EDGEWOOD

CHEMICAL BIOLOGICAL CENTER

U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND

ECBC-SP-022

DECONTAMINATION WORKSHOP FOR EMERGENCY RESPONDING PERSONNEL

"HOW CLEAN IS CLEAN ENOUGH?" 12-14 SEPTEMBER 2007

Gary Eifried

EAI CORPORATION
Abingdon, MD 21009

Michael DeZearn

ENGINEERING DIRECTORATE

September 2008

ABERDEEN PROVING GROUND, MD 21010-5424

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorizing documents.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
XX-09-2008	Final	Sep 2007

4. TITLE AND SUBTITLE
Decontamination Workshop for Emergency Responding Personnel, "How Clean is Clean Enough?", 12-14 September 2007

5a. CONTRACT NUMBER
W911SR-04-D-0014

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Eifried, Gary (EAI); and DeZearn, Michael (ECBC)

5d. PROJECT NUMBER

5e. TASK NUMBER
HLD 014 Task 007

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
EAI Corporation, 1308 Continental Drive, Abingdon, MD 21009
DIR, ECBC, ATTN: AMSRD-ECB-ENK-S, APG, MD, 21010-5424

8. PERFORMING ORGANIZATION REPORT NUMBER
ECBC-SP-022

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Research, Development and Engineering Acquisition Center
E5179 Hoadley Road, APG, MD 21010-5401

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
COR: Susan Hanle, AMSRD-ACC-E, (410) 436-4477

14. ABSTRACT-LIMIT 200 WORDS
The Decontamination Workshop, "How Clean is Clean Enough?" was conducted 12-14 September 2007 at Aberdeen Marriott, Aberdeen MD. The purpose was to determine an acceptable level of decontamination for victims before they can be released from a chemical incident site. Answers to this difficult question will influence ongoing and future decontamination equipment performance standards. The workshop brought together individuals from federal, state, and local agencies so that all pertinent concerns and views could be expressed in an open, neutral, and non-attribution forum. The workshop was hosted by the U.S. Army Edgewood Chemical Biological Center, Engineering Directorate, and Department of Homeland Security (DHS) / National Institutes of Standards and Technology (NIST) Standards Development Team, and was funded by DHS.

15. SUBJECT TERMS
Decontamination Standards Detection Workshop Clean

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Sandra J. Johnson
U	U	U	UL	80	19b. TELEPHONE NUMBER *(include area code)* (410) 436-2914

Blank

PREFACE

The Department of Homeland Security sponsored the production of this material under an Interagency Agreement with the National Institutes of Standards and Technology. The work described in this report was authorized under Contract No. W911SR-04-D-0014, Task No. 007. This work was started and completed in September 2007.

The use of either trade or manufacturers' names in this report does not constitute an official endorsement of any commercial products. This special publication may not be cited for purposes of advertisement.

This report has been approved for public release. Registered users should request additional copies from the Defense Technical Informational Center; unregistered users should direct such requests to the National Technical Information Service.

All individuals handling this information are required to protect it from unauthorized disclosure. This document is a product of the U.S. Government. It is intended for use as a reference by local, state, and federal government agencies in developing equipment performance standards.

Blank

CONTENTS

APPENDIXES

DECONTAMINATION WORKSHOP
FOR EMERGENCY RESPONDING PERSONNEL

"HOW CLEAN IS CLEAN ENOUGH?"
12-14 SEPTEMBER 2007

1. OBJECTIVE

The objective of this workshop was to reach an agreement on how clean individuals must be to be released from a first responder decontamination line. The released individuals must not pose a hazard to themselves or any other persons they may contact. Answering zero is not realistic because one cannot measure zero. Therefore, some measurable amount greater than zero needs to be agreed upon among the first responder and medical communities, with input from relevant subject matter experts (SMEs).

Even if the number cannot be currently measured, that is not a concern of the workshop because this number will become a benchmark for detection device developers. The information will be used in developing one or more consensus standards published by a Standards Development Organization (SDO).

2. ORGANIZATION AND CONDUCT OF THE WORKSHOP

The workshop began with a welcome and introductory presentation by Michael DeZearn, the Workshop Leader. He then stated the objectives of the workshop, and was followed by Gary Eifried presenting an initial scenario, which depicted the release of the chemical warfare agent (CWA) GB (sarin) in a symphony hall. This was followed by a series of presentations by SMEs from the responder community. Copies of the presentations are provided at Appendix A. Attendees are listed at Appendix F, and the workshop agenda is provided at Appendix G.

Participants were then separated into four work groups, which were primarily organized by discipline [federal, medical, and responder (two groups)], with each group also having at least one representative from each of the other disciplines. The objective of the initial breakout session was to determine the five key issues that the workshop needed to address. Each work group then adjourned to breakout rooms to discuss this objective under the guidance of a facilitator. A recorder in each breakout room documented and summarized the results of the discussions. After 1 hr, the work groups reported back to the main room and reported their results to the entire workshop. The summary of the initial breakout session for each work group is documented at Appendix B.

Next, the facilitators and workshop leader collated the results of the initial session and selected the five most frequent or consistent key issues from all of the work

groups. Theoretically, with four work groups selecting five key issues each, there could have been 20 issues to consider. In fact, there were many similar issues across the work groups, which made the task much simpler. After some discussion and analysis, we were able to break the issues down into four general categories:

- *Decontamination Process.* Concerns of the work groups included the difference between handling ambulatory and nonambulatory casualties and the determination of who actually needs to be decontaminated. The need to rapidly initiate decontamination as well as to train responders and potential victims in the process was discussed. The value of the decontamination process from the health and safety perspective, which is to minimize contamination spread, and the psychological benefits of decontamination were considered important. A key concern was the need to standardize and validate the process. This would result in guidelines for responders to follow so the results could be accepted and trusted by all.

- *Decontamination Standard(s).* The groups recognized the need to have objective standards by which to validate the decontamination process. There was discussion on whether there should be a single standard or multiple standards. For example, an individual who underwent mass decontamination and was showing no symptoms might be released under a different standard than someone who was exhibiting symptoms and was being prepared for transport to a hospital. There was discussion regarding existing standards and how they might be applied to the issue. The public trust in the standard selected was considered to be an important factor.

- *Detection Standard(s).* There was general agreement that detection equipment was needed to determine if the decontamination standard had been met. The capabilities of the equipment (sensitivity, selectivity, speed, agents detected), the manner that the results are expressed by the detection devices (go/no go, low to high, concentration), the resources required (personnel, logistics, maintenance), ease of use, training needed, and the costs were all of concern.

- *Detection Concept of Operations (CONOPS).* Regarding detection devices, there were issues related to who would use them, where in the process they would be used, and how many would be required. The potential for a sampling process was discussed, particularly if it could be supported from data resulting from a validated decontamination process.

The issues, as collated and selected by the facilitators and workshop leader, were then briefed back to the entire workshop, and consensus was obtained that these were the issues to be worked on during the remainder of the workshop. These consensus key issues were as follows:

Issue #1: How clean does decontamination need to be? (concept)

Issue #2: How should that be expressed? (numeric)

Issue #3: How should decontamination effectiveness be monitored/detected?

Issue #4: How should the decontamination process/detector effectiveness be validated?

Issue #5: How should information be obtained from user(s) of decontamination and detection equipment?

Participants were reorganized into five work groups, each containing a mix of the disciplines. The remainder of the workshop was devoted to each work group discussing and reporting on the issues as they applied to the baseline (GB) scenario.

3. DISCUSSION OF ISSUES

The results from each discussion issue by work group are provided at Appendix C. A compilation and summary of those results are provided in this section. (In collating the discussions of each issue from each work group, it was apparent that some points made in the discussion of an issue more appropriately applied to another issue. Therefore, some points made are reflected in the analysis of the more related issue.)

3.1 Issue #1: How Clean does Decontamination Need to Be? (Concept)

This issue was one of the key objectives of the conference. The goal was for the work groups to consider the concept of "clean" in terms of releasing a victim from the incident scene or for medical treatment.

3.1.1 Points of Agreement/Dissent

Several important points were made by the work groups.

- We should really be discussing "How clean is safe?" rather than "How clean is clean?" What is considered a safe level of remaining contamination could vary among victims, responders, and receivers (ambulance crews, hospitals, homes). Some felt it might be necessary to establish one level of "safe" for release from the incident site and another for entry into a hospital.

- There are three types of victims: nonambulatory and symptomatic, ambulatory and symptomatic, and non-symptomatic. The first group may be contaminated, the second exposed but not contaminated, and the third group probably neither exposed nor contaminated. It was recognized that this analysis would depend on the agent; therefore, the only viable alternative is to offer the opportunity to disrobe and process through water wash down at the scene.

- The need to offer symptomatic victims more intensive decontamination than non-symptomatic victims was recognized. However, initial resources on scene may preclude more than a gross decontamination with water until resources become available for more robust decontamination procedures.

- Early recognition of the incident and type of agent, primarily using signs and symptoms, drives successful decontamination. The first response must be gross decontamination consisting of water wash down due to the rapid action of the CWAs. A decontamination triage process (priority) needs to be established to result in the most good to the most people. As more becomes known about the agent used, the decontamination process needs to be adjusted to account for the agent properties. The criticality of other injuries (trauma) must also be considered in establishing decontamination priority.

- It is probably not feasible to check every person as they emerge from the decontamination line. If we have a validated decontamination process, with known results if that process is followed, confirmation sampling of the resulting level of decontamination should be sufficient. One group used the analogy of baking brownies. Once the recipe is developed (the task of the researchers), the cook (emergency responder) only needs to follow it to get prefect brownies. Similarly, if the validated decontamination procedure is followed, the results are assured to be "safe enough" in the field.

- The assumption is that in any terrorism incident, the majority of those ambulatory personnel exhibiting symptoms will have had inhalation exposure. Those who are nonambulatory could also be contaminated with liquid. Exposure of the skin to liquid agent would be minimal.

- It was recognized that many people will bypass decontamination or refuse to undress, with the result that they will leave the scene or self-report "dirty" to a medical facility.

3.1.2 Research Needed

There was unanimous consensus that not enough is known about the actual effectiveness of current mass or technical decontamination processes and what various levels of contamination remaining on either victims or responders mean in terms of further effects, spread of contamination, and impact on the response. For example, if dealing with a vapor, would removing the outer layer of clothing (without water wash down) be sufficient for most victims? Could high-volume air be substituted for water? If a person self-refers to a Medical Treatment Facility (MTF), can we assume that disrobing is sufficient? Is it possible to develop specific site clearance criteria? (also see Issue #4.)

3.1.3 Other Discussion Points

- Low-cost field detectors to identify every possible agent do not exist with current technology.

- Communication with MTFs to preclude the spread of contamination is important.

- Guidance and procedures regarding where and how to hold victims awaiting decontamination need to be developed.

- Standards for later decontamination of facilities and equipment also need to be addressed.

3.2 Issue #2: How Should that (the Safe Decontamination Level) Be Expressed? (Numeric)

Once the concept of what is "clean" was discussed, the workshop needed to address the issue in more concrete, measurable terms.

3.2.1 Points of Agreement/Dissent

There was some concern over the request to express the safe decontamination level numerically. Following discussion, it was agreed that the issue should be addressed as written, without necessarily considering the numeric value if the work group was uneasy with that concept. Therefore, some work groups addressed the issue numerically, and some did not.

Key discussions follow:

- The Acute Exposure Guideline Levels (AEGLs) provided in Appendix D were considered as a valid basis for determining decontamination safety levels. [Note: Acute Exposure Guideline Levels are intended to describe the risk to humans, resulting from a once-in-a-lifetime, or rare exposure to airborne chemicals. The National Advisory Committee (NAC) for AEGLs is developing these guidelines to help national and local authorities, as well as private companies, deal with emergencies involving spills or other catastrophic exposures.] Proposed guidelines for other media, such as water and soil, are provided at Appendix E for information; however, these guidelines were not discussed during the workshop.

- While the AEGL-1 level [initial level above which discomfort (minor transient reversible effects) begins to be noted] was considered by some groups to be a desirable goal. The group recognized that achieving and confirming this level may not be possible in an actual situation. The AEGL-2 level (the level where more obvious effects that potentially impact functional abilities or ability to escape begin and may result in delayed recovery) was felt to be more easily detectable, either by observation

of symptoms or by current instrumentation. A level between current AEGL-2 and AEGL-1 may be more realistic as an interim goal for decontamination and improved detection equipment. There was general agreement that the desired decontamination level should be no higher than the level of reversible effects.

- First responders in particular felt that although a numeric decontamination standard could be established by scientists and the medical community, it might be impractical to confirm in the field and certainly not with existing technology. The alternative suggested is to develop, validate the effectiveness of, and follow a "best practice" decontamination process (or processes) and confirm adequacy on scene by some visual means (e.g., wet hair, clothing removed, symptoms lacking). One group suggested developing a Personal Digital Assistant (PDA) - based algorithm that considers symptoms (and time to symptoms), agent, dissemination method, percent of those involved exhibiting symptoms, weather, and other appropriate factors. This information could be analyzed and presented in a format that would serve as a tool in determining the level of threat and lethality and deciding the need for and extent of protective gear and decontamination.

- Some responders stated that there should be no detectable contamination on equipment that is returned to duty.

- The standard selected (numeric or procedural) needs to be justifiable to the public and trusted by them.

- Knowledge of concentration and a numeric standard was considered necessary for making appropriate decisions regarding Personnel Protective Equipment (PPE), as well as for determining the efficacy of decontamination and detection instruments during testing and validation.

3.2.2 Research Needed (Same as Paragraph 3.1 2)

- Evaluation of the risk to others (responders, receivers, family members) from persons released from a decontamination site with (potentially) some acceptable level of contamination remaining.

- Determination and promulgation of guidelines by which the level of initial contamination of an individual might be estimated based on symptoms and how this estimate could be used to determine the appropriate decontamination method and intensity to achieve the desired AEGL.

3.2.3 Other Discussion Points

- Media should be enlisted to provide the facts regarding the incident, what signs and symptoms to look for, what actions an individual can take to mitigate exposure, procedures for sheltering, and the safety levels afforded by decontamination.

- The Technical Support Working Group (TSWG) has developed the *Best Practices and Guidelines for Mass Personnel Decontamination*. Any best practice doctrine developed for first responders needs to incorporate the considerations in that document.

- Exposed or contaminated persons who have been effectively decontaminated may still develop or continue to exhibit symptoms post decontamination. Decontamination is not medical treatment.

3.3 Issue #3: How to Monitor/Detect Decontamination Effectiveness

This issue flows from the first two. Given a standard for cleanliness following decontamination, how can we determine that the standard is being met during an actual situation?

3.3.1 Points of Agreement/Dissent

A number of ideas for monitoring and detecting decontamination effectiveness were presented. These include the following:

- Instrumentation. The groups described the desired features of a detection instrument in a variety of ways; but, each group pictured a portable instrument that would be easy to operate, would require minimal (if any) maintenance, would act rapidly, would have a reachback feature, and would have a sensitivity (equal to or lower than the established decontamination standard) to the threat agents. One group stated that detectors need to match the sensitivity to all agents that the M256A1 Chemical Agent Detector Kit has to nerve agents, be usable as quickly as the APD 2000, and have a reliability that does not exist today. Ideally, a single detector will detect all of the potential threat chemicals. Another group, recognizing the difficulty of developing a device that has all the desirable features, somewhat facetiously described the desired detector as the Star Trek "Tricorder."

- Use of materials that provide a color change reaction in the presence of toxic chemicals was another suggestion by one group.

- As in the discussion of Issues #1 and #2, the need for a system of sampling for the thoroughness of decontamination, rather than a 100% check of ambulatory victims, was emphasized. However, it was felt that nonambulatory victims require a 100% check after decontamination.

- The use of decontamination "police" (inspectors) was discussed. Part of their task would be to confirm the efficacy of decontamination by sampling victims entering and exiting the decontamination line to ensure that the contamination level is actually being reduced. They would also check victims' hair and bodies for signs (e.g., wetness), screen for symptoms, and ensure that decontamination appeared to be thorough.

3.3.2 Research Needed

A review of current field detection sensitivities against AEGL-1 standards shows that current detection technologies need to improve by a factor of about 10 to meet an AEGL-1 level. Laboratory-based systems can meet the standard today. Therefore, it would appear that the development of a field instrument with current lab-instrument sensitivities is a challenging but achievable goal.

Research is also needed on where and how best to perform sampling. For example, would sampling the air in a thorough decontamination tent (following mass decontamination) be used to validate the efficacy of the mass decontamination process? Could sampling runoff water provide some information? Where on a person's body should sampling be concentrated?

3.3.3 Other Discussion Points

- Systems for handling personal effects during and following the decontamination process are important to public acceptance of the process.

- Monitoring needs to be conducted at the end of the decontamination line and, periodically, in the Cold Zone.

- Use of a "buddy system" by victims while awaiting, undergoing, and following decontamination was also recommended.

3.4 Issue #4: How to Validate Decontamination Process/Detector Effectiveness

This issue supports the first three issues and answers concerns that, today, we really do not know how effective the emergency decontamination processes we have developed are. We essentially "do what we can and hope for the best." Better information on how best to perform effective decontamination is sorely needed.

3.4.1 Points of Agreement/Dissent

- Credibility of the test is vital. Development and validation of the appropriate test methods need to be accomplished by independent testing laboratories, with government input as required, to ensure credibility.

- Adequate test design is critical. A realistic threat agent, quantity, and delivery system must be incorporated into the test, and the right evaluation questions must be asked. Responders and representatives of the community need to be part of the test design process and included in the test. The decontamination process and the associated detection and monitoring procedures, and instrumentation, need to be validated as a system.

- Once a decontamination process is validated through testing and guidelines are published, training must be accomplished and the decontamination units tested to ensure compliance. Following actual events where the process was used, an evaluation of the use and effectiveness of the protocols in an actual situation needs to be conducted.

- The TSWG *Best Practices and Guidelines for Mass Personnel Decontamination* could serve as the starting point of any decontamination guidelines developed.

3.4.2 Research Needed

Testing needs to be conducted in phases: laboratory, small group, and large group. Laboratory testing is used to develop and evaluate each step in the process. Small group testing tests the ability to effectively implement each step in an operational environment, and large group testing validates the effectiveness and operational suitability of the decontamination system as a whole.

Testing needs to be conducted under various environmental conditions. Various methods (e.g., water wash, high-volume air, use of swimming pools) should be evaluated.

The test and validation program envisioned by the workshop groups is a multi-year, multi-phased program. The funding requirement should be incorporated into programmatic documents now.

3.4.3 Other Discussion Points

- It was recognized that some testing needs to be done with simulants, and some needs to be done with actual agents. If simulants are used, they must mimic the appropriate property of the actual agent. For example, if evaluating decontamination with water in a test involving people, the simulant should have a solubility and volatility similar to that of the actual agent, while being harmless to the test subjects. Conversely, actual agents should be used on simulated people (e.g., robotic manikins) performing realistic tasks.

- The list of agents needs to be defined for this purpose. There are several lists circulating among government agencies, each with some differences from the others (for valid reasons, depending on the purposes of the lists).

3.5 Issue #5: User(s) of Decontamination and Detection Equipment and Information from Them

This final issue supports the development of CONOPS for the decontamination and detection equipment, which in turn drive the technical requirements.

3.5.1 Points of Agreement/Dissent

- A listing of users of the decontamination and detection systems follows:
    - Decontamination personnel (to confirm adequacy of decontamination)
    - EMS personnel
    - Other designated responders
    - Hazardous Materials (HAZMAT) specialists (concentration, identification)
    - Hospital support personnel

There was some discussion and dissent regarding levels of training and users of equipment. Some participants in one group felt that instruments are best used by specialized teams, while others felt that the use of detectors should be a task common to all responders. Responders agreed that the shift in National Fire Protection Association (NFPA) 472 toward allowing operations level responders to perform decontamination tasks was a move in the right direction.

- The work groups indicated *many* users of the *information* from decontamination and detection systems, including but not limited to the following:
    - Persons being decontaminated
    - First responders, medical personnel, and the HAZMAT team
    - Incident Commanders
    - Public information officials
    - Hospitals and hospital networks
    - Process stakeholders (inventors, designers, vendors, testers, and the community at large)
    - Community leaders and politicians
    - The media
    - The perpetrators (an operational security issue)

- The public
- The law enforcement and judicial community (evidence)
- Other government agencies [US Environmental Protection Agency (EPA), Central Intelligence Agency (CIA), Health and Human Services (HHS), Federal Emergency Management Agency (FEMA), Centers for Disease Control and Prevention (CDC), etc.]

The information required was situation dependent. For example, while knowledge of the agent concentration was necessary for some users, only the identification of the agent was necessary for others.

3.5.2 Research Needed

Information availability, adequacy, and flow should be included in the validation testing proposed in Issue #4.

3.5.3 Other Discussion Points

- There are some operational security, moral, and ethical issues related to dissemination of information from the incident.
- Maintaining proficiency on and maintenance of equipment seldom used poses a real problem for response units.
- There is a need for a national education drive to inform the public about how to respond if Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive (CBRNE) materials are used, as has been done in Israel for many years.
- The need for establishment of common terms for decontamination and detection was recognized and strongly recommended by workshop participants.

3.6 Discussion of Alternate Scenarios

Following presentation of the reports on the last issue, Gary Eifried facilitated a discussion of the impact that other agents would have on the results of the workshop so far. The basic scenario did not change. Only the agent used did.

3.6.1 Impact of Alternate Agent, VX (Persistent Nerve Agent)

The workshop recognized that the greater persistency and lower water solubility of VX would make it more difficult to remove by water wash down alone. Also, its lower volatility would make it more difficult to detect with a vapor detector. Because skin exposures from liquid are slower to cause symptoms than inhalation exposures,

symptoms of nerve agent exposure might not be as apparent during the initial size-up at the scene, which could delay recognition of the problem and implementation of the appropriate actions. The potential for spread of contamination beyond the incident site would be higher for this scenario.

3.6.2 Impact of Alternate Agent, HD (Blister Agent)

A similar situation was deemed to exist with the blister agent HD. Its higher persistency and lower water solubility require more thorough decontamination measures; but, the probable lack of immediate symptoms would make this need difficult to recognize initially. The VX and HD scenarios made it clear that the decontamination process needs to be as robust as we can make it initially. Decontamination intensity can be adjusted as the identification of the agent is determined. The lack of an antidote and the potential for long-term effects also impact the medical care situation for blister agents.

3.6.3 Impact of Alternate Agent, Chlorine (Volatile Toxic Industrial Chemical)

The fact that chlorine will cause immediate irritation makes this incident easy to recognize. Chlorine's volatility also makes it relatively easy to decontaminate. Many thought that removal of the clothes and keeping victims upwind might be all that is necessary for decontamination of all but a few who were very close to the release and might be helped with water wash down. The insidious nature of lethal pulmonary (choking) agent exposures would require more medical observation and education of victims regarding symptoms to watch for before individuals are released from the scene.

4. CONCLUSIONS

4.1 Decontamination

A robust and flexible decontamination process needs to be developed and *validated through technical and operational testing,* and guidelines need to be provided to the emergency response community. The guidelines should detail the most effective "best practices" for decontamination of a variety of toxic agents under different environmental conditions, considering the realities of the situation and the resources likely to be available during the first hour of the response.

(Editor's Note: The TSWG has developed the Best Practices and Guidelines for Mass Personnel Decontamination. Any best practice doctrine developed for first responders needs to incorporate the considerations in that document.)

Workshop participants envisioned several levels of decontamination (terms for these levels vary by jurisdiction and agency and need to be standardized):

- Mass Decontamination. Primarily for ambulatory victims using equipment immediately available on the first arriving units. This first stage will likely

consist of disrobing, followed by water wash down. This level will decrease subsequent exposure from any liquids on the skin or clothing or vapor trapped in the clothing or hair. It will reduce the spread of contamination or vapors from off-gassing and will be of psychological benefit to those who feel they may have been exposed. It will likely *not* remove all contamination from the victims; but, *if done properly, this stage* has the potential to bring the decontamination down to a level at which any residual effects or exposures will be minimal. The AEGL-2 (8 hr) may be an appropriate standard for this level.

- Thorough Decontamination. This is a more deliberate process, requiring more equipment, including tents, shower systems, water heaters, decontaminants (soap, enzymes, etc.), and many more decontamination personnel to implement. It may begin functioning toward the later part of the first hour of the incident response. Although it may not remove all contamination, this process should bring it to a level where there is no further nonreversible risk to the victims or those coming in contact with them. This level is likely necessary for victims being transported or received in hospitals (nonambulatory and ambulatory victims exhibiting symptoms). This is due to their potential higher level of initial liquid contamination and the potential for a buildup of vapors released from multiple victims in a closed environment (e.g., an ambulance or a hospital emergency room. The AEGL-1 (8 hr) may be an appropriate standard for this level. As time and resources permit, ambulatory, non-symptomatic persons who have been through mass decontamination may also be given the opportunity to pass through thorough decontamination.

- Technical Decontamination. The detailed process for decontamination and removal of PPE for responders who are in some level of protective clothing typically used during a HAZMAT response. It is usually not as time-driven as mass or thorough decontamination, but by law and necessity will be established before response personnel enter the Hot Zone. Therefore, it is likely to be established early in the response, even before the thorough decontamination line is functioning. The AEGL-1 (8 hr) may be an appropriate standard for this level of decontamination.

4.2 Detection

Detection starts with the observation of signs and symptoms in victims and analysis of what is happening at the scene. A good scene size-up may result in a great deal of information about the probability that a toxic agent was used, its type [nerve, blood, pulmonary (choking), etc.], the likely effectiveness of the dissemination, whether the risk is primarily respiratory or skin exposure, the type and extent of decontamination needed, the possibility for spread of contamination, protective equipment requirements, appropriate medical treatment, and other aspects. A PDA-based decision support system would be very helpful to Incident Command in arriving at many of these conclusions. Detection and identification instruments and devices would be used to confirm the presence of the material suspected from scene size-up and would ideally provide its identification (e.g., GB, VX, HD, chlorine, etc.) and current concentration in the air. This information would support (or modify) earlier conclusions and decisions

concerning decontamination, medical treatment, protective equipment needed, degree and extent of the hazard, and future actions. Detection devices and instrumentation can also be used in determining the adequacy and effectiveness of the decontamination process being used.

If the decontamination system being used is validated (through the testing described below) and adhered to by those conducting the decontamination process, it should be possible to apply the principles of statistical process control to monitor actual effectiveness through sampling rather than attempting to conduct 100% checks of all decontaminated victims. This will significantly reduce the resources and time required to process masses of individuals. However, the system and procedures for this sampling process remain to be determined.

The ideal detection devices and instruments from the perspective of responders are handheld, rugged, intuitive to operate, maintenance free, and fast acting; have a low false-alarm rate; and provide information in a simple and understandable format. Specific chemical identification and indication of current concentration are important for making decontamination, protection equipment, and medical support decisions. High sensitivity is important for monitoring decontamination effectiveness. Because it is important to know that an individual has reached a safe level of contamination, the instrument must be able to detect *below* that safe level. Therefore, given the conclusions regarding safe decontamination levels in Section 3.1, instruments need to be able to detect agent levels below AEGL-1.

Although this level of sensitivity is considered to be within the realm of being possible, it should be considered a desirable goal rather than an absolute one. Any improvement over the capabilities of current technology would be beneficial. An instrument, which is five or eight times as sensitive as current instruments, would not meet the sensitivity goals described, but would certainly be more useful than current instruments.

4.3 Validation Testing

Although many mass and thorough decontamination procedures have been developed and practiced throughout the country, very little, if any, confirmation testing has been done to validate them. While they intuitively appear to be useful in reducing the level of contamination, rigorous scientific tests to confirm this have not been conducted. We think mass decontamination has benefits, but we do not know how much. We really have no idea how clean the victims are when they remove their clothes and run through the decontamination shower created by the side-by-side discharge of two fire engines. While several systems for decontamination of nonambulatory victims have been developed, equipment has been purchased, and procedures have been practiced, we do not know if this is adequate or if some additional steps need to be taken.

Rigorous test and evaluation of mass and thorough decontamination procedures need to be conducted to determine "best practices" and the expected results if these are followed. Empirical testing will provide validated, replicable procedures and processes that can in and of themselves assure effective decontamination even in the absence of adequate field detection capability. This will foster more effective decontamination. In fact, this type testing may result in fewer, rather than more resources being required by avoiding duplication of decontamination efforts on the scene and at hospital reception areas.

5. RECOMMENDATIONS

- Develop and document "best practices" for effective decontamination under a variety of environmental conditions and scenarios.

- Consider an AEGL-2 (8 hr) level of airborne detectable agent as the goal for adequate mass decontamination.

- Consider an AEGL-1 (8 hr) level of airborne detectable agent as the goal for adequate thorough and technical decontamination.

- Work to develop field detection and identification systems that meet the criteria described in Section 3.2 and the international standard American Society for Testing and Materials (ASTM) E2411-07, *Standard Specification for Chemical Warfare Vapor Detector (CWVD)*. It is desirable that systems used to confirm decontamination sufficiency have a sensitivity below the agent concentrations recommended in AEGL-2 and AEGL-1.

- Fund and conduct rigorous test and evaluation of the decontamination processes and the detection and identification equipment to document effectiveness as a system.

Blank

APPENDIX A

PRESENTATIONS

RDECOM

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

"How Clean is Clean Enough"

Michael B. DeZearn

12 September 2007

unclassified

Administrative Information

- Location of Rest Rooms
- Location of Business Center
- Breaks
- Lunch
- Emergency Contact Information

unclassified

Ground Rules

- Not for attribution
- Non-rank
- Treat each other with respect
- All ideas are on the table – though some may have to be put into parking lot

unclassified

Ground Rules cont.

- Identify yourself when speaking
- Avoid Acronyms
- Turn off or place on vibrate cell phones, etc.
- No Smoking in the Building

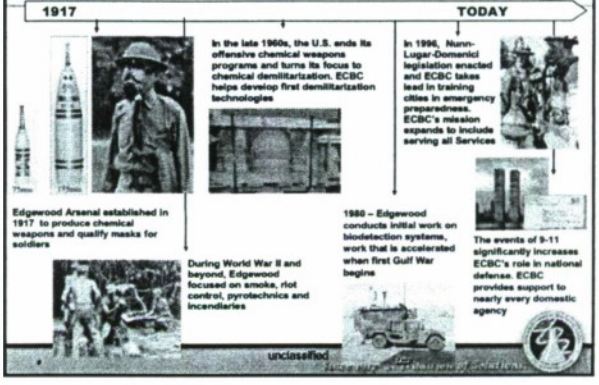
unclassified

9 May 2007

Edgewood Chemical Biological Center Overview

unclassified

Edgewood History



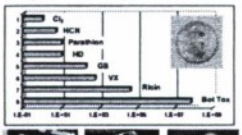
unclassified

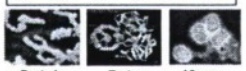
Edgewood Chemical Biological Center

Scientists working in ECBC's Biological Safety Level 3 Laboratory

Chemical specialists sample agent found in Albania

- **Primary DoD technical organization for non-medical CB defense**
- **Support over the entire lifecycle:** Basic research through technology development, engineering design, equipment evaluation, production support, sustainment, field operations, and disposal





Mission
Provide integrated science, technology and engineering solutions to address chemical and biological vulnerabilities

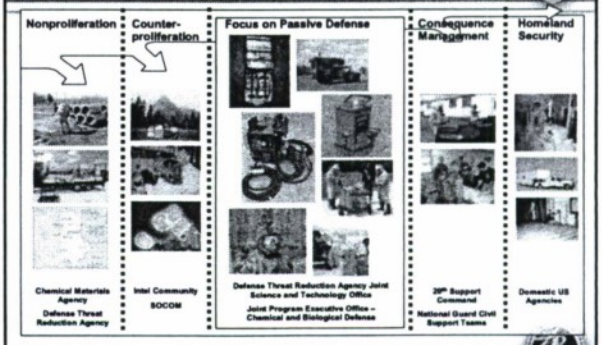
Vision
The premier national resource for chemical and biological solutions

Core Competence
Working with chemical and biological agents at all stages of the materiel lifecycle

Detection · Protection · Decontamination

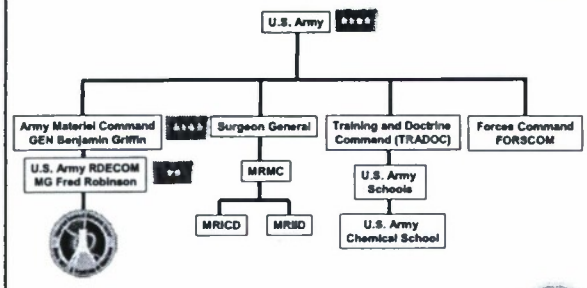
unclassified

ECBC Mission



unclassified

Where ECBC Fits



unclassified

ECBC Leadership

Distribution X

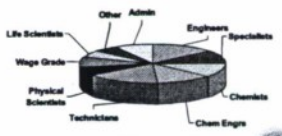
unclassified

CB Expertise Across the Lifecycle

- Chemistry and Bioscience of CB Warfare
- Inhalation Toxicology
- Aerosol Physics
- Filtration Sciences
- Agent Spectroscopy/Algorithm Development
- CB Testing & Evaluation
- CB Materiel Acquisition
- Agent Handling and Surety
- Chemical Munitions Field Operations

Extensive breadth and depth of "hands on" expertise across lifecycle

- 270 staff in Chemical Personnel Reliability Program
- 179 staff in Biological Personnel Reliability Program or in process of qualifying



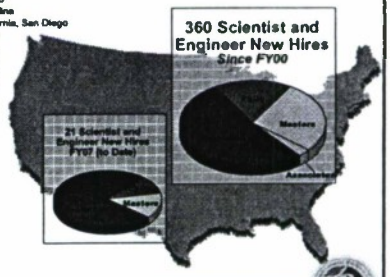
1,500+ staff

unclassified

Refresh Intellectual Capital

New hire PhDs from:

Brown Univ
California Coast Univ
Clarkson College
Florida State University
Foreign Sch
Johns Hopkins Univ
McMaster Univ
Mississippi State Univ
Ohio State Univ (3)
Penn State Univ (3)
Purdue Univ
Rutgers Univ
Stony Brook University
SUNY Upstate Medical Univ
Tulane University (2)
Univ of Arizona
Univ of Buenos Aires
Univ of California, Berkley
Univ of Delaware
Univ of Georgia
Univ of Maryland (6)
Univ of Maryland Medical Center
Univ of New Mexico
Univ of North Carolina
University of California, San Diego
Univ of Tennessee
Univ of Utah
Univ of Virginia (2)
Univ of Wisconsin
Univ of Wyoming
Virginia Tech
Yale Univ



unclassified

Advanced Planning and Initiatives Directorate

Essential Processes

- Operations management
  - Business processes
  - Technology transfer
  - Facilities and logistics
  - Information management
    - Communications
    - Outreach
    - Technical library
    - Chemical and Biological Information Analysis Center (CBIAC)
- Strategic planning and decision analysis
- Foreign Affairs Office

unclassified

Research and Technology Directorate

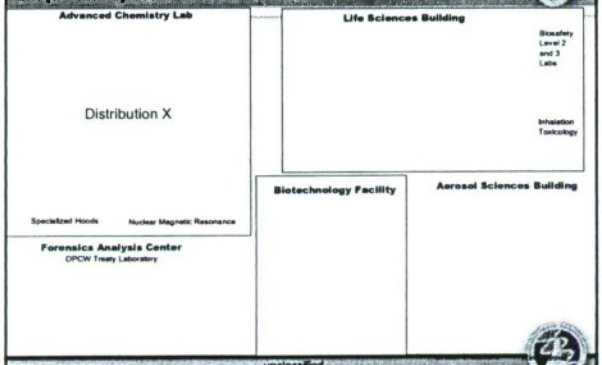
Basic and Applied Research

- Laboratory for chemical and biological defense research, technology and related services
  - Executes the Department of Defense's chemical and biological technology development programs in detection, individual and collective protection, and decontamination
  - Conducts fundamental CB science
  - Provides subject matter expertise in CB science and technology
- Critical capabilities
  - Chemistry and Bioscienca of chemical and biological warfare agents
  - Inhalation Toxicology
  - Aerosol Physics
  - Filtration Sciences
  - Agent Spectroscopy / Algorithm Development

unclassified

Research and Technology Directorate

Unique and Specialized Infrastructure



unclassified

Engineering Directorate

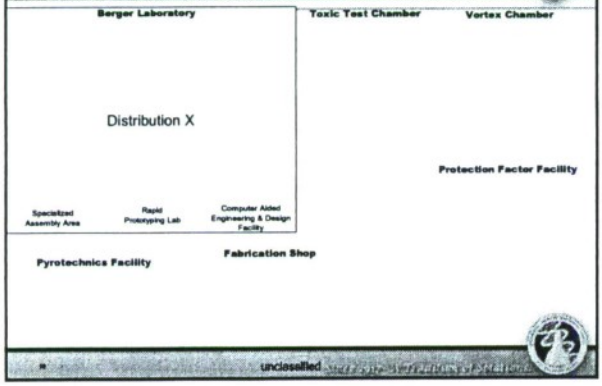
Acquisition and Test and Evaluation

- Design, engineering, fabrication, and acquisition support and sustainment
  - Pull technology forward to development
  - Production support and equipment sustainment:
    - Detectors
    - Individual and collective protection equipment
    - Decontamination solution and application equipment
  - Acquisition expertise
  - Lifecycle engineering and continuous improvement
  - Evaluation of developmental equipment, items in production and commercial-off-the-shelf products
- Critical capabilities
  - Chemical and biological materiel acquisition
  - Chemical and biological test and evaluation

unclassified

Engineering Directorate

Unique and Specialized Infrastructure



unclassified

Why Are We Here?

- First responders have to be able to verifiably decontaminate persons so that
  - The persons ere not a hazard to themselves
  - The persons are not a hazard to the responders
  - The persons are not a hazard to medical personnel
  - The persons are not a hazard to the community

unclassified

Why Are We Here?

- Medical facilities need to verifiably decontaminate self-referred persons
  - The persons are not a hazard to themselves
  - The persons are not e hazard to medical personnet
  - The persons ere not a hazard to the community

How to Answer the Questions

- Scenario as a straw-man
- Break-out Groups
- Plenary Sessions
- Workshop Report

In Summary

- We Are Here Because:
  - Response Community needs e set of verifiable criteria to be able to state that personnel have been adequately decontaminated after e chemical event
  - The decontamination methods need to be flexible enough to allow persons who have been exposed to gases, vepors, liquids, end viscous liquids to be decontaminated, monitored, and released for further treetment

QUESTIONS?

Contact Information:

Michael DeZeam

A Decade of Support to Homeland Security
Decades of Support to Non-proliferation
90 Years in CB Defense for the Warfighter

Baseline Scenario

Gary Eifried
EAI Corporation

ECBC Decontamination Workshop

Scenario

Distribution X

ECBC Decontamination Workshop

The Attack

Distribution X

ECBC Decontamination Workshop

The Venue

Distribution X

ECBC Decontamination Workshop

The Venue (continued)

- Distribution X

ECBC Decontamination Workshop

The Result

- Distribution X

ECBC Decontamination Workshop

The Result (continued)

- Distribution X

ECBC Decontamination Workshop

The Response

- Distribution X

ECBC Decontamination Workshop

Focus

Even though this event would stress many facets of the city's emergency response, please remember:

The purpose of this workshop is to discuss how clean personnel (both victims and first responders) need to be when they are released from the incident site (or treatment facility for those that make it to a hospital).

ECBC Decontamination Workshop

Focus

Other discussion topics which could affect the emergency response are beyond the scope of this workshop and will be immediately tabled by the facilitator so the discussions remain focused on the issues surrounding personnel decontamination.

ECBC Decontamination Workshop

Alternate Scenarios

- Once issues for this scenario have been addressed, may have time to address impact of a different agent.

ECBC Decontamination Workshop

Questions? Comments?

ECBC Decontamination Workshop

Firefighter/Hazmat View of Decontamination

George Griffin, Battalion Chief (ret.)
MS Public Safety
BS Fire Science
BS Management

Personal Introduction

- Philadelphia Fire Department
  - 35 years of service, retired following 15 years as Battalion Chief
  - Fire Service Instructor
    - incoming recruits WMD training
    - developed WMD department-wide refresher training
    - Chief officer IC training for WMD response
- Domestic preparedness
  - training exercises in 40+ cities since 1996
- US Department of State
  - WMD training in middle eastern countries
- US military installations worldwide
  - WMD training
- FEMA
  - US&R Program Office

Battalion Chief's Aide

Fire/Hazmat's Roles in Emergency Mass Decontamination

Fire

- Consists of engines and ladders
- Response time:
  - 4 minutes
- Responsibilities:
  - emergency decon of victims
- Primary concerns:
  - personnel protection
  - recognize need for additional resources
  - signs and symptoms

Hazmat

- Dedicated Hazmat unit
- Response time:
  - depends on location of unit
  - jurisdiction/region
- Responsibilities:
  - definitive decon
- Primary concerns:
  - extent of contamination
  - type of agent
  - hazard mitigation

ECBC Decontamination Workshop

Location of Decontamination Areas

In the Warm Zone

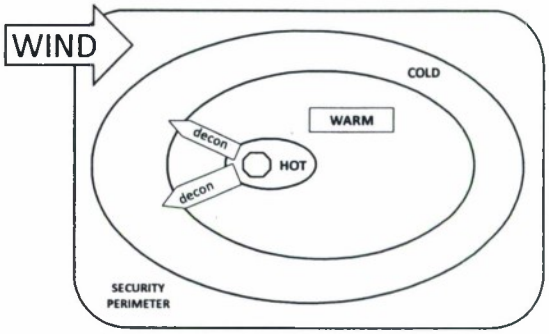
Fire

- Upwind, Upgrade
- Multiple lanes
- Water
  - large Volume, low pressure

Hazmat

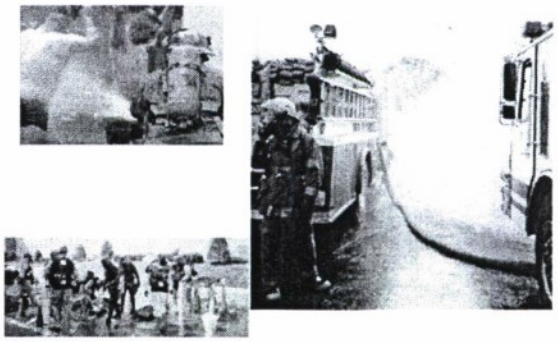
- Upwind, Upgrade
- Dedicated decon area
- Agency Hazmat protocols

ECBC Decontamination Workshop

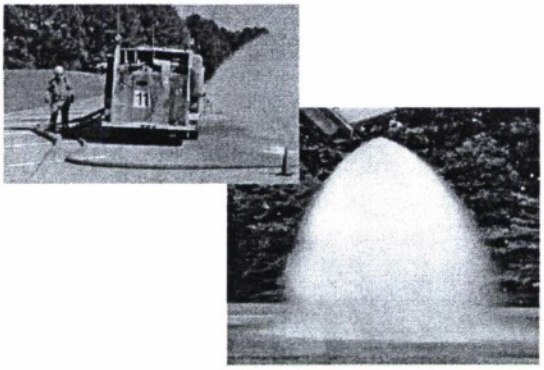


ECBC Decontamination Workshop

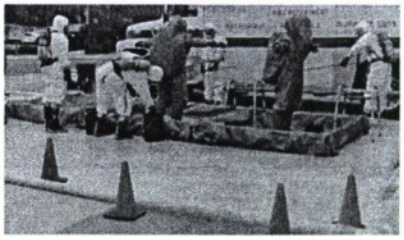
ECBC Decontamination Workshop



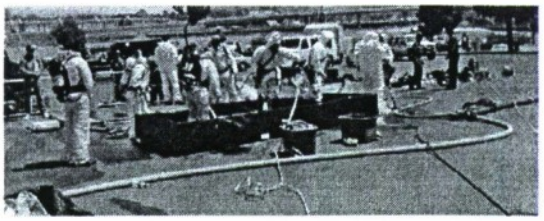
ECBC Decontamination Workshop



ECBC Decontamination Workshop



ECBC Decontamination Workshop



ECBC Decontamination Workshop

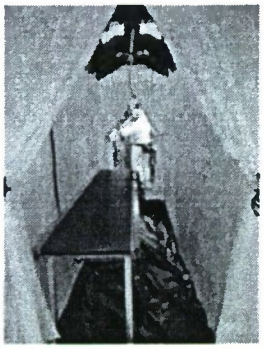
Decontamination Considerations

- Shelter of victims
  - hypothermia
  - modesty
- Zone adjustment
- Additional support
- Integration of EMS support
- Rescue and casualty extrication
- Decon priorities
  - ambulatory
  - non-ambulatory

ECBC Decontamination Workshop

ECBC Decontamination Workshop

ECBC Decontamination Workshop



ECBC Decontamination Workshop

Existing Jurisdictional Standards

- Municipalities
  - usually follow OSHA regarding hazardous material responses
- Agencies develop their own protocols in anticipation of CBRNE responses

ECBC Decontamination Workshop

Emergency Decontamination Process

- First responding fire units
  - hand lines and master streams
- Multiple lanes
  - number of victims
  - direction of exit
- Timeframes
  - ambulatory: 60 – 70 victims /hr /line
  - non-ambulatory: 15 victims /hr /line

ECBC Decontamination Workshop

Emergency Decontamination Process (cont.)

- Contamination monitoring
  - initial inability to assess cleanliness of victims
    - signs and symptoms
  - need instrumentation (Hazmat unit)

ECBC Decontamination Workshop

Decon Process Concerns

- Operating downwind of the release
- Victim control
  - limited manpower
- Evidence preservation/collection

ECBC Decontamination Workshop

Recommendations

- Knowledge of the agent
  - Communication center to convey information
    - multiple victims, signs and symptoms
- Logistics
  - available decon space, apparatus staging
- Crowd control support
- Adequate manpower
- Monitoring capability

ECBC Decontamination Workshop

Questions? Comments?

ECBC Decontamination Workshop

Decontamination

Law Enforcement Perspective

Richard Elliott

Law Enforcement Mission

- Provide a safe environment for the other responders and the public at large
- Safely assist with an efficient and effective response to the event
- Evidence preservation and collection
- Get the bad guy or gal
- Go home afterwards

Limits to Law Enforcement Response

- Insufficient or nonexistent PPE for Decon Support
- Knowledge Level of LE Personnel regarding CBRNs

Law Enforcement Support of a Decon Operation

- Are they equipped?
- Are they trained?
- Are they willing?

Options for Force Protection in the Decon Operation

- Hope for the best
- Rely on personnel doing decon to keep order
- Train and equip LE personnel to do it

LE Concerns Event

- How bad is this stuff?
- Am I going to die?
- What is a safe distance?

ECBC Decontamination Workshop

LE Concerns Decon

- Do I need to be deconned?
- Why?
- Why do I have to strip?
- You are not getting my gun!

ECBC Decontamination Workshop

Post Decon

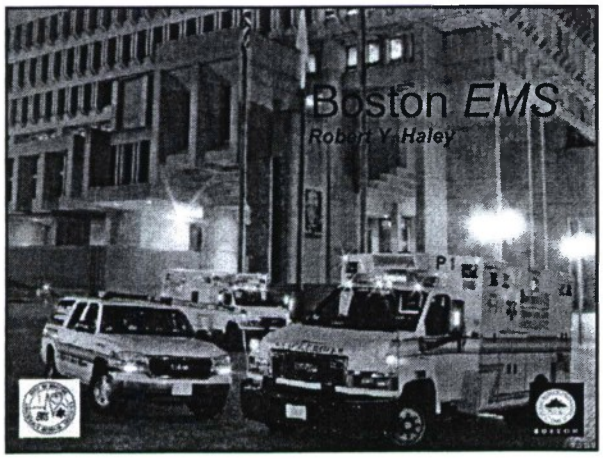
- Patient Identification
- Patient Interviews
- Patient Containment
- How clean is clean?

ECBC Decontamination Workshop

Questions? Comments?

Reminder: Always remember rule #1

ECBC Decontamination Workshop



ECBC Decontamination Workshop

More than "Just A Ride To The Hospital"

- Additional Areas of Responsibility
  - Special Operations Unit
  - Special Events Office
  - Boston MMRS
  - NDMS Boston DMAT MA-1
  - NDMS IMSuRT East
  - Surge Planning
  - Disaster Planning
  - DelValle Institute for Emergency Preperedness

ECBC Decontamination Workshop

Hazmat & Decon Training

All field personnel trained to the Hazmat Technician level through the DelValle Institute for Emergency Preparedness, Boston EMS

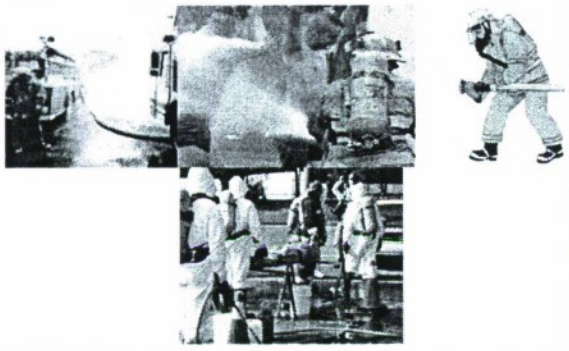
- **Employs two full time Hazmat personnel**
- **Offers free Hazmat and Decon training to health care and public safety partners throughout Metro Boston**

ECBC Decontamination Workshop

Mass Decon Units

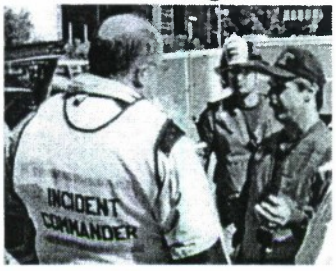
- Hospitals throughout Metro Boston have MDUs assigned to their facilities as part of an agreement with the Fire Department, which will facilitate unit deployment during an event
- Critical to Hospital Safety
- Important to incorporate into plans
  - Successful integration in DNC
  - Avoiding Tokyo

Decontamination Issues



ECBC Decontamination Workshop

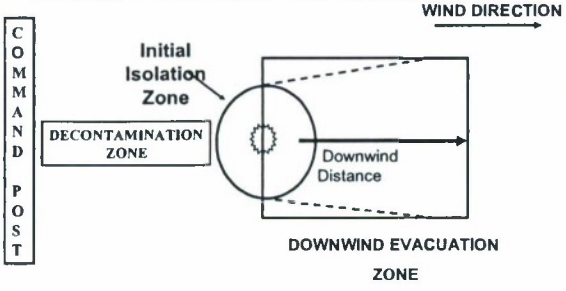
Incident Management



Incident Command Controls
Decontamination & Patient Transport

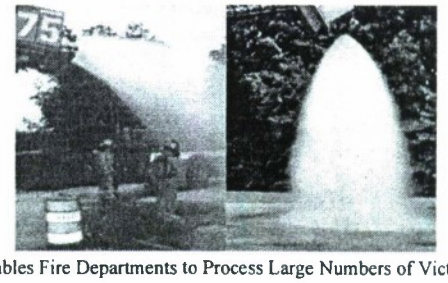
ECBC Decontamination Workshop

Decontamination Zone Setup



ECBC Decontamination Workshop

RAM – Rapid Access Mass Decontamination



Enables Fire Departments to Process Large Numbers of Victims

ECBC Decontamination Workshop

Additional Decontamination Required

Victims Move Through Too Quickly
Still Contaminated After Processing

ECBC Decontamination Workshop

Mass Decontamination Units [MDU]

MDU May Not Decontaminate Victims Enough for
Medical Transport & Treatment

ECBC Decontamination Workshop

Medical Treatment

Contaminated Victims May Need Treatment
Prior to Decontamination & Transport
Responders Lacking Protection Are At Risk

ECBC Decontamination Workshop

Barriers Prevent Contamination Migration

Set up Contamination Reduction Corridor in Cold Zone

ECBC Decontamination Workshop

Decon Can Be Set Up Outdoors or In Buildings

Wash or Decon Stations Can Vary With Each Hazardous Contaminant

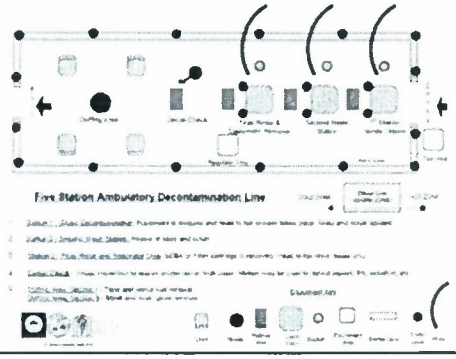
ECBC Decontamination Workshop

Ambulatory and Non-ambulatory Decontamination Stations

Berming Tarp Edges Prevent Contaminated Fluid Runoff

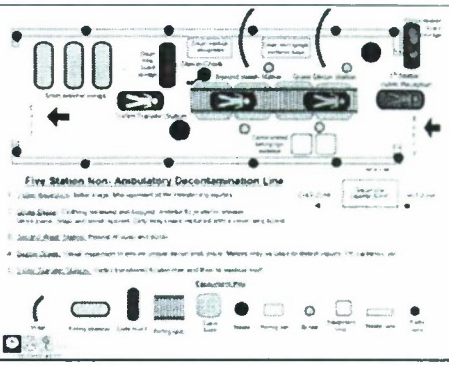
ECBC Decontamination Workshop

Ambulatory Decon



ECBC Decontamination Workshop

Non-Ambulatory Decon



ECBC Decontamination Workshop

Decon-Team Medical Surveillance

Each Team Member to Be Dressed Is Checked

ECBC Decontamination Workshop

Donning Protective Suits & Patient Decon Training

Putting On Suits, Warming Instruments, Setting Up Decon
"15 Minutes"

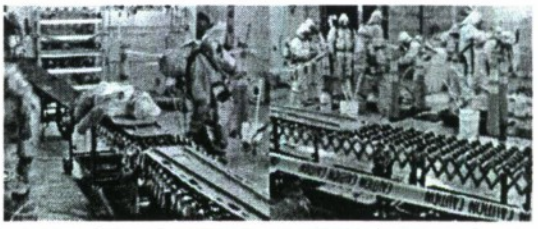
ECBC Decontamination Workshop

Patients Arrive

Medical Procedures & Antidotes Are Applied

ECBC Decontamination Workshop

Patient Transfer to Non-Ambulatory Decon



Ambulatory & Non-Ambulatory Decon Can Be in the Same Location

ECBC Decontamination Workshop

Triage & Decon

C-Spine Protection
UV Light Detects Fuels & Chemicals
Strip – Flush - Cover

ECBC Decontamination Workshop

After Second Wash Station Repeat Triage

Patient Can Be Redressed in Non-Contaminated Clothing or Tyvek

ECBC Decontamination Workshop

Emergency Responders Must Be Decontaminated

ECBC Decontamination Workshop

Post Response Checkup & Medical Surveillance

Avoid Heat Stress Symptoms Drink Water & Maintain Fluid Levels

ECBC Decontamination Workshop

Contaminated Spots May Require Special Decon

Biohazards May Require Disinfection with Bleach Solutions

ECBC Decontamination Workshop

Special Events

ECBC Decontamination Workshop

Special Events

- During special events, such as the 2004 DNC, as well as the annual Marathon, Fourth of July celebration, and First Night, the large crowds heighten the risk of terrorist actions
- Boston works proactively to prepare for such events by pre-staging decon equipment

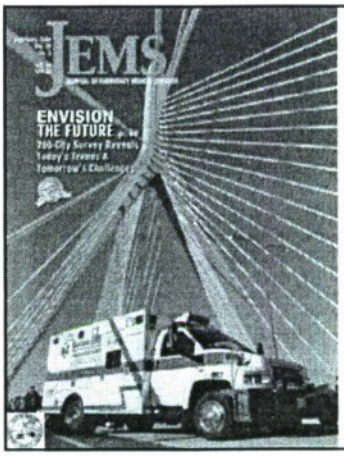
ECBC Decontamination Workshop

RAM Decon Units Established Along Evacuation Routes During 2004 DNC

ECBC Decontamination Workshop

In Summary…

- EMS Protection Issues
- Access to Those Affected
- Availability to Tx Modalities
- Post Decon Screening
- Weather
- Survivability
- TIME…TIME…TIME



Questions?
Comments?
Advice?

Robert Y. Haley

ECBC Decontamination Workshop

Incident Commander's View of Decontamination

Craig Walker Black

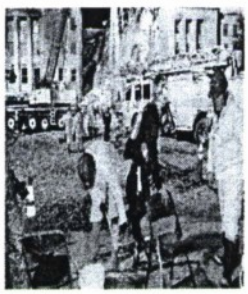
Mass Casualty Decontamination Planning in the National Capital Region (NCR)

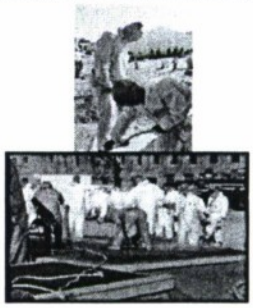
Regional planning for WMD Response

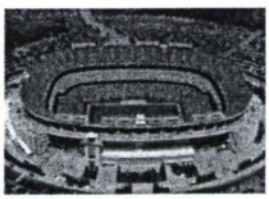
- No One Jurisdiction Capable of "going it alone"
- Multi Discipline, Multi Jurisdictional Response Effort

- Concept adopted as National Model within NDMS
  - National Medical Response Team (NMRT)
  - Metropolitan Medical Response System
- Deployed to most National Special Security Events in NCR
  - Presidential Inaugurations
  - Joint Sessions of Congress / SOU

- Response to Pentagon
  - Initially deployed as Local Medical Asset
  - Decontamination Corridors
    - Estimated 1200 persons daily
    - 24 hours a day / ten days
    - Health and Safety







Where have we been?

- Ten Years of WMD Training
- Specialized Equipment Acquisition
  - Decontamination
  - Detection
- Research and Guidance Documents
- Plans, Procedures, and Exercises

- The ultimate goal of any Incident Commander is to manage the incident, not have the Incident manage him/her
- Ensure that actions have favorable outcomes
- Ensure the safety of all personnel

- This is done by
  - Analyzing the Incident
  - Planning the Response
  - Implementing the Response
  - Evaluating Progress
  - Terminating the Incident or Transferring Command

Planning the Response

- Assess Incident Priorities (***why***)
- Determine Strategic Goals (***what***)
- Determine Tactical Objectives (***how***)
- Develop Incident Action Plan (***when***)
- Develop Organizational Structure (***who***)

Assess Incident Priorities (***why***)

- Saving Lives
  - Time, Toxicity, Mass Casualties
- Safety of Response Personnel
  - Limitations of PPE to the Mission
  - Numbers of Personnel Available
- Limit Spread of Contaminants

Determine Strategic Goals (***what***)

- Mass Casualty Decontamination
  - Time Constrained
  - Numbers of Contaminated Victims
  - Ambulatory versus Non-Ambulatory
  - Labor Intensive

Determine Strategic Goals (***what***) cont.

- Technical Decontamination
  - Not Time Constrained
  - Response Personnel
  - Equipment
  - Restoration

Determine Tactical Objectives (***how***)

- What is the Contaminant?
- Type of Decontamination (wet/dry)
- Adequacy of Decontamination Efforts
  - How clean is clean?
  - How do we verify effectiveness of decontamination?

Develop Incident Action Plan (***when***)

- Prior to the Incident
  - Facility pre-plans
  - Consolidated training
  - Standard Operating Procedures
- During the Incident
  - Technical – prior to entry
  - Mass Casualty – immediately when presented with victims

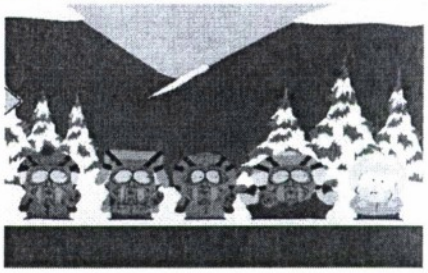
Develop Organizational Structure (***who***)

- Responsibility
- Accountability
- The beauty of Incident Management is that Incident Commanders can delegate. The ugly side is we are still accountable for those we delegate to

Where do we go from here?

- Away from Technician Level to Operations level for Mass Casualty
- Outside of traditional response - I.e.. hospitals
- Human Behavioral Analysis from Disasters
- Performance Standards for Equipment
- New Technologies

Kyle, Stan, Kenny and Cartman say...



Questions? Comments?

Decontamination
The Emergency Physician's Perspective

12 September, 2007
Edwin Leap, MD, FACEP

Background

Edwin Leap, MD, FACEP (Fellow of the American College of Emergency Physicians)

I completed my emergency medicine residency at Methodist Hospital of Indiana, in 1993.

I have been in the practice of emergency medicine since 1993.

- I was with the original Domestic Preparedness Program and have been involved in this educational endeavor since that time.
- I have taught the various incarnations of the course across the US and in Japan.

- I practice at Oconee Memorial Hospital, in Seneca, South Carolina.
- Our nine physicians and three physician's assistants see over 37,000 patients each year.

- We also are contracted to provide primary decontamination and medical stabilization to employees of Oconee Station Nuclear Power Plant, a property of Duke Energy.
- We are obviously expected to treat contaminated civilians.
- We practice for this, both with internal drills and FEMA evaluation drills.

Decon Training

- Several members of our team have attended courses at REACT/S, in Oak Ridge Tennessee. Others are trained locally by Duke Energy.
- We have also been trained in the use of supplied air respirators to respond to non-radiological industrial HAZMAT incidents.

Organization for Decontamination

The physician team leader is charged with ensuring the medical stabilization of the contaminated victim.

The physician team leader also directs hospital decontamination efforts in the case of single casualties brought into the department for decontamination.

- Consequently, though we are a bunch of hicks in the middle of nowhere, we're pretty good at decontamination.
- At least the FEMA evaluators seem to think so, since they once rated our exercise as "flawless." But I'm not going to brag...

Real-life Incidents

- We have managed many sick and injured patients from the nuclear plant believed to be contaminated, though none have been.
- In a striking demonstration that the patient's well-being supercedes contamination, we worked a "dirty" cardiac arrest with persistent ventricular tachycardia. (It was just a dirty back-board buckle.)

Decontamination

- It doesn't take an academic appointment or long emergency preparedness pedigree to learn how to do this effectively.
- It does take interest, practice, the belief that a real threat exists, and repetition.

ECBC Decontamination Workshop

Decontamination Process

- Since most of our decontamination, in reality and practice, relates to radioactive material, our procedure is straightforward.
- Stable patients are transported as clean as possible from Oconee Nuclear Station (ONS), thanks to procedures at the facility.

ECBC Decontamination Workshop

- EMS wraps patients in a clean sheet, undressed, outside the EMS door. These patients have been initially surveyed by ONS staff.
- Patients are transferred to ER stretchers leaving everything outside the ER except for dressings, life-saving equipment, or necessary immobilization.

ECBC Decontamination Workshop

- The patients are then placed on clean stretchers with clean sheets.
- As medical evaluation proceeds, an "inside" monitor surveys the patient with a Geiger-Mueller counter, from head to toe, with emphasis on open wounds.

ECBC Decontamination Workshop

- "Inside" staff wear scrubs, head covers, surgical masks, shoe covers, two pairs of gloves, surgical gown, and electronic dosimeters.
- Every 15 minutes, staff read the dosimeters to "control point attendant," who then records level.

ECBC Decontamination Workshop

Decontamination Facilities

- Our decontamination room has a door to the EMS bay and to the inside of the ER.
- There is a hot and cold shower head with spray attachment.
- Two drains in the floor lead to sewer and a holding tank.

ECBC Decontamination Workshop

- We have been instructed not to use the holding tanks to avoid fixed radioactive contamination.
- We generally run water into holding barrels, though we could not in larger scale events.

- We also have a portable shower system, with ability to attach to a warm water source.
- EMS has been trained in the rapid deployment of this system.

Radiological Decontamination Standards

- The patient is decontaminated down to one of two standards: 100 counts per minute (cpm) above background for ONS standards, or less than two times background, not to exceed 330 cpm for SC State limits for "clean."

Decon Verification

- Once the patient is stabilized and considered clean by survey, he or she is removed to another treatment area.
- Staff members remove protective gear, leaving it inside treatment room, and then are surveyed at the door by "outside" monitor using Geiger-Mueller counter.

- Staff is then released to return to emergency department.
- We have found this, at least in drills, a very effective method of dealing with one or two casualties.
- The ability to readily detect radiation makes this a relatively easy issue.

Issues

- What about hundreds?
- What if a plume of radioactive material were released?
- We are concerned with the sick and injured, not the mass exposure.

Issues

- Exposure does not necessarily equate with emergency. Though doubtless many patients would disagree if such an incident were to occur.
- We would try to convince non-injured, possibly exposed persons to change and shower at home.

ECBC Decontamination Workshop

Issues

- 'What do you mean go home doc! I just got nuked! You need to give me something or I'm going to die! Now don't you lie to me about this, or I'll sue you!'
- OK, so not everyone would listen...

ECBC Decontamination Workshop

More Issues

- The point is this: in many exposures, radiological and otherwise, patients could be safely directed to stay away from emergency care facilities, undress and shower; then come to the hospital for specific symptoms.
- The ER, after all, is for people who are drunk and don't want to go to jail.

ECBC Decontamination Workshop

- However, if our hospital had a large number of contaminated casualties, it would be difficult to thoroughly survey all of them before treatment.
- A technically appropriate survey means moving the monitor about one cm per second.

ECBC Decontamination Workshop

How Clean is Clean?

- How clean is clean? Maybe, it would mean a patient without particulate matter, or without an open wound, who has been briefly washed head to toe.
- In a "plume" release, which amounts to a gas/vapor, undressing and hair washing would probably suffice.

ECBC Decontamination Workshop

- This all refers only to nuclear issues.
- What about chemical? How do we know a patient is clean?
- We can't afford chemical detection equipment or training in its use.

ECBC Decontamination Workshop

Reality

- Remember, please, that hospitals struggle to finance daily medical care, much less paying for unique items for unlikely events.
- This is the reality of decontamination and the reality of the modern community E.D.

ECBC Decontamination Workshop

ED Scenario

Lessons learned over the years? Here's a little scenario and quiz:

An emergency physician is working a busy day shift. He has 15 patients in the department, three with chest pain, one intubated.

ECBC Decontamination Workshop

- EMS asks for him to speak on the phone.
- EMS reports that they are transporting two (only two) patients densely contaminated with radioactive material after an incident in a university lab.
- EMS reports they will require decontamination.

ECBC Decontamination Workshop

The physician will:

A) Pull out his trusty hospital decontamination guidelines, direct the staff preparations, and "suit up" for action.

ECBC Decontamination Workshop

The physician will:

B) Make odd, pitiful, bleating animal noises and run around in small circles as if paralyzed by indecision.

ECBC Decontamination Workshop

The physician will:

C) Repeat cycles of profanity while throwing things off of the desk, much like an agitated mountain gorilla.

ECBC Decontamination Workshop

The physician will:

D) Call the nursing supervisor for guidance, pull the policy, call for a backup physician, throw one or two charts, whisper profanity under his breath, and do the right thing.

- The answer is D.
- The lesson is this: in the midst of busy departments, sick and dying patients, and mountains of regulations, decontamination is one thing that physicians in emergency departments don't want to do and certainly don't practice enough.

Lessons Learned

- At our facility, getting physicians to train is difficult. They play the odds, and say "if it happens, I'll just call Dr. Leap from home!"
- This is fine if I'm home, which sometimes I'm not. Like right now, since I'm in Baltimore. And sometimes my wife needs me to stay home.

Lessons Learned

- The simpler we make this, and the simpler guidelines for "clean" that we develop, the better for every nurse and physician in the country.
- Fortunately, most exposures are vapors, and most victims (who are undressed) have less than dangerous levels of contaminant.

Problems Anticipated

- Specialty physicians, and hospital areas outside the E.D., will be very uncomfortable with any contamination, however low the level. This is an issue of education.

Problems Anticipated

- "No ma'am, it wasn't a nuclear weapon, no matter what the news report said."
- "Yes sir, the white powder has been adequately removed from the victim."
- "Yes ma'am, I realize you think I should keep the patient, but I can't reattach limbs."

- This is an important issue, as injured patients may require urgent life-saving surgery while still partly contaminated.
- Especially in the case of radiologic dispersal devices in which explosives propel radiological materials.

ECBC Decontamination Workshop

Problems Anticipated

- Patients may be relatively "dirty" but with contaminated areas covered, then may be moved on into other areas of the hospital as dictated by their medical needs.

ECBC Decontamination Workshop

Recommendations

- Simplify, simplify, simplify. The ED is a land of chaos at all times. If we believe undressing vapor exposures is enough, then let's say so.
- If we can avoid complex decon lines, we should avoid them.

ECBC Decontamination Workshop

Recommendations

- For obvious persistent liquid or solid contamination, more needs to be done, but always in tandem with patient care and staff safety.
- But...

ECBC Decontamination Workshop

Recommendations

- In truth, patients with life-threatening levels of contaminant will rarely come directly from the scene.
- As in the case of nerve agent, they may not be able to leave the scene without EMS involvement.

ECBC Decontamination Workshop

Decontamination

So, patients will likely arrive either:

A) undressed (i.e. partially to mostly decontaminated) or

B) contaminated minimally with vapor or with less dangerous levels of liquids/solids.

ECBC Decontamination Workshop

Conclusion

- These are important realities in the effort to streamline and simplify decontamination and keep costs of response and preparation reasonable.
- And to keep staff from going insane...

Conclusion

- Remember that hospital emergency departments are already at the breaking point in many places.
- The last thing they need are complex guidelines and requirements.

Conclusion

- Thank you for listening.
- Greetings from the Blue Ridge Foothills of South Carolina, where our last four words are always…

"Hey ya'll, watch this!"

Questions? Comments?

Headquarters
U.S. Army Center for Health Promotion and Preventive Medicine

Veronique Hauschild, MPH
Directorate of Occupational and Environmental Medicine

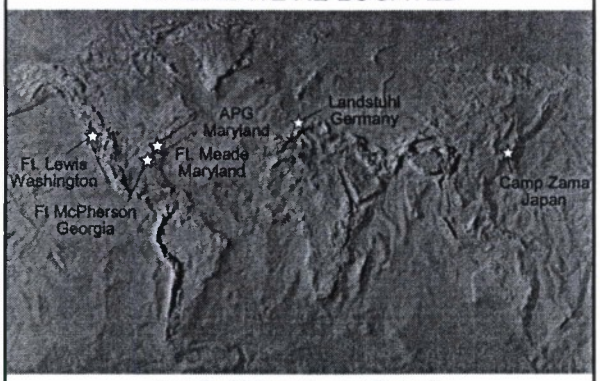
www.chppm.com
September, 2007

USACHPPM
Readiness thru Health

Mission:

Provide health promotion and preventive medicine leadership and services **to counter environmental, occupational, and disease threats to health, fitness, and readiness** in support of the National Military Strategy.

WHERE WE'RE LOCATED



Force Health Protection thru Prevention

CHPPM CBRN Mission:

Provide necessary health services and expertise to prevent adverse health effects resulting from chemical, biological, radiological, and nuclear threats.

Populations of interest include Soldiers as well as civilians (e.g., workers, dependents, local entities)

USACHPPM

CBRN Threats:

Chemical, biological, radiological, and nuclear hazards that have potential to cause acute catastrophic damage (i.e. health impact). Includes warfare agents as well as certain industrial/commercial materials.

Example: Toxic Industrial Chemicals (TICs) = commercial chemical that could cause immediate /significant health effects if significant amount intentionally was released

USACHPPM

USACHPPM Directorates with Key CBRN Roles/Expertise

- **Directorate of Occupational and Environmental Medicine (DOEM):**
  - Chemical /biological exposure standards/guidelines: civilian, occupational, military
  - Casualty treatment /field assessment and documentations
  - Medical surveillance and follow up
- **Directorate of Environmental Health and Engineering (DEHE):**
  - Sampling for site/building environmental health clearance (closure)
  - Hazardous and medical waste management
- **Directorate of Occupational Health Sciences (DOHS):**
  - PPE
  - Engineering controls/equipment
  - Radiation/nuclear (health physics) health standards and procedures
- **Directorate of Health Risk Management (DHRM):**
  - Risk assessments for site/building environmental health clearance (closure)
  - Risk assessments for deployed personnel; training field personnel to gather field data
  - Microbial (biological hazard) risk assessment and standards development

Others:

- Directorate of Laboratory Science (DLS)
- Directorate of Toxicology (DTOX)
- Directorate of Epidemiology and Disease Surveillance (DEDS)

Chemical Agent Projects associated with defining how "clean" and "safe"

Deployment/military operations:

- Items/materiel decontamination procedures
- Human remains decontamination procedures
- Acquisition/R &D: Equipment specifications (includes goals for detectors)*

**Provide NBC threshold/health effects criteria and standards for acquisition community* (AR 70-75/MEDCOM 10-1)

USACHPPM

Chemical Agent Projects associated with defining how "clean" and "safe"

Garrison:

- Chemical Demilitarization:
  - Coordination with CDC re: chemical agent health standards for CWA
  - Army policy re: routine decon of items/people
  - Coordination with EPA closure plans
- Chemical Stockpile Emergency Preparedness Program (CSEPP):
  - Coordination with CDC, EPA, state and local health departments
  - Response plans/sampling "clearance"

USACHPPM

Chemical Agent Projects associated with defining how "clean" and "safe"

Homeland Defense:

- National Advisory Panel for DHS Airport Study
- National Response Team (NRT) Fact Sheets
- Interagency Board for Equipment Standardization
- PPE/respirator criteria recommendations for CWA/TICs
  - ECBC Homeland Defense
  - NIOSH

TWG (Interagency) – Guidelines for Mass Decon

USACHPPM

Example "Products"

- **Army Medical Command/CHPPM threshold criteria recommendations for military CBRN equipment acquisition:**
  - Detection systems
  - IPE and COLPRO
  - Decontamination
- **Contributions to US Military CBRN Field Manuals (FMs), NATO documents, etc**
- **USACHPPM Reports:**
  - *Acute Toxicity Estimation of CWA and Operational Risk Management*, 2004
  - *Industrial Chemical Prioritization and Determination of Critical Hazards of Concern*-(ITF-40), 2003
- **USACHPPM Tech Guides** (*all are current being updated*):
  - TG 244 NBC Battle book
  - TG 195 Management of Human Remains
  - TG 230 Chemical Exposure Guidelines for Deployed Military Personnel
- **USACHPPM fact sheets/other:**
  - Chlorine and Improvised Explosive Devices (IEDS) (2007)
  - CBRN Contaminated Human Remains (drafted)
  - Toxic Industrial Chemicals (draft staying healthy Guide)

USACHPPM

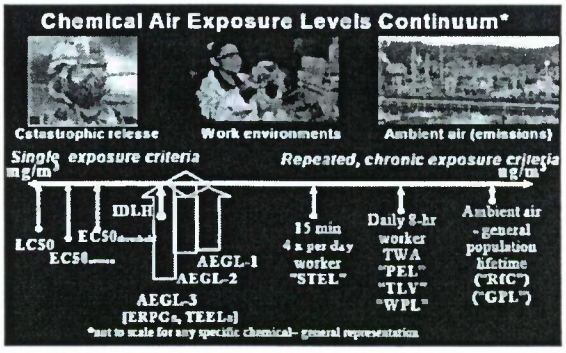
Points of Contact

Technical SMEs:

Call 1 (800) 222-9698

CHPPM Coordination/ Work Group POCs:

Call 1 (800) 222-9698



Some Personnel/Mass Decon Rules of Thumb

- General procedures exist/are adequate (even without monitors)
- Prioritize who gets decon and how
  - Liquid vs vapor (vapor = no decon/external clothing removal)
  - Severity of symptoms
  - Agent (persistence, time to effects → HD
- Aqueous decon:
  - water/soap vs bleach solutions
  - 2-3 minutes ideal
  - Balance benefits : option with outer layer clothing removal, air monitoring
- Run-off –not likely contaminated/hazardous
- Verification (real-time)
  - good air monitoring/detectors exist (w/ limitations) – but so do bad ones
  - water /runoff detection can also be done
  - PRIORITIZE what and when to sample
- Post-exposure medical surveillance/monitoring - doesn't address decon
  - Document a person was exposed, determine future medical care or work limitations
  - Cholinesterase (nerve agent) limited/questionable use
  - No specific tests for HD, Chlorine etc

Questions? Comments?

DECONTAMINATION
A Chemist's Perspective

Parker Ferguson

DECONTAMINATION

General principles of decon can apply to:

-Equipment

-Personnel

DECONTAMINATION

- Physical removal
- Chemical neutralization, e.g., hydrolysis usually leads to less toxic products

ethyl acetate → acetic acid (edible) + ethyl alcohol (drinkable)

Equipment and Agent

- **Sensitive:** weapons, electronics
  - Remove agent, decon removed agent
- **Non-sensitive:** apparatus and agent
  - Bleach: sodium hypochlorite,
  - Calcium hypochlorite (HTH),
  - Super tropical bleach (STB)
- **High or low pH (acidic or alkaline)**
- **Contact time**

Hydrolysis Rates For Agents

Agent	Half-Life($t_{1/2}$)	pH
Sarin	37 min (77°F)	9.0 (constant pH)
	4.2 min "	10.9
	47 hr "	6.0
	7.5 hr "	1.8
Tabun	8.5 hr (68°F)	7
VX*	40 hr (77°F)	7*
	100 days "	2-3
	12 min "	13
HD	8.5min (77°)	7

* Toxic products at pH 7-10

ECBC Decontamination Workshop

Solubility of Agents in Water

- **Sarin: miscible**
- **Tabun: 9.8 g / 100ml (77 °F)**
- **VX: 3 g / 100 ml (77 °F),**
  (miscible below 49° F)
- **HD: 0.092 g / 100 ml (72 °F)**

ECBC Decontamination Workshop

Bleach

Bleach gives three-pronged attack

- free (nascent) oxygen, [O]
- free (nascent) chlorine, [Cl]
- high alkaline pH (12 –13), OH^-

All are very aggressive species, which attack agents.

ECBC Decontamination Workshop

Personnel Decon

- Water is good
- Soapy water is better
- Bleach is controversial

ECBC Decontamination Workshop

Bleach for Personnel

- Bleach can abrade skin
- Bleach can form soap with skin

ECBC Decontamination Workshop

Edgewood Decontamination Guidance

- Guidance for ECBC agent workers has varied over time.
  - Pre-2004: 5% Hypochlorite (Bleach):
  - Jan, 2004 Interim Guidance: Soapy water
  - July, 2004: Dilute (0.5%) bleach:
- USAMRICD study

ECBC Decontamination Workshop

Personnel Mass Decon

Responder community practice:

- Many recommend water or soapy water
  - Safety
  - Logistics
- Follow local protocol

ECBC Decontamination Workshop

Decon of Skin

Helps:

- Prevent spread of contamination
- Prevent off-gassing of non-persistent agents
- Prevent reaerosolization of aerosols
- Remove liquid agent; prevent contact hazard

ECBC Decontamination Workshop

Other Technologies

- Alternates for equipment:
  - Steam - Sealants
  - Absorbents: Dry Powder
  - Environmental factors: UV, water
- Decon Foam
- Reactive Skin Decontamination Lotion (RSDL)

ECBC Decontamination Workshop

RunOff

Problems from runoff are overrated

- "Dilution is the solution to pollution"
  ...Dilution is greater than you think
- Hydrolysis leads to detoxified products

ECBC Decontamination Workshop

Key Points

- General principles are applicable to equipment and personnel
- Hydrolysis can give less toxic products
- Bleach is good for agents and non-sensitive equipment
- Water and soapy water are good for personnel; use of bleach remains controversial

ECBC Decontamination Workshop

Questions? Comments?

Blank

APPENDIX B

DEVELOPMENT OF WORKSHOP ISSUES

Workshop Discussions

Key Issues

Key Issues (Federal Group)

- What level of decon is required? (Always required? Mass decon on site, more detailed at hospital)
- Is equipment required? (for verification)
- Decon verification (equipment specifications and guidelines; maintain, detect, alarm, reliability)
- Who/How deploy limited detection equipment (for verification; personnel, equipment)
- Nonambulatory decon vs ambulatory
- Control of exposed (system bypass)
- Public education
- Who makes decision clean enough to proceed?

Key Issues (Medical Group)

- How do we determine who needs to be deconned?
  - At MCI, can't sort the mob. Who is a problem? Who is not?
- Decon process employed – cannot determine effectiveness of any process
  - Lack of test results on which to base tectical decisions
  - Need test end evaluation of decon methods
- Can't define the contamination level of self-evacuating victims
  - If they can run end drive, they probably are not e threat
  - Need to determine the contamination level that precludes self-evacuation to the home or hospital
- Need a measurement capability to permit ED entry

Key Issues (Responder Group A)

- Recognition is critical (signs, symptoms)
- Rapid initiation of decon provides immediate assistance and positive psychological value
- Immediate mass decon is more important than instrumental confirmation detection
- Guidelines for immediate response in place and practiced
- Control containment post decon

Key Issues (Responder Group B)

- AEGL Level 1 (perhaps % of that)
  - Distrust of feds/public distrust
  - Does equipment exist with needed sensitivity
- Verified Decon Process
  - Standard of process (doctrinal)
  - Standard of training
- How will we verify? Sampling, 100%?
- Public perception of answer must be considered
- Post decon follow-up

APPENDIX C

DISCUSSION OF WORKSHOP ISSUES

Workshop Discussions

Discussion of Key Issues
(by workgroup)

Workgroup Blue

- Issue #1: How clean does decon need to be? (concept)
  - Situational issue, as good as possible, given resources
  - Symptomatic more intensive decon
  - Explosive and panic injuries
- Points of agreement/dissent
  - Mass decon: do the best you can with what you have
  - Sample checks, individual checks unrealistic (time constraints issue)
  - Mass Rad checks possible
  - Mass Bio checks unrealistic
  - Mass Chem checks unrealistic
  - Product specific response concepts
  - Gross decon mass of water good enough initial (non-symptomatic fine), go home take good shower with soap and water
- Points requiring additional research
  - Pesticide industry response?

Workgroup Report

- Issue #2 (continued)
- Other discussion points
  - If AEGL used how to implement (no equipment)
- Notes
  - APG uses 10 minute wanding, 90 second check per quadrant (worker limits) good for small numbers ICAM/APD 2000/HazCad then to medical facility for observation
  - Boston uses symptoms, (technology is problematic as levels are not low enough) two technology check, spot checks (hands/feet/hair) ICAM/AP2C/APD 2000/PID/Symptoms/Ahura then to medical (low numbers)
  - Pentagon hazard jet fuel, asbestos 750 per day voluntary "dust off"
  - CST provides more definitive analysis, but does not verify agent
- Follow-on actions (if any)

Workgroup Report

- Issue #2: How should that be expressed?
  - Now AEGL possible, goal AEGL 1 if "safe" provides standard in terms of symptoms (equipment vapor detection level in real time)
- Points of agreement/dissent
  - Equipment must follow KISS principles (user friendly)
  - Baseline drives what is "safe" (Safe not clean)
- Points requiring additional research
  - Test and define standard practices to determine effectiveness and establish baseline (as done with turnout gear) "What is Safe"
  - Detection equipment to detect to these numbers to be established
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #3: How to monitor/detect decon effectiveness?
- Points of agreement/dissent
  - Gross decon (ambulatory) screening on-site
    - Random sampling of ambulatory via surface point detection
  - Redress (Cold Zone)
    - Area monitoring definitive decon
  - Nonambulatory check of agent issue victims 100% checked via surface detection
- Points requiring additional research
  - Tricorder/next generation of mobile/handheld detection
- Other discussion points
  - Prioritize detection efforts
  - Effectiveness is predicated on early agent identification
  - Check runoff water
- Follow-on actions (if any)

Workgroup Report

- Issue #4: How to validate decon process/detector affectiveness?
  - Research and Development $$$$$ REQUIRED NOW
    - Independent validating of empirical testing of decon processes in effect in controlled conditions with simulants and lab instruments
    - Develop quantitative baseline using actual equipment
  - Real-world testing $$$
    - Real-world evaluation of potential events using responders with simulants and actual equipment following R&D testing (trust but verify)
    - KISS, efficiency not technology
  - Responder involvement in development is required
  - Instrument testing following process testing (technology supports process)
- Points of agreement/dissent
  - Above points in agreement
- Points requiring additional research
  - Independent validating of testing in multiple temperature/environmental conditions
  - Radio tests once Tricorder is fielded
  - Testing of regional decon plans (fire truck, showers, car wash, pools, etc)
- Other discussion points
- Follow-on actions (if any)
  - Funding for evaluations

Workgroup Report

- Issue #5: User of decon and detection equipment and information from them?
  - Equipment
    - Decon, designated responders (fire, hospital support, etc)
    - Detection, protocol and site dependent (point detection specially trained; fire, HAZMAT, verification personnel, EMS, etc)
      - Police – passive only
  - Information
    - Decon confirmation (per ICS includes EMS, hospital, Incident Command, etc)
    - Detection (per ICS includes Incident Command, EMS, hospital, etc)
- Points of agreement/dissent
  - Dissent on training levels required for detection specialized units versus common task training (no dissent on decon, all protocol driven)
  - Porter's level of comment (good-bad)
- Points requiring additional research
- Other discussion points
  - Focus training on local protocols (don't overburden responders with "common" task sustainment training)
  - Gap analysis, detectors more user friendly (more equipment/less time due to training and use constraints)
- Follow-on actions (if any)

Workgroup Green

Workgroup Report

- Issue #1: How clean does decon need to be? (concept)
- Points of agreement/dissent
  - Situation dependent – ID signs, symptoms, size-up, type of HAZMAT drives decon decision
  - First response is gross decon
  - Decision tree/triage for decon
- Points requiring additional research
  - Effectiveness of best practices
  - Develop possible clearance level criteria (Issue #2)
- Other discussion points
  - What about later – facilities, equipment, building decon?
  - Decision of whom to hold, where
- Follow-on actions (if any)
  - ID HAZMAT, establish symptom presentation time, follow triage, hold/release

Workgroup Report

- Issue #2: How should that be expressed?
  - Levels of risk (associated with decon triage)
  - Levels defined by time, agent, process, conditions
  - Number (e.g., AEGL) embedded in testing
  - Variable over time, especially with various levels of response and the agent
- Points of agreement/dissent
  - Numbers exist for facility decon, not for people (i.e., mass decon)
  - Number not important for first responder (do the process)
  - Important number to responder is for PPE/entry decision (e.g., IDLH, etc.)
  - Number (for decon) is important to—
    - Validate through testing a "best practice"
    - Verify the process worked post-decon
  - Process actually based on time, resources available, HAZMAT used, situation
- Points requiring additional research
  - Do the validation – establish what steps to do to achieve a given risk level (range measured to what numbers)
- Other discussion points
  - Best practice = effective, timely, achievable on-site
- Follow-on actions (if any)
  - Person who departed may still become symptomatic later - refused decon, fled the scene, delayed symptomology after proper decon, etc.
  - Standardizing terminology

Workgroup Report

- Issue #3: How to monitor/detect decon effectiveness?
- Points of agreement/dissent
  - Monitoring tools
    - Humans as detectors (signs, symptoms, etc.)
    - Identify material, choose best tool available (on-site or get it quick)
    - Enforce training to standard (regulations, law, etc.)
  - Monitoring process
    - Statistical vs 100%
    - Where to check on person
    - How to check (air-pulls from tent, water from decon pool, etc.)
    - Mass decon, post mass decon, release or enter technical decon process
- Points requiring additional research
  - Desired tool for responders – clean/not clean, cheap, easy, intuitive, quick, handheld (palm size)
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #4 How to validata decon process/detector effectiveness?
- Points of agreement/dissent
  - Validation done by independent org – ASTM, NIST, ISO? Credibility
  - Test design is vital, ask the right questions
    - Define the threat is part of design
  - Include responders as stakeholders and in Beta testing
    - Include community involvement, in design, in Beta test
  - Education of public and media (e.g., remember civil defense?)
  - Test detector and decon process after actual events to validate actual use
- Points requiring additional research
  - Detectors – no one size will fit all
    - Re-look what is likely and available as threat
    - Incorporate into test design
- Other discussion points
- Follow-on actions (if any)
  - Real-world lessons learned, incorporate into test

Workgroup Report

- Issue #5: User of decon and detection equipment and information from them?
- Points of agreement/dissent
  - Operations and tech level responders are users of detection, decon
    - All-hands response, decon/detection at decon at ops and higher
  - Hospitals also configure decon setup (receivers, not respondere)
  - Info back to IC, release through media to public
    - Hospitals also share info (between hosp - IC), out to public
- Points requiring additional research
  - Info internal back to developers, government, industry, etc. to upgrade equipment
- Other discussion points
- Follow-on actions (if any)
  - Lessons learned about decon process – better "best practices"

Workgroup Red

Workgroup Report

- Issue #1: How clean does decon need to be? (concept)
- Points of agreement/dissent
  - Agree: "Safe" = the eye of the beholder (mass decon)
    - "Safe" for the victim
    - "Safe" for the responder
    - "Safe" for the receiver
  - Agree: Safe = 0 on the responder (technical)
  - Agree: "Safe" does not equal "Clean"
- Points requiring additional research
  - Research review to categorize more clearly what the levels of hazard means
  - What is the standard of care required for each of the hazard levels
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #2: How should that be expressed?
  - Victim (gross or mase decon)
    - "Safe" for the victim (AEGL-1)
    - "Safe" for the responder (AEGL-1)
    - "Safe" for the receiver (AEGL-1)
  - Responder = 0 (GPL) (following technical decon)
- Points of agreement/dissent
  - Agree: Hae to be a concentration that is reversible
  - Disagree: Answer should not be in terms defined ae AEGL; should be lower
- Points requiring additional research
  - Need additional validation of values
- Other discussion points
  - Why would anyone talk to any hazard that is not reversible
- Follow-on actions (if any)

Workgroup Report

- Issue #3: How to monitor/detect decon effectiveness?
  - Use a detector with these characteristics:
    - Portable, sensitive (AEGL-1), reliable, user friendly, rapid detecting, cheaper-the-better, reachback CONOPS, wide spectrum, rapidly deployable, simple to interpret, decon-able and weather resistant, easy to maintain
  - Could be either/or a handheld meter or a portal monitor
  - For liquids, could papers sensitive to AEGL-1
- Points of agreement/dissent
  - Dissent: Below AEGL-1
- Points requiring additional research
  - Detectors that are eensitive to above background levels
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #4a: How to validate detector effectiveness?
- Points of agreement
  - Before
    - Bump test the meter
    - Verify calibration
    - Ensure the operators are trained
    - Cull from a list of trusted manufacturers
    - Verify capability to detect from a secondary source
  - Test
    - Use a simulant
    - Use actual agent (test chamber)

    } • Test for sensitivity • Test for reliability
- Points requiring additional research
  - Defining the list of agents/TICs
  - One detector for all hazards
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #4b: How to validate decon process effectiveness?
- Points of agreement
  - Select a safe, non-miscible, persistent agent simulant (representing the worst-case scenario) or use actual agent
  - Determine what test protocols are already available
  - Determine how much agent should be applied to the subject
  - Determine where on the victim to test
  - Test after each stage of the decon process
  - Test each process against neat and mixed agent hazards
    - Strip
    - Flush (water only, soap and water, other?)

    } • Gross & Mass
- Points requiring additional research
- Other discussion points
  - Defining the list of agents/TICs
  - Validation of field decon – instill confidence in the decon process
- Follow-on actions (if any)

Workgroup Report

- Issue #5: Users of decon and detection equipment and information from them?
- Points of agreement
  - Decontamination – Operations Level
  - Detection – Technician or Specialist
  - Designee – Operations Level under supervision of Technician or Specialist
  - As directed by AHJ
  - Information - everyone
- Points requiring additional research
  - Get a common language
- Other discussion points
- Follow-on actions (if any)

Workgroup White

Workgroup Report

- Issue #1: How clean does decon need to be? (concept)
  - Establish level for responders?
  - Establish one level at incident site
    - AEGL-2? (is this precise enough)
    - Beginning of impairment (detectable, non-lethal)
  - Establish second level at hospital entry
    - Detection occurs here?
    - Second decon?
- Points of agreement/dissent
  - Don't know what agent is or time to detect
- Points requiring additional research
- Other discussion points
  - Method of first decon (wet, air, diarobing, evacuation)
  - AEGL-1 (difficult to detect) (percent below AEGL-2?)
- Follow-on actions (if any)

Workgroup Report

- Issue #2: How should that be expressed?
  - Process driven
  - Numerical level (process) (AEGL-2)
    - Nice to have (technology not currently practical)
  - Visual (clothing removal, hair wet)
- Points of agreement/dissent
  - Best we can do but not politically acceptable (needs to be justifiable)
  - Self-referral for medical treatment
  - On-site assumption – majority inhalation exposure
    - Vision impairment (varying levels)
    - Limited skin/liquid exposure
  - HVAC
- Points requiring additional research
  - Enlist media to be beneficial
- Other discussion points
  - High risk vs low risk (not necessarily numerical)
  - Survivability – inside vs outside
- Follow-on actions (if any)

Workgroup Report

- Issue #3: How to monitor/detect decon effectiveness?
  - Instrumentation (maintenance and affordability)
  - Inert material that provides color change upon contact (shelf life and reusability issues)
  - Decon "police"
- Points of agreement/dissent
  - Attention to those waiting
  - Address psychological issues
- Points requiring additional research
  - Detector with sensitivity to all agents that M256 kit has to volatile nerve agents and use as quickly as APD 2000 with reliability (that nothing has today)
- Other discussion points
  - Personal effects
  - Buddy system
- Follow-on actions (if any)

Workgroup Report

- Issue #4: How to validate decon process/detector effectiveness? (Note: This group was combined with another during discussion of this issue)
- Points of agreement/dissent
- Points requiring additional research
- Other discussion points
- Follow-on actions (if any)

Workgroup Report

- Issue #5: User of decon and detection equipment and information from them?
- Users of decon
  - Person being decon
  - First responders, medical personnel, and HAZMAT
  - Process stakeholders (vendors, inventors, designers, validators, and community)
- Users of detectors
  - Alpha – inventors, designers, testers
  - Beta – select field testers
  - Gamma – full scale user community
- Users of information
  - Stakeholders
  - Politicians
  - Medical community (from credible sources)
  - Community leaders
  - Perpetrator
  - Department of Justice (evidence)
- Points of agreement/dissent
  - Moral and ethical use/dissemination of information
- Points requiring additional research
- Other discussion points
- Follow-on actions (if any)

Workgroup Yellow

Workgroup Report

- Issue #1: How clean does decon need to be? (concept)
  - Three types of victims: those who are not symptomatic, those who are symptomatic, those who are nonambulatory
  - Those who are not symptomatic are probably not contaminated or exposed (chemical dependent). Those who are symptomatic have been exposed but may not be contaminated. The nonambulatory have been exposed and may be contaminated.
  - Only viable answer is to offer opportunity to disrobe and wash down at the scene
  - If a person self-refers to MTF – assume undressing is sufficient?
- Points requiring additional research
  - Definitely sign up for this – efficacy of water spray downs and taking clothes off after various type of exposure
- Other discussion points
  - Low cost detectors for ALL first responders that can ID every possible CBRN not feasible with existing technology
  - Communication with hospitals important to prevent further contamination
- Follow-on actions (if any)

Workgroup Report

- Issue #2: How should thet be expressed?
  - Real answer is best determined by academic/medical/research world given an unlimited budget and 20 years
  - First responders do not want a number – Pass/Fail Only
  - Varies by region/state
  - Depends on where you are in the process
    - At scene/incident site (AEGL2)
    - At the end of decon line (Less than AEGL2 – not AEGL1)
    - At hospital – will strip and gown at most facilities – bag clothes
  - The Leap Effect
    - Develop algorithm based on symptoms – put on PDA – based on Dispatch/9-1-1 call/responder info
      - What happened? (burst?)
      - Time to symptom
      - Number of symptoms
      - % involved
      - Decides safe or not safe – do not decon or decon
- Points requiring additional research
  - CBIRF library of information and TTPs

Workgroup Report

- Issue #3: How to monitor/detect decon effectiveness?
  - Assume we are stripping and deluging people with water and that process is validated as effective
- Points of egreement/dissent
  - During decon process:
    - Baseline – wand a sample going in (~10%?)
    - Monitor for symptoms AND wand a sample
  - Post decon:
    - Tag or take digital picture (controversial)
    - Hold and monitor (visual observation) for new or worsening symptoms (hour[s])
    - Surveillance later (day[s])
- Points requiring additional research
  - Validate mass decon process and what's practical/feasible based on what's available in the field
- Other discussion points
  - Decon does not equal treatment
  - Decon mitigates ongoing/additional exposure and contains contaminant
  - Decon renders people and responders safe or safer?

Workgroup Report

- Issue #4: How to velidete decon process/detector effectiveness?
- Points of egreement/dissent
  - Need laboratory testing to develop procedures and validate procedures
  - Need to establish a baseline; how contaminated at the start
  - Field testing under various weather conditions
  - Need a standard
- Points requiring additional research
  - Developing procedures first in laboratory conditions
  - Develop field test equipment which rapidly detects residual contamination
  - WMD incident response tool kit – what should/does each responder have to respond to an incident
- Other discussion points
  - CBIRF, COP, TEU, and other agency best practice and other test and training results need to be reviewed and best practices pulled out
  - Common terms and definitions need to be agreed on
- Follow-on actions (if any)

Workgroup Report

- Issue #5: User of decon and detection equipment and information from them?
- Users of Equipment and Information
  - Problem identification - Any public safety official, LE, Fire, EM, HAZMAT, Security, Public Information Officials
    - Border/shipping/anyone dealing with public safety, EPA, FEMA, CDC
    - ED/Hospital
    - Media/Public
  - Decision and mitigation planning - Incident Commanders and community leaders
  - Forensic and "We did the right thing" - LE, DoD, FBI, CIA, NSA, EPA, FEMA, CDC, etc.
- Where
  - "Tip of the spear" – must be with first public safety official on the scene
- Information required
  - What and concentration would be useful but not mandatory for all situations
  - LE and intelligence
  - Incident Commanders are users; basing decisions on info on hand; using judgment to respond appropriately
  - Information should improve as time moves on
  - Information should be quality assured – chain of evidence must be maintained

Blank

APPENDIX D

CHEMICAL AGENT AIR STATUS STANDARDS TABLE

Note: This document has been renumbered to coincide with the current report.

Table 1.Chemical Agent Air* Standards Status Table: Existing Standards and Guidelines as of Mar 2006

Media- AIR	Standard Name	Population	Exposure Scenario	H/HD/HT	GA (Tabun)	GB (Sarin)	GD/GF	VX	Lewisite	Notes/ Status
Airborne Exposure Limits (AELs) mg/m^3	**IDLH** (Immediately Danger to Life/health	civilian/ DoD worker	1 time exposure	NA **0.7** [a,b]	~~0.2~~ **0.1** [a,c]	~~0.2~~ **0.1** [a,c]	~~0.06~~ 0.05 [a,d]	~~0.02~~ **0.003** [a,c ++]	NA NA	US Army established new policy 18 June, 2004 ***(ref a)***, re: Airborne Exposure Limits for Nerve and blister agents. The implementing policy endorses use of CDC's recently recommended new AELs for agents GA, GB, VX { ***ref b}***, and sulfur mustard (H, HD) { ***ref c}***, as well as new AELs for additional agents GD, GF (these other agents were based on relative potency to the new CDC value of GB (per ***ref d***). The Army policy guidance applies to all agent operations and activities except tactical military operations and training. The policy includes new procedures including use of the STEL, which is a new AEL not addressed by previous Army Regs/DA Pams or procedures. The policy supercedes existing DA policies, regs, and DA Pams where guidance conflicts. † Note that the GD/GF STEL value (0.0002) in DA 2004 policy was a typo. **A Dec 2004 Supplement to the New Army guidance has also been published (ref c (x)).** ** See below (next page) for info re: new VX data. ***Since longer in US Stockpile, no re-evaluation of Lewisite performed since 1988 CDC-approved AELs. (see more next page))
	STEL (Short Term Exposure Limit)	civilian/DoD worker	occasional 15-minute exposure	**0.003** [a,b] [3 x 10E-3]	**0.0001** [a,c] [1 x 10E-4]	**0.0001** [a,c] [1 x 10E-4]	0.00005 [† d] [5 x 10E-5]	**0.00001** [a,c] [1 x 10E-5]**	NA NA	
	WPL (Worker Population Limit)	civilian/DoD worker	8-hr, daily/ 30-yr. Time-weighted average (TWA)	~~0.003~~ **0.0004** [a,b] [4 x 10E-4]	~~0.0001~~ **0.00003** [a,c] [3 x 10E-5]	~~0.0001~~ **0.00003** [a,c] [3 x 10E-5]	~~0.00003~~ 0.00003 [a,d] [3 x 10E-5]	~~0.00001~~ **0.000001** [a,c] [1 x 10E-6]**	0.003 [e,f***] --	
	GPL (General Population Limit)	civilian general population	24-hr/daily, lifetime time-weighted avg.	~~0.0001~~ **0.00002** [a,b] [2 x 10E-5]	~~0.000003~~ **0.000001** [a,c] [1 x 10E-6]	~~0.000003~~ **0.000001** [a,c] [1 x 10E-6]	~~0.000001~~ 0.000001 [a,d] [1 x 10E-6]	~~0.000001~~ **0.0000006** [a,c] [6 x 10E-7]**	0.003 [e,f***] --	
Acute Exposure Guideline Levels* (AEGLs) mg/m^3	**Acute Exposure Guideline Levels**	Emergency/ Accident scenario	1 time exposure :	***HD***	***GA***	***GB***	***GD/GF***	***VX***	***L****	* Lewisite AEGLs are now under development by the National Advisory Committee on AEGLs, anticipated proposal of draft values in mid 2005
	AEGL - LEVEL 1 Potential minor discomfort or noticeable effects; reversible	civilian general population	10 MIN:	0.40	0.0069	0.0069	0.0035	0.00057	NA	*no changes to AEGL values* Final CW AEGLs were published in May 04 by National Research Council (NRC) Committee on Toxicology (COT) (available at www.nap.edu) ***ref g***; * These are guidelines not regulatory standards, However, there is an Army-FEMA policy letter requiring use of these AEGLs for the Chemical Stockpile Emergency Planning Program (CSEPP) ***ref h***; associated CSEPP guidance provide suggested use (such as AEGL 2 as action level got shelter in place/evacuation); but policy includes allowance site-specific (State, local) decision-making USACHPPM has also prepared factsheets on AEGLs and there use, available at http://chppm-www.apgea.army.mil/chemicalagent/
			30 MIN:	0.13	0.0040	0.0040	0.0020	0.00033	"	
			1 HR:	0.067	0.0028	0.0028	0.0014	0.00017	"	
			4 HR:	0.017	0.0014	0.0014	0.00070	0.00010	"	
			8HR:	0.0083	0.0010	0.0010	0.00050	0.000071	"	
	AEGL- LEVEL 2 Level where more obvious effects begin; Potentially impacting functional abilities or ability to Escape; Potential delayed recovery	civilian general population	10 MIN:	0.60	0.087	0.087	0.044	0.0072	"	
			30 MIN:	0.20	0.050	0.050	0.025	0.0042	"	
			1 HR:	0.10	0.035	0.035	0.018	0.0029	"	
			4 HR:	0.025	0.017	0.017	0.0085	0.0015	"	
			8HR:	0.013	0.013	0.013	0.0065	0.00104	"	
	AEGL - LEVEL 3 Life threatening; Level of potential initial fatalities	civilian general population	10 MIN:	3.9	0.76	0.38	0.38	0.029	"	
			30 MIN:	2.7	0.38	0.19	0.19	0.015	"	
			1 HR:	2.1	0.26	0.13	0.13	0.010	"	
			4 HR:	0.53	0.14	0.070	0.070	0.0052	"	
			8HR:	0.27	0.10	0.051	0.051	0.0038	"	
MEGs mg/m^3	**Military Exposure Guidelines (Air)**	USACHPPM Technical Guide 230 (***ref l***) provides MEGs (for industrial chemicals as well as the agents listed here) and application guidance for assessing/characterizing exposures to military personnel in deployed settings as required by DoD Force Health Protection policy. The TG 230 was recently reviewed by the National Research Council (NRC) and will be updated (next version due out Jan-Feb 2005) to accommodate several NRC recommendations and other new information. The new versions will include slightly modified chem agent MEGs which will be based on findings of USACHPPM Technical Report 47-EM-5863-04 (see ***ref j*** below)								

Table 1.Chemical Agent Air* Standards Status Table: Existing Standards and Guidelines as of Mar 2006

HIGHLIGHTED values indicate changes from previous version (Aug 04) of this Table

( ) Numbers in parentheses are from draft documents

BLACK Numbers are final approved values documented by official Army regulation/policy as well as CDC

GREEN Numbers are final approved values documented by official Army regulation/policy but are not addressed by CDC/other Federal agency

BLUE Numbers have been developed/endorsed by non-DoD federal proponents for Army and non-Army use

RED or strike thru indicates previous official DA/CDC values that are now obsolete; outdated/superceded references

* The criteria listed in this Table are designed for protection from inhalation and ocular exposures as most sensitive exposure routes; separate vapor exposure limits for percutaneous vapor absorption are also now officially endorsed by Army for occupational use [in mg/m^3GA = 11.1; GB = 6.0; GD/GF= 1.5; VX= 0.13; and H=0.1; per ***ref d***)

** New 2004 data generated from animal toxicological studies specifically performed to assess validity of previous assumption re: VX toxicity (which is the warfare agent that had particularly limited toxicity data and was recommended to be studied further by the National Research Committee) are showing that the VX AELs may over estimate its toxicity (and thus be overly protective (low) AELs). Army has requested that the CDC consider the new data which is to be published in a report being prepared by the US Army Edgewood Chemical and Biological Ctr (ECBC) and is expected to be published @ end 2004. It is not yet known whether this will result in future reconsideration of the AELs for VX.

*** Lewisite values are all based on detection; no true IDLH exists (AR 385-61, Table 2-2, 2-3)

REFERENCES:

a) Department of the Army, Memorandum Subject: *Implementotion Guidonce Policy for New Airborne Exposure Limits for GB. GA, GD, GF, VX, H, HD, ond HT*; signed by Mr. Raymond J. Fatz, Deputy Assistant Secretary of the Army, (Environment, Safety and Occupational Health); OASA(I&E), **June 18 2004**.

b) Department of Health and Human Services (DHHS) Centers for Disease Control (CDC); Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard); Federal Register, vol 69, No 85, pp 24164-2468, **May 3 2004.**

c) Department of Health and Human Services (DHHS) Centers for Disease Control (CDC); Final Recommendations for Protecting Human Health from Potential Adverse Effects of Exposure to Agents GA, GB, and VX; Federal Register, vol 68, No 196, pp58348-58351, **Oct 9 2003**.

c (x) Interim Supplemental Chemical Material Agency (CMA) Implementation Guidance for Revised AELs, DA CMA, December 2004

d) Department of the Army Office of the Surgeon General Memorandum, Subject: *Nerve Agent Percutaneous Exposure Criteria and Airborne Exposure Levels (AELs) for GD.GF in Use of Interim DA Guidance on Implementotion of the New AELs,* **29 June 2004**

e) Department of Health and Human Services (DHHS) Centers for Disease Control (CDC); *Recommendations for Protecting Human Health and Safety Against Potential Adverse Effects of Long-Term Exposure to Low-Doses of Agents GA, GB, VX, Mustard Agents (H, HT, HD) and Lewisite (L), Federal Register*, Vol. 53 No 50, page 8504, Tuesday, March 15, 1988. **SUPERCEDED BY ABOVE, EXCEPT FOR LEWISITE**

f) AR 385-61: *The Army Chemical Agent Safety Program*; Safety; 28 February 1997 **PARTs OF THIS DOCUMENT ARE NOW SUPERCEDED BY Reference a.**

g) National Research Council (NRC) Volume 3, Acute Exposure Guidelines for Selected Airborne Chemicals, National Academy Press, 2003, www.nap.edu

h) Chemical Stockpile Emergency Preparedness Program, US Army and US Federal Emergency Management Agency (FEMA) Policy Paper #20 (Revised), Subject: Adoption of Acute Exposure Guidelines Levels (AEGLs); **February 2003**.

i) USACHPPM Technical Guide (TG) 230, Chemical Exposure Guidelines for Deployed Military Personnel, Current version: Version 1.3 with **May 2004 Update**; new version to be published in Jan-Feb 2005 – will have new chem. agent MEGs based on findings and conclusions of USACPPM Technical Report 47-EM-5863-04 (see ***ref j*** below).

j) USACHPPM Technical Report 47-EM-5863-04; Acute Toxicity Estimation and Operational Risk Management of Chemical warfare Agent Exposures; **May 2004**.

The following are references that were cited as key sources of values in the previous Update Table (s) but which are now largely superseded by newer references/policies above.

- ~~DA Pamphlet 40-173: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Nerve Agents G.A, GB, GD, and VX*; Medical Services, 4 Dec 1990~~
- ~~DA Pamphlet 40-8: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Mustard Agents H, HD, and HT*; Medical Services, August 1991~~
- ~~**Draft REV Jan 03** DA Pam 40-173: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Nerve Agents G.A, GB, GD, and VX*; Med Services,~~ new draft pending, currently superseded by ref a
- ~~**Draft REV Jan 03** DA Pam 40-8: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Mustard Agents H, HD, and HT*; Medical Services~~. new draft pending, currently superseded by ref a
- USACHPPM Technical Report: *Evaluation of Airborne Exposure Limits for Sulfur Mustard (HD): Occupational and General Population Exposure Criteria*, Technical Report 47-EM-3767-00, November, 2000
- Mioduszewski et al.; *Evaluation of Airborne Exposure Limits for G-Agents: Occupational and General Population Exposure Criteria*, ERDEC-TR-489; April 1998. (and February, 2000 Errata Summary)
- Reutter et al.; *Evaluation of Airborne Exposure Limits for VX: Occupational and General Population Exposure Criteria*; ECBC-TR-074; February 2000.

Blank

APPENDIX E

CHEMICAL AGENT MULTI MEDIA/TOXICITY EXPOSURE STANDARDS AND GUIDELINES SUMMARY TABLE

Note: This document has been renumbered to coincide with the current report.

Table 2. Chemical Agent Multi Media/Toxicity Exposure Standards and Guidelines Summary Table: Existing Values as of Mar 2006

Media	Standard Name	Population	Exposure Scenario	H/HD/HT (Mustard)	GA (Tabun)	GB (Sarin)	GD/GF	VX	Lewisite	NOTES/Status
WATER	FDWS (Field Drinking Water Standards) ug/L	Designed for military *but can have civilian applications	safe for for up to 7 days:	~~200~~	~~20~~	~~20~~	~~20~~	~~20~~	~~200~~	Old value officially superceded, new version TBMed577 published Dec 2005 (ref a) cites new values which have been endorsed by DoD (see *ref b*) * See note below (next page)
			Normal/humid climate: 5 L/day	(140) [ab]	(12* [eb])	(12* [eb])	(12* [ab])	(12* [eb])	(80 [ab])	
			Dry climate: 15 L/day	(47 [eb])	(4* [eb])	(4* [eb])	(4* [ab])	(4* [eb])	(27 [eb])	
SOIL (Health-Based Environmental Screening Levels (HBESL) (mg/kg)	HBESL-Residential	General population: adults and children	daily exposure, lifetime	0.01 [c,d,e]	2.8 [c,d,e]	1.3 [c,d,e]	0.22 [c,d,e]	0.042 [c,d,e]	0.3 [c,d,e]	HBESLs endorsed by headquarters Army (ESOH) in May 99 (*ref c*) were derived (by Army, *ref d*) using chronic toxicity criteria below with risk assessment model and assumptions like that used by EPA Reg IX to develop soil 'preliminary remediation goals (PRGs). These are conservative screening criteria for assessing potential long term human exposure/contact with soil contaminated from (liquid) agent (ambient vapor alone is not expected to result in deposition or soil contamination). Also identified as criteria to determine public release of decontaminated contaminated items/property (*ref e*). Note that many egent-certified laboratories may not be able to achieve these levels. Also note that were there is potential HD or VX soil contamination, breakdown products may also warrant evaluation (see *ref d*, App *F & ref f*).
	HBESL-Industrial	General adult population	frequent exposures 250 days/ yr. for 30 years	0.3 [c,d]	68 [c,d]	32 [c,d]	5.2 [c,d]	1.1 [c,d]	3.7 [c,d]	
WASTE	$HWCL_{sol}$[e] (solid hazardous waste control limit) (mg/kg)	worker civilian/ DoD	possible occasional exposure at HW treatment facility	6.7 [g,h]	680 [g,h]	320 [g,h]	52 [g,h]	10 [g,h]	37 [g,h]	Were derived (by Army – *ref g,h*) using the chronic toxicity criteria below with a risk assessment model similar to that used by EPA Region IX with assumptions denoting specific exposure scenarios associated with waste materials end workers potentially exposed to them (assumes exposures to the general public are controlled). Values were initially documented in a Department of Army proposed hazardous waste menagement rule presented to the State of Utah (*ref h*) and later in a Oct 2000 CHPPM memo to PMCD (*ref g*) Values were not officially endorsed by Utah but as of June 2004 were **endorsed in DA policy (ref e) for site-specific consideration/use.**
	$HWCL_{Liq}$[e] (liquid hazardous waste control limit) (mg/L)	worker civilian/ DoD	possible occasional exposure at HW treatment facility	0.7 [g,h]	20 [g,h]	8.3 [g,h]	0.3 [g,h]	0.08 [g,h]	3.3 [g,h]	
	NHWCL[e] (non-hazardous waste control limit (haz waste exemption level)[f] (mg/kg)	worker civilian/ DoD	at a non-HW land disposal facility, possible occasional exposures	0.3 [g,h e]	68 [g,h e]	32 [g,h e]	5.2 [g,h e]	1.1 [g,h e]	3.7 [g,h e]	
Chronic Toxicity Reference Criteria (used in risk assessment calculations)	RfD (Reference Dose) (mg/kg/day)	General population: adults and children	chronic (lifetime) ingested dose at or below which no adverse health effects are expected	0.000007 [i, j, k]	0.00004 [i, j, k]	0.00002 [i, j, k]	0.000004 [i, j, k]	0.0000006 [i, j, k]	0.0001 [i, j, k]	- NRC/COT (*ref i, 1999*) gave general endorsement of values; addressed in Final DA OTSG endorsement letter of final RfDs (Feb 2000, *ref j*), most current documentation of basis and overall status of these values is in peer reviewed article: Opresko, et al (*ref k*)
	Cancer Slope Factor) $(mg/kg/day)^{-1}$	General population: adults and children	represents the potency of the agent by Ingestion to cause increased cancer risk.	7.7 [i, j, k]	Not determined to be a carcinogen					-The NRC/COT *ref i, 1999* endorsed a less conservative HD Slope Factor of [1.6 $(mg/kg/day)^{-1}$]; DA OTSG (Feb 00) has currently endorsed use of the 7.7; *ref j, ref k*
	Inhalation Unit Risk) $(ug/m^3)^{-1}$	General population: adults and children	represents the potency of the agent by Inhalation to cause increased cancer risk	4.1×10^{-3} [i]						See Table 20 HD HCD, Nov 00 *ref l*

Table 2. Chemical Agent Multi Media/Toxicity Standards Status Table: Existing and proposed criteria as of Mar 2006

NOTES:

HIGHLIGHTED information indicate noteworthy change/addition from previous version of this Table (other non-substantial clarifying edits not highlighted)

( ) Numbers in parentheses are from draft documents

GREEN Numbers in Green are currently documented in official Army regulation/policy/or through DA Headquarter endorsement

BLUE Numbers have been developed/endorsed by non-DoD federal proponents for Army and non-Army use

RED Numbers are still officially used/endorsed by Army/other approving entity source **but** revisions are proposed/underway

BLACK Numbers black are final technical values but are not officially approved for implementation through a proponent agency

* Application of Drinking water criteria. It is noted that contamination of large water supplies with warfare agents is relatively unlikely due to effects of hydrolysis, dilution, and the neutralizing effects of common water treatment processes *e.g. chlorine). These values were designed for a military scenario, in which smaller containerized water supplies directly used for consumption might be intentionally contaminated with significant amounts of agent. Theoretically this situation could result in residual agent levels of concern for several days. The values here assume up to 7 days exposure at 5-15 liters/day consumption – which is an extremely high rate of drinking based on hot environments and high physical activity. So though these drinking water values were not originally developed for a general population application, they would be appropriate screening levels for even civilian applications where ingestion rates range form 1-2 liters/day and where most releases to a water supplies would involve the hydrolysis, dilution, and treatment processes

REFERENCES:

a) TB Med 577, *Sanitary Control and Surveillance of Field Water Supplies*, December 2005

b) Memorandum, DASG-HS-PE, 16 Apr 1997, Subject: Tri-Service Field Water Standards for Nerve Agents.

c) Memorandum, Headquarters Department of the Army, Office of the Assistant Secretary for Installations, Logistics, and Environment, SUBJ: Derivation of Health-Based Environmental Screening Levels (HBESLs) for Chemical Warfare Agents, May 28 1999.

d) USACHPPM/ORNL Technical Report: *Health-Based Environmental Screening Levels for Chemical Warfare Agents*, , March 99.

e) Department of the Army, Memorandum Subject: *Implementation Guidance Policy for New Airborne Exposure Limits for GB. GA, GD, GF, VX, H, HD, and HT*; signed by Mr. Raymond J. Fatz, Deputy Assistant Secretary of the Army, (Environment, Safety and Occupational Health); OASA(I&E), **June 18 2004**.

f) Munro et al.; *The Sources, Fate, and Toxicity of Chemical Warfare Agent Degradation Products,* Environmental Health Perspectives, Volume 107, Number 12, December 1999 pp933-974

g) Memorandum, Department of the Army – Center for Health Promotion and Preventive Medicine; MCHB-TS-EES; SUBJ: Response to State of Oregon Comments on the Utah Chemical Agent Rule (UCAR), 23 October 2000; NOTE: This response includes **USACHPPM Information Paper "*Management Criteria for Chemical Warfare Agent (CWA)-Contaminated Waste and Media*" 10 October 00 as well as USACHPPM Technical Paper: "*Chemical Warfare Agent Health-Based Waste Control Limits*", dated September 2000.**

h) U.S. Army –Proposed Utah Chemical Agent Rule (UCAR), May 1999 (Volume 1, Section XI. Development of Health-Based Waste Management Concentration Levels."

i) *Review of the U.S. Army's Health Risk Assessments for Oral Exposure to Six Chemical-Warfare Agents*, National Research Council, National Academy Press, WashDC, 1999; www.nap.edu

j) Memorandum, (Army OTSG) MCHB-CG-PPM, Chronic Toxicological Criteria for Chemical Warfare Compounds, 16 February 2000.

k) Opresko, D.M, et all, 2001. Chemical Warfare Agents: Current Status of Oral Reference Doses, *Reviews of Environmental Contamination and Toxicology Vol 172, pp 65-85.*

l) USACHPPM Technical Report: *Evaluation of Airborne Exposure Limits for Sulfur Mustard (HD): Occupational and General Population Exposure Criteria,* Technical Report 47-EM-3767-00, November, 2000

Blank

APPENDIX F

ORGANIZATION INDEX

Present or Former*Affiliation of Participants

Note: The workshop was designed and conducted as an open, neutral, non-attribution forum. Therefore, although the attendance of many participants was funded by their sending organizations, *individual presentations and the results of the workshop should not be construed as representing any organization's official position.*

Aberdeen Proving Ground (APG) Fire Department
Boston, Massachusetts, Special Operations Division
Dartmouth Hitchcock Medical Center, Dartmouth University
Department of Defense, Joint Program Manager, Guardian
Department of Homeland Security, Center for Domestic Preparedness (CDP)
EAI Corporation, Gaithersburg, Maryland,
Police Department Harford County, Maryland, Division of Emergency Operations
Montgomery County, Maryland, Fire Department
New York City Fire Department (NYFD)*
New York City Police Department (NYPD)*
Northern New England Metropolitan Medical Response System (NNEMMRS)
Oconee Memorial Hospital, Seneca, South Carolina
Office of Law Enforcement Standards, National Institute of Standards and Technology (NIST)
Philadelphia Fire Department*
Prince George's County, Maryland, HazMat Team
United States Army Center for Health Promotion and Preventive Medicine (USACHPPM)
United States Army Edgewood Chemical Biological Center (ECBC)

Blank

APPENDIX G

AGENDA

Start Time	Location	Topic	Presenter
		Day 1	
0800	Main	Introduction and administration (A-3)	Mr. Mike DeZearn
0815	Main	Keynote and goals	Mr. Mike DeZearn
0830	Main	Scenario (A-6)	Mr. Gary Eifried
0850	Main	Break	
0915	Main	Firefighter/HAZMAT view of decon (A-9)	Battalion Chief Griffin,
0930	Main	Law Enforcement view of decon (A-13)	Lt Rich Elliott,
0945	Main	EMS view of decon (A-14)	Capt Bob Haley,
1000	Break	Break	
1015	Main	Incident Command view of decon (A-19)	Chief Craig Black,
1030	Main	Emergency Physician's view of decon (A-23)	Dr. Ed Leap, ER
1045	Main	Hospital view of decon	Dr Robert Gougelet,
1100	Main	Break	
1115	Main	CHPPM view of decon (A-31)	Ms. Veronique Hauschild, MPH
1130	Main	Chemist's view of decon (A-34)	Mr. Parker Ferguson
1145	Main	Administrative time	
1200	Break	Lunch	
1300	Main	Agency view (open)	
1315	Main	Agency view (open)	
1330	Main	Breakout session organization	Mr. Gary Eifried
1345	Breakout Rooms	Breakout session discussion "What are the 5 key topics to address?"	Facilitators
1430	Break	Break	
1445	Main	Breakout session reports (10 minutes each)	Facilitators
1535	Main	Wrap-up for the day	Mr. Mike DeZearn
1545	Main	Administration	Mr. Gary Eifried
1600	Main	Adjourn	Mr. Mike DeZearn

Start Time	Location	Topic	Presenter
Day 2			
0800	Main	Administration	Mr. Gary Eifried
0815–1015	Breakout	Discussion topic #1 and back brief reports (break per facilitator)	Facilitators
1015–1200	Breakout	Discussion topic #2 and back brief reports (break per facilitator)	Facilitators
1200–1300	Break	Lunch	
1300–1500	Breakout	Discussion topic #3 and back brief reports (break per facilitator)	Facilitators
1500	Main	Wrap-up for the day	Mr. Mike DeZearn
1530	Main	Administration	Mr. Gary Eifried
1600	Main	Adjourn	Mr. Mike DeZearn
Day 3			
0800	Main	Administration	Mr. Gary Eifried
0815–1015	Breakout	Discussion topic #4 and back brief reports (break per facilitator)	Facilitators
1015–1200	Breakout	Discussion topic #5 and back brief reports (break per facilitator)	Facilitators
1200–1300	Break	Lunch	
1300–1400	Main	Workshop summary and closing	Mr. Mike DeZearn