

NARAC Technical Plot Guide: A Guide to NARAC Predictions and Analyses

Connee Foster, Brenda Pobanz, Kristen Yu,
Kevin Foster, and John Nasstrom

NARAC Operations

Lawrence Livermore National Laboratory

Livermore, CA

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NARAC Provides Standard Plots Based on Agency and Stakeholder Collaboration



- Plot standards are developed with user input and agency consensus
 - Standard plot format and color schemes
 - Standard plot types and contour values
 - Consequence reports provide model inputs and assumptions and interpretational guidance
 - Health effect plots are based on EPA guidance for public exposure if available
- Default plots are produced automatically when a model request is made
 - A Web user may directly initiate a modeling request
 - NARAC Operations can produce and share results with designated users
- NARAC Operations provides reachback support to:
 - Develop additional event-specific plots
 - Refine predictions based on field data and information
 - Provide subject matter expertise on plots and analyses

NARAC Provides an Automated Web-based Tool and a Full Reachback Modeling Service

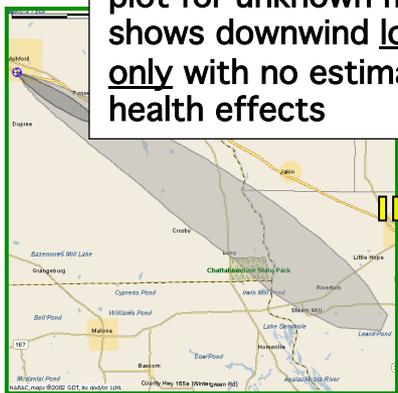


TYPE OF RUN	TYPE OF PRODUCTS	FEATURES
<p>Automated Web Run Uses many default model inputs and limited modeling capability</p>	<ul style="list-style-type: none"> • Standard default plots and consequence reports 	<ul style="list-style-type: none"> • Simple source terms with constant release rates • Readily available meteorology • Run time limited to 6 hours for all but Radiological & Biological • Automated quality assurance checks
<p>Reachback Run Based on an experienced NARAC Operations Scientist guiding an extensive set of model inputs and outputs with a full modeling capability</p>	<ul style="list-style-type: none"> • Initial: Standard plots and consequence reports • Refined: Specialized plot types with specific reports • Detailed wind analyses • Plume movies • Comparison with field measurement data 	<ul style="list-style-type: none"> • Detailed source terms with multiple time-varying source rates • Extensive meteorology • Analysis of dispersion conditions • Extensive run times • Expert quality-assured model inputs & products • Sequenced by Set #

Typical Progression of Reachback Plot Sets - Example for a Radiological Dispersal Device Exercise

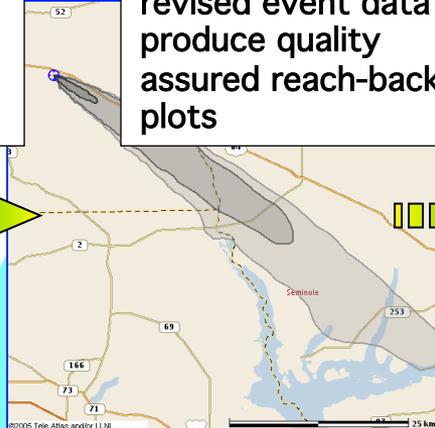


Set 1. An initial automated plot for unknown material shows downwind location only with no estimate of health effects



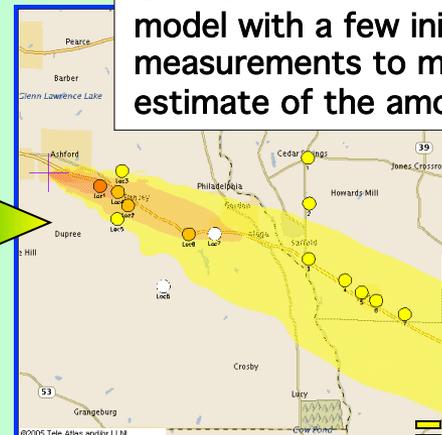
Automated Web-Initiated or via Emergency Call; Only know release time and location

Set 2. NARAC uses revised event data to produce quality assured reach-back plots



Example revised data: Updated source location, detailed weather

Set 3. NARAC compares the model with a few initial field measurements to make an initial estimate of the amount released



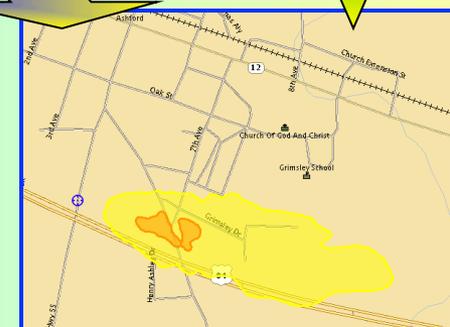
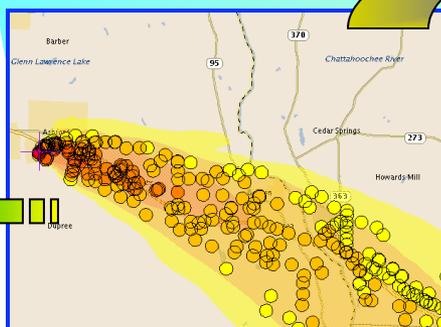
Source scaled to initial set of measurements

Cycle of new products based on updated sets of measurements

Later sets: NARAC develops Relocation and Food-Ingestion plots

Set 5. NARAC uses more extensive sets of field measurements to improve the accuracy of the source term calculation

Set 4. NARAC develops a dose plot based on a source term estimated from field measurements



NARAC Plot: Example Layout

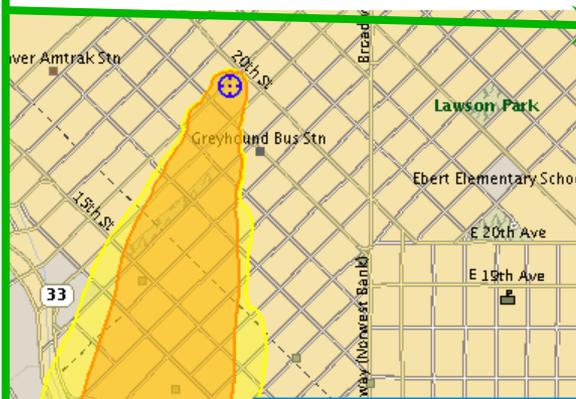
Example Only

Response Level (Testing, Emergency, Exercise)

Early Phase Evac Shelter TED (12-108 hrs)
(Evacuation/Sheltering based on Avoidable Total Effective Dose) Hypothetical RDD Automated Report - Testing

Title/Subtitles

- Description of dose/contamination contour areas on map
- Downwind extent and area covered
- Estimated number of people in each area



Time over which dose or contamination predicted on map

- Time material released in to the air (and amount, optional)
- Meteorological data used

Early Phase Dose		
Description	(rem) Extent Area	Population
Exceeds 5 rem total effective dose (upper limit early phase PAG for evacuation/sheltering).	>5 1.5km 0.5 km2	5,910
Exceeds 1 rem total effective dose (lower limit early phase PAG for evacuation/sheltering).	>1 2.6km 1.5 km2	12,100

Areas and counts in the table are cumulative.

Effects or contamination from December 28, 2006 12:00 PST to January 01, 2007 12:00 PST at 10.0 m.

Release Location: 39.752437 N, 104.993006 W

Material: Radionuclide X

Generated On: December 29, 2006 15:06 PST

Model: ADAPT/LODI

Comments:

Hypothetical release 12/28/2006 12:00 PST for 2 min met obs used

Source location and type of material released into the air

When plot was created

Model used for this product

Model calculation ID

Requestor and Approver Contact Info.

Contact Info.

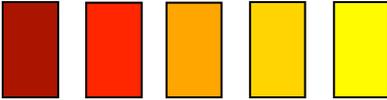
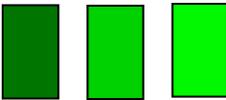
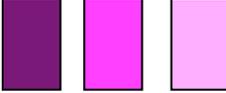
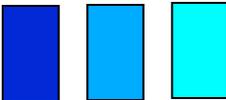
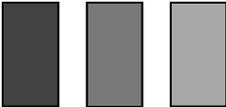
Map Size: 3.1 km by 3.1 km Id: Production.rcE15279.rcC1
NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925.424-6465
Requested by: Operations Coordinator
Not approved for further distribution

Map Size/Scale

Example Only

Standard Product Contour Level and Color Scheme are Used for Ease of Interpretation



Model Contour Levels	Have levels been reached?	Contour Colors	Description Wording
Acute/Chronic exposure/dose or protective action guideline levels exist in the NARAC database <i>(for when we have a source term)</i>	Yes		Consistent with EPA, NRC, FDA or other guidance.
	No		May be below health effect or PAG levels. Possibly contaminated area. Use to confirm with monitoring surveys.
Customer specified levels	Yes		Customer specified levels.
	No		Below customer specified levels.
No levels exist in NARAC database <i>(or no source term available)</i>			No guidelines specified. Possibly contaminated area.

A Standard Default Plot or Set of Plots is Provided for each Release Type



<i>Release Type</i>	<i>Default Plot Type</i>
Unknown material	Hourly average air concentration Deposition if particulate is used
Industrial chemical	“Peak” average air concentration, deposition (if applicable)
Chemical agent	“Peak” average air concentration, deposition
Biological agent	Time-integrated air concentration, deposition
Explosive	Health effects from blast overpressure
Radiological	Dose, dose rate, deposition
Nuclear Detonation	Prompt effects, dose, dose rate

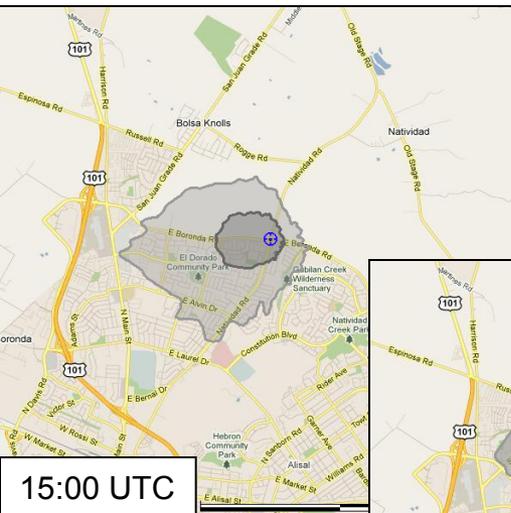
Default Plot Types:

Unknown Material



<i>Release Type</i>	<i>Default Plot Type</i>	<i>Contour Values</i>
Unknown gas or particulate matter	Up to 6 sequential 1hr-Averaged Air Concentrations	Three decades of normalized g/m^3 values, e.g., 10^{-6} , 10^{-7} , 10^{-8}
Unknown particulate matter	Also Total Deposition	Three decades of normalized g/m^2 values, e.g., 10^{-3} , 10^{-4} , 10^{-5}

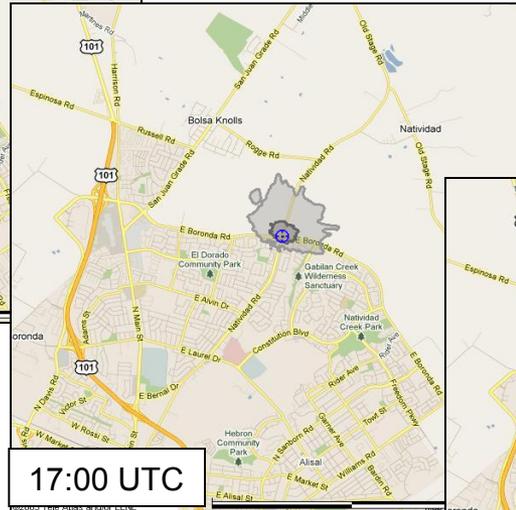
Unknown Material Results in a Time Series of 1-Hr Average Air Concentration Plots



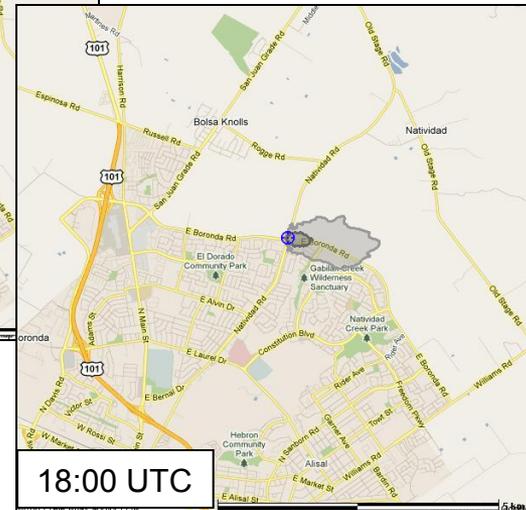
15:00 UTC



16:00 UTC



17:00 UTC



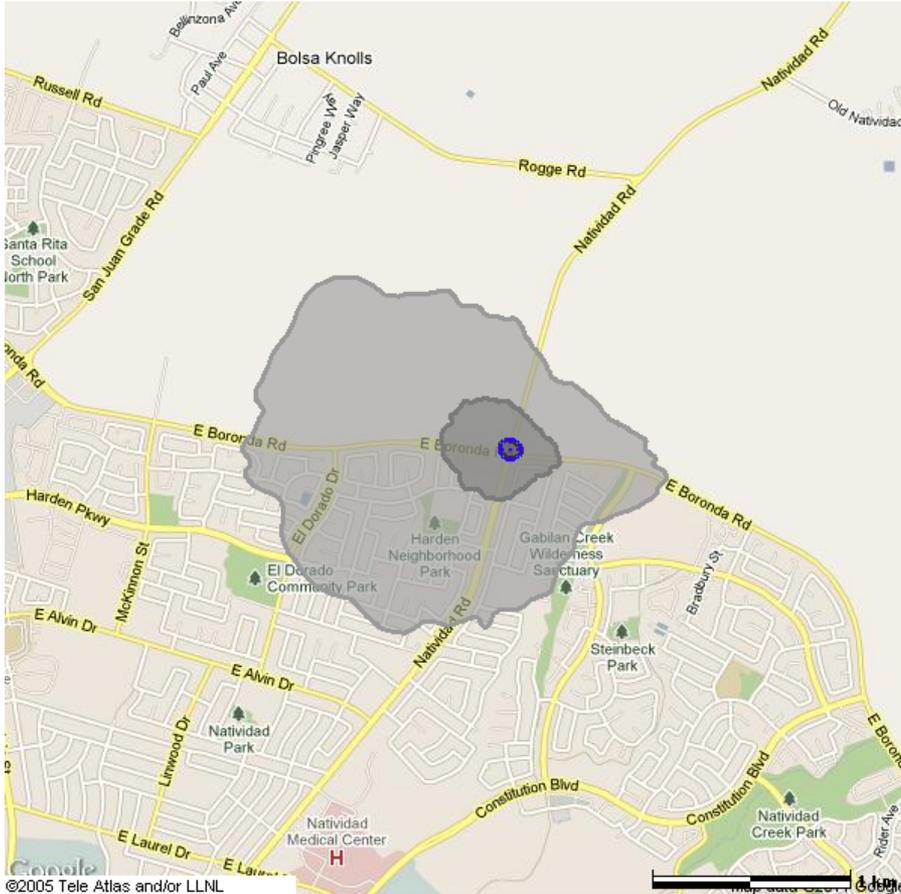
18:00 UTC

When there is not sufficient information about a release to estimate a source term, use a unit release of a generic “particulate” or “gas” to give a picture of the **downwind location of the plume**. A time series of plots will show hourly changes in plume position based on updated meteorology.



Grey contours indicate no health-effect guidelines are used.

Total Deposition of particulate



Concentration Levels			
	Description	(g/m2) Extent Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0010 0.06km 0.008 km2	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0001 0.4km 0.2 km2	140
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>1.00E-5 1.4km 2.6 km2	3,220
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

Effects or contamination at June 30, 2011 19:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: particulate
 Generated On: July 01, 2011 21:00 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release
 of 1 kg starting at
 06/30/2011 13:00:00 UTC for 6 hr
 met obs

For an unknown particulate source, a default generic deposition plot will also be produced. This may be used to plan monitoring surveys.

Map Size: 4.6 km by 4.6 km Id: Production.rcE18820.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}



Default Plot Type:

Industrial Chemical Release

Release Type	Default Plot Type	Contour Values
Industrial chemical	Public Health Action Criteria (<i>peak* avg air conc</i>)	60min-AEGLs, ERPGs, or TEELs** (ppm for gases, mg/m ³ for particulates)
	Predicted Emergency Worker Protection (<i>peak avg air conc</i>)	<ul style="list-style-type: none"> • 30min-IDLH, 30min-AEGL2, 60min-AEGL2, ERPG2, or TEEL2 • 30min-AEGL1, 60min-AEGL1, ERPG1, or TEEL1 (ppm for gases, mg/m ³ for particulates)
	Predicted Isolation and Protective Action Areas (<i>peak avg air conc</i>)	<ul style="list-style-type: none"> - Circle (Initial Isolation Zone) = Maximum distance of the following: <ul style="list-style-type: none"> • LC50 (median fatal air conc) or threshold lethality from animal studies • 7.5% Protective Action Zone (PAZ) extent for liquids • 15% PAZ extent for gases - Contour = 60min-AEGL2, ERPG2, TEEL2, or 1% LC50 from animal studies - Box (PAZ extent) = encompasses contour extent
	Predicted Explosive Potential (<i>peak avg air conc</i>)	10% of Lower Explosive Limit (LEL), 50% of LEL
	Surface Contamination (<i>deposition</i>)	3 decades of normalized levels (mg/m ²)

* "Peak" avg air conc = Average air concentration for the highest 15-min period during plume passage

**Public exposure guidelines are selected in the following priority:
1. AEGLs: 60-min EPA Acute Emergency Guideline Levels (*using a 60-min AEGL with 15-min model output adds conservatism to the result*)
2. ERPGs: AIHA Emergency Response Planning Guidelines
3. TEELs: DOE Temporary Emergency Exposure Limits

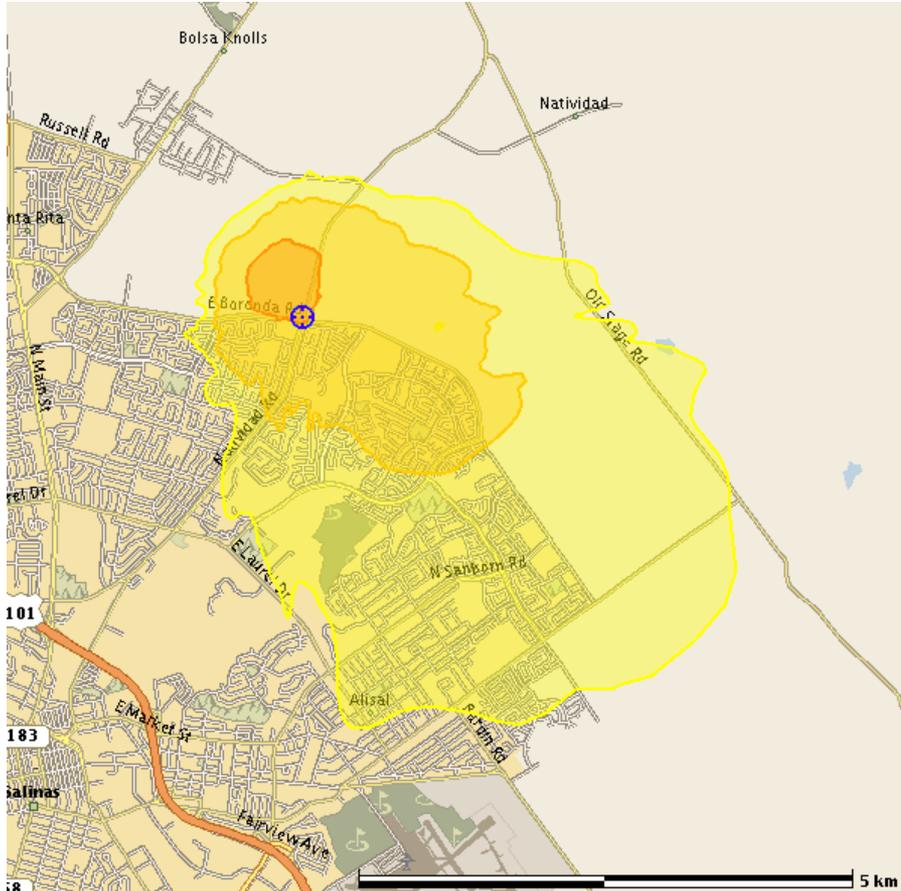
Note: Default plots are for **outdoor exposures**.
 Upon request, NARAC reachback staff can estimate indoor exposures, or exposures for other averaging times



AEGLs, EPRGs, and TEELs are defined differently

- **AEGLs** (EPA's Acute Emergency Guideline Levels)
 - Pertain to the general population including susceptible individuals
 - Defined as the level *above* which a certain health effect is expected
 - Developed for five-time periods (10-minutes to 8 hours)
 - No AEGL-0 level exists
- **ERPGs** (AIHA's Emergency Response Planning Guidelines)
 - Pertain to "nearly all individuals"
 - Defined as the level *below* which certain health effects are *not* expected
 - Refer to an exposure duration of one hour
 - No ERPG-0 level exists
- **TEELs** (DOE's Temporary Emergency Exposure Limits)
 - Pertain to "nearly all individuals"
 - Defined as the level *below* which certain health effects are *not* expected.
 - Recommended for a peak 15-minute time-weighted average concentration
 - TEEL-0 is the level below which no appreciable health effects are expected

Public Health Protective Action Criteria at 06/30/2011 13:00:00 PDT
 (Areas exceeding harmful vapor air concentration limits)



Acute (Short-Term) Effects			
	Description	(ppm) Extent Area	Population
	>60 min AEGL-3: Death or irreversible health effects possible.	>20 0.8km 0.5 km2	20
	>60 min AEGL-2: Serious health effects or impaired ability to take protective action.	>2 2.4km 5.8 km2	6,290
	>60 min AEGL-1: Minor reversible health effects. Possible odor.	>0.5 5.2km 21.7 km2	27,600

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

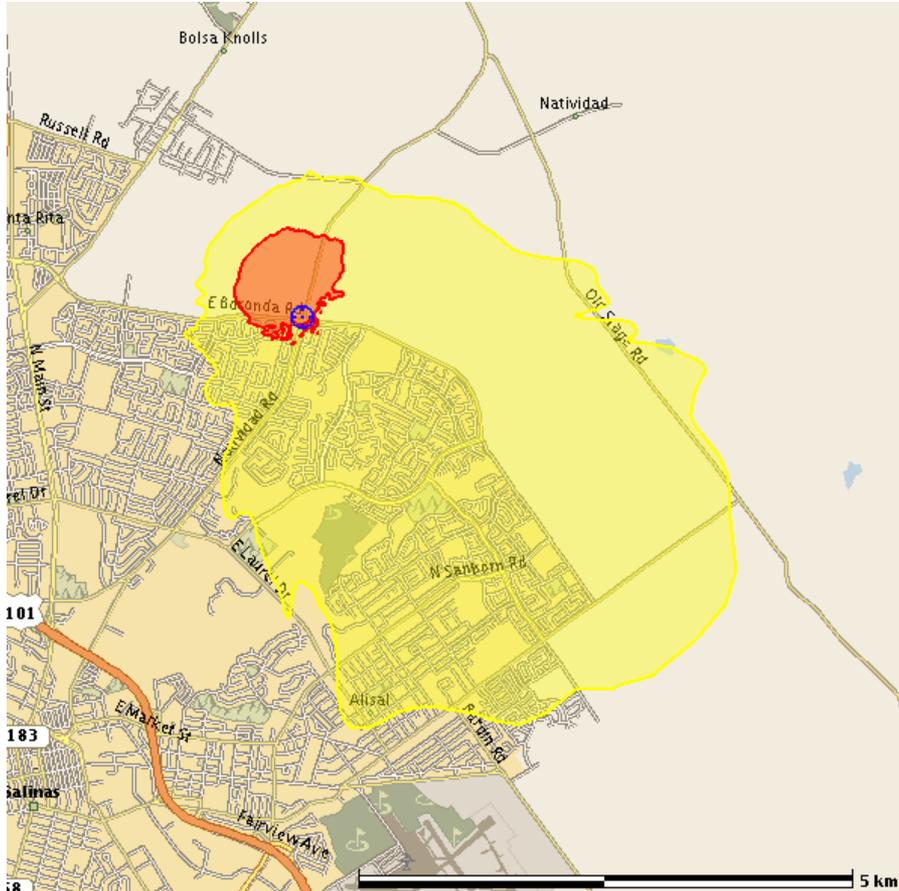
Effects or contamination from June 30, 2011 16:00 UTC to June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CHLORINE
 Generated On: July 23, 2012 15:37 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

This product presents the near-term health effects caused by an individual standing still outdoors and being exposed to the maximum air concentration averaged over overlapping 15-minute periods as the plume passes by.

Map Size: 9.2 km by 9.2 km Id: Beta.rcE16945.rc1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

Industrial Chemical Release

Predicted Emergency Worker Protection at 06/30/2011 13:00:00 PDT
 (Use of PPE by emergency workers is recommended)



Acute (Short-Term) Effects		
Description	(ppm) Extent Area	Population
Area where maximum respiratory PPE (Level A/B) is NIOSH-recommended for emergency workers, along with careful supervision and monitoring. (Level B affords less skin protection.) Exceeds 30 min IDLH	>10 0.9km 0.9 km2	50
Area where reduced (Level C) PPE is NIOSH-recommended for workers, with careful supervision and monitoring. Exceeds 30 min AEGL-1. Use Level A PPE if concentrations are not confirmed!	>0.5 5.2km 21.7 km2	27,600

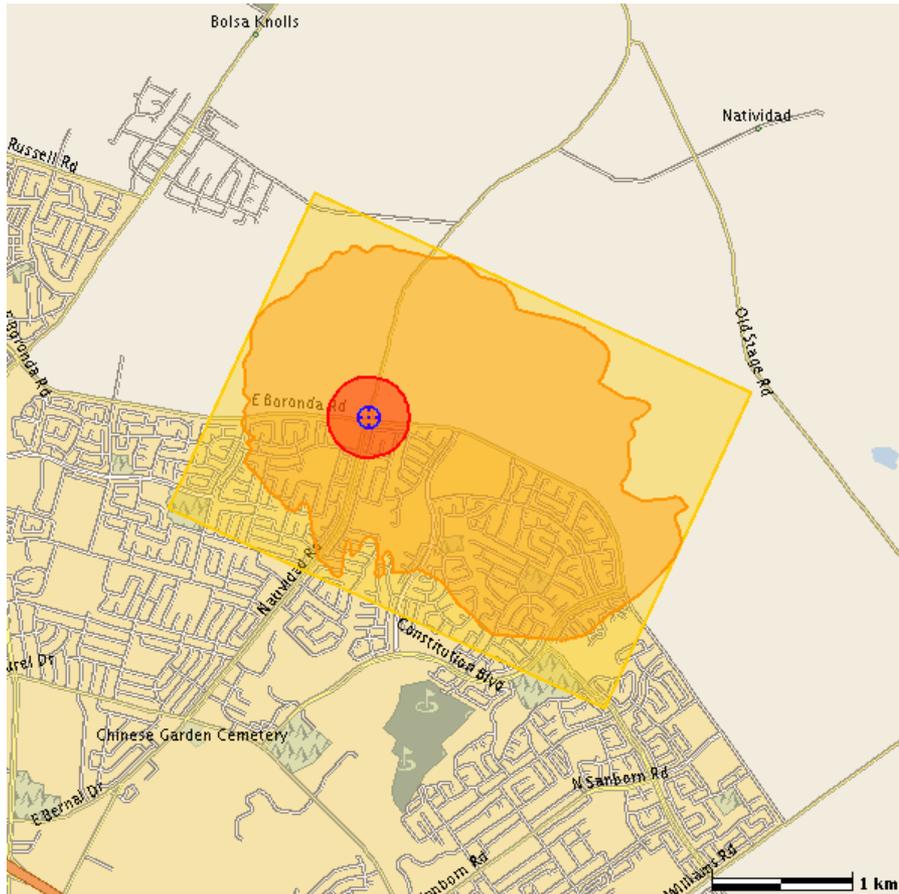
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

Effects or contamination from June 30, 2011 16:00 UTC to June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CHLORINE
 Generated On: July 23, 2012 15:37 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

This product presents up to two areas in which use of different levels of Personal Protective Equipment (PPE) by emergency responders may be warranted based on CDC/NIOSH recommendations.

Map Size: 9.2 km by 9.2 km Id: Beta.rcE16945.rc1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

**Predicted Isolation and Protective Action Areas at 06/30/2011 13:00:00 PDT
 (Areas to consider for restricted entry, evacuation, or sheltering)**



Acute (Short-Term) Effects			
	Description	(ppm) Extent Area	Population
	Initial Isolation Zone. Evacuation and restricted entry warranted unless protected and involved in emergency response. Extent based on Animal LC50 (293 ppm).	0.3km 0.3 km2	200
	>60 min AEGL-2: Serious health effects or impaired ability to take protective action.	>2 2.4km 5.8 km2	6,290
	Protective Action Zone. Evacuation or sheltering should be considered due to increased risk of harmful exposure.	2.7km 7.4 km2	8,030
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

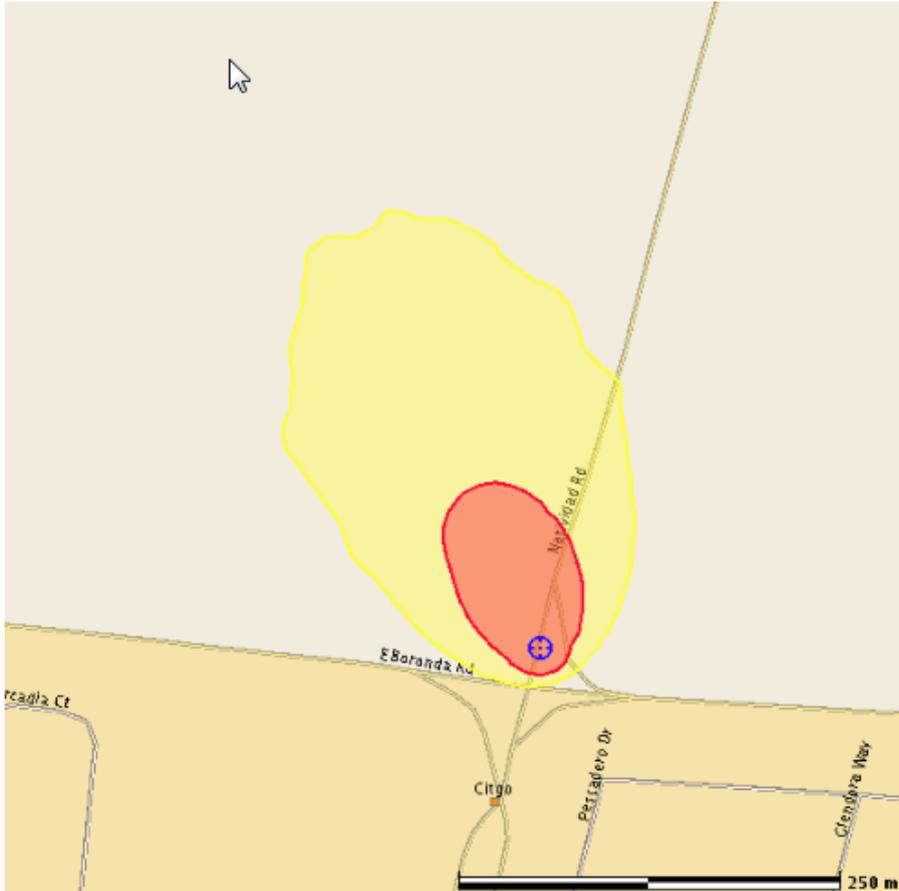
Effects or contamination from June 30, 2011 16:00 UTC to June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CHLORINE
 Generated On: July 23, 2012 15:37 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

This product presents areas where restricted entry, evacuation, or sheltering-in-place of the general public should be considered.

Map Size: 6.4 km by 6.4 km Id: Beta.rcE16945.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

Industrial Chemical Release

Predicted Explosive Potential
 (Areas with elevated potential for explosion due to chemical concentrations)



Acute (Short-Term) Effects			
	Description	(ppm) Extent Area	Population
	> 50% of Lower Explosive Limit. Extreme safety considerations against the hazards of explosion must be taken into account.	>10,000 116m 8,300m ²	0
	> 10% of Lower Explosive Limit. Safety considerations against the hazards of explosion must be taken into account.	>2,000 310m 52,565m ²	10
Areas and counts in the table are cumulative. Population Source = LandScanUSA10.			

Effects or contamination from June 30, 2011 16:00 UTC to June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: PROPANE
 Generated On: July 23, 2012 15:37 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release of 1e+05 lb starting at 06/30/2011 16:00:00 UTC for 15 min
 met obs

This product presents areas where chemical concentrations are approaching the chemical's explosive limit and a potential for explosion exists.

Map Size: 6.4 km by 6.4 km Id: Beta.rcE17251.rcC1
 NARAC Operations: (onDuty Assessor); narac@lInl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: { Operations Coordinator }

Default Plot Type:

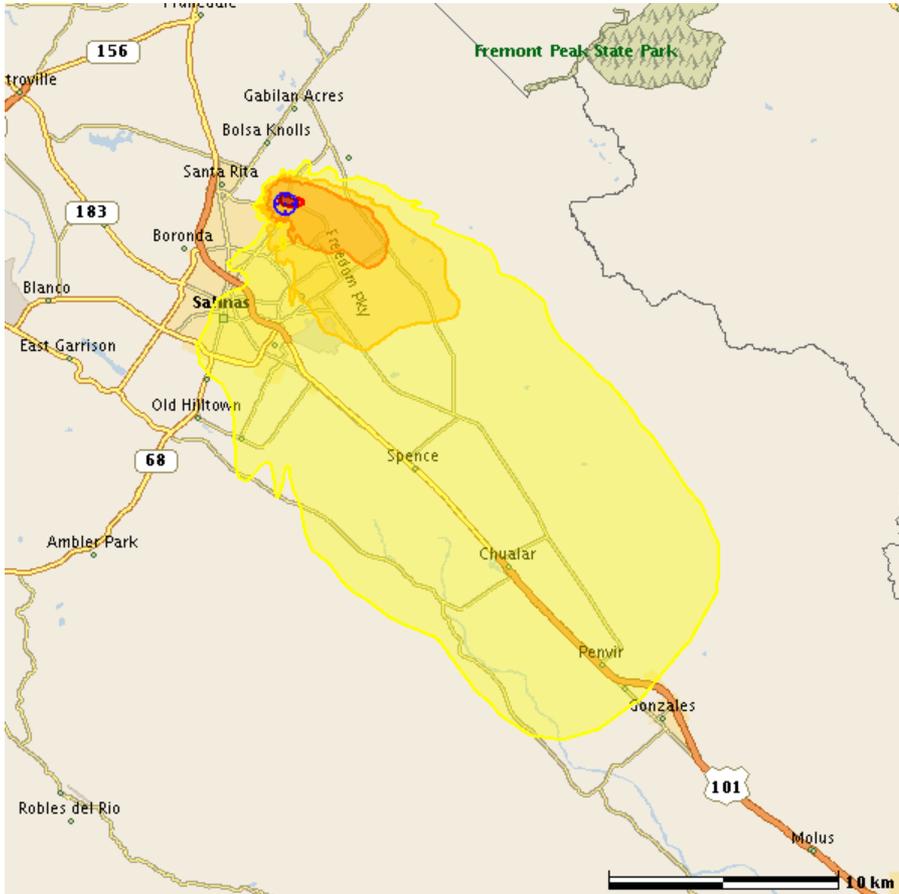
Chemical Agent Release



Release Type	Default Plot Type	Contour Values
Chemical agent	Public Health Action Criteria (<i>peak avg air conc</i>)	Lethal Doses (LD) for 85% and 50% of exposed population, plus AEGL3, AEGL2, and AEGL1
	Predicted Emergency Worker Protection (<i>peak avg air conc</i>)	<ul style="list-style-type: none">• 30min-IDLH, 30min-AEGL2, 60min-AEGL2, ERPG2, or TEEL2• 30min-AEGL1, 60min-AEGL1, ERPG1, or TEEL1
	Predicted Isolation and Protective Action Areas (<i>peak avg air conc</i>)	<ul style="list-style-type: none">- Circle (Initial Isolation Zone) = Maximum distance of:<ul style="list-style-type: none">• LC50 (median lethal air conc from animal studies)• 7.5% Protective Action Zone (PAZ) extent for liquids• 15% PAZ extent for gases- Contour = 60min-AEGL2, ERPG2, TEEL2, or 1% LC50- Box (PAZ extent) = encompasses contour extent
	Predicted Liquid-Skin Contact Effects (<i>deposition</i>)	Lethal Dose (LD) for 50% of exposed population, plus serious health effects for 50% and 2% of exposed population
	Surface Contamination (<i>deposition</i>)	3 decades of relative deposition levels (mg/m ²)

Note: Default plots are for **outdoor exposures**.
Upon request, NARAC reachback staff can estimate indoor exposures.

Public Health Protective Action Criteria at 06/30/2011 20:00:00 UTC
 (Areas exceeding harmful vapor air concentration limits)



Acute (Short-Term) Effects			
	Description	(ppm) Extent Area	Population
	>85% of the exposed population could receive a lethal dose.	>0.9 0.6km 0.3 km ²	80
	>50% of the exposed population could receive a lethal dose.	>0.6 0.8km 0.4 km ²	100
	>60 min AEGL-3: Death or irreversible health effects possible.	>0.02 4.9km 11.3 km ²	6,460
	>60 min AEGL-2: Serious health effects or impaired ability to take protective action.	>0.006 9.0km 40.3 km ²	30,900
	>60 min AEGL-1: Minor reversible health effects. Possible odor.	>0.0005 27.0km 332 km ²	104,000
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

Effects or contamination from June 30, 2011 16:00 UTC to June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: SARIN
 Generated On: July 23, 2012 16:36 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

This product presents the near-term health effects (including possible fatalities) caused by an individual standing still outdoors and being exposed to the maximum air concentration averaged over overlapping 15-minute periods as the plume passes by.

Map Size: 39.6 km by 39.6 km Id: Beta.rcE16946.rcC1
 NARAC Operations: (onDuty Assessor); narac@lmi.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

Predicted Liquid-Skin Contact Effects at 06/30/2011 20:00:00 UTC
 (Areas exceeding harmful liquid droplet deposition thresholds)



Map Size: 1.1 km by 1.1 km Id: Beta.rcE16946.rcC1
 NARAC Operations: (onDuty Assessor); narac@lInl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

Acute(Short-Term) Effects			
	Description	(mg) Extent Area	Population
	Greater than 50% fatalities expected in exposed general population.	>750 61.0m 4,798 m2	0
	Greater than 50% of exposed general population expected to develop severe health effects.	>440 88.5m 10,096 m2	0
	Greater than 2% of exposed general population expected to develop severe health effects.	>51 349m 117,802 m2	60

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

Effects or contamination at June 30, 2011 20:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: SARIN
 Generated On: July 23, 2012 16:36 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

This product presents areas where air concentrations are predicted to exceed levels that pose potentially serious (and possibly fatal) health effects due to absorption of the airborne chemical material through exposed skin.

Default Plot Type:

Biological Agent/Toxin Release

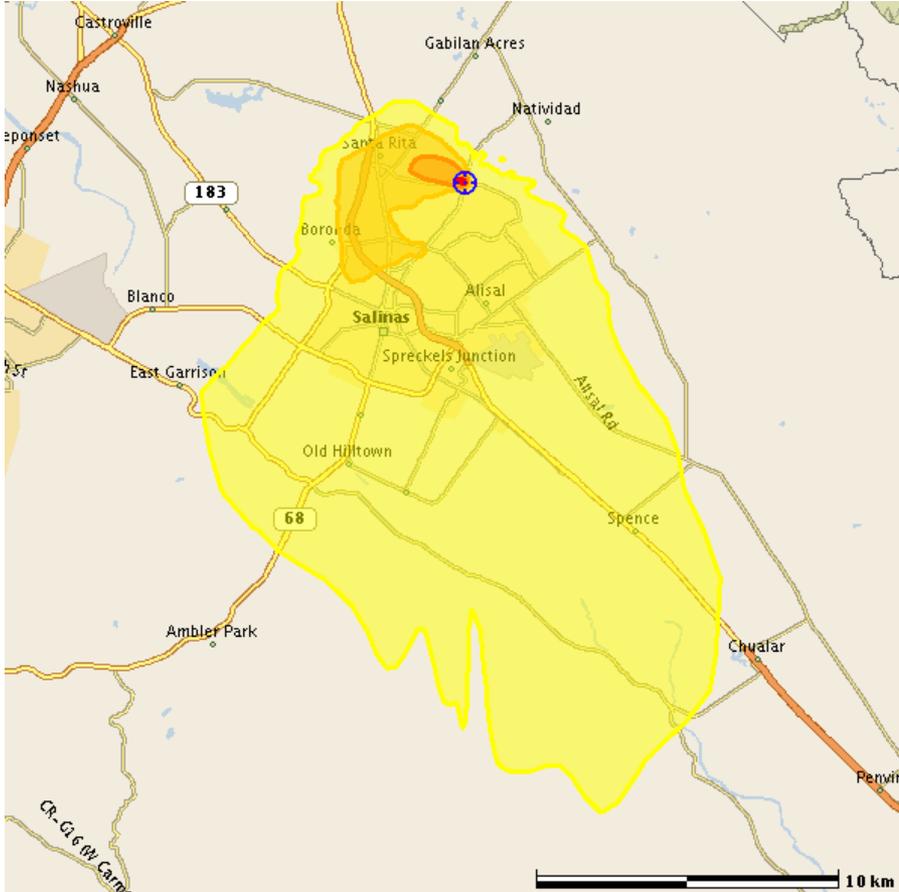


<i>Release Type</i>	<i>Default Plot Type</i>	<i>Contour Values</i>
Biological agent or toxin	Integrated air concentration	Lethal Doses (LD) for 85%, 50%, 15%, and 2% of the exposed population
	Initial surface contamination	3 decades of relative deposition levels (CFU/m² or mg/m²)

LD_{nn}: The concentration which can cause fatal or incapacitating effects for specific (nn) percentages of the exposed population

Note: Plots are for unsheltered outdoor exposures

**Predicted Short Term Human Health Effects
 (Integrated Air Concentration)**



Map Size: 30.1 km by 30.1 km Id: Beta.rcE16949.rcC1
 NARAC Operations: (onDuty Assessor); narak@lml.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {Operations Coordinator}

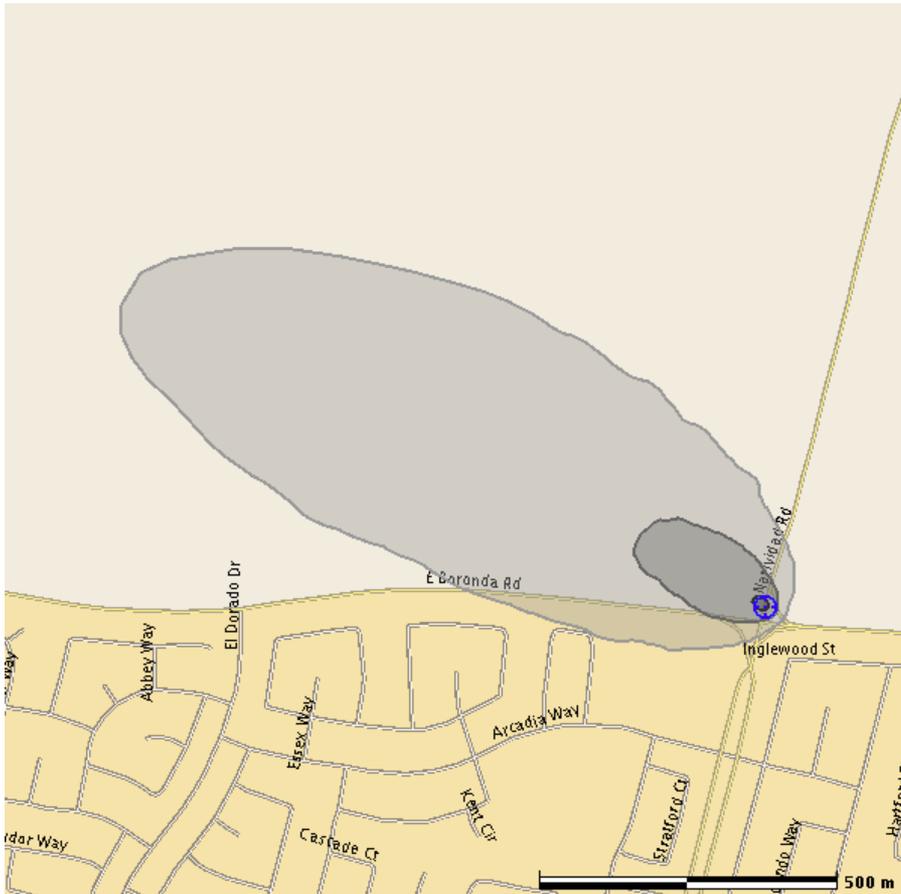
Acute (Short-Term) Effects			
	Description	(CFU-min/m3) Extent Area	Population
	>85% of the exposed population could receive a lethal dose.	>1.60E7 0.2km 0.03 km2	0
	>50% of the exposed population could receive a lethal dose.	>530,000 1.9km 1.2 km2	20
	>15% of the exposed population could receive a lethal dose.	>18,000 5.0km 12.7 km2	32,100
	>2% of the exposed population could receive a lethal dose.	>620 21.7km 241 km2	170,000

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

Effects or contamination from June 30, 2011 15:00 UTC to July 04, 2011 15:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: ANTHRAX-DRY
 Generated On: July 23, 2012 17:53 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

The product presents the near-term health effects caused by the inhalation of the biological agent in terms of percentages of the exposed population to experience the stated effect, such as death, incapacitation, or infection. CFU refers to colony-forming units.

**Initial Surface Contamination
 (No Material decay from ambient effects is applied post-deposition)**



Concentration Levels			
	Description	(CFU/m2) Extent Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys	>1.00E8 25.9m 500 m2	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys	>1.00E7 247m 27,373 m2	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys	>1.00E6 1,205m 454,923 m2	0

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

Effects or contamination at July 04, 2011 15:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: ANTHRAX-DRY
 Generated On: July 23, 2012 17:53 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

The product shows the areas where biological agent or toxin may be deposited onto the surface above the specified concentrations. The plot's sub-title indicates whether or not atmospheric and/or post-deposition decay of the biological material due to exposure to ambient environmental conditions is included in the calculations. This distinction is important when comparing these model predicted concentrations with measurements. CFU refers to colony-forming units.

Map Size: 1.5 km by 1.5 km Id: Beta.rcE16949.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Default Plot Type:

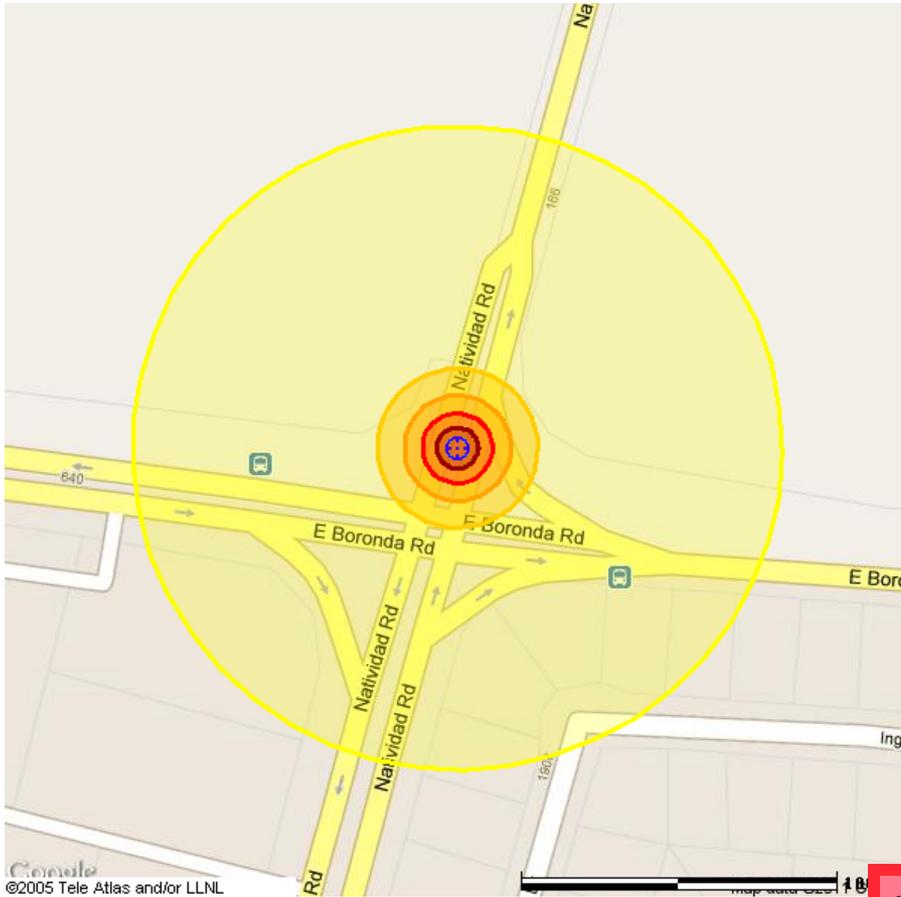
A Release with High Explosive (HE)



<i>Release Type</i>	<i>Default Plot Type (Plot Subtitle)</i>	<i>Contours</i>
High Explosive	Blast Effects from xxx lbs High Explosives (Radial Extent of Overpressures, producing onset of various health effects)	Pounds per square inch (psi)

Note: This plot is produced whenever an explosive source is selected for a chemical, biological, or radiological release

**Blast Overpressure Effects from 50 lb High Explosives
 (Radial Extent of Overpressure)**



Blast Effects		
	Description	(psi) Extent Area
	Fatalities in over 99% of the population.	>100 6.6m 137 m2
	Onset of lethality	>25 11.1m 388 m2
	Onset of lung damage	>10 16.9m 898 m2
	Onset of eardrum rupture	>5 25.5m 2,039 m2
	Onset of shattered glass from blast effects.	>0.5 103m 33,448 m2
Areas in the table are cumulative.		

Effects or contamination from June 30, 2011 13:00 UTC to June 30, 2011 13:00 UTC at or near ground level.
 Release Location: 36.715775 N, 121.623420 W
 Material: HE
 Generated On: July 01, 2011 21:03 UTC
 Model: BLAST

Map Size: 287 m by 287 m Id: Production.rcE18821.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

- This product identifies the distances at which specific health-related overpressure thresholds are expected as a result of a (non-nuclear) detonation of high-explosive.
- These distances are applicable for individuals outdoors in the open and without any mitigating protection.

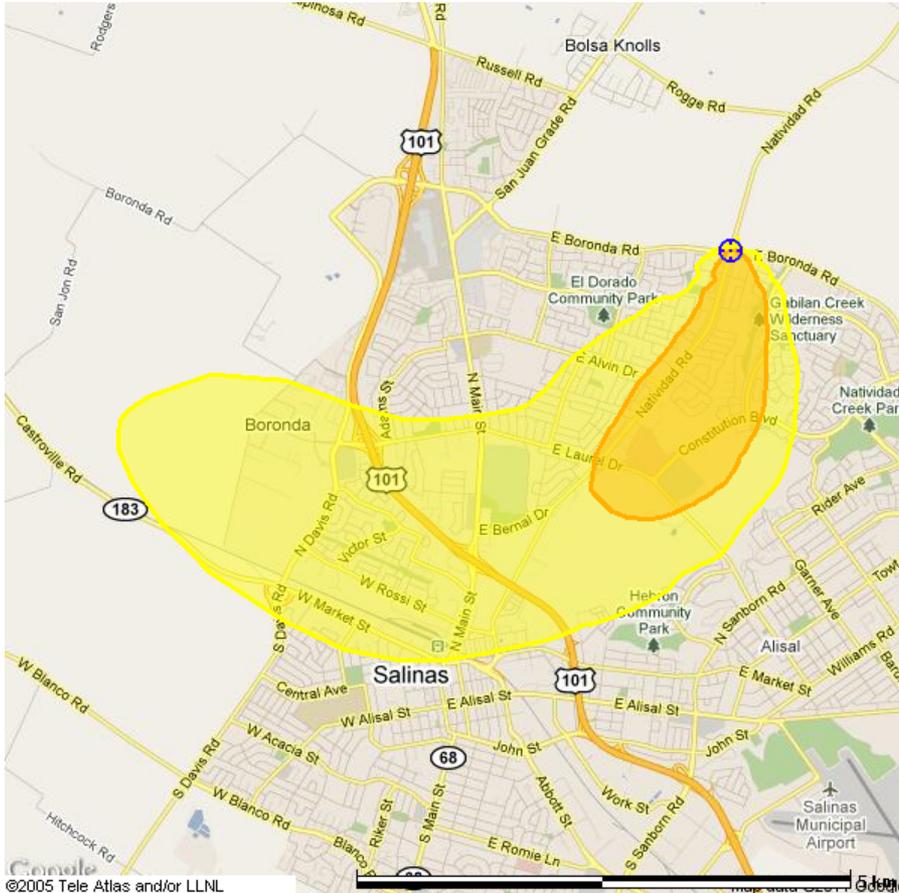
Default Plot Types:

Radiological Release



Release Type	Default Plot Type (Plot Subtitle)	Contour Values
Radiological Release	<p>1 - Early Phase TED (0-96 hrs) (Total Effective Dose Including Plume Passage)*</p>	1, 5 rem
	<p>2 - Early Phase Thyroid CDE (0-96 hrs) (Thyroid Committed Dose Equivalent Including Plume Passage)*</p>	5, 25 rem
	<p>3 - Early Phase Evac Shelter TED (12-108 hrs) (Evacuation/Sheltering PAG based on Avoidable Total Effective Dose)</p>	1, 5 rem
	<p>4 - Early Phase Evac Shelter Thyroid CDE (12-108 hrs) (Evacuation/Sheltering PAG based on Avoidable Thyroid Committed Dose Equivalent)</p>	5, 25 rem
	<p>5 – KI Administration Based on FDA (2001) (Thyroid CDE from Radioiodine)</p>	5, 10, 500 rem Adult, 5 rem Child
	<p>6 - Worker Protection Dose Rate at 12 hrs (Near Field) (Groundshine and Air Immersion Dose Rate at mm/dd/yyyy hh:mm:ss UTC)</p>	5, 10, 25, 50, 100 rem/hr
	<p>7 - Worker Protection Dose Rate at 12 hrs (Far Field) (Groundshine and Air Immersion Dose Rate at mm/dd/yyyy hh:mm:ss UTC)</p>	2, 10, 100, 1000, 10000 mrem/hr
	<p>8 - Deposition at 12 hrs (Surface Contamination from Deposited Radionuclides)</p>	Three decades [No guideline values]
	<p>9 - Intermediate Phase Relocation PAGs (Relocation based on Avoidable Groundshine and Resuspension Dose)</p>	2 rem 1 st yr, 0.5 rem 2 nd yr
	<p>10 - Intermediate Phase Dose (Based on Avoidable Groundshine and Resuspension Dose 12hr-50yr)</p>	5 rem

Early Phase TED (0-96 hrs)
(Total Effective Dose Including Plume Passage)



Early Phase Dose		
Description	(rem) Extent Area	Population
Exceeds 5 rem total effective dose.	>5 3.2km 3.8 km2	9,800
Exceeds 1 rem total effective dose.	>1 6.6km 18.2 km2	38,200

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

Effects or contamination from June 30, 2011 13:00 UTC to July 04, 2011 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133 + XE-133
 Generated On: July 01, 2011 21:19 UTC
 Model: ADAPT/LODI
 Comments: Doses shown are total accumulated from the beginning of release.

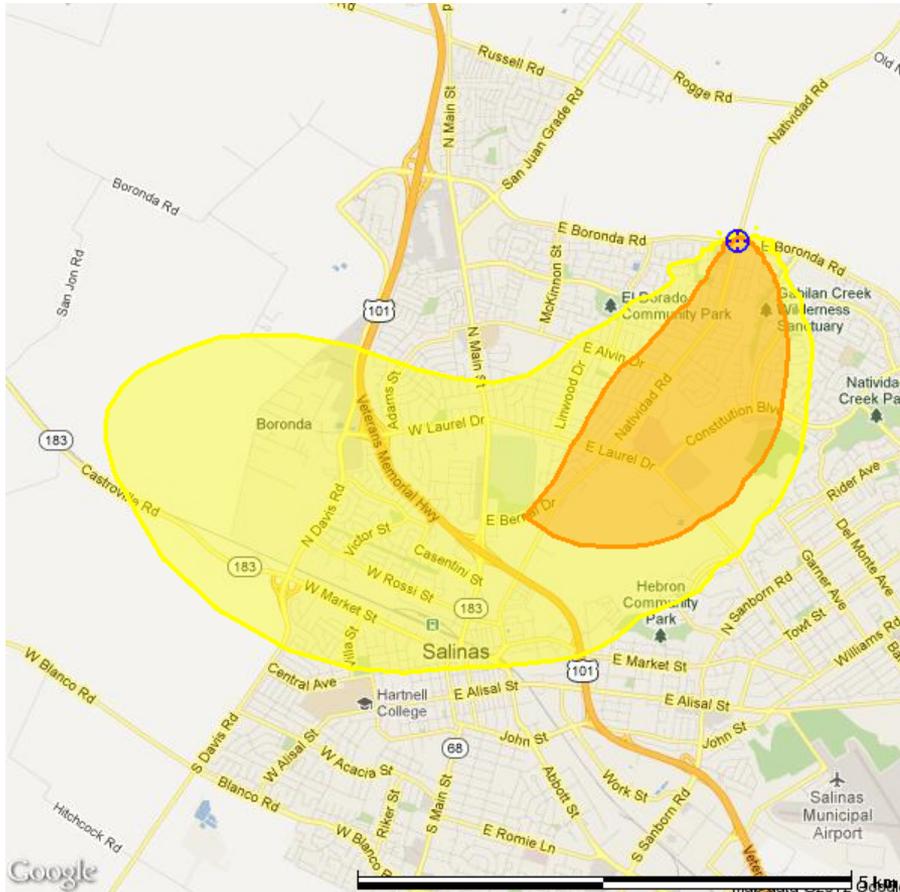
This product identifies areas that could exceed EPA Protective Action Guides (PAG) dose threshold limits at which specific protective or mitigating actions should be considered.

- The TED includes effects from radioactive material:**
1. Inhaled and retained in the body (inhalation) from plume passage and resuspension of deposited material
 2. Carried in the air (cloudshine) from plume passage,
 3. Deposited onto the surface (groundshine).

Map Size: 9.2 km by 9.2 km Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

PAGs are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations.

Early Phase Thyroid CDE (0-96 hrs)
 (Thyroid Committed Dose Equivalent Including Plume Passage)



Early Phase Dose		
Description	(rem) Extent Area	Population
Exceeds 25 rem thyroid dose.	>25 3.6km 4.5 km2	11,000
Exceeds 5 rem thyroid dose.	>5 6.8km 19.6 km2	39,600

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

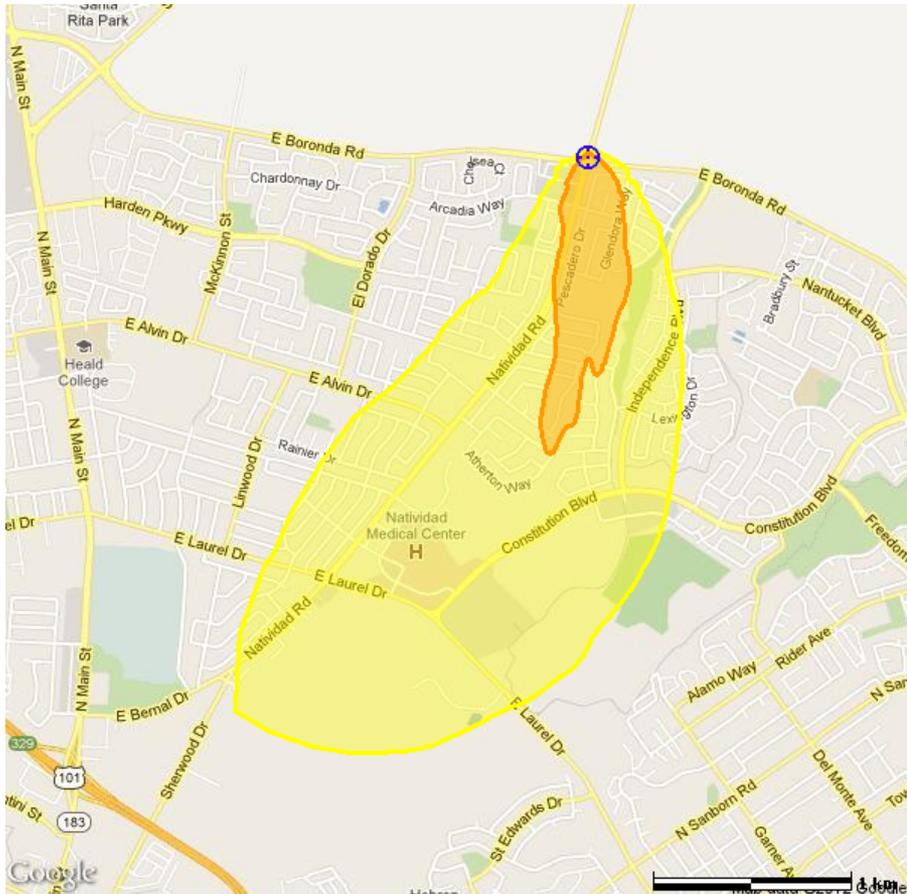
Effects or contamination from June 30, 2011 13:00 UTC to July 04, 2011 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133 + XE-133
 Generated On: September 27, 2012 15:49 UTC
 Model: ADAPT/LODI
 Comments: Doses shown are total accumulated from the beginning of release.

This product identifies areas that could exceed The PAG for evacuation, which is expressed in terms of the projected committed dose equivalent to the thyroid from inhalation of radioactive materials from exposure and intake during the first 4 days of the release.
Note: Inhalation effects due to resuspension of deposited material are included.

Map Size: 9.2 km by 9.2 km Id: Production3.rcE15151.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

PAGs are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations.

Early Phase Evac Shelter TED (12-108 hrs)
 (Evacuation/Sheltering based on Avoidable Total Effective Dose)



Map Size: 4.6 km by 4.6 km Id: Production3.rcE15151.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Early Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose (upper limit early phase PAG for evacuation/sheltering.)	>5 1.5km 0.4 km2	1,330
	Exceeds 1 rem total effective dose (lower limit early phase PAG for evacuation/sheltering.)	>1 3.4km 4.2 km2	10,500
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

Effects or contamination from July 01, 2011 01:00 UTC to July 05, 2011 01:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133 + XE-133
 Generated On: September 27, 2012 15:49UTC
 Model: ADAPT/LODI
 Comments: Doses shown are accrued after 07/01/2011 01:00:00 UTC and can be avoided by protective actions

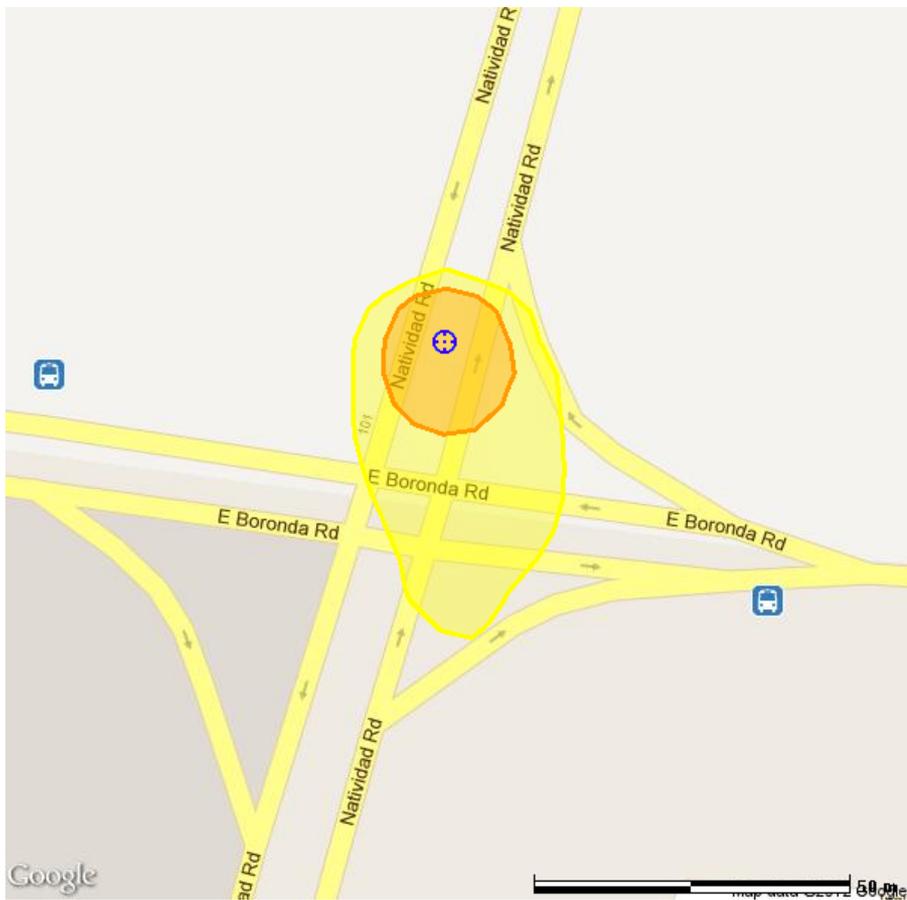
This product shows the dose that may be avoided if shelter and evacuation guidance based on EPA/DHS guidelines for the Early Phase (assumes 4 day duration) is followed.

The TED includes effects from radioactive material:

1. Inhaled and retained in the body (inhalation) from plume passage and resuspension of deposited material
2. Carried in the air (cloudshine) from plume passage,
3. Deposited onto the surface (groundshine).

Evacuation/shelter areas correspond to minimum and maximum evacuation/sheltering thresholds of 1 and 5 rem respectively, however some areas may not be shown if projected doses are not high enough to reach these threshold levels.

Early Phase Evac Shelter Thyroid CDE (12-108 hrs)
 (Evacuation/Sheltering based on Avoidable Thyroid Committed Dose Equivalent)



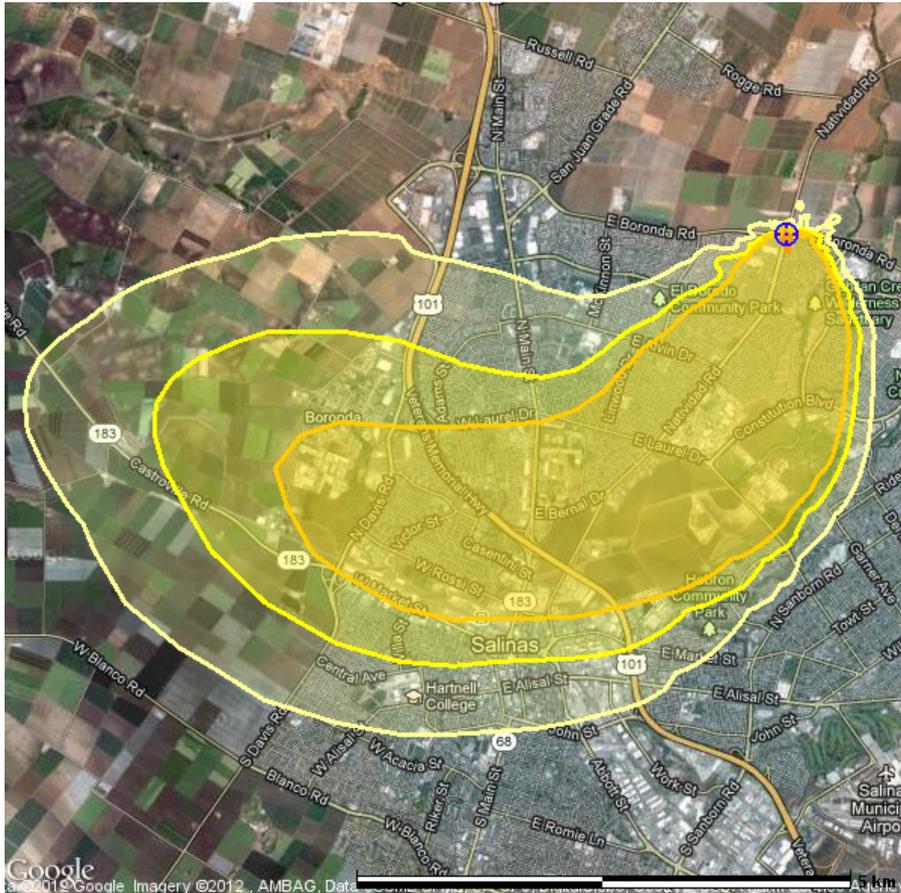
Early Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds 25 rem thyroid dose (upper limit early phase PAG for evacuation/sheltering.)	>25 14.8km 350 m2	0
	Exceeds 5 rem thyroid dose (lower limit early phase PAG for evacuation/sheltering.)	>5 47.7km 1,474 m2	0
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

Effects or contamination from July 01, 2011 01:00 UTC to July 05, 2011 01:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133 + XE-133
 Generated On: September 27, 2012 15:49UTC
 Model: ADAPT/LODI
 Comments: Doses shown are accrued after 07/01/2011 01:00:00 UTC and can be avoided by protective actions

This product shows the dose that may be avoided if shelter and evacuation guidance based on EPA/DHS guidelines for the Early Phase (assumes 4 day duration) is followed.
Note: Inhalation effects due to resuspension of deposited material are included.

Map Size: 4.6 km by 4.6 km Id: Production3.rcE15151.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

KI Administration Based on FDA (2001)
 (Thyroid CDE from Radioiodine)



Early Phase Dose and Actions		
Description	(rem) Extent Area	Population
Adult thyroid CDE - Early Phase FDA Guidance for KI administration to adults over 40.	>500 0.2km 0.008 km2	10
Adult thyroid CDE - Early Phase FDA Guidance for KI administration to adults under 40.	>10 5.8km 12.7 km2	30,500
Adult thyroid CDE - Early Phase FDA Guidance for KI administration to pregnant or lactating females.	>5 6.8km 19.6 km2	39,500
Child thyroid CDE - Early Phase PAG for KI administration to children under 18.	>5 8.0km 33.1 km2	64,000

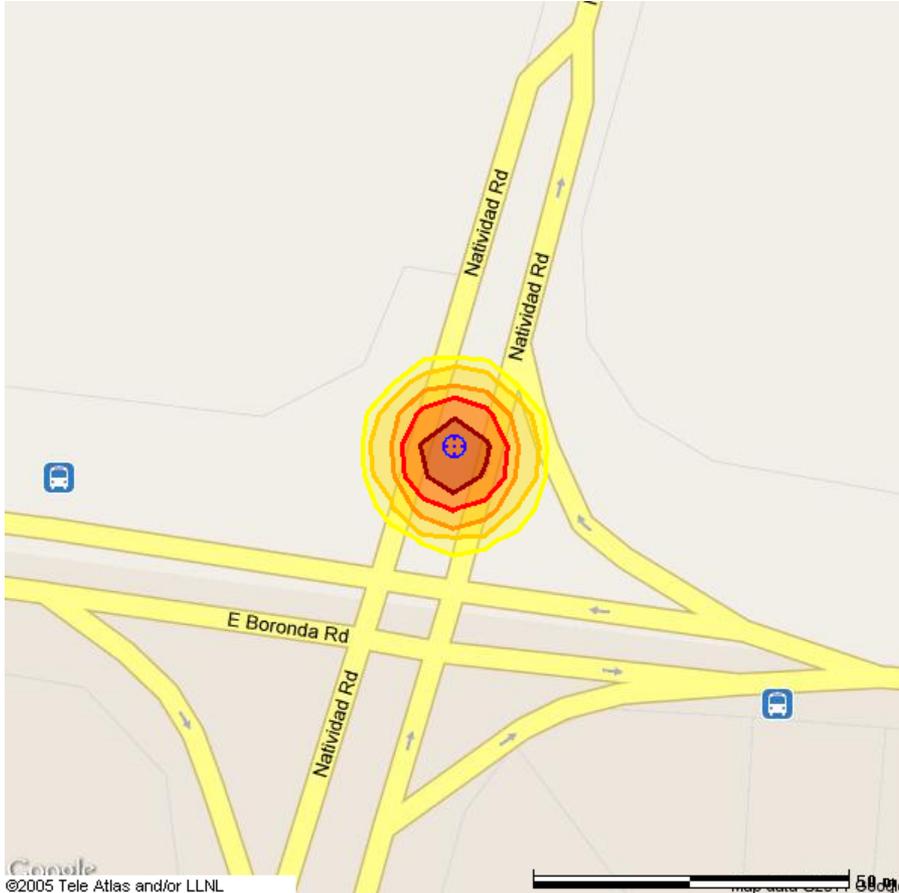
Areas and counts in the table are cumulative. Population Source = LandScanUSA10NARAC9.

Effects or contamination from June 30, 2011 13:00 UTC to July 04, 2011 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: I-133
 Generated On: October 17, 2012 18:43 UTC
 Model: ADAPT/LODI
 Comments: Doses shown are total accumulated from the beginning of release.
 Hypothetical release

In the event that radioiodines are released into the atmosphere, the child PAG level is based on the projected dose to a child's thyroid which may be reduced by administering of potassium iodide. Additional levels for adults based on guidance from the U.S. Food and Drug Administration are also shown.

Map Size: 9.2 km by 9.2 km Id: Beta.rcE17326.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Worker Protection Dose Rate at 12 hrs (Near Field)
 (Groundshine and Air Immersion Dose Rate at 07/01/2011 01:00:00 UTC)



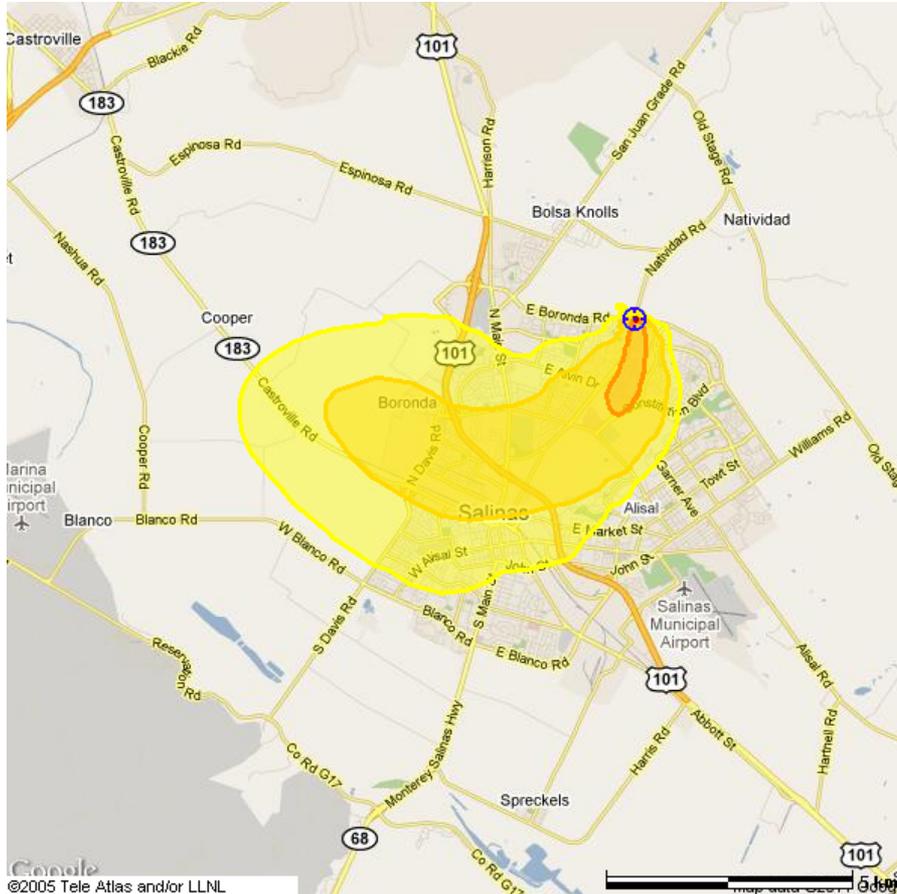
Exposure Limits			
	Description	(rem/hr) Extent Area	Population
	Four times PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>100 7.4m 100.0 m2	0
	Twice PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>50 10.4m 250 m2	0
	PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>25 13.2m 325 m2	0
	PAG for protection of major property needed for public welfare exceeded by exposure for 1 hour or less.	>10 15.3m 525 m2	0
	Limit for all occupational exposures exceeded by exposure for 1 hour or less.	>5 17.4m 650 m2	0

- This product identifies the location of the EPA/DHS's protective guideline threshold dose limits assuming a 1-hour stay time for unprotected workers performing various administrative, investigative, and life and property protecting emergency services.
- Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population.

Map Size: 144 m by 144 m Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Worker limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects.

Worker Protection Dose Rate at 12 hrs (Far Field)
(Groundshine and Air Immersion Dose Rate at 07/01/2011 01:00:00 UTC)



Exposure Limits			
	Description	(mrem/hr) Extent Area	Population
	Limit for all occupational exposures exceeded by exposure for 30 minutes or less.	>10,000 0.02km 0.0005 km2	0
	Limit for all occupational exposures exceeded by exposure for 5 hours or less.	>1,000 0.04km 0.002 km2	0
	Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>100 2.0km 0.9 km2	2,070
	NCRP radiological control boundary.	>10 6.6km 15.8 km2	27,300
	Limit for NRC public exclusion zone exceeded by exposure for 1 hour or less.	>2 8.3km 36.3 km2	74,000

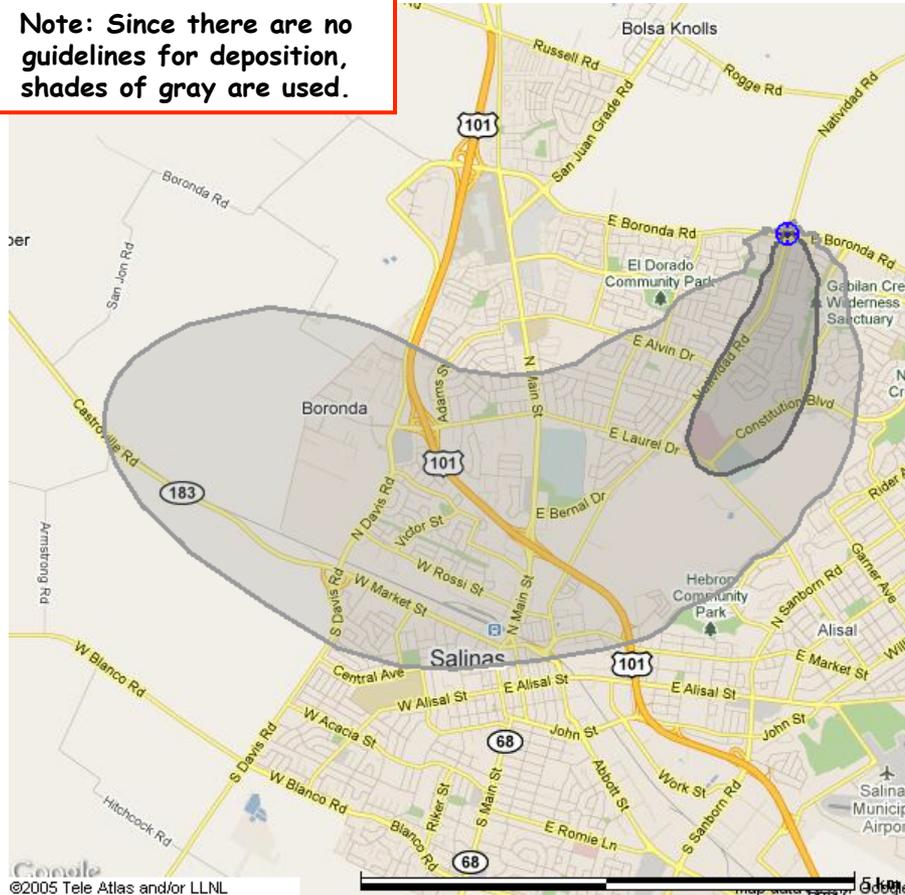
- This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services.
- Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population.

Map Size: 18.4 km by 18.4 km Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Worker limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects.

Deposition at 12 hrs
 (Surface Contamination from Deposited Radionuclides)

Note: Since there are no guidelines for deposition, shades of gray are used.



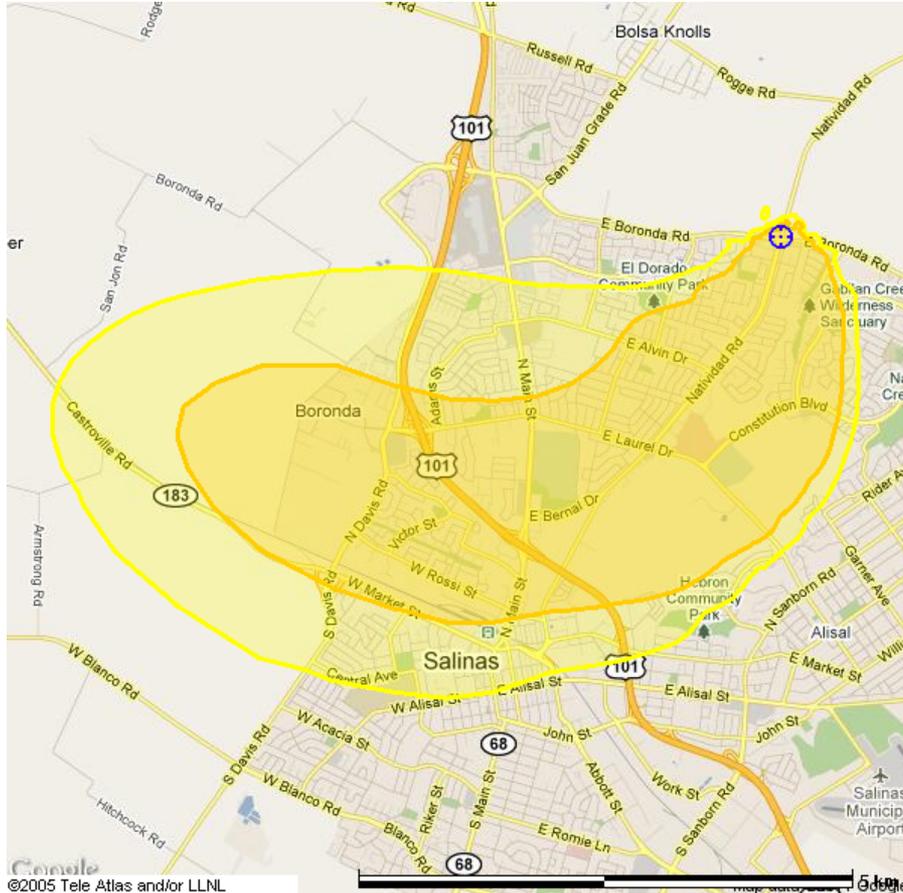
Concentration Levels			
	Description	(uCi/m2) Extent Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>1,00E7 0.01km 0.0002 km2	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>10,000 2.6km 1.8 km2	3,820
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>1,000 7.2km 21.2 km2	36,100
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.			

Effects or contamination at July 01, 2011 01:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133
 Generated On: July 01, 2011 21:19 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

- This product identifies the more highly contaminated areas due to fallout and deposition of the radioactive material.
- Depending upon the type of radiation emitted, deposited material may continue to give significant doses to individuals in these areas through inhalation of resuspended radioactive material or from direct external radiation.
- Areas of deposited radioactivity should be confirmed by monitoring surveys.

Map Size: 9.2 km by 9.2 km Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Intermediate Phase Relocation PAGs
 (Relocation based on Avoidable Groundshine and Resuspension Dose)



Intermediate Phase Dose		
Description	(rem) Extent Area	Population
Exceeds first-year relocation PAG (12 hrs to 1 yr 12 hrs).	>2 6.5km 15.0 km ²	32,200
Exceeds second-year relocation PAG.	>0.5 7.7km 28.7 km ²	57,800

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.

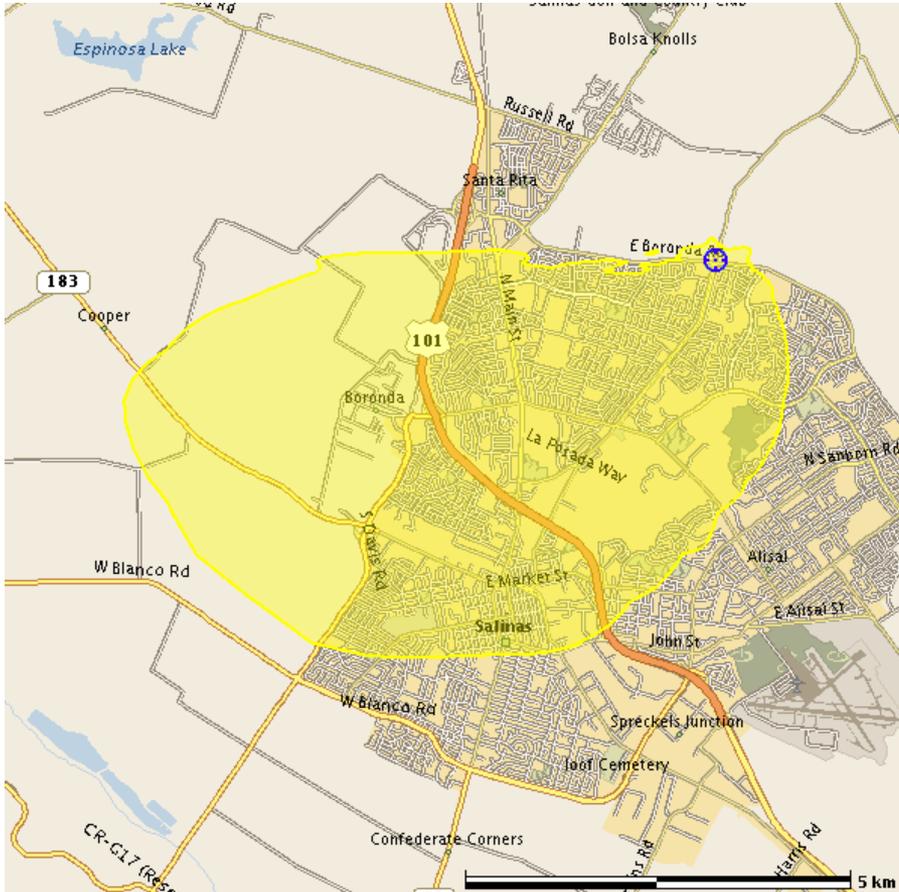
Effects or contamination from June 30, 2011 13:00 UTC to July 01, 2012 01:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133
 Generated On: July 01, 2011 21:19 UTC
 Model: ADAPT/LODI
 Comments: Doses shown are accrued after 07/01/2011 01:00:00 UTC and can be avoided by protective actions

- This product identifies areas that exceed long-term EPA-developed threshold dose limits or objectives at which extended relocation of the general population, or other mitigating actions, should be considered.
- The projected doses are a result of radiation produced from deposited material.
- Effects due to weathering and resuspension of deposited material are included in this calculation.

Map Size: 9.2 km by 9.2 km Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Contour values are based on an assessment of the risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations.

Intermediate Phase Dose
 (Based on Avoidable Groundshine and Resuspension Dose 12hr-50yr)



Intermediate Phase Dose		
Description	(rem) Extent Area	Population
Exceeds 5 rem dose.	>5 8.0km 34.4 km ²	66,300
Areas and counts in the table are cumulative. Population Source = LandScanUSA10NARAC9.		

Effects or contamination from July 01, 2011 01:00 UTC to June 30, 2061 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137 + I-133
 Generated On: September 27, 2012 15:49 UTC
 Model: ADAPT/LODI
 Comments: Doses shown are accrued after 07/01/2011 01:00:00 UTC and can be avoided by protective actions
 Hypothetical release

- This product identifies areas in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over an extended period.
- The projected doses are a result of radiation produced from deposited material.
- Effects due to weathering and resuspension of deposited material are included in this calculation.

Map Size: 11.8 km by 11.8 km Id: Production3.rcE15151.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

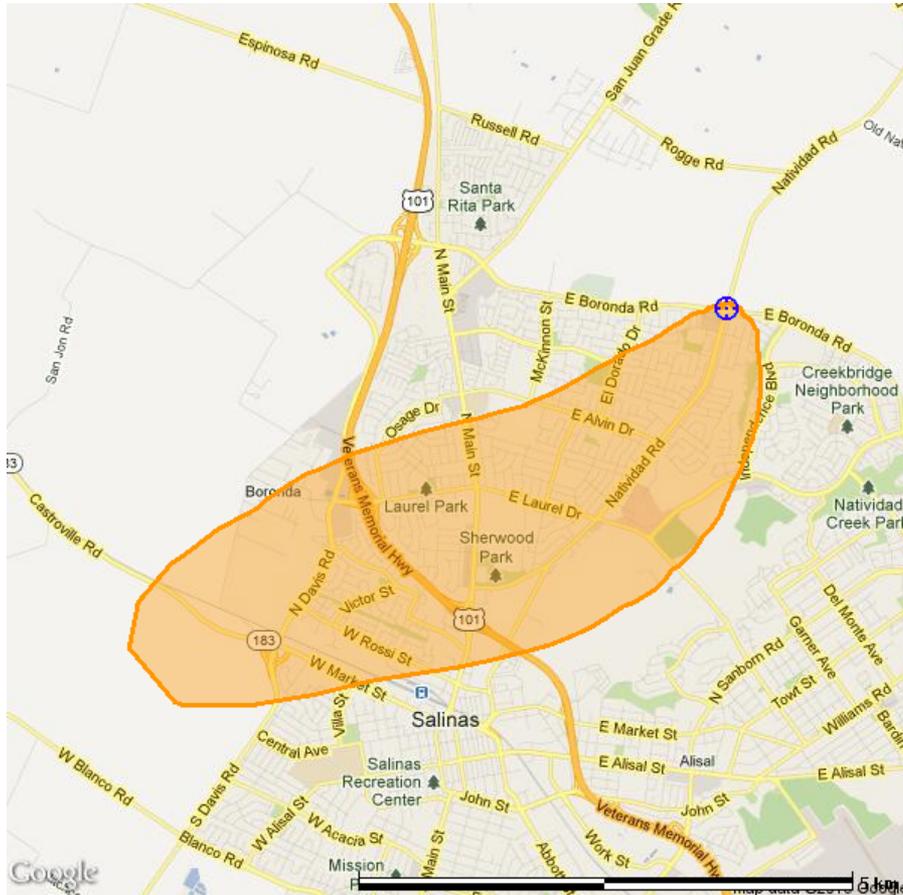
Additional Plot Included in Default Plot Types for NPP Radiological Release



<i>Release Type</i>	<i>Plot Type (Plot Subtitle)</i>	<i>Contour Values</i>
NPP Radiological Release	11 – KI Administration Based on EPA (1992)* (Thyroid CDE from Radioiodine)	25 rem (adult)

* Default plot sets for Nuclear Power Plant (NPP) radiological release scenarios include two plots for KI administration: one based on the newer (2001) FDA guidelines (shown as plot #5 of the radiological set), as well as one based on the older (1992) EPA PAG Manual, which continues to be widely used by NRC licensees, FEMA, and other organizations.

KI Administration Based on EPA (1992)
 (Thyroid CDE from Radioiodine)



Early Phase Dose and Actions		
Description	(rem) Extent Area	Population
EPA early phase PAG for administering stable iodine (with state agreement).	>25 7.0km 14.3 km ²	33,300
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0.		

Effects or contamination from June 30, 2011 13:00 UTC to July 04, 2011 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: I-131
 Generated On: April 25, 2013 15:31 UTC
 Model: ADAPT//LODI
 Comments: Doses shown are total accumulated from the beginning of release.
 Hypothetical release starting at 06/30/2011 13:00:00 UTC for 1 sec
 met obs at 1 hr intervals from 06/30/2011 13:00:00 UTC to 06/30/2011 18:00:00 UTC
 ICRP30 DCF's were used for this plot

In the event that radioiodines are released into the atmosphere, the adult PAG level is based on the projected dose to an adult's thyroid which may be reduced by administering of potassium iodide. This prediction utilizes the older KI guideline cited by EPA (1992) and dose estimation method, which considers only effects on adults, and employs the older FGR11 dose factors and ICRP 23/26/30 dosimetry model.

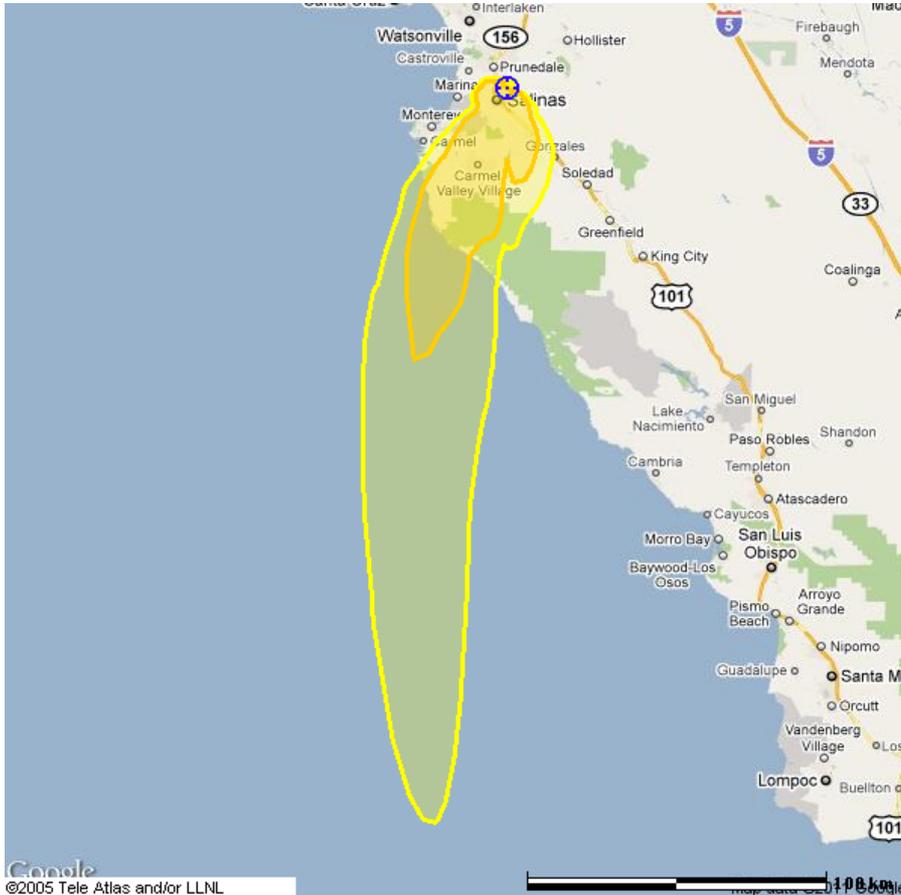
Map Size: 9.2 km by 9.2 km Id: Production.rcE20457.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

Additional Plots Available upon Request: Radiological Release



<i>Release Type</i>	<i>Plot Type (Plot Subtitle)</i>	<i>Contour Values</i>
Radiological Release	12 - Nuclide Areas of Concern for Agricultural Products (Ingestion DRLs Corresponding to FDA DILs)	<i>(nuclide-dependent from FDA)</i>

**Cs-137 Areas of Concern for Agricultural Products
 (Ingestion DRLs Corresponding to FDA DILs)**



Long-Term Effects			
	Description	(pCi/m2) Extent Area	Population
	Potentially exceeds FDA Derived Intervention Level for fresh produce ready for harvest. Further analysis recommended to determine if any embargo is required	>370,000 95.0km 1,881 km2	185,000
	Potentially exceeds FDA Derived Intervention Level for milk (grass-cow-infant). Further analysis recommended to determine if any embargo is required.	>130,000 245km 8,141 km2	200,000

Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination at July 04, 2011 13:00 UTC
 Release Location: 36.715775 N, 121.623420 W
 Material: CS-137
 Generated On: July 05, 2011 20:09 UTC
 Model: ADAPT/LODI
 Comments: Hypothetical release

- This product identifies those areas in which the consumption of a particular food produced in those areas could cause projected doses in excess of the EPA-developed Protective Action Guide (PAG) threshold levels for ingestion.
- It uses radioactivity deposition Derived Response Levels (DRLs) that, if reached, are likely to yield food contamination concentrations that exceed the limiting values established by the Food and Drug Administration Derived Intervention Levels (DILs).

Map Size: 298 km by 298 km Id: Production.rcE18819.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

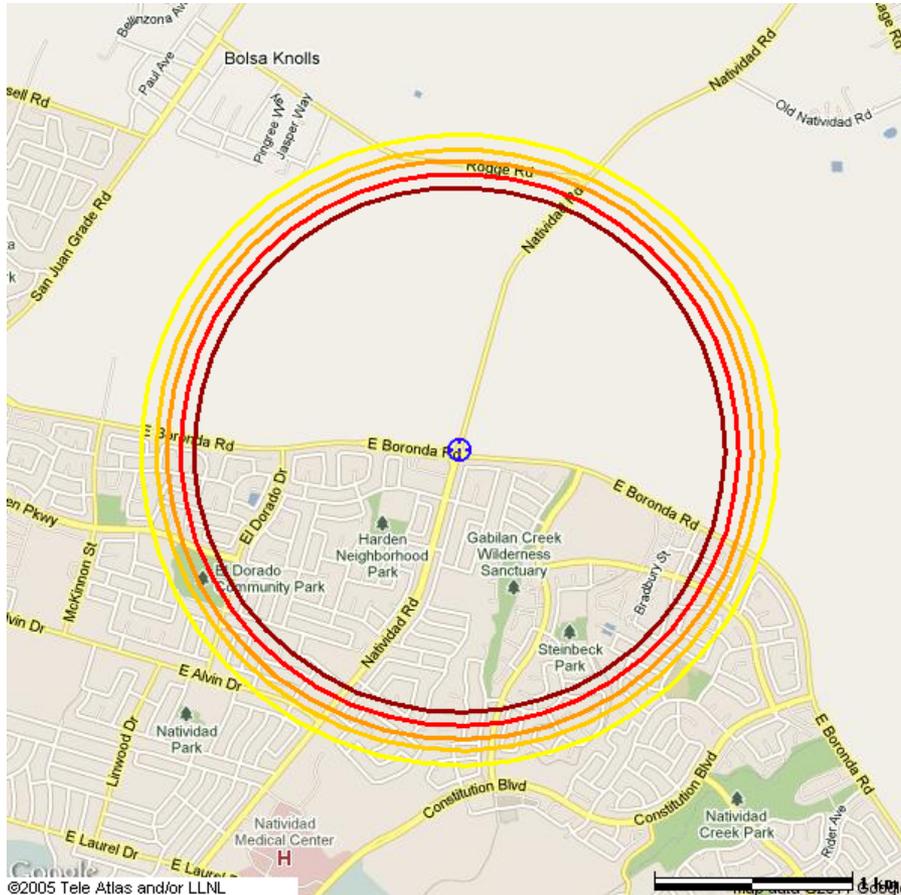
Default Plot Types:

Nuclear Detonation Release



Release Type	Default Plot Type (Plot Subtitle) [MODEL USED]	Contours
Nuclear Yield	<p>1 - Prompt Nuclear Detonation Pop. Effects (Overpressure, Thermal, and Radiation) [SNL NUKE]</p> <p>2 - Prompt Thermal Effects on Personnel (Radial Extent of Thermal Effects) [SNL NUKE]</p> <p>3 - Prompt Nuclear Detonation Heavy Structure Effects (Concrete/Brick-Type Structures) [SNL NUKE]</p> <p>4 - Prompt Nuclear Detonation Light Structure Effects (Residential-Type Structures) [SNL NUKE]</p> <p>5 - Early Fallout Casualties (1-Day Groundshine Dose) [LLNL KDFOC3 or LODI]</p> <p>6 - Early Phase Groundshine Dose (0-96 hrs) (Groundshine Dose Including Plume Passage) [LLNL KDFOC3 or LODI]</p> <p>7 - Early Phase Evac Shelter PAGs (12-108 hrs) (Evacuation/Sheltering based on Avoidable Groundshine) [LLNL LODI <u>only</u>]</p> <p>8 - Worker Protection Dose Rate at 12 hrs (Near Field) (Groundshine Dose Rate at mm/dd/yyyy hh:mm:ss UTC) [LLNL KDFOC3 or LODI]</p> <p>9 - Worker Protection Dose Rate at 12 hrs (Far Field) (Groundshine Dose Rate at mm/dd/yyyy hh:mm:ss UTC) [LLNL KDFOC3 or LODI]</p> <p>10 - Intermediate Phase Relocation PAGs (Relocation based on Avoidable Groundshine Dose) [LLNL LODI <u>only</u>]</p> <p>11 - Intermediate Phase Dose (Based on Avoidable Groundshine Dose 12hr-50yr) [LLNL LODI <u>only</u>]</p>	<p>90/50/10% fatalities & 50/10% casualties</p> <p>1st, 2nd, 3rd degree burns</p> <p>90/50/10% Severe & 50/10% moderate damage</p> <p>90/50/10% Severe o& 50/10% moderate damage</p> <p>90/50/10% fatalities & 50/10% casualties</p> <p>1, 5 rem</p> <p>1, 5 rem</p> <p>5, 10, 25, 50, 100 rem/hr</p> <p>0.002, 0.01, 0.1, 1, 10 rem/hr</p> <p>2 rem 1st yr, 0.5 rem 2nd yr</p> <p>5 rem</p>

Prompt Nuclear Detonation Pop. Effects
 (Overpressure, Thermal, and Radiation)



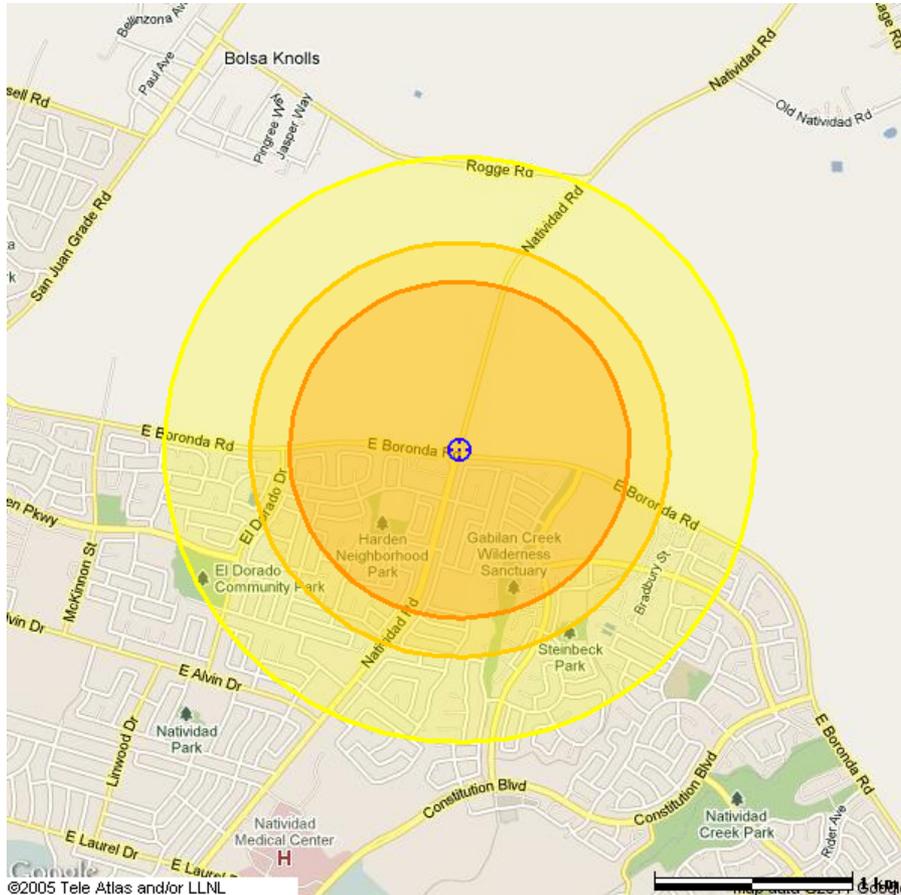
Prompt (Immediate) Effects			
	Description	Extent Area	Population Fatalities Casualties
	Fatalities in over 90% of population from prompt radiation, overpressure, and thermal effects.	1.3km 5.7 km2	8,510 8,450 8,510
	Fatalities in over 50% of population from prompt radiation, overpressure, and thermal effects.	1.4km 6.3 km2	9,620 9,250 9,620
	Fatalities in over 10% of population from prompt radiation, overpressure, and thermal effects.	1.5km 6.9 km2	10,800 9,580 10,700
	Major Injuries in over 50% of surviving population from prompt rad, overpressure, and thermal effects.	1.5km 7.5 km2	11,800 9,620 11,500
	Major Injuries in over 10% of surviving population from prompt rad, overpressure, and thermal effects.	1.6km 8.2 km2	13,300 9,630 11,800
Areas and counts in the table are cumulative. Casualties include both Fatal and Non-Fatal effects. Population Source = LandScan USA V1.0, LandScan2005.			

• Estimates of immediate blast overpressure, thermal, and radiation are calculated using a probit analysis and assume that the entire population is outdoors.

• This product provides estimates of the total number of people exposed, number of fatalities, and combined number of fatal and non-fatal casualties.

Map Size: 4.6 km by 4.6 km Id: Production.rcE18822.rc1
 NARAC Operations: (onDuty Assessor); narak@lml.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Prompt Thermal Effects on Personnel
 (Radial Extent of Thermal Effects)



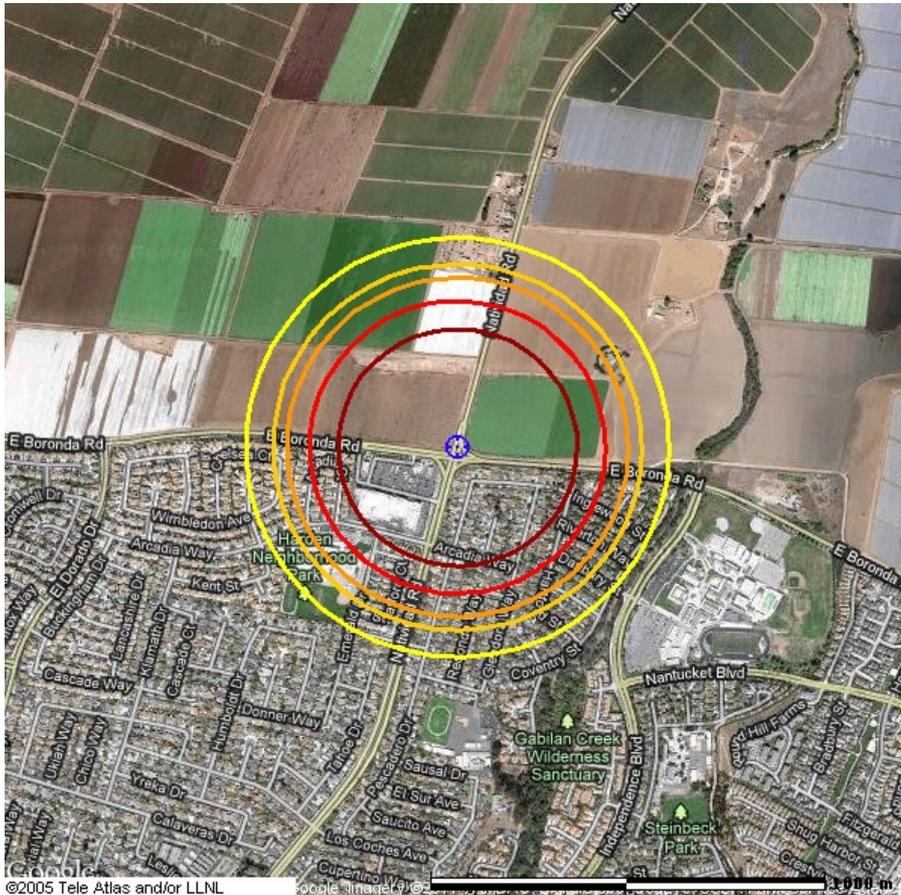
Prompt (Immediate) Effects			
	Description	(cal/cm ²) Extent Area	Population
	Third degree burns in exposed population. Survivability of direct exposure is expected to be possible only in the outer areas of this region	>7 0.9km 2.3 km ²	2,800
	Onset of second degree burns in exposed population.	>4.6 1.1km 3.6 km ²	4,540
	Onset of first degree burns in exposed population.	>2.3 1.5km 7.1 km ²	11,100
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0, LandScan2005.			

• These contours show where an individual's exposed skin is expected to receive the indicated type of skin burn. Within a given contour, the area of exposed skin expected to receive burns at the indicated level will be greater for individuals closer to the detonation.

• In the second and third degree burn areas, a portion of exposed skin will receive the highest degree burn indicated, and the remainder of directly exposed skin will receive lesser degree burns.

Map Size: 4.6 km by 4.6 km Id: Production.rcE18822.rcC1
 NARAC Operations: (onDuty Assessor); narac@lrl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

**Prompt Nuclear Detonation Heavy Structure Effects
 (Concrete/Brick-Type Structures)**



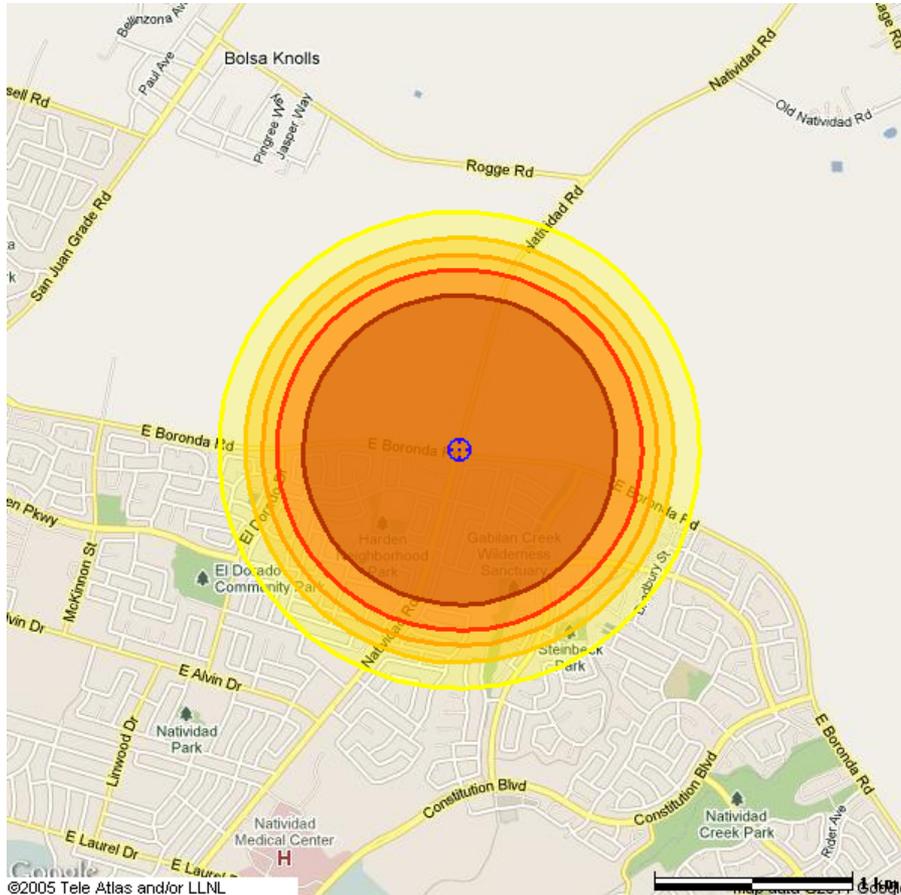
Prompt (Immediate) Effects		
Description	(psi) Extent Area	Population
Severe damage to over 90% of Heavy Buildings.	>54.6 304m 289,973 m2	320
Severe Damage to over 50% of Heavy Buildings.	>33.5 375m 441,980 m2	530
Moderate Damage to over 50% of Heavy Buildings.	>24.2 434m 592,782 m2	690
Severe Damage to over 10% of Heavy Buildings.	>20.5 469m 691,806 m2	850
Moderate Damage to over 10% of Heavy Buildings.	>15.5 538m 910,040 m2	1,140

Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0, LandScan2005.

Building effects are estimated using a probit analysis to specify the percentages of heavy buildings that suffer given levels of damage due to the overpressure effects produced by detonation of a nuclear device.

Map Size: 2.3 km by 2.3 km Id: Production.rcE18822.rc1
 NARAC Operations: (onDuty Assessor); narak@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

**Prompt Nuclear Detonation Light Structure Effects
 (Residential-Type Structures)**

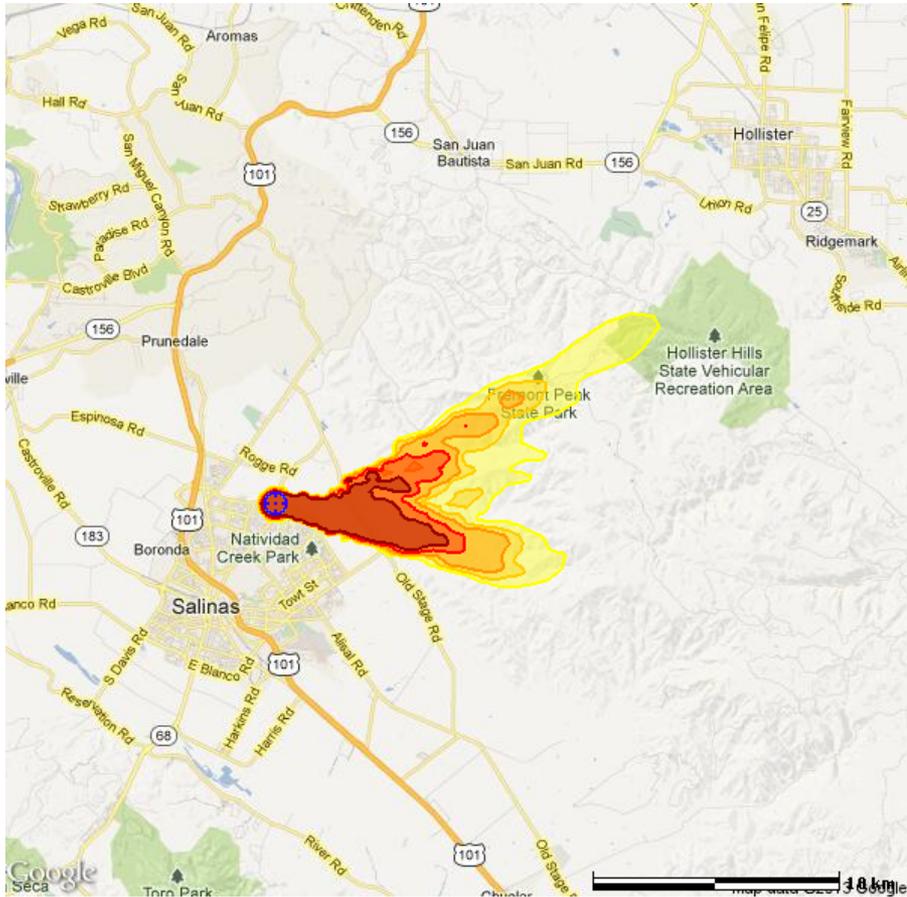


Prompt (Immediate) Effects			
	Description	(psi) Extent Area	Population
	Severe damage to over 90% of Light Buildings.	>7.4 0.8km 2.0 km2	2,310
	Severe Damage to over 50% of Light Buildings.	>5.7 0.9km 2.7 km2	3,310
	Moderate Damage to over 50% of Light Buildings.	>5.0 1.0km 3.2 km2	4,050
	Severe Damage to over 10% of Light Buildings.	>4.4 1.1km 3.7 km2	4,780
	Moderate Damage to over 10% of Light Buildings.	>3.7 1.2km 4.7 km2	6,340
Areas and counts in the table are cumulative. Population Source = LandScan USA V1.0, LandScan2005.			

Building effects are estimated using a probit analysis to specify the percentages of residential-type buildings that suffer given levels of damage due to the overpressure effects produced by a nuclear device detonation.

Map Size: 4.6 km by 4.6 km Id: Production.rcE18822.rc1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925-422-1867}
 Approved by: {NARAC Operations; NARAC}

Early Fallout Casualties
 (1-Day Groundshine Dose)

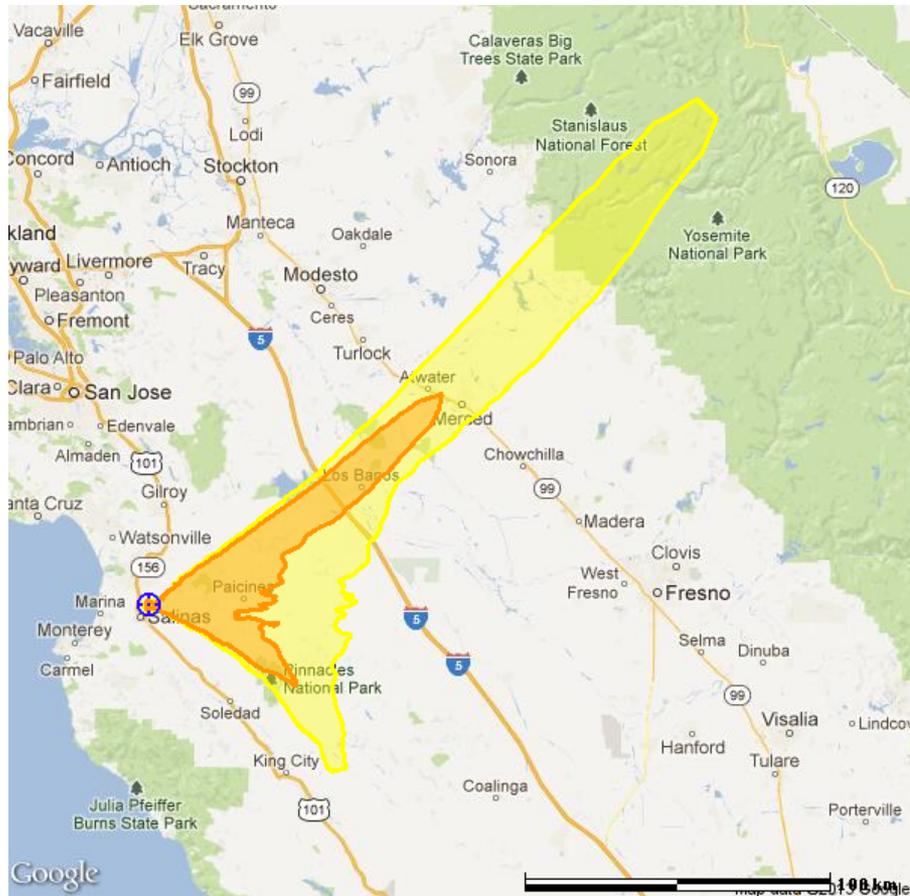


Map Size: 36.8 km by 36.8 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

Acute (Short-Term) Effects			
	Description	(rad) Extent Area	Population
	Fatalities in over 90% of Population.	>450 7.1km 10.2 km2	390
	Fatalities in over 50% of Population.	>300 8.4km 16.0 km2	460
	Fatalities in over 10% of Population.	>200 10.9km 25.9 km2	500
	Non-Fatal Injuries/Effects in over 50% of Surviving Population.	>150 12.0km 34.1 km2	540
	Non-Fatal Injuries/Effects in over 10% of Surviving Population.	>100 17.2km 57.6 km2	560
Areas and counts in the table are cumulative. Population Source = LandScan2010.			

- Short-term fatal and non-fatal injurious effects on health, which may occur within days to weeks, are estimated from the projected dose caused by radiation from the material deposited onto the ground surface.
- These short-term (acute) effects are estimated using a probit analysis based on published EPA relationships between comparatively high radiation doses received over short periods.
- Effects due to resuspension of deposited material are not included in this calculation.
- These doses from fallout of larger particles (tens to hundreds of microns) are expected to dominate the total dose received by the nearby population.

**Early Phase Groundshine Dose (0-96 hrs)
 (Groundshine Dose Including Plume Passage)**



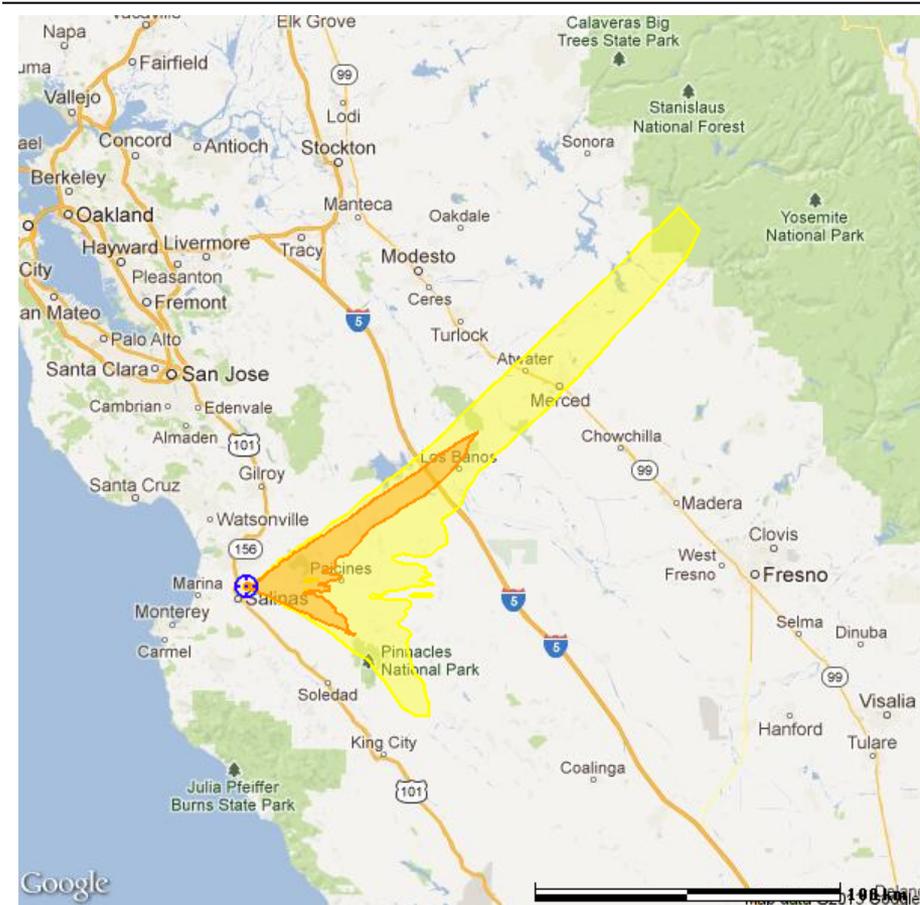
Early Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds 5 rem groundshine dose.	>5 116km 1,760 km ²	77,900
	Exceeds 1 rem groundshine dose.	>1 241km 6,645 km ²	220,000

Areas and counts in the table are cumulative. Population Source = LandScan2010.

- This product identifies areas that may exceed EPA/DHS-developed dose threshold limits at which specific protective or mitigating actions should be considered.
- Note that although these doses are those resulting from only the larger (tens to hundreds of microns) particles, this fallout dose is expected to dominate the total dose received by the nearby population.
- Effects due to resuspension of deposited material are not included in this calculation.

Map Size: 292 km by 292 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

**Early Phase Evac Shelter PAGs (12-108 hrs)
 (Evacuation/Sheltering based on Avoidable Groundshine)**



Early Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds upper limit early phase PAG for evacuation/sheltering.	>5 90.0km 869 km2	17,800
	Exceeds lower limit early phase PAG for evacuation/sheltering.	>1 186km 4,181 km2	152,000
Areas and counts in the table are cumulative. Population Source = LandScan2010.			

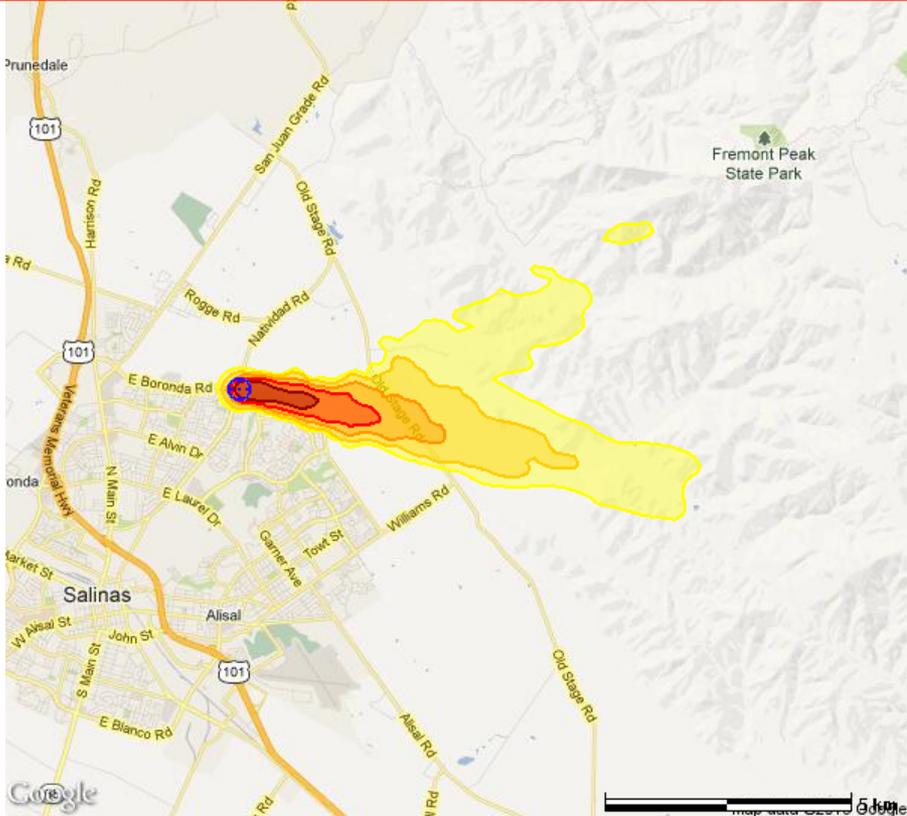
- This product shows the dose that may be avoided if shelter and evacuation guidance based on EPA/DHS guidelines for the Early Phase (assumes 4 day duration) is followed.
- Note that although these doses are those resulting from only the larger (tens to hundreds of microns) particles, this fallout dose is expected to dominate the total dose received by the nearby population.
- Effects due to resuspension of deposited material are not included in this calculation.

Map Size: 293 km by 293 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected dose caused by radiation from the material deposited onto the surface.

**Worker Protection Dose Rate at 12 hrs (Near Field)
 (Groundshine Dose Rate at 07/01/2011 01:00:00 UTC)**

Note that this default product is valid at 12 hours after detonation. Plots can be updated as needed.



Exposure Limits		
Description	(rem/hr) Extent Area	Population
Four times PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>100 1.6km 0.5 km2	20
Twice PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>50 2.9km 1.5 km2	170
PAG for lifesaving and protection of large populations exceeded by exposure for 1 hour or less.	>25 4.3km 3.2 km2	240
PAG for protection of major property needed for public welfare exceeded by exposure for 1 hour or less.	>10 7.0km 7.8 km2	370
Limit for all occupational exposures exceeded by exposure for 1 hour or less.	>5 9.5km 19.4 km2	450

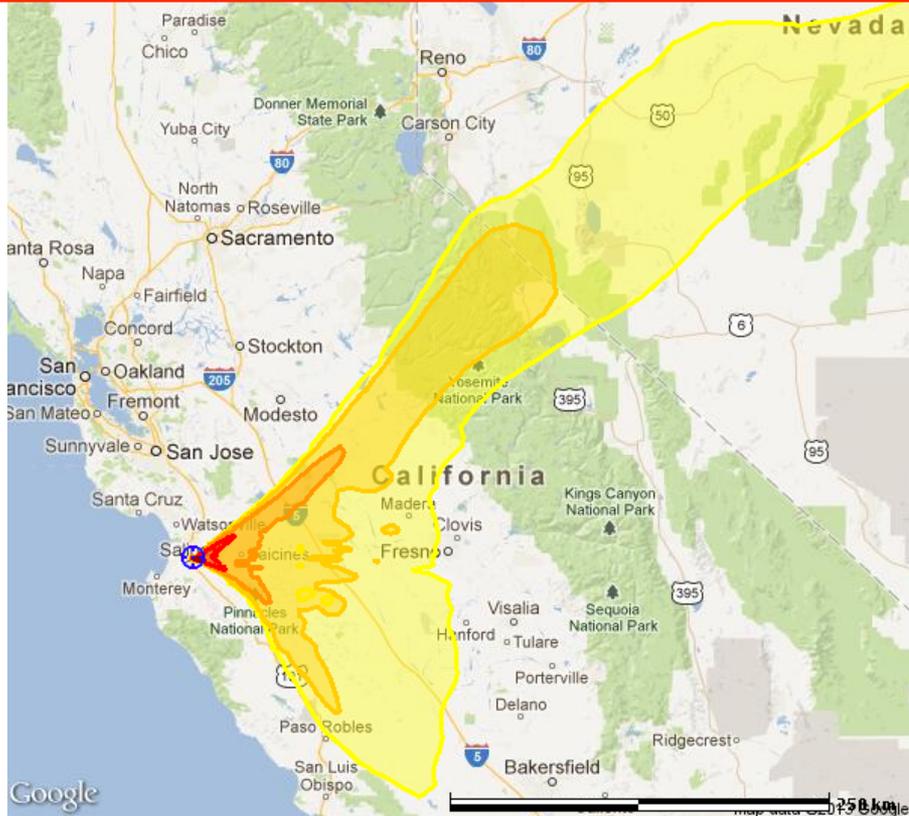
- This product identifies the location of the EPA/DHS's protective guideline threshold dose limits assuming a 1-hour stay time for unprotected workers performing various administrative, investigative, and life and property protecting emergency services.
- These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population.
- This dose rate is calculated from only the external radiation from the deposited material, and does not include effects from the airborne plume or from any potential resuspension of ground-deposited material.

Map Size: 18.4 km by 18.4 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

As a rule of thumb, the predicted dose rate from a nuclear detonation is expected to decrease by a factor of ten for every seven-fold increase in time since the passage of the fallout cloud (e.g. the dose rate at 42 hours after the detonation will be about one-tenth the dose rate at 6 hours after the detonation).

Worker Protection Dose Rate at 12 hrs (Far Field)
 (Groundshine Dose Rate at 07/01/2011 01:00:00 UTC)

Note that this default product is valid at 12 hours after detonation. Plots can be updated as needed.



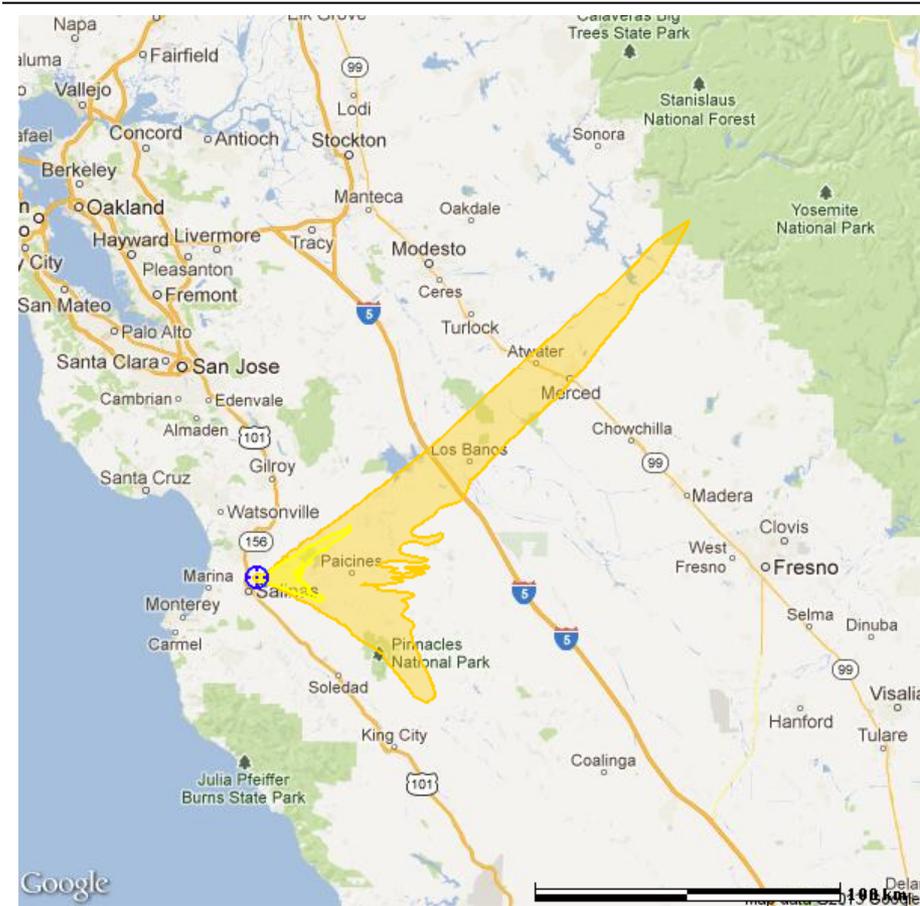
Exposure Limits		
Description	(rem/hr) Extent Area	Population
Limit for all occupational exposures exceeded by exposure for 30 minutes or less.	>10 7.0km 7.8 km2	370
Limit for all occupational exposures exceeded by exposure for 5 hours or less.	>1 30.1km 150 km2	5,020
Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>0.10 119km 1,853 km2	75,800
NCRP radiological control boundary.	>0.01 305km 15,989 km2	263,000
Limit for NRC public exclusion zone exceeded by exposure for 1 hour or less.	>0.002 667km 63,288 km2	600,000

- This product identifies NCRP and NRC administrative control areas, as well as the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services.
- These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population.
- This dose rate is calculated from only the external radiation from the deposited material, and does not include effects from the airborne plume or from any potential resuspension of ground-deposited material.

Map Size: 580 km by 580 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

As a rule of thumb, the predicted dose rate from a nuclear detonation is expected to decrease by a factor of ten for every seven-fold increase in time since the passage of the fallout cloud (e.g. the dose rate at 42 hours after the detonation will be about one-tenth the dose rate at 6 hours after the detonation).

**Intermediate Phase Relocation PAGs
 (Relocation based on Avoidable Groundshine Dose)**



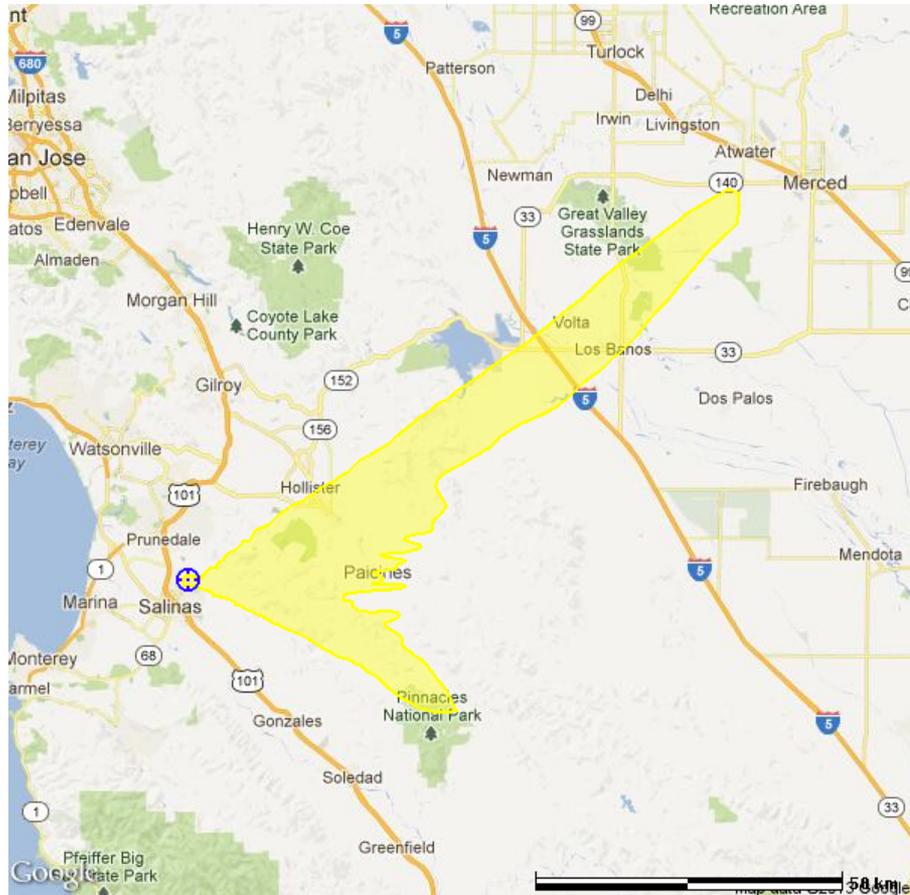
Intermediate Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds second-year relocation PAG.	>0.5 34.5km 176 km2	5,600
	Exceeds first-year relocation PAG (1 day to 1 yr 1 day).	>2 181km 3,339 km2	145,000
Areas and counts in the table are cumulative. Population Source = LandScan2010.			

- This product identifies areas that exceed long-term EPA-developed threshold dose limits or objectives at which extended relocation of the general population, or other mitigating actions, should be considered.
- The projected doses are a result of radiation produced from deposited material.
- Effects due to resuspension of deposited material are NOT included in this calculation.

Map Size: 293 km by 293 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

Contour values are based on an assessment of the risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations.

**Intermediate Phase Dose
 (Based on Avoidable Groundshine Dose 12hr-50yr)**



Intermediate Phase Dose			
	Description	(rem) Extent Area	Population
	Exceeds 5 rem dose.	>5 109km 1,468 km2	57,900
Areas and counts in the table are cumulative. Population Source = LandScan2010.			

- This product identifies areas in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over an extended period.
- The projected doses are a result of radiation produced from deposited material.
- Effects due to resuspension of deposited material are NOT included in this calculation.

Map Size: 147 km by 147 km Id: Production.rcE20445.rcC1
 NARAC Operations: (onDuty Assessor); narac@lnl.gov; 925-424-6465
 Requested by: {Connee Foster (mgr); NARAC -- Operations; 925.422.0708}
 Approved by: {NARAC Operations; NARAC}

Additional Plots Available upon Request: Nuclear Detonation Release



<i>Release Type</i>	<i>Plot Type</i> (Plot Subtitle) [<i>MODEL USED</i>]	<i>Contour Values</i>
Nuclear Yield	Dose from Ingestion expressed as Derived Response Level [DRL] (FDA Derived Intervention Level) [<i>LLNL LODI</i>]	From FDA