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Underground Storage Tank Impact Model

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UNDERGROUND STORAGE TANK IMPACT MODEL

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SURF 2019

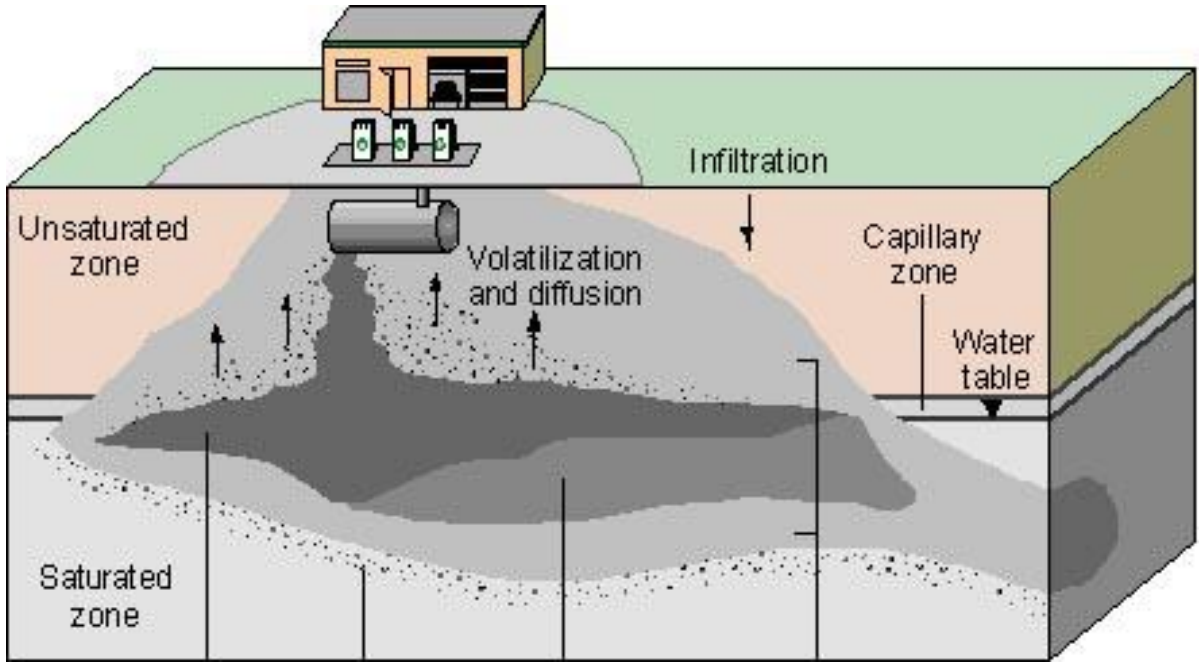
- Statement of Purpose
- Scope
- Importance
- Prior Risk Assessment

http.//petrotowery.com/product/underground-storage-tanks/

Tank Characteristics	Environmental Characteristics
Spill Prevention	Source Water Protection Zones
Under Dispenser Containment	Groundwater Well Data
Overfill Prevention	Surface Water
Piping Configuration	Water Quality
Piping Material	Soil Texture
Tank Configuration	Soil Permeability
Tank Material	Population Density
Age of Tank	Construction Material of UST
Pipe Leak Detection Methods	Down Gradient Receptors
Tank Leak Detection Methods	LUST
	Land Use

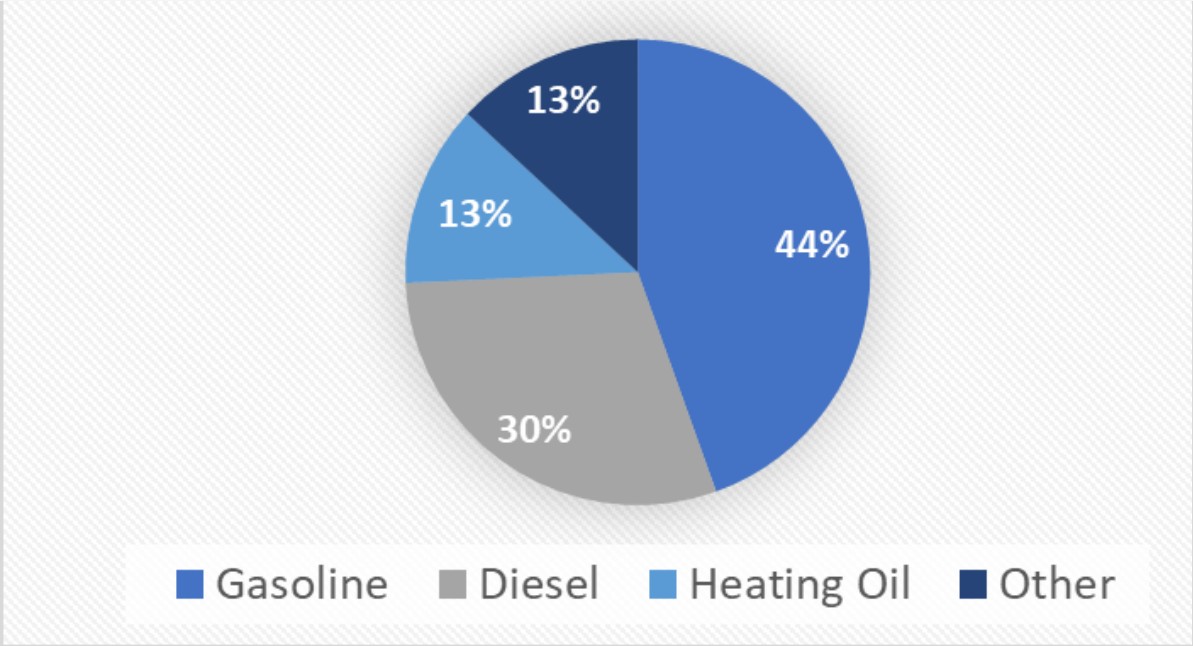
Background

- Montana Petroleum Fund
  - Financial Responsibility
- Environmental Impact
  - Vapors and Fires
- Community Impact
  - Property Values
  - Health Effects

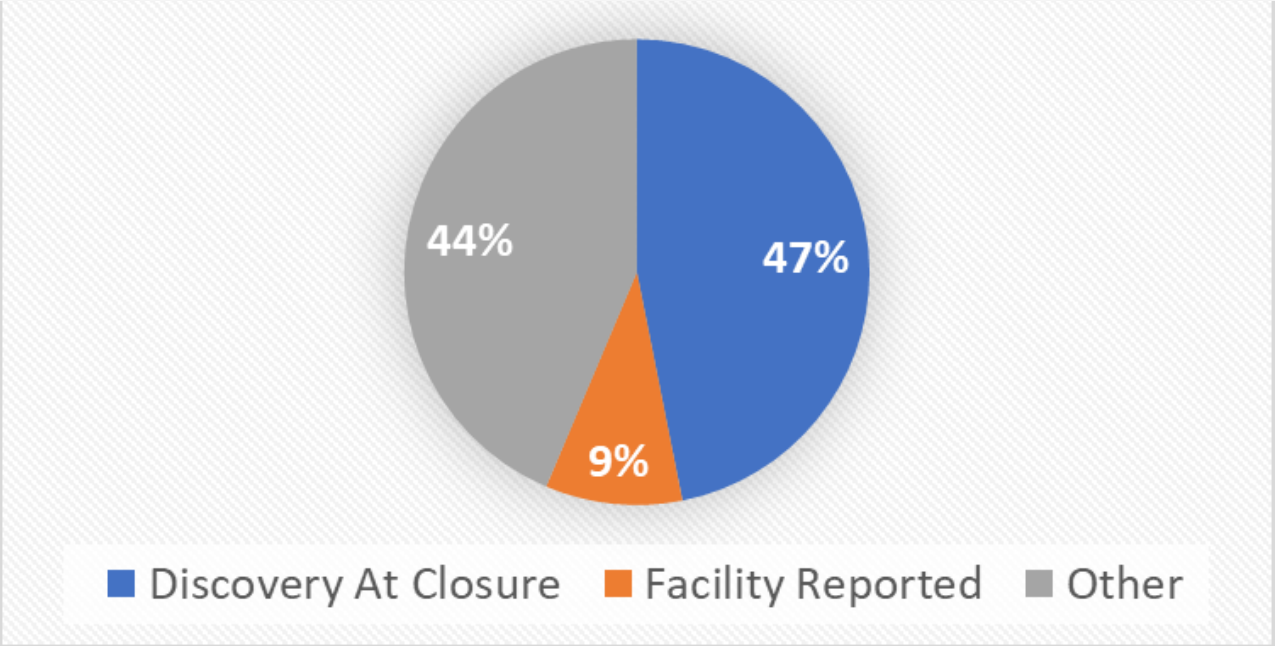


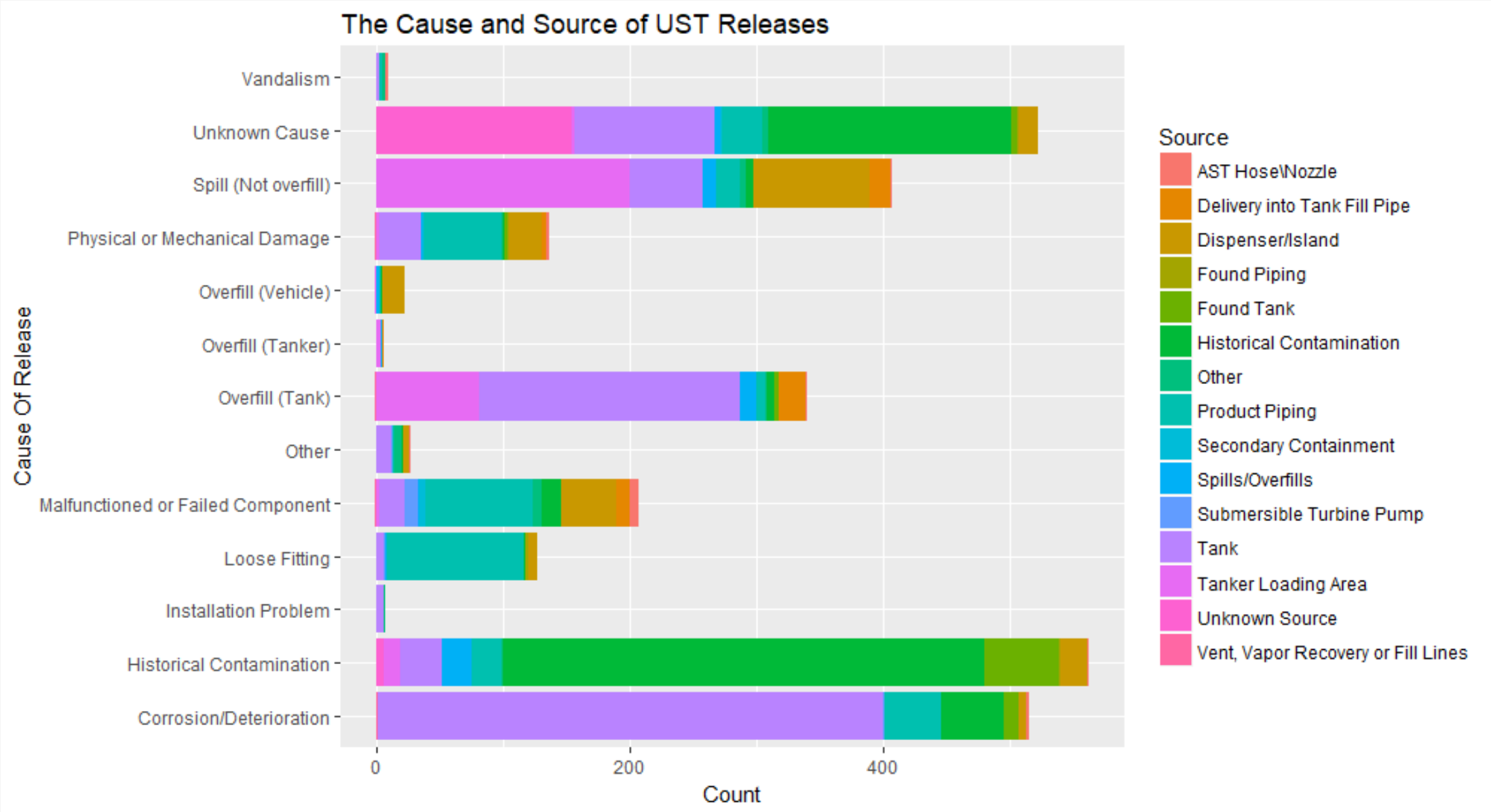
Description of Data

Substances in USTs



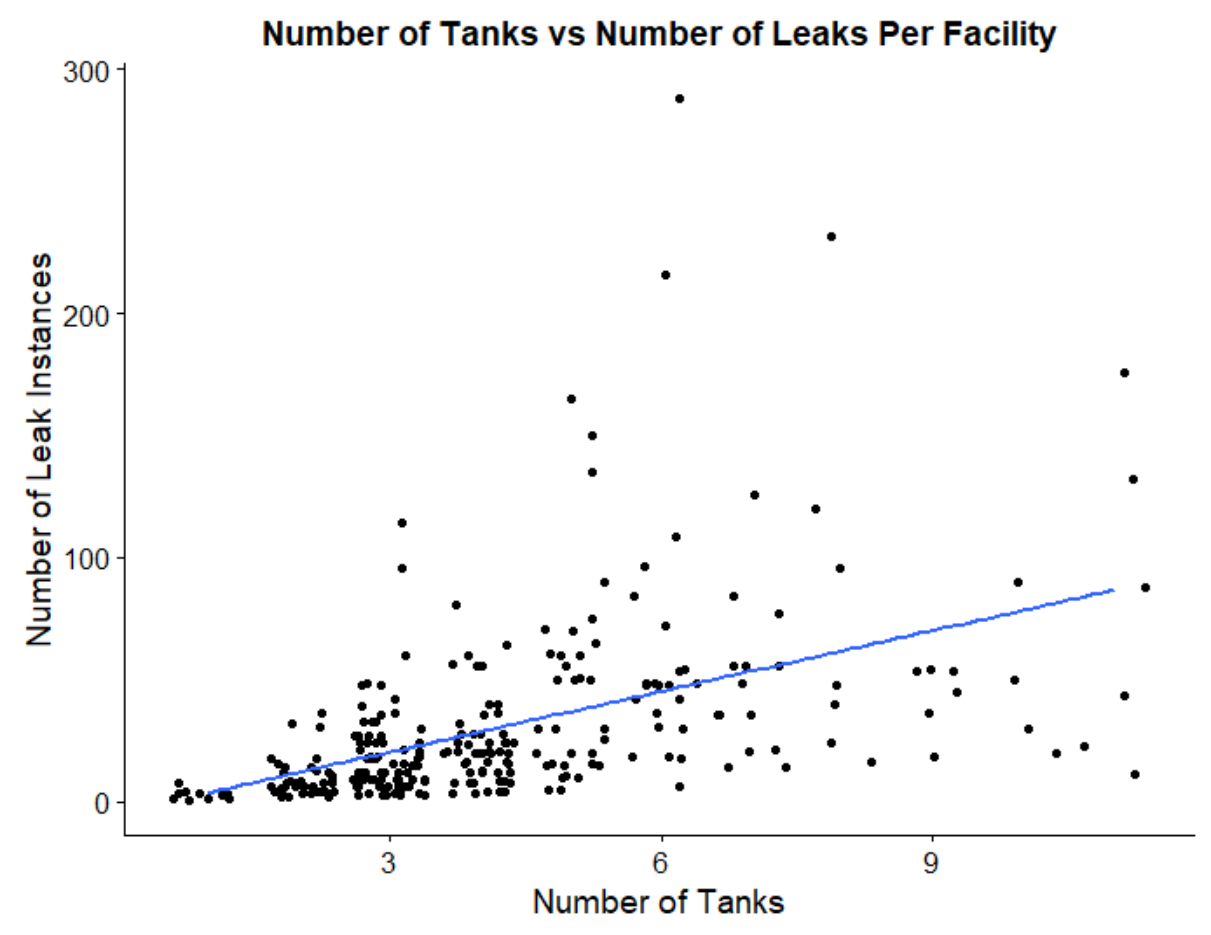
How The Releases Were Discovered



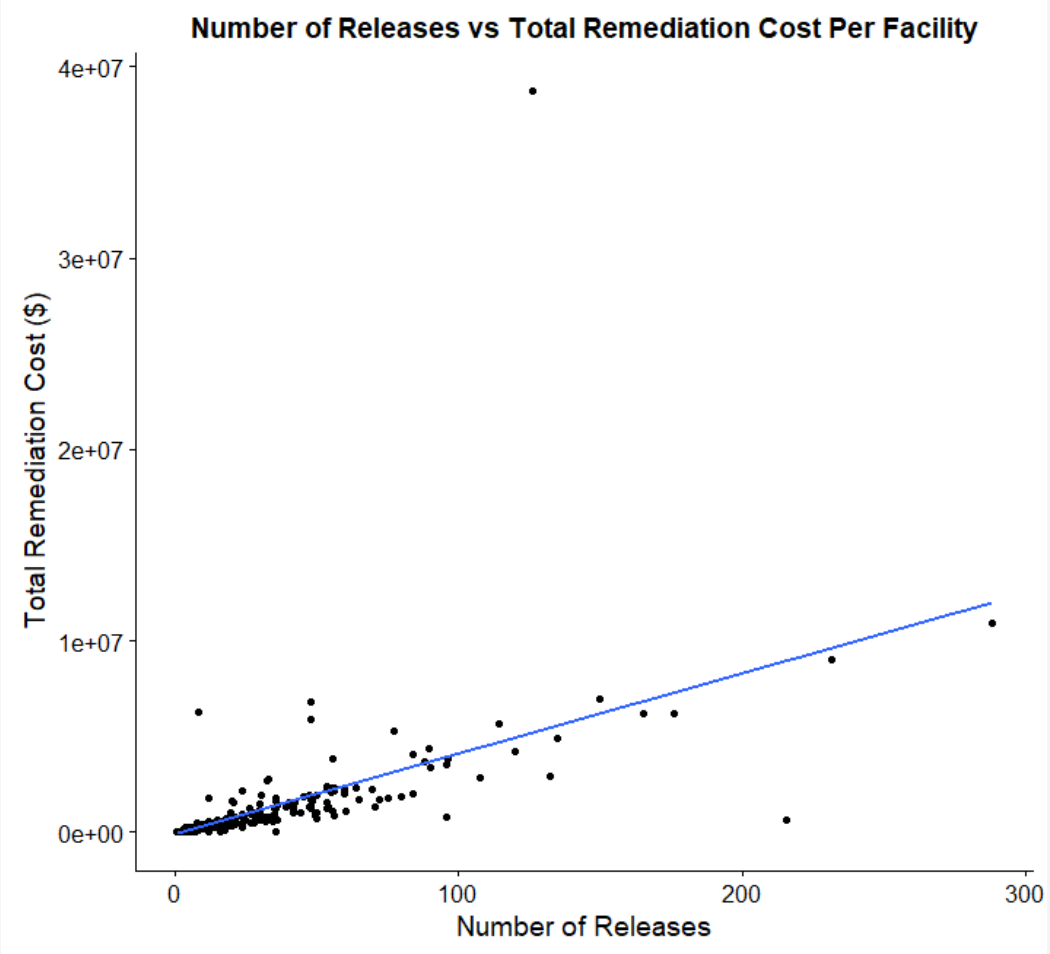

The Cause and Source of UST Releases
Cause Of Release
Vandalism
Unknown Cause
Spill (Not overfill)
Physical or Mechanical Damage
Overfill (Vehicle)
Overfill (Tanker)
Overfill (Tank)
Other
Malfunctioned or Failed Component
Loose Fitting
Installation Problem
Historical Contamination
Corrosion/Deterioration
0
200
400
Count
Source
AST Hose\Nozzle
Delivery into Tank Fill Pipe
Dispenser/Island
Found Piping
Found Tank
Historical Contamination
Other
Product Piping
Secondary Containment
Spills/Overfills
Submersible Turbine Pump
Tank
Tanker Loading Area
Unknown Source
Vent, Vapor Recovery or Fill Lines

Testing Hypothesized Relationships

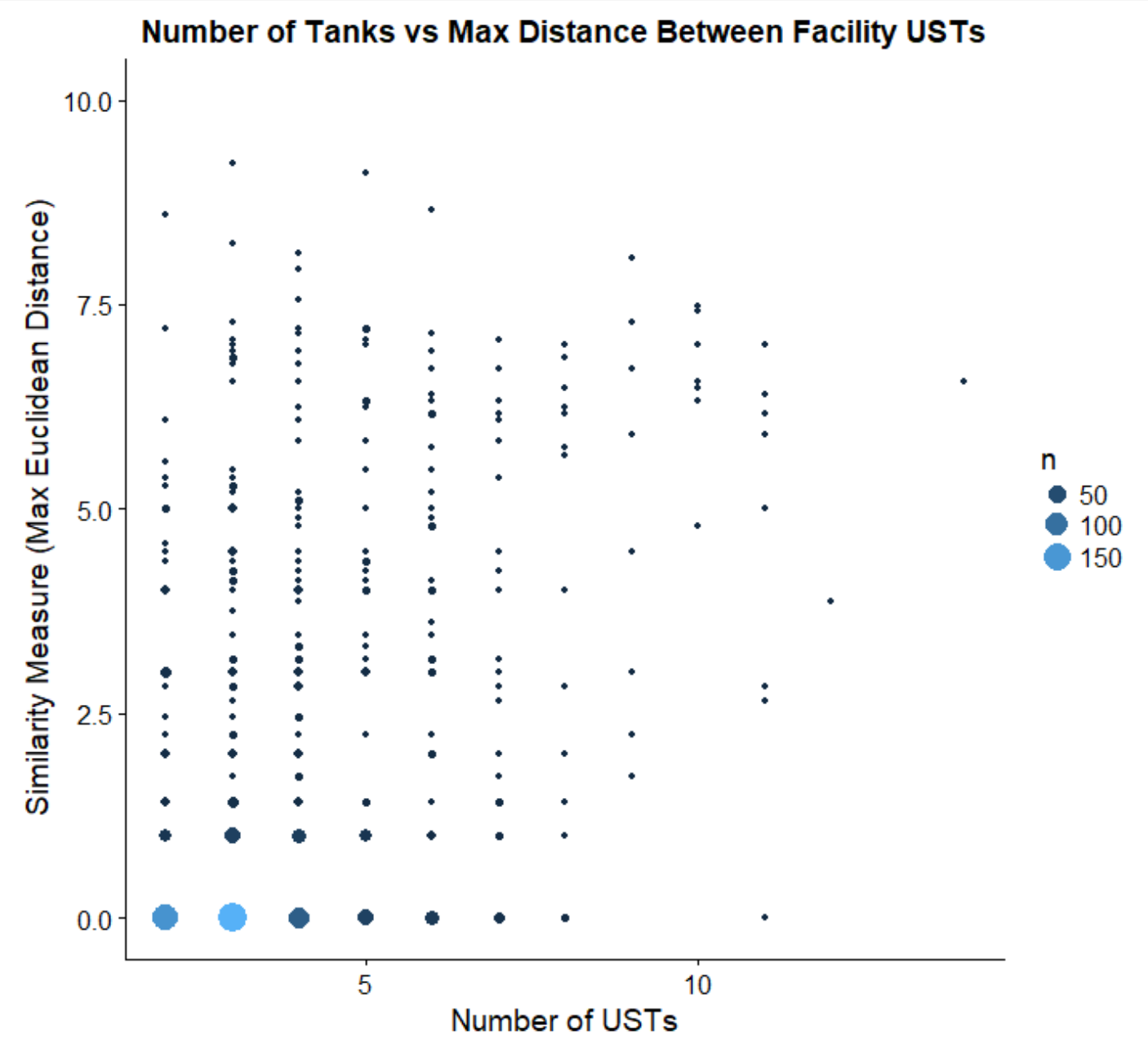
More USTs per facility would mean more releases per facility



More releases per facility would mean a greater total remediation cost.



UST Similarity – The Max Euclidean Distance



Predicting Remediation Cost

$$T = -2286.85(Source) + 1140.01(Overfill\ Protection) - 12698.38(Age) + 4599.49(Cause) + 508.21(How\ Found) + 24190.84(Petroleum\ Fund\ Eligible) + 1.35(Duration) + 1551.31(Tank\ Configuration) + 2025.14(Water\ Quality) + 1521.20(Source\ Water\ PRotection\ Zone) - 1579.77(Soil\ Texture) + 5885.75(Tank\ Category) - 2006.58(Pipe\ Leak\ Detection) + 1565.53(Surface\ Water) + 60.83(WPName) + 505.55(Substance) - 41350.36$$

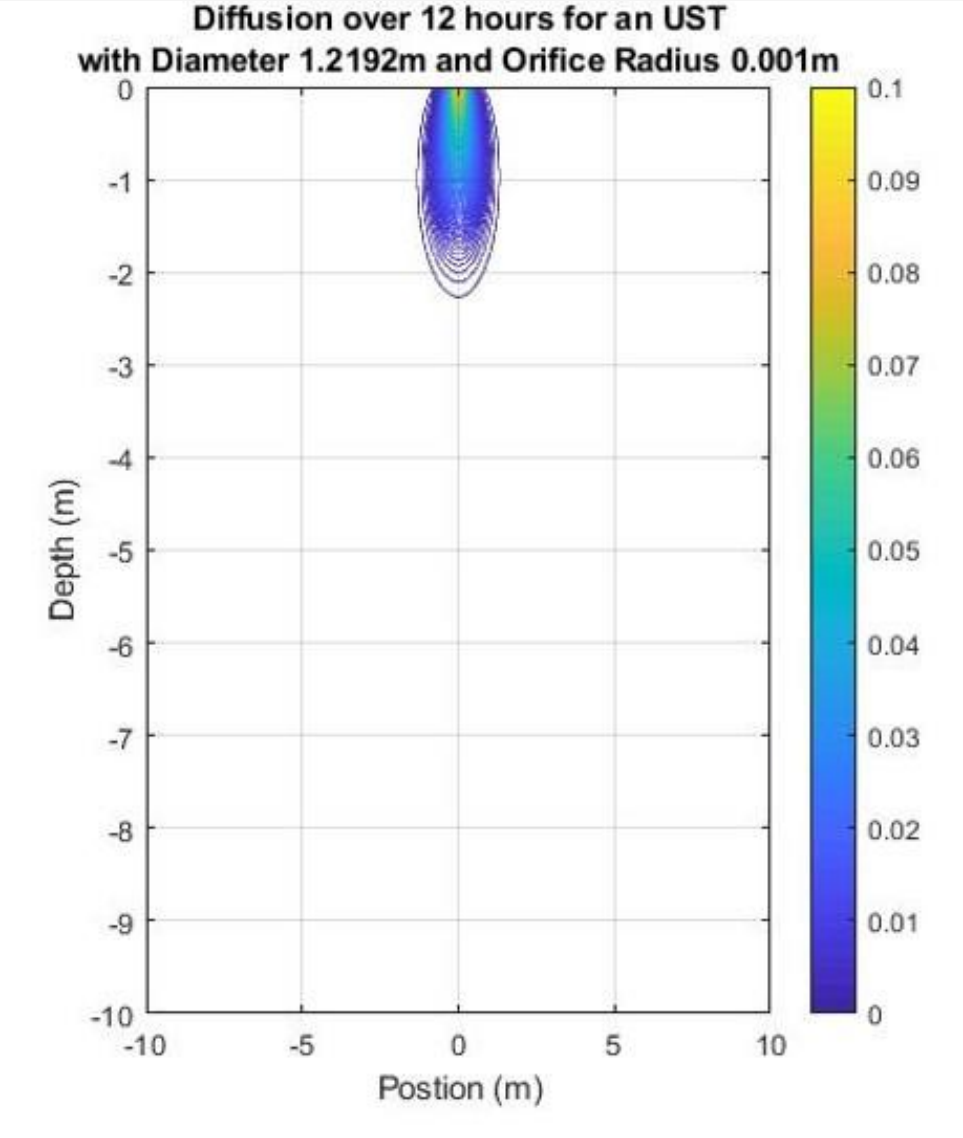
Predictors	2.5\%	97.5\%
Age	-13689.99106	-11706.77307
Petroleum Fund Eligible	18254.8372	30126.83756
Tank Category	3632.896849	8138.595737

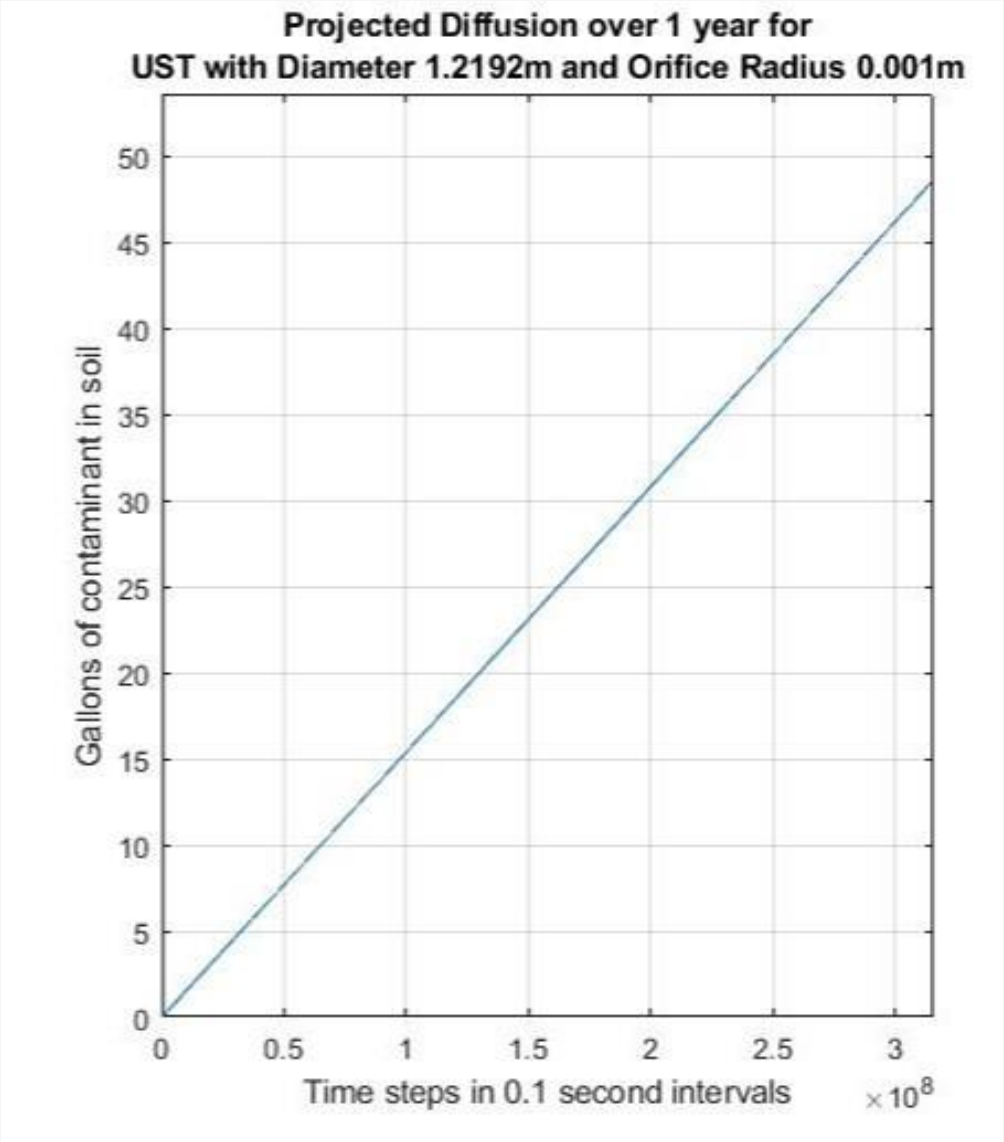
How Upgrades Affect Risk Coefficient

r = 0.019211(Source Water Protection Zone) + 0.013831(Distance To Closest Well) + 0.017834(Type of Closest Well) + 0.012589(Status of Closest Well) + 0.014882(Surface Water) + 0.028252(Water Quality) + 0.016965(Soil Texture) + 0.011879(Soil Permeability) + 0.020722(Population Density) + 0.002212(Land Use) + 0.018896(Spill Prevention) + 0.016654(Under Dispenser Containment) + 0.019582(Overfill Prevention) + 0.030484(Piping Configuration) + 0.027122(Piping Material) + 0.12521(Tank Configuration) + 0.022662(Tank Material) + 0.010689(Tank Age) + 0.004261(Pipe Leak Detection) + 0.003044(Tank Leak Detection) + 0.022718

Impact	Upgrade	2.50%	97.50%
1	Piping Configuration	0.030191753	0.030775555
2	Water Quality	0.027885401	0.028618624
3	Piping Material	0.026766524	0.027477117
4	Tank Material	0.022397723	0.022926916

Modeling Contaminant Diffusion

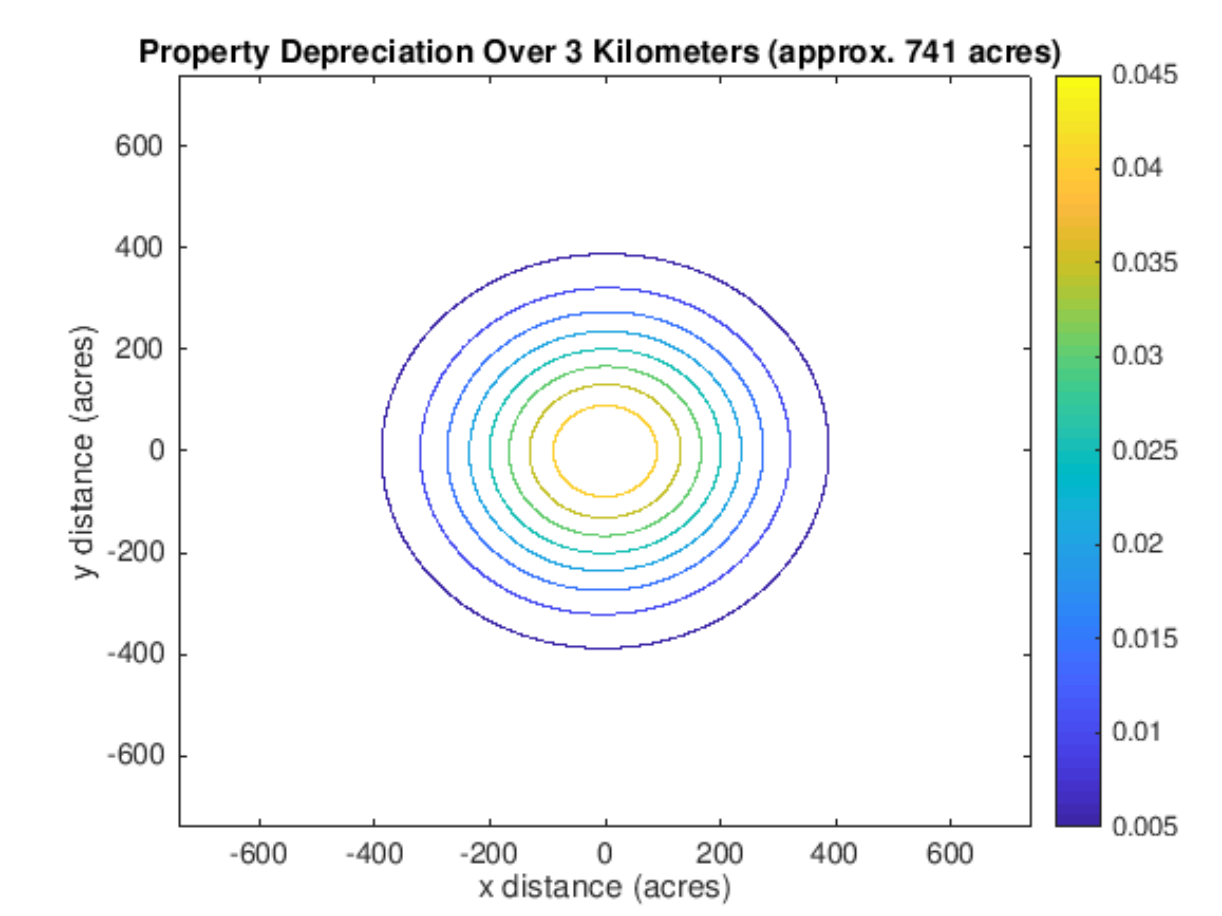




Diffusion Model Results

Capacity (gal)	Diameter (m)	Silty Sands	Clayey Sands	Clay
550	1.2192	11.24	11.31	11.42
1000	1.2192	20.43	20.56	20.76
1100	1.2192	22.47	22.62	22.83
1500	1.2192	30.64	30.84	31.14
1500	1.651	26.33	26.2	26.76
2000	1.651	35.11	35.34	35.68
2500	1.651	43.89	44.17	44.6
3000	1.651	52.67	53	53.52
4000	1.651	70.23	70.67	71.36
5000	1.8288	83.41	83.94	84.75
5000	2.1336	77.22	77.71	78.46
7500	2.1336	115.83	116.57	117.7
7500	2.4384	108.35	109.04	110.1
10000	2.4384	144.47	145.39	146.8
10000	3.048	129.22	130.04	131.3
12000	2.4384	173.37	174.47	176.16
12000	3.048	155.07	156.05	157.56
15000	2.7432	204.32	205.61	207.61
15000	3.048	193.84	195.07	196.95
20000	3.048	258.45	260.09	262.61
25000	3.048	323.06	325.11	328.26
30000	3.048	387.67	390.13	393.91

Depreciation in Property Values



Total Loss of Property Value In Surrounding Community

	Depreciation Values at Epicenter of Release		
Housing Price	**3%**	**4.5%**	**6%**
$59,329	$3.8M	$5.8M	$7.7M
$245,262	$1.6B	$2.4B	$3.2B
$1,182,212	$7.7B	$11.5B	$15.4B

Conclusion

- Future development
- More data
- Adapt other policies