

Predicting Risk Through Modeling of Leaker Plumes

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- Agenda
  - CMA Mission and Overview
  - CMA Risk Profile
  - Actions during a Leaker Event
  - Case Study



*Enhance national security by storing and ultimately eliminating US chemical warfare materiel (CWM), and support CWM responses.* 





Store

Mission



Destroy



Respond

Create a safer tomorrow by making chemical weapons history



## Stockpile Storage













## **Dominant Public Risk Drivers**

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As of 11 July 2010

	Public Population Surrounding Storage Yard <sup>a</sup>			Stockpile Status	
Site	Total Within 2 km	Total Within 5 km	Total Within 20 km	Rockets in Current Stockpile	Nerve Agent in Current Stockpile
Blue Grass, Kentucky	0	3,000	83,000	$\checkmark$	$\checkmark$
Pine Bluff, Arkansas	750	2,600	71,000	×	×
Anniston, Alabama	0	18	105,000	×	×
Umatilla, Oregon	0	46	33,000	×	×
Pueblo, Colorado	0	97	6,600	×	×
Tooele, Utah	0	87	1,300	×	√ b
Newport, Indiana	0	630	20,000	N/A	N/A
Aberdeen, Maryland	0	19,000	301,000	N/A	N/A

<sup>a</sup> Distance is measured from center of chemical agent storage yard

<sup>b</sup> Minimal nerve agent



Risk Actions in the Event of a Chemical Leak

- Stockpile is routinely monitored for vapor leaks
- Safety of workforce and public is critical for mission success
- Trained crews respond when leaks are discovered
- Mitigation actions begin immediately
- CMA Headquarters works to develop leak specific briefing



Data Required From Site for Briefing

- Igloo Location
- Agent Type
- Starting date/time of release (usually the most recent time of agent non-detect)
- Ending date/time of release (usually when igloo filter is installed and operational)
- Maximum agent concentration reading



 Data from the site and the local meteorological data is used to determine when the 'worst' meteorological conditions existed. This time period is used to construct the down wind plumes.

Analysis

• The briefing takes 2-3 work days to put together



## PCD Example

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# CASE STUDY



**Background Facts** 

- Mustard agent vapor detected in Igloo
  - 24 August 09:43
  - Vents closed ~10:00
  - Filter installed ~12:30
  - Concentration measurements 3.5 10.4 STEL
  - Last verified non-detect 17 August 11:30

## Modeling Assumptions



- H plumes simulated using computer model (WebPuff)
- WebPuff is designed to provide conservative estimates of hazard
  - unlikely to underestimate downwind hazards in terrain typical of that found in the vicinity of chemical depots (ref: IVV)
- Mustard (H) vapors (10.4 STEL) escape igloo continuously during week
  - Note: As dense gas, H vapors likely lingered *inside* igloo
- Plumes Evaluated every 12 hours
  - Noon -> midnight
  - Midnight -> noon
- Archived weather data from PCD towers 17-24 August
  - updated every 15 minutes
- Toxicity Standards Evaluated
  - Peak Concentration: IDLH/STEL/WPL/GPL
  - Accumulated Exposure: AEGL-2/AEGL-1/WPL/GPL



Note: circle shown is 50 meter (160 feet) chemical safety radius



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Results/Summary

### US ARMY CHEMICAL MATERIALS AGENCY

• The leak detected on 24 August in Igloo is very unlikely to have produced any acute or chronic hazards from mustard exposure to the PCD workers or general population



Note: circle shown is 50 meter (160 feet) chemical safety radius



Suggested Audiences

- The plume models can be used to educate:
  - Workforce
  - Regulators
  - Public
  - Media