

France at Risk?

The Potential Impact of Nuclear Terrorism in France

Background

Europe—especially France—has increasingly become the epicenter of terrorist activity in the West. With the attacks by the Islamic State of Iraq and the Levant (ISIL) in Paris, France is focused on state security. This focus extends to the power generation structures of France, spread throughout the country. France derives much of its electricity from large nuclear power stations. In fact, France produces approximately 75% of its electric power from nuclear power generation. With so many nuclear reactors spread throughout France, there is a risk, although small, that a carefully coordinated terrorist attack using explosives could cause a nuclear meltdown at one of these plants. Such an attack would generate a human and environmental catastrophe that would last for decades. There are two general levels of effects—12 miles and 50 miles:

- 12 Mile—Radiation would render area unlivable
- 50 Mile—Radiation effects that would complicate life

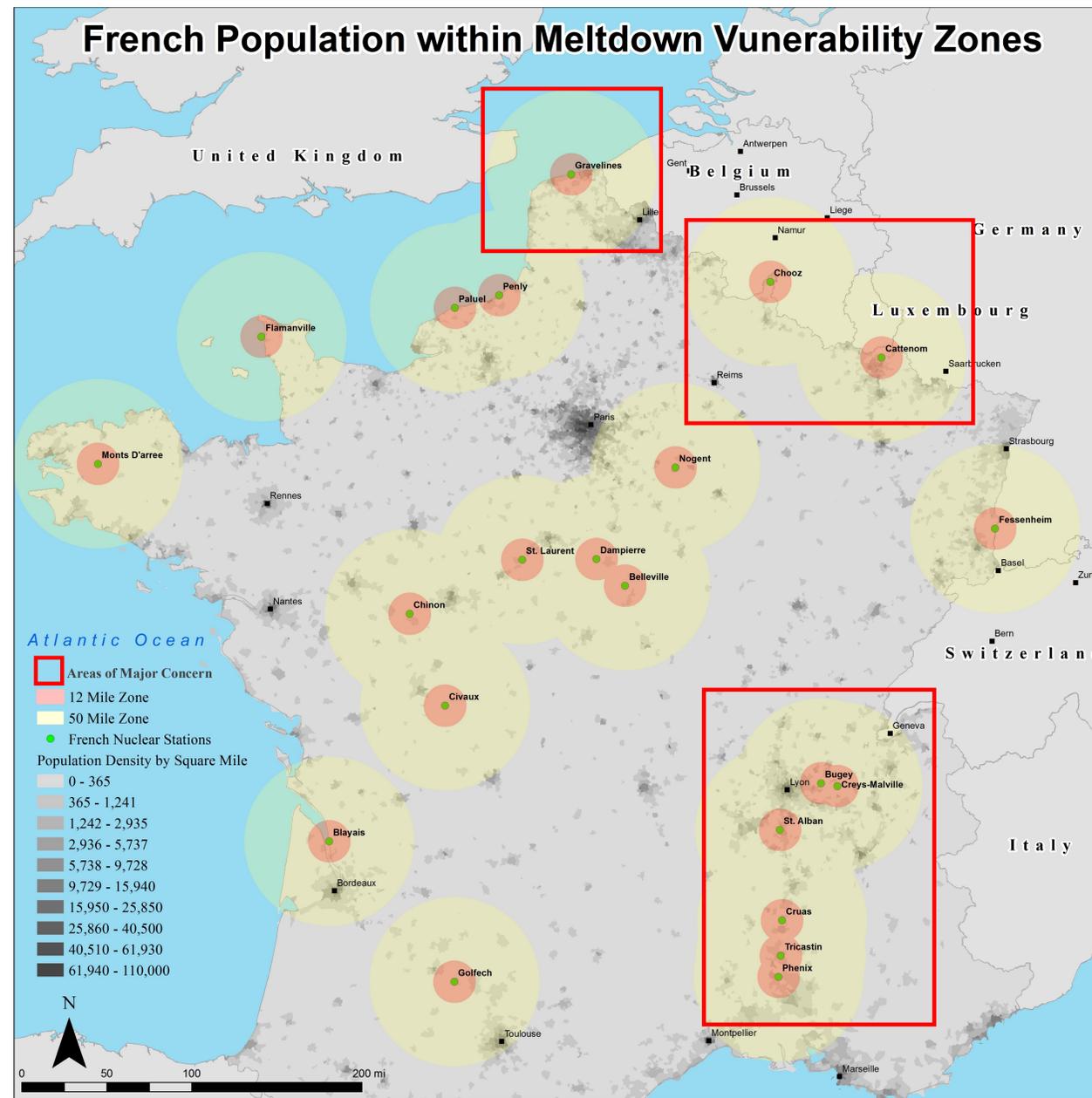
This project focused on three key spatial questions:

- How much of the French population would be affected by a nuclear meltdown in the 12 and 50 mile zones?
- What stations would most affect key land cover types?
- What neighboring countries would be affected by a potential meltdown and how much of those countries would be within the zone of effects?

Methodology

The analysis involved two levels of buffers around individual nuclear stations. The buffer ranges were based on affected zone size of other models. I used three different variables: population affected, land cover affected, and other countries affected. I analyzed each power station by the three variables.

- **Population Affected in France:** Calculated the number of people affected in each of the two zones—12 miles and 50 miles—using population data by municipalities in France.
- **Land Cover Affected:** Calculated the square miles of affected land cover around each of the plants in both France and surrounding countries.
- **Other Countries Affected:** Calculated the square miles affected in neighboring countries by individual station



Population Affected in France

12 Mile Zone		50 Mile Zone	
St. Alban	330,417	Bugey	4,737,013
Bugey	329,168	Creys-Malville	4,619,847
Gravelines	326,873	St. Alban	4,284,498
Cattenom	294,372	Nogent	3,087,441
Phenix	247,916	Gravelines	2,512,269
Tricastin	192,247	Phenix	2,404,311

Other Countries Affected

Station Name	Country	12 Mile (mi ²)	50 Mile (mi ²)
Bugey	Switzerland	-	44
Cattenom	Luxembourg	-	988
Cattenom	Germany	17	2,188
Cattenom	Belgium	-	723
Chooz	Luxembourg	107	77
Chooz	Belgium	341	4,923
Creys-Malville	Switzerland	-	91
Fessenheim	Switzerland	-	1,448
Fessenheim	Germany	220	2,722
Gravelines	Belgium	-	939
Gravelines	United Kingdom	-	286

Land Cover Affected

12 Mile Zone		50 Mile Zone	
Station Name	Cropland (mi ²)	Station Name	Cropland (mi ²)
Nogent	326	Nogent	4,000
Golfech	278	Chinon	3,847
Civaux	254	Golfech	3,714
St. Laurent	235	Belleville	3,378
Fessenheim	207	Gravelines	2,358

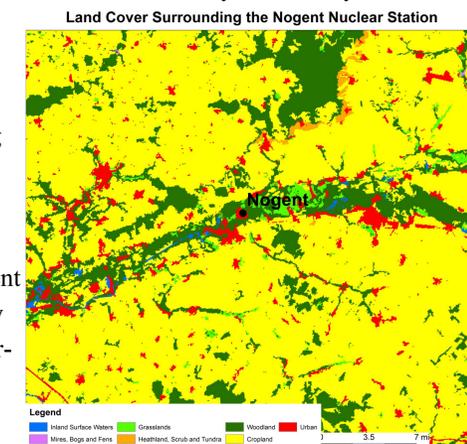
Station Name	Inland Water (mi ²)	Station Name	Inland Water (mi ²)
Phenix	9	Bugey	118
Bugey	8	Blayais	67
Cruas	8	Chinon	44
Chinon	7	Belleville	42
Fessenheim	6	Cattenom	42

Station Name	Grasslands (mi ²)	Station Name	Grasslands (mi ²)
Cruas	127	Bugey	2,324
St. Alban	117	Cattenom	1,975
Monts D'arree	114	Civaux	1,864
Belleville	103	Chooz	1,849
Cattenom	99	Chinon	1,581

Results

The tables below provide a snapshot of the results of this analysis. These results are focused on individual stations. Some key takeaways are:

- Six stations would have significant effects on neighboring countries if a meltdown occurred—for example Geneva is in the 50 mile zone for two power stations.
- Many of the stations are sited away from large population centers, however the impact on key types of land cover like cropland, inland water, and grasslands would have long term effects on France as a whole.
- Because all of the southern stations are close in proximity and utilize the Rhone river all would be limited in functionality if there was a meltdown at just one station.
- Maritime environments would be severely affected by a meltdown any of the coastal power stations.
- The global shipping route that runs through the English channel would be limited by an incident at Gravelines or any other station bordering the channel



Conclusions

The results and key takeaways should be understood in context. This study did not evaluate how secure each of the French nuclear power stations is nor the chances of meltdown if there was an attack on one of the stations. However, while the risk may be small, it is still important to understand where the vulnerability zones are around these stations and the potential impact on surrounding populations and environments in the event of a meltdown. The siting of most stations puts them away from major population centers—especially within the 12 mile zone that is most affected during a meltdown. Thus, the French should focus security specifically on the locations that could impact the most people or key parts of the surrounding environment. Additionally, neighboring countries should be working with the French government to ensure the security of stations on or near the borders because the effects of a meltdown would not stop at the border.

