A Geographic Assessment of the Risk Posed by Hazardous Materials in Oregon

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Citation Details
Geographic Assessment of Risk
Posed by Hazardous Materials in Oregon

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What is Risk?

Hazardous material exposure associated with storage at a fixed facility or transport over highways, railroads, or waterways.

Depends upon many factors
- Relative danger of the substance
- Size of the release
- People affected
- Environment impacted
• State Hazmat Team 12–LaGrande responded to a motor vehicle accident with a spill of 300 gallons of chromic acid. $500,000 estimated loss.

• State Hazmat Team 08–Southern Oregon responded to a motor vehicle accident with a spill of 150 gallons of diesel fuel. $250,000 estimated loss.

• State Hazmat Team 09–Tualatin Valley F&R responded to an incident where 680 pounds of Refrigerant 507 leaked from a chiller line.
Purpose of study

– Evaluate datasets that describe the storage, transport and accidental release of hazardous materials.

– Provide emergency planners a broad picture of locations, volumes and characteristics of hazardous material exposure.
Risk Framework

- Transport: Hwy, RR, Water
- Fixed Facility: stored, spill
- Risk

- Transport: spill

Diagram shows the flow of risk factors, including transportation and fixed facilities, leading to risk.
Key Datasets

**Fixed Facility**
- ERIS unplanned release
- HSIS

**Transport**
- ERIS unplanned release
- Highway
- Railway
- Waterborne

• **ERIS** Emergency Response Information System
• **HSIS** Hazardous Substance Information System
UN Risk Classification System

1: Explosive
2: Gas
3: Flammable Liquid
4: Flammable Solid
5: Oxidizer and Organic Peroxide
6: Poison
7: Radioactive
8: Corrosive
9: Miscellaneous

Highway Transport

• ODOT provided one year of records of hazardous materials at 158 weigh stations for 12 months (March 2009 to April 2010)

• Gross Weight in pounds

• ODOT reported that 3.33% of crashes involved hazardous materials in 2008.
Highway Transport: Weigh Stations
Highway Transport: Weigh Stations and Hazard Classes

![Graph showing the sum gross weight (tons) for different locations with various hazard classes.

- **Legend**:
  - unknown
  - 1 - Explosive
  - 2 - Gas
  - 3 - Flammable Liquid
  - 4 - Flammable solid
  - 5 - Oxidizer or Organic Peroxide
  - 6 - Poisonous Material
  - 7 - Radioactive Material
  - 8 - Corrosive Material
  - 9 - Miscellaneous Material]
Highway Transport: Summer/Winter
Highway Transport: Limitations

- Data are associated with points rather than a network or routes
- Impossible to assign direction and route of material across state
- Portland Region weigh stations are outside of city limits
- Washington highway data not available
- Data is a sample of weigh events when scales are open
- Make pertinent data publically available
Rail Transport

• Two years of rail transport (2008-2009) for UP and BNSF were provided by ODOT
• BNSF averages approximately 19,000 trains and 155,000 loads of hazardous freight annually
• UP averages approximately 33,000 trains and 120,000 loads of hazardous freight annually
Rail Transport: Routes and Yards
Rail Transport: HC 3 and HC 9

Hazard Class 3

Hazard Class 9

Portland Region
Rail Transport: UP vs. BNSF

Hazard Class

1  2  3  4  5  6  7  8  9

BNSF  UP
Rail Transport: Limitations

- Data were reported by commodity between segments without origin/destination
- Data were not reported by hazard class
- Yards are shared; yard names are inconsistent
- Data for minor railroads were not available

- Better than highway data!
Waterborne Transport

- Five years (2004-2008) of data were downloaded from the US Army Corps of Engineers Navigation Data Center.

- Material listed by product groupings.

- Columbia, Snake, Willamette River and Oregon Coast ports considered.
Waterborne Transport: Ports

Columbia, Snake and Willamette Ports
handling chemical or petroleum
Waterborne Transport: Columbia River System

- Petroleum and Petroleum Products
- Chemicals and Related Products
- Crude Materials, Inedible Except Fuels
- Primary Manufactured Goods
- Food and Farm Products
- All Manufactured Equipment, Machinery and Products
- Other

- Upbound:
  - Columbia River, Mouth
  - Below Vancouver and Portland
  - Between Vancouver and the Dalles
  - The Dalles to McNary
  - McNary to Kennewick
  - Snake River

- Downbound:
Waterborne Transport: Limitations

- Not linked to highway or rail data
- No hazard class designation
- No records of hazardous material transported along the coastline

- Better than highway and railroad data!!
Fixed Facility: HSIS

- Approximately 19,000 facilities with stored hazardous chemicals
- Multiple chemicals at each facility resulting in a total of approximately 108,000 records
- 81 attributes associated per record
Fixed Facility: HSIS

Portland Metro Area

Number of HSIS chemicals per facility:
- 1.0 - 10.0
- 10.1 - 100.0
- 100.1 - 498.0
Fixed Facility: HSIS by County & Class

Number of Facilities vs. Hazard Class for various counties.

- Gas
- Flammable Liquid
- Flammable Solid
- Oxidizer and Organic Peroxide
- Poisonous Material and Infectious Substance
- Corrosive Material
- Miscellaneous Hazardous Material
- Other
Fixed Facility: HSIS Volume by County

Gas

Liquid
Fixed Facility: HSIS Limitations

• Need correct and complete geocoding or lat/long
• Audit / qualify the completeness of data
• Not publicly available

• This is a very rich and comprehensive dataset for analysis
ERIS Spills 2000-2009

Spills 8900

Valid Location 8560

Unique 6576

Duplicate 1984

More than Zero 4399

Less than zero 267

Gallons 4200

Pounds 199

Blank
ERIS Spills 2000-2009

Gallons 4200

- Fixed 1961
  - Oil 1238
  - Chemical 484
  - Other 259

- Transport 2114
  - Oil 1931
  - Chemical 99
  - Other 84

- Sewer 125
ERIS Spills 2000-2009
ERIS Spills 2000-2009

Number of Spills by Material
ERIS Spills 2000-2009

- **Number of Spills**
  - Sewage/wastewater and Sewer removed:
    - Fixed
    - Transport

- **By Volume**
  - Sewage/wastewater, Sewer removed:
    - Fixed
    - Transport

- **Number of Spills**
  - In a UGB
    - Fixed
    - Transport
  - Not in a UGB
    - Fixed
    - Transport

State-Wide and UGB by Transit/Fixed
ERIS Spills 2000-2009

Metro Transit Related Liquid Spills
2000-2009

Transit Spills (gallons)
- 0 - 44
- 45 - 250
- 251 - 1,000
- 1,001 - 10,000
- 10,001 - 22,000

Map showing location of spills in the Metro area, with different sizes indicating the volume of liquid spilled.
ERIS: Limitations

• Duplicate records made summaries difficult
• For some attributes 30% of values are blank
• Locations not provided for all events
• Outliers skew data
• “Other” used indiscriminately
Compounding chemical exposure are overlays of additional risks including;

• Fire, flood, and tsunami events
• Patterns of high traffic volumes and trends of crashes
• Vulnerable populations such as school and elderly care facilities
Future Directions

This is a first attempt at determining broad patterns of risk of exposure to hazardous materials.

This information will be provided to emergency responders and planners.

There are many more research questions to ask.
In partnership with the Oregon Department of Environmental Quality
Don Pettit- Senior Emergency Response Planner and
Steven Jett- GIS Analyst Extraordinaire

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