Introduction to the IMAAC

March 2005

IMAAC

Interagency Modeling and Atmospheric Assessment Center

Note: This document is based on existing reviewed and released DHS and LLNL documents.
Reference: LLNL UCRL-PRES-208325, UCRL-PRES-211992.

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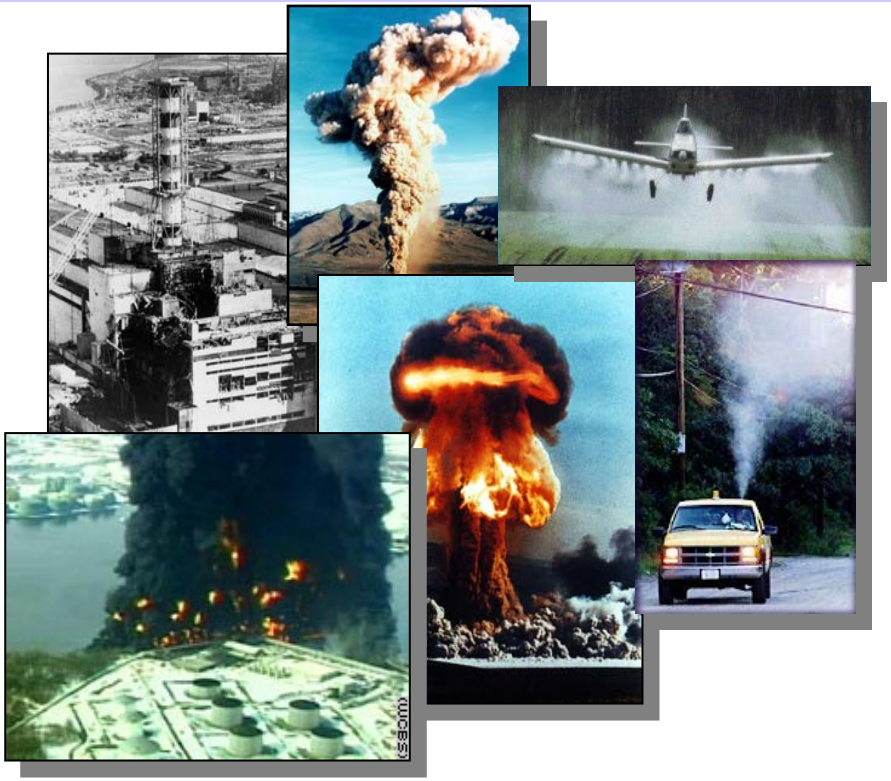
When a hazardous airborne release occurs, decision makers need answers to key questions



- ***What was released?***
- ***Where is it going?***
- ***Who is at risk?***
- ***How do we respond?***

IMAAC's mission is to provide the single source of federal hazards predictions during the response and recovery phases of Incidents of National Significance (as defined in the NRP)

Declaration of an Incident of National Significance (NRP)

1. When a ***Federal department or agency requests assistance*** of the Secretary of Homeland Security
2. When ***State and local authorities are overwhelmed*** and request Federal assistance
3. When ***more than Federal department or agency become involved*** in responding to an incident
4. When the ***President directs the Secretary of Homeland Security*** to assume responsibility for managing a domestic incident

National Response Plan, Page 4

IMAAC principles

- ***Integrate** the best and brightest scientific capability with the vast emergency response capacity of the federal government*
- ***Distribute** atmospheric hazard predictions to federal, state, and local response agencies to assure a common operating picture*
- ***Provide expert interpretation** of results to federal, state, and local government, especially DHS HSOC and FEMA NRCC*
- ***Eliminate** confusing and conflicting hazard predictions*

IMAAC Implementation

- April 15, 2004: The Homeland Security Council:
  - Agrees that DHS will establish the IMAAC
  - Designates the National Atmospheric Release Advisory Center (NARAC) as the primary provider of IMAAC products
- May 2004: DHS-led interagency working group stands up with representatives of 7 federal agencies:

  DHS, DOC NOAA, DOD, DOE, EPA, NASA, NRC
- Oct 2004-Mar 2005: IMAAC Working Groups developing:
  - A Memorandum of Understanding (MOU)
  - Standard Operating Procedures (SOP)

Sample IMAAC-supported events to date

- *February 18-25, 2004. United Defense 04 (UD-04) exercise*
- *May 25-26, 2004. Conyers, GA chemical fire at a chlorine processing plant*
- *May 27-30, 2004. NSSE: National World War II Memorial Dedication*
- *June 8-11, 2004. NSSE: G8 Summit and Reagan Funeral*
- *July 26-30, 2004. NSSE: Democratic National Convention*
- *August 1-5, 2004. NYC / DC alerts*
- *August 5-10, 2004. Determined Promise (DP-04) exercise*
- *August 13-29, 2004. NSSE: Summer Olympics in Greece*
- *August 19, 2004. Cincinnati, OH Queen City Barrel Co. building fire*
- *August 30-September 3, 2004. NSSE: Republican National Convention*
- *January 7, 2005. Graniteville, SC chlorine railcar accident*
- *January 20, 2005. NSSE: 2005 Presidential Inauguration*
- *April 4-7, 2005, TOPOFF3 National Exercise*

IMAAC support for the January 6, 2005 chlorine spill in Graniteville, SC and post-accident measurement analysis

Ron Baskett, Interim IMAAC Operations Manager and

Fernando Aluzzi, IMAAC-NARAC Operations Scientist

National Atmospheric Release Advisory Center

Lawrence Livermore National Laboratory

January 17, 2005

IMAAC response timeline – Thursday, January 6 (Day 1)

0230 am EST: Train accident occurs in Graniteville, SC and chlorine spill begins.

~**0755 am EST:** HSOC pages LLNL and requests IMAAC support.

0800 am EST: IMAAC Operations calls HSOC back; Gathers basic info; Specific location is unknown.

0810 am EST: Transportation Safety Operations Center (TSOC) calls IMAAC to suggest a location.

0815 am EST: Worst case Run 1 posted to NARAC Web. [Initial response time ~15 min]

0815-0840 am EST: Rerun based on new TSOC and HSOC location estimates; smaller source term.

0841 am EST: Post Run 3 to NARAC Web and share with HSOC, S&T, TSOC, SRS, DOE HQ users.

0910 am EST: IMAAC calls DOE SRS EOC (Chuck Hunter) who is supporting Aiken Co EOC.
Discuss weather and source location; share NARAC Web plots with SRS.
Chuck does not have confirmed coordinates, but used a downtown Graniteville location.
During this period, the winds were steadily from the SSW at ~5 mph.
Both products SRS and NARAC products show similar downwind locations with different graphics.

~**0915 am EST**: HSOC provides location near Avondale Mill at 133 Marshall St, Graniteville.

0929 am EST: Post Run 4 to NARAC Web and shared with HSOC, S&T, TSOC, SRS and DOE HQ users

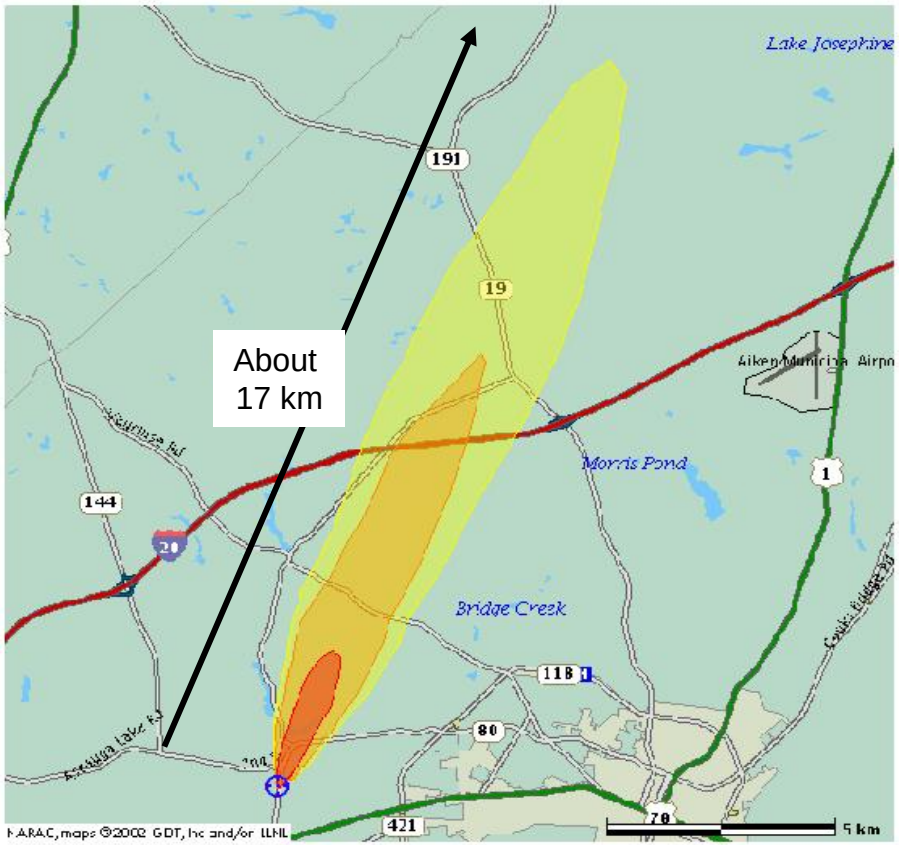
IMAAC Run 4 model inputs

- **Time:** Start of release at 0230 EST, January 6, 2005
- **Location:** HSOC: Avondale Mill at 133 Marshall; lat/long estimated from rail line near address
- **Meteorology:** Winds from the SSW during first 5 hours of release
- **Source:** 100,000 lbs of Chlorine over 5 hours (IMAAC estimate)
- **Sample product:**
  - Maximum short-term outside exposure during the first 5 hours
  - Contours in Emergency Response Planning Guidelines:
    - Red = potentially lethal
    - Orange = serious respiratory effects
    - Yellow = mild, reversible health effects
  - Shared with HSOC, S&T, TSOC, EPA Region, FEMA, DOE Savannah River Site (assisting Aiken County EOC), DOE HQ users.

Run 4 full-scale plot – Day 1 response

Max 10-min Avg Air Conc. of CHLORINE

Graniteville, SC railcar - Run 4
Automated Report - Actual Release



Effects or contamination from 06 Jan 2005 03:20 PST to 06 Jan 2005 03:30

Acute (Short-Term) Effects			
	(ppm) Area Extent	Population	Description
	>20 1.7 km2 n/a	119	>ERPG-3: Death or irreversible health effects possible.
	>3.0 13.5 km2 n/a	495	>ERPG-2: Serious health effects or impaired ability to take protective action.
	>1.0 38.9 km2 n/a	1,070	>ERPG-1: Minor reversible health effects. Possible odor.
Note: Areas and counts in the table are cumulative.			

Source Location: 33.566001 N, 81.807838 W
Material: CHLORINE
Comments: Hypothetical release of 5.5556 lb/s starting at 01/06/2005 07:30:00 UTC for 5 hr met obs

Location: 133 Marshall (HSOC input)
Source rate: 100,000 lbs (IMAAC estimate)
Release duration: 5 hr

Map Size: 18.65 km by 18.65 km **Id:** Production2.rcE11613.rcC11502.0
NARAC Operations: narac@llnl.gov; (925) 424-6465
Requested by: { baskett1-usa; NARAC Operations; 925-423-6731 }

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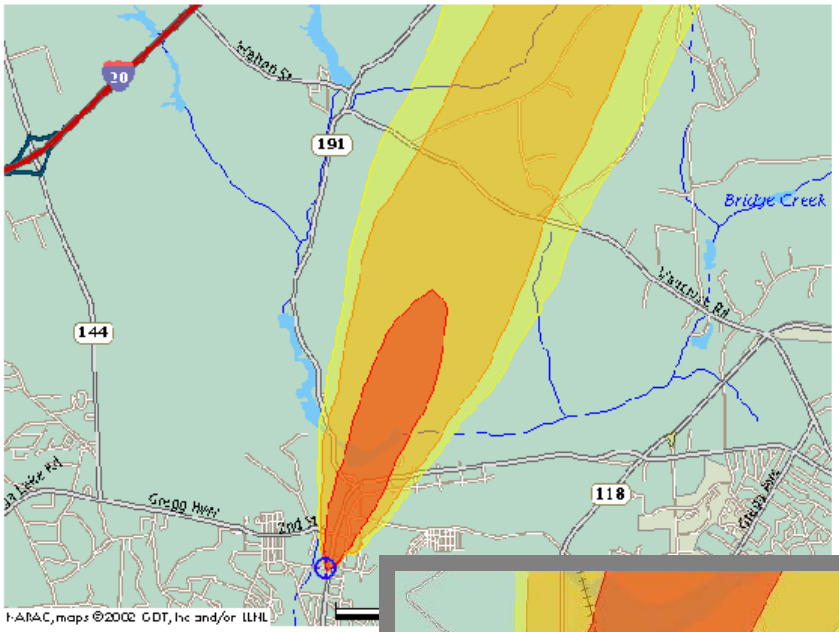
Run 4 IMAAC product – Day 1 response

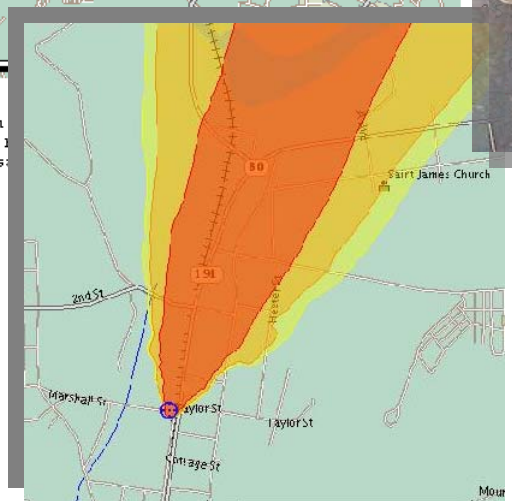
NARAC

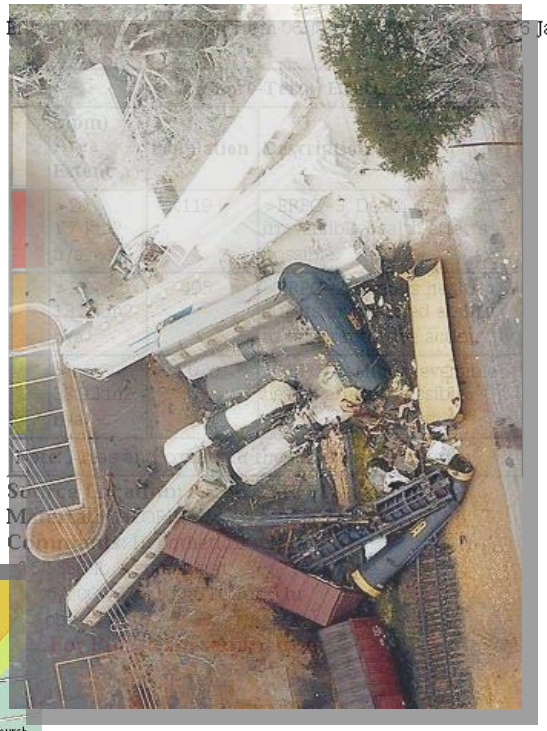
Max 10-min Avg Air Conc. of CHLORINE

Graniteville, SC railcar – Run 4
Automated Report – Actual Release



Map Size: 9 km by 6.75 km
NARAC Operations:
Requested by: { baskett1-us





Jan 2005 03:30

Location: 133 Marshall (according to HSOC)
Source rate: 100,000 lbs
Release duration: 5 hr

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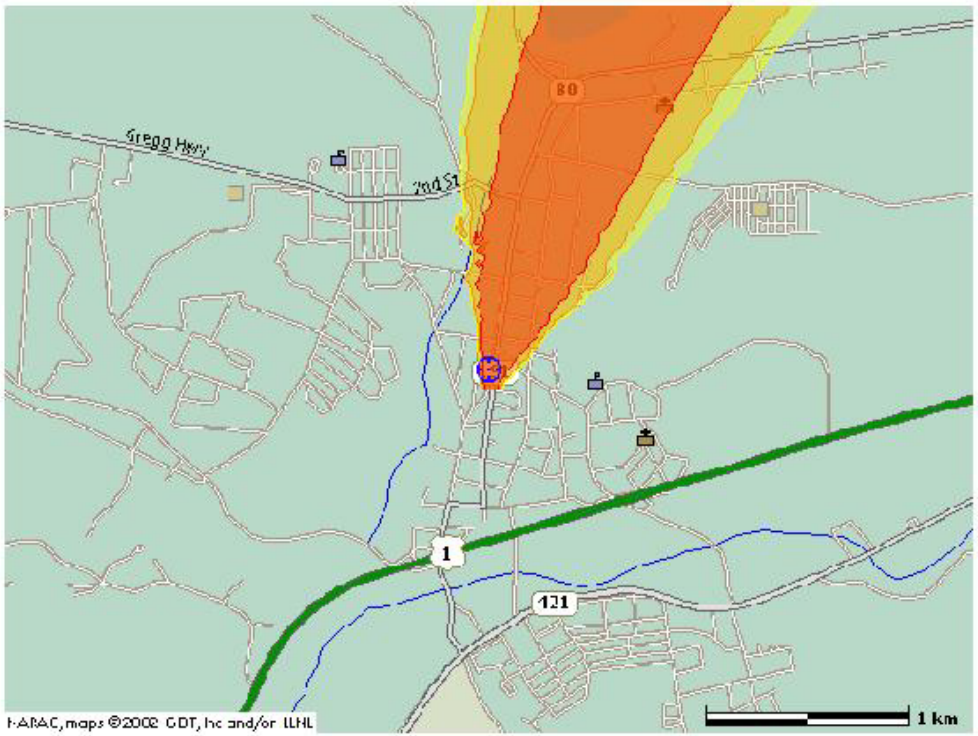
Model rerun of initial release with EPA source estimate

Max 10-min Avg Air Conc. of CHLORINE

Modified Release - Updated coordinates
Automated Report - Actual Release



Effects or contamination from 05 Jan 2005 23:30 PST to 06 Jan 2005 01:30

Acute (Short-Term) Effects			
	(ppm) Area Extent	Population	Description
	>20 4.0 km2 n/a	314	>ERPG-3: Death or irreversible health effects possible.
	>3.0 25.6 km2 n/a	1,070	>ERPG-2: Serious health effects or impaired ability to take protective action.
	>1.0 46.9 km2 n/a	1,510	>ERPG-1: Minor reversible health effects. Possible odor.
Note: Areas and counts in the table are cumulative.			

Source Location: 33.562095 N, 81.808366 W
Material: CHLORINE
Comments: Hypothetical release of 13.936 lb/s starting at 01/06/2005 07:30:00 UTC for 2 hr

Map Size: 4.56 km by 3.42 km **Id:** Production2.rcE11613.rcC11502.3
NARAC Operations: narac@llnl.gov; (925) 424-6465
Requested by: { baskett1-usa; NARAC Operations; 925-423-6731 }

EPA Source Information:
Location: ~450 m south from 133 Marshall St.
Source rate = 103,338 lbs versus 100,000 lbs
Release duration: 2 hr versus 5 hr

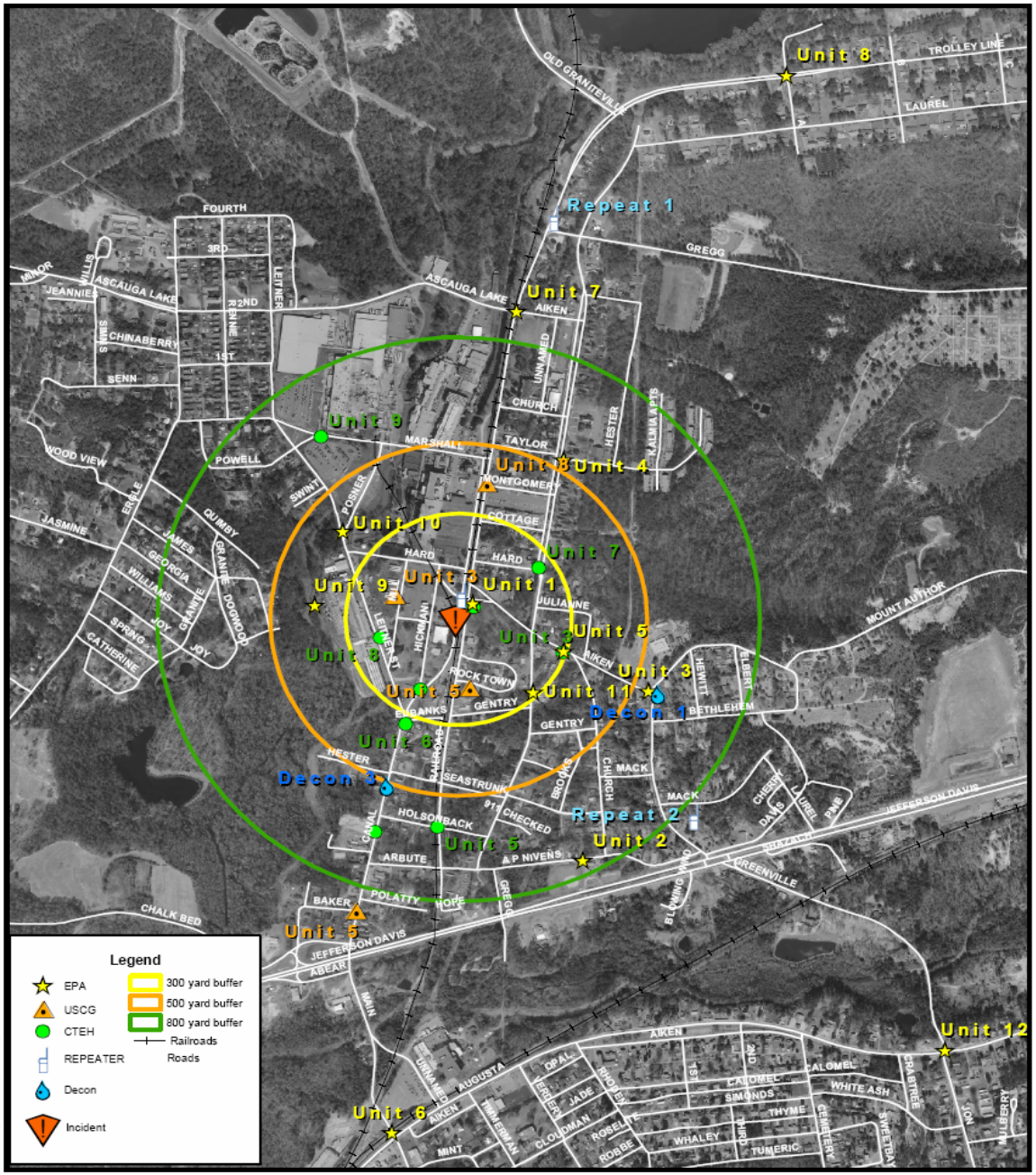
Measurement Locations

3 Teams:

- EPA – 12 units
- USCG – 6 units
- CTEH – 10 units

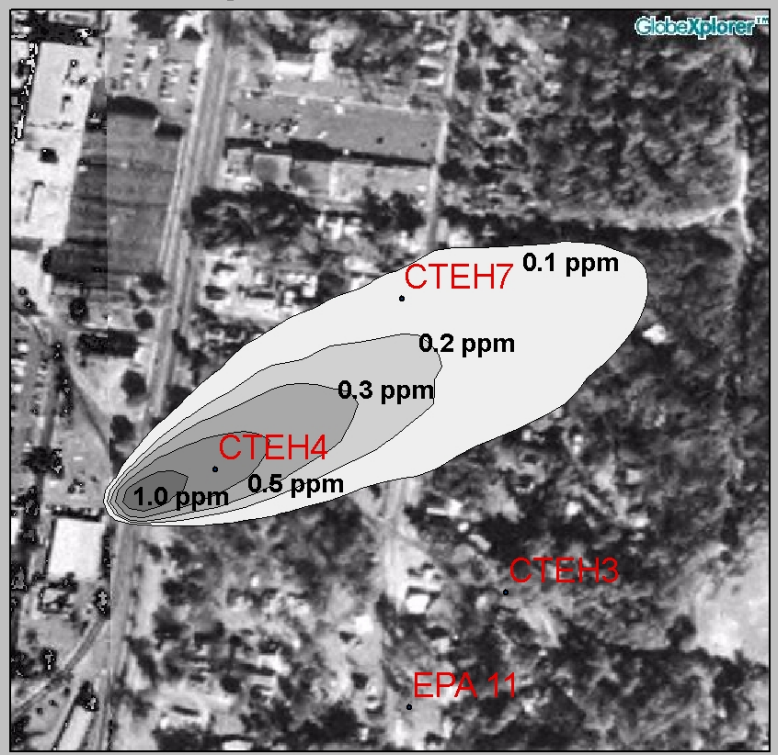
Initial measurements started Jan 6 at about 1430 EST or about 12 hr after release began

AreaRAE Locations for all Agencies
January 13, 2005 - 1000 Hours



Sample model comparison with measurements

- We selected a **period** when multiple stations appeared to have a consistent set of data in an area downwind of the source
- We made a 15-min averaged measurement data set to compare with model
- **Period:** January 10 at 0900 EST
- Model results shown as contours labeled in black ppm values
- Measurements listed below right
- Excellent agreement for this sample period

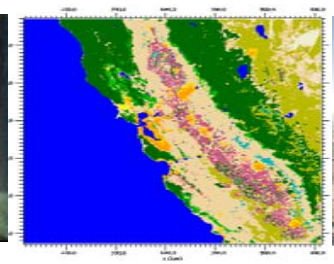


Average Air Calculation scaled to match measurements. Raw measurement data was averaged over a 15 minute period to match plume averaging time. Averaged field measurement values used in the calculation were as follows:

CTEH 4 (Park) - 0.91 ppm
CTEH 7 (Gregg & Hard) - 0.11 ppm
CTEH 3 - 0 ppm
Note - data not available for EPA 1 & 11 for this plot time

Summary

- IMAAC is a federal center for coordinating dispersion modeling for atmospheric hazards
- IMAAC roles are codified in National Response Plan and National Exercise Program
- IMAAC is the single source of federal dispersion products for “Incidents of National Significance”
- NARAC has been designated the primary initial provider of IMAAC capabilities



Questions?

IMAAC

Interagency Modeling and
Atmospheric Assessment Center

Homeland Security