Risk, Utilities, and Location

When we think of risk, we often think of things like the business of insurance companies, where staff members work to calculate the probability of something bad happening. They accumulate the combined risk of all policyholders. These folks make money if bad things don't happen and lose money if bad things do happen.

It has been said that utilities are risk averse. At least in the past, utilities have been very conservative regarding doing anything or not doing anything that could cause bad things to happen. The problem is that the cost of that conservatism is getting higher and higher. Given these trying economic times, utilities must figure out how to keep bad things from happening yet not spend more than they can afford. The problem is, in fact, getting worse because utility infrastructure is aging faster than companies can replace it. So as facilities fall into disrepair and hazards abound, reliability suffers.

What bad things can happen? To name a few: power failures, gas main breaks, fires, flooded substations, transformer leaks that contaminate sensitive wetlands, sabotage, cyber-attacks, and theft of current. It's enough to keep any utility executive up at night. How do utilities manage these risks?

Since insurance companies have always been in the business of risk modeling, they understand a simple fact: the more you know, the more accurately you can calculate risk. If insurance agents were to assess the risk of fire in a building, they wouldn't just be satisfied with statistics about the building. They would do a thorough inspection, look at maintenance records, check code violations, look for greasy rags next to furnaces, and document anything and everything that could contribute to a fire in the building. They would check the neighborhood crime statistics, gang activity, and nearby graffiti, the proximity of fire hydrants, and everything around the building. They might even check to see if there were any suspicious fires in the area. They would look at demographics for income levels and age distribution. The more they know—good or bad—the better they can determine the risk of paying out. The higher the risk, the higher the premiums. Simple.

Insurance agents are looking at both the condition of the building itself and the surroundings. So condition and location determine risk. As utilities attempt to mitigate risk, they too need more and more information. They need to know where facilities are located, the condition of the equipment, and what hazards may be lurking nearby. They need to do a proximity analysis—which, by the way, is one of the most common GIS spatial analytic functions. They can then perform a weighted overlay analysis to combine risk factors, another common GIS spatial analysis function.

Recently, I happened to be in a very sophisticated control room of a transmission operator. The staff constantly performed real-time power flow studies. They were doing n-1 and n-2 contingency analysis and building scenarios of what might happen if a certain generating unit or transmission line tripped out. I asked one of the dispatchers which of the two lines they were studying had the highest risk of failure. He said they didn't look at that. He did know that line 1 would cause more concern than line 2 but didn't have any insight into the relative risk of failure of one over the other. I thought that if one line had a higher probability of failure, like the old creaky house with greasy rags next to the furnace, then that

might change the decisions about how the system operated. He agreed but stated that they didn't have that kind of data or the means to determine the relative risk. Ironically, the data and the tool exist. The tool is GIS. I'm not talking about the GIS that is used to simply create maps. I'm talking about the GIS that can collect a whole host of data content from within the company and from over the web, perform spatial analysis, and display the results in the control room or on a tablet computer.

Utilities can use GIS to do exactly what insurance companies do every day. They can scour internal databases and the web for datasets such as lightning strike history maps, flood maps, wildfire zone maps, earthquake shake maps, high crime area maps, and real-time weather services. Utilities can see where a critical transmission line crosses a river or is next to a steep slope. They can assess areas where it might be easy to fix a transmission line compared to one where they need a helicopter. Utilities can combine this data in a GIS to discover what parts of the system are more at risk than others and can disseminate that knowledge throughout the company. A gas company can assess where high-pressure transmission lines cross under heavily traveled highways or where there are regulator stations that could be flooded during a 100-year storm event.

Insurance companies hate surprises more than anything else. A surprise is another term for a failure of the risk model. A surprise is simply a factor that they forgot to include in the model. If a transmission operator is surprised that a transmission line is now under threat of a nearby wildfire, it would indicate that the risk analysis did not include a fire zone. Sure, surprises happen. They even happen to insurance companies sometimes, but rarely.

When I ran operations for a power company, I experienced too many surprises. I discovered that risk analysis for utilities can be simple: know where your stuff is, determine its condition, and identify all possible threats. Then perform a GIS spatial analysis that combines factors using common spatial tools like proximity, buffering, overlay, spatial statistical analysis, heat maps, and cluster maps. Like the insurance companies, you can minimize surprises, mitigate risk, and sleep soundly.

To learn more about how ArcGIS for Electric helps utilities determine the risk and vulnerability of their distribution system, visit http://solutions.arcgis.com/utilities/electric/help/storm-vulnerability/