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MARTIN MARIETTA

Chemical Stockpile Disposal Program Rapid Accident Assessment

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OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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CHEMICAL STOCKPILE DISPOSAL PROGRAM
RAPID ACCIDENT ASSESSMENT

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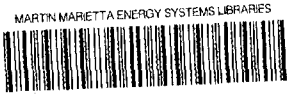

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ACRONYMS AND ABBREVIATIONS

AAS	accident assessment system
ACAMS	automatic continuous air monitoring system
ANAD	Anniston Army Depot
APG	Aberdeen Proving Ground
A/C Crash	aircraft crash
CHB	container-handling building
CONUS	Continental United States
CSDP	Chemical Stockpile Disposal Program
DAAMS	depot area air monitoring system
DFS	deactivation furnace system
Dropped	dropped munition
DUN	dunnage incinerator
EQK	earthquake
ECV	explosion containment vestibule
ECR	explosion containment room
EIS	environmental impact statement
EOC	Emergency Operations Center
FEMA	Federal Emergency Management Agency
Fkl	forklift
ΔP	differential pressure
HF	handling operation at the facility
HO	handling operation related to on-site transportation
JACADS	Johnston Atoll Chemical Agent Disposal System
LBAD	Lexington-Bluegrass Army Depot
LIC	liquid incinerator
MDB	Munitions Demilitarization Building
MHI	munitions holding igloo
MPF	metal parts furnace
NA	not applicable
ONC	on-site transport container
ORNL	Oak Ridge National Laboratory
PAS	Pollution abatement system
PBA	Pine Bluff Arsenal
PRA	probabilistic risk assessment
PUDA	Pueblo Depot Activity
TEAD	Tooele Army Depot
TMI	Three Mile Island
TOX	toxic cubicle
UMDA	Umatilla Depot Activity
UPA	unpack area
WC	worst case

ABSTRACT

This report develops a scheme for the rapid assessment of a release of toxic chemicals resulting from an accident in one of the chemical weapon demilitarization plants or storage areas. The system uses such inputs as chemical and pressure sensors monitoring the plant and reports of accidents radioed to the Emergency Operations Center by work parties or monitoring personnel. A size of release can be estimated from previous calculations done in the risk analysis, from back calculation from an open-air chemical sensor measurement, or from an estimated percentage of the inventory of agent at the location of the release. Potential consequences of the estimated release are calculated from real-time meteorological data, surrounding population data, and properties of the agent. In addition to the estimated casualties, area coverage and no-death contours vs time would be calculated. Accidents are assigned to one of four categories: *community emergencies*, which involve a threat to off-site personnel; *on-post emergencies*, which involve a threat only to on-site personnel; *advisory*, which involves a potential for threat to on-site personnel; and *chemical occurrence*, which can produce an abnormal operating condition for the plant but no immediate threat to on-site personnel.

1. INTRODUCTION AND SUMMARY

This work is a continuation of work begun in 1984 when the Oak Ridge National Laboratory undertook to develop the final Project Environmental Impact Statement for the Chemical Stockpile Disposal Program (CSDP) (PEO-PMCD 1988). This is one of the technical support studies done in conjunction with and as an input to the emergency planning program being undertaken under the U.S. Federal Emergency Management Agency (FEMA)–U.S. Department of the Army Memorandum of Understanding.

At several of the disposal-plant sites, civilians live or work within a few kilometers of the proposed locations and existing storage areas. Under some meteorological conditions, credible accidental releases could disperse dangerous concentrations of agent aerosol or vapor off post within a few minutes. If people in the area are to respond effectively to potential emergencies, a warning system and accident-assessment system (AAS) with a very fast response time must be installed. This study is concerned primarily with accident assessment and consequence evaluation. Warning is the subject of another study (Sorensen 1988), as is protective action (Rogers et al. 1990). The design goal for response time of the AAS phase is 5 min.

In theory, all possible accidents were considered in the risk analysis (PEO-PMCD 1987), but many small accidents were omitted because they would not produce dangerous concentrations of agent off-site under worst-case meteorological conditions or because the probability of the accident was less than 10^{-8} per year. One of the tasks confronting any AAS is correctly identifying these high-probability, low-consequence accidents as low-consequence accidents not requiring an off-site emergency response. Likewise, some skepticism is warranted on the low probability calculated for some accidents. For example, the catastrophes at Bhopal, Three-Mile Island (TMI), and Chernobyl were not predicted but were the result of concatenations of highly improbable human errors, exacerbated at TMI by equipment failures and at Bhopal by deliberate sabotage (Kalelkar 1988).

The objective of this study is to devise a scheme for the rapid assessment of an accident that would release chemical agent during chemical-weapons-stockpile-disposal operations at any of the eight sites planned in the continental United States (CONUS). Inputs to the assessment would include

- the type of agent and munition being processed;
- the output and location of chemical, pressure, and temperature sensors both outside and inside the Munition Demilitarization Building (MDB), including process instrumentation and fire detectors;
- periodically (5–15 min) updated meteorological measurements, including stability assessments; and
- prompt radio or telephone reports of any accidents/incidents and their locations from work, surveillance, or escort parties in the field.

The magnitude of a release would be estimated by one of three methods:

- back calculating plume size from a concentration-time measurement by an open-air chemical sensor, measured meteorological conditions, and the relative location of the sensor and point of release;

- using the release estimated in the risk analysis if it can be determined that the accident is one of those analyzed in the risk analysis;
- estimating the inventory of agent involved from the location and nature of the accident and by estimating the fraction airborne from experiments with similar agents in similar accident scenarios.

The no-deaths contours would be calculated from the estimated amount of release and from meteorological conditions. Potential casualties would be calculated from population-distribution data.

On the basis of the inputs and calculations, the accident/incident would be assigned to one of four categories:

- Community emergency: involves a release for which the estimated no-deaths contours include off-post personnel.
- On-post emergency: occurs if the no-deaths contour covers normally unmasked personnel on post but the release does not travel off post.
- Advisory condition: occurs if there is no release but if an abnormal condition exists that substantially increases the potential for a release that can threaten personnel.
- Chemical occurrence: involves an unplanned occurrence of abnormal operation or an abnormal condition at the post that does not immediately threaten the lives or safety of personnel.

A 5-min assessment time appears to be achievable if

- the Emergency Operations Center (EOC) or other assessment facility is manned and operating when the incident occurs,
- personnel at the accident site are able to communicate directly with the EOC,
- meteorological data are being collected and stability conditions are being calculated,
- a computer program that supports the assessment is operating.

2. APPROACH

The philosophy was to emphasize simplicity in the scheme. Rather than attempting to apply an expert system or some other more general artificial-intelligence software, a simple decision tree tailored to the problem was developed. Where possible, inputs and outputs were grouped to reduce the number of logic steps in the analysis. Emphasis is on the accidents identified in the risk analysis, although the proposed system recognized the potential for occurrences not identified in the Probabilistic Risk Analysis.

2.1 LOGIC

The steps in the assessment are to (1) detect the accident from sensors or field reports, (2) identify the accident from the munitions being processed and the location of the accident, (3) estimate the release size by one of three methods, (4) calculate the consequences of the accident in terms of population exposed, and (5) decide which of the four categories the accident falls in for emergency response.

2.1.1 Input

Real-time inputs consist of radio reports of abnormal situations from monitoring and work parties, sensor readings of abnormal circumstances and their locations, and frequently updated measurements of wind speed, direction, and atmospheric stability. Data that change more slowly include the population distribution and density around the site, the flow sheets of the demilitarization process, the planned inventories for each agent, and the munition and identity of the agent and munition currently being processed. To meet the requirement of a 5-min response time for accident assessment, chemical sensors must respond in 1 or 2 min and be connected to an alarm and readout in the EOC. The improved automatic continuous air monitoring system (ACAMS) would be suitable, but depot area air monitoring system (DAAMS) would not. Field personnel, such as escort or monitoring personnel in a position to report releases or accidents, must have direct communication with the EOC.

2.1.2 Detection

An accident outside the MDB is most likely to be detected by field personnel reporting by radio or by sensors with readouts and alarms in the on-post EOC. People or monitors reporting an accident occurrence would report its location. Exceptions would include the detection of an airborne agent by an outside sensor. Location of the point of release would have to be determined by back-calculating the trajectory of the cloud from meteorological information.

2.1.3 Identification

In general, the nature of an accident can be identified from its location in the demilitarization process, as specified in the process flow sheet (see Appendix A) for the munitions being processed (Sect. 3). The munitions and the agent under process are known from the operations plan. In some cases, differentiation between two or more possible

accidents at a given location would have to be made by referring to sensor reports or reports by personnel at the scene.

2.1.4 Estimated Release

Three different methods (depending on available information) are used to estimate the quantity of agent released for any given accident. If the accident is one of those listed in the risk analysis, the amount released by that accident is estimated in the analysis and can be used in subsequent calculations. The amount released can subsequently be revised as more information regarding the accident becomes available.

Potentially, the most accurate estimation of release can be made from a real-time concentration-time reading by one or more outdoor chemical sensors; from the known distance and direction from a known site of a release, as determined by the locations of each sensor; and from the site of the release and meteorology. The size of the release can then be back-calculated from meteorological information. This method is only as accurate as the plume models used to predict downwind concentrations. A program to do this has been developed by the DuPont Company and is incorporated in its SAFER©* system (Whiteside 1989). However, estimating by this technique would be the exception rather than the rule because of the scarcity of sensors measuring concentration vs time.

The third and probably the most likely method of estimating the release is by estimating the inventory of the agent involved in the accident. This could be a single munition, a pallet, an on-site container, a truckload or room inventory in the MDB, or a building or bunker inventory, depending on the nature of the accident. Information on the extent of the accident would be radioed from on-site personnel to the EOC. With the inventory, the fraction airborne can be estimated by percentages, which are estimated in the risk analysis for the nature of the accident (explosion, fire, spill, etc.).

Detection of an accident by an outside point sensor would be unusual, because most of the sensors currently deployed outside do not provide real-time concentration readings; they are generally for historical record. Real-time sensors are available but are expensive to purchase and maintain. If located close to the sites of all potential accidents, the sensors still have a good chance of being missed by the plume from an accident because the plume may be narrow at its source or may be carried over the sensors by heat from an associated explosion or fire.

2.1.5 Estimated Consequences

Given the results of one of the three methods of estimating the release and meteorological data exposure as a function of time can be calculated for any downwind distance providing contours of exposure at varying levels. If the estimated no-deaths contours extend beyond the site boundary and into civilian population, then an off-post emergency would be declared. A variety of computer programs will do the meteorological calculations, plume contours, and casualty estimates, given the location and data on surrounding populations; D2PC is such a program. The location and extent of expected casualties would provide the basis of recommended emergency response.

2.1.6 Accident Categories

In similarity with nuclear accidents, four categories are proposed: community emergency, on-post emergency, advisory, and chemical occurrence (Schneider 1989).

A chemical occurrence is an unplanned, unscheduled occurrence of abnormal operation or abnormal condition of the plant that does not pose any immediate threat to the safety of the personnel. An advisory is an unusual condition or occurrence; it does hold a potential threat to the safety of personnel or the plant. On notification of an advisory, plant personnel would be expected to locate their gas masks. An on-post emergency would be declared in the event of the release of an agent out of controlled spaces in a quantity that can threaten the safety of plant personnel or a condition posing an imminent threat of such release. A community emergency is one in which the safety of off-site personnel is threatened by the release of an agent in quantities that can produce agent exposures off-site greater than the no-deaths criterion or that have the potential to do so.

2.2 PROGRAM

A program to classify accidents and provide an early estimate of their consequences is shown in Fig. 1. The required data inputs of the program are shown at the top of the page. They have been briefly discussed previously. The individual operations in the program are shown in the boxes, also discussed previously. Branch points or decision points in the program are shown in the diamonds.

The program would be initiated by an abnormal sensor reading or a radioed report of an accident or abnormal condition from field personnel. Sensor readings could indicate loss of negative pressure in the toxic handling areas of the MDB; reading of a stationary chemical sensor, installed to send its output back to the EOC; or smoke detectors or fire detectors designed to alarm the EOC. Radio reports could include those of a fire and its location, an explosion and its location, or a spill or leak and its location. Radio reports could also include damage from an aircraft crash, a vehicle collision, a drop of a munition pallet or on-site container, or other mechanical accidents. In general, the detection of the accident also will identify its location. Exceptions to this might be (1) the explosion in one storage igloo in a storage area at night or (2) the detection of an agent cloud by a chemical sensor.

The identity of the agent and munition would be known for accidents occurring at the demilitarization plant site; the munition being processed would be identified by the operations plan. Identification of the munitions involved in the explosion of one munitions igloo in a remote area of the storage area could, in general, not be done until the igloo is identified.

If real-time chemical sensors are part of the suite of monitoring instruments, they would be interrogated early in the analysis of an accident. Positive readings on one or more sensors would initiate a subroutine to back-calculate, using current meteorological data and possible trajectories of the material affecting the sensor. This hopefully will identify the accident's source. If the source can be determined and concentration-time information is obtained from the sensor(s), the size of the release can be back-calculated from the sensor and source positions and meteorological data, which are tracked and recorded in real time by the meteorological instrumentation system. The release thus calculated would be used as input to the module which would calculate the dose contours and potential population exposed.

If there is not an external chemical sensor reading or if the source of the reading cannot be determined, then the program would default to trying to identify the accident, as described in the risk analysis. With knowledge of the munition and agent, reference should be made to 1 of the 16 "flow sheets" prepared for each of the agent-munition combinations which list the

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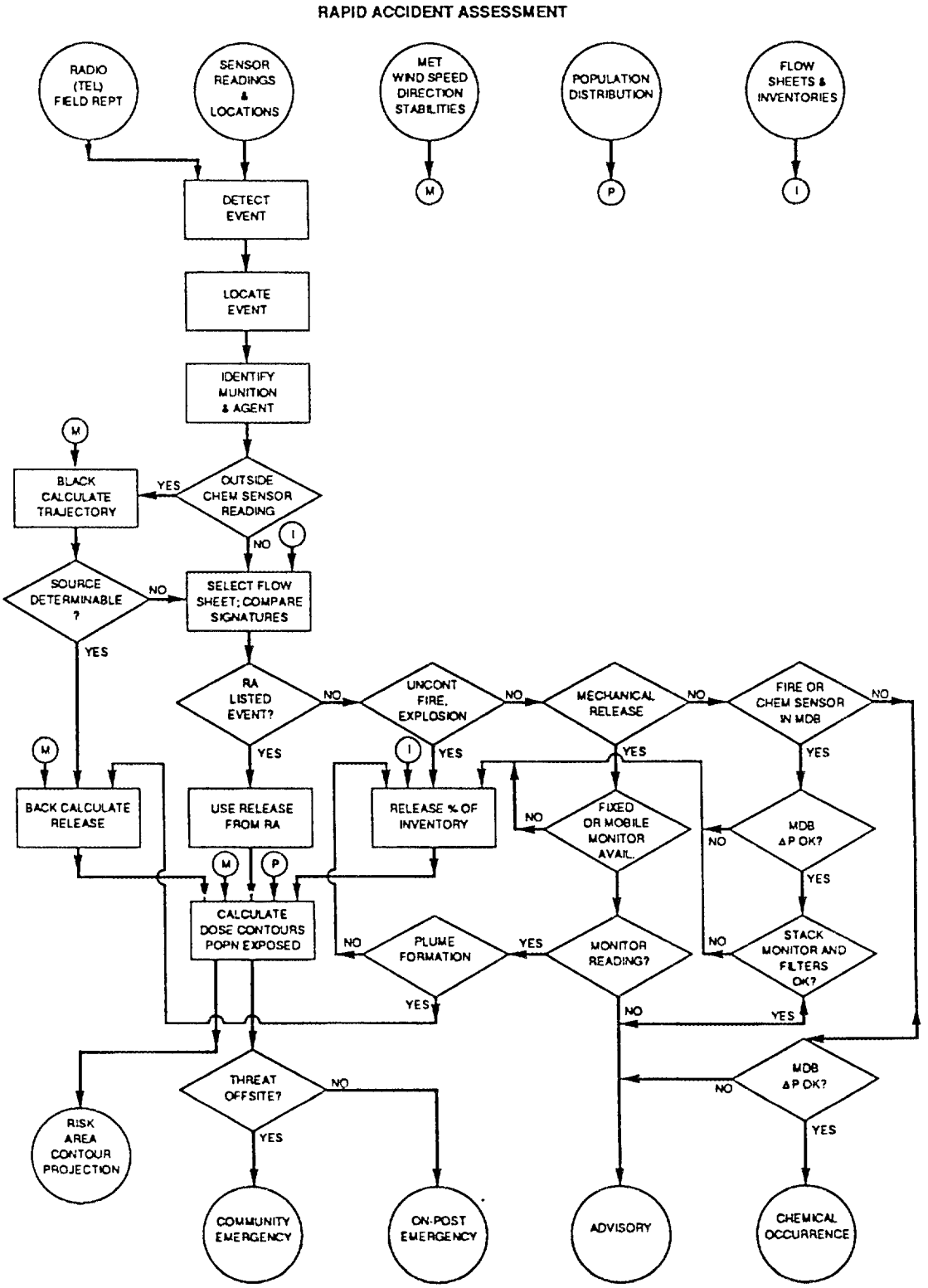

Fig. 1. Rapid accident assessment.

processing steps for that combination and the accidents identified in the risk analysis with each step in the process (Sect. 3). In general, if there is one or more accidents associated with a given step in the process, other information about the accident (such as the presence or absence of fire, explosion, earthquakes, plane crashes, chemical sensor reading, and pressure sensor reading) will unambiguously identify the accident or reduce it to one of a small set, with roughly the same consequences. Once the specific accident is identified, the prediction of the release expected from the accident can be obtained from the risk analysis. The prediction obtained becomes the input to the calculation of exposure contours and population exposed.

If the event cannot be found on the flow sheets with the risk analysis accidents, then the logic branches to a side program. The first step is to determine, from sensors or radioed reports of field personnel, if there is an uncontained fire or explosion. If there is a fire or explosion, the inventory of agent involved in the area is estimated from either field personnel input, truck capacity, or operating plans. From the inventory and the nature of the accident, the percentage released (assumed in the risk analysis for that type of accident) and the quantity released can be determined. A chemical sensor reading in the Container Handling Building (CHB) is a special case of an outside sensor reading because the CHB is not pressurized in the present design (Parsons Co. 1989). A release rate can be estimated from the change of concentration with time, estimated exfiltration rate, and building volume.

If there is no fire or explosion, the next step is to determine if the accident is some type of mechanical accident, such as a forklift collision, a vehicle collision, a plane crash, an earthquake, or a dropped munition. If the answer is yes, the next step is to determine if there is a chemical detector, either portable or fixed, which can monitor the area of the accident. If the answer is no, one reverts to the previous method of estimating the inventory involved in the accident and the percentage of release from the nature of the accident. If a monitor is available, then it would be used to monitor the accident and determine if any agent had been released. If no agent is detected, then the accident would be declared an advisory until it could be ascertained that the accident truly did not release any agent.

If the monitor on the accident indicates a release, an attempt would be made to move downwind to determine if a plume is emanating from a damaged munition or facility. If a plume could be measured, then the concentration reading and its distance downwind from the point of the accident could be used to back-calculate the rate of release or the total release that would provide input to the calculation of dose contours and the population exposed. If no plume could be identified or detected, then the calculation would revert to estimating the inventory involved in the mechanical accident and making an estimate of the rate of evaporation from the damaged munition or process equipment.

If there is no fire, explosion, or mechanical accident, then the fire detectors and chemical detectors in the MDB would be interrogated. If a positive reading is obtained, the vacuum reading with respect to atmosphere of the toxic areas in the MDB would be checked. If the negative pressure on the MDB is not maintained, then an estimate of the inventory of the affected area would be obtained from operating plans. A percentage inventory release would be estimated by the nature of the condition in the MDB. If the negative pressure in the MDB is maintained, then the system would interrogate the stack and filter monitors on the ventilation system of the MDB. If an agent is detected in the stack, or even between the filters in the filter system on the ventilation system, the calculation would revert to an estimation of the inventory in the affected area and the appropriate percentage release. If the stack and filter monitors give no indication of any agent breakthrough, then the event would be classified as an advisory. Agent would be loose in the MDB but contained in the MDB, presenting no immediate threat to site personnel not in the MDB.

If there is no fire or chemical reading in the MDB, then the program would check the pressurization of the toxic areas in the MDB. If pressurization has been lost as part of the event activating the system, then the incident would be classified as an advisory. There would be no agent loose in the MDB, but there would be no containment in the MDB, an abnormal condition with the potential for getting worse. If the MDB were properly pressurized, then the event triggering the alert would be classified as a chemical occurrence. Examples might be a small propellant fire without release of an agent, or a mechanical accident without release of an agent.

Tables 2.2.1 through 2.2.4 give examples for each class of incidents that could be put in that class.

Table 2.2.1. Examples of chemical occurrence

- Out-of-specification reading on incinerator instrumentation during agent processing
- Any automatic process shutdown during agent processing
- Dropped munition without damage
- Collision of vehicle carrying munitions, without damage to munitions
- Single instrument failure
- Small fire, causing no damage and releasing no agent

Table 2.2.2. Example of accidents evoking an advisory

- Loss of one layer of containment in MDB
- Unplanned agent spill in agent containment area because of piping or equipment failure
- Mechanical accident (e.g. vehicle collision) resulting in damaged munitions, with no leaks in unfavorable meteorological conditions
- Failure of automatic process shutdown with out-of-specification instrument reading during agent processing

Table 2.2.3. Example of accidents evoking on-post emergency

· Accident and meteorological conditions to produce no-potential-deaths dose contour inside post fence
· Detonation or fire of a single munition (not bulk container or bomb) or spill of GB outdoors in favorable meteorological conditions (unstable atmosphere and high wind)
· Complete loss of electric power during agent processing
· Tornado damage to buildings. Some agent released
· Most truck or forklift accidents releasing agent in favorable meteorological conditions

Table 2.2.4 Example of accidents evoking community emergency

· Accident and meteorological conditions with potential to produce no-deaths contour in off-site populated area
· Explosion and/or uncontrollable fire in storage igloo
· Large aircraft crash with fire on igloo, storage warehouse, CHB, or MDB
· Major earthquake, damaging building integrity and/or starting fires
· Fire-induced launch of M-55 rocket off post

3. USE OF RISK-ANALYSIS DATA

This section indicates how risk analysis data could be used to classify an accident (primarily by identifying its location and the munition involved) and obtain a rough upper bound of its severity. Appendix B describes accident scenarios. Sorted data from the risk analysis are tabulated in Appendix C.

3.1 ACCIDENT PROBABILITY

The use of probabilistic risk analysis (PRA) to predict accident risk during normal operation is quite proper, as is the exclusion of many accidents on the basis of low probability. However, some classes of unique events result from concatenations of improbable human decisions, emotional reactions, and equipment failures, to which it is quite difficult to assign meaningful probabilities (e.g., Three-Mile Island). The probabilities usually can be made lower by security precautions, training, and institutional designs. It is necessary to accommodate these events when designing an accident response system, even though they may be properly excluded by the risk analysis.

Similarly, accidents below a certain severity can be excluded from lists of risk analysis accidents but must be included in an accident assessment system, because the emergency manager at the EOC must know that an accident is inconsequential to make a decision regarding an appropriate response.

3.2 ACCIDENT LOCATION TABLES

Tables 3.2.1 to 3.2.16 indicate the locations of accidents identified in the risk analysis for each of the 16 combinations of munitions and agents (excluding the small supplies of GA and L) in the stockpile. All steps in the demilitarization process for each munition are listed under "location" in column 1. Column 2 lists the code numbers of accidents from the risk analysis that were considered possible for that location (or step in the process) for the given agent-munition combination. Most of these accidents have been screened to eliminate those with a probability lower than 10^{-8}, or a downwind no-deaths contour extending less than 0.5 km, under worst-case meteorological conditions. Column 3 lists the maximum downwind distance of the no-deaths contours for worst-case meteorology (1.0-m/s windspeed, E stability). Associated with this number is a unique value for the quantity of agent airborne for each agent.

The values for the worst-case downwind distance are, at best, accurate to one significant figure. The numbers given were generated by the computer that did the risk analysis calculations. The nonsignificant additional digits have been retained to point out instances of an assumption of identical releases from similar accidents.

Column 4 gives a brief indication of the nature of the accident, indicated by the accident number. Column 5 lists the signature of the accident, which includes those properties of the accident that are easily identified and are generally available to the person on duty in the EOC either by a sensor alarm or a telephone or radio message from field workers. Causes may include such things as an explosion, fire, earthquake, plane crash, vehicle collision, a dropped munition, loss of pressure control in the toxic handling areas of the MDB, or alarm from a chemical sensor.

Table 3.2.1. VX Mines

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HS11 HO11	5.39	Dropped pallet, detonation	Explosion
	SL22	5.39	Earthquake	Earthquake, explosion
	SL25	5.39	Dropped munition, detonation	Explosion
	HO12	5.39	Forklift collision	Explosion
Transportation from storage	VO4	32.87	Vehicle collision, fire	Vehicle collision, fire
	HF43,23	.35	Forklift collision, fire	Forklift collision, fire
Load/unload CHB	PO61	27.8	A/C crash, explosion	A/C crash, explosion
	PO62	67.45	A/C crash, explosion, fire	A/C crash, explosion, fire
	PO63	2.91	Earthquake, explosion	Earthquake, explosion
	PO64	67.45	Earthquake, explosion, fire	Earthquake, explosion, fire
MDB elevator				
Unpack area	PO29	27.89	Earthquake, fire	Earthquake, fire, ΔP
	PO33	27.89	Earthquake, fire in MDB, intact	Earthquake, fire
Conveyor				
ECV				
ECR				
Drain				
DFS (no MPF)				
Liquid to TOX				
TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
Incinerate in DUN	PO52	2.91	Burster fed to DUN	Explosion in DUN

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DFS = deactivation furnace system; DUN = dunnage incinerator.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.2. GB M55 Rockets

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage Igloo	HO 11	4.07	Dropped pallet, detonation	Explosion
Transport from storage	VO4	12.26	Vehicle crash, detonation	Explosion
	VO12	14.00	Vehicle crash, earthquake, detonation	Earthquake, explosion
Load/unload CHB	HF21,24	.22	Inside spill	Spill
	HF41,42	.22	Inside spill	Spill
	HF23,43	.48	Fire	Fire
	PO61	44.02	A/C crash in CHB, no fire	A/C crash, no fire
	PO62	50.39	A/C crash in CHB, fire	A/C crash, fire
	PO63	5.90	Earthquake damage in CHB, no fire	Earthquake, no fire
	PO64	50.39	Earthquake damage in CHB, fire	Earthquake, fire
Transport to MDB	HFO12	2.70	Munition dropped, MDB detonation	Explosion, ΔP loss
Unpack area	PO33	17.49	Earthquake, fire in MDB	Earthquake, fire
	PO29	13.49	Earthquake, fire in MDB	Earthquake, fire
Conveyor				
ECV				
ECR	PO50	2.70	Munition detonation, fire	Explosion, fire, ΔP loss
	PO49	2.70	Munition detonation, no fire	Explosion, fire, ΔP loss
Punch and drain				
Shear (ECR)				
Move to DFS				
Incinerate				
Liquid to TOX	PO21	4.90	Outdoor piping, A/C crash, no fire	A/C crash, no fire
	PO22	4.45	Outdoor piping, A/C crash, fire	A/C crash, fire
Store liquid in TOX				
Move liquid to LIC	PO41	6.27	Failure to stop feed	Stack monitor alarm
Incinerate liquid				
Move dunnage				
Incinerate dunnage	PO52	2.70	Fed munition to DUN, detonation	Explosion in DUN

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.3. VX M55 Rockets

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HS11 HO11	4.18	Dropped pallet, detonation	Explosion
	SL22	4.18	EQ munition detonation	Explosion
	SL25	4.18	Dropped munition explosion	Explosion
Transportation from storage	VO4	14.11	Vehicle collision, fire, detonation	Vehicle collision, fire, explosion
Load/unload CHB	HF23,43	34	Forklift collision, fire	Fire
	PO61	19.73	A/C crash, detonation, no fire	A/C crash, no fire
	PO62	48.65	A/C crash, detonation, fire	A/C crash, explosion, fire
	PO63	2.84	Earthquake, detonation, no fire	Earthquake, explosion, no fire
	PO64	48.65	Earthquake, detonation, fire	Earthquake, explosion, fire
Unpack area	HF12	2.84	Dropped munition, detonation	Explosion in MDB, ΔP loss
	PO29,33	16.81	Earthquake, MDB fire	Earthquake fire, ΔP loss
Convey to ECV				
ECR	PO49	2.84	Munition detonation in ECR	Explosion, ΔP loss
	PO50	2.84	Munition detonation in ECR, fire	Explosion, fire, ΔP loss
Punch and drain				
Shear				
Convey to DFS				
Incinerate				
Store liquid TOX				
Liquid to LIC				
Incinerate LIC				
Move dunnage				
Incinerate dunnage	PO52	2.84	Munition fed to DUN	Explosion in DUN

[a]CHB = container-handling building; ECV = explosion containment vestibule; ECR = explosion containment room; TOX = toxic cubicle; LIC = liquid incinerator.
[b]Accurate to one significant figure. See Sect. 3.2.
[c]EQ = earthquake; A/C = aircraft; MDB = munition demilitarization building.

Table 3.2.4. GB Bombs, 750-lb

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HO1	1.05	Dropped pallet or munition	Spill, forklift
	HO3	1.05	Forklift tine accident	Spill, forklift
	HO4	1.05	Forklift collision	Spill, forklift
	HO5	1.62	Dropped ONC	Spill, forklift
	HO7	1.62	Forklift collision, no fire	Spill, forklift
	HO6	2.67	Forklift collision, ONC fire	Forklift ONC fire
Transportation from storage to CHB	VO1	.55	Vehicle overturn, crush	Spill, vehicle crash
	VO3	.55	Vehicle overturn, puncture	Spill, vehicle crash
	VO9	.55	Earthquake, vehicle accident, crushed	Earthquake, spill
Load/unload CHB	HF1	1.62	Dropped pallet or container	Spill, forklift
	PO21,24	0.83	Forklift collision, spill indoors	Spill, forklift
	PO41,42	0.83	Forklift collision, spill outdoors	Spill, forklift
	PO23,43	2.67	Forklift collision, fire	Fire, forklift
	PO61	20.52	A/C crash, no fire	A/C crash
	PO62	35.79	A/C crash, fire	A/C crash, fire
	PO64	31.29	Earthquake, fire	Earthquake, fire
Transport to MDB				
Unpack area	PO25	1.68	Earthquake, MDB damage, puncture	Earthquake, ΔP loss
	PO29	7.84	Earthquake, fire in MDB	Earthquake, fire
Drain				
Convey				
MPF incinerate	PO42	2.67	MPF explosion, failure to turn off fuel	MPF explosion, ΔP loss
Liquid to storage				
Store (TOX)				
Move to LIC	PO21	4.90	Plane crash into outdoor piping, no fire	A/C crash
	PO22	4.45	Plane crash into outdoor piping, fire	A/C crash, fire
Incinerate liquid (LIC)	PO41	6.27	Feed shutoff failure	Stack sensors
Move dunnage				
Incinerate dunnage				

[a]CHB = container-handling building; MDB = munitions demilitarization building; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator.
[b]Accurate to one significant figure. See Sect. 3.2.
[c]ONC = on-site transport container; A/C = aircraft.

Table 3.2.5. VX Spray Tanks

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage warehouse	SL8	79.46	Meteorite, fire	Explosion, fire
	SL15	53.48	Small A/C crash, fire	Small A/C crash, fire
	SL27	74.03 to 108.	Earthquake, fire	Earthquake, fire
	SL4	18.90	Large A/C crash, fire	A/C crash, fire
	HO6	5.51	Forklift collision, fire	Forklift collision, fire
Transportation from storage				
Load/unload CHB	HF23,43	5.51	Forklift collision, fire	Forklift collision, fire
	PO61	0.25	A/C crash, no fire	A/C crash, no fire
	PO62	22.87	A/C crash, fire	A/C crash, fire
	PO64	19.72	Earthquake, fire	Earthquake, fire
Transport to MDB				
Unpack area	PO25	3.75	Earthquake damage MDB, no fire	Earthquake, no fire, ΔP MDB
	PO26,29	11.64	Earthquake damage MDB, fire	Earthquake fire, ΔP, MDB
Conveyor				
Punch and drain				
Buffer storage				
Conveyor				
MPF	PO42	5.51	Fuel shutoff failure	Explosion in MPF
Liquid to TOX				
TOX storage				
To LIC				
Incinerate in LIC				

[a]CHB = container-handling building; MDB = munitions demilitarization building; MPF = metal parts furnace; TOX = toxic cubicle.
[b]Accurate to one significant figure. See Sect. 3.2.
[c]A/C = aircraft.

Table 3.2.6. GB Bulk Containers

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage area	HS1 HO1	1.32	Dropped pallet, no fire	Dropped pallet
	HS2	7.78	Forklift collision, fire	Forklift collision, fire
	HS4 HO4	1.32	Forklift collision, no fire	Forklift collision, no fire
	SL7	2.32	Earthquake, no fire	Earthquake
	SL9	1.06	Dropped munition, puncture	Dropped munition
	HO5	4.2	Dropped on-site container	Dropped ONC
	HO6	7.78	Forklift collision in ONC, fire	Forklift collision, fire
	HO7	4.29	Forklift collision in ONC, no fire	Forklift collision, no fire
Transport from storage	VO1	1.50	Vehicle collision, crush	Vehicle collision
	VO3	1.50	Vehicle collision, puncture	Vehicle collision
	VO9	1.50	Earthquake, vehicle accident	Earthquake, vehicle collision
Load/unload CHB	HF21.24	1.97	Indoor spill	Spill
	HF41,42	1.97	Indoor spill	Spill
	HF23,43	7.78	Fire	Fire
	PO61	31.71	A/C crash on CHB, no fire	A/C crash, no fire
	PO62	55.92	A/C crash on CHB, fire	A/C crash, fire
	PO64	50.22	Earthquake fire	Earthquake, fire
Transport to MDB	PO25	5.53	Earthquake damage to MDB, no fire	Earthquake, ΔP loss
Unpack area	PO26	16.52	Earthquake, fire	Earthquake, fire, ΔP loss
Conveyor	PO45	3.65	Sill in ECV, fire	Fire in ECV
ECV	PO51	2.62	Spill in MDB, fire	Fire in MDB
Punch and drain				
Buffer storage				
Conveyor				
MPF	PO42	3.60	Fuel flow after shutdown	Explosion, ΔP loss
Liquid to TOX				
TOX storage				
To LIC				
Incinerate in LIC				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]ONC = on-site transport container; A/C = aircraft.

Table 3.2.7. VX Bulk Containers

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage	SL5	292.60	Large A/C crash, fire	A/C crash, fire
	SL15	296.60	Small A/C crash, fire	A/C crash, fire
	SL26	304	Earthquake, fire	Earthquake, fire
	HO6	6.06	Forklift collision, fire	Collision, fire
Transportation from storage				
Load/unload CHB	HF21,24	6.0	Indoor spill	Spill
	41,42	0.0	Indoor spill	Spill
	HF23,43	6.06	Fire	Fire
	PO61	0.32	A/C crash, no fire in CHB	A/C crash, no fire
	PO62	34.20	A/C crash, fire in CHB	A/C crash, fire
	PO63	0	Earthquake, no fire in CHB	Earthquake, no fire
	PO64	30.21	Earthquake, fire in CHB	Earthquake, fire
Transportation to MDB	PO12	.70	Large A/C crash, no fire in MDB	A/C crash into MDB
	PO13	15.48	Large A/C crash, fire in MDB	A/C crash into MDB, fire
Unpack area	PO19	15.46	Indirect A/C crash, fire in MDB	A/C crash into MDB, fire
	PO25	4.16	Earthquake, no fire in MDB	Earthquake, no fire
	PO26	12.91	Earthquake, fire in MDB	Earthquake, fire
Conveyor	PO29	12.91	Earthquake, fire in MDB	Earthquake fire
	PO51	1.99	Large spill, fire, structural failure	Fire in MPF
Punch and drain				
Buffer storage				
Conveyor				
MPF	PO42	6.06	Fuel flow after shutdown in MPF	Explosion in MPF
Liquid to TOX				
TOX storage				
To LIC				
Incinerate in LIC				

[a]CHB = container-handling building; MDB = munitions demilitarization building; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator.
[b]Accurate to one significant figure. See Sect. 3.2.
[c]A/C = aircraft.

Table 3.2.8. H, HD, and HT Bulk Containers

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage	SL15	17.45	Small A/C crash, fire	A/C crash, fire
	SL18	1.44	Small A/C crash, no fire	A/C crash
	SL19	7.57	Small A/C crash, 30-min fire	A/C crash, 30-min fire
	H52	1.50	Forklift collision, fire	Fire
	SL4	85.22	Large A/C crash, fire	A/C crash, fire
	SL5	85.22	Large A/C indirect crash, fire	A/C crash, fire
	SL16	17.45	Large A/C crash, no fire	A/C crash
	SL20	2.45	Large A/C indirect crash, no fire	A/C crash
	SL28	202-314	Earthquake damage, warehouse Fire (one or two warehouses)	Earthquake, fire
Load/unload CHB	HF21,24	.1	Forklift accident, outdoor spill	Spill
	HF42,41	.1	Forklift accident, outdoor spill	Spill
	HF43,23	1.50	Forklift collision, fire	Forklift collision, fire
	PO61	4.22	A/C crash, no fire	A/C crash, no fire
	PO62	31.18	A/C crash, fire	A/C crash, fire
	PO64	31.09	Earthquake, fire	Earthquake, fire
Transportation to MDB	HF23,43	1.50	Forklift collision, fire in ONC	Fire
Elevator	PO12	3.01	Large A/C crash into MDB, no fire	A/C crash into MDB
	PO13	4.37	Large A/C crash into MDB, fire	A/C crash into MDB, fire
Unpack area	PO25	1.50	Earthquake damage to MDB, no fire	Earthquake, ΔP loss
	PO29,26	4.37	Earthquake damage to MDB, fire	Earthquake, ΔP loss
Conveyor	PO51	.59	Spill in MDB, fire, structural failure	Fire in MDB, ΔP loss
Punch and drain				
Liquid to TOX				
Buffer storage				
Conveyor				
MPF	PO42	0.99	Fuel flow after shutdown	Explosion in MPF
TOX storage				
To LIC				
Incinerate in LIC				

[a]CHB = container-handling building; MDB = munitions demilitarization building; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator.
[b]Accurate to one significant figure. See Sect. 3.2.
[c]A/C = aircraft; ONC = on-site transport container.

Table 3.2.9. H, HD, and HT 4.2-in. Mortar Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	SL4	39.92	Large A/C crash, detonation, fire	A/C crash, fire, explosion
	SL16	7.95	Large A/C crash, detonation, no fire	A/C crash, explosion
Transport from storage	VO4	3.37	Vehicle crash, fire, detonation	Crash, fire, explosion
Load/unload CHB	HF23,43	0.5	Forklift collision, fire	Forklift collision, fire
	PO61	4.78	A/C crash into CHB	A/C crash into CHB
	PO62	21.51	A/C crash into CHB, fire	A/C crash into CHB, fire
	PO63	.41	Earthquake	Earthquake
	PO64	21.51	Earthquake, fire	Earthquake, fire
Transport to MDB				
Unpack area	PO29	4.30	Earthquake, fire, ventilation damage	Earthquake, fire, ΔP
	PO33	4.30	Earthquake, fire, MDB intact	Earthquake, fire
	PO12	.80	Large A/C crash into MDB, no fire	A/C crash into MDB, no fire
	PO13	4.30	Large A/C crash, MDB fire	A/C crash into MDB, fire
	PO19	4.30	Indirect A/C crash, fire	A/C crash into MDB, fire
ECV				
Conveyor				
ECR Remove explosives				
DFS				
Convey Munition Processing Bay (Drain)				
MPF	PO42	0.66	Fuel flow after shutdown	MPF explosion, ΔP

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.10. GB 105-mm Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HS5, SL25	1.12	Dropped munition, detonation	Explosion
	HS6	1.12	Forklift collision, detonation	Explosion
	HS7	2.91	Forklift collision, fire	Fire
	HS11, HO11	1.12	Dropped pallet, detonation	Explosion
	SL22	1.12	Earthquake, detonation	Earthquake explosion
	HO12	1.12	Forklift collision, detonation	Explosion
Transport from storage	VO4	6.35	Vehicle collision, fire, explosion	Fire, explosion
Load/unload CHB	PO61	25.97	A/C crash, no fire, detonation	A/C crash, explosion
	PO62	46.29	A/C crash, fire, detonation	A/C crash, fire, explosion
	PO63	3.93	Earthquake, detonation	Earthquake, explosion
	PO64	46.29	Earthquake, explosion, fire	Earthquake, explosion, fire
Transport to MDB				
Unpack area	HF12	.96	Dropped munition, detonation	Explosion
ECV	PO29,33	7.95	Earthquake, damage to MDB, fire	Earthquake, fire in MDB
ECR	PO49	.96	Munition detonation in ECR	Explosion in ECR, ΔP loss
Remove explosive	PO50	.96	Munition detonation in ECR, fire	Fire, explosion in ECR, ΔP loss
DFS				
Convey				
Munition process bay (Drain)				
MPF				
Liquid to TOX				
Storage TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
Move to DUN	P52	1.53	Munition fed to DUN	Explosion

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.11. H, HD, and HT 105-mm Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	SL4	23.58	Large A/C direct crash, fire detonation	A/C crash, fire, detonation
	SL5	23.58	Large A/C indirect crash, fire, detonation	A/C crash, fire, detonation
	HOH2,6	1.50	Forklift collision, fire	Forklift collision, fire
Transportation from storage	VO4	1.53	Vehicle crash, fire	Vehicle crash, fire
Load/unload CHB	PO61	4.79	A/C crash	A/C crash
	PO62	15.01	A/C crash, fire	A/C crash, fire
	PO63	.28	Earthquake	Earthquake
	PO64	15.01	Earthquake, fire	Earthquake, fire
Transport to MDB	HF3	1.50	Forklift collision, fire	Forklift collision, fire
Unpack area	PO33	1.95	Earthquake, MDB OK, fire	Earthquake, fire, ΔP loss
	PO25	1.50	Earthquake, damage to MDB	Earthquake, ΔP loss
Conveyor				
ECV	PO29	1.95	Earthquake damage to MDB, fire	Earthquake, fire, ΔP loss
ECR				
Remove explosive				
DFS				
Convey				
Munition processing bay				
(Drain)				
MPF				
Liquid to TOX				
Store TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
DUN				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C - aircraft.

Table 3.2.12. GB 155-mm Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HO11	2.07	Vehicle collision, fire, detonation	Explosion
	HO12	2.07	Dropped pallet, detonation	Explosion
Transportation from storage	VO4	17.31	Vehicle collision, detonation	Explosion
Load/unload CHB	PO61	39.64	A/C crash, no fire	A/C crash, no fire
	PO62	69.10	A/C crash, fire	A/C crash, fire
Transport to MDB	HF11	3.02	Dropped pallet, detonation	Explosion
Unpack area	HF12	2.06	Dropped munition in MDB, detonation	Explosion
Conveyor	PO33	9.40	Earthquake, fire in MDB	Earthquake, fire
	PO29	9.40	Earthquake, fire in MDB	Earthquake, fire
ECV	PO49	2.06	Munition detonation, no fire	Explosion
ECR	PO50	2.06	Munition detonation, fire	Explosion
Remove explosive				
DFS				
Convey				
Munition processor bay				
Drain				
Shear				
Incinerate MPF	PO42	2.20	Failure to stop fuel flow to MPF	Explosion
Liquid to storage	PO21	4.90	Outdoor piping, damage from A/C crash	A/C crash, no fire
	PO22	4.45	Outdoor piping damage from A/C crash, fire	A/C crash, fire
Store liquid TOX				
Move liquid to LIC	PO41	6.27	Failure to stop feed to LIC	Stack monitor
Incinerate liquid				
Move dunnage				
Incinerate dunnage				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.13. VX 155-mm Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HS5 SL25	2.14	Dropped munition, detonation	Explosion
	HS6	2.14	Collision, detonation	Explosion
	HS7	3.27	Collision, fire	Fire
	HS11 HO11	2.14	Dropped pallet, detonation	Explosion
	SL4	150	Large A/C crash, fire, explosion	A/C crash, fire, explosion
	SL16	40.82	Large A/C crash, no fire, explosion	A/C crash, no fire, explosion
	SL22	2.14	Earthquake, detonation	Earthquake, detonation
	HO12	2.14	Forklift collision, detonation	Explosion
Transportation from storage	VO4	8.85	Vehicle collision, fire, explosion	Fire, explosion
Load/unload CHB	PO61	16.48	Large A/C crash, no fire	A/C crash, no fire
	PO62	66.19	Large A/C crash, fire	A/C crash, fire
Transport to MDB	HF11	2.14	Dropped pallet, explosion	Explosion
Unpack area	HF12	2.14	Dropped munition, detonation	Explosion in MDB, ΔP
	HF13	2.14	Dropped pallet, explosion	Explosion in MDB, ΔP
ECV	PO29	8.92	Earthquake damage to MDB, fire	Earthquake, fire, ΔP loss
	PO33	8.92	Earthquake, MDB OK, fire	Earthquake, fire, ΔP loss
ECR	PO49	2.14	Munition detonation in ECR	Explosion in ECR, ΔP loss
Remove explosive	PO50	2.14	Munition detonation in ECR, fire	Explosion in ECR, fire, ΔP loss
DFS				
Convey				
Munition processing bay (Drain)				
MPF	PO42	3.37	Failure to stop fuel flow	Explosion in MPF, ΔP loss
Liquid to TOX				
Store TOX				
Liquid to LIC				
Incinerate liquid				
Move Dunnage				
DUN				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.14. H, HD, and HT 155-mm Projectiles

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	HS7	0.75	Forklift collision, fire	Collision, fire
	SL4,5	56.	Large A/C crash, detonation, fire	A/C crash, explosion, fire
	SL16	11	Large A/C crash, detonation, no fire	A/C crash, explosion, no fire
Transportation from storage	VO4	2.60	Vehicle accident, fire, detonation	Vehicle accident, fire, explosion
Load/unload CHB	PO61	6.18	A/C crash, detonation, no fire	A/C crash, explosion, no fire
	PO62	8.02	A/C crash, detonation, fire	A/C crash, explosion, fire
	PO63	0.54	Earthquake, explosion, no fire	Earthquake, explosion, no fire
	PO64	28.02	Earthquake, explosion, fire	Earthquake, explosion, fire
Unpack area MDB	PO29,33	2.20	Earthquake, fire in MDB	Earthquake, fire in MDB, ΔP loss
	PO12	1.67	A/C crash on MDB, no fire	A/C crash, no fire, ΔP loss
	PO13	2.20	A/C crash on MDB, fire	A/C crash, fire
	PO19	2.20	Indirect A/C crash, fire	A/C crash fire
Conveyor				
ECV				
ECR Remove explosive				
DFS				
Convey				
Munition processing bay (Drain)				
MPF	PO42	0.77	MPF fuel shutoff fails	MPF explosion, ΔP loss
Liquid to TOX				
Store TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
DUN				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.15. GB 8-in. Projectile

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	H35 SL25	3.53	Dropped munition, detonation	Explosion
	H37	4.63	Collision, fire	Fire
	HS11 HO11	3.53	Dropped pallet, detonation	Explosion
	SL22	3.53	Earthquake, detonation	Earthquake, explosion
Transportation from storage	VO4	2.60	Vehicle accident, fire, detonation	Fire, explosion
Load/unload CHB	PO62	64.17	A/C crash, fire	A/C crash, fire
	PO61	35.31	A/C crash, no fire	A/C crash
	PO63	7.18	Earthquake, no fire	Earthquake
	PO64	64.17	Earthquake, fire	Earthquake, fire
Transport to MDB				
Unpack area	PO29,33	12.50	Earthquake, damage to MDB, fire	Earthquake, fire
ECV				
ECR	PO49	3.20	Munition detonation	Explosion, ΔP loss
Remove explosive				
DFS				
Convey				
Munition processing bay				
MPF				
(Drain) Liquid to TOX				
Store TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
DUN				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

Table 3.2.16. VX 8-in. Projectile

Location[a]	Accident number	Worst-case km downwind[b]	Characteristic[c]	Signature
Storage igloo	SL22	3.49	Earthquake, detonation	Earthquake, explosion
	HS5 SL25	3.49	Dropped munition, detonation	Explosion
	H37	4.56	Collision, fire	Fire
	HS11 HO11	3.49	Pallet dropped, detonation	Explosion
Transportation from storage	VO4	10.36	Vehicle accident, fire	Vehicle accident, fire
Load/unload CHB	PO61	15.92	A/C crash	A/C crash
	PO62	64.11	A/C crash, fire	A/C crash, fire
	PO63	3.49	Earthquake	Earthquake
	PO64	64.11	Earthquake, fire	Earthquake, fire
Transport to MDB				
Unpack area	HF12	3.49	Dropped munition, explosion	Explosion in MDB
	PO33	12.44	Earthquake, MDB OK, fire	Earthquake, fire
ECV				
ECR	PO49	3.49	Detonation in ECR, no fire	Explosion in ECR, ΔP loss, no fire
Remove explosive				
DFS				
Convey				
Munition processing bay				
(Drain)				
MPF				
Liquid to TOX				
Store TOX				
Liquid to LIC				
Incinerate liquid				
Move dunnage				
DUN				

[a]CHB = container-handling building; MDB = munitions demilitarization building; ECV = explosion containment vestibule; ECR = explosion containment room; MPF = metal parts furnace; TOX = toxic cubicle; LIC = liquid incinerator; DUN = dunnage incinerator; DFS = deactivation furnace system.

[b]Accurate to one significant figure. See Sect. 3.2.

[c]A/C = aircraft.

In many cases, a single accident is listed for a given munition/agent combination at a given location in the processing scheme. In all cases, so far, several accidents at a given location have been differentiated to a single-release magnitude or single-worst-case downwind range on the basis of the accident signature.

The tables in this version have been modified to include the addition of a container-handling building (CHB) to the flowsheet.

Propellant unloading operations on 105-mm cartridges and 4.2-in. mortars have not been included on the flowsheets at this writing.

3.2.1 VX Mines

Table 3.2.1 lists the accidents in the risk analysis involving mines filled with agent VX. Mines are equipped with bursters. The accidents listed at the storage location all occur outside the igloo on the pad and involve the detonation of one munition. All are signaled by an explosion at the storage location not involving the entire igloo. The risk analysis indicates that the worst-case downwind distance of the no-deaths contour from this type of accident is 5.39 km. Most meteorological conditions would result in a plume of much less length (in most cases) not getting off site.

An accident involving a plane crash or earthquake igniting the whole igloo has been screened out of the risk analysis on the basis of low probability. This accident would have a worst case downwind range of no-deaths contour of tens to hundreds of kilometers. It would be identified by the logic tree described in Sect. 2.2.

The risk analysis lists as a potential accident a collision with the vehicle carrying munitions, followed by a fire that involves the entire truckload. Under worst-case meteorological conditions, this could result in a plume extending 32 km downwind. The signature for this accident is a vehicle collision and a fire. A forklift collision with a fire occurring at the CHB would be expected to produce a plume extending only 0.35 km downwind under worst-case conditions. The signature of this accident is a forklift collision, followed by a fire.

The large inventory in the CHB can result in accidents with considerable area coverage if the CHB is subjected to massive external force from an airplane crash or a large earthquake; with fire following either of these incidents, the no-deaths contour approaches 70 km downwind under worst-case conditions. The distinguishing signature of these accidents is the initiating event—an earthquake or large airplane crash followed by fire. An airplane crash on the CHB (without fire) could be expected to cause the explosion of some of the bursters of the munitions, which can still produce a potential plume extending tens of kilometers downwind. A fire involving this munition in the MDB (PO29 and PO33) can have the same result through failure of the ventilation system. The signature is an earthquake followed by a fire in the MDB. The final accident considered for mines is the inadvertent transfer of a burster to the dunnage incinerator in the dunnage from the unpacking area. Worst-case conditions would produce effects 2.9 km downwind, and the signature would be an explosion in the dunnage incinerator (DUN).

3.2.2 GB M55 Rockets

Accidents considered in the risk analysis involving GB-filled M55 rockets are listed in Table 3.2.2. The only accidents listed at the storage site are HO11, SL22, and SL25. These involve detonation of a single munition because of the dropping of a munition or pallet or

because of a severe earthquake. The signature would be an explosion of a single munition in the handling area at a storage igloo. Under the worst conditions, detonation of a single GB warhead would produce a plume (no-deaths contour) extending a little more than 4 km downwind.

An igloo fire that was screened out by low probability must be considered in an accident assessment.

During transportation to storage, a vehicle crash, or one caused by an earthquake, could result in fire and detonation of one or more warheads. The signature would be the vehicle crash accompanied by an explosion and fire reported by escort personnel.

An aircraft crash into the CHB, with or without fires, could result in a plume extending about 50 km downwind under worst-case meteorological conditions (PO61, PO62). The signature of this accident is a plane crash into the CHB.

Handling accidents inside the CHB could result in a spill of an agent with no fire. These accidents, in general, will not produce a plume that escapes the site. In munitions handling operations between the CHB and the MDB, a munition drop could occur in the MDB, resulting in detonation and a 2.7 km plume under worst-case meteorological conditions. The signature would be an explosion of a munition in the MDB, probably followed by loss of negative pressure in the MDB.

A pair of accidents (PO33 and PO29) initiated by an earthquake, resulting in fire in the MDB, which eventually causes the ventilation system to fail, results in a 17-km plume (worst-case conditions). The signature for this accident is an earthquake, followed by indications of fire in the MDB.

Detonation of a single munition in the explosive containment room could result in structural failure, ventilation failure, and a small fire (PO49, PO50). The plume from this accident, under worst-case conditions, could extend about 3 km downwind. The signature is an explosion in the explosion containment room.

Accidents PO21 and 22 are the result of a plane crash in the outdoor piping of the MDB. With or without fire, they produce a plume under worst-case conditions that might extend nearly 5 km downwind. The unambiguous signature of this accident would be a plane crash into the external piping of the MDB.

Failure to stop the feed of toxic agent to the liquid incinerator after a shutdown can result in overload of the ventilation filters and escape of agent from the building, producing a plume extending approximately 6 km under worst-case meteorological conditions. The signature of this event would be detection of agent in the stack effluent by a chemical monitor (PO41).

It is considered possible to feed a munition inadvertently to the dunnage incinerator, resulting in an explosion that can release enough agent to produce a no-deaths contour that can reach 2.7 km downwind under worst-case meteorological conditions. The signature of this accident is an explosion in the dunnage incinerator.

3.2.3 VX M55 Rockets

Table 3.2.3 lists the risk analysis accident for M55 rockets with warheads containing VX. Accidents given for the storage site for these munitions are SH11, HO11, SL22, and SL25, all of which involved the detonation of a single munition from a dropped pallet, a dropped munition, or an earthquake. The signatures are all the same, and the explosion of a single munition could result in a no-deaths contour extending as much as 4 km downwind under worst-case meteorological conditions.

An igloo fire that was screened out of the risk analysis on the basis of low probability must be considered in an accident assessment.

The accident listed during transportation (VO4) is a vehicle collision, followed by a fire and detonation of more than one of the warheads. The signature is a vehicle collision, followed by a fire and explosions, that can result in a downwind plume as long as 14 km under worst-case meteorological conditions.

Accidents at the CHB that do not involve fire or explosions do not produce any off-site effects because of the low volatility of VX.

Externally caused accidents at the CHB [airplane crash, followed by explosion with or without fire, or a severe earthquake, with or without fire (PO61, 62, 63, and 64)] result in plumes extending tens of kilometers downwind. The signature of these is obviously the external cause of the accident and the presence of a fire and explosion.

Explosion of the single munition in the unpack area of the MDB can result in a 2.8-km plume under worst-case meteorological conditions. The signature is an explosion in the MDB and a loss of negative pressure in the munitions-handling areas. An earthquake, followed by fire and explosion at the MDB (PO29, 33), can result in a 17-km-long plume under worst-case meteorological conditions. The signature of this event is the earthquake followed by a fire and loss of negative pressure in the MDB. Explosion of a munition in the explosive containment room can damage the structure and result in a 2.8-km plume under worst-case meteorological conditions. An explosion in the dunnage incinerator due to a munition fed with the dunnage has the same result. In this case, from the standpoint of accident analysis, it does not matter where in the building an explosion occurs, as long as it involves only one warhead.

3.2.4 GB 750 lb. Bombs

Table 3.2.4 lists the risk analysis accidents and their locations for 750-lb bombs filled with GB. A variety of forklift accidents are listed at the storage location. There are no explosions, because the bombs are not equipped with bursters. These accidents would result in a downwind plume of a little more than 1 km under worst-case conditions. If a fire resulted, a worst-case plume might extend as far as 3 km downwind. A signature for this group of accidents is any type of accident that occurs from handling of bombs at the storage location.

During transport to storage, three accidents are considered possible. All involve vehicle accidents that crush or puncture the bombs, and all have downwind no-deaths contours, under worst-case meteorological conditions, of a little more than 500 m in length. A handling accident (dropped pallet or container) at the CHB or at the MDB could result in a spill producing a downwind no-deaths contour of 1.6 km. The same would result from a handling accident in the MDB, resulting in puncturing of munitions from an earthquake. Here the signature would be the earthquake and the loss of negative pressure in the toxic handling areas in the MDB. Presence of fire would indicate a longer potential plume, up to 7.8 km (PO29).

Forklift accidents in and around the CHB would result in spills with downwind no-deaths distances less than 1 km. The same accident resulting in a fire could produce a downwind no-death distance of a little less than 3 km (PO21, 24, 41, 42, 23, 43).

Externally caused accidents involving the CHB are more serious. A plane crash into the CHB will produce downwind no-deaths plumes under worst-case conditions of 20.5 km with no fire and 35.8 km with a post-crash fire. A no-deaths plume under worst-case conditions of 31.3 km would be caused by a severe earthquake followed by a fire and a negligible release with no fire. The signature for these accidents would be the initiating event (plane crash or earthquake) and the presence or absence of fire.

In the same vein, a plane crash into the outdoor piping (PO21, PO22) produces a no-deaths downwind plume under worst-case conditions of 4.9 km in the case of no fire and 4.45 km in the case of fire.

Failure to turn off the fuel in the metal parts furnace on shutdown, leading to an explosion, can produce a no-deaths downwind plume under a worst-case condition of 2.7 km. The signature for this incident is the detection of an explosion in the metal parts furnace, followed by a loss of negative building and pressurization in the toxic handling areas. Failure to stop the feed to the liquid incinerator on shutdown would overload the filters on the exhaust stack, resulting in the release of agent. The risk analysis estimates that this incident has a potential of producing a plume of 6.3 km under worst-case meteorological conditions. Its signature would be the detection of toxic chemicals by the chemical monitor on the stack.

3.2.5 VX Spray Tanks

Table 3.2.5 lists the risk analysis accidents for spray tanks containing VX. Spray tanks in storage areas are especially vulnerable to energetic externally caused accidents that result in fires. The externally caused accident can be a result of meteorite impact; a small or large aircraft crash on a storage warehouse or earthquake, which results in damage to some of the spray tanks; and a fire. In general, these accidents produce no-deaths plumes extending for tens of kilometers downwind under worst-case meteorological conditions. A handling accident, such as a forklift collision resulting in a fire, will produce a no-deaths plume extending downwind only a few kilometers. In general, VX spills not accompanied by fire produce little or no off-site damage. Similarly, externally caused accidents, involving the CHB, such as an aircraft crash with fire or a severe earthquake-induced fire, can produce accidents with no-deaths plumes extending tens of kilometers downwind (PO62, 64). Earthquake damage to the MDB involving loss of containment is estimated to cause a no-deaths plume extending as much as 3.7 km downwind under worst-case meteorological conditions. If the earthquake results in a fire in the MDB, the no-deaths plume extends 11.6 km downwind.

Failure to shut off fuel on shutdown of the metal processing furnace can result in an explosion in that area that could release enough agent to cause a downwind no-deaths plume extending as far as 5.5 km under worst-case meteorological conditions.

3.2.6 GB Bulk Containers

Table 3.2.6 lists the risk analysis accidents for bulk containers (1 ton) containing GB. Handling and storage accidents involving a single tank generally result in no-deaths downwind plumes under worst-case conditions of 1 or 2 km, which under most meteorological conditions would not produce any off-site effects. Vehicle collisions involving fire-produced downwind no-deaths plumes under worst-case conditions of over 7 km involve a situation with the potential for off-site effects. Transportation accidents between the storage igloos and the CHB do not include any accidents involving fire and, as a result, have downwind no-death plumes of less than 2 km.

Forklift accidents without fire at the CHB can result in spills with downwind no-deaths plume distances of a little less than 2 km. The presence of fire will extend this to more than 7 km. Externally caused accidents at the CHB, such as a plane crash or an earthquake, with or without fires, will produce downwind plumes on the order of tens of kilometers, posing a serious off-site problem for almost any meteorological conditions (PO61, 62, 63, 64).

An earthquake can produce a release from the MDB, extending the no-deaths contour to more than 5 km downwind under worst-case meteorological conditions (PO25). The signature

would be an earthquake accompanied by a loss of negative pressure in the MDB and indications on any chemical sensors in the MDB. If the earthquake results in a fire, the calculated no-death downwind distance would be more than 16 km. The signature would be an earthquake followed by a fire in the MDB.

The spill accompanied by a fire in the explosion containment vestibule (ECV) (PO45) could result in a downwind no-deaths plume distance under worst-case meteorological conditions of 3.6 km. A signature would be a fire in the ECV. A fire elsewhere in the MDB (PO51) is estimated to have the downwind no-deaths plume distance under worst conditions of 2.6 km. The signature would be a fire in some other part of the MDB.

An explosion in the metal processing furnace, caused by failure to shut off the fuel flow after shutdown (PO42), can produce a downwind no-deaths plume of 3.6 km. The signature would be an explosion in the metal-processing furnace.

3.2.7 VX Bulk Containers

Table 3.2.7 contains the accidents estimated in the risk analysis for bulk containers containing VX. Although these containers have no explosives with them, their presence in large numbers in accidents that can start fires produces very large theoretical plumes from the storage area following plane crashes or earthquakes that rupture containers. In all cases, no-deaths downwind contours theoretically can reach hundreds of kilometers. It is clear that fire from any source, whether it be earthquake, plane crash, or vehicle collision involving large numbers of bulk containers of VX, will produce releases extending well off site (SL5, SL15, SL26, PO13, PO19, PO26, PO29, PO51, PO62, and PO64). A forklift collision in the storage area, involving a single tank in a fire, could produce a no-deaths contour extending 6 km downwind under worst-case meteorological conditions. The signature would be a report of a forklift collision, followed by a fire. The same accident (HF23, 43) could occur at the CHB. Similar results are obtained from an explosion caused by failure to shut off fuel after shutdown on the metal processing furnace (PO42).

3.2.8 H, HD, and HT Bulk Containers

Table 3.2.8 lists the accidents in the risk analysis for bulk containers of mustard gas. The large accidents are those involving aircraft crashes, especially large aircraft, and fires, which are also the signatures of these very serious accidents. A large aircraft or a meteorite striking a storage area, followed by a fire, is calculated to be capable of producing a no-deaths contour under worst-case meteorological accidents extending 85 km downwind. For a small aircraft, this distance is listed as 17 km and 7 km for a fire that is extinguished after 30 min (SL15,SL19). Crashes without fire produce plumes of 1.4 km for a small aircraft and 7.4 km for a large aircraft. Severe earthquake damage (SL28) to the storage warehouse, involving variously one or two warehouses and fire, can produce downwind no-deaths contours under worst-case conditions greater than 100 km. Aircraft crashes or earthquakes producing fires in the CHB can produce plumes of tens of km. Fires produced by forklift collisions are estimated to produce a no-deaths contour extending 1-1/2 km downwind. For any location, externally caused accidents without fire, such as aircraft crashes or earthquakes, produce no-deaths contours only a few kilometers downwind from the MDB. An air crash resulting in fire and an earthquake-induced fire in the MDB produce a no-deaths contour extending 4.4 km downwind. All violations of the integrity of the MDB would be accompanied by loss of negative pressure in the toxic areas of the MDB. There is one accident listed in which a spill

in the MDB followed by a fire and structural failure produces a no-deaths contour of less than 1 km downwind.

Failure of fuel flow shutdown in the metal-processing furnace can result in an explosion that can release enough agent to produce a no-deaths contour of a little less than 1 km downwind.

3.2.9 H, HD, and HT 4.2-in. Mortar Projectiles

Table 3.2.9 lists the risk analysis accidents calculated for 4.2-in. mortar shells filled with mustard. At the storage location, an aircraft crashing into the igloo could detonate the bursters of some shells and cause a fire. This could produce a no-deaths contour extending downwind a little less than 40 km under worst-case conditions. The same crash without a fire would have a no-deaths contour that extends downwind a little less than 8 km. The signature would be an aircraft crash on the storage igloo, followed by an explosion and a fire. In one case (SL4, SL16) the accident listed for transport from storage is a vehicle crash, resulting in detonation of the bursters of the munition and a fire (VO-4). The no-deaths contour for this accident is calculated to extend downwind a little less than 3.4 km. A forklift accident resulting in fire at the CHB would produce a downwind no-deaths contour of 0.5 km. An aircraft crash into the CHB or an earthquake destroying the CHB, followed by fire, produce the same no-deaths downwind contours under worst-case conditions of 21.5 km (PO62, PO64). An aircraft crash into the CHB, without fire, will cause detonation of the bursters and result in a downwind no-deaths contour extending 4.8 km. An earthquake that destroys the CHB but that does not cause a fire might produce a downwind no-deaths contour of 0.4 km. The signatures of these accidents are the combinations of aircraft crashes, earthquakes, and fires. At the MDB the same combination of possible accidents exists for the case of earthquakes or aircraft crashes accompanied by fire. The downwind no-deaths contour is 4.3 km in the worst meteorological case. In the case of an aircraft crash with no fire, the downwind no-deaths contour for the worst case extends 0.8 km. In the case of any major external accident to the MDB, the key variable is whether or not a fire is started (PO29, PO33, PO12, PO19).

Failure of the fuel flow shutdown valve on the metal-parts furnace can result in an explosion, damaging the integrity of the containment of the MDB. This could result in a no-deaths downwind worst-case contour of 0.6 km.

3.2.10 GB 105-mm Projectile

Table 3.2.10 lists the risk analysis accidents for 105-mm projectiles filled with GB. In the storage area, a number of handling accidents are listed, involving forklift collisions that result in dropped munitions or pallets but no fire. All are estimated to produce a downwind no-deaths contour extending 1.1 km under worst-case meteorological conditions. In the event that the accident is associated with a fire, the downwind no-deaths contour is expected to extend 2.9 km. The signature of these accidents is a handling accident at the storage location, involving the detonation of a single munition.

On transport from storage (VO4), a vehicle collision resulting in explosion of one or more munitions and a fire is estimated to cause a downwind no-deaths contour extending 6.35 km.

Externally caused accidents at the CHB include aircraft crashes and earthquakes. An aircraft crash producing detonations but no fire was estimated to produce a no-deaths contour for worst-case meteorological conditions extending about 26 km. An aircraft crash with a fire is expected to produce a no-deaths contour of 15 km downwind. An earthquake producing

detonations of bursters but no fire is expected to produce a downwind no-deaths contour for worst-case conditions of a little less than 4 km; an earthquake producing detonations and a fire is estimated to produce a downwind no-deaths contour of a little more than 46 km. In the MDB, dropped munitions resulting in detonation produce downwind no-deaths contours of a little less than 1 km (HF12, PO49, PO50). Earthquake damage to the MDB, resulting in a fire, is estimated to cause a release producing a no-deaths downwind contour extending a little less than 8 km.

With this munition it is possible to inadvertently feed a round to the dunnage incinerator, producing a release of an agent that can result in a no-deaths contour extending 1.5 km downwind.

3.2.11 H, HD, HT 105-mm Projectiles

Table 3.2.11 lists the risk analysis accidents for 105-mm projectiles filled with mustard gas. At the storage area, an aircraft crash on or near the munitions igloo, followed by detonations and fire, can result in a no-deaths contour for worst-case meteorological conditions extending a little less than 24 km downwind. A forklift collision followed by a fire can release mustard, producing a plume with a no-death contour extending 1.5 km downwind. The signature of the aircraft crash is the crash itself and the following fire. The signature of the forklift collision is the observation of the forklift by the work party. During transportation of the munition from storage to the CHB, a vehicle crash followed by a fire is possible and would result in the release of an agent, producing a no-deaths contour extending 1.5 km downwind.

At the CHB, an aircraft crash without fire would produce a downwind no-deaths contour extending 4.8 km. The same crash followed by a fire would produce a contour extending 15 km downwind. An earthquake followed by no fire would produce a downwind no-deaths contour extending 2.8 km but, followed by a fire, would produce the same contours as an aircraft crash with a fire, 15 km (PO61, 62, 63, 64). At the MDB, an earthquake starting a fire but not damaging the integrity of the building, has the same release as an earthquake damaging the building, producing a no-deaths contour extending a little less than 2 km downwind.

3.2.12 GB 155-mm Projectiles

Table 3.2.12 lists the risk analysis accidents for 155-km projectiles loaded with GB. Accidents in the storage area include a vehicle collision followed by a fire and detonation of burstered munition as well as the drop of a pallet followed by an explosion of a single munition. In both cases a toxic vapor plume is produced, with a no-deaths contour extending a little more than 2 km downwind. A signature would be an explosion during the handling operations of the storage area.

On transport a vehicle collision is possible, resulting in detonation of several munitions and producing a toxic cloud that would have a no-deaths contour, under worst-case meteorological conditions, extending 17 km downwind.

At the CHB, an aircraft crash into the building, with no resulting fire, could result in the release (by explosion) of a toxic cloud that would leave a no-deaths contour extending a little less than 40 km downwind. In the event of a fire, the downwind extent would be a little less than 70 km. It is estimated that dropping a pallet in the course of transport between the CHB and MDB could result in the explosion of a munition and a downwind no-deaths contour extending 3 km under worst-case meteorological conditions. Several accidents involve detonation of munition in the MDB either in the unpack area, the ECV, or the explosion

containment room. In all cases, the signature is the same and the estimated downwind distance of the no-deaths contour would be the same, a little more than 2 km. An earthquake followed by a fire in the MDB is estimated to produce a downwind no-deaths contour extending 9.4 km.

Failure of the fuel cutoff to the MPF could result in an explosion in the MPF, which would result in the release of a toxic cloud producing a no-deaths contour extending 2.2 km downwind (PO42). An aircraft crash into the outdoor piping on the MDB could result in a release producing a downwind no-deaths contour extending 4.9 km in a case of a crash without a fire and 4.45 in a case of a crash followed by a fire. The signature of this event would be an aircraft crash into the outdoor piping on the MDB.

Failure to stop the feed onto the liquid incinerator when the furnace is shut down would result in overloading the charcoal filters on the gas cleanup system. This could result in the release of a toxic cloud, with the downwind no-deaths contour extending 6.3 km. It probably would be first indicated by an alarm, which is connected to the stack monitor.

3.2.13 VX 155-mm Projectiles

Table 3.2.13 lists the risk analysis for accidents involving 155-mm projectiles filled with VX. At the storage igloo are a variety of handling accidents that result in the detonation of a single projectile through dropping or falling. A vehicle collision followed by a fire can result in a release of a cloud with a no-deaths contour extending 3.3 km downwind. A large aircraft crash into a storage area can produce a massive release, in the case of no fire, of a cloud that has a theoretical no-deaths contour extending for more than 40 km downwind. If the aircraft crash is followed by a fire, the contour has a theoretical capability of reaching 240 km downwind. These accidents are easily differentiated from the forklift collisions and other munitions mishandling accidents by the presence of a large aircraft crash.

During transport of munitions to a storage area or to the CHB, a vehicle collision followed by a fire and explosion could release enough toxic agent to produce a downwind no-deaths contour extending 9 km (VO4). At the CHB, an aircraft crash into the building not resulting in a fire can produce a toxic cloud that would have a no-deaths downwind contour extending about 16.5 km. If the crash is followed by a fire, the contour may extend as far as 66 km downwind.

The explosion of a single munition, whether it is from a dropped pallet during transport to the MDB, a dropped munition in the unpack area, a dropped pallet in the unpack area, or a detonation in the explosion containment room, would result in the release of an agent that would produce a no-deaths downwind contour, under worst-case meteorological conditions, of a little more than 2 km. Earthquake damage to the MDB, followed by fire, whether or not the building structure is damaged, would result in the release of a toxic cloud having a no-deaths contour extending downwind for a little less than 9 km.

Failure of fuel-flow shutoff in the metal-parts furnace could cause an explosion strong enough to release toxic agent to produce a no-deaths contour extending downwind 3.4 km.

3.2.14 H, HD, HT 155-mm Projectiles

Table 3.2.14 lists the risk analysis accidents tabulated for demilitarization of 155-mm projectiles filled with mustard. Accidents at the storage igloo include a large aircraft crash into the igloo, followed by burster detonations and fire. This would release a toxic cloud, which under worst-case meteorological conditions would produce a no-deaths contour extending 56 km in the downwind direction. If there is no subsequent fire, the downwind

no-deaths contour is reduced to 11 km. A forklift collision and fire would release a toxic cloud with a downwind no-deaths contour of 0.75 km (SL16,SL4,5,HF7).

During transportation from storage, a vehicle accident followed by fire and detonation of the munitions would produce a toxic cloud that could have a no-deaths contour extending 2.6 km downwind.

At the CHB, aircraft crashes and earthquakes are potential sources of externally caused accidents. An aircraft crash with no fire would release a cloud producing a no-deaths contour extending 6.2 km downwind. If the crash is followed by a fire, the estimated contour would extend a little more than 8 km downwind. An earthquake without a fire would possibly release an agent producing a no-deaths contour of 0.5 km downwind. If the earthquake is followed by a fire, the downwind no-deaths contour could be as far as 28 km.

At the MDB, an earthquake, aircraft crash, or indirect aircraft crash followed by a fire would result in the release of an agent that would produce a no-deaths contour extending 2.2 km downwind. If there is no fire, the corresponding figure would be 6.67 km. The signatures would be the aircraft crash and the presence or absence of fire.

Failure of fuel shutoff at the metal-parts furnace would result in an explosion that could release enough agent to produce a downwind no-deaths contour of 0.8 km.

3.2.15 GB 8-in. Projectile

Table 3.2.15 lists the risk analysis accidents considered in the demilitarization of 8-in. projectiles filled with GB. Explosion of single projectiles from mishandling is estimated to produce a toxic cloud, which under worst-case meteorological conditions would produce a no-deaths downwind contour extending 3.5 km. If a fire followed a vehicle collision, it could result in the release of an agent that would produce a no-deaths contour 4.6 km downwind.

An accident during transportation from the storage igloo to the CHB could be a vehicle collision resulting in fire and projectile detonation. It is estimated that this would release a toxic cloud, producing a no-deaths contour extending 2.6 km downwind under worst-case meteorological conditions. Accidents listed for the CHB include aircraft crashes and earthquakes with and without an ensuing fire. Either an aircraft crash or an earthquake followed by a fire could produce a plume having a no-deaths contour extending approximately 64 km downwind. If there is no fire, the aircraft crash would produce a contour extending 35 km downwind and an earthquake 7 km downwind. The signature of these accidents is obvious from the aircraft crash and the earthquake and fire.

Earthquake damage of the MDB, followed by a fire, is estimated to produce a toxic cloud that would have a no-deaths contour extending 12.5 km downwind. The detonation of a single munition in the MDB explosion containment room could cause ventilation equipment and the structure to fail, releasing a toxic cloud that would have a downwind no-deaths contour extending 3.2 km.

3.2.16 VX 8-in. Projectile

Table 3.2.16 lists the risk analysis accidents for the demilitarization of 8-in. projectiles filled with VX. The detonation of a single munition from mishandling (dropping) would produce a cloud with a toxic agent that, under worst-case meteorological conditions, would produce a no-deaths contour extending for 3.5 km downwind. A forklift collision resulting in a fire could result in the release of an agent that would produce a no-deaths contour extending a little more than 4.5 km downwind.

A vehicle accident followed by a fire, during transport between the storage igloo and the CHB, would produce a plume having a no-deaths contour extending 10.4 km downwind (VO4) under worst-case meteorological conditions.

Accidents listed for the CHB include those caused by large aircraft crashes and earthquakes, followed by fire in one case and no fire in the other case. Both the aircraft crash and the earthquake followed by fire are estimated to release a quantity of agent, producing a no-deaths contour that extends more than 64 km downwind under worst-case meteorological conditions. An aircraft crash with no fire would produce a corresponding no-deaths contour extending a little less than 16 km downwind. The earthquake with no fire has the same effect as the explosion of a single round, producing a toxic cloud with a no-death contour extending 3.5 km downwind. A similar consequence is produced by dropping a munition, producing an explosion in the MDB or detonating of a munition in process in the explosion containment room, each with no fire. In the event of an earthquake followed by a fire, even if the MDB structure is intact, a quantity of agent could be released, which would produce a no-deaths contour extending a little more than 12 km downwind under worst-case meteorological conditions.

4. SENSORS

Any accident assessment system will depend to a certain degree on sensors: chemical detectors, smoke detectors, fire detectors (ionization detectors), pressure sensors, and acoustical detectors (a sensitive type of pressure sensor). These sensors must have a readout in the EOC, as well as in the control room. If not, they would be less useful in rapid accident assessment. Also, they must read in real time or near real time if the overall systems have a rapid response.

Here, it is impractical to attempt to deploy enough sensors to detect every conceivable accident at every conceivable location on the facility. Very important input to the accident assessment process will be verbal reports from field personnel, communicating by radio or telephone, to the EOC. Accidents such as vehicle and aircraft crashes and handling accidents not resulting in any agent release would normally be reported verbally. Most releases from transport accidents would be detected by escort personnel with chemical agent detectors and reported verbally.

4.1 Chemical Sensors Available

Chemical sensors of interest to this problem are high-level, rapid-acting sensors, both fixed and portable, with the fixed capability of activating a remote alarm. They are described by Kuryk et al. (1987). Historical monitoring systems, such as DAAMS or bubbler absorption systems, are of little help in a system requiring rapid response. The instrument probably used most for fixed installation is ACAMS. Another possibility for fixed location sensors is the real-time monitor. However, with a low level of agent, it can have a response time of up to 12 min compared with 2 min for the ACAMS monitor, for similarly low levels. Portable monitors are the M8A1 and the CAM. These all have response times of less than 2 min for GB, and most of them respond to other agents in a minute or less. The M8 is not reliable for mustard detection and must use a fluorinating filter for the detection of VX. These detection response times are for concentrations immediately dangerous to life and health.

4.2 Remote Sensing Systems

Development is under way, in more than one location, for systems that can use optical properties to detect hazardous chemicals in air from long distances. Some of these systems use infrared or ultraviolet light sources to measure the absorption, at one or more wavelengths, of the airborne contaminant, employing either a widely separated transmitter and receiver or a co-located transmitter and receiver, with a corner reflector at the other end of the path to be monitored (Simpson, 1989). Length of the path can be up to 5 km. At least one instrument can be programmed to scan across an array of mirrors and retroreflectors to construct a "detection cage" around a building or other location where toxic chemicals are expected.

The systems can be expensive, costing up to $100 to 200 thousand per site. However, they offer the possibility of high-confidence perimeter detection of very toxic vapors.

5. CONCLUSIONS

1. Many of the accidents/incidents covered in the risk analysis can be quickly and unambiguously assigned to one of the four accident categories (chemical occurrence, advisory, on-post emergency, and community emergency) on the basis of the already known munition and agent involved and the location. Ambiguous cases can be resolved by the accident's signature (externally observable characteristics).

2. Accidents not considered significant or credible by the probabilistic risk analysis can be assigned to one of the four accident categories by a simple decision tree, given the inputs of munition type, agent, meteorology, inventory in affected area, and accident signature, including sensor readings.

3. In some circumstances the magnitude of an outdoor release may be estimated from a concentration-time integral reading by a fast chemical sensor, the meteorology, and the position of the sensor with respect to the point of release and the wind direction.

4. Five-minute assessment time appears to be achievable if:

   a. The EOC or other assessment facility is manned and operating when the accident/incident occurs,

   b. Personnel at the accident site are able to communicate directly with the EOC,

   c. Meteorological data are being collected and stability conditions are being calculated,

   d. Computer analytical program is up and running.

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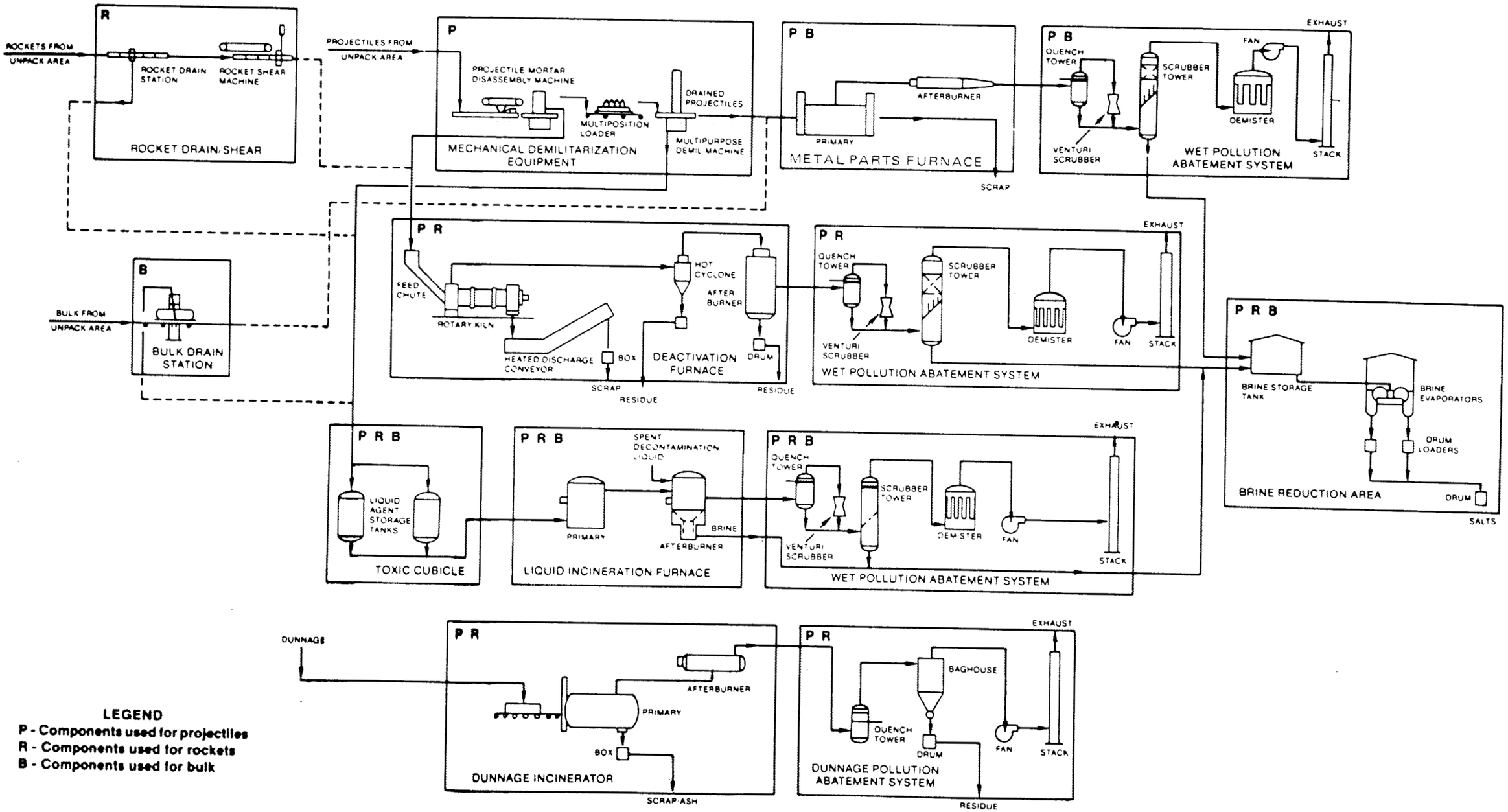
APPENDIX A

CHEMICAL DEMILITARIZATION PROCESS FLOW SHEET (JACADS)

ORNL-DWG 86-11961



LEGEND
P - Components used for projectiles
R - Components used for rockets
B - Components used for bulk

APPENDIX B

ACCIDENT DESCRIPTIONS

Table B.1. Long-term storage and handling accident scenario descriptions

Code	Accident Description
HS 02	Forklift collision with short-duration fire
HS 03	Forklift tine puncture
HS 04	Forklift collision without fire
HS 05	Drop of munition leads to detonation
HS 06	Collision accident leads to detonation
HS 07	Collision accident with prolonged fire
HS 08	Munition pallet dropped during pallet inspection
HS 09	Forklift tine puncture during pallet inspection
HS 10	Forklift collision during pallet inspection
HS 11	Munition pallet dropped during pallet inspection; detonation occurs
HS 12	Forklift collision; detonation occurs
SL 02	Munition punctured by forklift tine during leaker-handling activities
SL 03	Spontaneous ignition of rocket during storage (not analyzed for lack of quantitative data)
SL 04	Large aircraft direct crash onto storage area; fire not contained in 30 min (note: assume that detonation occurs if burstered munitions are hit, fire involving burstered munitions not contained at all)
SL 05	Large aircraft indirect crash onto storage area; fire not contained in 30 min (see note in SL04)
SL 06	Tornado-generated missiles strike the storage magazine, warehouse, or open storage area; munitions breached (no detonation)
SL 07	Severe earthquake breaches the munitions in storage igloos; no detonation
SL 08	Meteorite strikes the storage area; fire occurs; munitions breached (if burstered, detonation also occurs)
SL 09	Munition dropped during leaker isolation operation; munition punctured
SL 10	Storage igloo or warehouse fire from internal sources
SL 11	Munitions are dropped because of pallet degradation
SL 12	Liquid petroleum gas (LPG) infiltrates igloo/building
SL 13	Flammable liquids stored in nearby facilities explode; fire propagates to munition warehouse
SL 14	Tornado-induced building collapse leads to breaching/detonation of munitions

Table B.1. (continued)

Code	Accident Description
SL 15	Small aircraft direct crash; no fire; detonation (if burstered)
SL 16	Large aircraft direct crash; no fire; detonation (if burstered)
SL 17	Large aircraft direct crash; fire contained within 30 min (applies to nonburstered munitions only)
SL 18	Small aircraft direct crash onto warehouse or open storage yard; no fire
SL 19	Small aircraft direct crash onto warehouse or open storage yard; fire contained in 30 min
SL 20	Large aircraft indirect crash onto storage area; no fire
SL 21	Large aircraft indirect crash onto storage area; fire contained in 30 min
SL 22	Severe earthquake leads to munition detonation
SL 23	Tornado-generated missiles strike the storage igloo and lead to munition detonation
SL 24	Lightning strikes ton containers stored outdoors
SL 25	Munition dropped during leaker isolation, munition detonates
SL A26	Earthquake occurs; NAAP warehouse is intact; no ton containers damaged; fire occurs
SL A27	Earthquake occurs; Tooele Army Depot (TEAD) warehouses intact; munitions intact; fire occurs at one warehouse
SL A28	Earthquake occurs; Umatilla Depot Activity (UMDA) warehouses intact; munitions intact; fire occurs at one warehouse
SL B26	Earthquake occurs; NAAP warehouse is intact; ton container damaged; no fire
SL B27	Earthquake occurs; TEAD warehouses intact; munitions intact; fire occurs at two warehouses
SL B28	Earthquake occurs; UMDA warehouses intact; munitions intact; fire occurs at two warehouses
SL C26	Earthquake occurs; NAAP warehouse is intact; ton container damaged; fire occurs
SL C27	Earthquake occurs; one TEAD warehouse is damaged; munitions intact; fire occurs at one warehouse
SL C28	Earthquake occurs; UMDA warehouses intact; munitions in one warehouse damaged; no fire occurs
SL D26	Earthquake occurs; NAAP warehouse is damaged; ton containers damaged; fire occurs
DL D27	Earthquake occurs; one TEAD warehouse is damaged; munitions intact; fire occurs at two warehouses

Table B.1. (continued)

Code	Accident Description
SL D28	Earthquake occurs; UMDA warehouses intact; munitions in one warehouse damaged; fire occurs at warehouse with undamaged munitions
SL E26	Earthquake occurs; NAAP warehouse is damaged; ton containers damaged; no fire occurs
SL E27	Earthquake occurs; two TEAD warehouses damaged; munitions intact; fire occurs at one warehouse
SL E28	Earthquake occurs; UMDA warehouses intact; munitions in one warehouse damaged; fire occurs at warehouse with undamaged munitions
SL F27	Earthquake occurs; two TEAD warehouses damaged; munitions intact; fire occurs at two warehouses
SL F28	Earthquake occurs; UMDA warehouses intact; munitions in one warehouse damaged; fire occurs at two warehouses
SL G28	Earthquake occurs; UMDA warehouses intact; munitions in two warehouses damaged; no fire occurs
SL H28	Earthquake occurs; UMDA warehouses intact; munitions in two warehouses damaged; fire occurs at warehouse with damaged munitions
SL K28	Earthquake occurs; one UMDA warehouse damaged; munitions in one warehouse damaged; fire occurs at warehouse with damaged munitions

Table B.2. Accident scenario description

Code	Accident Description
HF 01	Muniton pallet or container dropped during movement from munitions holding igloo (MHI) to munitions demilitarization building (MDB)
HF 03	Forklift collision accident with short-duration fire during handling from MHI to MDB
HF 07	Collision accident without fire
HF 11	Drop of munition pallet from the MHI to MDB leads to detonation
HF 12	Drop of bare, single munition inside the MDB leads to detonation
HF 13	Drop of palletized munition (in container) inside the MDB leads to detonation
HO 01	Drop of bare pallet or single item at storage area
HO 02	Forklift collision with short duration fire at storage area, involving bare munitions
HO 03	Forklift tine accident involving bare munitions at storage area
HO 04	Forklift collision accident without fire at storage area, involving bare munitions
HO 05	Drop of on-site container
HO 06	Forklift collision with short-duration fire during handling of on-site container
HO 07	Forklift collision without fire during handling of on-site container
HO 11	Drop of bare palletized munition leads to detonation
HO 12	Forklift collision accident at storage area leads to detonation of burstered munition
PO 21	Direct crash of a large or small aircraft damages the outdoor agent piping system at Tooele Army Depot (TEAD); no fire
PO 22	Direct crash of a large or small aircraft damages the outdoor agent piping system at TEAD; fire occurs and is not contained
PO 12	Direct crash of large aircraft on MDB; no fire
PO 13	Direct crash of large aircraft on MDB; fire
PO 19	Indirect crash of large aircraft on MDB; fire
PO 25	Earthquake damages the MDB structure; munitions fall and are punctured; fire is suppressed

Table B.2. (continued)

Code	Accident Description
PO 26	Earthquake damages the MDB structure; munitions fall and are punctured; earthquake also initiates fire; fire suppression system fails
PO 29	Earthquake damages the MDB; munitions are intact; fire occurs; fire suppression system fails
PO 30	Earthquake damages the MDB; munitions are intact; toxic cubicle (TOX) damaged; no fire occurs
PO 33	Earthquake causes munitions to fall, but no detonation occurs; the MDB is intact; the TOX is intact; earthquake also initiates fire; fire suppression system fails
PO 34	Earthquake causes munitions to fall, but no detonation occurs; the MDB is intact; the TOX is damaged; fire occurs; fire suppression system fails
PO 41	Failure to stop agent feed to the liquid incinerator (LIC) overloads the ventilation system
PO 42	MPF explosion due to failure to stop fuel flow after a shutdown
PO 45	Ton container is spilled in the explosion containment vestibule (ECV); MDB structure fails due to subsequent agent fire
PO 49	Munition detonation in explosion containment room (ECR) causes structural and ventilation system failure
PO 50	Munition detonation in ECR causes structural failure, a fire, and a ventilation failure
PO 51	Ton container spill in the MDB results in fire and structural failure
PO 52	A burstered munition is fed to the dunnage incinerator (DUN)
VO 01	A munitions vehicle collision/overturn occurs, and crush forces fail the agent containment
VO 03	A munitions vehicle collision/overturn occurs, and puncture forces fail the agent containment
VO 04A	A munitions vehicle accident with fire occurs, causing detonation of burstered munitions. Ignition of the propellant by a probe could also detonate the burster of a cartridge, and the burster of a rocket could be detonated by induced impact
VO 04B	Ignition of the rocket propellant
VO 09	A severe earthquake occurs, causing a munitions vehicle accident, and crush forces fail the agent containment
VO 12	A severe earthquake occurs, causing a munitions vehicle accident and fire that detonates burstered munitions

Table B.2. (continued)

Code	Accident Description
PO 61	Direct or indirect crash of large aircraft on container-handling building (CHB) results in rupture of agent containment and (for burstered munitions) detonation
PO 62	Direct or indirect crash of large aircraft on CHB results in fire; burstered munitions detonate
PO 63	Severe earthquake damages CHB structure and results in rupture of agent containment and (for burstered munitions) detonation
PO 64	Severe earthquake damages CHB structure and results in fire; burstered munitions detonate

Table B.3. CHB handling accident scenarios

Code	Accident Description
HF 21	Forklift collision at unloading dock or during movement to storage location results in rupture of agent containment
HF 22	Forklift collision at unloading dock or during movement to storage location results in detonation
HF 23	Forklift collision at unloading dock or during movement to storage location results in fire
HF 24	On-site container dropped at unloading dock or during movement to storage location results in rupture of agent containment
HF 25	On-site container dropped at unloading dock or during movement to storage location results in detonation
HF 41	Forklift collision during movement from storage to lift results in rupture of agent containment
HF 42	On-site container dropped during movement from storage to lift results in rupture of agent containment
HF 43	Forklift collision during movement from storage to lift results in fire
HF 44	Forklift collision during movement from storage to lift results in detonation
HF 45	On-site container dropped during movement from storage to lift results in detonation

APPENDIX C

CALCULATED ACCIDENT DATA FROM RISK ANALYSIS

(Results are accurate to one significant figure)

Table C.1. All accident scenarios for Long-Term Storage and Handling
Disposal Option sorted by site, munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
Anniston Army Depot										
HS 5	0.37	1.12	0.000	1.600	5.545	2.143	60	C	G	C
HS 6	0.37	1.12	0.000	1.600	0.545	2.143	60	C	G	C
HS 7	0.92	2.94	0.000	9.594	2.877	12.474	60	C	G	C
HS 11	0.37	1.12	0.000	1.600	0.545	2.143	60	C	G	C
SL 22	0.37	1.12	0.000	1.600	0.545	2.143	360	C	G	C
SL 25	0.37	1.12	0.000	1.600	0.545	2.143	120	C	G	C
SL 4	6.61	39.92	0.000	17298.200	2594.180	19906.730	20	C	G	C
SL 16	1.75	7.95	0.000	1381.570	0.200	1383.566	240	D	H	C
HS 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
SL 22	1.64	5.39	0.000	31.477	0.000	31.477				
SL 25	1.64	5.39	0.000	31.477	0.000	31.477	120	M	V	C
HS 5	0.66	2.08	0.000	6.501	0.125	6.622	60	P	G	C
HS 7	1.07	3.48	0.000	13.002	3.899	16.904	20	P	G	C
HS 11	0.79	2.50	0.000	6.501	2.799	9.290	60	P	G	C
SL 22	0.79	2.50	0.000	6.501	2.799	9.290	360	P	G	C
SL 25	0.79	2.50	0.000	6.501	2.799	9.290	120	P	G	C
HS 7	0.22	0.75	0.000	23.388	3.508	26.915	20	P	H	C
HS 5	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HS 6	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HS 7	1.06	3.27	0.000	11.995	0.899	12.882	20	P	V	C
HS 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
SL 4	29.42	150.42	0.000	15488.200	1164.130	16634.130	20	P	V	C
S 16	9.05	40.82	0.000	1241.650	0.002	1241.652	240	P	V	C
SL 22	0.72	2.14	0.000	5.998	0.000	5.998	360	P	V	C
SL 25	0.72	2.14	0.000	5.998	0.000	5.998	120	P	V	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HS 5	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
HS 7	1.39	4.63	0.000	21.727	6.531	28.249	20	Q	G	C
HS 11	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
SL 22	1.09	3.53	0.000	14.488	2.799	17.298	360	Q	G	C
SL 25	1.09	3.53	0.000	14.488	2.799	17.298	120	Q	G	C
HS 11	1.36	4.53	0.000	21.380	5.794	27.164	60	R	G	C
SL 4	23.08	124.53	0.000	10115.800	3033.890	13152.250	20	R	G	C
SL 16	10.61	48.35	0.000	2023.020	51.168	2074.914	240	R	G	C
SL 22	1.36	4.53	0.000	21.380	5.794	27.164	360	R	G	C
SL 25	1.36	4.53	0.000	21.380	5.794	27.164	120	R	G	C
HS 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
SL 22	1.32	4.18	0.000	19.999	0.000	19.999	360	R	V	C
SL 25	1.32	4.18	0.000	19.999	0.000	19.999	120	R	V	C
Aberdeen Proving Ground										
SL 15	3.38	17.45	0.000	0.000	5105.050	5105.050	30	K	H	F
SL 18	0.40	1.44	25527.000	0.000	0.000	81.283	240	K	H	S
SL 19	1.67	7.57	0.000	0.000	1276.440	1276.439	30	K	H	F

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount tool agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
Lexington-Bluegrass Army Depot										
HS 7	0.22	0.75	0.000	23.388	3.508	26.915	20	P	H	C
HS 5	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HS 7	1.06	3.27	0.000	11.995	0.899	12.882	20	P	V	C
HS 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
SL 22	0.72	2.14	0.000	5.998	0.000	5.998	360	P	V	C
SL 25	0.72	2.14	0.000	5.998	0.000	5.998	120	P	V	C
HS 5	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
HS 7	1.39	4.63	0.000	21.727	6.531	28.249	20	Q	G	C
HS 11	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
SL 22	1.09	3.53	0.000	14.488	2.799	17.298	360	Q	G	C
HS 11	1.36	4.53	0.000	21.380	5.794	27.164	60	R	G	C
SL 22	1.36	4.53	0.000	21.380	5.794	27.164	360	R	G	C
SL 25	1.36	4.53	0.000	21.380	5.794	27.164	120	R	G	C
HS 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
SL 22	1.32	4.18	0.000	19.999	0.000	19.999	360	R	V	C
SL 25	1.32	4.18	0.000	19.999	0.000	19.999	120	R	V	C
NAAP										
SL 5	56.46	292.60	0.000	0.000	74644.900	74644.880	60	K	V	F
SL 15	57.39	296.60	0.000	0.000	74644.900	74644.880	30	K	V	F
SL 26	45.38	304.21	0.000	0.000	74989.400	74989.420	360	K	V	F
SL 26	45.38	304.21	0.000	0.000	74989.400	74989.420	360	K	V	F

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
Pine Bluff Arsenal										
HS 2	0.41	1.50	0.000	0.000	84.918	84.918	30	K	H	F
SL 4	11.91	85.22	0.000	0.000	68076.900	68076.940	60	K	H	F
SL 5	11.91	8522	0.000	0.000	68076.900	68076.940	60	K	H	F
SL 8	11.91	85.22	0.000	0.000	68076.900	68076.940	60	K	H	F
SL 15	3.38	17.45	0.000	0.000	5105.050	5105.050	30	K	H	F
SL 16	1.35	5.76	339625.000	0.000	0.000	833.681	240	K	H	S
SL 18	0.40	1.44	25527.000	0.000	0.000	81.283	240	K	H	S
SL 19	1.67	7.57	0.000	0.000	1276.440	1276.439	30	K	H	F
SL 20	0.63	2.45	68076.900	0.000	0.000	196.336	240	K	H	S
HS 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
SL 22	1.64	5.39	0.000	31.477	0.000	31.477	360	M	V	C
SL 25	1.64	5.39	0.000	31.477	0.000	31.477	120	M	V	C
HS 11	1.36	4.53	0.000	21.380	5.794	27.164	60	R	G	C
SL 6	0.26	0.86	0.000	0.000	7.534	7.534	360	R	G	C
SL 22	1.36	4.53	0.000	21.380	5.794	27.164	360	R	G	C
SL 25	1.36	4.53	0.000	21.380	5.794	27.164	120	R	G	C
HS 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
SL 22	1.32	4.18	0.000	19.999	0.000	19.999	360	R	V	C
SL 25	1.32	4.18	0.000	19.999	0.000	19.999	120	R	V	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
Pueblo Depot Activity										
SL 4	4.33	23.58	0.000	7294.580	1093.960	8394.600	20	C	H	C
SL 5	4.33	23.58	0.000	7294.580	1093.960	8394.600	20	C	H	C
SL 4	6.61	39.92	0.000	17298.200	2594.180	19906.730	20	D	H	C
SL 5	6.61	39.92	0.000	17298.200	2594.180	19906.730	20	D	H	C
SL 16	1.75	7.95	0.000	1383.570	0.200	1383.566	240	D	H	C
HS 7	0.22	0.75	0.000	23.388	3.508	26.915	20	P	H	C
SL 4	8.65	56.22	0.000	30199.500	4539.420	34753.620	20	P	H	C
SL 5	8.65	56.22	0.000	30199.500	4539.420	34753.620	20	P	H	C
SL 16	2.32	11.13	0.000	2421.030	0.200	2421.029	240	P	H	C
Tooele Army Depot										
HS 1	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 3	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 4	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 8	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 9	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 10	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
SL 2	0.25	0.83	0.000	0.000	4.256	4.256	60	B	G	C
SL 7	0.50	1.84	0.000	0.000	25.586	25.586	360	B	G	C
SL 9	0.25	0.83	0.000	0.000	4.256	4.256	60	B	G	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HS 5	0.37	1.12	0.000	1.600	0.545	2.143	60	C	G	C
HS 6	0.37	1.12	0.000	1.600	0.545	2.143	60	C	G	C
HS 7	0.92	2.94	0.000	9.594	2.877	12.474	20	C	G	C
HS 11	0.37	1.12	0.000	1.600	0.545	2.143	60	C	G	C
SL 22	0.37	1.12	0.000	1.600	0.545	2.143	360	C	G	C
SL 25	0.37	1.12	0.000	1.600	0.545	2.143	120	C	G	C
HS 1	0.41	1.32	0.000	0.000	6.397	6.397	15	K	G	C
HS 2	2.04	7.78	0.000	0.000	149.968	149.968	30	K	G	F
HS 4	0.41	1.32	0.000	0.000	6.397	6.397	15	K	G	C
SL 7	0.60	2.32	0.000	0.000	37.068	37.068	360	K	G	C
SL 9	0.31	1.06	0.000	0.000	6.397	6.397	60	K	G	C
HS 2	0.41	1.50	0.000	0.000	84.918	84.918	30	K	H	F
SL 8	11.91	85.22	0.000	0.000	68076.900	68076.940	60	K	H	F
SL 15	3.38	17.45	0.000	0.000	5105.050	5105.050	30	K	H	F
SL 16	1.35	5.76	339625.000	0.000	0.000	833.681	240	K	H	S
SL 18	0.40	1.44	25527.000	0.000	0.000	81.283	240	K	H	S
HS 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
SL 22	1.64	5.39	0.000	31.477	0.000	31.477	360	M	V	C
SL 25	1.64	5.39	0.000	31.477	0.000	31.477	120	M	V	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount Agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HS 5	0.66	2.08	0.000	6.501	0.125	6.622	60	P	G	C
HS 6	0.79	2.50	0.000	6.501	2.799	9.290	60	P	G	C
HS 7	1.07	3.48	0.000	13.002	3.899	16.904	20	P	G	C
HS 11	0.79	2.50	0.000	6.501	2.799	9.290	60	P	G	C
SL 22	0.79	2.50	0.000	6.501	2.799	9.290	360	P	G	C
SL 25	0.79	2.50	0.000	6.501	2.799	9.290	120	P	G	C
HS 7	0.22	0.75	0.000	23.388	3.508	26.915	20	P	H	C
HS 5	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HS 6	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HS 7	1.06	3.27	0.000	11.995	0.899	12.882	20	P	V	C
HS 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
SL 22	0.72	2.14	0.000	5.998	0.000	5.998	360	P	V	C
SL 25	0.72	2.14	0.000	5.998	0.000	5.998	120	P	V	C
HS 5	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
HS 7	1.39	4.63	0.000	21.727	6.531	28.249	20	Q	G	C
HS 11	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
SL 22	1.09	3.53	0.000	14.488	2.799	17.298	360	Q	G	C
SL 22	1.12	3.49	0.000	14.488	0.000	14.488	360	Q	V	C
HS 11	1.36	4.53	0.000	21.380	5.794	27.164	60	R	G	C
SL 22	1.36	4.53	0.000	21.380	5.794	27.164	360	R	G	C
SL 25	1.36	4.53	0.000	21.380	5.794	27.164	120	R	G	C
HS 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
SL 22	1.32	4.18	0.000	19.999	0.000	19.999	360	R	V	C
SL 25	1.32	4.18	0.000	19.999	0.000	19.999	120	R	V	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount Agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
SL 8	14.18	79.46	0.000	0.000	4581.420	4581.419	60	S	V	C
SL 15	10.75	53.48	0.000	0.000	2032.360	2032.357	30	S	V	F
SL 27	10.91	74.03	0.000	0.000	4497.800	4497.799	360	S	V	F
SL 27	15.47	108.04	0.000	0.000	8994.980	8994.976	360	S	V	F
SL 27	15.47	108.04	0.000	0.000	8994.980	8994.976	360	S	V	F
SL 27	10.91	74.03	0.000	0.000	4497.800	4497.799	360	S	V	F
SL 27	10.91	74.03	0.000	0.000	4497.800	4497.799	360	S	V	F
SL 27	10.91	74.03	0.000	0.000	4497.800	4497.799	360	S	V	F
Umatilla Depot Activity (UMDA)										
HS 1	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 3	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 4	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 8	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 9	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HS 10	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
SL 7	0.50	1.84	0.000	0.000	25.586	25.586	360	B	G	C
SL 9	0.25	0.83	0.000	0.000	4.256	4.256	60	B	G	C
SL 4	22.54	201.70	0.000	0.000	269153.000	269153.500	60	K	H	F
SL 5	22.54	201.70	0.000	0.000	269153.000	269153.500	60	K	H	F
SL 15	22.54	201.70	0.000	0.000	269153.000	269153.500	30	K	H	F
SL 16	1.35	5.76	339625.000	0.000	0.000	833.681	240	K	H	S
SL 18	0.40	1.44	25527.000	0.000	0.000	81.283	240	K	H	S

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount Agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
SL 28	30.83	314.00	0.000	0.000	539511.000	539510.600	360	K	H	F
SL 28	22.56	202.00	0.000	0.000	269774.000	269773.000	360	K	H	F
SL 28	30.83	314.00	0.000	0.000	539511.000	539510.600	360	K	H	F
SL 28	22.56	202.00	0.000	0.000	269774.000	269773.900	360	K	H	F
SL 28	22.56	202.00	0.000	0.000	269774.000	269773.900	360	K	H	F
HS 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
SL 22	1.64	5.39	0.000	31.477	0.000	31.477	360	M	V	C
SL 25	1.64	5.39	0.000	31.477	0.000	31.477	120	M	V	C
HS 5	0.66	2.08	0.000	6.501	0.125	6.622	60	P	G	C
HS 7	1.07	3.48	0.000	13.002	3.899	16.904	20	P	G	C
HS 11	0.79	2.50	0.000	6.501	2.799	9.290	60	P	G	C
SL 22	0.79	2.50	0.000	6.501	2.799	9.290	360	P	G	C
SL 25	0.79	2.50	0.000	6.501	2.799	9.290	120	P	G	C
HS 5	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
H 7	1.06	3.27	0.000	11.995	0.899	12.882	20	P	V	C
HS 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
SL 22	0.72	2.14	0.000	5.998	0.000	5.998	360	P	V	C
SL 25	0.72	2.14	0.000	5.998	0.000	5.998	120	P	V	C
HS 5	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
HS 7	1.39	4.63	0.000	21.727	6.531	28.249	20	Q	G	C
HS 11	1.09	3.53	0.000	14.488	2.799	17.298	60	Q	G	C
SL 22	1.09	3.53	0.000	14.488	2.799	17.298	360	Q	G	C
SL 25	1.09	3.53	0.000	14.488	2.799	17.298	120	Q	G	C
HS 5	1.12	3.49	0.000	14.488	0.010	14.488	60	Q	V	C
HS 7	1.42	4.56	0.000	21.727	1.633	23.335	20	Q	V	C
HS 11	1.12	3.49	0.000	14.488	0.000	14.488	60	Q	V	C

Table C.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount Agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
UMDA										
SL 22	1.12	3.49	0.000	14.488	0.000	14.488	360	Q	V	C
SL 25	1.12	3.49	0.000	14.488	0.000	14.488	120	Q	V	C
HS 11	1.36	4.53	0.000	21.380	5.794	27.164	60	R	G	C
SL 4	23.08	124.53	0.000	10115.800	3033.890	13152.250	20	R	G	C
SL 5	23.08	124.53	0.000	10115.800	3033.890	13152.250	20	R	G	C
SL 16	10.61	48.35	0.000	2023.020	51.168	2074.914	240	R	G	C
SL 20	1.74	5.95	0.000	10.691	33.729	44.463	240	R	G	C
SL 22	1.36	4.53	0.000	21.380	5.794	27.164	360	R	G	C
SL 25	1.36	4.53	0.000	21.380	5.794	27.164	120	R	G	C
HS 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
SL 22	1.32	4.18	0.000	19.999	0.000	19.999	360	R	V	C
SL 25	1.32	4.18	0.000	19.999	0.000	19.999	120	R	V	C
SL 4	3.85	18.90	0.000	0.000	338.844	338.844	60	S	V	F

[a]Conservative most likely.
[b]Worst-case.

Table C.2.1. All accident scenarios for Anniston Army Depot for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 11	0.33	1.01	0.000	1.600	0.160	1.758	60	C	G	C
HO 12	0.33	1.01	0.000	1.600	0.160	1368	60	C	G	C
VO 4	1.85	6.35	0.000	38.371	11.508	49.888	20	C		C
HF 11	0.51	1.46	7.998	1.600	0.000	4.055	60	C	G	C
HF 12	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
PO 29	2.26	7.95	0.000	57.544	17.298	74.817	360	C	G	C
PO 33	2.26	7.95	0.000	57.544	17.298	74.817	360	C	G	C
PO 49	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
PO 50	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
PO 52	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
VO 4	0.41	1.53	0.000	76.736	11.508	88.308	20	C	H	C
PO 33	0.51	1.95	0.000	115.080	17.298	132.434	360	C	H	C
PO 29	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
PO 33	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
PO 42	0.19	0.66	0.000	0.000	21.577	21.577	12	D	H	C
VO 4	0.83	3.37	0.000	287.740	43.152	331.131	20	D	H	C
HF 11	1.64	5.39	157.398	31.477	0.000	31.477	60	M	V	C
HO 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
HO 12	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
PO 29	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 33	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 52	0.96	2.91	0.000	10.495	0.000	10.495	0	M	V	C
VO 4	7.52	32.87	0.000	377.572	449.780	827.942	20	M	V	C

Table C.2.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 11	0.66	2.07	0.000	6.501	0.110	6.607	60	P	G	C
VO 4	4.45	17.31	0.000	52.000	255.270	306.610	20	P	G	C
HF 11	1.02	3.02	32.509	6.501	0.000	15.171	60	P	G	C
HF 12	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
PO 33	2.62	9.40	0.000	77.983	23.388	101.391	360	P	G	C
PO 49	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
VO 4	0.66	2.60	0.000	93.541	119.950	213.304	20	P	H	C
PO 29	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
PO 33	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
HO 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HO 12	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
VO 4	2.50	8.85	0.000	47.973	28.379	76.384	20	P	V	C
HF 11	0.72	2.14	29.992	5.998	0.000	5.998	60	P	V	C
HF 12	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
HF 13	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
PO 29	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 33	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 42	0.98	3.37	0.000	0.000	14.388	14.388	12	P	V	C
PO 49	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
PO 50	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
HO 11	1.00	3.22	0.000	14.488	0.170	14.655	60	Q	G	C
VO 4	2.63	9.47	0.000	87.096	15.596	102.802	20	Q	G	C
HF 11	1.49	4.60	72.444	14.488	0.000	32.285	60	Q	G	C
HF 12	0.99	3.20	0.000	14.488	0.000	14.488	0	Q	G	C

Table C.2.1. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
PO 29	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 33	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 49	0.99	3.20	0.000	14.488	0.000	14.488	0		G	(C
HO 11	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
HO 12	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
VO 4	3.30	12.26	0.000	160.325	3.597	164.059	20	R	G	C
HF 11	1.91	6.04	138.995	21.380	0.000	53.456	60	R	G	C
HF 12	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 29	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 33	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 49	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 50	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 52	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
HO 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
HO 12	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
VO 4	3.70	14.11	0.000	149.968	26.122	176.198	20	R	V	C
HF 11	1.32	4.18	130.017	19.999	0.000	19.999	60	R	V	C
HF 12	0.94	184	0.000	10.000	0.000	10.000	0	R	V	C
PO 29	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 33	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 49	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 50	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 52	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C

[a]Conservative most likely.
[b]Worst-case.

Table C.2.2. All accident scenarios for Aberdeen Proving Ground for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 2	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HO 6	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HF 3	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
PO 25	0.41	1.50	0.000	0.000	84.918	84.918	360	K	H	C
PO 29	1.04	4.37	0.000	0.000	510.505	510.505	360	K	H	C
PO 42	0.28	0.99	0.000	0.000	42.462	42.462	12	K	H	C

[a]Conservative most likely.
[b]Worst-case.

Table C.2.3. All accident scenarios for Lexington-Bluegrass Army Depot for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
VO 4	0.66	2.60	0.000	93.541	119.950	213.304	20	P	H	C
PO 33	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
HO 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
VO 4	2.50	8.85	0.000	47.973	28.379	76.384	20	P	V	C
HF 11	0.72	2.14	29.992	5.998	0.000	5.998	60	P	V	C
PO 29	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 33	2.52	8.92	0.000	71.945	5.395	77.26	360	P	V	C
PO 49	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
HO 11	1.00	3.22	0.000	14.488	0.170	14.655	60	Q	G	C
VO 4	2.63	9.47	0.000	87.096	15.596	102.802	20	Q	G	C
HF 11	1.49	4.60	72.444	14.488	0.000	31285	60	Q	G	C
PO 29	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 33	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 49	0.99	3.20	0.000	14.488	0.000	14.488	0	Q	G	C
HO 11	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
HO 12	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
VO 4	3.30	12.26	0.000	160.325	3.597	164.059	20	R	G	C
HF 11	1.91	6.04	138.995	21.380	0.000	53.456	60	R	G	C
HF 12	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 29	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 33	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 49	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 50	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 52	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C

Table C.2.3. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
VO 4	3.70	14.11	0.000	149.968	26.122	176.198	20	R	V	C
HF 11	1.32	4.18	130.017	19.999	0.000	19.999	60	R	V	C
HF 12	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 29	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 33	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 49	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 50	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 52	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C

[a]Conservative most likely.
[b]Worst-case.

Table C.2.4. All accident scenarios for NAAP for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 6	1.64	6.06	0.000	0.000	39.994	39.994	10	K	V	F
HF 3	1.64	6.06	0.000	0.000	39.994	39.994	10	K	V	F
PO 12	0.19	0.70	8016.780	0.000	0.000	1.706	360	K	V	S
PO 13	3.24	15.48	0.000	0.000	240.436	240.436	60	K	V	F
PO 19	3.23	15.46	0.000	0.000	239.883	239.883	60	K	V	F
PO 25	1.00	4.16	0.000	0.000	39.994	39.994	360	K	V	C
PO 26	2.50	12.91	0.000	0.000	239.883	239.883	360	K	V	C
PO 29	2.50	12.91	0.000	0.000	239.883	239.883	360	K	V	C
PO 42	1.64	6.06	0.000	0.000	39.994	39.994	12	K	V	C
PO 51	0.62	1.99	0.000	0.000	5.794	5.794	34	K	V	F

[a]Conservative most likely.
[b]Worst-case.

Table C.2.5. All accident scenarios for Pine Bluff Arsenal for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 2	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HO 6	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HF 3	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
PO 25	0.41	1.50	0.000	0.000	84.918	84.918	360	K	H	C
PO 29	1.04	4.37	0.000	0.000	510.505	510.505	360	K	H	C
PO 42	0.28	0.99	0.000	0.000	42.462	41462	12	K	H	C
PO 51	0.18	0.59	0.000	0.000	17.989	17.989	60	K	H	F
HO 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
VO 4	7.52	32.87	0.000	377.572	449.780	827.942	20	M	V	C
HF 11	1.64	5.39	157.398	31.477	0.000	31.477	60	M	V	C
PO 29	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 33	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 52	0.96	2.91	0.000	10.495	0.000	10.495	0	M	V	C
HO 11	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
HO 12	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
VO 4	3.30	12.26	0.000	160.325	3.597	164.059	20	R	G	C
VO 12	3.70	14.00	0.000	160.325	48.195	208.449	20	R	G	C
HF 11	1.91	6.04	138.995	21.380	0.000	53.456	60	R	G	C
PO 29	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 33	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 49	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 50	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 52	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
HO 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
VO 4	3.70	14.11	0.000	149.968	26.122	176.198	20	R	V	C

Table C.2.5. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HF 11	1.32	4.18	130.017	19.999	0.000	19.999	60	R	V	C
PO 29	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 33	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 49	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 50	0.94	2.84	0.000	10.000	0.000	10.000	0	R	v	C
PO 52	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C

[a]Conservative most likely.
[b]Worst-case.

Table C.2.6. All accident scenarios for Pueblo Depot Activity for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
VO 4	0.41	1.53	0.000	76.736	11.508	88.308	20	C	H	C
PO 12	0.41	1.49	335.738	69.183	0.000	85.114	360	C	H	C
PO 13	0.51	1.96	0.000	115.080	17.989	133.045	20	C	H	C
PO 19	0.51	1.95	0.000	115.080	17.298	132.434	20	C	H	C
PO 29	0.51	1.95	0.000	115.080	17.298	132.434	360	C	H	C
PO 33	0.51	1.95	0.000	115.080	17.298	132.434	360	C	H	C
VO 4	0.83	3.37	0.000	287.740	43.152	331.131	20	D	H	C
PO 12	0.80	3.23	1221.800	259.418	0.000	310.456	360	D	H	C
PO 13	1.03	4.30	0.000	431.519	65.464	496.592	20	D	H	C
PO 19	1.03	4.30	0.000	431.519	64.863	496.592	20	D	H	C
PO 29	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
PO 33	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
PO 42	0.19	0.66	0.000	0.000	21.577	21.577	12	D	H	C
VO 4	0.66	2.60	0.000	93.541	119.950	213.304	20	P	H	C
PO 12	0.45	1.67	406.443	84.333	0.000	103.276	360	P	H	C
PO 13	0.57	2.20	0.000	140.281	21.777	162.181	20	P	H	C
PO 19	0.57	2.20	0.000	140.281	21.038	161.436	20	P	H	C
PO 29	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
PO 33	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
PO 42	0.22	0.77	0.000	0.000	28.119	28.119	12	P	H	C

[a]Conservative most likely.
[b]Worst-case.

Table C.2.7. All accident scenarios for Tooele Army Depot for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
PO 21	1.40	4.90	548.277	0.000	0.000	110.154	60	A	G	S
PO 22	1.24	4.45	0.000	0.000	54.828	54.828	10	A	G	F
PO 41	1.68	6.27	0.000	0.000	101.391	101.391	15	A	G	C
PO 22	0.24	0.83	0.000	0.000	31.915	31.915	10	A	H	F
PO 22	0.92	3.13	0.000	0.000	12.706	12.706	10	A	V	F
HO 1	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 3	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 4	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 5	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
HO 6	0.78	2.67	0.000	0.000	21.979	21.979	10	B	G	F
HO 7	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
VO 1	0.21	0.55	219.786	0.000	0.000	1.879	15	B	G	S
VO 3	0.21	0.55	219.786	0.000	0.000	1.879	15	B	G	S
VO 9	0.21	0.55	219.786	0.000	0.000	1.879	15	B	G	S
HF 1	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
HF 7	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
PO 25	0.46	1.68	0.000	0.000	21.979	21.979	360	B	G	C
PO 29	1.67	7.84	0.000	0.000	264.241	264.241	360	B	G	C
PO 42	0.78	2.67	0.000	0.000	21.979	21.979	12	B	G	C
HO 11	0.33	1.01	0.000	1.600	0.160	1.758	60	C	G	C
HO 12	0.33	1.01	0.000	1.600	0.160	1.758	60	C	G	C
VO 4	1.85	6.35	0.000	38.371	11.508	49.888	20	C	G	C
HF 11	0.51	1.46	7.998	1.600	0.000	4.055	60	C	G	C

Table C.2.7. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HF 12	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
HF 13	0.33	1.01	0.000	1.600	0.160	1.758	60	C	G	C
PO 29	2.26	7.95	0.000	57.544	17.298	74.817	360	C	G	C
PO 33	2.26	7.95	0.000	57.544	17.298	74.817	360	C	G	C
PO 42	0.39	1.25	0.000	0.000	5.794	5.794	12	C	G	C
PO 49	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
PO 50	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
PO 52	0.32	0.96	0.000	1.600	0.000	1.600	0	C	G	C
VO 4	0.83	3.37	0.000	287.740	43.152	331.131	20	D	H	C
PO 29	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
PO 33	1.03	4.30	0.000	431.519	64.863	496.592	360	D	H	C
HO 1	0.41	1.32	0.000	0.000	6.397	6.397	15	K	G	C
HO 4	0.41	1.32	0.000	0.000	6.397	6.397	15	K	G	C
HO 5	1.38	4.29	1499.680	0.000	0.000	68.077	15	K	G	S
HO 6	2.04	7.78	0.000	0.000	149.968	149.968	10	K	G	F
HO 7	1.38	4.29	1499.680	0.000	0.000	68.077	15	K	G	S
VO 1	0.53	1.50	1499.680	0.000	0.000	10.568	15	K	G	S
VO 3	0.53	1.50	1499.680	0.000	0.000	10.568	15	K	G	S
VO 9	0.53	1.50	1499.680	0.000	0.000	10.568	15	K	G	S
HF 1	1.38	4.29	1499.680	0.000	0.000	68.077	15	K	G	S
HF 3	2.04	7.78	0.000	0.000	149.968	149.968	10	K	G	F
HF 7	1.38	4.29	1499.680	0.000	0.000	68.077	15	K	G	S
PO 25	1.25	5.53	0.000	0.000	149.968	149.968	360	K	G	C
PO 26	3.11	16.52	0.000	0.000	899.498	899.498	360	K	G	C
PO 29	3.11	16.52	0.000	0.000	899.498	899.498	360	K	G	C

Table C.2.7. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
PO 42	1.02	3.60	0.000	0.000	37.497	37.497	12	K	G	C
PO 45	0.93	3.65	0.000	0.000	50.350	50.350	106	K	G	F
PO 51	0.69	2.62	0.000	0.000	28.973	28.973	61	K	G	F
HO 2	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HO 6	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HF 3	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
PO 25	0.41	1.50	0.000	0.000	84.918	84.918	360	K	H	C
PO 26	1.04	4.37	0.000	0.000	510.505	510.505	360	K	H	C
PO 29	1.04	4.37	0.000	0.000	510.505	510.505	360	K	H	C
PO 42	0.28	0.99	0.000	0.000	42.462	42.462	12	K	H	C
PO 51	0.18	0.59	0.000	0.000	17.989	17.989	69	K	H	F
HO 6	1.64	6.06	0.000	0.000	39.994	39.994	10	K	V	F
PO 25	1.00	4.16	0.000	0.000	39.994	39.994	360	K	V	C
PO 29	2.50	12.91	0.000	0.000	239.883	239.883	360	K	V	C
PO 42	1.64	6.06	0.000	0.000	39.994	39.994	12	K	V	C
HO 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
VO 4	7.52	32.87	0.000	377.572	449.780	827.942	20	M	V	C
HF 11	1.64	5.39	157.398	31.477	0.000	31.477	60	M	V	C
HF 12	0.96	2.91	0.000	10.495	0.000	10.495	0	M	V	C
PO 29	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 33	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 52	0.96	2.91	0.000	10.495	0.000	10.495	0	M	V	C
HO 11	0.66	2.07	0.000	6.501	0.110	6.607	60	P	G	C
HO 12	0.66	2.07	0.000	6.501	0.110	6.607	60	P	G	C
VO 4	4.45	17.31	0.000	52.000	255.270	307.610	20	P	G	C

Table C.2.7. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HF 11	1.02	3.02	32.509	6.501	0.000	15.171	60	P	G	C
HF 12	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
PO 29	2.62	9.40	0.000	77.983	23.388	101391	360	P	G	C
PO 33	2.62	9.40	0.000	77.983	23.388	101.391	360	P	G	C
PO 42	0.65	2.20	0.000	0.000	15.596	15.596	12	P	G	C
PO 49	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
PO 50	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
VO 4	0.66	2.60	0.000	93.541	119.950	213.304	20	P	H	C
PO 29	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
PO 33	0.57	2.20	0.000	140.281	21.038	161.436	360	P	H	C
HO 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
HO 12	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
VO 4	2.50	8.85	0.000	47.973	28.379	76.384	20	P	V	C
HF 11	0.72	2.14	29.992	5.998	0.000	5.998	60	P	V	C
HF 12	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
PO 29	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 33	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 49	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
PO 50	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
HF 11	1.49	4.60	72.444	14.488	0.000	32.285	60	Q	G	C
HF 12	0.99	3.20	0.000	14.488	0.000	14.488	0	Q	G	C
PO 29	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 33	3.36	12.50	0.000	130.617	39.174	169.824	360	Q	G	C
PO 49	0.99	3.20	0.000	14.488	0.000	14.488	0	Q	G	C
HF 12	1.12	3.49	0.000	14.488	0.000	14.488	0	Q	V	C

Table C.2.7. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 11	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
VO 4	3.30	12.26	0.000	160.325	3.597	164.059	20	R	G	C
VO 12	3.70	14.00	0.000	160.325	48.195	208.449	20	R	G	C
HF 11	1.91	6.04	138.995	21.380	0.000	53.456	60	R	G	C
HF 12	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 29	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 33	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 49	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 50	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 52	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
HO 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
VO 4	3.70	14.11	0.000	149.968	26.122	176.198	20	R	V	C
VO 12	3.55	13.43	0.000	149.968	11.246	161.065	20	R	V	C
HF 11	1.32	4.18	130.017	19.999	0.000	19.999	60	R	V	C
HF 12	0.94	184	0.000	10.000	0.000	10.000	0	R	V	C
PO 29	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 33	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 49	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 50	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 52	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
HO 6	1.51	5.51	0.000	0.000	33.884	33.884	10	S	V	F
HF 3	1.51	5.51	0.000	0.000	33.884	33.884	10	S	V	F
PO 25	0.92	3.75	0.000	0.000	33.963	33.963	360	S	V	C
PO 26	2.29	11.64	0.000	0.000	203.236	203.236	360	S	V	C
PO 29	2.29	11.64	0.000	0.000	203.236	203.236	360	S	V	C
PO 42	1.51	5.51	0.000	0.000	33.884	33.884	12	S	V	C

Table C.2.7. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
VO 1	0.27	0.70	348.337	0.000	0.000	2.844	15	W	G	S
VO 3	0.27	0.70	348.337	0.000	0.000	2.844	15	W	G	S
VO 9	0.27	0.70	348.337	0.000	0.000	2.844	15	W	G	S

[a]Conservative most likely.
[b]Worst-case.

Table C.2.8. All accident scenarios for Umatilla Depot Activity for ON-SITE disposal option sorted by munition type, agent within munition type, and activity within munition type

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 1	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 3	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 4	0.33	1.05	0.000	0.000	4.256	4.256	15	B	G	C
HO 5	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
HO 7	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
VO 1	0.21	0.55	219.786	0.000	0.000	1.879	15	B	G	S
VO 3	0.21	0.55	219.786	0.000	0.000	1.879	15	B	G	S
HF 1	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
HF 7	0.57	1.62	219.786	0.000	0.000	12.106	15	B	G	S
PO 29	1.67	7.84	0.000	0.000	264.241	264.241	360	B	G	C
HO 6	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
HF 3	0.41	1.50	0.000	0.000	84.918	84.918	10	K	H	F
PO 12	0.78	3.01	8511.380	0.000	0.000	291.743	360	K	H	S
PO 13	1.04	4.37	0.000	0.000	510.505	510.505	60	K	H	F
PO 25	0.41	1.50	0.000	0.000	84.918	84.918	360	K	H	C
PO 29	1.04	4.37	0.000	0.000	510.505	510.505	360	K	H	C
PO 42	0.28	0.99	0.000	0.000	42.462	42.462	12	K	H	C
HO 11	1.64	5.39	0.000	31.477	0.000	31.477	60	M	V	C
HF 11	1.64	5.39	157.398	31.477	0.000	31.477	60	M	V	C
PO 29	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 33	6.55	27.89	0.000	567.545	42.560	609.537	360	M	V	C
PO 52	0.96	2.91	0.000	10.495	0.000	10.495	0	M	V	C

Table C.2.8. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 11	0.66	2.07	0.000	6.501	0.110	6.607	60	P	G	C
HO 12	0.66	2.07	0.000	6.501	0.110	6.607	60	P	G	C
VO 4	4.45	17.31	0.000	52.000	255.270	307.610	20	P	G	C
HF 11	1.02	3.02	32.509	6.501	0.000	15.171	60	P	G	C
HF 12	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
PO 29	2.62	9.40	0.000	77.983	23.388	101.391	360	P	G	C
PO 33	2.62	9.40	0.000	77.983	23.388	101.391	360	P	G	C
PO 49	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
PO 50	0.66	2.06	0.000	6.501	0.000	6.501	0	P	G	C
HO 11	0.72	2.14	0.000	5.998	0.000	5.998	60	P	V	C
VO 4	2.50	8.85	0.000	47.973	28.379	76.384	20	P	V	C
HF 11	0.72	2.14	29.992	5.998	0.000	5.998	60	P	V	C
HF 12	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
PO 29	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 33	2.52	8.92	0.000	71.945	5.395	77.268	360	P	V	C
PO 49	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
PO 50	0.72	2.14	0.000	5.998	0.000	5.998	0	P	V	C
HO 11	1.00	3.22	0.000	14.488	0.170	14.655	60	Q	G	C
VO 4	2.63	9.47	0.000	87.096	15.596	102.802	20	Q	G	C
HF 11	1.49	4.60	72.444	14.488	0.000	32.285	60	Q	G	C
HF 12	0.99	3.20	0.000	14.488	0.000	14.488	0	Q	G	C
HO 11	1.12	3.49	0.000	14.488	0.000	14.488	60	Q	V	C
VO 4	2.85	10.36	0.000	87.096	14.028	101.158	20	Q	V	C

Table C.2.8. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HF 11	1.12	3.49	72.444	14.488	0.000	14.488	60	Q	V	C
PO 33	3.33	12.44	0.000	130.617	9.795	140.281	360	Q	V	C
PO 49	1.12	3.49	0.000	14.488	0.000	14.488	0	Q	V	C
HO 11	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
HO 12	1.24	4.07	0.000	21.380	1.040	22.439	60	R	G	C
VO 4	3.30	12.26	0.000	160.325	3.597	164.059	20	R	G	C
VO 12	3.70	14.00	0.000	160.325	48.195	208.449	20	R	G	C
HF 11	1.91	6.04	138.995	21.380	0.000	53.456	60	R	G	C
HF 12	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 12	7.05	28.17	685.488	144.544	0.000	829.851	360	R	G	C
PO 13	4.50	17.53	0.000	240.991	73.451	314.775	20	R	G	C
PO 18	1.22	4.02	0.000	21.380	0.545	21.928	60	R	G	C
PO 19	4.49	17.49	0.000	240.991	72.277	313.329	20	R	G	C
PO 29	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 33	4.49	17.49	0.000	240.991	72.277	313.329	360	R	G	C
PO 49	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 50	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
PO 52	0.85	2.70	0.000	10.691	0.000	10.691	0	R	G	C
HO 11	1.32	4.18	0.000	19.999	0.000	19.999	60	R	V	C
VO 4	3.70	14.11	0.000	149.968	26.122	176.198	20	R	V	C
HF 11	1.32	4.18	130.017	19.999	0.000	19.999	60	R	V	C
HF 12	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 29	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 33	4.28	16.81	0.000	224.905	16.866	241.546	360	R	V	C
PO 49	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 50	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C
PO 52	0.94	2.84	0.000	10.000	0.000	10.000	0	R	V	C

Table C.2.8. (continued)

Activity ID and scenario	CML[a] plume distance (km)	WC[b] plume distance (km)	Amount agent spilled (lb_m)	Amount agent detonated (lb_m)	Amount agent emitted (lb_m)	Amount total agent (lb_m)	Event duration (min)	Munition type	Agent type	Release mode
HO 6	1.51	5.51	0.000	0.000	33.884	33.884	10	S	V	F
HF 3	1.51	5.51	0.000	0.000	33.884	33.884	10	S	V	F
PO 25	0.92	3.75	0.000	0.000	33.963	33.963	360	S	V	C
PO 29	2.29	11.64	0.000	0.000	203.236	203.236	360	S	V	C

[a]Conservative most likely.
[b]Worst-case.

Table C.3. Accident scenarios for container-handling building (CHB) Operation

DBASE ID	Scenario ID	Qspill	Qdet	Qemit	Qevap	Qtotlml	Time	Activity	Munition	Agent	Release	CML[a] Dist. (km)	WC[b] Dist. (km)
ONS374	HFBGS 21	220.0	0.0	4.3	0.0	4.3	60	Handling CHB	Bombs	GB-Sarin	Spill	0.25	0.83
ONS375	HFBGS 24	220.0	0.0	4.3	0.0	4.3	60	Handling CHB	Bombs	GB-Sarin	Spill	0.25	0.83
ONS376	HFBGS 41	220.0	0.0	4.3	0.0	4.3	60	Handling CHB	Bombs	GB-Sarin	Spill	0.25	0.83
ONS377	HFBGS 42	220.0	0.0	4.3	0.0	4.3	60	Handling CHB	Bombs	GB-Sarin	Spill	0.25	0.83
ONS378	HFBGF 23	0.0	0.0	22.0	0.0	22.0	10	Handling CHB	Bombs	GB-Sarin	Fire	0.78	2.67
ONS379	HFBGF 43	0.0	0.0	22.0	0.0	22.0	10	Handling CHB	Bombs	GB-Sarin	Fire	0.78	2.67
ONS380	HFDHS 21	6.0	0.0	0.0	0.0	0.0	60	Handling CHB	Mortar(4.2")	H-Mustard	Spill	0	0
ONS381	HFDHS 24	6.0	0.0	0.0	0.0	0.0	60	Handling CHB	Mortar(4.2")	H-Mustard	Spill	0	0
ONS382	HFDHS 41	6.0	0.0	0.0	0.0	0.0	60	Handling CHB	Mortar(4.2")	H-Mustard	Spill	0	0
ONS383	HFDHS 42	6.0	0.0	0.0	0.0	0.0	60	Handling CHB	Mortar(4.2")	H-Mustard	Spill	0	0
ONS384	HFDHF 23	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Mortar(4.2")	H-Mustard	Fire	0.02	0.05
ONS385	HFDHF 43	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Mortar(4.2")	H-Mustard	Fire	0.02	0.05
ONS386	HFKGS 21	1500.0	0.0	17.9	0.0	17.9	60	Handling CHB	Ton Container	GB-Sarin	Spill	0.54	1.97
ONS387	HFKGS 24	1500.0	0.0	17.9	0.0	17.9	60	Handling CHB	Ton Container	GB-Sarin	Spill	0.54	1.97
ONS388	HFKGS 41	1500.0	0.0	17.9	0.0	17.9	60	Handling CHB	Ton Container	GB-Sarin	Spill	0.54	1.97
ONS389	HFKGS 42	1500.0	0.0	17.9	0.0	17.9	60	Handling CHB	Ton Container	GB-Sarin	Spill	0.54	1.97
ONS390	HFKGF 23	0.0	0.0	150.0	0.0	150.0	10	Handling CHB	Ton Container	GB-Sarin	Fire	2.04	7.78
ONS391	HFKGF 43	0.0	0.0	150.0	0.0	150.0	10	Handling CHB	Ton Container	GB-Sarin	Fire	2.04	7.78
ONS392	HFKHS 21	1700.0	0.0	0.9	0.0	0.9	60	Handling CHB	Ton Container	H-Mustard	Spill	0.03	0.10
ONS393	HFKHS 21	1700.0	0.0	0.9	0.0	0.9	60	Handling CHB	Ton Container	H-Mustard	Spill	0.03	0.10
ONS394	HFKHS 21	1700.0	0.0	0.9	0.0	0.9	60	Handling CHB	Ton Container	H-Mustard	Spill	0.03	0.10
ONS395	HFKHS 21	1700.0	0.0	0.9	0.0	0.9	60	Handling CHB	Ton Container	H-Mustard	Spill	0.03	0.10
ONS396	HFKHF 23	0.0	0.0	85.0	0.0	85.0	10	Handling CHB	Ton Container	H-Mustard	Fire	0.41	1.50
ONS397	HFKHF 43	0.0	0.0	85.0	0.0	85.0	10	Handling CHB	Ton Container	H-Mustard	Fire	0.41	1.50
ONS398	HFKVS 21	1600.0	0.0	0.0	0.0	0.0	60	Handling CHB	Ton Container	VX	Spill	0	0
ONS399	HFKVS 24	1600.0	0.0	0.0	0.0	0.0	60	Handling CHB	Ton Container	VX	Spill	0	0
ONS400	HFKVS 41	1600.0	0.0	0.0	0.0	0.0	60	Handling CHB	Ton Container	VX	Spill	0	0
ONS401	HFKVS 42	1600.0	0.0	0.0	0.0	0.0	60	Handling CHB	Ton Container	VX	Spill	0	0
ONS402	HFKVF 23	0.0	0.0	40.0	0.0	40.0	10	Handling CHB	Ton Container	VX	Fire	1.64	6.06
ONS403	HFKVF 43	0.0	0.0	40.0	0.0	40.0	10	Handling CHB	Ton Container	VX	Fire	1.64	6.06
ONS404	HFMVS 21	10.5	0.0	0.0	0.0	0.0	60	Handling CHB	Mines	VX	Spill	0	0
ONS405	HFMVS 24	10.5	0.0	0.0	0.0	0.0	60	Handling CHB	Mines	VX	Spill	0	0
ONS406	HFMVS 41	10.5	0.0	0.0	0.0	0.0	60	Handling CHB	Mines	VX	Spill	0	0

Table C.3.(continued)

DBASE ID	Scenario ID	Qspill	Qdet	Qemit	Qevap	Qtotlml	Time	Activity	Munition	Agent	Release	CML[a] Dist. (km)	WC[b] Dist. (km)
ONS407	HFMVS 42	10.5	0.0	0.0	0.0	0.0	60	Handling CHB	Mines	VX	Spill	0	0
ONS408	HFMVF 23	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Mines	VX	Fire	0.12	0.35
ONS409	HFMVF 43	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Mines	VX	Fire	0.12	0.35
ONS410	HFRGS 21	10.7	0.0	0.5	0.0	0.5	60	Handling CHB	Rockets(M55)	GB-Sarin	Spill	0.07	0.22
ONS411	HFRGS 24	10.7	0.0	0.5	0.0	0.5	60	Handling CHB	Rockets (M55)	GB-Sarin	Spill	0.07	0.22
ONS412	HFRGS 41	10.7	0.0	0.5	0.0	0.5	60	Handling CHB	Rockets(M55)	GB-Sarin	Spill	0.07	0.22
ONS413	HFRGS 42	10.7	0.0	0.5	0.0	0.5	60	Handling CHB	Rockets(M55)	GB-Sarin	Spill	0.07	0.22
ONS414	HFRGF 23	0.0	0.0	1.1	0.0	1.1	10	Handling CHB	Rockets(M55)	GB-Sarin	Fire	0.16	0.48
ONS415	HFRGF 43	0.0	0.0	1.1	0.0	1.1	10	Handling CHB	Rockets(M55)	GB-Sarin	Fire	0.16	0.48
ONS416	HFRVS 21	10.0	0.0	0.0	0.0	0.0	60	Handling CHB	Rockets(M55)	VX	Spill	0	0
ONS417	HFRVS 24	10.0	0.0	0.0	0.0	0.0	60	Handling CHB	Rockets(M55)	VX	Spill	0	0
ONS418	HFRVS 41	10.0	0.0	0.0	0.0	0.0	60	Handling CHB	Rockets(M55)	VX	Spill	0	0
ONS419	HFRVS 42	10.0	0.0	0.0	0.0	0.0	60	Handling CHB	Rockets(M55)	VX	Spill	0	0
ONS420	HFRVF 23	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Rockets(M55)	VX	Fire	0.11	0.34
ONS421	HFRVF 43	0.0	0.0	0.3	0.0	0.3	10	Handling CHB	Rockets(M55)	VX	Fire	0.11	0.34
ONS422	HFSVS 21	1356.0	0.0	0.0	0.0	0.0	60	Handling CHB	Spray Tank	VX	Spill	0	0
ONS423	HFSVS 24	1356.0	0.0	0.0	0.0	0.0	60	Handling CHB	Spray Tank	VX	Spill	0	0
ONS424	HFSVS 41	1356.0	0.0	0.0	0.0	0.0	60	Handling CHB	Spray Tank	VX	Spill	0	0
ONS425	HFSVS 42	1356.0	0.0	0.0	0.0	0.0	60	Handling CHB	Spray Tank	VX	Spill	0	0
ONS426	HFSVF 23	0.0	0.0	33.9	0.0	33.9	10	Handling CHB	Spray Tank	VX	Fire	1.51	5.51
ONS427	HFSVF 43	0.0	0.0	33.9	0.0	33.9	10	Handling CHB	Spray Tank	VX	Fire	1.51	5.51
ONS428	HFRGC 22	139.1	0.0	3.0	0.0	24.4	60	Handling CHB	Rockets(M55)	GB-Sarin	Complex	1.29	4.27
ONS429	HFRGC 44	139.1	0.0	3.0	0.0	24.4	60	Handling CHB	Rockets(M55)	GB-Sarin	Complex	1.29	4.27
ONS430	HFRVC 22	130.0	0.0	0.0	0.0	20.0	60	Handling CHB	Rockets(M55)	VX	Complex	1.40	4.30
ONS431	HFRVC 44	130.0	0.0	0.0	0.0	20.0	60	Handling CHB	Rockets(M55)	VX	Complex	1.40	4.30
ONS432	POBGC 61	1584.0	0.0	0.0	0.0	1584.0	360	Plant operations	Bomb	GB-Sarin	Spill	5.46	20.52
ONS433	PODHC 61	2506.0	501.0	0.0	0.0	598.0	360	Plant operations	Mortar(4.2")	H-Mustard	Complex	1.13	4.78
ONS434	POCGC 61	588.0	118.0	0.0	0.0	706.0	360	Plant operations	Cartridge(105mm)	GB-Sarin	Complex	6.55	25.97
ONS435	POCHC 61	1382.0	276.0	0.0	0.0	333.0	360	Plant operations	Cartridge(105mm)	H-Mustard	Complex	0.83	
ONS436	POKGC 613	3600.0	0.0	0.0	0.0	3600.0	360	Plant operations	Ton container	GB-Sarin	Spill	6.20	31.71
ONS437	POKHC 61	15912.0	0.0	0.0	0.0	513.0	360	Plant operations	Ton container	H-Mustard	Spill	1.05	4.22
ONS438	POKVC 61	2304.0	0.0	0.0	0.0	0.55	360	Plant operations	Ton container	VX	Spill	0.10	0.35
ONS439	POKVC 61	2024.0	605.0	0.0	0.0	606.0	360	Plant operations	Mines	VX	Complex	6.53	27.80

Table C.3.(continued)

DBASE ID	Scenario ID	Qspill	Qdet	Qemit	Qevap	Qtotlml	Time	Activity	Munition	Agent	Release	CML[a] Dist. (km)	WC[b] Dist. (km)
ONS440	POPGC 61	1264.0	370.0	0.0	0.0	1633.0	360	Plant operations	Projectile(155mm)	GB-Sarin	Complex	9.56	39.64
ONS441	POPHC 61	3875.0	775.0	0.0	0.0	918.0	360	Plant operations	Projectile(155mm)	H-Mustard	Complex	1.41	6.18
ONS442	POPVC 61	1166.0	233.0	0.0	0.0	233.0	360	Plant operations	Projectile(155mm)	VX	Complex	4.21	16.48
ONS443	POQGC 61	1096.0	219.0	0.0	0.0	1315.0	360	Plant operations	Projectile(8")	GB-Sarin	Complex	8.68	35.31
ONS444	POQVC 61	1096.0	219.0	0.0	0.0	219.0	360	Plant operations	Projectile(8")	VX	Complex	4.09	15.92
ONS445	PORGC 61	1725.0	345.0	0.0	0.0	2070.0	360	Plant operations	Rockets(M55)	GB-Sarin	Complex	10.61	44.08
ONS446	PORVC 61	1612.0	323.0	0.0	0.0	323.0	360	Plant operations	Rockets(M55)	VX	Complex	4.89	19.73
ONS447	POSVC 61	1139.0	0.0	0.0	0.0	0.4	360	Plant operations	Spray Tank	VX	Spill	0.07	0.25
ONS448	POBGC 62	0.0	0.0	2640.0	0.0	2640.0	60	Plant operations	Bomb	GB-Sarin	Complex	7.06	35.79
ONS449	PODHC 62	0.0	6264.0	940.0	0.0	7204.0	20	Plant operations	Mortar(4.2")	H-Mustard	Complex	4.01	21.51
ONS450	POCGC 62	0.0	1469.0	441.0	0.0	1910.0	20	Plant operations	Cartridge(105mm)	GB-Sarin	Complex	10.24	46.29
ONS451	POCHC 62	0.0	3456.0	518.0	0.0	3974.0	60	Plant operations	Cartridge(105mm)	H-Mustard	Complex	2.98	15.01
ONS452	POKGC 62	0.0	0.0	6000.0	0.0	6000.0	60	Plant operations	Ton container	GB-Sarin	Complex	10.65	55.92
ONS453	POKHC 62	0.0	0.0	13200.0	0.0	13200.0	60	Plant operations	Ton container	H-Mustard	Complex	5.42	31.18
ONS454	POKVC 62	0.0	0.0	960.0	0.0	960.0	20	Plant operations	Ton container	VX	Complex	6.50	34.20
ONS455	POMVC 62	0.0	3024.0	227.0	0.0	3251.0	20	Plant operations	Mines	VX	Complex	14.00	67.45
ONS456	POPGC 62	0.0	3159.0	948.0	0.0	4107.0	20	Plant operations	Projectile(155mm)	GB-Sarin	Complex	14.27	69.10
ONS457	POPHC 62	0.0	9688.0	1453.0	0.0	11141.0	20	Plant operations	Projectile(155mm)	H-Mustard	Complex	4.98	28.02
ONS458	POPVC 62	0.0	2916.0	219.0	0.0	3135.0	20	Plant operations	Projectile(155mm)	VX	Complex	13.77	66.19
ONS459	POQGC 62	0.0	2740.0	822.0	0.0	3562.0	20	Plant operations	Projectile(8")	GB-Sarin	Complex	13.42	64.17
ONS460	POQVC 62	0.0	2740.0	205.0	0.0	2945.0	20	Plant operations	Projectile(8")	VX	Complex	13.39	64.11
ONS461	PORGC 62	0.0	1726.0	518.0	0.0	2244.0	20	Plant operations	Rockets(M55)	GB-Sarin	Complex	10.99	50.39
ONS462	PORVC 62	0.0	1612.0	121.0	0.0	1733.0	20	Plant operations	Rockets(M55)	VX	Complex	10.52	48.65
ONS463	POSVC 62	0.0	0.0	475.0	0.0	475.0	60	Plant operations	Spray Tank	VX	Complex	4.57	22.97
ONS464	POBGC 63	0.0	0.0	71.0	0.0	71.0	360	Plant operations	Bomb	GB-Sarin	Complex		
ONS465	PODHC 63	0.0	6.0	4.0	0.0	10.0	360	Plant operations	Mortar(4.2")	H-Mustard	Complex	0.13	0.41
ONS466	POCGC 63	0.0	1.6	19.4	0.0	21.0	360	Plant operations	Cartridge(105mm)	GB-Sarin	Complex	1.20	3.93
ONS467	POCHC 63	0.0	3.0	2.4	0.0	5.4	360	Plant operations	Cartridge(105mm)	H-Mustard	Complex	0.09	0.28
ONS468	POKGC 63	0.0	0.0	193.4	0.0	193.0	360	Plant operations	Ton container	GB-Sarin	Complex		
ONS469	POKHC 63	0.0	0.0	15.2	0.0	15.2	360	Plant operations	Ton container	H-Mustard	Complex		
ONS470	POKVC 63	0.0	0.0	0.1	0.0	0.1	360	Plant operations	Ton container	VX	Complex		
ONS471	POMVC 63	0.0	10.5	0.0	0.0	10.5	360	Plant operations	Mines	VX	Complex	0.96	2.91
ONS472	POPGC 63	0.0	6.5	44.4	0.0	50.9	360	Plant operations	Projectile(155mm)	GB-Strain	Complex	1.89	6.42

Table C.3.(continued)

DBASE ID	Scenario ID	Qspill	Qdet	Qemit	Qevap	Qtotlml	Time	Activity	Munition	Agent	Release	CML[a] Dist. (km)	WC[b] Dist. (km)
ONS473	POPHC 63	0.0	11.7	3.9	0.0	15.6	360	Plant operations	Projectile(155mm)	H-Mustard	Complex	0.16	0.54
ONS474	POPVC 63	0.0	6.0	0.0	0.0	6.0	360	Plant operations	Projectile(155mm)	VX	Complex	0.72	2.14
ONS475	POQGC 63	0.0	14.5	47.9	0.0	62.4	360	Plant operations	Projectile(8")	GB-Sarin	Complex	2.06	7.18
ONS476	POQVC 63	0.0	14.5	0.0	0.0	14.5	360	Plant operations	Projectile(8")	VX	Complex	1.12	3.49
ONS477	PORGC 63	0.0	10.7	33.0	0.0	43.7	360	Plant operations	Rockets(M55)	GB-Sarin	Complex	1.73	5.90
ONS478	PORVC 63	0.0	10.0	0.0	0.0	10.0	360	Plant operations	Rockets(M55)	VX	Complex	0.94	2.84
ONS479	POSVC 63	0.0	0.0	0.04	0.0	0.04	360	Plant operations	Spray Tank	VX	Complex		
ONS480	POBGC 64	0.0	0.0	2640.0	0.0	2640.0	360	Plant operations	Bomb	GB-Sarin	Complex	5.32	31.29
ONS481	PODHC 64	0.0	6264.0	940.0	0.0	7204.0	360	Plant operations	Mortar(4.2")	H-Mustard	Complex	4.01	21.51
QNS482	POCGC 64	0.0	1469.0	441.0	0.0	1910.0	360	Plant operations	Cartridge(105mm)	GB-Sarin	Complex	10.24	46.29
ONS483	POCHC 64	0.0	3456.0	518.0	0.0	3974.0	360	Plant operations	Cartridge(105mm)	H-Mustard	Complex	2.98	5.01
ONS484	POKGC 64	0.0	0.0	6000.0	0.0	6000.0	360	Plant operations	Ton container	GB-Sarin	Complex	7.96	50.22
ONS485	POKHC 64	0.0	0.0	13200.0	0.0	13200.0	360	Plant operations	Ton container	H-Mustard	Complex	5.41	31.09
ONS486	POKVC 64	0.0	0.0	960.0	0.0	960.0	360	Plant operations	Ton container	VX	Complex	5.02	30.21
ONS487	POMVC 64	0.0	3024.0	227.0	0.0	3251.0	360	Plant operations	Mines	VX	Complex	14.00	67.45
ONS488	POPGC 64	0.0	3159.0	948.0	0.0	4107.0	360	Plant operations	Projectile(155mm)	GB-Sarin	Complex	14.27	69.10
ONS489	POPHC 64	0.0	9688.0	1453.0	0.0	11141.0	360	Plant operations	Projectile(155mm)	H-Mustard	Complex	4.98	28.02
ONS490	POPVC 64	0.0	2916.0	219.0	0.0	3135.0	360	Plant operations	Projectile(155mm)	VX	Complex	13.77	66.19
ONS491	POQGC 64	0.0	2740.0	822.0	0.0	3562.0	360	Plant operations	Projectile(8")	GB-Sarin	Complex	13.42	64.17
ONS492	POQVC 64	0.0	2740.0	205.0	0.0	2945.0	360	Plant operations	Projectile(8")	VX	Complex	13.39	64.11
ONS493	PORGC 64	0.0	1726.0	518.0	0.0	2244.0	360	Plant operations	Rockets(M55)	GB-Sarin	Complex	10.99	50.39
ONS494	PORVC 64	0.0	1612.0	121.0	0.0	1733.0	360	Plant operations	Rockets(M55)	VX	Complex	10.52	48.65
ONS495	POSVC 64	0.0	0.0	475.0	0.0	475.0	360	Plant operations	Spray Tank	VX	Complex	3.53	19.72

[a]Conservative most likely.
[b]Worst-case.

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