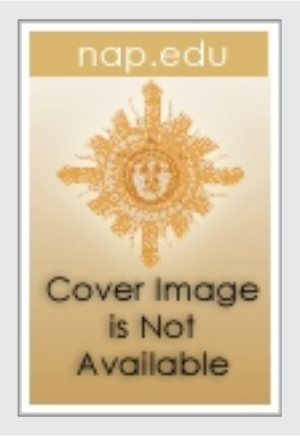

Review and Assessment of Closure Plans for the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System: Letter Report

DETAILS

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January 7, 2010

Mr. Conrad F. Whyne
Director
Chemical Materials Agency
5183 Blackhawk Road
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Aberdeen Proving Ground, MD 21010-5424

RE: Letter Report on Review and Assessment of Closure Plans for the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System

Dear Mr. Whyne:

The Chemical Materials Agency (CMA), under your direction, requested the National Academies' Board on Army Science and Technology to examine the current state of closure activities for the Tooele Chemical Agent Disposal Facility (TOCDF) and the Chemical Agent Munitions Disposal System (CAMDS). In this brief interim report, the Committee on Review and Assessment of Closure Plans for the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System addresses some of the issues pertaining to closure at the TOCDF and CAMDS facilities. It also provides insights into what the committee believes are important parameters to ensure the success of the CMA's closure program for these and CMA facilities at other locations. As indicated in the statement of task for the committee (see Attachment A), this interim report is to be followed by another report, referred to hereinafter as "the full report," which will use these parameters to conduct a comprehensive assessment of closure activities and issues.

For this interim report, the committee examined the current status of closure plans for both the TOCDF and CAMDS based on presentations by key members of your staff and the systems contractor. It then developed a set of parameters based on this high-level evaluation that it believes are important in ensuring a consistently effective approach to the closures of the four currently operating CMA chemical agent disposal facilities. The committee also assessed regulatory requirements imposed by the state of Utah, where TOCDF and CAMDS are located.

TOCDF and CAMDS are totally different facilities with different missions and different life cycles. They are located at Deseret Chemical Depot (DCD) near Tooele, Utah, and share the same systems contractor for closure. Likewise, both are under the jurisdiction of the same Utah state regulatory authorities and share many of the same regulatory challenges. They are often viewed by the public as one facility. At present, it is

anticipated that both facilities will stay under Army control after closure as part of the nearby Tooele Army Depot.

TOCDF is a large, active facility where disposal operations for mustard agent munitions and ton containers will continue until well into 2011. In addition to the baseline facility, a small skid-mounted liquid combustion unit, complete with a pollution abatement system, is being designed and will be constructed in the adjacent munitions storage area known as Area 10 to dispose of small quantities of the nerve agent tabun (GA) and lewisite. It is further anticipated that an explosive destruction technology chamber will be brought on-site to handle mustard agent munitions referred to as "rejects," which present problems for processing through the TOCDF disassembly and destruction processes. A further complication affecting the closure of TOCDF is the approximately 2 million pounds of legacy secondary wastes in storage that must be managed and disposed of during closure operations.

Closure planning for TOCDF, including the disposal of legacy wastes and the planning for the new units noted above, is presently at an early stage. While a general closure plan was initially submitted as part of the initial permit application for TOCDF, a more detailed closure plan is expected to be submitted to the state for TOCDF in June 2010. This and other information on the use of specific processes and analyses will be the subject of the full NRC report, to be prepared. Discussions with the state of Utah Department of Environmental Quality (UDEQ) are already under way to identify challenges that will eventually be addressed in the more detailed closure plan.

The closure of CAMDS is at an entirely different stage, and except for the laboratories (discussed below), CAMDS is no longer operational. It was the pilot facility for the U.S. Army's chemical demilitarization activities and operated between 1979 and 2005. The CAMDS site encompasses 61 hazardous waste management units, a ventilation system, and a number of buildings, some of which were used in testing equipment for chemical agent destruction processes. Initial closure activities were carried out by personnel affiliated with the Tennessee Valley Authority, who have recently been replaced by the TOCDF systems contractor, the EG&G Division of URS Corporation. Closure has progressed, with some equipment already removed from the buildings. More detailed closure plans are being written for CAMDS, and their approval is being requested on a unit-by-unit basis from the UDEQ. Final closure is expected to be completed by the first quarter of 2012. The main challenges associated with CAMDS closure stem from its age, its use as a pilot facility, and to the site having many interconnected buildings and common utility services whose closure requires careful staging.

Laboratory capabilities at CAMDS are being upgraded and will be used throughout the remaining disposal operations at DCD and the closure campaigns for CAMDS and TOCDF. It is anticipated that the laboratory closure will take place in 2015. The committee is not aware of any current detailed closure plans for the laboratory.

The committee spoke with the chair of the Citizens Advisory Commission (CAC), who indicated that the CAC fully understands that the closures of the TOCDF and CAMDS facilities are a separate issue from the disposition of other solid waste management units (SWMUs) on the site that will require remediation. The CAC chair further indicated that at this time closure has not yet become an important issue except

for concern about loss of jobs. The Army and community have not so far developed a plan for community involvement during closure.

The committee also spoke with members of the UDEQ that oversee compliance with state hazardous waste laws and requirements. In its exercise of regulatory jurisdiction over the TOCDF and CAMDS, the state of Utah developed some unique regulatory requirements.[1] Authority to regulate hazardous waste facilities and closure under the Resource Conservation and Recovery Act (RCRA) was delegated to the state by the federal Environmental Protection Agency (EPA). Utah requirements generally adhere to all the EPA RCRA regulations, but in addition to these, waste listings specific to chemical agent operations have been added to the regulations. That is, "Nerve, Military and Chemical Agents" is a class of materials listed as acute P999 hazardous waste. "Residues from Treatment and Testing of Nerve Military and Chemical Agents" are a class of materials listed as F999 hazardous waste. In addition, all wastes that have been potentially exposed to agent liquid or vapor are considered a P999 or F999 "listed waste." Any hazardous waste that meets the waste control limits (WCL) for agent by chemical analysis is an F999 waste that, on a case-by-case basis, can be considered for shipment off-site for additional treatment if necessary and subsequently sent to a hazardous waste landfill. Used (spent) activated carbon poses a particular challenge in this regard because Utah considers any activated carbon from chemical agent disposal operations, whether or not it was actually exposed to one or more chemical agents, to be a P999 waste that must be treated on-site. Utah's practices for chemical agent wastes and residues are atypical within Utah; commercial hazardous wastes within the state are not so regulated. That is, these practices are considered more restrictive and may impede the efficient disposition of wastes and the closure of the TOCDF and CAMDS sites.

In this interim study, the committee also considered prior closure experiences for three other chemical agent disposal facilities: the prototype baseline Johnston Atoll Chemical Agent Disposal System on Johnston Island in the Pacific Ocean and the hydrolysis-based facilities in Aberdeen, Maryland, and Newport, Indiana, where, respectively, bulk mustard agent and VX nerve agent were destroyed. In doing so, the committee remained mindful of the differentiating characteristics of these facilities in relation to TOCDF and CAMDS. After evaluating these earlier closures and the closure planning to date for TOCDF and CAMDS, the committee identified parameters that are key to the successful closure of the still-operating CMA facilities. These are discussed in more detail in Table 1 of the main body of this interim report, which follows the committee's findings and recommendations.

FINDINGS AND RECOMMENDATIONS

Finding 1. The Tooele Chemical Agent Disposal Facility operates with a strong safety culture, but this admirable approach to safety as an overriding parameter was not

[1]Unique in this context has two meanings. Utah's regulations and practices for chemical demilitarization activities located in Utah differ from those of other states. Utah also regulates chemical demilitarization facilities and the wastes they produce in a manner different from how it regulates other hazardous waste facilities in Utah—that is, facilities that do not produce chemical agent wastes.

sufficiently emphasized in either the briefings the committee received or the Programmatic Closure Planning document.

Recommendation 1. The management of the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System should consider safety the primary value in all of its decisions and work activities, and it should make its commitment to a safe operation highly visible to all workforce personnel and site visitors.

Finding 2. Parameters and metrics provide important guidance for planning, organizing, and implementing efficient closure of chemical demilitarization sites.

Recommendation 2. The Army should consider the parameters and metrics presented in Table 1 (in the main body of this report) as it plans for the closure of the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System.

Finding 3. As deconstruction activities proceed over the course of closure operations at the Chemical Agent Munitions Disposal System and the Tooele Chemical Agent Disposal Facility, a separate workforce will be on-site specifically to conduct demolition. This situation raises the possibility that safety performance could degrade because the new demolition workforce may be unfamiliar with the dangers of agent and agent degradation products and unfamiliar with the background circumstances regarding any demolition work done before its arrival.

Recommendation 3. The Tooele Chemical Agent Disposal Facility/Chemical Agent Munitions Disposal System management should establish a cross-training and hazards familiarization program to ensure continued strong safety performance and effective utilization of personnel.

Finding 4. The Utah Department of Environmental Quality (UDEQ) and the Army and contractor continue to have good relations. Some UDEQ regulatory practices differ from those in force for commercial hazardous waste management facilities in Utah and, in some cases, in other states that host chemical demilitarization facilities. All wastes from agent operations are considered listed wastes even if there is only a potential for exposure to vapor, and they often require treatment on-site to meet waste control limits before they are transported off-site and ultimately disposed of in a hazardous waste landfill.

Recommendation 4. The Army should negotiate risk-based criteria based on attainable waste control limits with Utah Department of Environmental Quality to establish the reuse, recycling, on-site treatment, off-site treatment (if necessary), and off-site disposal for all major waste streams—especially metal, activated carbon, and concrete.

Finding 5a. The Army and its contractor have been planning for the Tooele Chemical Agent Disposal Facility closure for some time. Plans are to submit a request for a Resource Conservation and Recovery Act (RCRA) permit modification that will establish details for meeting relevant regulatory requirements applicable to the closure plan by June 2010. Although some early closure activities have been initiated as approved partial

closure authorizations under RCRA, formal closure operations of the munitions demilitarization building are expected to begin in September 2011, with closure of the metal parts furnace and liquid incinerators later on (mid-2013) to allow their availability for continued waste processing, including closure waste processing. The committee finds this schedule optimistic.

Finding 5b. Based on the information provided in the basic closure plan of the current permit, which will be combined into a single permit covering both the Chemical Agent Munitions Disposal System and the Tooele Chemical Agent Disposal Facility, there appears to be sufficient time to meet the Army's indicated milestones for closure of the Chemical Agent Munitions Disposal System.

Recommendation 5. The Army should confirm with the regulators their willingness to consider partial closure with attendant more detailed closure plans and permit modifications. It should establish a realistic accelerated schedule for submitting its Tooele Chemical Agent Disposal Facility Resource Conservation and Recovery Act Closure Plan to ensure that closure operations are not delayed.

Finding 6. At the time of this report, it is anticipated that the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System sites will be closed to an industrial use specification and have an end use that involves becoming part of the Tooele Army Depot. Still, a risk-based closure performance standard that would reflect an industrial end use, in the form of specific concentrations of specific constituents in the various waste types and media, has not been negotiated. It is also unclear whether analytical methods have been approved in Utah that are capable of measuring the analytes at the selected performance standard.

Recommendation 6. The end use for the Tooele Chemical Agent Disposal Facility and Chemical Agent Munitions Disposal System sites should remain as defined at the start of closure planning to avoid extensive delays. The Army should expedite its discussions with Utah Department of Environmental Quality on specific risk-based closure performance standards that must be achieved. Further, if necessary, the Army should expedite its effort to gain approval of analytical methods.

Finding 7. The risk of exposure to chemical agents during closure operations is expected to be significantly lower than what potentially could be encountered during agent disposal operations. The regulatory standards and practices used by the state of Utah for controlling agent-contaminated materials were developed early in the program when there was little experience with managing the risks of materials exposed to agent. These practices and regulations may be more restrictive than necessary considering the nature of the closure operations.

Recommendation 7. The Army should evaluate the reduced risk of exposure to chemical agents and their degradation products from closure operations and waste materials in view of Utah's restrictive regulatory practices and consider negotiating with the Utah

regulatory community to obtain less restrictive, but safe, regulatory practices that allow for more efficient closure operations.

Finding 8. Through the Citizens Advisory Commission, Outreach Office, and other forums, the Army has created a successful public participation program. The Army and community have not developed a plan for community involvement during closure.

Recommendation 8. The Army should discuss with the Citizens Advisory Commission ways to establish a continuing, constructive public involvement between the end of demilitarization and formal closure.

Finding 9. A comprehensive Lessons Learned program for operations has been implemented by Tooele Chemical Agent Disposal Facility (TOCDF) management, and is also being applied to the TOCDF and the Chemical Agent Munitions Disposal System closure. For example, a comprehensive worker retention program for use during closure operations is in place.

Sincerely,

Peter B. Lederman, Ph.D., *Chair*
Committee on Review and
Assessment of Closure Plans for the
Tooele Chemical Agent Disposal
Facility and the Chemical Agent
Munitions Disposal System

Attachments:

A Statement of Task
B Acronyms and Abbreviations
C Committee on Review and Assessment of Closure Plans for the Tooele Chemical Agent Disposal Facility and the Chemical Agent Munitions Disposal System
D Acknowledgement of Reviewers

Assessment Criteria and Status Review of Closure Planning for TOCDF and CAMDS

CLOSURE PARAMETERS AND RELATED METRICS

In satisfying the statement of task, the committee identified a series of key parameters for overall program management of the closure of the Tooele Chemical Agent Disposal Facility (TOCDF) and the Chemical Agent Munitions Disposal System (CAMDS). The committee considered the lessons learned by the U.S. Army Chemical Materials Agency (CMA) at earlier facility closures, specifically, the closure of the Johnston Atoll Chemical Agent Disposal System (JACADS), which was the first full-scale incineration-based disposal facility; the Aberdeen Chemical Agent Disposal System (ABCDF), which was the first neutralization-based disposal facility; and the Newport Chemical Agent Disposal Facility (NECDF), another neutralization-based facility. It used the information from these closure experiences and committee member expertise and knowledge of the plans and activities for TOCDF and CAMDS as the basis for developing the parameters in Table 1, which are discussed below.

The parameters in Table 1 are shown along with associated metrics for promoting a safe and successful program for facility closure. These metrics are of two kinds: leading metrics, which help predict performance, and lagging metrics, which indicate the actual performance. While the metrics listed are considered important by the committee, they should not be considered all-inclusive. Moreover, it is important to note that as has been the practice during agent disposal operations, all plans and actions regarding closure need to be fully documented for future use and analysis.

Safety, Health, and Security

The committee believes that safety must continue to be at the forefront during closure operations. Both leading and lagging metrics for safety, health, and security (as well as other parameters) need to be tracked and documented as part of the normal deconstruction process. While not an exhaustive list, the metrics provided in Table 1 for this parameter represent a strong start. Good outcomes concerning safety and health are supported by the establishment of systemic data collection, site observations, and incident reporting and investigation processes. Also, the committee believes that the existing operations workforce should be briefed on the hazards of the deconstruction activities.

Communications for Promoting Safety Culture

The committee likewise believes that a strong, positive, safety culture will continue to prevail at TOCDF/CAMDS if the management maintains an active and involved safety communication and audit program. A good safety and operations culture rests on frequent formal and informal sharing of information and ongoing dialogue.

TABLE 1 Facility Closure Parameters and Associated Leading and Lagging Metrics[a]

Parameter	Leading Metrics	Lagging Metrics
Safety, health, and security	• Near misses (potential injury, potential exposure, potential breach) • Site orientation for visitors and workforce • Incident investigations completed within 30 days • Cross training for workforces and supervisors • Appropriate personal protective equipment for all tasks (goal is 100 percent) • Closure of open safety items in a timely manner • Random drug testing	• First aid cases by body part • Recordable injuries and exposures • Lost-time injuries (number) • Days away from work due to workplace incident/injury • Fatalities (all causes) • Transportation incidents on-site/off-site • Fires (ranging from smoke through explosion) • Security (actual breach of fence line, procedures)
Communications for promoting safety culture	• Periodically survey employees, supervisors, and managers with respect to criteria important to a strong safety culture	• Document frequency of safety communication sessions where employee leadership and participation are encouraged
Maintenance	• Planning and scheduling of all maintenance work • Appropriate maintenance for construction equipment • Preventive maintenance program for key equipment • Predictive maintenance program for key equipment • Appropriate calibration and checking of instrumentation and controls	• Audit maintenance process regularly • Monitor maintenance
Training and development	• Cross train and educate for critical operation and deconstruction positions • Continuing education: at least 40 hours per year of technical coursework • Workforce training on the facility and on non-normal process situations for operation personnel, including drills for abnormal conditions • Workforce training on the facility and on non-normal process situations for deconstruction personnel, including emergency and abnormal conditions	• Not applicable

Parameter	Leading Metrics	Lagging Metrics
Communications with various stakeholders	• Scheduled communications with a local community action committee with a consistent agenda • Communications with the state of Utah regulatory personnel on a regular and as needed basis • Regularly scheduled two-way communications with the workforce throughout the life cycle of the site • Track the lessons-learned program to ensure that the lessons are utilized throughout the chemical demilitarization program	• Measure response to meetings scheduled with stakeholders
Quality criteria	• Identify complete inventory of units to be closed and the end state plan for each • Ensure the environmental health and safety management system is complete and operating with appropriate data analysis and management • Develop project schedule milestone projections for the next period (week, month)	• Track engineering changes • Regularly track project schedule milestones from preplanning to completion
Cost criteria	• Project program costs over similarly selected periods and verify	• Track program costs over selected periods
Operations and deconstruction	• Monitor lockout-tag-clear-and-try process • Establish and document safe operating conditions for all major process equipment • Establish expected frequency and duration of “hot” electrical work	• Document excursions outside operating conditions • Document frequency and duration of safety interlock bypasses • Document frequency and duration of “hot” electrical work • Track deconstruction progress (e.g., weight, volume, or number of units)

Parameter	Leading Metrics	Lagging Metrics
Management	• Ensure that supervisors and managers have appropriate experience with respect to operations, maintenance, or laboratory skills for high-hazard processes • Develop processes by which top managers regularly audit and assess all key activities	• Monitor implementation of personnel development and retention plan
Environmental regulatory compliance	• Establish facility end-state conditions • Establish performance standards for closure wastes • Modify Resource Conservation and Recovery Act (RCRA) permit to include detailed closure plans • Modify other applicable permits to include closure	• Monitor compliance with RCRA permit • Monitor compliance with closure plans • Monitor compliance with other permits
Monitoring plan compliance	• Develop waste analysis plan and waste characterization protocols • Develop monitoring plans for air and other media	• Monitor implementation of waste analysis plan
Analytical	• Establish criteria for use of generator knowledge • Identify validated analytical methods to be used • Obtain regulatory acceptance of validated analytical methods	• Not applicable
Materials management	• Identify reuse and recycling options for deconstruction materials • Develop protocols for segregation of generated hazardous and nonhazardous materials • Obtain prior regulatory agreement for reuse, recycling, or disposal of all materials • Identify means for control of inventory of hazardous and nonhazardous materials • Establish a time line for risk-based disposition of all materials resulting from closure	• Implement control of inventory of hazardous and nonhazardous materials

[a] A leading indicator is a prospective metric or set of metrics that can be used to develop strategies for project success; a lagging indicator is a retrospective metric or set of metrics that can point to a need for corrective action (NRC, 2009).

Maintenance

Many injuries can be prevented through well-managed maintenance work processes. Basic maintenance begins with planning and scheduling, and it is a good goal to have at least 85 percent of all maintenance activities planned and scheduled at least one week in advance. To minimize worker exposure, it would be advantageous to implement both preventive and predictive maintenance programs for equipment that will operate during closure, such as the metal parts furnace.

Training and Development

Training and development of the workforce is a key strategic element for successful program completion. The technical aspects of the TOCDF and CAMDS closure operations mandate that the workforce be properly prepared through education and training provided by their employer. Additionally, it is imperative that an effective communication strategy be developed to ensure that there is open two-way dialogue with the workforce, regulators, and the community on critical issues. The committee believes that a concerted effort should be made to train the deconstruction workforce on hazards awareness pertinent to the site situation. This cross training between personnel familiar with operations at the site and the deconstruction workforce is believed to be essential for the safe outcomes that all stakeholders are interested in seeing. Establishing a program to assess the effectiveness of the training provided is also necessary.

Communications with Various Stakeholders

TOCDF/CAMDS management must actively lead and support communications with key stakeholders. Good communications build trust and provide more opportunities to understand the changing nature of risk.

Quality Criteria

Program quality is a key strategic element for successful program completion. Quality elements, such as adequate and appropriate analytical capabilities and retention of key personnel, comprise critical program management items that can significantly affect the outcome. Integrating quality into the operation supports all activities for continuous improvement.

Cost Criteria

Program cost objectives are a key strategic parameter of the successful completion of site closure. Management should be able to both forecast anticipated costs and to effectively explain all expenditures—both committed and expended— during any period.

Operations and Deconstruction

The committee identified some common work activities for this parameter and listed them in Table 1). If done safely, these activities can lead to a safe and reliable closure operation.

Management

With all work activities, management sets the tone and leads the site effort by its example and their leadership. The metrics listed for this parameter in Table 1 offer ways to consider how management may want to measure their activities and their effectiveness along with exercising appropriate oversight of all leading and lagging metrics in Table 1.

Environmental Regulatory Compliance

Obtaining regulatory agreement to the closure plan in a timely manner is key to achieving efficient closure. This requires close coordination with the regulatory community to obtain early agreement on closure performance standards. Before closure performance standards can be negotiated, the end state must be established. Based on this anticipated end use, environmental standards and guidelines can be established, closure plans completed, and permits modified. Continued monitoring for meeting the permit requirements will minimize delays.

Monitoring Plan Compliance

Development of the waste analysis plan requires agreement between the site contractor, the Army, and the Utah Department of Environmental Quality (UDEQ). This requires determination of what is to be analyzed and what analytical methods are to be used. If methods have to be developed or validated, this activity requires a long lead time. If waste is to be shipped off-site, the recipient of the off-site waste may require additional testing and certification of the waste.

Analytical

For closure wastes, there are several methods for determining whether the waste poses residual hazards. Typically, generator knowledge[2] and standard methods such as those provided in the EPA publication SW-846 are used to determine if a waste meets the release criteria. When these are not available, new methods may have to be developed and validated. This may be time- and resource-intensive.

Materials Management

Careful materials management is a key to successful facilities closure. Decontamination, reuse, recycle, and disposal options for equipment and secondary waste materials generated during closure should be identified. Protocols for segregation of generated hazardous and nonhazardous materials should then be implemented, including planning for prevention of cross-contamination. This will require proper identification and inventory control of these materials. A time line for risk-based disposition of all materials resulting from closure should be developed. Prior regulatory agreement and approval should be obtained for reuse, recycling, and disposal of all materials. In addition, protocols that have been established to prevent releases from stored waste should be continued.

[2]"Generator knowledge" is an evaluation method for hazardous waste that is commonly accepted and defined by the EPA and individual states based on some or all of the following information (EPA, 2005):

1. Facility process flow diagram or narrative description of the process generating the waste (should be used in most cases).
2. Chemical makeup of all ingredients or materials used in the process that generates the waste (should be used in most cases).
3. List of constituents that are known or believed to be by-products or side reactions of the process that produces the waste.
4. Material safety data sheets and/or product labels or substances used in the process that generates the waste.
5. Data obtained from approved methods of sampling and laboratory analysis of waste generated from the same process using the same ingredients/materials.
6. Data obtained from literature regarding waste produced from a similar process using the same ingredients/materials.
7. Documentation of product specifications or input materials and output products.

TOCDF CLOSURE STATUS AND ISSUES

Facility Description

To dispose of chemical agents, TOCDF uses an incineration process comprising five interconnected systems:

- System for unloading and unpacking system for munitions from the adjacent Area 10 storage of the Deseret Chemical Depot (DCD);
- Separate disassembly systems for rockets, bulk containers, mines, and projectiles;
- Furnace and incinerator systems that include a deactivation furnace system for energetic materials, a metal parts furnace, and two liquid incinerators for agent;
- Various safety systems that include areas for explosive containment, a cascaded ventilation system that moves plant air from less contaminated to more contaminated areas, airborne agent monitoring, fire protection, and door access monitoring; and
- Various support systems, including pollution abatement systems, and controls for electric, fuel gas, instrumentation, compressed air, hydraulics, and cooling. The pollution abatement system has recently been upgraded by the addition of a postcombustion mercury abatement system to capture various degrees of mercury contamination in mustard agent ton containers and projectiles.

Current Operations

TOCDF began agent disposal operations in August 1996 and completed disposal of GB nerve agent and munitions in March 2002. Disposal operations for VX nerve agent began in March 2003 and were completed in June 2005. The mustard agent campaign began in July 2006 and is projected for completion in the third quarter of 2011. This date will meet the treaty obligation date of April 29, 2012.

Closure Planning Status

Closure planning for TOCDF is in early stages. A project management approach is envisioned, with experienced senior management personnel presently assigned to closure planning and implementation as their chief responsibilities. Moreover, experienced technical personnel familiar with the facility will be engaged during closure planning and implementation. Subject matter experts and proven procedures are also expected to be used as much as possible during closure. Closure planning will employ best practices and approaches based on lessons learned from JACADS and other closures. Detailed plans and procedures have yet to be developed, but a general framework and time line have been established. The committee anticipates that these plans and

procedures for closure would include an appropriate emphasis on safety, which were not discussed fully in the closure documents and presentations obtained while this letter report was being prepared. Approval of the basic closure plan is expected to be requested from the UDEQ in June 2010. The target date for planning completion is January 2011, and the expanded plans will include development of new documentation for unit-by-unit closure and the closure implementation schedule.

TOCDF closure planners are maintaining good relations and cooperation with the UDEQ. Closure operations, including those for the munitions demilitarization building, are projected to begin in September 2011, but some advance work was being carried out as this report was being prepared (as discussed below). The metal parts furnace and liquid incinerators will be closed later in the schedule (mid-2013) to allow for their availability to process closure waste process.

Present planning for TOCDF closure is based on a strategy of decontamination by moving progressively from the most contaminated to the least contaminated areas and structures. In general, this will involve removal of any residual agent and explosive material residues, followed by removal of agent-exposed equipment and subsequent decontamination of occluded spaces and exposed surfaces. Scabbling will be used if in-progress sampling shows it is needed.[3] When an area and structure have been completely decontaminated, the strategy for decontaminating the cascaded ventilation systems is to use a final washdown, certify that occluded spaces have been appropriately decontaminated**,** and, finally, use ventilated and unventilated testing to measure internal ambient air agent concentrations in a controlled manner.

Certain closure tasks, such as decontamination and removal of equipment, will be performed under partial-closure plans when possible without disrupting disposal operations. Already a number of such tasks have been completed. Early closure activities are projected to continue through August 2011.

A large quantity of stored legacy secondary waste, secondary waste being generated during continuing munitions disposal operations, and waste from TOCDF closure operations is projected to be either processed on-site and/or shipped off-site. Treatment, if necessary, and shipment of such wastes will take place during continuing disposal operations as scheduling opportunities present themselves or, alternatively, during closure operations. Secondary waste from all sources is projected to be disposed of by the third quarter of 2014.

The time line for TOCDF closure indicated above takes into consideration uncertainties concerning the UDEQ determinations on allowable standards for secondary waste treatment and off-site disposal. Site deconstruction is projected to continue until June 2014, with final administrative closure of TOCDF in February 2016. Notwithstanding the planning described above, and based largely on committee members' collective experience and observations in obtaining permit changes, the committee believes that the current schedule is optimistic. Moreover, certain members of the public are known to take great issue with some of the activities surrounding the chemical demilitarization program. Generally speaking, the more contentious the issues, the longer the permitting processes are likely to take.

[3]Scabbling is the removal of a surface layer of material (such as concrete) to a specified depth.

Current Permit Status

The currently approved version of the TOCDF RCRA permit includes a basic closure plan (Army, June 2009). The Army is presently pursuing a permit modification for both CAMDS and TOCDF that combines active operations of both facilities, including closure, under the TOCDF permit.[4] Utah officials have indicated that they will soon be ready to act on permit modification approvals, following RCRA public involvement and administrative actions.[5]

TOCDF has held initial discussions with the UDEQ regarding closure, focusing on specific issues. A RCRA permit modification to establish details for the regulatory-required closure plan is planned for submittal by June 2010. TOCDF closure plans within the existing (prepermit modification) permits indicate that the closure performance standard will be based on an industrial future use scenario.

The TOCDF closure plans also indicate that the incinerators and other units will be decontaminated as needed and dismantled. Some structures for TOCDF (primarily those used for nonagent operations) may remain following closure. Presently, TOCDF plans to remove all materials, including scrap metal and demolition wastes (e.g., concrete) from structures. Current requirements call for all of these materials to be disposed of in a hazardous waste landfill as designated F999 wastes. Some wastes, such as demilitarization protective ensemble suits, may retain the combined P999/F999 waste code (discussed later under *Utah Regulatory Requirements*) following decontamination.

Waste analysis to meet waste control limits (WCLs) and other criteria have been required for both chemical agent and for agent degradation products prior to the off-site transport of various wastes generated during disposal operations (such as decontaminated munitions casings). However, analytical methods for these analytes in certain closure wastes (such as concrete and carbon) are still under development and will require regulatory approval.

End Use and End Use Status

The site is envisaged at present to be closed to meet an industrial end use specification and will become part of the Tooele Army Depot following closure. Complete closure of the TOCDF site and remediation to levels of residual contamination for industrial use is envisioned.

[4]Information here has been taken from a question-and-answer session between Ted Ryba, Site Project Manager, TOCDF Field Office, and the committee, on October 22, 2009.

[5]Information in the final sentence of this paragraph and from the next three paragraphs is from a question-and-answer session between Dennis Downs, Director, Utah Department of Solid and Hazardous Waste, and the committee, on October 22, 2009.

CAMDS CLOSURE STATUS AND ISSUES

Description

CAMDS was constructed to develop and test equipment and technologies for dismantling and treating the stockpile of chemical agents and munitions stored on Johnston Island and at eight storage sites in the continental United States. The CAMDS facility was originally constructed between 1974 and 1978 and began munitions processing on September 10, 1979. CAMDS was a pilot plant for various processes later constructed as fixed units at either baseline incineration or chemical hydrolysis-based chemical agent disposal facilities. Some of the processes developed and tested at the facility are listed in Table 2. A total of 98,051 munitions and 363,524 pounds of chemical agents, including GB, VX, and mustard agent, were destroyed at the facility ending in March 2005.[6] Many of the process units and much of the equipment at CAMDS have been dismantled. CAMDS closure is complicated by a number of factors, including the following: (1) the age of the various units, resulting in incomplete knowledge of the operating history; (2) its use as a pilot plant, resulting in use for a wide variety of chemical demilitarization operations; and (3) its configuration as multiple interconnected buildings having a common ventilation system and common utility services that require careful attention to the order of shutting down parts of the system.

TABLE 2 Examples of Equipment Developed at CAMDS

Process type	Equipment
Bulk neutralization	Area detection system
	Instrumented ton container
Incineration	Liquid incinerator
	Deactivation furnace system
	Metal parts furnace
Hydrolysis (Assembled Chemical Weapons Alternative [ACWA] program)	Projectile washout system
Thermal destruction (ACWA program)	Metal parts treater

SOURCE**:** Elizabeth Lowes, Deputy General Manager, Closure Integration, EG&G**, "**CAMDS and TOCDF closure approach/status," Presentation to the committee, October 21, 2009.

[6]Elizabeth Lowes, Deputy General Manager, Closure Integration, EG&G**, "**CAMDS and TOCDF closure approach/status," Presentation to the committee, October 21, 2009.

Current Closure Operations

Current operations are limited to closure activities and the on-site laboratory, the last mentioned of which continues to provide analytical support for the DCD, including capabilities not found elsewhere at DCD. Closure activities are focused on 61 hazardous waste management units, including the following:

- 14 Subpart I units (chemical storage areas)
- 43 Subpart J units (tank systems)
- 1 Subpart O unit (incinerator)
- 3 Subpart X units (miscellaneous)

Closure activities will involve the facility ventilation system as well, including the carbon filter units; the destruction of a number of buildings from which the bulk of the processing units have already been removed and that will also require asbestos abatement measures; and outside chemical and agent transfer lines.

Closure Planning Status

The current operator of the CAMDS facility, the EG&G Division of URS Corporation, only recently assumed control of the facility, and final closure planning is not complete. However, many of the processing units were dismantled and removed by an earlier contractor. The current contractor has prepared partial closure plans for the material treatment facility and chemical test facility, and acceptance is being negotiated with the UDEQ. Current efforts are directed toward the material treatment facility to refine and test closure procedures. They will be followed by deconstruction of the remaining buildings, from the most contaminated to the least contaminated. For each building, decommissioning work packages will be prepared that recognize the unique processes and contamination history of the building and utilize a 10-step approach for each building as follows:

(1) Establishment of engineering controls and monitoring,
(2) Preliminary survey,
(3) Preparation for work execution,
(4) Decontamination and equipment disposition,
(5) Post-disposition survey,
(6) Ventilated vapor screening level (VSL) monitoring,[7]
(7) Unventilated VSL monitoring,
(8) Final isolation,
(9) Demolition, and

[7]The VSL concentrations are equivalent to the short-term limit (STL) value, which is a concentration typically expressed in milligrams of specific agent per cubic meter of air. STLs are similar to short-term exposure limits (STELs) but without the 15-minute exposure time component. The VSL and short-term limit values for agents of interest are as follows: GB, 0.0001 mg/m^3; VX, 0.00001 mg/m^3; mustard agent, 0.003 mg/m^3 (NRC, 2007).

(10) Closure verification sampling.

CAMDS closure involves some unique complications. Because different process units were originally constructed over time, their closure involves dismantling numerous buildings with potentially different challenges. The buildings are also tied together with common utilities, including ventilation and sump drains, which could also complicate the decontamination procedures.

The analytical laboratory at CAMDS is not a hazardous waste management unit identified within the permit covering CAMDS, so no specific permit actions are required to remove it from the applicable RCRA permit. However, it is anticipated that the heating, ventilation, and air conditioning filters for the laboratory will need to be worked out in the future.

Finally, current closure planning does not address issues that will limit reuse of the property, such as the presence of subsurface fuel oil contamination. This contamination, unrelated to the destruction of agent, is designated Solid Waste Management Unit (SWMU) 13. This and other SWMUs on DCD are separate from the closure of CAMDS.

Current Permit Status

A pending permit modification for both CAMDS and TOCDF provides for combining the active operations of both facilities, including closure, under the TOCDF permit.[8] Utah officials have indicated that they will soon be ready to act on permit modification approvals, following RCRA public involvement and administrative actions. The resulting permit will contain basic closure plans for CAMDS, which will eventually need to be expanded into unit-by-unit detailed closure plans and approved by the state prior to execution.[9] CAMDS has already started work on these more detailed closure plans, which were not, however, made available to the committee in time for this report. In the interim, CAMDS has proceeded with preclosure decommissioning activities (e.g., decontamination, removal of equipment) with the knowledge and oversight of the UDEQ.[10]

End Use and End Use Status

Like TOCDF, the CAMDS site will become part of the Tooele Army Depot upon closure. Closure will involve decontamination and disposal of all agent-contaminated facilities and all buildings and facilities not needed by the depot. Closure of the CAMDS site will not resolve outstanding contamination issues, if any, associated with the analytical laboratory. In addition, subsurface fuel oil contamination from SWMU 13,

[8]Information from a question-and-answer session between Ted Ryba, Site Project Manager, TOCDF Field Office, and the committee, on October 22, 2009.

[9]Information from a question and-answer session between Dennis Downs, Director, Utah Department of Solid and Hazardous Waste, and the committee, on October 22, 2009.

[10]Information from a question-and-answer session between Jerold Lynn, Site Project Manager, CAMDS, and the committee, October 22, 2009.

below the CAMDS site, is being addressed under a general permit corrective action program for DCD and thus is not an issue for TOCDF or CAMDS closure.

ENVIRONMENTAL REGULATORY ISSUES APPLICABLE TO CAMDS AND TOCDF

In closing CAMDS and TOCDF, the Army must comply with regulations established by the UDEQ under its delegated authority for a number of different environmental regulatory programs, including the Clean Air Act, the Clean Water Act and hazardous waste management regulations established under RCRA. The most challenging of these for CAMDS and TOCDF are the facility closure regulations under RCRA (40 CFR Part 264, Subpart G).

RCRA Regulatory Background

Utah has adopted EPA's RCRA closure regulations established under 40 CFR Part 264, Subpart G (Utah R315-8-7). These require facilities to comply with a closure performance standard. The performance standard for closing a facility is typically translated into risk-based quantitative criteria (such as concentrations) for specific constituents in waste materials. These criteria depend on the future use of the site. Criteria for unrestricted (residential) use are generally more protective than those for industrial use. The RCRA closure regulations also require facilities to submit detailed closure plans when applying for the permit. The plan then becomes part of the permit when it is issued. It may dictate a simple closure that applies to the entire unit or facility or may propose a series of partial closures for specific units that will eventually lead to final closure for the entire facility. Further, the closure plan includes waste inventory estimates, identification of the closure performance standard, and a schedule for closure, among other information. Closure plans may be revised as needed as closure operations proceed, but such revision would require a formal permit modification.

Utah Regulatory Requirements and Practices

Utah has imposed regulations and practices with respect to chemical agents, many of which can be considered more restrictive than the usual RCRA requirements. These unique regulations and practices have evolved over the years and are currently applicable to closure. Specific Utah regulations and practices are identified below.

Utah Regulatory Requirements

P999 and F999 Waste Codes. Utah has listed "Nerve, Military, and Chemical Agents" as acute hazardous waste under hazardous waste code P999 and "Residues from Demilitarization, Treatment and Testing of Nerve Military and Chemical Agents" as

listed hazardous waste under hazardous waste code F999.[11] Throughout the demilitarization campaign at CAMDS and TOCDF, restrictions were placed on management of acutely hazardous waste P999, and wastes resulting from treatment of the P999 wastes were designated F999. Residues from treatment, storage, or disposal of F999 wastes retain the hazardous waste designation and the code F999. Thus, wastes produced during closure, even those that result from treatment of F999 wastes, are required to be managed as F999 hazardous wastes, even if they are known to contain no detectable agent or other hazardous constituents.[12]

Cleanup Action and Risk-Based Closure Standards. Utah has established specific requirements for closure of industrial sites: "Cleanup Action and Risk-Based Closure Standards" (UDEQ, 2001). Closure performance standards are developed in accordance with RCRA regulations. Risk-based closure performance standards are determined case by case for nearly all facility closures.

Utah Regulatory Practices

Agent Vapors. Utah includes materials contaminated as a result of actual or potential contact with agent vapors as F999 waste. The result is that significant additional volumes of various types of materials would become regulated as hazardous waste once generated during closure.

Off-site Restrictions. Utah places restrictions on the off-site transportation of potentially agent-contaminated materials for further treatment and/or disposal. In Utah, wastes must be tested against the WCLs and may be transported off-site only if these levels are met. The WCLs were initially developed as drinking water standards for soldiers in the field (HQDA, 2005; HQDA, 2008). Even if the WCL is met, these wastes are still controlled as hazardous waste under the Utah F999 waste code.

Waste Characterization. Since the early days of the chemical demilitarization program, the Army, being concerned primarily with worker exposure to agent vapor hazards, has relied on the vapor screening of materials and wastes that have been exposed to chemical agents (HQDA, 2008). In contrast, RCRA has historically used direct chemical analysis of wastes for constituents of concern (EPA, 2009). Utah has been reluctant to accept vapor screening as a means of characterizing wastes that may have been exposed to liquid or vapor chemical agent. In those limited cases where it has accepted vapor screening, Utah has required the Army to apply more stringent criteria than the Army itself has established. For example, whereas the Army's screening level for protection of workers is 1.0 VSL, Utah requires the Army to apply a more stringent standard, 0.5 VSL, as added protection. Further, some waste streams, in particular those that may absorb chemical agent, must be decontaminated before vapor screening.

[11]Acute hazardous wastes are established under the RCRA program at 40 CFR 261.33(e) (Utah R315-2-9). F999 is added by the UDEQ to the listing of hazardous wastes from nonspecific sources found in 40 CFR 261.31 (Utah R315-2-11).

[12]While RCRA and the Utah regulations provide means of demonstrating that F999 wastes are not hazardous (that is, of "delisting"), the demonstration required is often arduous and prohibitively expensive.

Waste Activated Carbon and P999. Waste carbon that is actually or potentially contaminated with chemical agent is designated P999 under Utah regulations. Under present Utah restrictions, P999 wastes may not be sent off-site for treatment and disposal. For example, much of the activated carbon (the final four of six banks) of the heating, ventilation, and air conditioning system has not, based on generator knowledge, been exposed to agent. It will also be necessary to evaluate in detail the disposal of carbon from the TOCDF pollution abatement system filter system, which is likely to contain mercury or mercury compounds from the processing of mustard agent munitions having mercury contamination.

Dual Waste Code for Some Materials. Some waste materials, primarily permeable solids, can be difficult to sample and analyze for chemical agents. Others, such as demilitarization protective ensemble suits that become waste after use, can be difficult to sample. In these cases, Utah has required decontamination of the materials and application of a dual P999/F999 waste code prior to off-site transport for disposal.

The standards and practices that Utah uses to address demilitarization disposal operations were developed before chemical agent began to be destroyed at CAMDS and TOCDF. Now, however, there will not be any significant amount of agent present during closure. Furthermore, decontamination procedures will further reduce any agent residues that may be contaminating waste materials. Thus, the risks to human health and the environment from agent and its degradation products during closure operations will be reduced. This should provide the basis for considering less restrictive practices than the present UDEQ requirements, based on an evaluation of the risks of managing the closure wastes.

PUBLIC PARTICIPATION

Community involvement at the Utah demilitarization facilities is conducted primarily through the Citizens Advisory Commission (CAC), appointed by the Governor of Utah. The committee expects the CAC to provide opportunities for public participation in closure planning. Thus far, although the CAC is aware that closure planning is under way, it is still engaged in the oversight of demilitarization operations. Although the committee found the community was concerned that the end of demilitarization operations might lead to layoffs or have other economic consequences, it did not find any community concerns that the closure of TOCDF and CAMDS would affect the environment. The CAC, as well as other community bodies, such as the Restoration Advisory Board for the entire DCD, are concerned about munitions response, corrective action, and related disposal activities, but those issues are beyond the scope of the task for this committee.

The Army and community have not yet developed a plan for community involvement during closure other than the requisite state forums under RCRA. While closure oversight is likely to be less intense than discussions of demilitarization, the CAC or a similar body can serve a valuable role during closure. The committee urges the Army

to discuss with the CAC ways to continue constructive public involvement between the end of demilitarization and formal closure.

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Attachment A

Statement of Task

The NRC will form a committee to provide two reports. The first is an interim report assessing the following:

- Examine the current closure plans for TOCDF and CAMDS and make recommendations as required.
- Recommend key parameters to assess an integrated approach to common closure requirements.
- Assess planning for compliance with unique regulatory requirements of the State of Utah towards closure of the two chemical disposal facilities.

Following the issuance of the interim TOCDF-CAMDS closure report, the National Research Council will issue a comprehensive report as follows:

- Update the 2002 NRC report, Closure and Johnston Atoll Chemical Agent Disposal System Report, as required.
- Using the key parameters to assess an integrated approach to common closure requirements (as recommended in the interim TOCDF-CAMDS closure report), determine applicable lessons-learned from the closure of JACADS, ABCDF, and the ongoing closure of NECDF for potential use during TOCDF and CAMDS closure.

The interim report will be issued not later than six months after receipt of the contract and the comprehensive report will be issued no later than twelve months after the release of the interim report.

Attachment B

Acronyms and Abbreviations

ABCDF	Aberdeen Chemical Agent Disposal Facility
ACWA	Assembled Chemical Weapons Alternatives (program)
CAC	Citizens Advisory Commission
CAMDS	Chemical Agent Munitions Disposal System
CMA	Chemical Materials Agency
DCD	Deseret Chemical Depot
EPA	Environmental Protection Agency
GA	a nerve agent (tabun)
GB	a nerve agent (sarin)
JACADS	Johnston Atoll Chemical Agent Disposal System
NECDF	Newport Chemical Agent Disposal Facility
RCRA	Resource Conservation and Recovery Act
SWMU	solid waste management unit
TOCDF	Tooele Chemical Agent Disposal Facility
UDEQ	Utah Department of Environmental Quality
UDSHW	Utah Division of Solid and Hazardous Waste
VSL	vapor screening level
VX	a nerve agent
WCL	waste control limit

Attachment C

Committee Members

COMMITTEE TO REVIEW AND ASSESS CLOSURE PLANS FOR THE TOOELE CHEMICAL AGENT DISPOSAL FACILITY AND THE CHEMICAL AGENT AND MUNTIONS DISPOSAL SYSTEM

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Attachment D

Acknowledgement of Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's (NRC's) Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

Harold K. Forsen, NAE, Bechtel Corporation (retired),
George W. Parshall, NAS, E.I. du Pont de Nemours & Company (retired),
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William R. Rhyne, Consultant,
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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Hyla S. Napadensky, NAE. Appointed by the National Research Council, she was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.