

U.S. EPA Emergency Response Program Chemical & Biological Agents Entry/Egress Guidelines

INTRODUCTION

Key elements in any chemical and biological agent (CBA) site investigation are site entry and egress. Safe and proper entry/egress requires careful and coordinated effort. The focus of these guidelines is entry/egress procedures to and from the Exclusion Zone during CBA incidents.

Purpose

The primary objective of this document is to provide operating guidelines and establish procedures for entry/egress procedures and the initial assessment at CBA incidents. This document includes:

- Pre-planning
- Site safety considerations
- Entry/egress procedures
- On-site operations guidelines
- Decontamination procedures.

This document does not present site-specific procedures, detailed sampling, and site characterization protocols. It describes general guidelines applicable to a variety of CBA incidents.

Scope

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

Assumptions

This SOG assumes that all persons responding to the scene of a chemical agent incident on behalf of the EPA possess the requisite OSHA hazardous material training required by their duty position. These individuals should be trained to achieve individual competencies in 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 guidelines outlined are applicable to all personnel who participate in investigations of sites where CBA 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.

ERTG

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PRE-ENTRY CHECKLIST:	✓
1.0 Initial Response Management	
a. Complete notification procedures.	
b. Mobilize assets.	
c. Establish or integrate into ICS, fill positions as necessary.	
1.1 Initial Site Characterization and Operational Planning	
a. Review 201 Incident Briefing	
b. Gather information about the scene and incident.	
c. Assess hazards, establish site boundaries.	
d. Develop incident objectives, ICS 202	
e. As personnel arrive, expand the ICS as required.	
f. Complete ICS Form 201 (Incident Briefing).	
1.2 Establish Work Zones	
a. Exclusion Zone; identify areas for initial reconnaissance efforts.	
b. Contamination Reduction Zone (CRZ); Contamination Reduction Corridor (CRC), entry/egress points.	
c. Support Zone; incident command post (ICP), staging, MET station, medical monitoring.	
d. Establish site security; request law enforcement support to restrict access to site, if necessary.	
1.3 Operations Section	
a. Develop 215. And review 215A with SO	
b. Haz Mat Entry/Backup.	
c. Decontamination.	
d. Site Access Control, develop 204A for entry Team/Branch/Div	
e. Sample Coordination.	
1.4 Safety Officer	
a. Develop 215A with Ops SC	
b. Conduct Pre-Entry Medical Monitoring (Medical Unit if available)	
1.5 Planning Section	
a. Compile Intel (Situation Unit Leader)	
b. Personnel Check in (Resource Unit Leader, form 211).	
c. Compile Incident Action Plan (Forms 202, 203, 204, 205, 206, 207) if applicable.	
1.6 Logistics Section	
a. Medical Group (206).	
b. Documentation Unit.	
c. Communications Unit (205).	
1.7 Equipment Calibration and Function Checks (OPS to assign) <i>Staging or Logs?</i>	
a. Inspect PPE and check all monitoring and communication equipment is functioning.	
b. Bag or wrap instruments to minimize contamination.	
1.8 Entry Clearance	
a. Obtain clearance from Ops SC and SO. Ensure medical monitoring was completed.	
b. Record entry time/time on air (SO).	
INITIAL ASSESSMENT PROCEDURES:	✓
2.0 Haz Mat Group / Entry	
a. Haz Mat Entry Team	
i. Field check PPE and Monitoring Equipment.	
ii. Identify/assemble needed sampling equipment.	
b. Conduct decon and evacuation briefing	
c. Conduct radio check prior to entry	
d. Conduct final safety briefing (SO)	

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2.1. Decontamination Team	
a. Have Decon line staffed prior to entry team entering Exclusion Zone. Decon personnel may be "off-air," until needed; requires SO approval.	
b. Provide resources to entry teams. Monitor condition of entry personnel during bottle changes & decon.	
c. Decon Team should be equipped with monitoring equipment sensor, to confirm decontamination.	
d. Soapy water and 0.5% bleach solution initially used, until hazard identification requires other.	
e. Monitor radio for situation updates. Adjust decon solution as necessary.	
f. Monitor effectiveness of decon solution. Manage disposal of PPE, decon solution, and IDW. Replenish CRC.	
g. Decon personnel, samples & equipment during egress.	
h. At conclusion of operation, process Decon Team through decon line. CRC prepared for future operations.	
2.2 Backup Team (Minimum of 2)	
a. Monitor radio to receive situation updates.	
b. Backup Team does not assist in decon, Awaits direction for deployment fro SO	
c. May provide relief to decon personnel, who then assume roles on the Backup Team; both teams must be fully staffed at all times during entry operations.	
EGRESS PROCEDURES:	✓
3.0 Sample/Evidence Transfer Procedures	
a. Seal, label, and double bag all samples for decon in re-sealable plastic bags.	
b. Maintain visual custody or transfer sample custody to decon team.	
c. After decon seal sample inside new re-sealable bag and placed by egress control point.	
d. Sampler completes chain of custody, and all necessary documentation.	
e. Samples are transferred to receiving custodian upon signature.	
3.1 Personnel & Technical Decontamination	
a. Refer to appendix, consult tech experts (ERT, ORD, NDT,DOD...) to select decon solution.	
b. Decon Team Leader directs Entry Team through decon sequence.	
c. Remove tape, outer gloves, & boot covers, prior to crossing from Exclusion Zone to CRZ.	
d. Decon personnel, re-useable PPE, SCBAs, packs, & masks, through technical decon.	
e. Verify effectiveness of decon with detection instruments. Contaminated personnel, or equipment must repeat decon process.	
f. After completion of decon, proceed to egress control point for medical monitoring.	
3.2 Equipment Decontamination	
a. Place equipment at pre designated location for potential re-entry or decon.	
b. Technical decon consists of cleaning apparatus (i.e. brushes, sponges, cloths) & 3 immersion bins, containing (warm soapy water, a 0.5 - 5.0% bleach solution, and clean rinse water). Refer to the appendix to select appropriate decontamination solution. (Do NOT! Immerse monitoring equipment)	
c. Proceed with equipment decontamination <ul style="list-style-type: none"> i. See appendix for agent specific solution and contact times; ii. Immerse contaminated equipment. Brush & wipe equipment after each bin; iii. Decon all other equipment by hand; iv. Equipment deemed unsalvageable, may be immersed for decon & and disposal. 	
d. Verify effectiveness of decon with detection instruments. Contaminated equipment must repeat decon process.	
e. Place equipment in transfer area for use by subsequent entry teams.	
3.3 Egress Control Point	
a. Release Entry Team Leader for debrief with Ops SC following medical clearance.	
3.4 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 EMTs, if available.	
c. Individuals identified by medical monitoring team for observation or treatment should be taken to treatment area in the support zone. Personnel undergoing observation must remain in the support zone until released by medical personnel.	

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d. Entry personnel are sent to the debriefing area after medical monitoring is completed and they are medically cleared.	
3.5 Debriefing	
a. Team Leaders review actions conducted in Exclusion Zone with entry team, and collect site documentation from team (logbooks, logs, photo & video equipment) for the Ops SC.	
CONTINGENCY PROCEDURES:	✓
POST-ASSESSMENT INCIDENT COMMAND SYSTEM MANAGEMENT CYCLE:	✓
The procedures and steps outlined above are the initial response and assessment phase of a generic chemical/biological agent 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.	
Initial Unified Command Meeting	
UC Set Incident Objectives	
Tactics Meeting	
Preparation for Planning Meeting	
Planning Meeting	
Incident Action Plan Preparation and Approval	
Operations Briefing	
Execute Plan and Assess Progress	

CHEMICAL INFORMATION

SPECIFIC GRAVITY:

Water = 1, >1 Sink, <1 Float

VAPOR PRESSURE

0 = Rock
25 = Water
250 = Acetone
760 = Gas, 1 ATM
1 mmHg = 1315 ppm

VAPOR DENSITY:

1 = Air, >1 Sink, <1 Rise

MOLECULAR Wt.:

Air = 29, >29 Sink, <29 Rise

PH = <7 Acid, >7 Base

1% in Air = 10,000 PPM

LEL = Lowest concentration in air that burns

FLAMMABLE RANGE = It will burn!

>UEL = too rich to burn

Flash Point = Lowest temp that a liquid gives off vapors to ignite.

NFPA 704 Haz Mat Classification

BLUE - Health Hazard

4-Lethal
3- Extreme Danger
2-Hazardous
1-Slightly Hazardous
0-Normal Material

RED - Fire Hazard / Flash Point

4-Below 73' F Extremely Flammable
3-Below 100' F
2-Below 200' F
1-Above 200' F
0-Will Not Burn

YELLOW – Reactivity

4-May Detonate
3-Shock or Heat may Detonate
2-Violent Chemical Change
1-Unstable if Heated
0-Stable

WHITE – Specific Hazard

OX – Oxidizer

ACID - Acid

ALK - Alkali

COR – Corrosive

W – use NO WATER 

 - Radioactive 

EXPOSURE JARGON

IDLH - Immediately Dangerous to Life and Health - 30-min. exposure, Get Out.

TLV - Threshold Limit Values 8hr Day, 40 hr week

TWA - Time Weighted Average – for 8 Hr. TLV, PEL or up to 10 Hr REL workday and 40-Hr. workweek

REL – Recommended Exposure Limits

PEL – Permissible Exposure Limits (OSHA)

STEL – Short-Term Exposure Limit – Usually 15 Min TWA

$\text{mg/m}^3 = ((\text{ppm})(\text{mol. wt.}))/24.45$ $\text{ppm} = ((\text{mg/m}^3)(24.45))/(\text{mol.wt.})$

COMMAND STEPS

1. Command
2. ID Material
3. ID Hazards
4. PPE
5. Control & Contain
6. Decon
7. Terminate

DOT Hazard Classes

1. Explosives
2. Gasses
3. Flammable Liquids
4. Flammable Solids
5. Oxidizers
6. Poisons
7. Radioactives
8. Corrosives
9. Miscellaneous

Medical Monitoring./Vital Signs Checklist

Name _____ Employee Number: _____

Date: _____ Incident Location: _____

Birth Date: _____ Age: _____

Medications: _____ Allergies: _____

Entry	First		Second		Third	
	Pre	Post	Pre	Post	Pre	Post
Level of PPE (A, B, C, D, amended?)						
Time						
Mental Status						
Weight (lbs.)						
Pulse						
Respirations (<24 per minute)						
Blood Pressure (Systolic / Diastolic)	/	/	/	/	/	/
Temperature (°F)						
TLD Badge						

Pre-Entry Exclusion (per NFPA 471 Chap. 8-3):

1. Pulse > 70% age-predicted heart rate (see table)
2. BP > 105 mm Hg diastolic (lower)
3. °F < 97.0 or > 99.5
4. Respirations > 24/min
5. Questions/Observations:
 - a. Medications within the last 72 hours: _____.
 - b. Alcohol within the last 24 hours: Yes / No
 - c. Symptoms of fever, nausea, vomiting, diarrhea, cough in last 24 hours: Yes / No
 - d. Consumed 8-16 ounces of water or diluted activity drink : Yes / No
6. Other considerations for exclusion: broken skin, altered mental status, heavy alcohol intake in 72 hours or any alcohol in 6 hours, pregnancy, history of heat injury, medication* or conditions that could contribute to dehydration.

*Benadryl, Actifed, and other antihistamines can reduce the ability to sweat—such medications may or may not be the basis for medical exclusion from an entry in PPE

Post-Entry Conditions Requiring Follow-Up and/or Potential Medical Treatment:

1. Post-entry weight loss of > 3%
 2. °F > 101
 3. Pulse > 85% age-predicted heart rate at 10 minutes (see table)
- Nausea, vomiting, altered mental status, or respiratory, cardiac or dermatological complaints

Pre-Entry Pulse	
Age	70%
20-25	140
25-30	136
30-35	132
35-40	128
40-45	125
45-50	122
50-55	119
55-60	116

Post-Entry Pulse	
Age	85%
20-25	170
25-30	165
30-35	160
35-40	155
40-45	152
45-50	148
50-55	144
55-60	141

Chemical Warfare Agent Characteristics and Detection Equipment - EPA Region 10

Physical and Chemical Properties									Region 10 Detection Instrumentation Usage										
AGENT TYPE	Chemical Agent, Symbol & Chemical Structure	Odor	Vapor Density (Air = 1)	Vapor Pressure (mm Hg)	Boiling Point (deg C)	Volatility (mg/m3)	Flash Point (deg. C)	State @ 20 deg. 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(CHN)N(CH3)2	Fruit, none if pure	5.63	0.037 @ 20 deg. C	240	610 @ 25 deg. C	78	Liq. Brown-colorless	X	X	X	X	X	X	X	X*		X**	10.6
Nerve	Sarin (GB) , CH3PO(F)OCH(CH3)2	None	4.86	2.10 @ 20 deg. C	158	22,000 @ 25 deg C	Non flammable	Liquid, colorless	X	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 deg. C	198	3,900 @ 25 deg. C	Non flammable	Liquid, colorless	X	X	X	X	X	X	X	X*		X**	10.6
Nerve	Cyclo-sarin (GF) , CH3PO(F)OC6H11	Musty, peaches	6.2	0.044 @ 20 deg. C	239	438 @ 20 deg. C	94	Liquid	X	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	.0007 @ 20 deg C	298	10.5 @ 25 deg. C	159	Liq. Amber-colorless	X	X	X	X	X*	X	X	X*		X**	10.6
<i>*PID will detect organic and inorganic vapors with an ionization potential less than or equal to that of the PID's lamp.</i>																			
Blister	Distilled Mustard (HD) , (CLCH2CH2)2S	Garlic	5.4	0.072 @ 20 deg C	217	610 @ 20 deg. C	105	(l) yellow-colorless	X	X	X	X	X	X	X	X*		X**	10.6
Blister	Nitrogen Mustard (HN) , N(CH2CH2CL)3	Fishy, soapy	7.1	0.0109 @ 25 deg. C	256	121 @ 25 deg. C	Non flammable	Dark liquid	X	X	X	X	X		X	X*		X**	10.6
Blister	Lewisite (L) , CLCHCHAsCL2	Geraniums	7.1	0.394 @ 20 deg. C	190	4,480 @ 20 deg. C	None	Colorless to Brown	X	X			X		X	X*		X**	10.6
Blister	Phosgene Oxime (CX) , CCL2NOH	Sharp	3.9	13 @ 40 deg. C	54 @ 28 mmHg	1,800 @ 20 deg. C	N/A	Colorless solid/liquid	X	X			X			X*		X**	NA
<i>** FID will detect organic vapors with ionization potentials less than 15.4</i>																			
Blood	Hydrogen Cyanide (AC) , HCN	Bitter Almonds	0.990 @ 20 deg C	612 @ 20 deg C	25.7	1,080,000 @ 25 deg C	0	Colorless gas or liquid		X					X		X		ND
Blood	Cyanogen Chloride (CK) , CNCL	Pungent, biting	2.1	1,000 @ 20 deg C	12.8	2,600,000 @ 20 deg C	None	Colorless gas or liquid		X					X				ND
Blood	Arsine (SA) , AsH3	Mild garlic	2.69	11,100 @ 20 deg C	-62.5	30,900,000 @ 20 deg C	Below detonation temperature	Colorless gas		X					X				10.6
<i>NA = Information Not Available, ND = Not Detectable by PID</i>																			
Choking	Phosgene (CG) , COCl2	New mown hay, grass	3.4	1.173 @ 20 deg C	7.6	4,300,000 @ 7.6 deg C	None	Colorless gas							X				11.7

Biological Agent Characteristics and Detection Equipment - EPA Region 10

Physical and Biological Properties										Detection				References
AGENT TYPE	Agent and Disease State	Dormancy	Stability in Air	Infectious/Incapacitating Dose*	Endpoint without Treatment	Transmissibility	Incubation Period or Time to Symptoms	Natural Reservoir or Source	WMD HazCat	BTA	HazMat ID	DoD Handheld Assay		
Bacteria	<i>Bacillus anthracis</i> , Anthrax	Spore	Very High	8,000 - 50,000 organisms	100% Lethal (Inhalational)	No	2-5 days	Grazing mammals and associated soils	Protein Detection	X	Protein Detection	Performance Classified	Textbook of Military Medicine	
Bacteria	<i>Francisella tularensis</i> , Tularemia	None	Moderate	10-50 organisms	35% Lethal (ulceroglandular)	No	3-5 days	North American ticks, Eurasian water	Protein Detection	X	Protein Detection	Performance Classified	Textbook of Military Medicine	
Bacteria	<i>Yersinia pestis</i> , Pneumonic plague.	None	Probably Low	100-20,000 organisms	100% Lethal (pneumonic)	Yes	2-6 days	Many mammals, especially rodents	Protein Detection	X	Protein Detection	Performance Classified	Textbook of Military Medicine	
Bacteria	<i>Brucella species</i> , Brucellosis	None	Moderate	Unknown	2% Lethal	No	2-8 weeks	Cattle, swine, sheep, goats	Protein Detection	X	Protein Detection	Performance Classified	FM 3-11.9	
Bacteria	<i>Burkholderia species</i> , glanders, melioidosis	None	Melioidosis: Moderate Glanders: Low	Unknown	Glanders 50% Lethal Melioidosis 90% Lethal	Glanders: yes Melioidosis No	10-14 days	Glanders: horses, mules, donkeys Melioidosis: soil and water	Protein Detection		Protein Detection	Performance Classified	FM 3-11.9	
Rickettsia	<i>Rickettsia</i> species, typhus, spotted fever	None	Low	<10 organisms	13-25% Lethal	No	6-15 days	Ticks and arthropods	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Rickettsia	<i>Coxiella burnetii</i> , Q fever	Pseudo spore	High	As low as 1 organism	1-2% Lethal, potential Chronic Q Fever	No	10-20 days	Cattle, sheep, goats	Protein Detection		Protein Detection	Performance Classified	CDC Website	
Virus	Smallpox virus, Smallpox	None	Moderate	Highly infectious	3% vaccinated, 30% unvaccinated	Yes	7-17 days	Eradicated; lab specimens survive	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Virus	Equine encephalidies viruses, Encephalitis	None	Low	1 organism	Low	No	2-6 days	Horses, mules, other mammals	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Virus	Hemorrhagic Fever, <i>Filovirus</i> , Hemorrhagia	None	Low	< 10 organisms	50-90% Lethal	Yes	5-12 days	Unknown	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Virus	Hemorrhagic Fever, <i>Arenavirus</i> , Hemorrhagia	None	Low to Moderate	Unknown	5-30% Lethal	Yes	7-16 days	Rodents	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Virus	Hemorrhagic Fever, <i>Bunyavirus</i> , Hemorrhagia	None	Low to Moderate	Unknown	1-30% Lethal (Blindness 1-10% in Rift Valley Fever)	No	2-16 days, depending upon virus	Rodents, ticks, livestock	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Virus	Hendra virus and Nipah virus	None	Unknown	Unknown	40-60% Lethal	No	3-14 days	Australian bats	Protein Detection		Protein Detection	Performance Classified	CDC Website	
Virus	Herpes B virus, encephalomyelitis	None	Moderate	Unknown	70% Lethal	No	3 days to 4 weeks	Old World monkeys, especially macaques	Protein Detection		Protein Detection	Performance Classified	www.cbwinfo.com	
Toxin	Abrin, systemic poisoning	Not Applicable	High	LD50 0.04 ug/kg	Lethality is Dose Dependent	No	Comparable to Ricin	Rosary Pea plant	Protein Detection		Protein Detection	Performance Classified	Textbook of Military Medicine	
Toxin	Ricin, systemic poisoning	Not Applicable	High	LD50 3-5ug/kg	Lethality is Dose Dependent	No	Rat 12-18 hours	Castor Bean plant	Protein Detection	X	Protein Detection	Performance Classified	NBC Med	
Toxin	T-2 Mycotoxins (and diacetoxyscirpenol) dermal, systemic toxicity	Not Applicable	High	LD50 1200 ug/kg	Lethality is Dose Dependent	No	Immediate irritation with systemic poisoning in hours	Trichothecene Molds				Performance Classified	Textbook of Military Medicine	
Toxin	<i>Staphylococcal enterotoxins</i> , immune hyperresponse	Not Applicable	High	LD50 0.02 ug/kg	Lethality is Dose Dependent	No	3-8 hours	Bacterial toxins of <i>Staphylococcus aureus</i>	Protein Detection	X	Protein Detection	Performance Classified	Textbook of Military Medicine	
Toxin	Saxitoxin, rapid respiratory arrest	Not Applicable	Unknown	LD50 2 ug/kg	Lethality is Dose Dependent	No	Minutes	Marine algae				Performance Classified	Textbook of Military Medicine	
Toxin	<i>Clostridium perfringens</i> , epsilon toxin, enteritis	Not Applicable	High	LD50 0.1 -5.0 ug/kg	Lethality is Dose Dependent	No	8-12 hours	<i>Clostridium perfringens</i> , a soil bacterium	Protein Detection		Protein Detection	Performance Classified	Textbook of Military Medicine	
Toxin	Shiga toxins, hemorrhagia	Not Applicable	Unknown	LD50 0.002 ug/kg	Lethality is Dose Dependent	No	Hours	<i>Shigella</i> species bacteria	Protein Detection		Protein Detection	Performance Classified	Textbook of Military Medicine	
Toxin	Tetrodotoxin, paralysis	Not Applicable	High	LD50 8 ug/kg	Lethality is Dose Dependent	No	20 minutes - 3 hours	Puffer fish, a marine fish				Performance Classified	Textbook of Military Medicine	
Toxin	Conotoxins, paralysis	Not Applicable	Unknown	LD50 5 ug/kg	Lethality is Dose Dependent	No	Immediate	Cone snail, an Australian marine snail	Protein Detection		Protein Detection	Performance Classified	Textbook of Military Medicine	
Toxin	Botulinum toxins, A-E, botulism (flaccid paralysis)	Not Applicable	Moderate	LD50 0.001 ug/kg	Lethality is Dose Dependent	No	24-36 hours (high doses < 12 hrs)	<i>Clostridium botulinum</i> , a soil bacterium	Protein Detection	X	Protein Detection	Performance Classified	JAMA 285(8)	
Fungus	<i>Coccidioides</i> species, Valley fever	Arthro spore	High	Unknown	Most asymptomatic -- minority progress to fatal meningitis	No	1 to 4 weeks	Domestic and wild animals	Protein Detection		Protein Detection	Performance Classified	CDC Website	

Draft Decontamination Solution Matrix - EPA Region 10

<u>Solution Formulation and Characteristics</u>						<u>Typical Decontamination Application</u>								
<u>Solution</u>	<u>Formulation</u>	<u>Mechanism</u>	<u>Cautions</u>	<u>Comments</u>	<u>Contact Time</u>	<u>Chemical</u>			<u>Biological</u>			<u>Radiological</u>		
						Responder	Equipment	Patient	Responder	Equipment	Patient	Responder	Equipment	Patient
Soap/Detergent	Use a ratio of approximately 1 lb. of soap per gallon water	Removal	None	Limited Neutralization	Not applicable	X	X	X	X	X	X	X	X	X
DS2	Use neat, flush with water after 30 min.	Destruction	Flammable, corrosive	Ineffective against spores.	30 min.		X			X				
STB	Chem: slurry of 50 lbs. in 10 gal. water Bio: 6 lbs. in 10 gal. waterBio: 6 lbs. in 10 gal. water	Destruction	Corrosive, oxidizer	Supertropical bleach	30 min.	X	X		X	X				
HTH or HTB	Chem: 5 lbs. to 6 gallons water Bio:1 lb. to 6 gallons water	Destruction	Corrosive, oxidizer	High Test Bleach HT Hypochlorite	15 min.	X	X		X	X				
Bleach	Chem: neat (undiluted) Bio: dilute 1 gallon in 5 gallons water	Destruction/R emoval	Corrosive	Household Bleach	Chem: 5 min., Bio: 15 min.	X	X		X	X		X	X	
Diluted Bleach	Bleach solution diluted at ratio of 1 gallon bleach in 10 gallons water.	Destruction/R emoval	Not for mustard exposure	No open wounds	Not applicable			X			X			X
Caustic Soda or Lye	10 lbs. of sodium or potassium hydroxide in 12 gallons water.	Destruction	Highly corrosive	No Al, Sn, Cu, Zn containers	Undetermined		X			X				
Organic Solvents	Paint remover, gasoline, acetone, kerosine, turpentine, alcohols, etc, used neat.	Removal	Highly flammable	Some bio agents neutralized	Not applicable		X			X				
Complexing Agents	Citrates, versenates, polyphosphates, oxalates in water at ratio of 3-5 lbs. per 12 gal. water.	Removal	No neutralization	Radiological materials only	5-30 min. typical									X
Peracetic Acid	Mix 1 qt. of 40% peracetic acid solution with 3.5 gal. water	Destruction/R emoval	Peracetic acid strong oxidizer	Relatively uncorrosive	10-15 min.	X	X		X	X		X	X	
Sorbents	Fuller's Earth, M291, and many expedients, including soil, sawdust, ashes and rags.	Removal	Only liquid contamination	Little or no neutralization	Not applicable		X			X				
Sodium Carbonate	5lbs. of soda ash, washing soda, sal soda, or laundry soda in 6 gal. water	Destruction	No neutralization of VX, HD		5 min.		X							
Water	Available from many sources	Removal	Large quantities required	Limited Neutralization	Not applicable			X			X			X
Ammonia	Household cleanser used neat	Removal/ Destruction	Do not mix with bleach solutions.	Only G agent neutralized	Slow		X			X				

Note that many decontamination procedures do not allow adequate contact times to achieve destruction during decontamination-- instead, the destructive effect of the decontamination solution ensures that used solution is not a source of secondary spread.
Useful conversions: 1 gallon water = 8.3 lbs.; 1 gal. = 4 qts.; 1 gal. = 8 pts.; 1 gal. = 128 fluid ozs; 1 gal = 3.8 liters..
Reference: FM 3-5 *NBC Decontamination*