

CSEPP RECOVERY WORKGROUP RESPONSE TO
STATE AND LOCAL ISSUES

developed by the

CSEPP Recovery Work Group
for
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NOTE: The following responses represent technical assessments by members of the former CSEPP Reentry/Restoration Subcommittee and the present CSEPP Recovery Work Group. As such, they summarize the Subcommittee's and Work Group's interpretation of the best available data on each subject and are offered in the spirit of information exchange. These responses have not been staffed through DA or FEMA, and should not be interpreted as overall Programmatic policy.

Many of these issues are addressed by two documents provided in the *CSEPP Reentry/Restoration Resource Material "Mini-Library"*; Leffingwell's (1990) "Results of a Workshop Meeting to Discuss Protection of Public Health and Safety During Reentry into Areas Potentially Contaminated with Lethal Chemical Agent (GB, VX, or Mustard Agent)," and Watson and Munro's (1990) *Reentry Planning: The Technical Basis for Offsite Recovery Following Warfare Agent Contamination*. Additional details are provided in other publications contained within the "Mini-Library." Brief responses follow.

1. Should baseline studies for the IRZ, at a minimum, include air, water, soil, animal populations, vegetation, and human populations?

Some concern has been expressed re accurate determination of post-incident agent residues in environmental media that may also contain analytical interferences. There is particular interest in differentiating between (a) residues of organophosphorus nerve agents and commercial organophosphorus insecticides, and (b) naturally occurring arsenic or sulfur compounds (due to area geology or mining history) and arsenic or sulfur residues resulting from Lewisite or sulfur mustard agent degradation, respectively.

There are differences of scientific opinion on this issue. For compounds that are chemically unique, such as the nerve agents, it has been stated by knowledgeable chemists that there is no need to determine baseline concentrations of organophosphorus insecticides in environmental media prior to a release incident. The analytical "signal" (e.g., ion spectra) and carbon-phosphorus (C-P) bonds of nerve agents are not duplicated by any other compound, and would thus eliminate any concern re analytical interference by agricultural pesticides as long as agent-specific analytical methods are employed. Organophosphate nerve agents and their derivatives in environmental media could also, in theory, be rapidly and uniquely identified by means of agent-specific immunoassays. An immunoassay has been developed to test for the presence of agent GB in human body fluids (Hunter et al 1982). The Recovery Work Group understands that immunoassays specific for agents GA, VX, and the sulfur mustard agents in human body fluids are under development at the U.S. Army Medical Research Institute of Chemical Defense. These immunoassays are not yet developed for testing soil, food items, or other environmental media. Immunoassays and other analytical approaches for monitoring agent concentrations in all environmental media (other than air) is a priority objective of

the conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") on unitary agent detection and analytical protocols scheduled for September 20-21, 1994, at the Holiday Inn/Chesapeake House in Aberdeen, MD.

For chemical warfare agents with non-unique "signals," such as the sulfur (S) and arsenic (As) atoms of sulfur mustard and Lewisite, more thinking is needed to determine how useful baseline data would be, the parameters and detection levels of interest, and whether such a pre-assessment is a good use of resources. Baseline determinations of total S and total As in selected environmental media may allow later certification of the sampled area as above or below "clean" pre-existing levels of sulfur or arsenic. Much information on natural concentrations of sulfur and arsenic in soils and water is already available through soil conservation and geological survey records.

The (former) Subcommittee noted that, since there is one atom of S in each molecule of sulfur mustard ($C_4H_8Cl_2S$; i.e., a one-to-one correspondence), total sulfur could be a baseline determination for sulfur mustard agent in environmental media. By the same reasoning, (one-to-one correspondence for As in Lewisite, $C_2H_2AsCl_3$), total arsenic could be a baseline determination for Lewisite in environmental media near TEAD (Only installation where Lewisite is currently stockpiled).

Baseline cholinesterase activity data would need to be gathered for any species under consideration as biomonitors for nerve agents (e.g., livestock such as sheep or cattle. Sheep are the preferred species due to their stable red blood cell cholinesterase profile through time, small size and relative docility). Protocols and guidance developed under Subcommittee oversight are provided in Halbrook et al (1992a, b).

2. What could be the effect of mustard agent on cultivated crops, natural vegetation used for livestock grazing, or other vegetation?

All available experimental data indicate that uptake (translocation) of sulfur mustard into living plant material does not occur, so internal plant tissue content of H/HD/HT does not appear to be an issue of concern. High concentrations on plant surfaces results in plant tissue damage. Grains and fruits, and products made from them, would be affected only if surface contamination occurs.

Sulfur mustard was developed for military use as a persistent "terrain denial" material; thus, at high concentrations of droplet, aerosol or liquid release, persistent surface contamination is a practical concern. Mustard is known to evaporate from grassland more rapidly than from permeable surfaces such as sand. Evaporation (melting point of 13-15°C [55-59°F]) and dissipation appear to be the most significant sources of mustard degradation.

The World Health Organization (WHO) has characterized the persistence of "battlefield concentrations" of liquid sulfur mustard under various weather conditions as follows (Small 1983, as cited in Sage and Howard 1989):

- (1) "12-48 h at 10°C (50°F) with rain and moderate wind,"
- (2) "2-7 d at 15°C (59°F) with sun and light breeze, and"
- (3) "2-8 weeks at -10°C (14°F) with sun, no wind, and snow cover."

These times will vary, depending on the concentration and form in which mustard agent is deposited.

CDC suggests that "Any growing crops thought, on the basis of modeling or other information, to have been exposed to mustard agent at concentrations greater than the 8-hour time weighted average for human workers ($3 \times 10^{-3} \text{ mg/m}^3$) should not be harvested for use as human food. ...If mustard agent is found in or on the crops, the crops should be let stand for 1 year before the land is used. Retesting should be done near the end of that period; the quarantine could then be lifted under most conditions..." (Leffingwell 1990).

In general, sulfur mustard is not taken up or distributed by plants to tissue, fruits or grains.

Any sulfur mustard contamination would be primarily a surface interception or cross-contamination phenomenon.

For additional information, see Leffingwell (1990), and Watson and Munro (1990).

3. **What could be the effect of mustard agent on surface and groundwater quality?**

Military doctrine, as documented in the Army Field Manual 10-52 *Water Supply Point Equipment and Operations* (DA 1991), is that agent HD "is not regarded as a water contaminant" due to its "density...and water insolubility" (pp. 7-16). Again, in FM 10-52 (p. 6-2) "blister agents (mustard and lewisite) are lesser threats [than nerve agents] due to low solubility." These positions are supported by the physical and chemical characteristics known for sulfur mustard:

- * HD is sparingly soluble in water,
- * HT is considered practically insoluble,
- * sulfur mustard agent HD freezes solid at 13-15°C (55-59°F) while agent HT freezes solid at 1°C (34°F) and both agents may become a semisolid or gel at temperatures near the freezing point (such temperatures are found at the bottom of deep still water, such as pools and ponds),
- * sulfur mustard is more dense (specific gravity of 1.27) than water and tends to coalesce on the bottom of water bodies
- * hydrolysis occurs slowly, forming a thin "monolayer," after which reaction rates for the entire volume of agent droplet or mass are negligible (Dacre and Burrows 1988, MSDS, Chapter 5 in Pechura and Rall, 1993).

Dacre and Burrows (1988) further consider than any sulfur mustard ingested in drinking water is most likely to be undissolved. Undissolved mustard in water supplies could only occur if the water intake point were in "turbulent water downstream from a [liquid] mustard discharge" (small globules could remain in the water column and be transported downstream) or if the intake were dropped directly into a body of water containing an undispersed volume of sulfur mustard (cooled into a semisolid mass) on the bottom.

Briefly then, for GROUNDWATER, sulfur mustard would not be a contamination concern unless there has been direct spill or leak into a well or spring. For all practical purposes, it is physically impossible to contaminate wells or springs with sulfur mustard vapor during an atmospheric release. For SURFACE WATER, sulfur mustard contamination COULD be an issue if a spill of liquid agent occurred directly into turbulent surface water; globules of mustard in unaltered form could be transported downstream. In quiet pools, mustard would tend to coalesce and settle out.

Water disinfection to the point of excess chlorination is thought to sufficiently degrade sulfur mustard so as to eliminate the threat of ingestion exposure. Monitoring may still need to be performed to provide assurance.

Additional information can be obtained from Leffingwell (1990), the Agent Fact Sheets, Watson and Munro (1990), and Watson and Griffin (1992).

4. **What could be the effect of mustard agent on livestock and wildlife?**

At appropriate doses, sulfur mustard produces skin blisters and damage to the eyes and respiratory tract. It can be lethal at sufficiently high doses. Depending on the concentration and form in which mustard is released, sources of animal exposure (inhalation, dermal or ingestion) could be: contact with the agent plume, contact or licking of contaminated surfaces, and degassing from fouled objects.

Sulfur mustard is fat-soluble and may be excreted in milk (Note that the former Reentry/Restoration Subcommittee found no data to characterize mustard metabolism in dairy

animals so this hypothesis cannot be confirmed). CDC considers that "If, on the basis of modeling or other information, dairy animals are believed to have been exposed to mustard agent greater than the 8-hour time-weighted average for human workers (3×10^{-3} mg/m³), they should be used only for breeding stock, or they should be destroyed and disposed of in an environmentally sound manner. If dairy animals have been exposed to mustard agent at concentrations less than the 8-hour time-weighted average for human workers, the milk should be tested for the presence of mustard agent and mustard hydrolysates, using the best analytical methods available. The methods should be approved by the FDA and appropriate State authorities. Discard dairy products with elevated concentrations of mustard hydrolysates in an environmentally sound manner. We doubt that dairy products with detectable amounts of mustard agent would be encountered following a release; if they should be, they must be held for disposal by the Army" (Leffingwell 1990).

Additional pertinent material is provided in Sections 2.2 (Livestock and Companion Animals) and 3.4 (Veterinary Diagnosis and Treatment Guidelines) of Watson and Munro (1990).

5. How does one make a determination of "safe" levels of contamination for the above mentioned categories, with further breakout of human population categories based on sex, age, and physical makeup?

To date, agent control limits (ACLs) for public exposure to unitary agents have been established for atmospheric concentrations only; values were recommended by a U.S. Surgeon General's working group (DHHS) after review of pertinent data, and documented in the *Federal Register*, 52FR:48548 (December 22, 1987) and 53FR:8504 (March 15, 1988).

A working group of the (former) Reentry/Restoration Subcommittee developed estimates of no-observed-adverse-effects levels to be considered as agent control limits for water, milk, food crops and soil. The routes of exposure evaluated were ingestion for water, milk, food, crops and soil; and dermal contact for soil only. Adults, infants and toddlers were considered. The analysis, logic and assumptions used to derive this set of working estimates is documented in the Oak Ridge National Laboratory technical memo *Estimated General Population Control Limits for Unitary Agents in Drinking Water, Milk, Soil and Unprocessed Food Items* (ORNL/TM-12035; January 1992), and are further developed in Kistner et al (1992). These estimates were reviewed by the Office of the Army Surgeon General (OTSG) in January, 1993. The OTSG "concur[s] with the basic premise of the document and in general with the methodology used to develop these proposed standards" and suggested that "these standards may need to be reviewed in the future." Further, the OTSG "will continue to monitor these areas in the future as detection technology improves." This document was submitted for review to the National Center for Environmental Health (NCEH) of the Centers for Disease Control and Protection (CDC; DHHS) in November, 1993. In December, 1994, the NCEH concurred in general with the methods used to estimate agent control limits, but suggested development of alternative exposure assumptions. This work is presently underway, with guidance from the NCEH and the U.S. EPA. The (former) Subcommittee's (1992) estimated agent control limits are not currently approved for CSEPP use as decision criteria by any regulatory authority.

Development of dermal contact hazard guidelines for use in deciding when civilian emergency responders should don protective clothing was completed by staff of the Edgewood Research Development and Engineering Center (ERDEC, at Aberdeen Proving Ground, MD) in late September, 1993. The logic, assumptions and derivation are documented in "Validation of Contact Hazard Toxicity Estimates for VX and HD, Phase II", which has been published as an ERDEC report (Reutter et al 1994). At this writing, a companion dermal contact hazard guideline for the general public has not been tasked.

See also response to Q20 below.

6. **Is there any specific guidance on how response agencies will determine that casualties, property, livestock, or vehicles are not contaminated, have been decontaminated effectively, or can be decontaminated effectively?**

Specific guidance on decontamination of injured persons is incorporated into Appendix L "Planning Guidelines for Response Phase Decontamination for the Chemical Stockpile Emergency Preparedness Program" of the *Planning Guidance for the Chemical Stockpile Emergency Preparedness Program* document. Self- and buddy-decontamination is emphasized, and step-by-step procedures are described for prioritizing and decontaminating casualties, needed physical and human resources, and recommended methods of decon certification.

Decontamination of property, livestock, vehicles, etc. has been determined by the Office of the Assistant Secretary of the Army to be sufficiently distinct from decon activities necessary to save lives (see Appendix L, as summarized above) that they should be treated in a different programmatic planning standard. This standard (Appendix M) is currently under review with a working title of "Planning Guidelines for Recovery Phase Activities for the Chemical Stockpile Emergency Preparedness Program." Priorities and specific approaches to dealing with potentially contaminated livestock and companion animals, human remains, drinking water, real and personal property, the general environment, foodstuffs, fodder, feed and crops are provided.

The draft Appendix M underwent peer review at Oak Ridge National Laboratory in December, 1993. The edited draft was reviewed by the Reentry/Restoration Subcommittee Co-Chairs and all current Subcommittee members between January and April, 1994. On June 29, the document was also reviewed by an interagency Review Team; all comments are being incorporated into a final draft scheduled for completion in August, 1994.

See also response to Q7, below.

7. **What could be the effect of mustard agent on buildings, other improvements and personal belongings?**

Since sulfur mustard is a persistent agent (see previous responses to Q2 and Q3 above) and is readily absorbed by porous surfaces, decontamination and monitoring of contaminated or potentially contaminated building surfaces (brick, cinder block, concrete, wood), plastic items, fabrics and leather is problematic. Surface analysis is a developing area of environmental chemistry; the Recovery Work Group is organizing a conference on unitary agent detection and analytical protocols to direct attention to technical resolution of this issue. The conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") is planned for September 20-21, 1994, at the Holiday Inn/Chesapeake House in Aberdeen, MD.

The (former) Subcommittee examined a number of sources to compile existing recommendations for removing or reducing agent contamination on porous surfaces. **All sources recommend initial abandonment of the building or object with later determination of acceptable exposure levels after treatment.** Basic treatment approaches employ either heat, dilution, chemical solutions to denature agent, or a combination thereof. These are summarized in Section 6.0 (Contaminated Buildings and Personal Property) of Watson and Munro (1990) and pp. 4, 5, 8, 9, 10, 11 of Leffingwell (1990).

An experimental measurement protocol for agent contamination on wood, brick, cinder block and gypsum wall board is provided in the "Mini-Library" as *Protocol for Determination of Chemical Warfare Agent Simulant Movement Through Porous Media* (Jenkins et al 1992). Agent simulants were "spiked" on wafers of building materials (brick, cinder block, gypsum wall board, wood), and simulant movement monitored through time. This work is considered an initial protocol for confirmation testing with "live" agent. The (former) Subcommittee recommended that "live" agent confirmation testing be performed.

8. We are conducting "Act Fast" training for our medical community and field response personnel under the assumption that casualties have been decontaminated. What if they have not been?

According to the "Planning Guidelines for Response Phase Decontamination for the Chemical Stockpile Emergency Preparedness Program" (Appendix L) of the *Planning Guidance for the Chemical Stockpile Emergency Preparedness Program* document, certification procedures are required for all individuals processed through decon stations as follows:

"L.6 i. each individual to have undergone decontamination at the station should be marked (e.g., by a casualty tag, hospital bracelet, or by writing directly on the chest or forehead with an indelible marker) with an indication of the specific treatment that was applied to the individual and the time at which decontamination was completed;

j. each individual processed through the station should be provided with a certificate indicating

- (1) a description of the decontamination actions taken,
- (2) the time decontamination was completed,
- (3) the time the individual was released from the observation area, and
- (4) a description of any medical treatment administered in conjunction with decontamination.

Decontamination station personnel should also retain a copy of the certificate."

It is recommended that there be coordination between those responsible for decon station operation and "Act Fast" training to assure that certification procedures are consistent and well understood.

Further, planning standard L.7 states that "emergency medical personnel should be trained, equipped, and clothed to safely decontaminate any injured person suspected of being contaminated before placing the person in the ambulance for transport to a care facility."

9. Is the decontamination process time-critical? Must it be accomplished within a specific short time to be effective? Or is money critical, so that the least expensive option of decontamination is adequate?

Personnel decontamination is extremely time-critical. Available studies (Sidell 1990, Leffingwell 1990, Watson and Munro 1990, Munro et al 1990, U.S. Dept. of the Army 1989) stress that immediate action to remove or neutralize the agent is necessary to minimize adverse health impacts of exposure. The decontamination of exposed people must begin within a very few minutes after exposure if severe injury or death is to be avoided. This time-criticality is why emphasis in the response phase decontamination planning standards is on rapid self- and buddy-decontamination.

Recovery phase decontamination is generally thought to be less time-critical because it is considered to occur after all emergency lifesaving and safety/security measures have been accomplished. Of course, residual contamination may still exist and be a hazard.

Some procedures considered appropriate for disposition of potentially contaminated items during the recovery phase are indeed low cost but effective, and possess the advantage of preventing additional risk of agent exposure to personnel. For example, it has been recommended that agent contamination of fodder, feed, and crops could be disposed of by weathering in place until residual agent degrades to acceptable levels, after which the fodder, etc., could be plowed under. To be effective, it is further recommended that weathering be considered in conjunction with a strict quarantine of the suspect area.

10. Who will monitor for the above-mentioned contamination? (Policy Paper II only references soil, air, and water sampling.)

The (former) Reentry/Restoration Subcommittee considered that these decisions should be jointly developed among the civilian and military authorities involved. The Subcommittee further considered that final decision authority for decisions on all resources outside installation boundaries rests with the appropriate civil jurisdiction. Compliance with all applicable public health laws and regulations is a priority. It is the Subcommittee's position that decision-makers should be sensitive to the need for civilian public health and safety officials to assure food safety and protection of life and property.

During the Spring Valley incident in January, 1993, the U.S. EPA collected field samples and the Department of the Army screened the sampled material for the presence of specific chemical warfare agents. The U.S. EPA provided oversight for, and collaborated in, decisions regarding the sample treatment and analytical protocols employed during the Spring Valley response. It was the (former) Reentry/Restoration Subcommittee's opinion that Army monitoring teams are not generally equipped to monitor vegetation, livestock, wildlife, buildings and structures, and personal property at this time. Agent determination in or on these media is presently performed largely on an as-needed or R&D basis. In the near future, lab certification and analytical procedures for agents in environmental media will be a part of the Chemical Weapons Convention (CWC) compliance. The (former) Reentry/Restoration Subcommittee recommended that these procedures be adopted for CSEPP monitoring purposes. The Department of the Army is currently participating with international laboratories to develop standard methods of analysis to support the CWC; the International Secretariat is to develop standard procedures and certify labs. Surety labs that can receive and process agent-contaminated material are identified in an Appendix of the *Recovery Plan Workbook*.

Identifying best analytical approaches and capabilities for monitoring agent concentrations in all environmental media (other than air) is a priority objective of the conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") on unitary agent detection and analytical protocols scheduled for September 20-21, 1994, at the Holiday Inn/Chesapeake House in Aberdeen, MD.

11. When does monitoring need to be done? How can the oversight team determine that the correct zone is being monitored at the correct time? Isn't this especially applicable to vapor cloud dispersion?

The (former) Reentry/Restoration Subcommittee recommended that monitoring be performed as soon as reasonably possible after the source of the chemical agent is no longer discharging to the environment. A major objective in any monitoring scheme is to determine the boundaries of the contaminated or suspect areas. At present, the first best estimate of the pattern and distribution of agent deposition and for identifying the most appropriate locations to perform field monitoring for deposited agent is provided by the "depletion module" of the Department of the Army's Chemical Hazard Prediction Model (D2PC). This is a "flat-earth" model that can be made more site-specific by consideration of site topographic and vegetation characteristics.

12. Will there be independent verification of the monitoring results? (Policy Paper II only references the possibility of state and/or local personnel accompanying Army sampling and monitoring teams).

There was Reentry/Restoration Subcommittee consensus that the text of CSEPP Policy Paper II does not prohibit independent verification, nor does it prohibit state and local agencies from working side-by-side with DA in the lab or reviewing and certifying sampling and analytical

techniques/procedures to be used by the surety labs designated to process the environmental samples collected. The basic proviso is that all civilians involved receive appropriate training and be outfitted with appropriate personal protective clothing and equipment. The (former) Subcommittee considered that the text of Policy Paper II does not prohibit working things out at the local level.

The (former) Subcommittee recommends that these decisions be made jointly by the civilian and military authorities involved.

13. If there is independent verification of monitoring results, what technical resources will be available and who will pay for the second opinion?

The (former) Subcommittee recommended that these decisions be made jointly by the civilian and military authorities involved. A recent example of the involvement of a civilian authority in Army monitoring at an "off-site" location was the WWI-era munitions dump discovered in a residential neighborhood of Washington D.C. in January, 1993 (the Spring Valley situation). During site evaluation and monitoring, the U.S. EPA collected field samples and the Department of the Army screened the sampled material for the presence of specific chemical warfare agents. The U.S. EPA provided oversight for, and collaborated in, decisions regarding the sample treatment and analytical protocols employed during the Spring Valley response.

Techniques used by Army labs to evaluate samples collected from the Spring Valley site were primarily by means of solvent extraction followed by gas chromatography and/or mass spectrometry. Much of the existing and developmental equipment used or considered for mustard agent determination is summarized in Section 7.0 (Detection capabilities available...) in Watson and Munro (1990). The (former) Subcommittee considered that more methods development is needed, as there are no standard protocols for agent determination in media other than air. This will be a topic at the conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") on unitary agent detection and analytical protocols (September 20-21, 1994, in Aberdeen, MD).

There is no Programmatic policy on payment for a second opinion.

14. What equipment will be used to monitor off-site effects? (Will Desert Storm assets be available, e.g., the "Fox vehicle"?)

Off-site concentrations of agent were evaluated in samples collected from the Spring Valley site primarily by means of solvent extraction followed by gas chromatography and/or mass spectrometry. Much of the existing and developmental equipment used or considered for mustard agent determination is summarized in Section 7.0 (Detection Capabilities Available...) in Watson and Munro (1990) and in an Appendix of the *Recovery Plan Workbook*. The (former) Subcommittee considered that more methods development is needed, as there are no standard protocols for agent determination in media other than air. This will be a topic at the September, 1994, conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") on unitary agent detection and analytical protocols.

The "Fox Vehicle" measures agent concentration in off-gas, and can thus only indirectly determine agent presence in environmental media. The Subcommittee recommended that Fox Vehicles be made available for use at each unitary stockpile installation as the agent incinerator facilities go on line. A policy decision on Fox Vehicle access by CSEPP has not been made.

15. Is there written guidance on protective clothing levels required for the following response personnel categories: a) emergency medical personnel, i.e., field, hospital, shelter; b) hazardous materials responders; c) coroner's representatives; d) fire personnel; and e) law enforcement?

A policy statement on PPE for civilian emergency personnel is under development by Army

and FEMA staff. "Interim Planning Guidelines for Emergency Support Operations for the Chemical Stockpile Emergency Preparedness Program" (Appendix H of the *Planning Guidance for the Chemical Stockpile Emergency Preparedness Program*) addresses PPE for response- and recovery-phase workers, including individuals performing search and rescue, livestock caretaking, accompaniment of off-site Army monitoring teams, and other activities related to response and recovery operations.

Copies of the *Planning Guidance* (including Appendix H) will be available as handouts at the CSEPP National Conference, July 19-21, in Indianapolis, Indiana. This document also mentions procurement procedures, tested and approved respiratory devices, etc.

16. Where can access to recommended protective clothing be obtained? Is there documentation of studies done on protective clothing that is available to local personnel (commercially available)?

Lists of personal protective clothing for use in CSEPP and mention of procurement information, is provided in Attachment 1 to the "Interim Planning Guidelines for Emergency Support Operations for the CSEPP" (Appendix H of the *Planning Guidance for the Chemical Stockpile Emergency Preparedness Program*).

There is some literature on commercial chemical protective clothing in the Reentry/Restoration Subcommittee Mini-Library--a review article by Daugherty et al ("Currently available permeability and breakthrough data characterizing chemical warfare agents and their simulants in civilian protective clothing materials" *J. Haz. Mat.* 30:243; 1992), and experimental results of breakthrough tests performed with swatches of commercial protective clothing spiked with chemical warfare agent simulants (Pal et al "Permeation measurements of chemical agent simulants through protective clothing materials" *J. Haz. Mat.* 33:123; 1993).

17. Are there written copies of the reports on respirator challenges that were conducted? Which cartridges were successful in filtering agent? Is there any specific care different than usual for these cartridges?

The test results were summarized and provided to NIOSH and the CDC as of late December, 1993. It is suggested that requests for written copies of these reports and specific guidance on cartridge care be forwarded to the (former) CSEPP Planning Subcommittee, Laurel Lacy (FEMA) and LTC R. Jackson (Army), Co-chairs.

A brief summary of the GB challenge test results is provided below:

* Four, powered air-purifying respirator designs (Survivair NIOSH # TC-23C-1047, American Optical NIOSH # TC-23C-969, Racal Airstream, Inc. NIOSH # TC-14G-122, Mine Safety Appliances NIOSH # TC-23G-1262) successfully completed agent GB challenge tests.

Guidance on storage, care, maintenance, handling and disposition of the protective clothing and equipment will be provided by the supplier(s). Special care needs to be used to protect the filter cartridge from moisture, and the face unit seal from abrasive material and excess heat.

19. Is there guidance on the training that will be required for our environmental health specialists and hazardous materials responders, both in and out of protective clothing, for their role as oversight for soil sampling and handling procedures conducted by federal personnel?

Development of appropriate training for oversight teams has been tasked to the U.S. Army Defense Ammunition Center and School in Savanna, IL. At this writing (July, 1994), these training materials are undergoing development.

A pilot training on the use of PPE approved and recommended for use by CSEPP response- and recovery-phase workers was held June 27 in Salt Lake City, UT. The CSEPP PPE training materials have been prepared and are currently under review by DA and FEMA.

20. **What is the safe exposure limit to each of the agents for the general population?**

To date, control limits for public exposure to unitary agents have been established for atmospheric concentrations only; values were recommended by a U.S. Surgeon General's Working Group (DHHS) after review of pertinent data, and documented in *Federal Register*, 52:48548 (December 22, 1987) and 53:8504 (March 15, 1988). The limits are presented as a time-weighted average (TWA) over a 72-hour averaging time in units of mg/m³. The U.S. Surgeon General (DHHS) considers these values protective for all members and age classes of the general public. The values are as follows:

H,HD,HT:	1 x 10 ⁻⁴ mg/m ³
GA, GB:	3 x 10 ⁻⁶ mg/m ³
VX:	3 x 10 ⁻⁶ mg/m ³
L:	3 x 10 ⁻³ mg/m ³

The Reentry/Restoration Subcommittee recognized the need to develop parallel estimates for general public ingestion and contact exposure to potentially agent-contaminated food, water, etc. To get technical discussions started on resolving this gap, the Subcommittee used conservative exposure assumptions in estimating a "strawman" set of agent control limits for drinking water, milk, soil, and unprocessed food items (ingestion and contact hazard); these estimated limits are documented in the technical memo *Estimated General Population Control Limits for Unitary Agent in Drinking Water, Milk, Soil, and Unprocessed Food Items* (Watson et al 1992), and are expanded in Kistner et al 1992. Proposed control limits include age-specific estimates for infant consumption of milk and unprocessed produce, and for infant and toddler consumption of soil as a consequence of "mouthing" behavior common to young children. Soil ingestion in children with pica, a pathological condition of non-food ingestion, was also evaluated. These estimated values were reviewed by the Office of the Army Surgeon General in January, 1993. The Army Surgeon General concurred with the basic premise of the analysis and the methodology used to develop the proposed agent control limits. The Army Surgeon General further pointed out that "Especially for carcinogenic agents, these standards may need to be reviewed in the future. We have no recommended changes at the present time to report or to the established air control limits. We will continue to monitor these areas in the future as detection technology improves."

This document was submitted for review to the National Center for Environmental Health of the Centers for Disease Control and Protection (CDC; DHHS) in November, 1993. In December, the NCEH concurred in general with the methods used to estimate agent control limits, but suggested development of alternative exposure assumptions. This work is presently (June, 1994) underway, with guidance from the NCEH and the U.S. EPA. The Subcommittee's estimated agent control limits are not currently approved for CSEPP use as decision criteria by any regulatory authority.

21. **What is the impact of aerosol deposition of agent compared to the liquid and vapor deposition that has been described?**

Liquid spills, splash or droplets will be found near the point of origin due to their size and mass. People off-post are unlikely to encounter liquid agent in the form of spills, splash or droplets. If a chemical release were large enough to pose a threat to the public, the dominant hazard would be from breathing air in which agent exists as a vapor (air movement can disperse volatile agents widely). Aerosolized agent would be fine solid or liquid agent particles suspended in air, usually associated with an energetic release such as an explosion or fire. Depending on their size, aerosols would be expected to be found further away from the source than droplets, but not as far as vapor.

Only liquid forms of agent (including droplet and aerosol forms) pose a risk of significant

personal contamination; vapor is generally not considered a significant source of contamination that poses an immediate threat to human health. Hazardous contamination from a vapor release would likely be limited to materials, such as clothing, which are in contact or very close proximity to the human body, and should be best dealt with during personal decontamination.

22. What training courses should the oversight team have in order to be prepared for responding and reviewing the sampling during the clean up and recovery efforts?

See responses to Q15 and Q19 above.

Note that the (former) Reentry/Restoration Subcommittee recommends that state, local and installation staff with responsibilities and concerns re field sample design and collection, laboratory analytical procedures, and interpretation of results work together to develop mutually acceptable protocols and quality assurance procedures well in advance of any release incident. To this end, the CSEPP Recovery Work Group is organizing a conference on unitary agent detection and analytical protocols. The conference ("Analytical Methods for Environmental Sampling of Chemical Warfare Agents and Their Degradation Products") is planned for September 20-21, 1994, at the Holiday Inn/Chesapeake House in Aberdeen, MD.

23. Where does recovery start and end in the overall process of incident response?

The phases of a chemical event are not distinct. There is no single point in time when all response phase actions terminate and recovery phase actions begin. These actions overlap through much of the event.

The response (acute; emergency, etc.) phase of a chemical event covers the initial action in response to an actual or potential chemical agent release. It covers the actions taken to eliminate the source of the release, lifesaving measures for affected personnel, safety measures for potentially affected personnel, and initial security measures taken to preclude the exposure of additional personnel.

The recovery phase (includes reentry and restoration) is considered to cover the period of time from the end of the response phase until the affected area can be re-occupied without protective equipment, and that there is no short- or long-term health risk to humans present. At the end of the recovery phase, other typical operations (e.g., agriculture, grazing livestock, etc.) can be conducted without any restrictions stemming from the chemical event. Detection, removal and/or decontamination of agent will also have been accomplished, and utilities and services would be re-established to near-normal levels.

However, note that decisions made during the response phase (e.g., abandoning companion animals and livestock during evacuation) may create adverse recovery phase situations such as cross-contamination by stray animals moving through and exiting contaminated areas in search of water and food. These are the kind of situations that could be readily eliminated with advance planning and recognition of the overlap in chemical event phases.

24. What are the requirements for protective clothing for the state coroner? What type of training should he or she have in order to be prepared for contaminated individuals?

See responses to Q15 and Q19 above.

At present, there is no specific programmatic training for civilian personnel who may be involved in handling contaminated human remains. The "Chemical Awareness" training, which provides information on chemical agent characteristics and effects, is recommended for gaining familiarity with the components of the installation unitary agent stockpile.

25. How will human remains be handled? Who is responsible for the processing of bodies?

The draft "Planning Guidelines for Restoration Phase Activities for the CSEPP" (Appendix M of the *CSEPP Planning Guidance*) recommend that state and local plans be developed for the handling and decontamination of human remains. These plans should address the following issues:

- * retrieval of remains and personal effects
- * decontamination of remains
- * monitoring of the decontaminated remains and certification that they have no detectable agent greater than the allowable atmospheric exposure limit for workers (see 53FR 8504)
- * preparation of the remains for transfer by placing them in an approved human remains pouch
- * provision of approved chemical protective clothing, equipment, and procedures for retrieval and decontamination personnel (see "Interim Planning Guidelines for Emergency Support Operations for the CSEPP"; Appendix H of the *CSEPP Planning Guidance*)
- * availability of a crisis intervention team to provide religious and psychological counseling for any personnel handling human remains.

Local and state decontamination plans will need to include provisions and assign personnel and resources to ensure that the removal and decontamination of remains is consistent with all applicable state and local laws, regulations, policies and procedures (e.g., those regarding pronouncement of death, signing of death certificates, identification of remains, forensic investigation of the remains or the site of death, etc.).

Particular attention needs to be paid to establishing certification procedures for agent decontamination with the Department of the Army and individual state medical examiner's offices, as well as to determining who can declare the individual dead (and under what circumstances) (varies according to state law).

Consultation with the USEPA Office of Solid Waste has determined that the EPA excludes human corpses, remains, or personal effects from any medical waste or hazardous waste tracking/disposal requirements [40 CFR 259.30 (b)(1)(u) and 40 CFR 261.4 (b)(1)]. However, states or localities can have stricter regulation or requirements that are broader in scope; these additional requirements are most appropriately identified by state and local emergency planners.

At this point in the review process of the draft "Planning Guidelines for Restoration Phase Activities...", it appears that processing of off-post fatalities is the responsibility of civilian authorities.

26. What is the role of CDC? What is the role of USADACS?

CDC--The Centers for Disease Control and Prevention (CDC) of the U.S. Public Health Service, an organization of the U.S. Department of Health and Human Services. Main offices of the CDC are in Atlanta, Georgia. One of the many "Centers" of the CDC is the National Center for Environmental Health (NCEH), established as a focus for assessment and prevention of environmentally related diseases. Many legislatively mandated programs have been delegated to the NCEH. Mandated responsibilities in Public Law 91-121 and Public Law 91-441 directs the Department of Health and Human Services or its designee to review the Department of Defense (DOD) plans to dispose of or to transport chemical warfare agents. This responsibility has been assigned to the National Center for Environmental Health since 1983.

Additional information on CDC's role can be obtained from Brown, Anderson and Caldwell (1985; "The Public Health Service role in the disposal of chemical munitions" *Public Health Reports* 100:374-378).

USADACS-the U.S. Army Defense Ammunition Center and School in Savanna, Illinois.

USADACS is involved with the development of CSEPP training courses and course materials.

27. **How will claims be handled?**

There is fairly extensive treatment of claims in Appendix L of the CAIRA Manual (DA-PAM 50-6) and Appendix L of the *Recovery Plan Workbook*. This is an ongoing topic of discussion at the Reentry/Restoration Symposia, which are being held in each of CSEPP host areas. Upcoming Symposia are scheduled for Umatilla, OR, in August, 1994; and for Anniston, AL, in November, 1994. Dates for Newport, IN, Richmond, KY, and Aberdeen, MD are pending.

28. **Who will be responsible for authorizing reentry by the general public, i.e., who decides when it is safe to go home?**

The (former) Reentry/Restoration Subcommittee recommended that decisions on food safety, reentry, etc. be made jointly with input from federal, state, and local officials and DA. The (former) Subcommittee further considered that final decision authority for reentry to areas outside installation boundaries rests with the appropriate civil jurisdiction. Compliance with all applicable public health laws and regulations is a priority. Decision-makers should be sensitive to the need for civilian public health and safety officials to assure food safety and protection of life and property.

State and local authorities are to identify which agencies and personnel are responsible for participation in reentry decision-making. Currently, the DA Service Response Force (or Installation Response Force) Commander and staff are considered the principal coordinator(s) in making reentry decisions.

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