The Graniteville Train Crash:
Emergency Response Support
Provided by the Savannah River
National Laboratory

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Outline
- Accident Details
- Support from SRNL and SRS
- ATG's Capabilities
- Modeling Effort
- Post Analysis
- Prior Training/Preparation
- Summary

Accident Details
- Time of accident: 2:39 am Thursday January 6, 2005
- Location: Graniteville, SC
- Situation: Norfolk Southern Railroad freight train collided with stationary train parked on a siding
- Accident involved rail cars containing chlorine, creosol, and sodium hydroxide
- Chlorine greatest airborne concern due to high volatility

Mutual Aid Agreements with Local Governments
Mutual Aid Agreements signed in 1996 establishes SRNL partnerships with local Emergency Response agencies
- Participants are Aiken, Barnwell, Allendale, Richmond, and Columbia counties
- Agreements identified three primary areas of collaboration:
  - Establish meteorological monitoring in critical hazard zones
  - Provide custom hazard consequence assessment software
  - Provide EMA directors consultation and support, as needed, during hazardous material or severe weather emergencies

Graniteville Train Wreck

SRS Assistance
- SRSFD
  - 16 On duty
- Fire/Haz-Mat/ Law Enforcement Agencies
  - Approximate 30 volunteer members from SRS
- WSRC Emergency Management
  - 7 Critical Incident Stress Counselors
### SRS Assistance (cont.)

- **SRS Operations Center (SRSOC)**
  - 6 Personnel
  - Logistics requests
  - DOE Headquarters Briefings
  - Department of Homeland Security Briefings

- **Wackenhut Services Incorporated**
  - 7 Personnel

- **SRNL Atmospheric Technologies Group**
  - 6 Personnel
  - Consequence modeling & meteorological data
  - Weather forecasting & consulting

### SRS Tower Network

- 9 towers on SRS (200ft)
- 4 towers Richmond county (120 ft)
- 1500 ft TV tower
- Data available every 15 minutes

### Regional Observing Stations

**NWS Observing Stations**
- SC & GA

- SRNL forecast models use weather analyses derived from data from NWS observing stations
- SRNL receives data from all NWS stations across all USA (as well as worldwide)
  - Surface observations
  - Upper air balloon soundings

### Regional Atmospheric Modeling at SRS

SRNL Forecasts Weather Conditions 24-36 hours For South East USA

- SRNL uses the Regional Atmospheric Modeling System (RAMS) to forecast winds etc. at SRS for:
  - Emergency response
  - Prescribed forest burns
  - Operational forecasting
- Model runs updated every 12 hrs

### Local Atmospheric Modeling at SRS

SRNL Forecasts Weather Conditions 3 - 6 hours For SRS & environs

- SRNL uses RAMS to nest a fine scale forecast for winds etc. at SRS for emergency response
- Model runs updated every 3 hrs

### Meteorological Data Flow

- **Local weather data**
- **Weather center computers**
- **Sun Unix relational database & LINUX RAMS**
- **Atmospheric Modeling Unix & LINUX Computer Array**
- **World System Software Applications**
- **Internet**

- **TV Tower**
- **SRS Towers**

### Worldwide Weather Data

- **Regional Observing Stations**
- **NWS Observing Stations**
- **SC & GA**

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**Consequence Assessment Modeling**

- Hierarchical Menu of Consequence Assessment Codes
  - Area Evacuation (immediate phase, < 5 km)
  - Puff / Plume (early phase, 0.5 - 50 km)
  - 2DPUF (early-intermediate phase, 1 - 100 km)
  - LPDM (intermediate phase, 5 - 300 km)
  - Stream II (aqueous)
- Supporting codes:
  - NARAC, CAMEO/ALOHA, HOTSPOT, VSMOKE, HPAC, HYSPLIT

**Modeling Considerations**

- Estimating a Chlorine release rate
  - Extent of damage (small crack vs. large rupture)
  - Amount of inventory remaining
- Dense gas behavior for Chlorine
  - Boiling point -29.3 F
- Other chemicals

**Synopsis of Meteorological Conditions - Morning of Jan 6**

- Surface high (1022 mb) off the Southeast U.S. coast producing south to southwesterly flow over Georgia and South Carolina
- Partly cloudy sky with areas of fog
- Observations from the SRS Regional Tower Network
  - Wind: SSW 2-4 mph (sfc); 6-8 mph (200 ft)
  - Temp: Mid 50s F
  - RH: 90%
  - Atm. Stability: Slightly stable to neutral

**Initial SRNL Response (Day 1)**

- Assistance requested shortly after 7:00 am
- First Puff-Plume model result web-posted for external access by 8:00 am
- Subsequent model results posted throughout the day (every 2-3 hours) with updated meteorology from local meteorological towers
- Ongoing discussions with Aiken County EOC including briefings on current and forecast meteorological conditions
- Weather support for the SRS on-scene responder teams

**Ongoing SRNL Response (Day 2)**

- Continued posting of model results posted throughout the day (every 2-3 hours)
- Ongoing discussions with Aiken County EOC including briefings on current and forecast meteorological conditions
- Modeling to support recovery actions
  - Case 1: Spill of rail car with 40% inventory
  - Case 2: Spill of rail car with 100% inventory
Local Atmospheric Modeling at SRS

SRNL Forecasts Weather Conditions 12 hours For SRS & environs

- SRNL uses RAMS (to nest a fine scale forecast for winds etc at SRS for emergency response
- Forecast wind fields updated every 3 hrs

Land-Use Features for Inner Grids

- Topography shows north-south oriented valley in which Graniteville is located.

Incorporation of Nested Grids

- Lowest level above ground (outer 2 grids, 10 m AGL; inner 2 grids, 7 m AGL).
- Initialize model with RUC and nudge to lateral BC’s every 3 hours
- Simulate from 18UTC, 05 Jan to 00UTC, 07 Jan
Close-up of railroad track "spur"

Note the green tree tops. Possible indication of plume depth.
### Prior Training / Preparation

- Annual Emergency Response Organization exercises
- Scenarios for accidents involving multiple tankers for an onsite railway (non-SRS shipments)
- Multiple chemical types used (HF, NH₄, etc)
- Use of ALOHA for source term
- Integration with ATG's models
- Post analysis in our own backyard

### Summary

- SRNL resources worked as designed, providing timely information directly to the local decision-maker
  - Aiken County Joint Operations Center
  - State authorities in Columbia (DHEC)
- Very positive feedback from Aiken County authorities.
  
  > 'It was very crucial to give us up-to-date wind conditions and plume models'
  
  - Mike Hunt, Aiken Co. Sheriff
  courtesy Augusta Chronicle