible. If the equipment cannot be decontaminated, containerize in plastic 5-gallon bucket with tight-fitting lid. Identify and leave on site with permission of PM.	Perform technical decontamination.
Spent Solvents	Containerize in original containers. Clearly identify contents. Leave on site with permission of PM.	N/A
Decontamination Water	Containerize in 55-gallon drum with tight-fitting lid. Identify and leave on site with permission of site operator, otherwise arrange with PM for testing and disposal.	Containerize in 55-gallon drum with tight-fitting lid. Identify and leave on site with permission of site operator, otherwise arrange with PM for testing and disposal.
Disposable Equipment	Containerize in 55-gallon drum or 5-gallon plastic bucket with tight-fitting lid. Identify and leave on site with permission of site operator, otherwise arrange with PM for testing and disposal.	Containerize in 55-gallon drum or 5-gallon plastic bucket with tight-fitting lid. Identify and leave on site with permission of site operator, otherwise arrange with PM for testing and disposal.
Trash	N/A	Double bag waste. Place in dumpster with permission of site operator, preferably in writing.

Source: *USEPA Management of Investigation-Derived Wastes During Site Inspections.*
*All PPE shall be rendered non-usable by cutting or tearing prior to disposal.

3.3 Technical Decontamination

This procedure is designed for the external decontamination of samples, detection equipment, and reusable PPE coming out of the Exclusion Zone with the entry team. The process begins when equipment is left at the Segregated Equipment Drop by the entry team as they leave the Exclusion Zone, or when the PPE is removed during personnel decontamination. A member of the decontamination team will then externally decontaminate the item by scrubbing it off or immersing it in a warm soapy water solution, followed by a 0.5 - 5.0% bleach solution. The item will then be passed along the line to the next attendant who will rinse the decontaminant off of the sample with clean water and then place on a table to air-dry, or in the case of samples, place the sealed container into another re-sealable plastic bag for transfer to the sampler waiting for it at the egress control point. Equipment and PPE should be monitored to assess the efficiency of decontamination and if any chemicals are detected, the equipment should be decontaminated again. Once equipment is “clean” it can be picked up by the entry team personnel or transferred to the Site Access Control Team at the egress control point to allow entry personnel who have completed the egress procedures to retrieve their equipment once it has been decontaminated.

3.4 Egress Control Point

At the egress control point, members of the Site Access Control Team will use the medical monitoring, equipment, and personnel documentation provided at the entry access control point to ensure accountability of all entry personnel, their equipment, and any samples that must be in custody of waiting samplers before continuing to the post-decontamination medical monitoring station. When all equipment and entry team personnel have processed through the egress control point, the Site Access Control Team will provide the entry team leader with the team's medical monitoring documentation from prior to entry to take with him to post-decontamination monitoring.

3.5 Post-Decontamination Medical Monitoring

Medical monitoring is required for all personnel exiting the Exclusion Zone. The EMTs should record vitals and compare these statistics to those from prior to the entry. Any personnel with anomalies should be assessed, required to hydrate, and held for observation until their vitals improve or until required medical attention is given. After vitals have been taken, each entry team member must submit to a thorough post-entry health assessment, to include the questionnaire below:

Post - Entry Questionnaire (Check one)

(Y)(N)

☐ ☐ During the entry or decontamination process were you concerned about possible exposure?

☐ ☐ Do you feel well, i.e. any nausea, headache, areas of localized pain, or loss of sensation?

☐ ☐ Is your vision blurry or dark, i.e. any tearing, dilated pupils, red, or bloodshot in appearance?

☐ ☐ Are you breathing okay, i.e. any coughing, chest irritation, shallow breathing, or gurgling?

☐ ☐ Do you feel weak or shaky, i.e. any mild tremors, random twitching, drooling, or paralysis?

☐ ☐ Does your skin appear normal, i.e. any redness, itchiness, discoloration, or blistering?

☐ ☐ Are you perspiring normally, i.e. any signs of dehydration or heat stroke?

☐ ☐ Are your vitals comparable to those prior to entry, i.e. elevated pulse, temperature or BP?

Reason (if applicable):

How do you feel right now?

Affirmative responses to any of these questions may indicate an exposure to toxic chemicals and entry personnel should be transferred into the care of the Treatment Team for further assessment and required treatment.

3.6 Debriefing

Once personnel have completed their post-decontamination medical monitoring, the entry team leaders should collect information and documentation about the scene from their teams as quickly as possible. The team leader must then organize the information and be prepared to rapidly discuss the critical points with the Unified Commanders or the command staff in a 5-10 minute debriefing session. If entry teams conducted split operations on the site and it is not possible for the entry team leader to brief the entire scope of work accomplished during the entry, another member of the team may be asked to assist with the debriefing. Once the information is sufficiently organized, the team leader and any team members should proceed to the debriefing area or command post to discuss their findings with the Unified Commanders, Lead OSC, or the Operations Section Chief. The reconnaissance information gathered by the three entry teams during the initial assessment will be critical to setting objectives, developing strategies, and managing the overall incident. The information derived from the debriefing should be used by the command staff and distributed throughout the ICS structure to ensure that all response personnel have the updated situational derived by the entry team.

Important points about debriefings:

- The number of personnel involved in the debriefing should be kept to a minimum to prevent wasting valuable time in group discussions.
- The debriefing is not an after-action review or a critique of the tactics employed by the entry teams, it is designed to quickly relay critical information to the UC and the command staff for use in the management of the incident.
- Time is of the essence - team leaders must organize the information prior to debriefing.
- Pictures speak louder than words - make video or photo documentation available to the entire debriefing audience.

POST-ASSESSMENT INCIDENT MANAGEMENT CYCLE

4.1 Initial Unified Command (UC) Meeting

This meeting can occur prior to the completion of the initial assessment work performed by the entry teams. It is designed to be the first face-to-face meeting of the Incident Commanders that will comprise the Unified Command. It provides UC officials with an opportunity to discuss and concur on important issues prior to joint incident action planning. The meeting should be brief and important points must be documented. Prior to the meeting, the parties should have an opportunity to review and prepare to address the agenda items. Planning meeting participants will use the results of this meeting to guide the operational efforts prior to the first tactics meeting.

The agenda for the Initial UC Meeting should include:

- Identifying the UC, based on ICS criteria
- Identify jurisdictional priorities and objectives
- Present jurisdictional limitations, concerns, and restrictions
- Develop a collective set of incident objectives
- Establish and agree on acceptable priorities
- Agree on basic organizational structure
- Designate the best-qualified and acceptable Operations Section Chief
- Agree on General Staff personnel designations and planning, logistical, and financial agreements and procedures
- Agree on resource ordering procedures
- Agree on cost-sharing procedures
- Agree on informational matters
- Designate a Unified Command Information Officer

4.2 UC Sets Incident Objectives

Based upon the information gathered in the initial assessment, the UC, the command staff, and the general staff will identify, review, and prioritize objectives for the next operational period on the ICS Form 202 (Incident Objectives). Objectives from the initial assessment or the previous operational period are reviewed and any new objectives are identified. If the Initial UC Meeting was successful, this step should be easy to complete.

The critical components of this step in the management cycle include:

- Identify/review objectives for the next operational period (clearly stated and attainable with the available resources, yet flexible enough to allow members to choose tactics).
- Review any open agenda items from the Initial UC Meeting or previous meetings.

4.3 Tactics Meeting

This 30-minute meeting creates the blueprint for tactical deployment during the next operational period. In preparation for the Tactics Meeting, the PSC and OpsSC review the initial assessment status or the current Incident Action Plan (IAP), as provided by the Situation Unit, to assess work progress against IAP objectives. The OpsSC/PSC will jointly develop primary and alternate strategies to meet objectives for consideration at the next Planning Meeting. In addition a draft ICS Form 215 (Operations Planning Worksheet) should be used to identify resources that should be ordered through Logistics.

4.4 Preparations for Planning Meeting

During this phase, the section chiefs and their associated staff members begin the work of preparing for the upcoming Planning Meeting. Each section chief is responsible for ensuring that his/her Planning Meeting responsibilities are met. The PSC should facilitate this to the greatest extent possible to ensure that the material, information, resources, etc. to be used or discussed in the Planning Meeting is organized and prepared. There is no

time for surprises in the Planning Meeting.

4.5 Planning Meeting

This 45-minute meeting (depending on incident complexity) with UC, command and general staffs, the resource unit leader, SSO, and technical specialists, defines incident objectives, strategies, and tactics, and identifies resource needs for the next operational period. This meeting fine tunes objectives and priorities, identifies and solves problems, and defines work assignments and responsibilities on a completed ICS Form 215 (Operations Planning Worksheet). Displays in the meeting room should include ICS Form 202 for the next operational period, large sketch maps or charts clearly marked with the date-time group, a poster sized ICS Form 215, a current resource inventory prepared by the Resource Unit, and current situation status displays prepared by the Situation Unit.

The agenda for the Planning Meeting and the organization briefing the item is as follows:

- State incident objectives and policy issues. - Unified Command
- Briefing of situation, critical and sensitive area, weather forecast and resource status/availability. - Situation Unit Leader
- State primary and alternate strategies to meet objectives. – OpsSC
- Designate Group boundaries and functions, as appropriate, using maps and ICS Form 215 (Operations Planning Worksheet). – OpsSC
- Specify tactics for each Group, noting limitations. – OpsSC
- Specify resources needed by each Group. – OpsSC
- Specify operations facilities and reporting locations, using plotted map points. – OpsSC
- Develop resources, support, and overhead orders. - Logistics Section Chief (LogSC)
- Consider support: communications, traffic, safety, medical, etc. – LogSC
- Contributing organization/agency considerations regarding work plan. - Liaison Officer
- Safety considerations regarding work plan. – SSO
- Report on expenditures and claims. - Finance/Admin Section Chief (F/ASC)
- Finalize and approve work plan for the next operational period. - Unified Command
- Specify IAP component deadline for inclusion in the IAP. - PSC

After the meeting, ICS Form 215 is used by the LogSC to prepare the off-incident tactical and logistical resource orders, and used by the PSC to develop IAP assignment lists.

4.6 Incident Action Plan Preparation and UC Approval

Attendees of the Planning Meeting immediately prepare their assignments for the IAP to meet the PSC deadline for assembling the IAP components. The deadline will be early enough to permit timely UC approval and duplication of sufficient copies for the Operations Briefing and for overhead.

Common components of the IAP and the organizations responsible for submission are:

1. Incident Objectives (ICS Form 202) - Resources Unit
2. Organization List / Chart (ICS Form 203/207) - Resources Unit

3. Assignment List (ICS Form 204) - Resource Unit
4. Communications Plan (ICS Form 205) - Communications Unit
5. Medical Plan (ICS Form 206) - Medical Unit
6. Incident Map - Situation Unit
7. Safety Plan – SSO
8. Decontamination Plan - Decontamination Unit
9. Waste Management or Disposal Plan - Technical Specialist / Decontamination Unit

4.7 Operations Briefing

This 30-minute (or less) meeting, which should occur about an hour prior to each shift change, represents the IAP to the oncoming shift of the response organization. After this meeting, off-going supervisors should be interviewed by their relief and by OpsSC in order to further confirm or adjust the course of the oncoming shift's IAP. Shifts in tactics may be made by the Group supervisor in whose purview they are. Similarly, a supervisor may reallocate resources within the Group to adapt to changing conditions.

The agenda for the Operations Briefing and the organization briefing the item is as follows:

1. Review UC objectives and changes to the IAP. – PSC
2. Discuss current response actions and last shift's accomplishments. – OpsSC
3. Review weather forecast for the next operational period. - Situation Unit Leader
4. Review Group assignments. – OpsSC
5. Trajectory/progress analysis. - Situation Unit Leader
6. Transportation, communications, and supply updates. – LogSC
7. Safety message. – SSO
8. Incident Action Plan approval and final remarks. - UC

4.8 Execute Plan and Assess Progress

Following the Operations Briefing, all Section Chiefs will implement the IAP, review the incident response progress, and make recommendations to the UC in preparation for the next UC Objective Meeting for the next operational period. This feedback/information is gathered from various sources, including field observers, responder debriefs, stakeholders, etc., and it provides the baseline for repeating the cycle beginning with when the UC Sets Incident Objectives.

APPENDICIES

AEGL

AEGLs for Selected Chemical Warfare Agents

Nerve Agent GA (Tabun) 77-81-6 (Final)					
ppm [mg/m^3]					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.0010 [0.0069]	0.00060 [0.0040]	0.00042 [0.0028]	0.00021 [0.0014]	0.00015 [0.0010]
AEGL 2	0.013 [0.087]	0.0075 [0.050]	0.0053 [0.035]	0.0026 [0.017]	0.0020 [0.013]
AEGL 3	0.11 [0.76]	0.057 [0.38]	0.039 [0.26]	0.021 [0.14]	0.015 [0.10]

Agent GB (Sarin) 107-44-8 (Final)					
ppm [mg/m^3]					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.0012 [0.0069]	0.00068 [0.0040]	0.00048 [0.0028]	0.00024 [0.0014]	0.00017 [0.0010]
AEGL 2	0.015 [0.087]	0.0085 [0.050]	0.0060 [0.035]	0.0029 [0.017]	0.0022 [0.013]
AEGL 3	0.064 [0.38]	0.032 [0.19]	0.022 [0.13]	0.012 [0.070]	0.0087 [0.051]

Agent GD (Soman) 96-64-0 (Final)					
ppm [mg/m^3]					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.00046 [0.0035]	0.00026 [0.0020]	0.00018 [0.0014]	0.000091 [0.00070]	0.000065 [0.00050]
AEGL 2	0.0057 [0.044]	0.0033 [0.025]	0.0022 [0.018]	0.0012 [0.0085]	0.00085 [0.0065]
AEGL 3	0.049 [0.38]	0.025 [0.19]	0.017 [0.13]	0.0091 [0.070]	0.0066 [0.051]

Agent GF 329-99-7 (Final)					
ppm [mg/m^3]					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.00049 [0.0035]	0.00028 [0.0020]	0.00020 [0.0014]	0.00010 [0.00070]	0.000070 [0.00050]
AEGL 2	0.0062 [0.044]	0.0035 [0.025]	0.0024 [0.018]	0.0013 [0.0085]	0.00091 [0.0065]
AEGL 3	0.053 [0.38]	0.027 [0.19]	0.018 [0.13]	0.0098 [0.070]	0.0071 [0.051]

Agent VX 50782-69-9 (Final)					
ppm [mg/m^3]					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.000052 [0.00057]	0.000030 [0.00033]	0.000016 [0.00017]	0.0000091 [0.00010]	0.0000065 [0.000071]
AEGL 2	0.00065 [0.0072]	0.00038 [0.0042]	0.00027 [0.0029]	0.00014 [0.0015]	0.000095 [0.0010]
AEGL 3	0.0027 [0.029]	0.0014 [0.015]	0.00091 [0.010]	0.00048 [0.0052]	0.00035 [0.0038]

Arsine 7784-42-1 (Final)					
ppm					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.30	0.21	0.17	0.040	0.020
AEGL 3	0.91	0.63	0.50	0.13	0.060

BZ 6581-06-2 (Proposed)					
mg/m^3					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.20 mg/m^3	0.067 mg/m^3	0.033 mg/m^3	NR	NR
AEGL 3	3.7 mg/m^3	1.2 mg/m^3	0.62 mg/m^3	NR	NR

Chloropicrin 76-06-2 (Proposed)					
ppm					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	0.050	0.050	0.050	0.050	0.050
AEGL 2	0.15	0.15	0.15	0.15	0.15
AEGL 3	2.0	2.0	1.4	0.79	0.58

Lewisite 1 (CAS No. 541-25-3), including mixtures with Lewisite 2 (CAS No. 40334-69-8) and Lewisite 3 (CAS No. 40334-70-1) (Interim)					
(mg/m^3) 11/13/06					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.65 mg/m^3	0.23 mg/m^3	0.12 mg/m^3	0.035 mg/m^3	0.018 mg/m^3
AEGL 3	3.9 mg/m^3	1.4 mg/m^3	0.74 mg/m^3	0.21 mg/m^3	0.11 mg/m^3

Nitrogen Mustard-1 538-07-8 (Interim)					
(mg/m^3)					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.13 mg/m^3	0.044 mg/m^3	0.022 mg/m^3	0.0056 mg/m^3	0.0028 mg/m^3
AEGL 3	2.2 mg/m^3	0.74 mg/m^3	0.37 mg/m^3	0.093 mg/m^3	0.047 mg/m^3

Nitrogen Mustard-2 51-75-2 (Interim)					
(mg/m^3)					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.13 mg/m^3	0.044 mg/m^3	0.022 mg/m^3	0.0056 mg/m^3	0.0028 mg/m^3
AEGL 3	2.2 mg/m^3	0.74 mg/m^3	0.37 mg/m^3	0.093 mg/m^3	0.047 mg/m^3

Nitrogen Mustard-3 555-77-1 (Interim)					
(mg/m^3)					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.13 mg/m^3	0.044 mg/m^3	0.022 mg/m^3	0.0056 mg/m^3	0.0028 mg/m^3
AEGL 3	2.2 mg/m^3	0.74 mg/m^3	0.37 mg/m^3	0.093 mg/m^3	0.047 mg/m^3

Phosgene 75-44-5 (Final)					
Ppm					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	0.60	0.60	0.30	0.080	0.040
AEGL 3	3.6	1.5	0.75	0.20	0.090

Hydrogen cyanide 74-90-8 (Final)					
Ppm					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	2.5	2.5	2.0	1.3	1.0
AEGL 2	17	10	7.1	3.5	2.5
AEGL 3	27	21	15	8.6	6.6

Source: http://www.epa.gov/oppt/aegl/pubs/chemlist.htm

Blister Agents
Lewisite (L) ($C_2H_2AsCl_3$) CAS 541-25-3, UN 1556; and
Mustard-Lewisite Mixture (HL) CAS Number not available, UN 2810

Synonyms for Lewisite include L, arsine (2-chlorovinyl) dichloro-, arsenous dichloride (2-chloro-ethenyl)-, chlorovinylarsine dichloride, 2-chlorovinyldichloroarsine, beta-chlorovinyldichloroarsine, dichloro-(2-chlorovinyl)arsine, EA1034.

Synonyms for Mustard-Lewisite include HL and Sulfur Mustard/Lewisite.

Persons whose skin or clothing is contaminated with liquid Lewisite or Mustard-Lewisite Mixture can contaminate rescuers by direct contact or through off-gassing vapor.

- **Lewisite is an oily, colorless liquid with an odor like geraniums. Mustard-Lewisite Mixture is a liquid with a garlic-like odor. Volatility of both agents is significant at high ambient temperatures.**
- **Lewisite and Mustard-Lewisite Mixture are rapidly absorbed by the skin causing immediate pain and burning followed by erythema and blistering. Ocular exposure to Lewisite or the mixture may cause immediate incapacitating burning and inflammation of the cornea and conjunctiva. Inhalation damages the respiratory tract epithelium and may cause death.**

Description

Lewisite is an organic arsenical known for its vesicant properties. Pure Lewisite is an oily, colorless liquid, while impure Lewisite is amber to black. It remains a liquid at low temperatures and is persistent in colder climates. It has the odor of geraniums.

Mustard-Lewisite Mixture is a liquid mixture of distilled Mustard (HD) and Lewisite. Due to its low freezing point, the mixture remains a liquid in cold weather and at high altitudes. The mixture with the lowest freezing point consists of 63% Lewisite and 37% Mustard. It has a garlic-like odor.

Routes of Exposure

Inhalation

Exposure to Lewisite vapor at a concentration of 8 mg-min/m^3 causes immediate burning pain of the respiratory tract. Its odor is noted at about 20 mg-min/m^3. The LCt_{50} (the product of concentration times time that is lethal to 50% of the exposed population by inhalation) is approximately 1,500 mg-min/m^3. Exposure to Mustard-Lewisite Mixture vapor induces immediate respiratory tract irritation and severe inflammation after a few

Blister Agents
Nitrogen Mustard (HN-1) ($C_6H_{13}Cl_2N$) CAS 538-07-8, UN 2810;
Nitrogen Mustard (HN-2) ($C_5H_{11}Cl_2N$) CAS 51-75-2, UN 2927;
and
Nitrogen Mustard (HN-3) ($C_6H_{12}Cl_3N$) CAS 555-77-1, UN 2810

Synonyms:

HN-1: Bis(2-chloroethyl)ethylamine; 2-chloro-N-(2-chloroethyl)-N-ethylethanamine; 2,2'-dichlorotriethylamine; ethylbis(2-chloroethyl)amine; ethyl-S

HN-2: MBA; mechlorethamine; mustine; 2,2'-dichloro-N-methyldiethylamine; dichloren; caryolysin; mechlorethanamine; chlormethine; bis(2-chloroethyl)methylamine

HN-3: Tris(2-chloroethyl)amine; 2-chloro-N,N-bis(2-chloroethyl)ethanamine; 2,2',2"-trichlorotriethylamine

People whose skin or clothing is contaminated with nitrogen mustard can contaminate rescuers by direct contact or through off-gassing vapor.

- **Nitrogen mustards are colorless to yellow, oily liquids with variable odors.**
- **Nitrogen mustards are absorbed by the skin causing erythema and blisters. Ocular exposure to these agents may cause incapacitating injury to the cornea and conjunctiva. When inhaled, nitrogen mustard damages the respiratory tract epithelium and may cause death.**

Description

Nitrogen mustards are vesicants and alkylating agents. They are colorless to pale yellow, oily liquids that evaporate slowly. HN-1 has a faint, fishy or musty odor. It is sparingly soluble in water but miscible with acetone and other organic solvents. At temperatures greater than 194 °C, it decomposes.

HN-2 has a fruity odor at high concentrations and a soapy odor at low concentrations. Its solubility is similar to HN-1.

HN-3 is odorless when pure but has been reported to have a butter almond odor. It is the most stable of the nitrogen mustards but decomposes at temperatures greater than 256 °C. It has a much lower vapor pressure than HN-1 or HN-2 and is insoluble in water.

Routes of Exposure

Inhalation

Inhalation is an important route of exposure. Nitrogen mustard vapors are heavier than air. The LCt_{50} (the product of concentration times time that is lethal to 50% of the exposed

Nerve Agents
Tabun (GA) CAS 77-81-6; Sarin (GB) CAS 107-44-8; Soman (GD) CAS 96-64-0; and VX CAS 5078269-9

Synonyms:

GA: ethyl dimethylamidocyanophosphate; ethyl N,N-dimethylphosphoramidocyanidate; ethyl dimethyl-phosphoramidocyanidate; dimethylaminoethoxy-cyanophosphine oxide; dimethyl-amidoethoxy-phosphoryl cyanide; EA1205; dimethylphosphoramidocyanidic acid ethyl ester

GB: isopropyl methylphosphonofluoridate; isopropoxymethylphosphoryl fluoride; trilone; MFI; TL1 618; isopropylmethanefluorophosphonate; T144; T2106; fluoro(isopropoxy)methylphosphine oxide; methylisopropoxyfluorophosphine oxide; zarin

GD: pinacolyl methylphosphonofluoridate; 1,2,2-trimethylpropyl methylphosphonofluoridate; methyl-pinacolyloxyfluorophosphine oxide; pinacolyloxymethylphosphonyl fluoride; pinacolylmethyl-fluorophosphonate; 1,2,2-trimethylpropoxyfluoro(methyl)phosphine oxide; pinacolyl methyl-phosphonyl fluoride

VX: O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate; methylphosphonothioic acid; S-2-(diisopropylamino)ethyl O-ethyl methylphosphonothioate; O-ethyl S-(2-diisopropyl-aminoethyl)methylphosphonothioate; O-ethyl S-(2-diisopropoylaminoethyl) methylthiol-phosphonoate; O-ethyl S-diisopropylaminoethyl methylphosphonothiolate

- **Persons whose skin or clothing is contaminated with nerve agent can contaminate rescuers by direct contact or through off-gassing vapor. Persons whose skin is exposed only to nerve agent vapor pose no risk of secondary contamination; however, clothing can trap vapor.**
- **G-type nerve agents (GA, GB, and GD) are clear, colorless liquids that are volatile at ambient temperatures. VX is an amber-colored, oily liquid with low volatility unless temperatures are high.**
- **Nerve agents are readily absorbed by inhalation, ingestion, and dermal contact. Rapidly fatal systemic effects may occur.**

Description Nerve agents are the most toxic of the known chemical warfare agents. **They are chemically similar to organophosphate pesticides and exert their biological effects by inhibiting acetylcholinesterase enzymes.** G-type agents are clear,

Blister Agents
Sulfur Mustard Agent H or HD ($C_4H_8Cl_2S$)
CAS 505-60-2, UN 2927;
and Sulfur Mustard Agent HT CAS 6392-89-8

Synonyms:

H and HD: Bis(2-chloroethyl) sulfide; bis(beta-chloroethyl) sulfide; di-2-chloroethyl sulfide; 1-chloro-2(beta-chloroethylthio)ethane; 2,2'-dichloroethyl sulfide; sulfur mustard; Iprit; Kampstoff "Lost"; mustard gas; senfgas, S-yperite; yellow cross liquid; yperite

HT: Mixture of bis(2-chloroethyl) sulfide and bis[2-(2-chloroethylthio)-ethyl]ether

People whose skin or clothing is contaminated with sulfur mustard can contaminate rescuers by direct contact or through off-gassing vapor.

- **Sulfur mustards are yellow to brown oily liquids with a slight garlic or mustard odor. Although volatility is low, vapors can reach hazardous levels during warm weather.**
- **Sulfur mustards are absorbed by the skin, causing erythema and blisters. Ocular exposure to these agents may cause incapacitating damage to the cornea and conjunctiva. Inhalation damages the respiratory tract epithelium and may cause death.**

Description

Sulfur mustards are vesicants and alkylating agents. They are colorless when pure but are typically a yellow to brown oily substance with a slight garlic or mustard odor. H contains about 20 to 30% impurities (mostly sulfur); distilled mustard is known as HD and is nearly pure; HT is a mixture of 60% HD and 40% agent T (a closely related vesicant with a lower freezing point). Sulfur mustards evaporate slowly. They are very sparingly soluble in water but are soluble in oils, fats, and organic solvents. They are stable at ambient temperatures but decompose at temperatures greater than 149°C.

Routes of Exposure

Inhalation

Sulfur mustards are readily absorbed from the respiratory tract; injury develops slowly and intensifies over several days. The odor of sulfur mustards does not provide adequate warning of detection. The LCt_{50} (the product of concentration times time that is lethal to 50% of the exposed population by inhalation) is approximately 1,500 mg-min/m^3. The vapors are heavier than air. When inhaled, these agents may cause systemic effects. The estimated Ct for airway injury is 100 to 200 mg-min/m^3.

MEG

TABLE C-1. AIR MILITARY EXPOSURE GUIDELINES FOR CHEMICAL WARFARE AGENTS

Chemical CAS No.	Air-MEG Health Effect Level	10-Minute mg/m^3 [ppm]	1-Hour mg/m^3 [ppm]	8-Hour mg/m^3 [ppm]	24-Hour mg/m^3 [ppm]	Potential Symptoms and Target Organs/Systems	Notes
GA (Tabun) 77-81-6	MINIMAL	0.0069 [0.0010]	0.0028 [0.00042]	0.0010 [0.00015]	0.0003 [0.00005]	Running nose; tightness of chest; miosis and dim vision; difficulty breathing; drooling and excessive sweating; nausea, vomiting; CNS effects.	Based on relative potency from GB (see text for more information); (EPA 2001) 24-hour MEG estimate derived from 8-hour AEGL by straight-line extrapolation of 8-hour AEGL Ct (see EPA 2001 and document text) Existing (Recommended) IDLH = 0.2 (0.1) mg/m^3
	SIGNIFICANT	0.087 [0.013]	0.035 [0.0053]	0.013 [0.0020]	0.004 [0.00067]		
	SEVERE	0.76 [0.11]	0.26 [0.039]	0.10 [0.015]	0.03 [0.005]	Local effects to pupil of the eye; Respiratory system, CNS	

NRT Quick Reference Guide: Lewisite

Agent Characteristics

Agent Classification: Chemical Warfare Blister (Vesicant) Agent **CAS:** 541-25-3

Description: Oily, colorless to yellow brown liquid, with distinctive odor of geraniums. It was developed as a warfare agent that can cause severe injuries the skin, eyes, respiratory tract. Unlike the sulfur mustard blister agents, Lewisite is volatile and not persistent. Because it is very volatile, it has also been manufactured in mixtures such as with sulfur mustard to provide a mixture of low freezing point for use in cold weather operations or as a high altitude spray agent. If released in air as small aerocolized droplets or as a vapor, the residual agent in air or residual deposition of small droplets on surfaces of pure Lewisite might last minutes to hours depending on weather conditions – heat and moisture increase agent breakdown; vapors/droplets can settle in cooler/low-lying areas. Lewisite breaks down in hours to two toxic products - lewisite oxide and arsenic - which can persist longer (days +). The effects caused by Lewisite are not typically fatal, but at high enough concentration exposures (direct liquid contact or high vapor concentrations) can cause immediate eye pain and eye/skin/respiratory tract irritation with lesions forming hours later (unlike sulfur mustard agents which have delayed effects). Lesser airborne exposures may just cause temporary eye irritation). Can penetrate normal clothing. There is an antidote for Lewisite exposure.

Mol. Weight: 207.35 **Vapor Density:** 7.1 **Aqueous Solubility:** 0.5, slight
Volatility (mg/m3): 4480 @20C **Boiling Point:** 190 C **Soluble:** organic solvents; oils, fats
Freezing Point: 0.1 C **Flashpoint:** None **Specific Gravity:** 1.89 g/mL
Vapor Pressure: 0.58 mm Hg@25°C **Conversion Factors:** 1ppm = 8.5 mg/m3; C = 0.56 (F - 32)
Persistance: *vapor* – hours-day; *liquid* -hours-day depending on amount, temperature, rain/other weather conditions, & type of surface

Release Scenarios

Ambient Air: The resulting aerosol droplets and vapors will be largely broken down by physical and chemical processes (e.g. volatilization, oxidation, dilution)-and expected to result in limited/localized surface contamination. Some residual of breakdown products lewisite oxide and/or arsenic may be present if liquid is deposited on surfaces.
Water: If vapor/droplets contact large water surfaces, hydrolysis is expected to breakdown agent. Water movement/mixing further facilitates breakdown/hydrolysis processes. Chlorination/water treatment processes will also degrade/neutralize the agent. Lewisite Oxide can be formed and though of lesser toxicity should be evaluated.
Facility: Although ground level releases or enclosed facilities are typically smaller localized areas, they are likely to have greater liquid contamination and/or be less subject to various 'natural' environmental breakdown processes and thus expected to need decontamination. Some residual of breakdown products lewisite oxide and/or arsenic may be present if liquid is deposited on surfaces.

Health Effects

Onset	Immediate burning pain (eye and skin), skin redness within 15-30min.; then blister formation & deep skin burns (hours) - but time of onset and severity of effects depends on dose, duration and route of exposure (not all signs/symptoms may develop).
Signs/ Symptoms	**Inhalation:** Immediate burning pain, violent sneezing, coughs, lung edema, sinus pain, shortness of breath, low blood pressure. Also lung at higher concentrations and exposure durations) tissue damage. **Skin:** Delayed effects, redness, blisters (blister size/number vary with dose). Blisters may form in 4-24hrs depending on dose; warm and sweaty skin areas (underarms, groin) most susceptible. **Ingestion (rare):** Initially tissue damage and severe pain to mouth/throat (cellular damage to first tissue contacted), then nausea, vomiting **Eyes:** Instant pain, tearing, irritation, and swelling of the eyelids. Corneal scarring and iritis, blindness.
Exposure Routes	**Inhalation:** Most probable route exposure for Lewisite. Injury develops immediately. Vapor exposure is absorbed through mucous membranes (eyes, throat, lungs) **Skin:** Direct contact with a liquid can cause effects in hour or more. Mustard produces effects by entering cells of the skin, eye or mucous membranes (including respiratory tract), causing DNA damage/cell death in seconds. **Eyes (Sensative organ):** Eyes greatly affected by vapor hazard exposure would result in immediate pain and tissue damage. **Ingestion (rare):** Consumption of contaminated food or drink could cause local and systemic effects.

Effect Levels

AIR (in mg/m): EPA & National Research Council are in the process of developing **Acute Exposure Guideline Levels (AEGLs)** for Lewisite for one—time exposure emergency scenarios -- anticipated by 2006:

▼*AEGL level*	*exposure duration* ▶	10 min:	30 min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:						
AEGL 2: threshold for potentially notable but not permanent or severe effects		———— *under development* ————				
AEGL 3: threshold for severe effects/medical needs/increasing potential for lethality:						

Other airborne guidelines/standards for Lewisite have also been developed by the Army and/or CDC for purposes of ensuring occupational and general population safety during destruction of US chemical warfare agent stockpiles (Public Law 91-121 and 91-441 requires CDC to oversee safety of Army demilitarization operations). The most current air exposure values are:

IDLH= not specifically established but note existing 'TLV' and GPL "ceiling level" below STEL= NA
8 hr time-weighted average (TWA) occupational "TLV" type limit called the Worker Population Limit ("WPL) = * 0.003 mg/m³ *(treated as a ceiling limit)
Lifetime chronic General Population Limit TWA ("GPL") = *0.003 mg/m³ **SOIL:** screening/action levels from *USACHPPM 1999*: peer-reviewed reference doses (RfDs and SFs) with EPA RAGs risk multi- and single pathway exposure models: **Adult long term exposure scenario** = 3.7-7.8 mg/kg **Residential exposure scenario** 0.3 - 7.8 mg/kg
Drinking water: Although Lewisite contamination of large water supplies is unlikely; the military has developed screenings levels for the potential intentional contamination of smaller contained water supplies that could pose a health threat. Exposure limits set by military for troops drinking 5- 15 L/day of a contaminated supply for 7 days is 80 ug/L (5L/dy) – 27 ug/L (for 15 L) (field water M272 kits can typically near upper end of that range)

Health and Safety

General	Under ICS, check with your appointed Health and Safety Officer regarding PPE, Medical Surveillance, and Safety Plans. Level of PPE may vary depending upon the circumstances of the site and the incident. PPE Levels below are general suggestions only.
Medical Surveillance	Pre-exposure: annual exams/ensure proper respiratory function; During Exposure: Wear PPE as designated by the Health and Safety plan. Set up a medical monitoring plan, documenting PPE levels used, exposure/symptom incidents, antidotes used, etc. Post exposure: Monitor for signs/symptoms and treat accordingly.
Personnel Decon & First Aid	Bleach solutions are not generally recommended for civilian skin/personal decon (unless there is heavy liquid contamination) as bleach can irritate skin and possibly exacerbate agent absorption into skin. Use (warm) soapy water for intact skin decon (best within 1-2 min after exposure, but delayed decon is better than no decon). Use water or saline rinse for eyes and saline for wounds. Outer PPE may be decontned with warm water/soap unless heavy agent contamination is expected, then use 10% household bleach solution for PPE not in contact with skin (see "Decon" section) followed by thorough water rinsing. For general public, precautionary "dry decon" is appropriate when only vapor plume exposure was expected-- involves changing clothes, washing of exposed skin, and shampooing hair. Antihistamines and corticosteroids may relieve skin and eye irritation; guard against infection. Antidote available and effective for severe cases only: Dimercaprol (AKA British Anti-Lewisite), a chelating agent.
PPE	Site dependent factors will determine. General guidelines: Hazard evaluation in Level A. Use NIOSH approved CBRN self-contained breathing apparatus (SCBA) respirators when the types of inhalation hazards and their concentrations are unknown or expected to be high. The CBRN APR full-face respirator provides a lower level of protection than the SCBA and its use is generally allowed once conditions are understood and exposures are determined to be at lower levels. Inner suit: Tyvek Outer suit: Saranex (per NIOSH Official Use Only Emergency Preparedness Guide) SEE http://www.osha.gov/SLTC/emergencypreparedness/guides/

Field Detection

Real time field (hand held) detectors (results not confirmatory or quantified): The following devices summarize a 'common list' of detectors procured by most EPA response teams, which include a few commonly used military kits/items. Other devices/items may be used by other agencies/responders – some with similar capabilities/limitations. Ongoing research is identifying potential future advances to these real-time detectors capabilities –caution should be given to other equipment that has not been properly evaluated by appropriate organizations.

- M256 kits- plastic sample detectors that take over 15 minutes to obtain results. They have a sensitivity 9 mg/m3 for L in @ 15 min.
- Dräger Detector Tubes: Glass detector tubes are filled with an inert reagent carrier material and impregnated with an indicating agent. Reagent produces a colorimetric indication in the presence of a particular gas, vapor, or aerosol. Gross levels can be read directly from the discoloration on the tube's printed scale; for more confirmatory results, the tubes can be sent to the lab for desorbtions and GC/MS analyses.
- M8 and M9 papers: simple gross level liquid detectors using colorimetric paper strips. M8 has potential for false positives. Used for liquids only.
- M272 Water Test Kit – can be used for raw or treated water; they are colorimetric test kits that can detect L between 2.0 mg/L in @ 7 minutes. (over)

NRT Quick Reference Guide: Sulfur Mustard (H/HD/HT)

Report any release of WMD to the National Response Center 1-800-424-8802
For References, Please See: Key References Cited/Used" in National Response Team (NRT) Quick Reference Guide (QRG) for Chemical Warfare Agents.

Agent Characteristics

Agent Classification: Chemical Warfare Blister (Vesicant) Agent **CAS:** (H/HD) 505-60-2; (HT) 63918-89-8

Description: Despite the common term "mustard gas," H/HD/HT (sulfur mustard) is a oily liquid and not a "gas," unless heated or exploded. H/HD/HT was developed as a warfare agent to cause severe injuries to the skin, eyes, and respiratory tract. It was manufactured in three forms of purity: 1) The nearly pure (distilled) substance, HD; 2) Agent H, which contains 20-30% impurities; and 3) HT, a mixture of 60% HD with thickening material to reduce freezing point. It is colorless when pure, but is typically a yellow to brown oily liquid with a slight garlic or mustard odor. Because of its high freezing point, H/HD/HT can persist for decades if significant quantities are buried in the soil or when stored in munitions. Large liquid spills will persist in cooler temperatures. Bulk liquid can settle in water and remain for years if undisturbed. If released in air as small aerosolized droplets or as a vapor, the residual deposition of small droplets on surfaces can last hours to days depending on weather conditions (heat and moisture increase agent breakdown). Vapors/droplets can settle in cooler/low-lying areas and may persist for days. Environmental breakdown products of H/HD/HT are relatively nontoxic. Health effects from H/HD/HT are delayed until hours after the exposure—so those exposed may not be aware. The effects caused by H/HD/HT are not typically fatal, but can require substantial supportive medical care as there is no antidote. Immediate decontamination is only means to minimize effects. High concentration exposures (especially direct liquid contact), can cause severe effects to include blister¬ing of the skin and permanent eye and respiratory tract damage; lesser airborne concentrations may just cause temporary eye irritation. Long-term effects of high concentra¬tion exposures to H/HD/HT include scarring of skin, eye damage, and possibly cancer.

Molecular Weight: (H/HD) 159 g/mol, (HT) 263 g/mol
Volatility: (H) 610 mg/m³ @ 68°F; (H/HD) 920 mg/m³ @ 86°F, (HT) 831 mg/m³ @ 77°F
Freezing Point: (H/HD) 57°F, (HT) 69°F
Vapor Pressure: (H/HD) 0.072 mm Hg @ 68°F, (HT) 0.077 mm Hg @ 68°F
Vapor Density: (H/HD) 5.4, (HT) 6.9 (air=1.0)
Boiling Point: (H/HD)~422°F, (HT)>442°F
Flashpoint: (H/HD) 223°F, (HT) 227-237°F
Conversion Factors: (H/HD) 1 ppm=6.5 mg/m³ °C=0.56 x (°F – 32)
Aqueous Solubility: (H/HD) practically ins. (HT) slightly soluble
Soluble: (all) organic solvents, oils, fats
Specific Gravity: (H/HD) 1.27 g/cm³ @ 77°F (HT) 1.26 g/cm³ @ 77°F

Release Scenarios

Sulfur mustard is unique in that its freezing point is ~57°F, so that in cooler temperatures it will be in a very thick, viscous form that will not volatilize.

Air Release: Though vapors and even aerosol droplets can be largely broken down by physical and chemical processes (e.g., volatilization, oxidation, dilution), temperature and climate condition (e.g. rain) will determine the likelihood of some residual surface hazards. Cooler, dry environments and low-lying areas would be areas of greatest concentration/persistence. **Water:** If vapor/droplets contact large water surfaces, hydrolysis is expected to break down agents rapidly. Water movement/mixing further facilitate breakdown/hydrolysis processes. Chlorination/water treatment processes will also facilitate degradation of agents. If a large quantity of H/HD/HT liquid is directly poured into a small, untreated water source with limited agitation, there is potential for "globules" of agent to settle out. **Facility:** Due to its low volatility, VX would be difficult to distribute effectively throughout a building or facility from a point source. Possible localized areas of liquid contamination. **U.S. Munitions Stockpiles:** H/HD is undergoing destruction in Utah, Maryland, Arkansas, Alabama, Oregon, Kentucky, and Colorado. State/local plans to address potential vapor plume releases from Army properties are in place at these sites. These sites provide potential local subject matter experts (SMEs) and pertinent plans (go to *http://www.cma.army.mil/csepp.aspx* for more info).

Health Effects

ONSET

H/HD/HT produce effects by entering cells of the skin, eyes or mucous membranes (including respiratory tract), causing DNA damage/cell death in seconds (this is not like an acid burn). Despite the immediate DNA damage, actual signs/symptoms are DELAYED 1-48 HOURS AFTER EXPOSURE. Time of onset and severity of effects depend on dose, duration, and route of exposure (not all signs/symptoms may develop).

SIGNS/ SYMPTOMS

Mild: Effects are delayed 2-48 hours: Eye irritation (tearing, grittiness); runny nose, sneezing, nosebleed, hoarseness, hacking cough.
Moderate: Effects are delayed 2-24 hours: Above plus reddening, swelling of eyelids, severe cough, shortness of breath, reddening of skin.
Severe: Effects are delayed 1-24 hours: Upper respiratory/lung damage may occur at high concentrations and longer exposure durations. While high concentration H/HD/HT exposure is not generally lethal, without medical treatment infections from open blisters/respiratory tissue damage could be fatal. High concentration exposures that produce visible symptoms could later result in cancer.
Inhalation: Vapor exposure is absorbed through the mucous membranes (nose, mouth, throat, and lungs) and inhaled. Injury develops slowly and intensifies over time. High concentration can cause lung damage.
Skin: Direct contact with H/HD/HT liquid can cause redness or blisters in two to 24 hours. Warm and sweaty skin areas (under¬arms, groin) most susceptible.
Eyes: Eyes are the most sensitive to H/HD/HT injury; effects noted 1-12 hours; Irritation, burning, gritty feeling, itching, weeping, reddening, lid swelling, light-sensitivity, pain, and corneal injury. High concentration effects extremely painful and generally require extended medical treatment.
Ingestion (rare): Consumption of contaminated food or drink could cause nausea and vomiting.

EXPOSURE ROUTES

Inhalation: H/HD and HT can be heated or otherwise released as vapor/aerosol and inhaled. Injury develops slowly and intensifies over several days. Vapor exposure is absorbed through the mucous membranes (eyes, mouth, throat, and lungs) and induces DNA damage/cell death within seconds.
Skin: Direct contact with H/HD/HT can cause effects in one or more hours. H/HD/HT produce effects by entering cells of the skin, eyes or mucous membranes (including respiratory tract), causing DNA damage/cell death in seconds.
Eyes: Greatly affected by vapor hazard; symptoms occur in an hour or more with direct liquid contact.
Ingestion (rare): Consumption of contaminated food or drink could cause local effects.

Effect Levels

Air:
Acute Exposure Guideline Levels (AEGLs) (complete definitions are available in *Key* References Cited/Used" in NRT Quick Reference Guides for Chemical Warfare Agents) for general population one-time exposure emergency scenarios for H/HD/HT:

▼AEGL Level / exposure duration ▶	10 min:	30min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:	0.40 mg/m³ *	0.13 mg/m³ *	0.067 mg/m³ *	0.017 mg/m³ *	0.0080 mg/m³ *
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 *

Occupational: IDLH = 0.7 mg/m³; **STEL** = 3.0 x 10^{-3} mg/m³; **Worker Population Limit (WPL)** [an 8-hour time-weighted average occupational value] = 4.0 x 10^{-4} mg/m³
General Population Limit (GPL): [a 24-hour time weighted average lifetime chronic value] = 2.0 x 10^{-5} mg/m³.

Soil: Industrial Exposure Scenario = 0.3-14 mg/kg (10-4 cancer risk); **Residential Exposure Scenario** = 0.01-0.55 mg/kg (10-5 cancer risk).

Drinking Water: Although H/HD/HT contamination of large water sources is unlikely, there are military screening levels to determine if smaller, contained water supplies (e.g., water buffalo or tank truck) have been contaminated. Acceptable levels for troops drinking 5-15 L/day of a contaminated supply for 7 days are 47-140 µg/L. This level is a reasonable value to use for the general population since their consumption rate is considerably less.

Personal Safety

SITE SPECIFIC CONCERNS

Check with the Health and Safety Officer regarding Personal Protective Equipment (PPE), Medical Surveillance, and Safety Plans. Level and type of PPE may vary depending upon the circumstances of the site and the incident. PPE levels below are general recommendations only.

MEDICAL SURVEILLANCE

Baseline: Annual physical and respiratory function exams. **During Incident:** Conduct medical monitoring; use PPE designated by the Health and Safety (H&S) Plan; document PPE levels used; observe for any signs and symptoms and treat accordingly. **Post-Incident:** Monitor for signs/symptoms and treat accordingly.

FIRST AID/ DECON

THERE IS NO ANTIDOTE. The only way to minimize effects is to perform immediate and thorough decon. Decon outer PPE with a dilute household bleach solution. Household bleach is 5% sodium hypochlorite. To create a dilute bleach solution, combine water to household bleach (add 1 part bleach to 9 parts water) yielding a 0.5% sodium hypochlorite solution. USE WARM SOAPY WATER INSTEAD OF DILUTE BLEACH FOR DECON OF BARE SKIN. Use water or saline eye rinse for eyes. Antihistamines and corticosteroids may relieve skin and eye irritation, and guard against infection. Follow burn regimen for blisters. To administer first aid or cardiopulmonary resuscitation, ensure the victim is decontaminated first.

PPE

Hazard evaluation responders use NIOSH-approved chemical, biological, radiological, and nuclear (CBRN) self-contained breathing apparatus (SCBA) respirators when the types of inhalation hazards and their concentrations are unknown or expected to be high. The CBRN APR full-face respirator provides a lower level of protection than the SCBA and its use is generally allowed once conditions are understood and exposures are determined to be at lower levels. Outer suit: Tychem F, BR, LV, Responder, TK, or Reflector. Gloves: Butyl Rubber Gloves, M3 and M4 Norton, or Chemical Protective Set.
See: *http://www2.dupont.com/Personal_Protection/en_US/assets/downloads/tychem/permguide82004.pdf*. During decontamination operations there should also be PPE/respiratory measures to minimize potential exposures to associated chlorine vapors.

Final — Rev #00 (2006)

NRT Quick Reference Guide: Sarin (GB)

Report any release of WMD to the National Response Center 1-800-424-8802
For References, Please See: Key References Cited/Used" in National Response Team (NRT) Quick Reference Guide (QRGs) for Chemical Warfare Agents.

Agent Characteristics

Agent Classification: Chemical Warfare Nerve Agent **CAS:** 107-44-8

Description: Colorless to brown liquid; generally odorless, but may have fruity odor if impure. GB was manufactured as a warfare agent and is a lethal cholinesterase inhibitor. It has the same mechanism of toxicity as organophosphate insecticides only it is much more potent...GB is the most volatile of all nerve agents, with volatility similar to that of water. While easier to disperse in air it is less likely to persist in the environment than persistent agents such as VX or HD (sulfur mustard). While considered non-persistent, liquid GB could be present for hours to a day or more if in large amounts or in cold or enclosed environments. Breakdown/hydrolysis in water (especially treated water) is expected to be fairly rapid. Environmental degradation/breakdown products of GB are relatively nontoxic. Signs/symptoms of GB exposure will occur within minutes or hours depending on dose received. Even relatively low dose exposure to GB can be fatal, though immediate administration of an antidote can be lifesaving (see First Aid/Decon below).

Persistence: vapor: minutes-hours; liquid: 2-24 hours depending on amount, temperature, rain or other weather conditions, and type of surface.

Molecular Weight: 140.10 g/mol	**Vapor Density:** 4.86 (air = 1)	**Aqueous Solubility:** miscible with H_2O
Volatility: 22,000 mg/m³ @ 77°F	**Boiling Point:** 316°F	**Soluble:** organic solvents
Freezing Point: -69°F	**Flashpoint:** > 280°F	**Specific Gravity:** 1.09 g/ml @ 68°F
Vapor Pressure: 2.94 mm Hg @ 77°F	**Conversion Factors:** 1ppm = 5.7 mg/m³; °C = 0.56 x (°F – 32)	

Release Scenarios

Air Release: GB is one of the more easily generated nerve agents (an impure version of GB was the agent used in the 1995 Tokyo subway event). Because it is volatile (liquid droplets or aerosols evaporate about as quickly as rain), it is not considered a "persistent" agent. Its volatility makes it easier to disperse as a vapor than other agents, thus GB is a plausible agent of concern for facilities or large outdoor areas. Since relatively non-persistent GB will degrade in environment fairly rapidly; however liquid on surfaces could persist for hours or days in colder environments..

Water: If released into water, GB will likely degrade from evaporation and hydrolysis, and be further broken down by dissolution and treatment processes, such as chlorination. Environmental and hydrolytic degradation products of GB are not significant toxic concerns.

Facility: Due to its volatility, GB could potentially be dispersed in a building or facility. Decontamination should focus on areas of liquid contamination. Breakdown products of GB are not significant toxic concerns

U.S. Munitions Stockpiles: U.S. munitions stockpiles of GB are/have undergone destruction/disposal in Utah, Oregon, Arkansas, Alabama, and Kentucky. State/local plans to address potential releases from Army properties are in place at these sites. These sites provide potential local subject matter experts (SMEs) and pertinent plans (go to *http://www.cma.army.mil/cseppp.aspx* for more info).

Health Effects

ONSET	Symptoms are dose dependent and may occur within seconds after exposure to vapors and within minutes or hours from exposure to liquid from.
SIGNS/ SYMPTOMS	**Mild:** Runny nose, reduction in pupil size (miosis), dimness of vision, tightness of chest, difficult breathing. **Moderate:** Increased miosis (to level of pinpointing of pupils), headaches, confusion, drowsiness, nasal congestion, tightness of chest, nausea vomiting diar¬rhea, cramps, generalized weakness, twitching of large muscle groups. **Severe:** Involuntary defecation and urination, drooling, twitching, staggering, convulsions, cessation of breathing, loss of consciousness, coma, and death.
EXPOSURE ROUTES	**Inhalation:** A primary exposure route; inhalation of very small concentrations can produce effects. **Skin:** Especially toxic from contact with liquid agent; usually moderate to severe localized effects (e.g., sweating) and systemic effects. Effects can also result from absorption of vapors through skin. **Eyes:** Eyes are the most sensitive target organs of nerve agent exposure: miosis (reduction in pupil size) will typically be the first sign of exposure. **Ingestion:** Overall systemic effects.
OTHER	Females appear to be more susceptible to nerve agent effects. Small percentages of general population have genetic traits that may increase susceptibility.

Effect Levels

Air:

Acute Exposure Guideline Levels (AEGLs) (complete definitions are available in Key References Cited/Used" in NRT Quick Reference Guides for Chemical Warfare Agents) for general population one-time exposure emergency scenarios for GB:

▼AEGL Level / exposure duration ▶	10 min:	30min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:	0.0069 mg/m³	0.0040 mg/m³	0.0028 mg/m³	0.0014 mg/m³	0.0010 mg/m³
AEGL 2: potentially irreversible effects or impaired ability to escape:	0.087 *	0.050 *	0.035 *	0.017 *	0.013 *
AEGL 3: threshold for severe effects/medical needs/increasing potential for lethality:	0.38 *	0.19 *	0.13 *	0.070 *	0.051 *

Occupational: IDLH = 0.1 mg/m³; STEL = 1.0 x 10^{-4} mg/m³; **Worker Population Limit (WPL)** [an 8-hour time-weighted average occupational value] = 3.0 x 10^{-4} mg/m³

General Population Limit (GPL) [a 24-hour time weighted average lifetime chronic value] = 1.0 x 10^{-5} mg/m³.

Soil: **Industrial Exposure Scenario** = 32-41 mg/kg. **Residential Exposure Scenario** = 1.3-1.6 mg/kg.

Drinking Water: Although G-agent contamination of large water sources is unlikely, there are military screening levels to determine if smaller, contained water supplies (e.g., water buffalo. tank truck) have been contaminated. Acceptable levels for troops drinking 5-15 L/day of a contaminated supply for 7 days are 4-12 µg/L. This level is a reasonable value to use for the general population since their consumption rate is considerably less.

Personal Safety

SITE SPECIFIC CONCERNS	Check with the Health and Safety Officer regarding Personal Protective Equipment (PPE), Medical Surveillance, and Safety Plans. Level and type of PPE may vary depending upon the circumstances of the site and the incident. PPE levels below are general recommendations only.
MEDICAL SURVEILLANCE	**Baseline:** Annual physical and respiratory function exams and a baseline cholinesterase activity. **During Incident:** Conduct medical monitoring; use PPE designated by the Health and Safety (H&S) Plan; document PPE levels used; observe for any signs and symptoms and treat accordingly. **Post-Incident:** Monitor for signs/symptoms and treat accordingly.
FIRST AID/ DECON	**Effective Antidote: Atropine and (if more severe) 2-PAM Chloride injections; atropine eye drops.** Decon outer PPE with a dilute household bleach solution. Household bleach is 5% sodium hypochlorite. To create a dilute bleach solution, combine water to household bleach (add 1 part bleach to 9 parts water) yielding a 0.5% sodium hypochlorite solution. USE WARM SOAPY WATER INSTEAD OF DILUTE BLEACH FOR DECON OF BARE SKIN.
PPE	Hazard evaluation responders use NIOSH-approved chemical, biological, radiological, and nuclear (CBRN) self-contained breathing apparatus (SCBA) respirators when the types of inhalation hazards and their concentrations are unknown or expected to be high. The CBRN APR full-face respirator provides a lower level of protection than the SCBA and its use is generally allowed once conditions are understood and exposures are determined to be at lower levels. Outer suit: Tychem F, BR, LV, Responder, TK, or Reflector. Gloves: Butyl Rubber Gloves, M3 and M4 Norton, or Chemical Protective Set. See: *http://www2.dupont.com/Personal_Protection/en_US/assets/downloads/tychem/permguide82004.pdf*. During decontamination operations there should also be PPE/respiratory measures to minimize potential exposures to associated chlorine vapors.

Field Detection

Real-time field screening tools (results not confirmatory or quantified): Caution should be given to equipment that has not been properly evaluated. The following is a summary of screening tools procured by most EPA response teams. Other screening tools may be used by other agencies and responders, some with similar capabilities and limitations. **Hand-Held:** 1) *APD-2000/(CAM)* and *Improved Chemical Agent Monitor (ICAM):* Hand-held vapor detection devices that identify presence of G-agents at concentrations ≥ 0.1 mg/m³ within 10 seconds. This device is subject to false positives (e.g., perfumes, exhausts, and diesel). It can specify type of nerve agent, which is an improvement over previous military monitors that could not distinguish between the nerve agents. 2) *AP2C:* A hydrogen flame spectrophotometer that detects phosphorous (contained in G, V agents) and sulfur (contained in HD, V agents). Identifies presence of G-agents at concentrations ≥ 0.03 mg/m³ within 10 seconds. 3) *Dräger Detector Tube:* Glass detector tubes impregnated with an indicating agent. Reagent produces a colorimetric indication in the presence of a particular gas, vapor, or aerosol. Gross

Final — Rev #00 (2006)

NRT Quick Reference Guide: Soman (GD)

Report any release of WMD to the National Response Center 1-800-424-8802
For References, Please See: Key References Cited/Used" in National Response Team (NRT) Quick Reference Guides (QRGs) for Chemical Warfare Agents.

Agent Characteristics

Agent Classification: Chemical Warfare Nerve Agent **CAS:** 96-64-0

Description: Colorless liquid; generally odorless, possibly fruity. GD was manufactured as a warfare agent and is a lethal cholinesterase inhibitor. It has the same mechanism of toxicity as organophosphate insecticides but is much more potent. GD is considered to have low persistence; though it is less volatile than sarin (GB), it is much more volatile than persistent agents VX or sulfur mustard (HD). While considered relatively non-persistent, liquid GD could be present for hours to days if in large amounts, or in cold or enclosed environments. Breakdown/hydrolysis in water (especially treated water) is expected. Environmental breakdown products of GD are relatively nontoxic. Signs/symptoms of exposure to GD will occur within minutes or hours, depending on the dose. Even relatively low dose exposure to GD can be fatal; administration of antidotes within 2 minutes of exposure may be effective. (See First Aid/Decon below)

Persistence: vapor: minutes-hours; liquid: hours to days depending on amount, temperature, rain or other weather conditions, and type of surface.

Molecular Weight: 182.18 g/mol	**Vapor Density:** 6.33 (air = 1)	**Aqueous Solubility:** 21 g/L 68°F
Volatility: 3900 mg/m³ 77°F	**Boiling Point:** 388°F	**Soluble:** organic solvents
Freezing point: -44°F	**Flashpoint:** 250°F	**Specific Gravity:** 1.02 g/ml 68°F
Vapor Pressure: 0.4 mm Hg @ 77°F	**Conversion Factors:** 1ppm= 7.5 mg/m³; °C = 0.56 x (°F – 32)	

Release Scenarios

Air Release: Because it is somewhat volatile, GD is not generally considered a "persistent" agent. GD is a plausible agent of concern for facilities or large outdoor areas. Liquid-contamination on surfaces could persist for hours or days in colder environments and areas protected from open weathering.

Water: If released into water, GD would likely degrade from evaporation and hydroly¬sis, and be further broken down by dissolution and treatment processes, such as chlori¬nation. Environmental and hydrolytic degradation products of GD are not significant toxic concerns.

Facility: Due to its volatility, GD could feasibly be dispersed in a building or facility. Decontamination should focus on areas of liquid contamination. Breakdown products of GF are not significant toxic concerns.

U.S. Munitions Stockpiles: U.S. munitions stockpiles of G-agent are/have undergone destruction/disposal in Utah, Oregon, Arkansas, Alabama, and Kentucky. State/local plans to address potential releases from Army properties are in place at these sites. These sites provide potential local subject matter experts (SMEs) and pertinent plans (go to *http://www.cma.army.mil/csepp.asp x* for more info).

Health Effects

ONSET	Symptoms are dose dependent and may occur within seconds after exposure to vapors and within minutes or hours from exposure to liquid from.
SIGNS/ SYMPTOMS	**Mild:** Runny nose, reduction in pupil size (miosis), dimness of vision, tightness of chest, difficult breathing. **Moderate:** Increased miosis (to level of pinpointing of pupils), headaches, confusion, drowsiness, nasal congestion, tightness of chest, nausea vomiting diar¬rhea, cramps, generalized weakness, twitching of large muscle groups. **Severe:** Involuntary defecation and urination, drooling, twitching, staggering, convulsions, cessation of breathing, loss of consciousness, coma, and death.
EXPOSURE ROUTES	**Inhalation:** A primary exposure route; inhalation of very small concentrations can produce effects. **Skin:** Especially toxic from contact with liquid agent; usually moderate to severe localized effects (e.g., sweating) and systemic effects. Effects can also result from absorption of vapors through skin. **Eyes:** Eyes are the most sensitive target organs of nerve agent exposure: miosis (reduction in pupil size) will typically be the first sign of exposure. **Ingestion:** Overall systemic effects.
OTHER	Females appear to be more susceptible to nerve agent effects. Small percentages of general population have genetic traits that may increase susceptibility.

Effect Levels

Air:

Acute Exposure Guideline Levels (AEGLs) (complete definitions are available in Key References Cited/Used" in NRT Quick Reference Guides for Chemical Warfare Agents) for general population one-time exposure emergency scenarios for GD:

▼AEGL Level / exposure duration ▶	10 min:	30min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:	0.0035 mg/m³	0.0020 mg/m³	0.0014 mg/m³	0.00070 mg/m³	0.00050 mg/m³
AEGL 2: potentially irreversible effects or impaired ability to escape:	0.044 ?	0.025 ?	0.018 ?	0.0085 ?	0.0065 ?
AEGL 3: threshold for severe effects/medical needs/increasing potential for lethality:	0.38 *	0.19 *	0.13 *	0.070 *	0.051 *

Occupational: IDLH = 0.05 mg/m³; **STEL** = 5.0 x 10^{-4} mg/m³; **Worker Population Limit (WPL)** [an 8-hour time-weighted average occupational value] = 3.0 x 10^{-5} mg/m³

General Population Limit (GPL) [a 24-hour time weighted average lifetime chronic value] = 1.0 x 10^{-6} mg/m³.

Industrial Exposure Scenario = 32-41 mg/kg; **Residential Exposure Scenario** = 1.3-1.6 mg/kg.

Drinking Water: Although G-agent contamination of large water sources is unlikely, there are military screening levels to determine if smaller, contained water supplies (e.g., water buffalo, tank truck) have been contaminated. Acceptable levels for troops drinking 5-15 L/day of a contaminated supply for 7 days are 4-12 µg/L. This level is a reasonable value to use for the general population since their consumption rate is considerably less.

Personal Safety

SITE SPECIFIC CONCERNS	Check with the Health and Safety Officer regarding Personal Protective Equipment (PPE), Medical Surveillance, and Safety Plans. Level and type of PPE may vary depending upon the circumstances of the site and the incident. PPE levels below are general recommendations only.
MEDICAL SURVEILLANCE	**Baseline:** Annual physical and respiratory function exams and a baseline cholinesterase activity. **During Incident:** Conduct medical monitoring; use PPE designated by the Health and Safety (H&S) Plan; document PPE levels used; observe for any signs and symptoms and treat accordingly. **Post-Incident:** Monitor for signs/symptoms and treat accordingly.
FIRST AID/ DECON	**Antidote:** Nerve agent antidotes Atropine and (if more severe) 2-PAM Chloride injections are of limited effectiveness with GD – 2-PAM chloride must be given within 2 minutes of exposure for any antidote effect; atropine drops for eyes. Decon outer PPE with a dilute household bleach solution. Household bleach is 5% sodium hypochlorite. To create a dilute bleach solution, combine water to household bleach (add 1 part bleach to 9 parts water) yielding a 0.5% sodium hypochlorite solution. USE WARM SOAPY WATER INSTEAD OF DILUTE BLEACH FOR DECON OF BARE SKIN.
PPE	Hazard evaluation responders use NIOSH-approved chemical, biological, radiological, and nuclear (CBRN) self-contained breathing apparatus (SCBA) respirators when the types of inhalation hazards and their concentrations are unknown or expected to be high. The CBRN APR full-face respirator provides a lower level of protection than the SCBA and its use is generally allowed once conditions are understood and exposures are determined to be at lower levels. Outer suit: Tychem F, BR, LV, Responder, TK, or Reflector. Gloves: Butyl Rubber Gloves, M3 and M4 Norton, or Chemical Protective Set. See: *http://www2.dupont.com/Personal_Protection/en_US/assets/downloads/tychem/permguide62004.pdf*. During decontamination operations there should also be PPE/respiratory measures to minimize potential exposures to associated chlorine vapors.

Field Detection

Real-time field screening tools (results not confirmatory or quantified): Caution should be given to equipment that has not been properly evaluated. The following is a summary of screening tools procured by most EPA response teams. Other screening tools may be used by other agencies and responders some with similar capabilities and limitations. **Hand-Held:** 1) *APD-2000/(CAM)* and *Improved Chemical Agent Monitor (ICAM)*: Hand-held vapor detection devices that identify presence of G-agents at concentrations ≥ 0.1 mg/m³ within 10 seconds. This device is subject to false positives (e.g., perfumes, exhausts, diesel). It can specify type of nerve agent, which is an improvement over previous military monitors that could not distinguish between the nerve agents. 2) *AP2C*: A hydrogen flame spectrophotometer that detects phosphorous (contained in G, V agents) and sulfur (contained in HD, V agents). Identifies presence of G-agents at concentrations ≥ 0.03 mg/m³ within 10 seconds. 3) *Dräger Detector Tube:* Glass detector tubes impregnated with an indicating agent. Reagent produces a colorimetric indication in the presence of a particular gas, vapor, or aerosol. Gross

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NRT Quick Reference Guide: Tabun (GA)

Report any release of WMD to the National Response Center 1-800-424-8802
For References, Please See: "Key References Cited/Used" in National Response Team (NRT) Quick Reference Guides (QRGs) for Chemical Warfare Agents.

Agent Characteristics

Agent Classification: Chemical Warfare Nerve Agent **CAS:** 77-81-6

Description: Colorless to brown liquid; generally odorless, though possibly fruity. GA was manufactured as a warfare agent and is a lethal cholinesterase inhibitor. It has the same mechanism of toxicity as organophosphate insecticides but is much more potent. GA is considered to have moderately low persistence as it is less volatile than GB (sarin), but it is much more volatile than persistent agents, such as VX or HD (sulfur mustard). Liquid GA could be present for hours to days if present in large amounts, or in cold or enclosed environments. Breakdown/hydrolysis in water (especially treated water) is expected. Environmental degradation/breakdown products of GA are relatively nontoxic. However, liquid agent GA reaction with high-pH decon solutions (e.g., household bleach) may produce toxic intermediate products (e.g., cyanide gas). Signs/symptoms of exposure to GA will occur within minutes or hours depending on the dose. Even relatively low dose exposure to GA can be fatal, though immediate administration of an antidote can be lifesaving (see First Aid/Decon below).

Persistence: vapor: minutes to hours; liquid: hours to days depending on amount, temperature, rain or other weather conditions, and type of surface.

Molecular Weight: 162.13 g/mol	**Vapor Density:** 5.63 (air = 1)	**Aqueous Solubility:** 73 g/L 68°F
Volatility: 610 mg/m³ @ 77°F	**Boiling Point:** 446-473°F	**Soluble:** organic solvents
Freezing point: -58°F	**Flashpoint:** 172°F	**Specific Gravity:** 1.08 g/ml @ 77°F
Vapor Pressure: 0.07 mm Hg @ 68°F	**Conversion Factors:** 1ppm = 6.6 mg/m³; °C = 0.56 x (°F – 32)	

Release Scenarios

Air Release: Because it is somewhat volatile, GA is not considered a "persistent" agent. Though less so than GB, GA is a plausible agent of concern for facilities or large outdoor areas. Liquid contaminated surfaces could persist for hours or days in colder environments/areas protected from open weathering.

Water: If released into water, GA would likely degrade from evaporation and hydrolysis, and be further broken down by dissolution and treatment processes such as chlorination. Environmental and hydrolytic degradation products of GA are not significant toxic concerns.

Facility: GA could potentially be dispersed in a building or facility. Decontamination should focus on areas of liquid contamination. Breakdown products of GA are not significant toxic concerns however, liquid GA reaction with high-pH decon solutions may produce cyanide gas.

U.S. Munitions Stockpiles: U.S. munitions stockpiles of G-agent are/have undergone destruction/disposal in Utah, Oregon, Arkansas, Alabama, and Kentucky. State/local plans to address potential releases from Army properties are in place at these sites. These sites provide potential local subject matter experts (SMEs) and pertinent plans (go to *http://www.cma.army.mil/csepp.aspx* for more info).

Health Effects

ONSET	Symptoms are dose dependent and may occur within seconds after exposure to vapors and within minutes or hours from exposure to liquid from.
SIGNS/ SYMPTOMS	**Mild:** Runny nose, reduction in pupil size (miosis), dimness of vision, tightness of chest, difficult breathing. **Moderate:** Increased miosis (to level of pinpointing of pupils), headaches, confusion, drowsiness, nasal congestion, tightness of chest, nausea vomiting diarrhea, cramps, generalized weakness, twitching of large muscle groups. **Severe:** Involuntary defecation and urination, drooling, twitching, staggering, convulsions, cessation of breathing, loss of consciousness, coma, and death.
EXPOSURE ROUTES	**Inhalation:** A primary exposure route; inhalation of very small concentrations can produce effects. **Skin:** Especially toxic from contact with liquid agent; usually moderate to severe localized effects (e.g., sweating) and systemic effects. Effects can also result from absorption of vapors through skin. **Eyes:** Eyes are the most sensitive target organs of nerve agent exposure: miosis (reduction in pupil size) will typically be the first sign of exposure. **Ingestion:** Overall systemic effects.
OTHER	Females appear to be more susceptible to nerve agent effects. Small percentages of general population have genetic traits that may increase susceptibility.

Effect Levels

Air:

Acute Exposure Guideline Levels (AEGLs) (complete definitions are available in *Key References Cited/Used*" in NRT Quick Reference Guides for Chemical Warfare Agents) for general population one-time exposure emergency scenarios for GA:

▼AEGL Level / exposure duration ▶	10 min:	30min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:	0.0069 mg/m³	0.0040 mg/m³	0.0028 mg/m³	0.0014 mg/m³	0.0010 mg/m³
AEGL 2: potentially irreversible effects or impaired ability to escape:	0.087 *	0.050 *	0.035 *	0.017 *	0.013 *
AEGL 3: threshold for severe effects/medical needs/increasing potential for lethality:	0.76 *	0.38 *	0.26 *	0.14 *	0.10 *

Occupational: IDLH = 0.1 mg/m³; STEL = 1.0 x 10^{-4} mg/m³; **Worker Population Limit (WPL)** [an 8-hour time-weighted average occupational value] = 3.0 x 10^{-5} mg/m³

General Population Limit (GPL) [a 24-hour time weighted average lifetime chronic value] = 1.0 x 10^{-6} mg/m³.

Soil: Industrial Exposure Scenario = 68-82 mg/kg; **Residential Exposure Scenario** = 2.8-3.1 mg/kg.

Drinking Water: Although G-agent contamination of large water sources is unlikely, there are military screening levels to determine if smaller, contained water supplies (e.g., water buffalo, tank truck) have been contaminated. Acceptable levels for troops drinking 5-15 L/day of a contaminated supply for 7 days are 4-12 µg/L. This level is a reasonable value to use for the general population since their consumption rate is considerably less.

Personal Safety

SITE-SPECIFIC CONCERNS	Check with the Health and Safety Officer regarding Personal Protective Equipment (PPE), Medical Surveillance, and Safety Plans. Level and type of PPE may vary depending upon the circumstances of the site and the incident. PPE levels below are general recommendations only.
MEDICAL SURVEILLANCE	**Baseline:** Annual physical and respiratory function exams and a baseline cholinesterase activity. **During Incident:** Conduct medical monitoring; use PPE designated by the Health and Safety (H&S) Plan; document PPE levels used; observe for any signs and symptoms and treat accordingly. **Post-Incident:** Monitor for signs/symptoms and treat accordingly.
FIRST AID/ DECON	**Effective Antidote: Atropine and (if more severe) 2-PAM Chloride injections; atropine eye drops. Decon outer PPE with a dilute household bleach solution.** Household bleach is 5% sodium hypochlorite. To create a dilute bleach solution, combine water to household bleach (add 1 part bleach to 9 parts water) yielding a 0.5% sodium hypochlorite solution. USE WARM SOAPY WATER INSTEAD OF DILUTE BLEACH FOR DECON OF BARE SKIN. Liquid agent GA reaction with high-pH solutions, such as undiluted bleach, may produce toxic intermediate products (e.g., cyanide gas), which are much less toxic than liquid agent GA.
PPE	Hazard evaluation responders use NIOSH-approved, chemical, biological, radiological, nuclear (CBRN) self-contained breathing apparatus (SCBA) respirators when the types of inhalation hazards and their concentrations are unknown or expected to be high. The CBRN APR full-face respirator provides a lower level of protection than the SCBA and its use is generally allowed once conditions are understood and exposures are determined to be at lower levels. Outer suit: Tychem F, BR, LV, Responder, TK, or Reflector. Gloves: Butyl Rubber Gloves, M3 and M4 Norton, or Chemical Protective Set. *See: http://www2.dupont.com/Personal_Protection/en_US/assets/downloads/tychem/permguide62004.pdf* During decontamination operations there should also be PPE/respiratory measures to minimize potential exposures to associated chlorine vapors.

Field Detection

Real-time field screening tools (results not confirmatory or quantified): Caution should be given to equipment that has not been properly evaluated. The following is a summary of screening tools procured by most EPA response teams. Other screening tools may be used by other agencies and responders some with similar capabilities and limitations. **Hand-Held:** 1) *APD-2000/(CAM)* and *Improved Chemical Agent Monitor (ICAM):* Hand-held vapor detection devices that identify presence of G-agents at concentrations ≥ 0.1 mg/m³ within 10 seconds. This device is subject to false positives (e.g., perfumes, exhausts, diesel). It can specify type of nerve agent, which is an improvement over previous military monitors that could not distinguish between nerve agents. 2) *AP2C:* A hydrogen flame spectrophotometer that detects phosphorous (contained in G, V agents) and sulfur (contained in HD, V agents). Identifies presence of G-agents at concentrations ≥ 0.03 mg/m³ within 10 seconds. 3) *Dräger Detector Tube:* Glass detector tubes impregnated with an indicating agent. Reagent produces a colorimetric indication in the presence of a particular gas, vapor, or aerosol. Gross levels can be read directly from the discoloration on the tube's printed scale; for confirmatory agent identification the tubes must be sent to an appropriate lab for further analysis. Tubes identify presence

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NRT Quick Reference Guide: VX

Report any release of WMD to the National Response Center 1-800-424-8802
For References, Please See: Key References Cited/Used" in National Response Team (NRT) Quick Reference Guides (QRGs) for Chemical Warfare Agents.

Agent Characteristics

Agent Classification: Chemical Warfare Nerve Agent **CAS:** 50782-69-9

Description: Odorless, oily, yellow/amber colored liquid when pure. VX was developed as a warfare agent and is a lethal cholinesterase inhibitor. It has the same mechanism of toxicity as organophates insecticides but in much more potent—in fact is the most potent of the nerve agents. However, VX has a very low vapor pressure and is difficult to maintain or disperse as vapor in air (unlike nerve agent GB). Liquid VX is relatively persistent on surfaces and can last for days to weeks if in large amounts or in cold environments. Under certain conditions, VX breakdown can result in the presence of compound EA-2192, which is considered almost as equally toxic as VX through ingestion (EA 2192 is a solid and thus not an inhalation hazard). Signs/symptoms of exposure to VX will occur within minutes or hours depending on the dose received. Even extremely low dose exposure to VX can be fatal, though immediate administration of an antidote (see First Aid/Decon below) can be lifesaving.
Persistence; vapor: hours-day; liquid: hours-months depending on amount, temperature, rain or other weather conditions, and type of surface.

Molecular Weight: 267.38 g/mol
Volatility: 10.5 mg/m³ @ 77°F
Freezing Point: < -38 °F
Vapor Pressure: 7 x 10⁻⁴mm Hg @ 77°F
Vapor Density: 9.2 (air = 1)
Boiling Point: 568°F
Flashpoint: 318°F
Conversion Factors: 1ppm= 11 mg/m3; °C = 0.56 x (°F – 32)
Aqueous Solubility: 30g/L @ 77°F
Soluble: organic solvents
Liquid Density: 1.008 g/ml @ 68°F

Release Scenarios

Air Release: VX is very difficult to disperse in air due to low volatility, however it may be possible to disperse VX as a vapor/aerosol plume if an appropriate heat/explosive device is employed. The low volatility of VX would limit the size and extent of plume dissipation (significantly less than what would be expected of G-agents, such as GB). Droplets from a VX plume would likely settle near the initial point of release, posing localized surface hazards. Liquid contaminated surfaces will likely need decontamination due to liquid VX persistence (several days, weeks, or longer especially in colder environments and areas protected from open weathering).
Water: If released into water, VX is expected to degrade from hydrolysis and be further broken down by dissolution and treatment processes, such as chlorination (high pH). Warm temperatures also hasten degradation. During environmental or hydrolytic degradation of VX, the breakdown product EA 2192 may be a potential oral toxic concern.
Facility: Due to its low volatility, VX would be difficult to distribute effectively throughout a building or facility from a point source. Possible localized areas of liquid contamination.
U.S. Munitions Stockpiles: U.S. munitions stockpiles of VX are undergoing destruction in Kentucky, Oregon, Arkansas, Alaberma, Indiana, and Utah. State/local plans to address potential vapor plume releases from Army properties are in place at these sites. These sites provide potential local subject matter experts (SMEs) and pertinent plans (go to *http://www.cma.army.mil/csepp.aspx* for more info).

Health Effects

ONSET	Symptoms are dose dependent and may occur within seconds after exposure to vapors and within minutes or hours from exposure to liquid from.
SIGNS/ SYMPTOMS	**Mild:** Runny nose, reduction in pupil size (miosis), dimness of vision, tightness of chest, difficult breathing. **Moderate:** Increased miosis (to level of pinpointing of pupils), headaches, confusion, drowsiness, nasal congestion, tightness of chest, nausea vomiting diar¬rhea, cramps, generalized weakness, twitching of large muscle groups. **Severe:** Involuntary defecation and urination, drooling, twitching, staggering, convulsions, cessation of breathing, loss of consciousness, coma, and death.
EXPOSURE ROUTES	**Inhalation:** A primary exposure route; inhalation of very small concentrations can produce effects. **Skin:** Especially toxic from contact with liquid agent; usually moderate to severe localized effects (e.g., sweating) and systemic effects. Effects can also result from absorption of vapors through skin. **Eyes:** Eyes are the most sensitive target organs of nerve agent exposure: miosis (reduction in pupil size) will typically be the first sign of exposure. Ingestion: Overall systemic effects.
OTHER	Females appear to be more susceptible to nerve agent effects. Small percentages of general population have genetic traits that may increase susceptibility.

Effect Levels

Air:
Acute Exposure Guideline Levels (AEGLs) (complete definitions are available in *Key* References Cited/Used" in NRT Quick Reference Guides for Chemical Warfare Agents) for general population one-time exposure emergency scenarios for VX:

▼AEGL Level / exposure duration ▶	10 min:	30min:	1 hr:	4 hr:	8 hr:
AEGL 1: threshold mild effects:	0.00057 mg/m³	0.00033 mg/m³	0.00017 mg/m³	0.00010 mg/m³	0.000071 mg/m³
AEGL 2: potentially irreversible effects or impaired ability to escape:	0.0072 *	0.0042 *	0.0029 *	0.0015 *	0.0010 *
AEGL 3: threshold for severe/incapacitating effects, medical needs:	0.029 *	0.015 *	0.010 *	0.0052 *	0.0038 *

Occupational: IDLH= 0.003 mg/m³; STEL= 1.0 x 10⁻² mg/m³; **Worker Population Limit (WPL)** [an 8-hour time-weighted average occupational value] = 1.0 x 10⁻³ mg/m³; **General Population Limit (GPL)** [a 24-hour time weighted average lifetime chronic value] = 6.0 x 10⁻⁷ mg/m³.

Soil: Industrial Exposure Scenario = 1.1-1.2 mg/kg; **Residential Exposure Scenario** = 0.042-0.047 mg/kg.

Drinking Water: Although VX contamination of large water sources is unlikely, there are military screening levels to determine if smaller, contained water supplies (e.g., water buffalo, tank truck) have been contaminated. Acceptable levels for troops drinking 5-15 L/day of a contaminated supply for 7 days are 4-12 µg/L. This level is a reasonable value to use for the general population since their consumption rate is considerably less.

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FIRST AID/ DECON	**Effective Antidote: Atropine and (if more severe) 2-PAM Chloride injections; atropine eye drops.** Decon outer PPE with a dilute household bleach solution. Household bleach is 5% sodium hypochlorite. To create a dilute bleach solution, combine water to household bleach (add 1 part bleach to 9 parts water) yielding a 0.5% sodium hypochlorite solution. USE WARM SOAPY WATER INSTEAD OF DILUTE BLEACH FOR DECON OF BARE SKIN.
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DETECTION & MONITORING EQUIPMENT CAPABILITIES

What equipment can first responders use to detect if a nerve agent is present?

The military has a number of devices to detect nerve agent vapor and liquid. The most portable of the vapor detectors are the M256A1 card or ticket and the Chemical Agent Monitor (CAM). The simplest liquid detectors are the M8 and M9 papers. Direct reading instruments that are available include specialized gas chromatographs (minicams) and ion mobility spectrometers such as the APD 2000. Since some of these detectors cannot adequately detect the agents at safe airborne levels, users should be trained in regards to the use and limitations of the detectors.

Listed below is a table of military detection and monitoring equipment.

Military Detection and Monitoring Equipment

Equipment	Agent	Sensitivity	Time	Cost	Operations/ Maintenance/ Limits	Notes
M-8 Paper	Nerve-G Nerve-VX Mustard-H Liquids only	100-µ drops 100-µ drops 100-µ drops	<=30 sec	$1 per book of 25 sheets	Disposable/ hand-held Dry, undamaged paper has indefinite shelf life	Chemical agent detector paper; 25 sheets/book and 50 booklets/box; potential for false positives.
M-9 Paper	Nerve-G Nerve-VX Mustard-H Liquids only	100-µ drops 100-µ drops 100-µ drops	<=20 sec	$5 per 10-m roll	Disposable/ hand-held 3-year shelf life Carcinogen	Adhesive-backed dispenser roll or books.
M-18A2 Detector Kit	Nerve-GB Nerve-VX Mustard-H, HN, HD, HT Lewisite-L, ED, MD Phosgene-CG Blood-AC Liquid, vapor, aerosol	0.1 mg/m^3 0.1 mg/m^3 0.5 mg/m^3 10.0 mg/m^3 12.0 mg/m^3 8.0 mg/m^3	2—3 min	$360	Disposable tubes Hand-held	25 tests per kit; Detector tubes, detector tickets, and M-8.
M-256A1 Detector Kit	Nerve-G and VX Mustard-HD Lewisite-L Phosgene oxime-CX Blood-AC, CK Vapor or liquid	0.005 mg/m^3 0.02 mg/m^3 2.0 mg/m^3 9.0 mg/m^3 3.0 mg/m^3 8.0 mg/m^3	15 min Series is longer AC--25 min	$140	Disposable/ Hand-held 5-year shelf life	Each kit contains 12 disposable plastic sampler-detectors and M-8 paper.
M-272 Water Test Kit	Nerve-G and VX Mustard-HD Lewisite	0.02 mg/l 2.0 mg/l 2.0 mg/l	7 min 7 min 7 min	$189	Portable/ lightweight 5-year shelf life USN, USMC	Used to test raw or treated water; Type I and II detector tubes, eel enzyme detector

	Hydrogen cyanide	20.0 mg/l	6 min			tickets; Kit conducts 25 tests for each agent.
CAM Chemical Agent Monitor	Nerve-GA, GB, VX Blister-HD and HN Vapor only	0.03 mg/m^3 0.1 mg/m^3	30 sec <=1 min	$7,500	Hand-held/portable battery operated 6—8 hours continuous use. Maintenance required.	Radioactive source. False alarms to perfume, exhaust paint, additives to diesel fuel.
ICAM Improved Chemical Agent Detector	Nerve-G and V Mustard-HD	0.03 mg/m^3 0.1 mg/m^3	10 sec 10 sec	$7,500	4.5 pounds Minimal training	Alarm only; False positives common.
ICAM-APD Improved Chemical Agent Detector--Advanced Point Detector	Nerve-G Nerve-V Mustard-H Lewisite-L	0.1 mg/m^3 0.04 mg/m^3 2.0 mg/m^3 2.0 mg/m^3	30 sec 30 sec 10 sec 10 sec	$15,000	12 pounds including batteries Low maintenance Minimal training	Audible and visual alarm.
ICAD Miniature Chemical Agent Detector	Nerve-G Mustard-HD Lewisite-C Cyanide-AC, CK Phosgene-CG	0.2—0.5 mg/m^3 10 mg/m^3 10 mg/m^3 50 mg/m^3 25 mg/m^3	2 min (30 sec for high levels) 2 min 15 sec	$2,800	8 oz pocket-mounted 4 months service No maintenance Minimal training	Audible and visual alarm; Marines; No radioactivity.
M-90 D1A Chemical Agent Detector	Nerve-G, V Mustard Lewisite Blood Vapor only	0.02 mg/m^3 0.2 mg/m^3 0.8 mg/m^3 N/A	10 sec 10 sec 80 sec	$16,000	15 lb. with battery Radioactive source exempt from licensing. Minimal training	Ion mobility spectroscopy and metal conductivity technology can monitor up to 30 chemicals in parallel. Alarm only.
M-8A1 Alarm Automatic Chemical Agent Alarm	Nerve-GA, GB, GD Nerve-VX Mustard-HD Vapor only	0.2 mg/m^3 0.4 mg/m^3 10 mg/m^3	<=2 min <=2 min <=2 min	$2,555	Vehicle battery operated Maintenance required	Radioactive source (license required); Automatic unattended operation; Remote placement.
MM-1 Mobile Mass Spectrometry Gas Chromatograph	20—30 CWA Vapor	<10 mg/m^2 of surface area	<=45 sec	$300,000 military $100,000 civilian	Heater volatizes surface contaminants.	German "Fuchs" (FOX Recon System/Vehicle)
RSCAAL M-21	Nerve-G Mustard-H Lewisite-L Vapor	90 mg/m^3 2,300 mg/m^3 500 mg/m^3		$110,000	Line-of-sight dependent 10 year shelf life 2-person portable tripod	Passive infrared energy detector 3 miles; Visual/ audible warning from 400 meters
SAW Mini-CAD	Nerve-GB Nerve-GD Mustard-HD Vapor	1.0 mg/m^3 0.12 mg/m^3 0.6 mg/m^3	1 min 1 min 1 min 1 pound No calibration	$5,500	Minimal training Field use	Alarm only; False alarms from gasoline vapor, glass cleaner.

ACADA (XM22)	Nerve-G Mustard-HD Lewisite Vapor	0.1 mg/m^3 2 mg/m^3 --	30 sec 30 sec --	$8,000	Vehicle mounted, battery powered Radioactive source (license required) Minimal training	Audible alarm; Bargraph display--low, high, very high.
Field Mini-CAMs	Nerve-G, V Mustard-H Lewisite-L	<0.0001 mg/m^3 <0.003 mg/m^3 <0.003 mg/m^3	<5 min <5 min <5 min	$34,000	Designed for field industry monitoring (10 lb.) 8 hours training 24 hour/7 day operations	Plug-in modules increase versatility; Threshold lower than AEL.
Viking Spectratrak GC/MS	Nerve-G, V Mustard-HD Many others	<0.0001 mg/m^3 <0.003 mg/m^3	<10 min <10 min	$100,000	Field use, but 85 pounds Needs 120v AC, helium 40 hours training	Lab quality analysis; Library of 62,000 chemical signatures.
HP 6890 GC with flame photometric detector	Nerve-G, V Mustard-HD Many others	<0.0001 mg/m^3 <0.0006 mg/m^3	<10 min <10 min	$50,000	Not designed for field use Gas, air, 220v AC 40 hours training	State-of-the-art gas chromatograph; Used by CWC treaty lab.

Reference from National Research Council's Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response.

ERT Radiation Monitoring Equipment

Type	Detector type	Manuf.	Model	Measures	Instrument	Bar code	Serial	Frequency	Comments
Survey Meter	Sodium iodide (NaI)Tl scintillator	Berkeley Nucleonics	SAM 9352BAGQ	G (filters out Bremsstrahlung /Compton scattering)	Gamma Spectrometer/ Rate Meter/MCA	000698	25776-25195	Monthly inspection/ Annual calibration	On-Scene Coordinator's Readiness Training Program
Survey Meter	Sodium iodide (NaI)Tl scintillator	Berkeley Nucleonics	SAM 9352BAGQ	G (filters out Bremsstrahlung /Compton scattering)	Gamma Spectrometer/ Rate Meter/MCA	828464	26152	Monthly inspection/ Annual calibration	ship back to manufacturer 18Jan08
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013319	8523	Monthly	Added 1/08
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013320	8517	Monthly	Added 1/08.
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013321	8300	Monthly	Added 1/08.
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013322	8526	Monthly 	Added 1/08.
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013323	8563	Monthly	Added 1/08.
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013324	8535	Monthly	Added 1/08.

Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013325	8532	Monthly	Added 1/08.
Air sampler	high volume air sampler	F&J Specialty Products, Inc.	DH-100V.2-30	gross alpha and gross beta activity	N/A	013326	8525	Monthly	Added 1/08.
Air Sampler Calibrator	Digital Venturi Calibrator for air sampler	F&J Specialty Products, Inc.	D-530B	calibrator	N/A	013317	3351	Monthly	Added 1/08.
Air Sampler Calibrator	Digital Venturi Calibrator for air sampler	F&J Specialty Products, Inc.	D-530B	calibrator	N/A	013318	3352	Monthly	Added 1/08.
Detector Probe	Alpha Scintillator	Ludlum	43-90	A	100 cm Alpha Scintillator	000697	PR197303	Monthly	
Detector Probe	Alpha Scintillator	Ludlum	43-90	A	100 cm Alpha Scintillator	000933	PR-204722	Monthly	
Detector Probe	Geiger-Mueller	Ludlum	44-9	A/B/G	Alpha beta gamma survey; Frisking probe	000696	PR200865	Monthly	
Detector Probe	Geiger-Mueller	Ludlum	44-9	A/B/G	Alpha beta gamma survey; Frisking probe	000932	PR-204889	Monthly	
Portal Monitor	Plastic scintillation detector	Ludlum	52-1	A/B/G	Portable Portal Monitor	828634	187630	Monthly inspection/Annual calibration	
Portal Monitor	Plastic scintillation detector	Ludlum	52-1	A/B/G	Portable Portal Monitor	828635	210048	Monthly inspection/Annual calibration	
Scaler	ZnS(Ag) adhered to plastic scintillation material	Ludlum	3030	A/B	Sample Counter	000693	190638	Monthly inspection/Annual calibration	On-Scene Coordinator's Readiness Training Program

Scaler	ZnS(Ag) adhered to plastic scintillation material	Ludlum	2929	A/B	Sample Counter	000734	185274	Monthly inspection/Annual calibration	Shipped back to manufacturer 17Jan08
Survey Meter	End Window G-M Detector/^{3}He Proportional Detector	Ludlum	15	A/B/G/N	Survey Meter	000798	187699	Monthly inspection/Annual calibration	On-Scene Coordinator's Readiness Training Program
Survey Meter	End Window G-M Detector/^{3}He Proportional Detector	Ludlum	15	A/B/G/N	Survey Meter	000799	184458	Monthly inspection/Annual calibration	ship back to manufacturer 18Jan08
Survey Meter	Sodium iodide (NaI)Tl scintillator	Ludlum	19	G/X	Micro-R Meter	000735	187829	Monthly inspection/Annual calibration	ship back to manufacturer 18Jan08
Survey Meter	Sodium iodide (NaI)Tl scintillator	Ludlum	19	G/X	Micro-R Meter	000736	187830	Monthly inspection/Annual calibration	ship back to manufacturer 18Jan08
Survey Meter	Sodium iodide (NaI)Tl scintillator	Ludlum	192	G/X	Micro-R Meter	000694	184855	Monthly inspection/Annual calibration	On-Scene Coordinator's Readiness Training Program
Survey Meter	Compatible w/G-M, proportional, scintillation	Ludlum	2241-2	A/B/G	Digital Scaler, Ratemeter	000695	194170	Monthly inspection/Annual calibration	ship back to manufacturer 22Jan08
Survey Meter	Compatible w/G-M, proportional, scintillation	Ludlum	2241-2	A/B/G	Digital Scaler, Ratemeter	000931	198292	Monthly inspection/Annual calibration	ship back to manufacturer 19Jan08

Detector Probe	Geiger-Mueller	Thermo Eberline	AC37MHV LV	A/B/G	Alpha beta gamma survey; Frisking probe	000833	01179	Monthly	Probe w/ E600 S/N: 02608
Detector Probe	Geiger-Mueller	Thermo Eberline	AC37MHV LV	A/B/G	Alpha beta gamma survey; Frisking probe	000834	00805	Monthly	Probe w/ E600 S/N: 02608
Detector Probe	Geiger-Mueller	Thermo Eberline	AC37MHV LV	A/B/G	Alpha beta gamma survey; Frisking probe	000836	731296	Monthly	Probe w/ E600 S/N: 02608
Detector Probe	Geiger-Mueller	Thermo Eberline	AC37MHV LV	A/B/G	Alpha beta gamma survey; Frisking probe	012170	731300	Monthly	Probe w/ E600 S/N: 02887
Detector Probe	Geiger-Mueller	Thermo Eberline	SHP360	A/B/G	Alpha beta gamma survey; Frisking probe	012171	00878	Monthly	Probe w/ E600 S/N: 02887
Detector Probe	Scintillation detector	Thermo Eberline	SHP380AB	A/B/G	Alpha/Beta Scintillator Internal	012172	1220	Monthly	Probe w/ E600 S/N: 02887
Detector Probe	Plastic Scintillator	Thermo Eberline	SSPA-6	A/B/G	Detector Probe	012481	576	Monthly	Probe w/ E600 S/N: 02887
Detector Probe	Geiger-Mueller (External)	Thermo Eberline	SHP270	A/B/G	Detector Probe	012482	00728	Monthly	Probe w/ E600 S/N: 02887
Ion Chamber	Air Ionization Chamber	Thermo Eberline	RO-20	B/G/X	Ion Chamber	000800	4454	Monthly inspection/Annual calibration	ship back to manufacturer 28Jan08
Ion Chamber	Air Ionization Chamber	Thermo Eberline	RO-20	B/G/X	Ion Chamber	012483	005101	Monthly inspection/Annual calibration	On-Scene Coordinator's Readiness Training Program

Ion Chamber	Air Ionization Chamber	Thermo Eberline	RO-20	B/G/X	Ion Chamber	012484	005103	Monthly inspection/Annual calibration	
Ion Chamber	Air Ionization Chamber	Thermo Eberline	RO-20	B/G/X	Ion Chamber	000830	4576	Monthly inspection/Annual calibration	ship back to manufacturer 28Jan08
Ion Chamber	Air Ionization Chamber	Thermo Eberline	RO-20	B/G/X	Ion Chamber	000831	4586	Monthly inspection/Annual calibration	
Survey Meter	1 to 1.2 million cpm Alpha, Beta, Gamma, X-Ray, Neutron	Thermo Eberline	E600	A/B/G	Rate Meter/Scaler	000835	02608	Monthly inspection/Annual calibration	
Survey Meter	1 to 1.2 million cpm Alpha, Beta, Gamma, X-Ray, Neutron	Thermo Eberline	E600	A/B/G	Rate Meter/Scaler	012169	02887	Monthly inspection/Annual calibration	
Survey Meter	Multi-Channel-Analyzer, PMT, Nal (TI) scintillator	Thermo Eberline	Identifinder CZTHE3	G (filters out Bremsstrahlung/ Compton scattering)	Gamma Spectrometer/Rate Meter/MCA	828523	04F31530	Monthly inspection/Annual calibration	
Survey Meter	Multi-Channel-Analyzer, PMT, Nal (TI) scintillator	Thermo Eberline	Identifinder CZTHE3	G (filters out Bremsstrahlung/ Compton scattering)	Gamma Spectrometer/Rate Meter/MCA	828462	03F31710	Monthly inspection/Annual calibration	ship back to manufacturer 28Jan08

Radioactive Sources

	Type	Manuf.	Isotope	Half-life (y)	Activity= A(0)	Time = (t)	Decay Corrected= A(n)	Barcode	Model Number	Serial
1	Sealed Check Source	Isotope Products	Eu-154	8.59	1.041 uCi	15-Sep-04	0.797 uCi	012164	GF-154-D	1062-57-1
2	Sealed Check Source	Isotope Products	Eu-154	8.59	1.039 uCi	15-Sep-04	0.795 uCi	012165	GF-154-D	1062-57-2
3	Sealed Check Source	Isotope Products	Cs-137	30.17	1.014 uCi	16-Sep-04	0.94 uCi	012167	GF-137-D	1062-59-1
4	Sealed Check Source	Isotope Products	Cs-137	30.17	1.024 uCi	15-Sep-04	0.949 uCi	012168	GF-137-D	1062-59-2
5	Sealed Check Source	Isotope Products	**Co-60**	**5.272**	**0.949 uCi**	**15-Sep-04**	**0.615 uCi**	**012166**	**GF-060-D**	**971-48-3**
6	Sealed Check Source	Spectrum Techniques	Cs-137	30.17	1.0 uCi	Jul-03	0.90 uCi	?	?	?
7	Sealed Check Source	Spectrum Techniques	Cs-137	30.17	1.0 uCi	Jun-04	0.92 uCi	?	?	?
8	Sealed Check Source	Spectrum Techniques	Cs-137	30.17	1.0 uCi	Sep-03	0.90 uCi	?	?	1612
9	Sealed Check Source	Spectrum Techniques	Cs-137	30.17	1.0 uCi	Sep-03	0.90 uCi	?	?	723
10	Sealed Check Source	Thermo Eberline	Sr-Y-90	28.8	0.00192 uCi	22-Jul-03	0.0017 uCi	000817	DNS14	5043-03
11	Sealed Check Source	Thermo Eberline	Th-230	77000	0.00312 uCi	23-Jul-03	0.00312 uCi	000818	DNS4	5044-03

CWA Kits & Equipment

	Item_Description	Manufacturer	Barcode	Model Number	Serial
1	GUARDIAN READER	ALEXETEER	828269	R1000	R1000C06B2201
2	CAM (CHEMICAL AGENT MONITOR)	E.T.& G.	828474	APD2000	3066
3	CAM (CHEMICAL AGENT MONITOR)	E.T.& G.	828475	APD2000	3125
4	CONDUCTIVITY & PH METER	HACH	000852	DR2400	030900002518
5	CONDUCTIVITY & PH METER	HACH	000853	DR2400	030900002514
6	HAZCAT KIT	HAZTECH	000942	KT1009	?
7	HAZCAT KIT	HAZTECH	000943	KT1009	?
8	HAZCAT WMD TEST KIT	HAZTECH SYSTEMS, INC	000944	KT1035	?
9	HAZCAT WMD TEST KIT	HAZTECH SYSTEMS, INC	000945	KT1035	?
10	R.A.P.I.D. SYSTEM	IDAHO TECHNOLOGY	828463	AF0422	AF0422
11	BIO CAPTURE AIR SAMPLER	MESO SYTEM TECH INC.	828521	650	530-001-0037
12	COLLECTIVE CHEMICAL MONITOR	PROENGIN	828491	AP2CE	0518
13	COLLECTIVE CHEMICAL MONITOR	PROENGIN	828492	AP2CE	0524
14	SUBSTANCES SAMPLING SYSTEM	PROENGIN	008157	IF183800	30106611648
15	SUBSTANCES SAMPLING SYSTEM	PROENGIN	008158	IF183800	30106611647