SAND2011-2012P

Support to NEMA Exercise:

Magnitude 9.0 Cascadia Earthquake and Tsunami Quick Turn-around Analysis using SUMMIT and FastMap

March 24, 2011

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Analysis Pedigree

Data Sources:

- Inundation data: NOAA Method Of Splitting Tsunamis (MOST) model, Center for Tsunami Research
- Earthquake shake data: USGS ShakeMap
- Earthquake damage effects (casualties, buildings, critical infrastructure) and zones: FEMA HAZUS
- Critical infrastructure data: HSIP Gold
- Population data: LandScanUSA 2008

Model and Data Integration: Standard Unified Modeling, Mapping and Integration Toolkit (SUMMIT, PM: DHS S&T Jalal Mapar)

- Medical surge requirements: HHS/AHRQ Surge Model
- Critical infrastructure impacts: Sandia Critical Infrastructure Effects Model

Critical infrastructure impacts: Sandia FastMap Model

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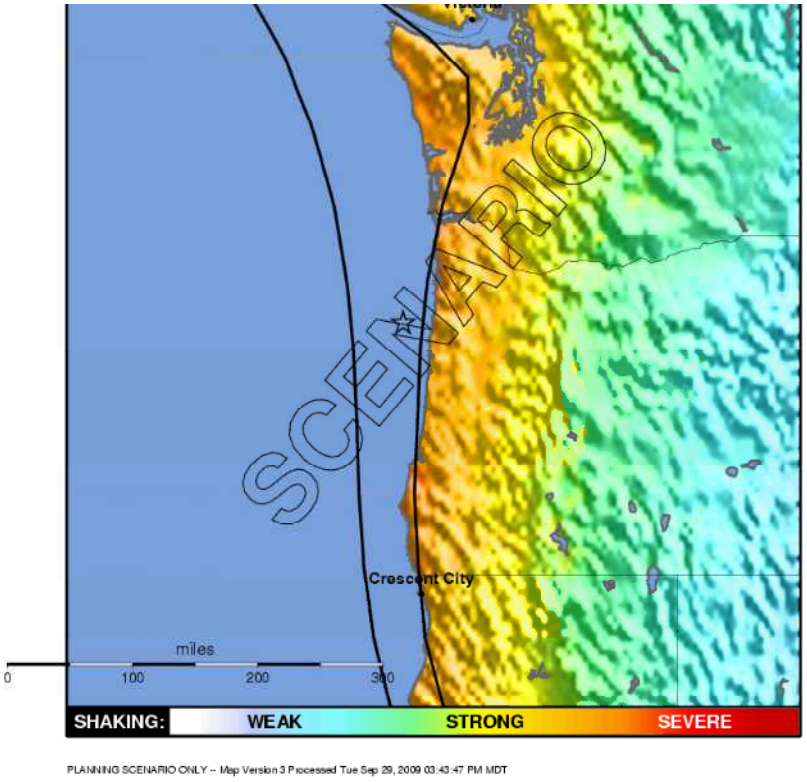
Analysis Scenario and Summary Results

Scenario: Magnitude 9.0 earthquake along the Cascadia fault 25 miles west of Salem, Oregon and ensuing tsunami*

- Data on, and visualization of, three inundation zones and affected critical infrastructure
  - Inundation calculated for 3 heavily impacted outer coastal locales
- Data on, and visualization of, earthquake damage zones and affected critical infrastructure
- Medical surge requirements resulting from earthquake damage (does not account for tsunami impact)



*USGS-calculated earthquake scenario: http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/Casc9.0_se/#download; NOAA-calculated tsunami scenario

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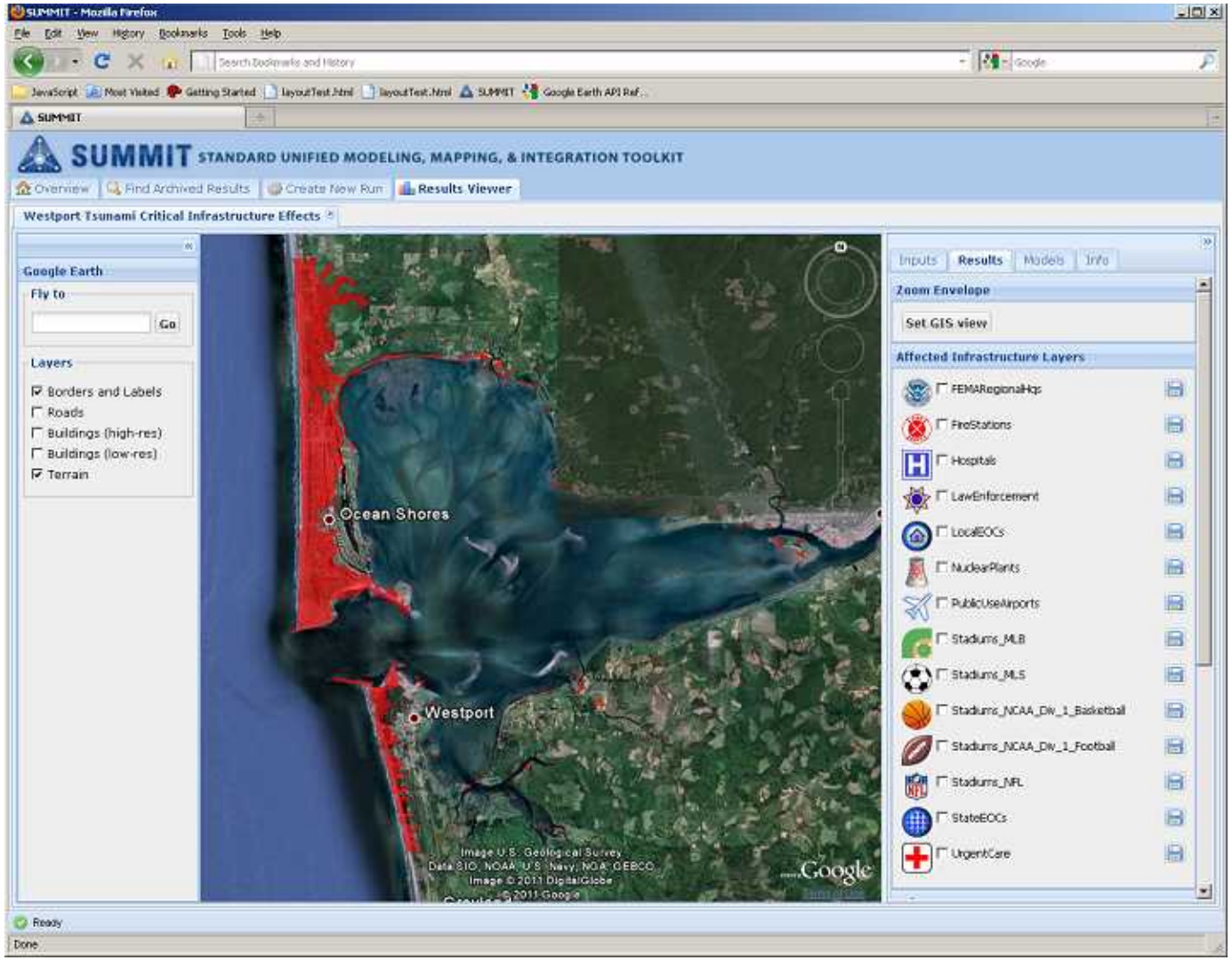
Inundation Effects

Inundation Zones for Three Heavily Impacted Outer Coastal Locales: 1. Westport, WA



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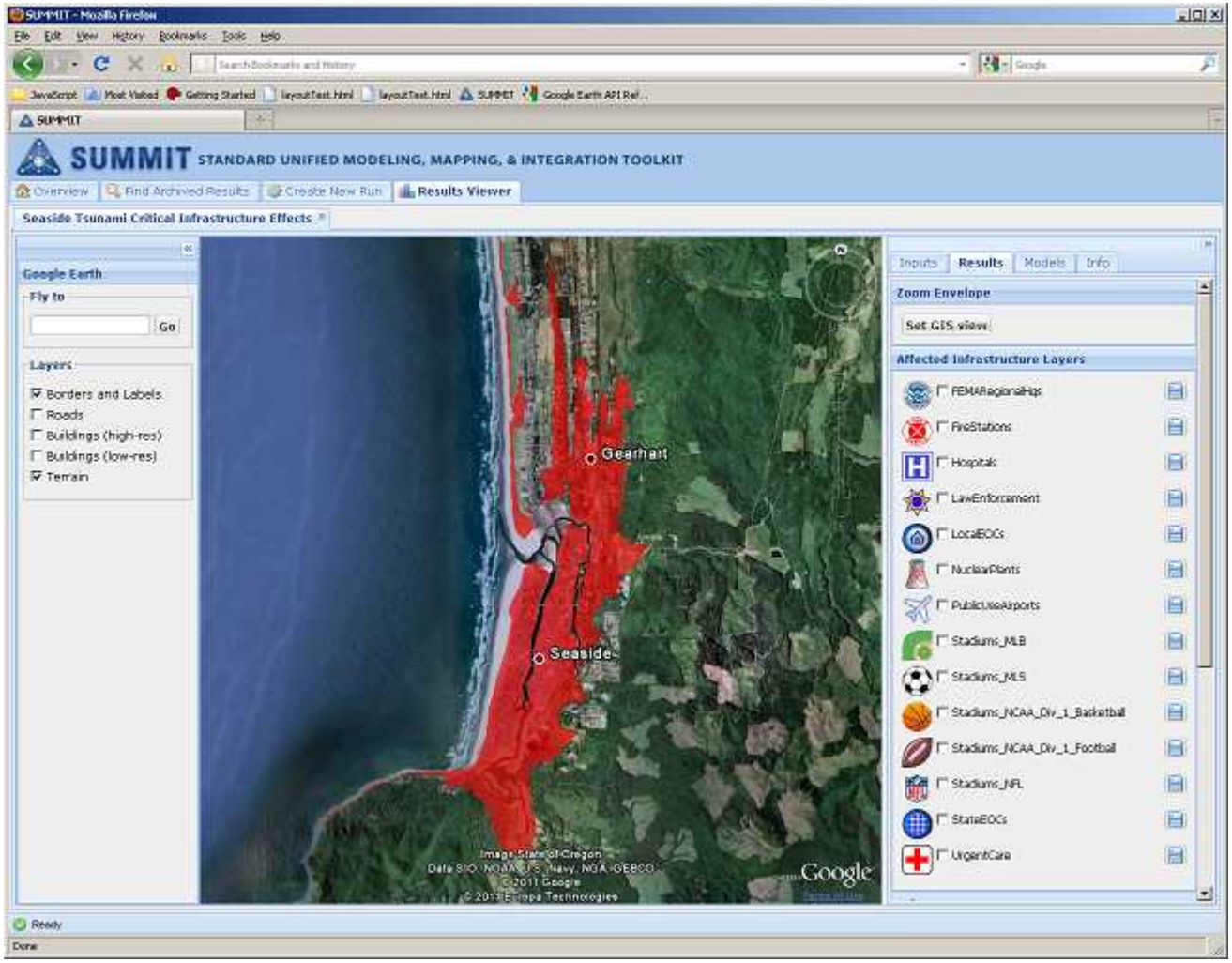
Inundation Zones for Three Heavily Impacted Outer Coastal Locales: 2. Seaside, OR



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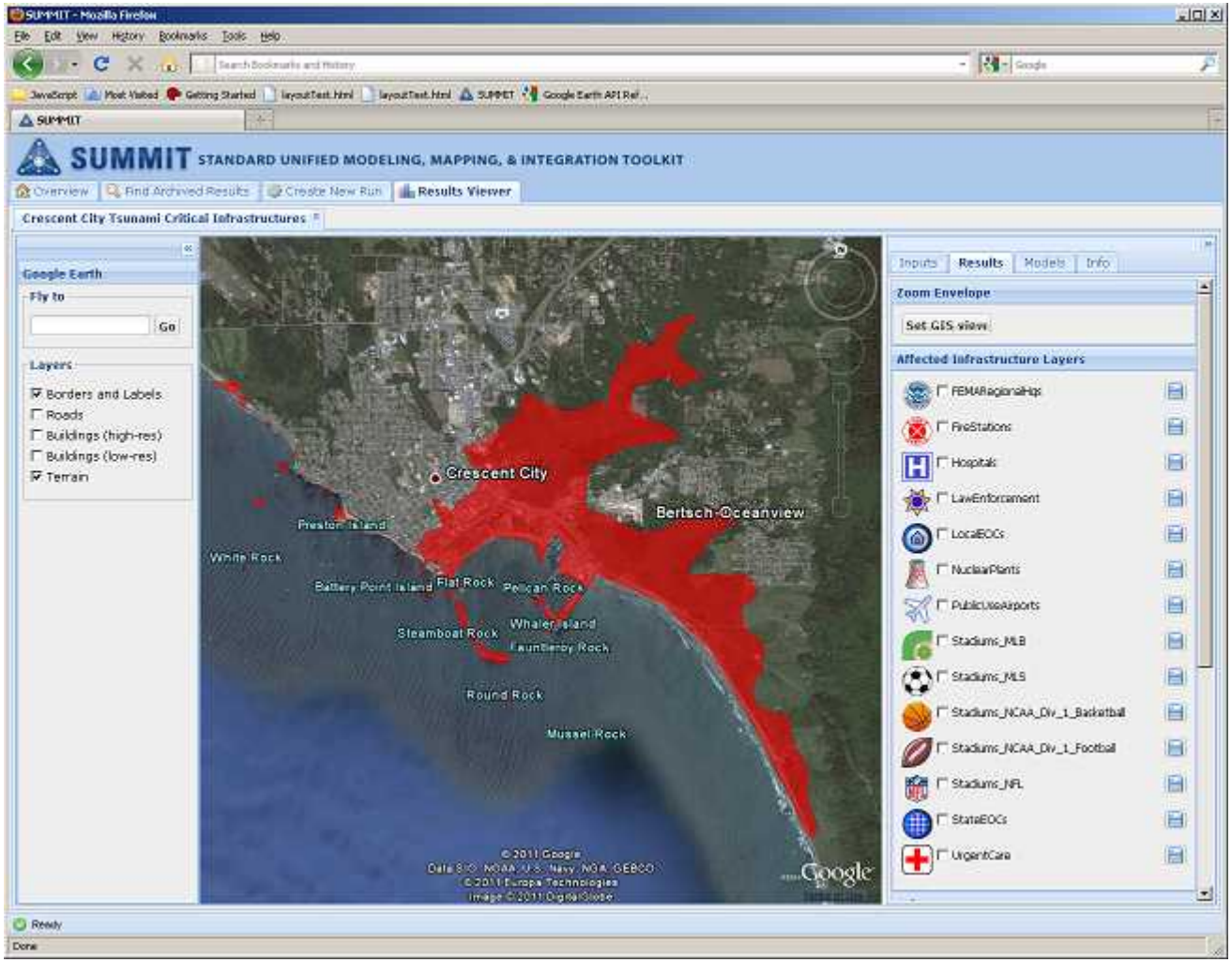
Inundation Zones for Three Heavily Impacted Outer Coastal Locales: 3. Crescent City, CA



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Population in Three Inundation Zones

POPULATION IN SELECT INUNDATION ZONES*

Daytime Population for:

Westport Area:	2,771
Seaside Area:	6,096
Crescent City Area:	2,716
All zones total:	**11,583**

Nighttime Population for:

Westport Area:	3,132
Seaside Area:	5,129
Crescent City Area:	560
All zones total:	**8,821**

* Counts based on 2008 LandScanUSA data.

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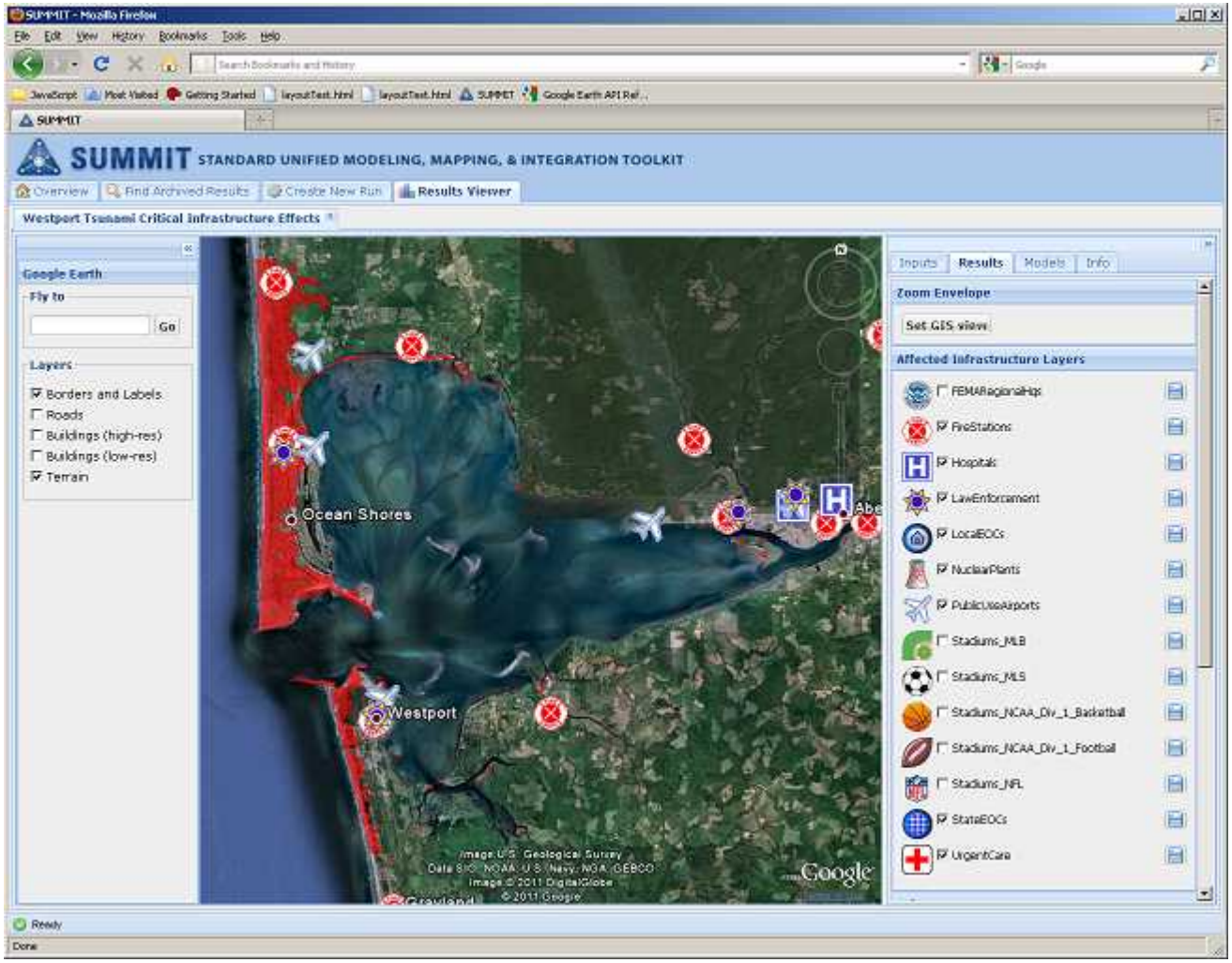
Critical Infrastructure in Three Inundation Zones:
1. Westport, WA



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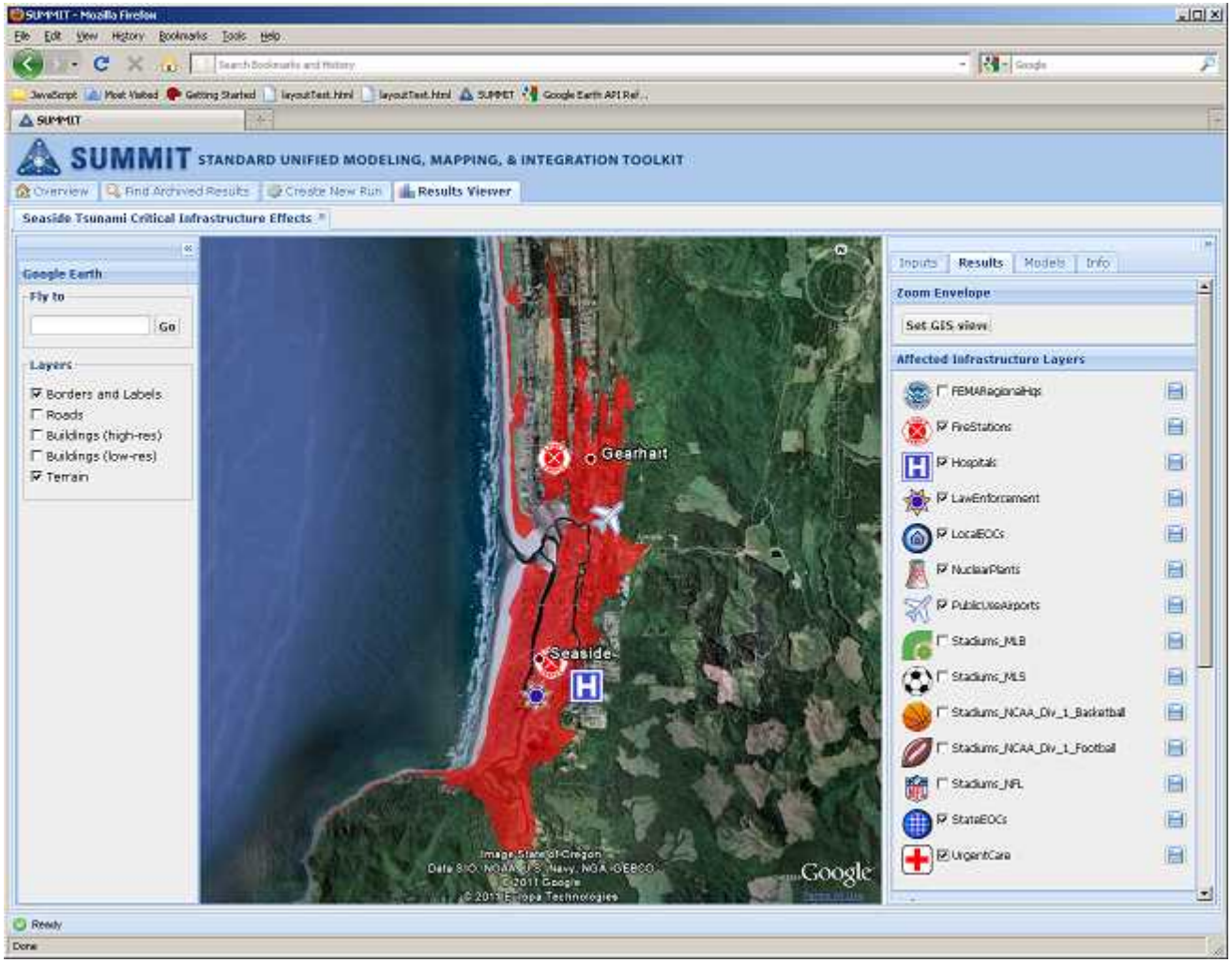
Critical Infrastructure in Three Inundation Zones: 2. Seaside, OR



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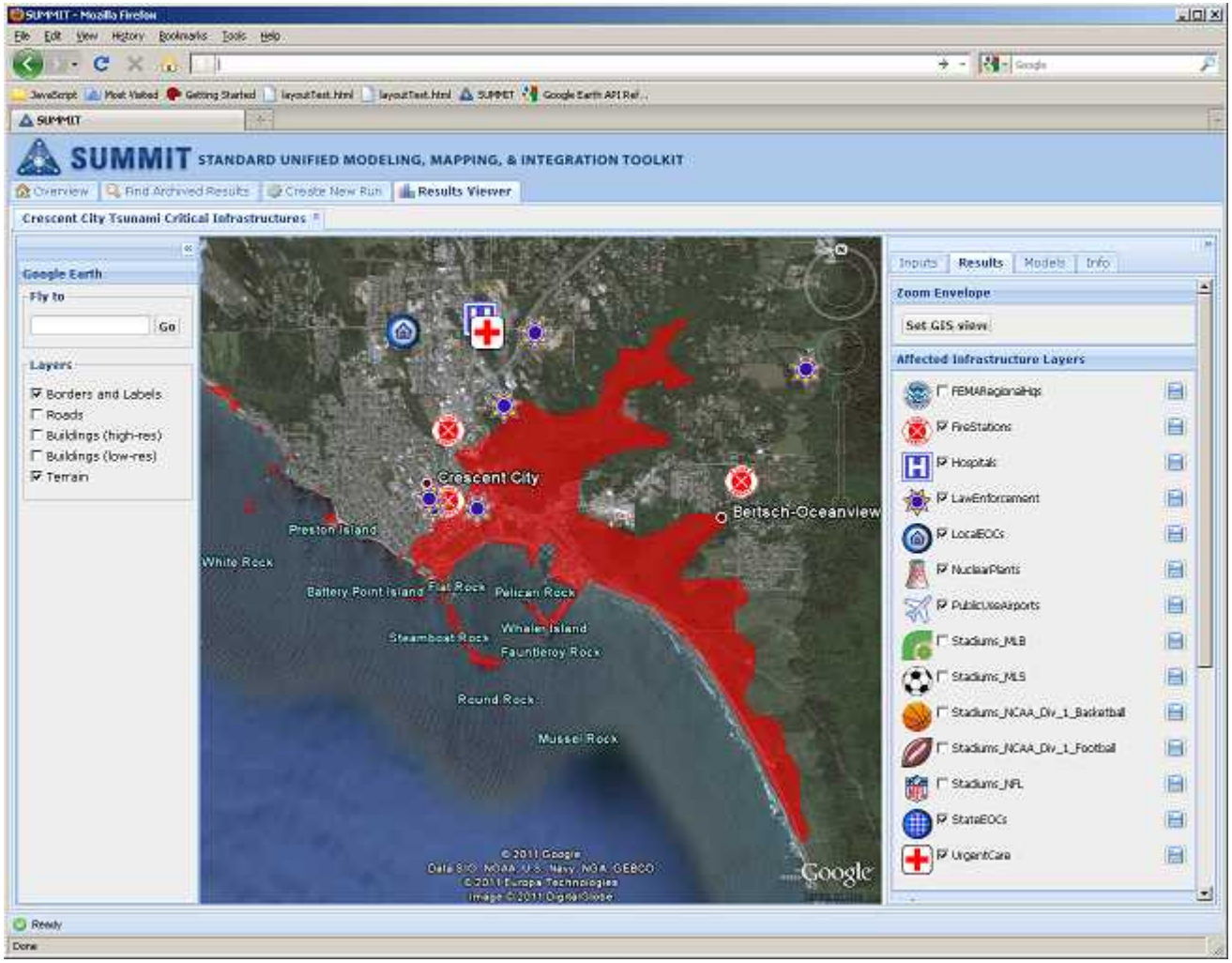
Critical Infrastructure in Three Inundation Zones: 3. Crescent City, CA



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Nuclear Power Assets Relative to WA and OR Selected Inundation Damage Zones*

The extent of inundation <u>in the selected inundation zones</u> show that the nuclear power plant is far outside the inundation zone.

***Data on this slide was generated using NOAA MOST, HSIP Gold, and FastMap**

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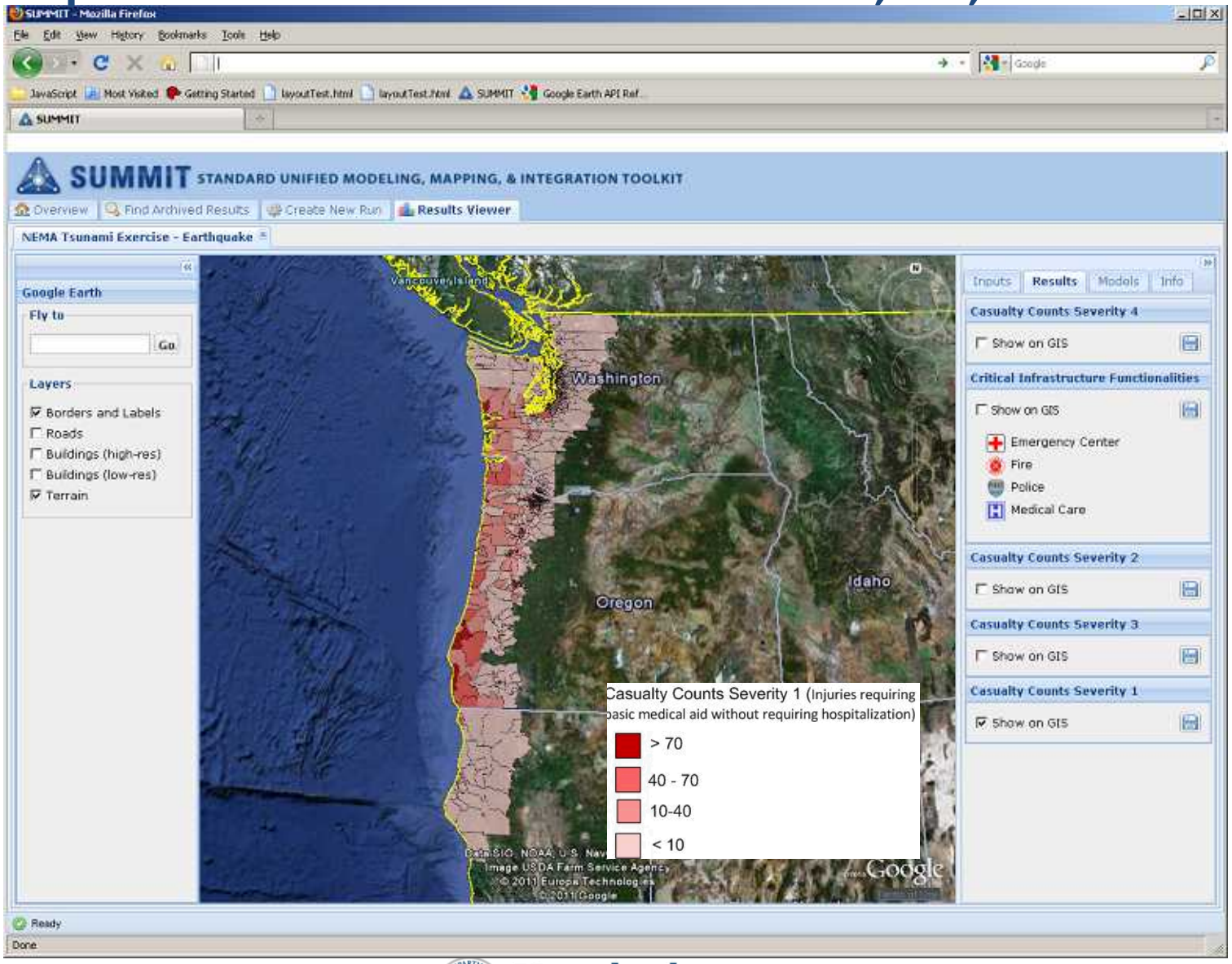
Earthquake Effects

Earthquake Casualties Distribution for WA, OR, Northern CA



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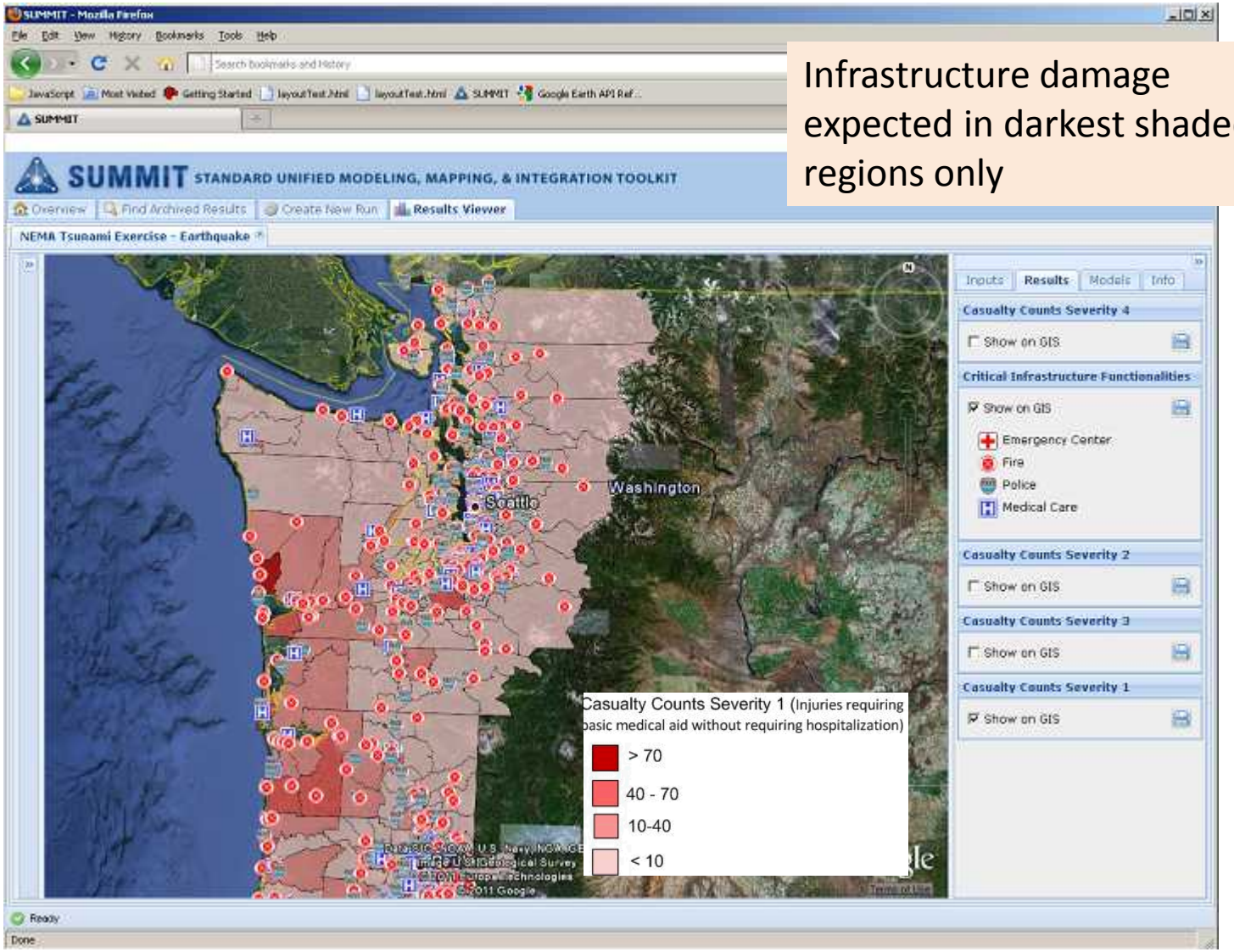
Critical infrastructure and Earthquake Casualties Distribution in WA



Infrastructure damage expected in darkest shaded regions only

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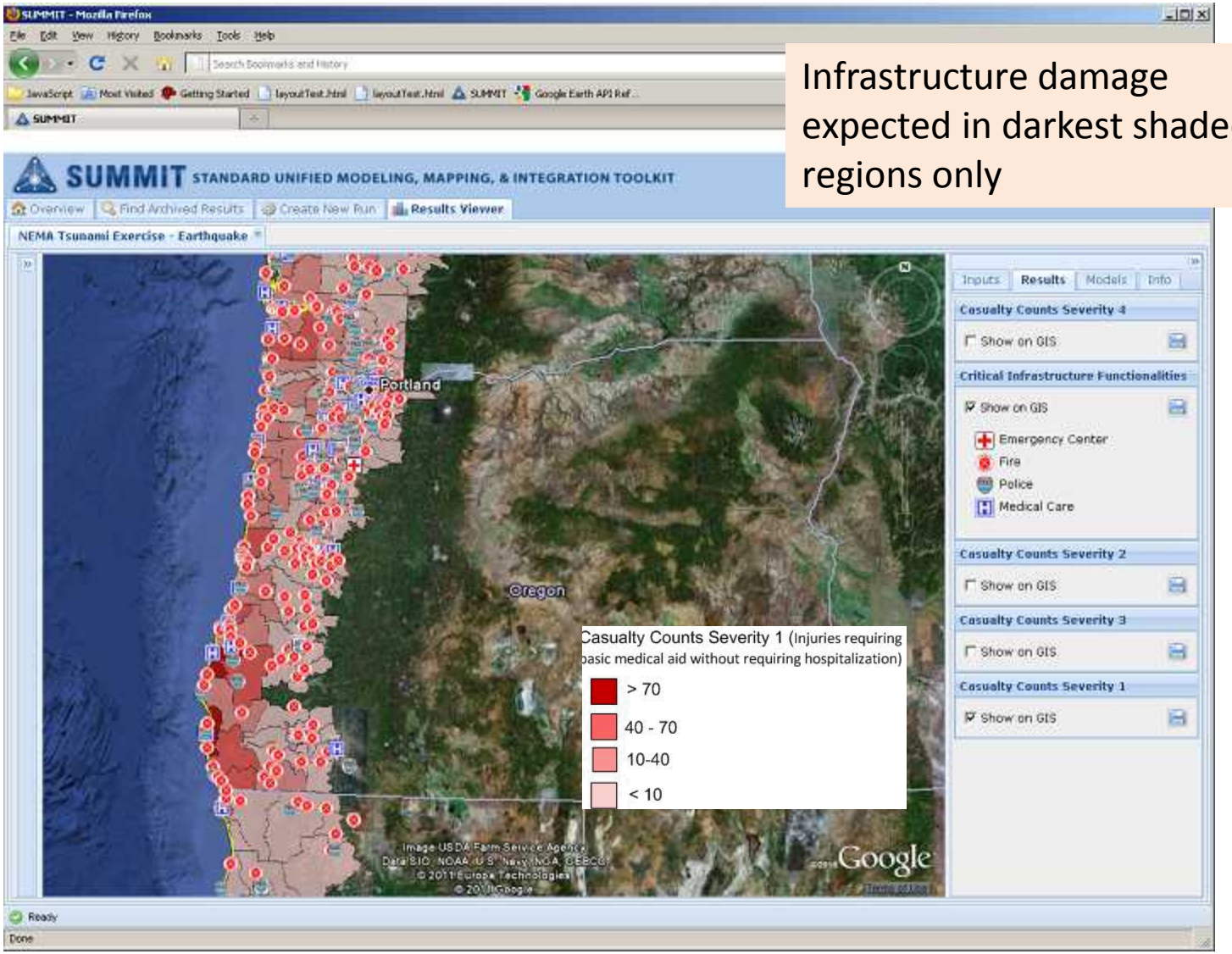
Critical infrastructure and Earthquake Casualties Distribution in OR



Infrastructure damage expected in darkest shaded regions only

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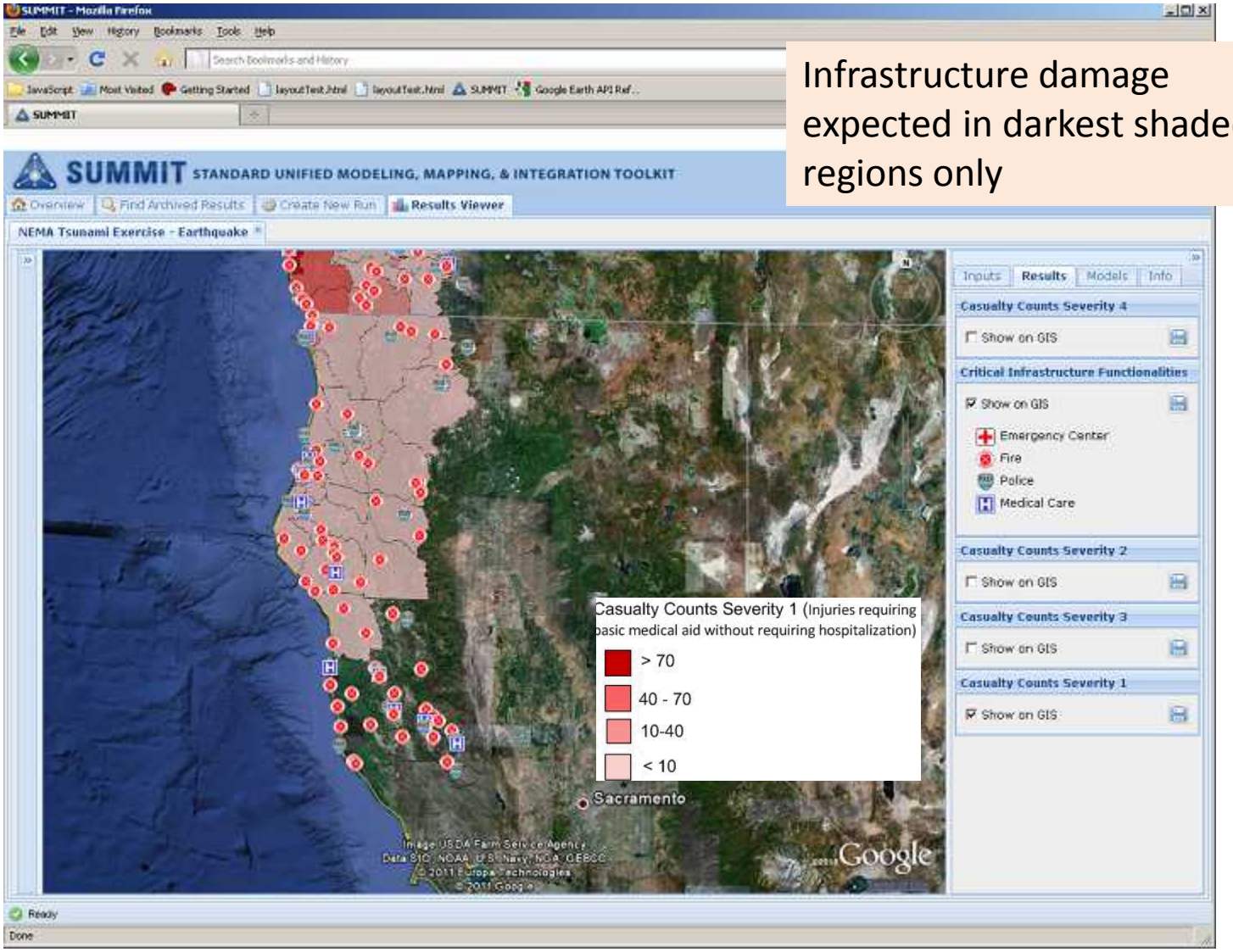
Critical infrastructure and Earthquake Casualties Distribution in CA



Infrastructure damage expected in darkest shaded regions only

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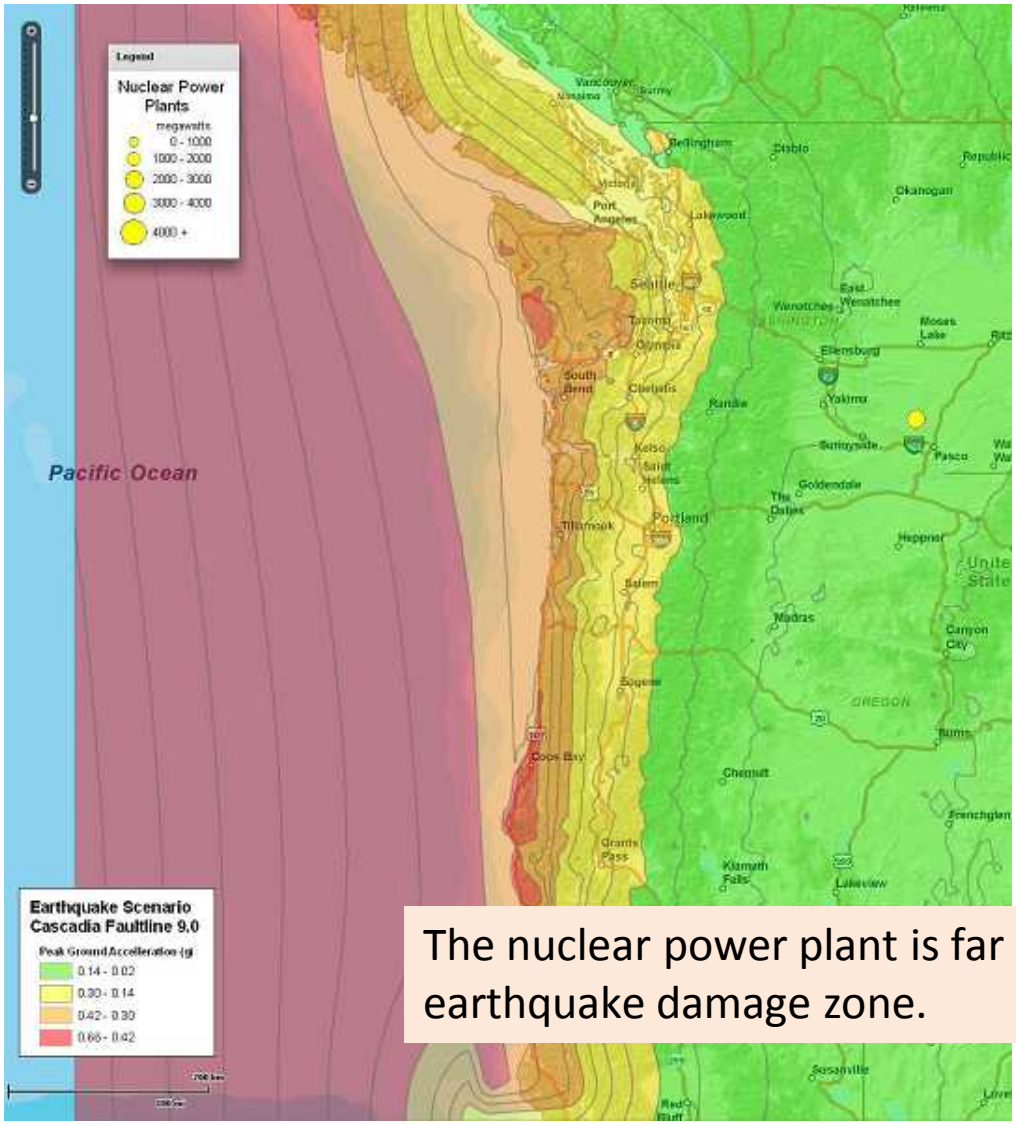
Nuclear Power Assets in Earthquake Damage Zones, WA, OR, and CA *



The nuclear power plant is far outside the earthquake damage zone.

*Data on this slide was generated using HAZUS, HSIP Gold, and FastMap

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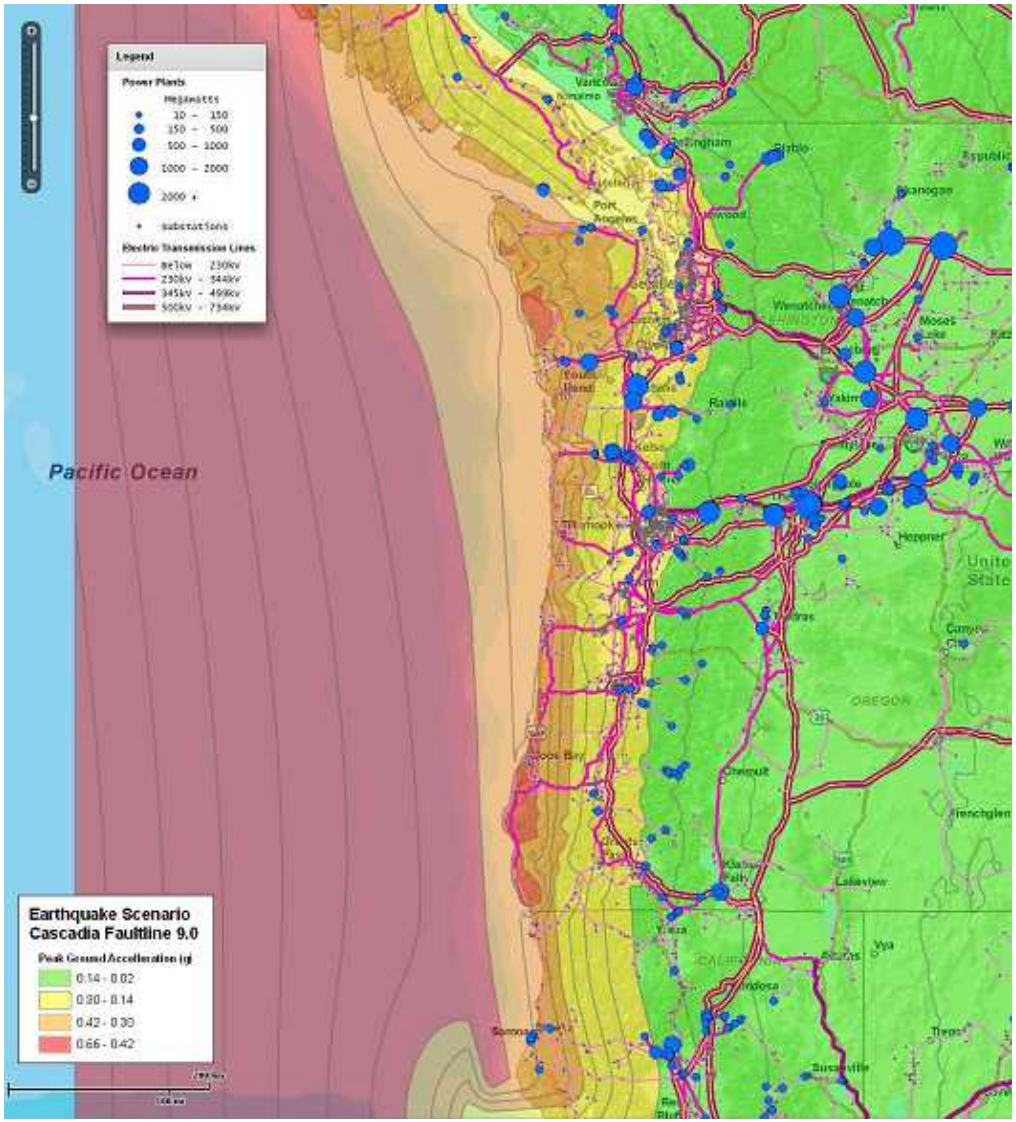
Electric Power Assets in Earthquake Damage Zones, WA, OR, and CA*



*Data on this slide was generated using HAZUS, HSIP Gold, and FastMap

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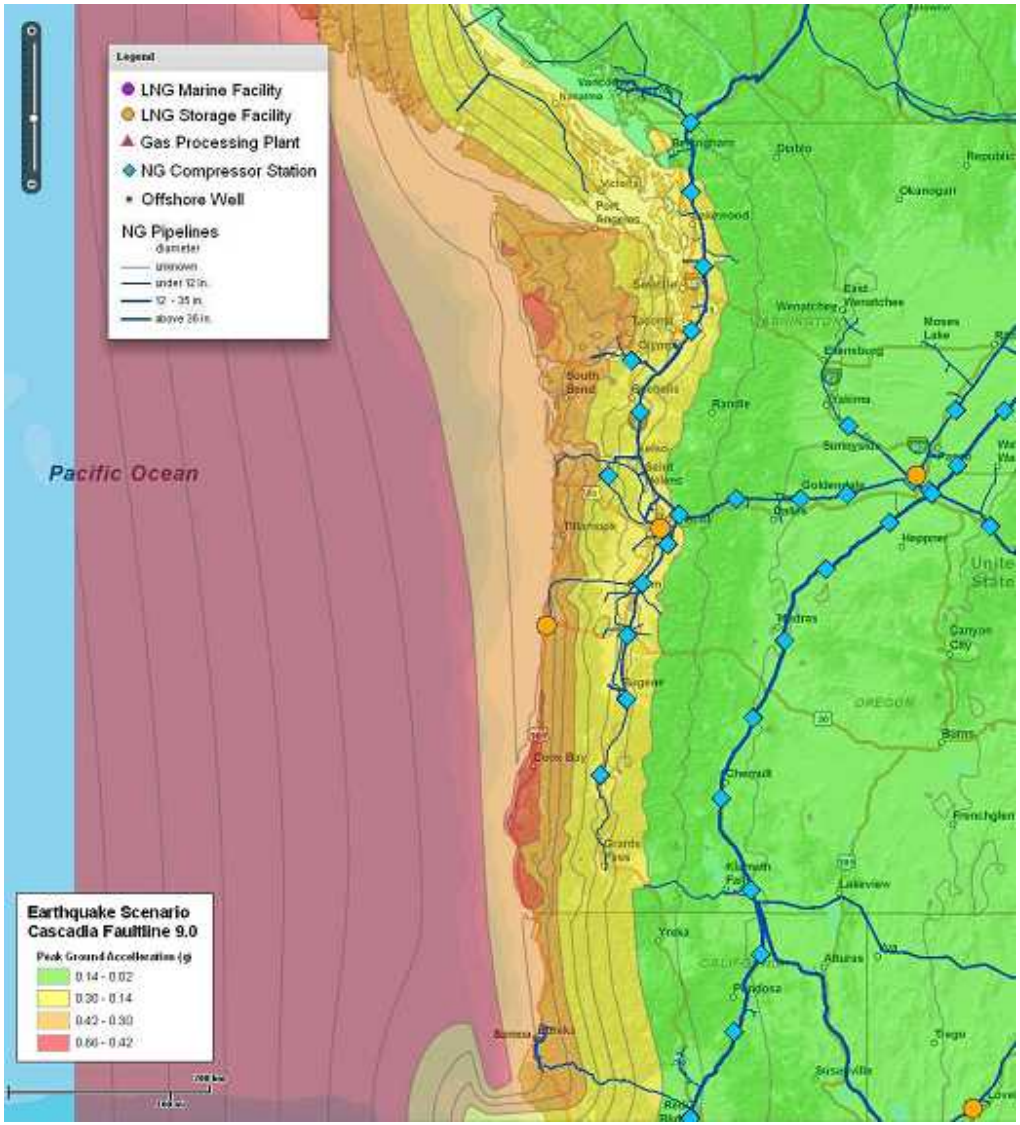
Natural Gas Assets in Earthquake Damage Zones, WA, OR, CA*



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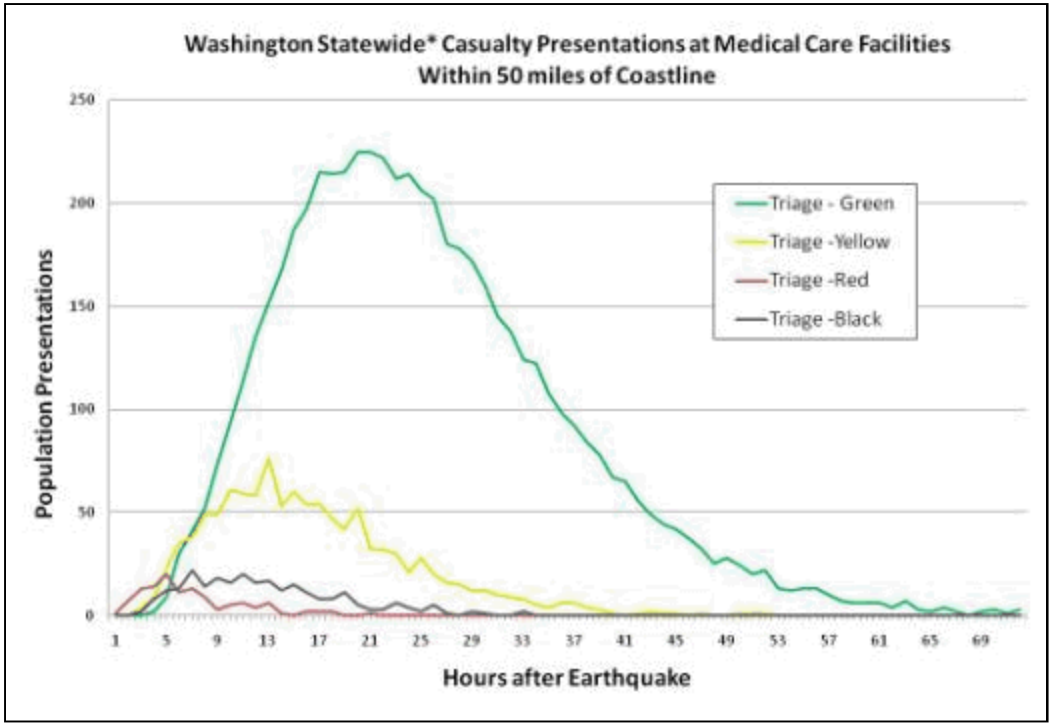
Medical Surge Requirements (1 of 2)*

(for earthquake only)



Casualty presentations and demand at medical care facilities continues to rise throughout the days following the earthquake.

Peak Daily Surge for Statewide Casualty Presentations at Medical Care Facilities (for earthquake only)

State	Peak Daily Surge (all occurring on Day 1)
Washington	4,300
Oregon	6,600
Northern California	300

***Data on this slide was generated using SUMMIT to integrate FEMA HAZUS and HHS Medical Surge Model**

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Medical Surge Requirements (2 of 2)*
(for earthquake only)

Statewide Medical Resource Requirements for Earthquake

State	Surgical Infection Prophylaxis/ Treatment	Laboratory supplies	Universal Precautions PPE	Oral food (3 meals /day per patient)	Sheet change	Ventilator equipment	Oxygen (O2)	Intravenous Fluids
Washington	5,700	8,800	5,700	3,500	5,700	1,600	6,600	3,800
Oregon	10,400	15,400	10,400	7,000	10,400	3,400	12,300	7,400
Northern California	400	700	400	300	400	200	500	300
TOTAL	**16,500**	**24,900**	**16,500**	**10,800**	**16,500**	**5,200**	**19,400**	**11,500**

For earthquake only, medical equipment surge requirements are on the order tens of thousands.

***Data on this slide was generated using SUMMIT to integrate FEMA HAZUS and HHS Medical Surge Model**

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Cascadia Subduction Zone Analysis Efforts

- Cascadia earthquake/tsunami effects for this exercise were developed to *facilitate discussion* and are based on *existing or fast-turnaround* models and datasets.

- Earlier this week, the National Tsunami Hazard Mitigation Program & NOAA conducted a tsunami warning exercise called PACIFEX 11. The scenario was based on a similar Cascadia subduction zone earthquake.

- A more in-depth analytical effort involving local, state, federal agencies as well as infrastructure owners/operators is currently underway as part of a larger Cascadia planning activity led by the FEMA Region X and IX regional offices. This will provide an authoritative set of analytical products for future Cascadia planning, exercise, and response needs.

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Acknowledgements

- NOAA Center for Tsunami Research, Pacific Marine Environmental Laboratory: Vasily Titov, Chris Chamberlin

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