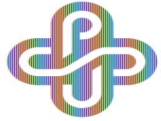


HAZARD ANALYSIS: EARTHQUAKE-INDUCED HAZMAT RELEASES IN THE NORTH PORTLAND INDUSTRIAL AREAS



Institute for
Sustainable So

PORTLAND STATE UNIVERSITY

ISS is: Focused on a more resilient and sustainable region, ISS matches the passion and expertise of PSU faculty and students with the experience and needs of community. We have worked several years with the City of Portland on issues related to climate change, and resilience.

Long-term transformational change. Requires strategies that will work within context, given the “wicked” or complex problems that will lead us toward a more sustainable world. We focus on process, especially on collaboration, as the foundation of our work.

PROJECT BACKGROUND & GOALS

- Improve collaboration of HAZMAT experts, emergency response personnel, public information officers and other stakeholders to increase resilience to this hazard.
- Increase our understanding and awareness of risk of an earthquake-induced HAZMAT release in the urban industrial areas to support mitigation and response planning.
- Identify protective action recommendations and communication recommendations for the event of post-earthquake HAZMAT releases.
- Recommend next steps for increasing community resilience to this hazard.

Planning Team:

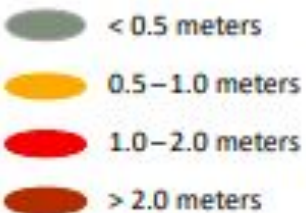
- Luke Hanst (ISS)
- Beth Gilden (ISS)
- Yumei Wang (ISS)
- Grisha Post (ISS)
- Alice Busch (MCEM)
- Arini Farrell (MCEM)

Critical Collaborators

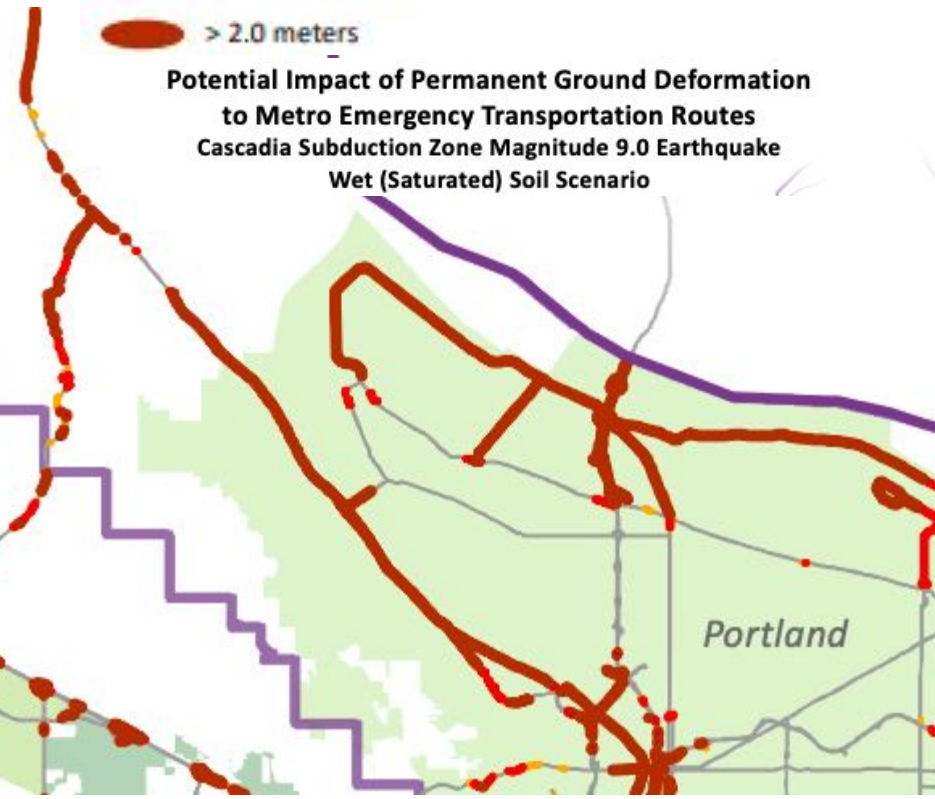
- Shon Christensen (PF&R)
- Bryan Profit (PF&R)
- Terry Wolfe (OSFM)
- Todd Raska (OSFM)
- Alliance Solutions Group
- Defense Threat Reduction Agency

Potential Permanent Ground Deformation Due to Earthquake-Induced Landslides or Liquefaction Lateral Spreading Cascadia Subduction Zone Magnitude 9.0 Earthquake Wet (Saturated) Soil Scenario

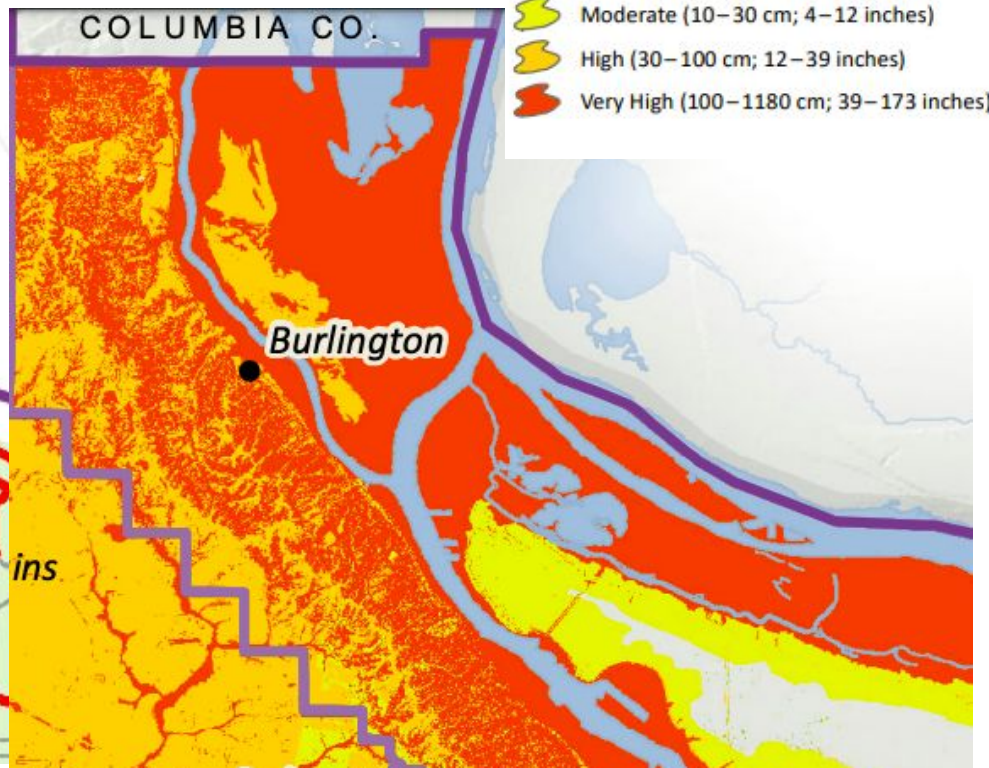
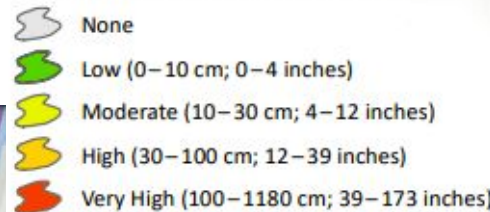
Potential Permanent Ground Deformation



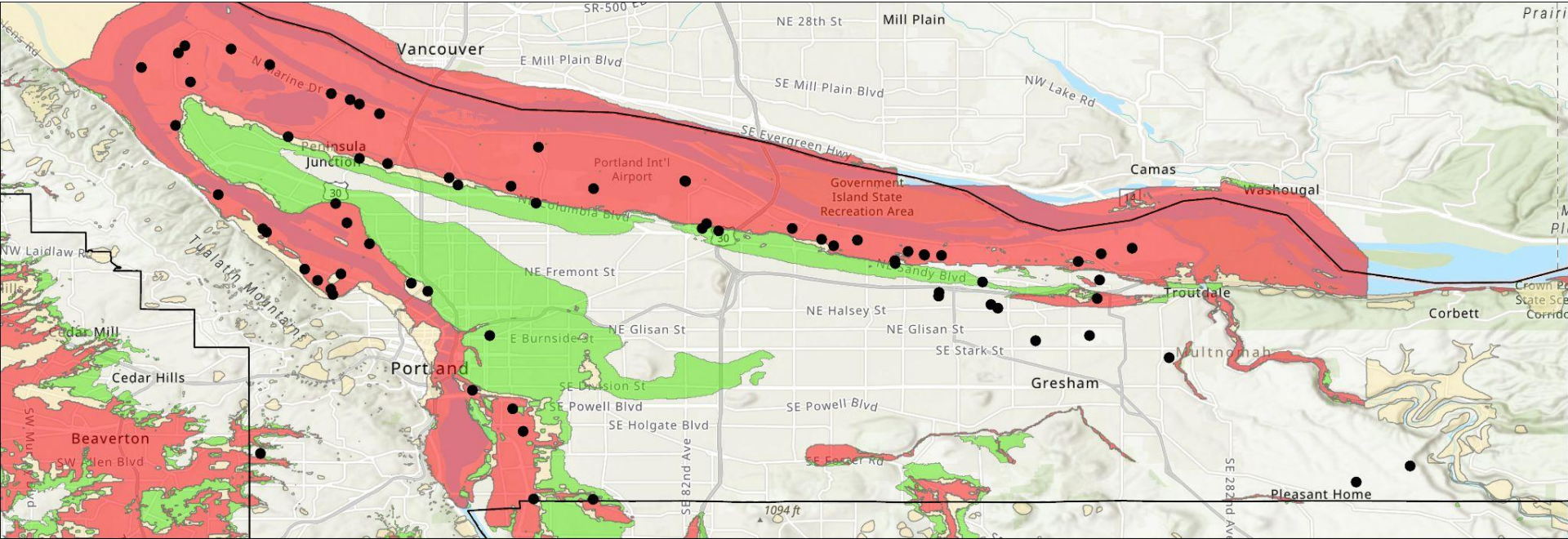
Potential Impact of Permanent Ground Deformation to Metro Emergency Transportation Routes Cascadia Subduction Zone Magnitude 9.0 Earthquake Wet (Saturated) Soil Scenario



Permanent Ground Deformation

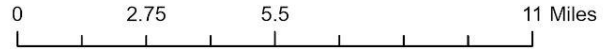


MULTNOMAH COUNTIES TOP 70 TIER II FACILITIES

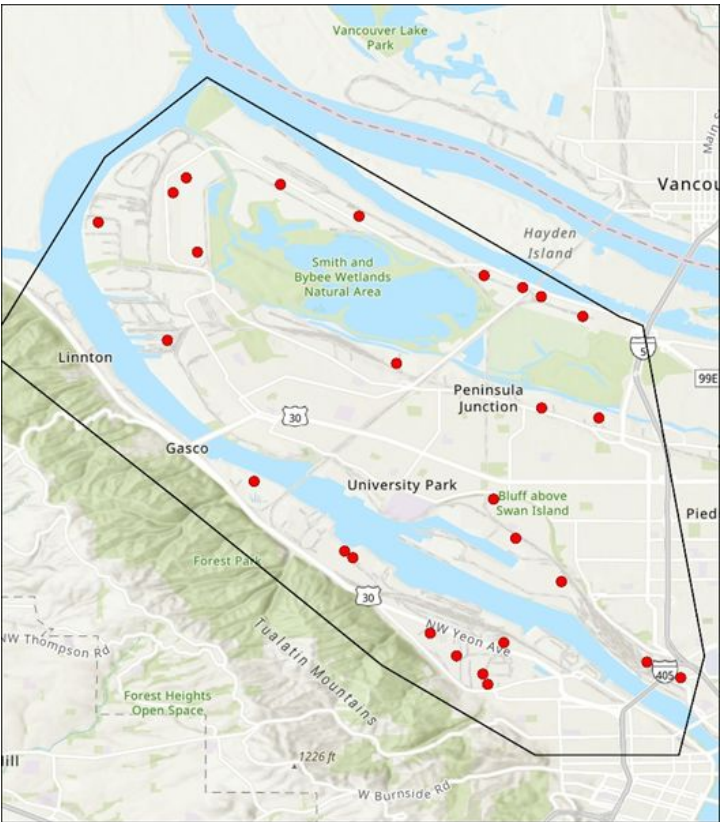


DoGAMI Soil Liquefaction

- High
- Moderate
- Low
- Critical Facilities
- Multnomah County Boundary



FACILITY SELECTION & METHODS



Qualitative Selection Criteria:

- Large quantity of TIH chemicals
- Contained in storage tank(s) & cylinders
- Older facilities
- Proximity to residential areas
- Located in high liquefaction zones
- Emphasis on the Northwest Industrial areas

Of the 27 facilities:

- 23 facilities are assumed to be seismically vulnerable based on date of construction
- All are located in areas expected to receive at least moderate or heavy damage
- 15 pose risks of toxic gas plumes
 - 11 of these are stored in either above ground tanks or pressurized cylinders
 - 12 of 15 are seismically vulnerable
- From these we selected the 4 facilities with the highest life-safety threat based on LEPC preliminary modeling
- **This sample of facilities does not reflect all facilities in Multnomah County**

SENSITIVE INFORMATION AND FOUO

Controlled or Classified Information:

- Facility names
- Exact facility locations
- Name of material shown in a plume
- Quantity of material stored or released
- Container type

Protocol for Sharing Information:

- Facility pseudonyms (e.g., facility 1)
- Material pseudonyms (e.g., chemical 1)
- No quantities provided



HAZARDOUS MATERIALS OF CONCERN

Toxic Inhalation Hazards (TIH):

- Greatest threat to life safety due to dispersion over wide area.
- Potential for severe long-term health impacts or death.
- Acute symptoms include:
 - Severe irritation and burns to the eyes, skin, mouth, and respiratory system
 - Constriction of the airway
 - Buildup of fluid in the lungs

READING AEGLs AND PLUME MODELS

Reading Plume Models:

- The path a cloud (plume) of gas is expected to travel prior to dissipation.
- In these scenarios, the plume will travel fast enough for exposure to last less than ten minutes before it passes.
- Show color-coded AEGL level and the population at risk of exposure.

Acute Exposure Guideline Levels (AEGL):

- AEGL 1 (Yellow): Notable discomfort and irritation. No long lasting effects.
- AEGL 2 (Orange): Irreversible or other long-lasting health effects. May require urgent hospitalization.
- AEGL 3 (Red): Life-threatening health effects or death.

TWO SCENARIOS : SUMMER AND WINTER

Summer:

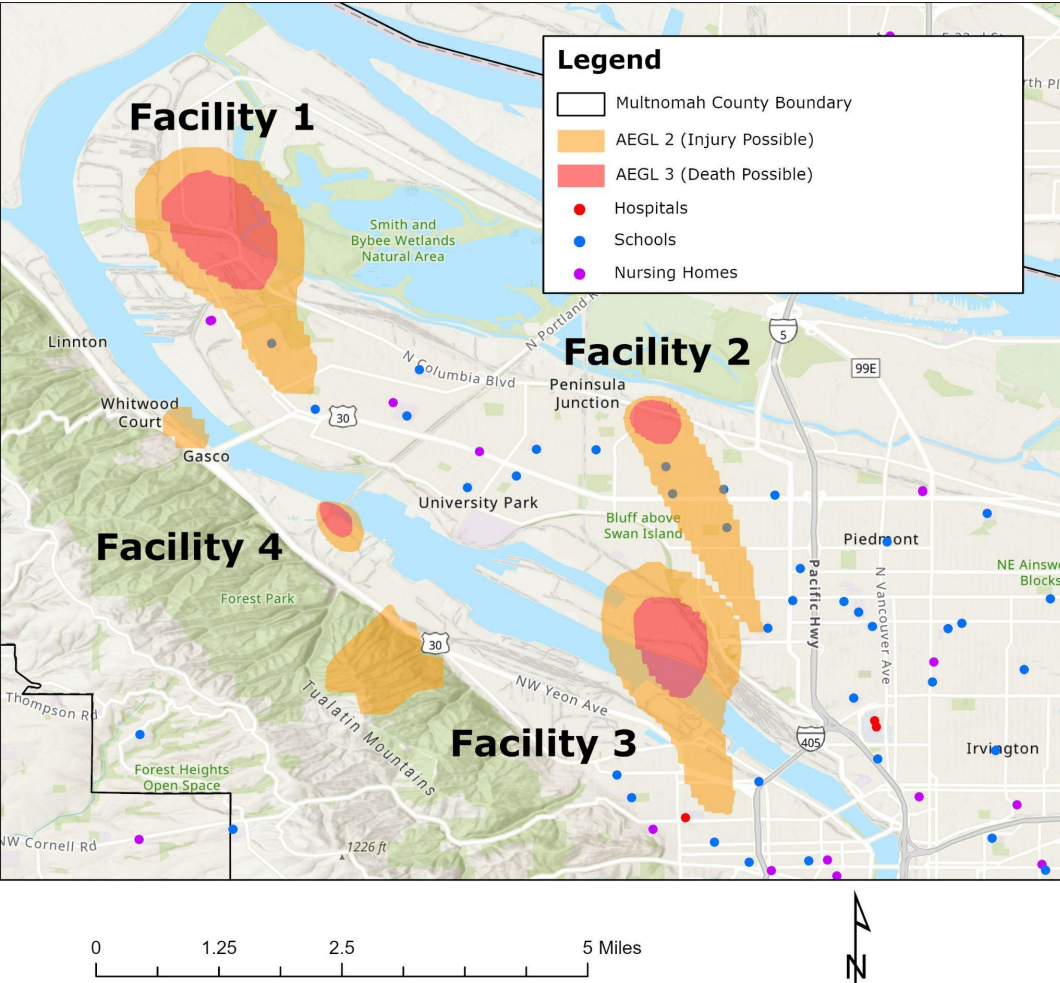
- April - August (Sept. is a coin flip)
- Wind from the Northwest
- Average wind speed of 4 mph
- Higher risk of heat dome or little wind

Winter:

- October - March
- Winds from the South East
- Average wind speed of 6.2 mph
- Higher liquefaction risk



SUMMERTIME RELEASE SCENARIO



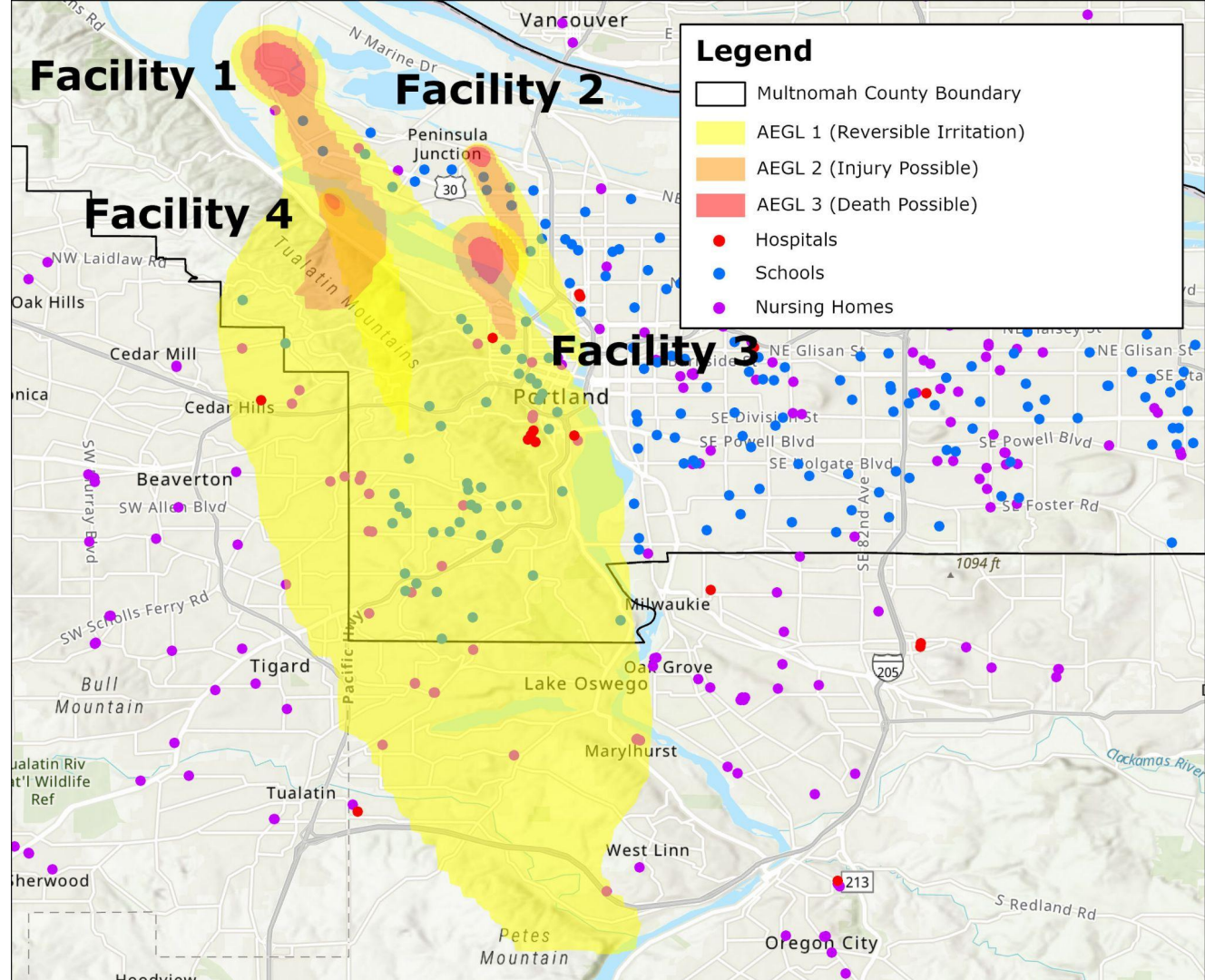
July 24th, 2022 at 5 PM:

- 90° F, mild overcast and humid
- Wind at 5 mph into the South East

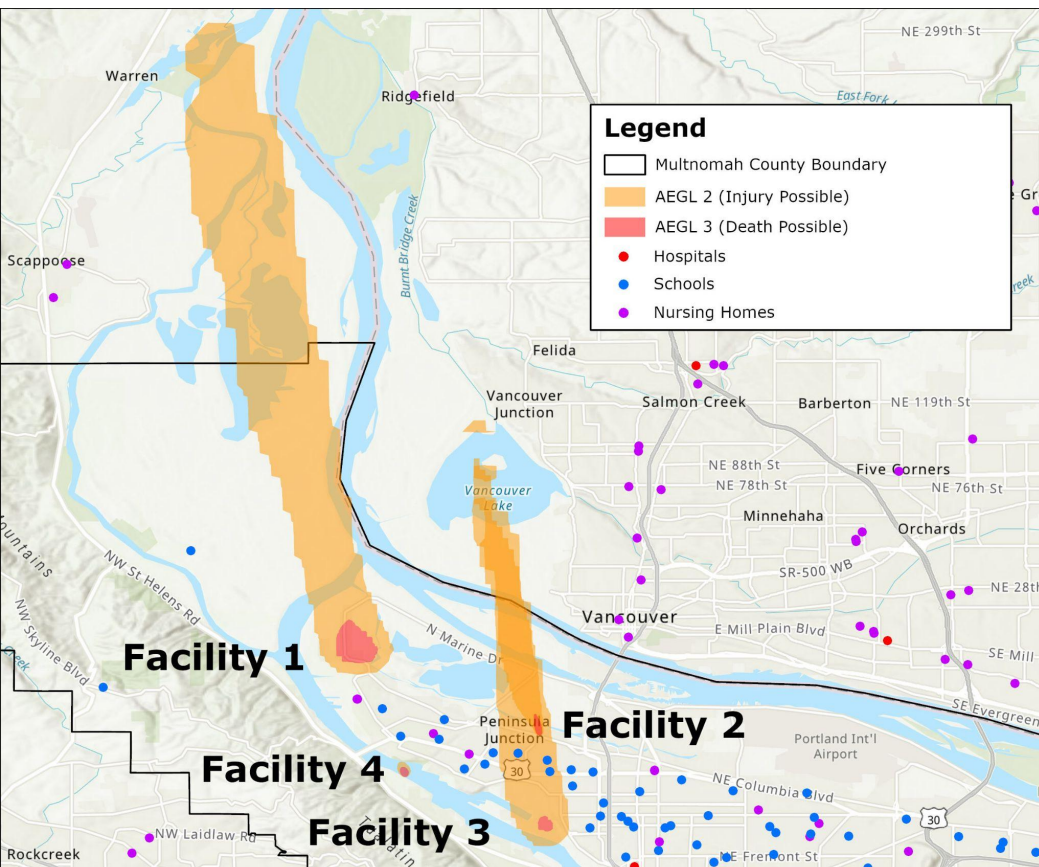
Casualty Estimates:

- Facility 1
 - 535 possible deaths
 - 3284 possible injuries
 - 110000 irritation exposures
- Facility 2
 - 541 possible deaths
 - 5138 possible injuries
 - 16000 irritation exposures
- Facility 3
 - 1649 possible deaths
 - 9263 possible injuries
 - 220000 irritation exposures
- Facility 4
 - 38 possible deaths
 - 81 possible injuries
 - 4640 irritation exposures

SUMMERTIME RELEASE MODELS w/COMBINED MODELING



WINTERTIME RELEASE SCENARIO



0 2.5 5 10 Miles



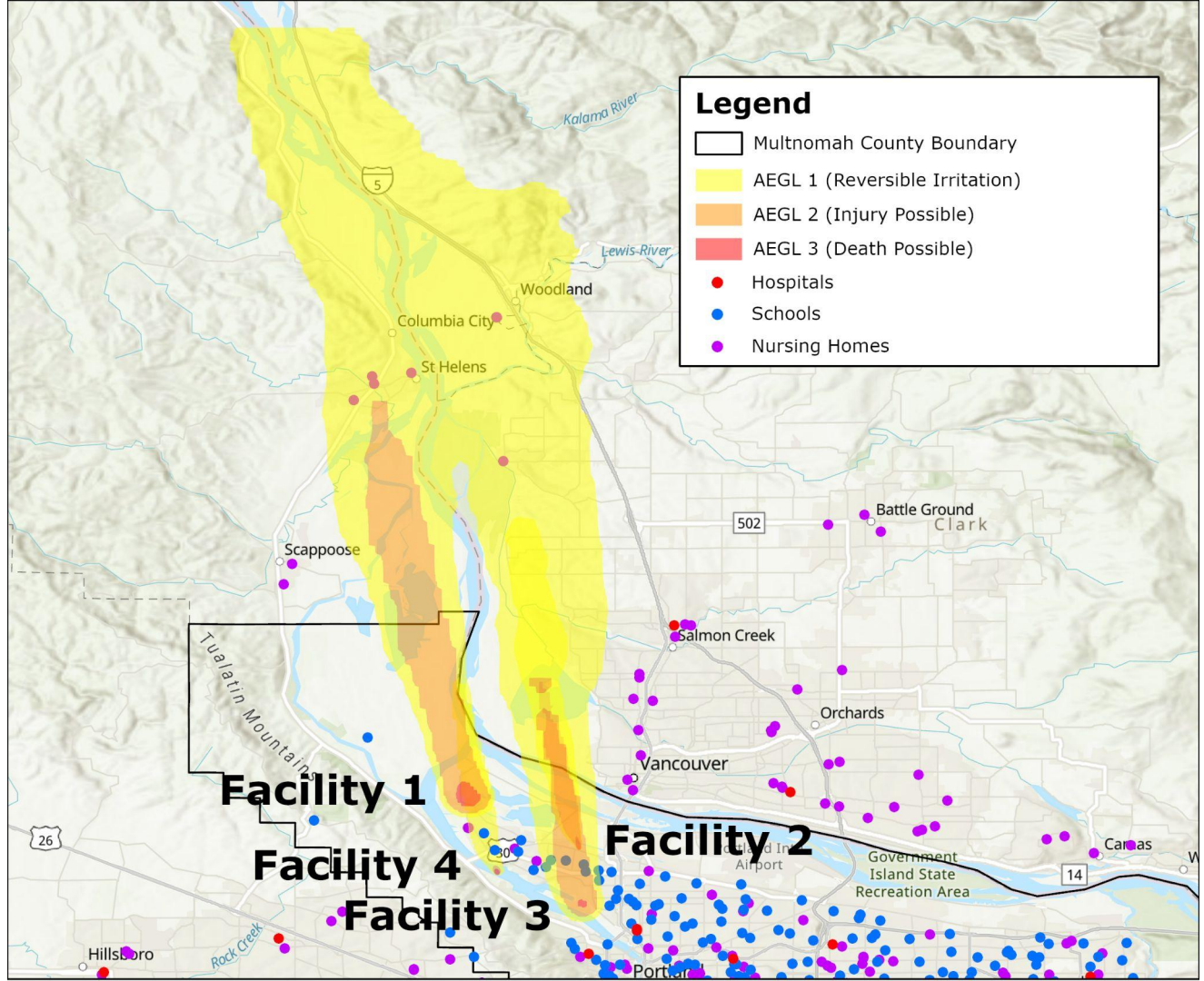
January 2nd, 2022 at 12 PM

- 28° F, overcast and low humidity
- Wind at 10 mph into the North West

Casualty Estimates:

- Facility 1
 - 812 possible deaths
 - 3510 possible injuries
 - 44000 irritation exposures
- Facility 2
 - 37 possible deaths
 - 355 possible injuries
 - 3400 irritation exposures
- Facility 3
 - 389 possible deaths
 - 14742 possible injuries
 - 27000 irritation exposures
- Facility 4
 - 19 possible deaths
 - 45 possible injuries
 - 15440 irritation exposures

WINTERTIME RELEASE MODEL w/COMBINED MODELING



PROTECTIVE ACTION RECOMMENDATIONS (PARs)

Evacuations:

Post-incident evacuations occur during or after an incident when it is unsafe for affected populations to remain in the incident area.

Important to consider populations with critical transportation needs.

Personal Protective Equipment:

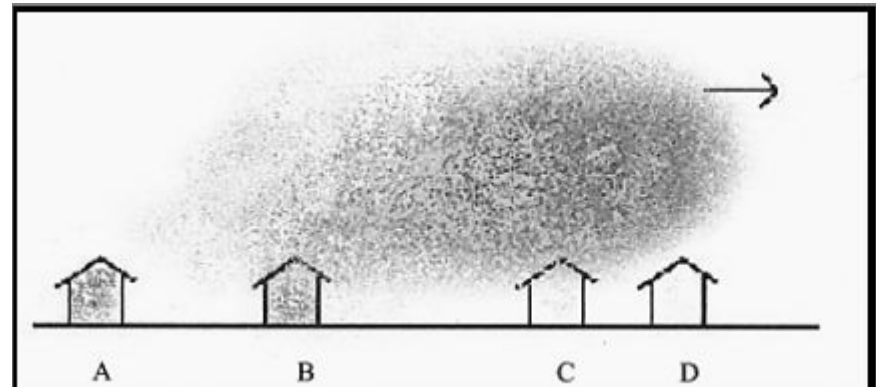
Equipment which protects the respiratory system, mouth, eyes, or skin from exposure to hazardous substances.

Necessary equipment varies according to the type and severity of the hazard.

Shelter in Place:

Prompt sheltering of a population in enclosed structures to minimize initial exposure to a plume.

Residents stay indoors in the most tightly sealed space possible until the plume has passed. At which point they should vacate to the cleaner outside air.



HEALTH AND MEDICAL CONSIDERATIONS

After exposure:

- Decontamination with new clothing and copious amounts of water is essential.
 - Damage to water infrastructure will impede public decontamination efforts.
- Serious exposures may require hospitalization and mechanical ventilation.
 - Access to EMS, transport, and hospitals may be limited.
- AEGL 1 plumes can extend across large areas.
 - Exposure at AEGL 1 can cause physical symptoms and may be more harmful to vulnerable populations.

RECOMMENDED NEXT STEPS (BRIEF)

- Inter & Intra-Government Outreach and Coordination
 - Coordinate and collaborate with neighboring jurisdictions and the State to jointly pursue mitigation and preparedness efforts.
- Hazard Analysis (Risk Assessments) and Pre-Planning
- Support hospitals in preparing for mass casualty incidents
- Develop decontamination and medical response plans and capabilities
- Public education and outreach efforts
 - Inform residents of the hazard and protective action recommendations