Bruce Power: How to Implement a World-Class Emergency Response Program

Introduction

In the wake of the 2011 Fukushima Daiichi nuclear plant accident in Japan, Bruce Power, the world's largest-operating nuclear facility, performed an in-depth analysis of its operations and safety programs. As a world leader in nuclear power, the company continually seeks to improve its processes and operate at the highest safety standards. In particular, Bruce Power wanted to examine its stations' abilities to withstand a beyond-design-basis event (BDBE)—any extreme threat, however unlikely, that may exceed what the stations were designed to handle.

Bruce Power turned to ScottMadden and RTI International to help formulate and execute a strategy that would allow the company to take a leadership position within the industry in the post-Fukushima era. ScottMadden and RTI worked with Bruce Power to conduct a gap assessment, design and deploy a state-of-the-art remote radiological-monitoring system, and customize a centralized, analytical software tool that enables all responders to access a "single version of the truth" in the event of an emergency. These new tools and associated processes significantly reduce the risk of radiation exposure for first responders in the field. They also diminish the potential for erroneous or conflicting data that could hamper response efforts in a rapidly evolving situation.

The Challenge

While Bruce Power has a strong history of safe nuclear power operations, the company wanted to position itself as the worldwide leader in safety and emergency preparedness. ScottMadden and RTI worked closely with Bruce Power to examine its preparedness for an extraordinary event (i.e., one on par with the Fukushima Daiichi accident).

Two important lessons arose from Fukushima. First, in the aftermath of the accident, it was extremely challenging for officials to gain a coherent, credible understanding of the facts. This in turn led to a lack of direction. Second, the magnitude of the accident extended the restricted zone to 80 km, which substantially exceeded the scope of the pre-planned emergency response (typically 10 km). This meant that large numbers of surveyors were taking radiological measurements without knowing whether they were entering hot zones, elevating their risk of exposure. In addition, with only limited data from the field, official recommendations for actions to protect the public were invalidated by field data, potentially putting the community at greater risk.

Bruce Power asked ScottMadden and RTI to devise and deploy a strategy that would improve emergency response communications and bolster radiological-monitoring systems.

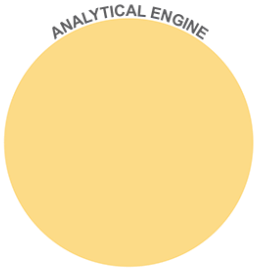
How We Helped

After conducting a thorough gap assessment, with special attention to key lessons learned from Fukushima, ScottMadden and RTI identified three key focus areas. In the event of a BDBE, nuclear plants should have the following:

- An analytical engine that collects and evaluates radiological data in real time, eliminating human calculation errors
- A single dashboard that displays real-time radiological and environmental data, providing a centralized, authoritative version of events as they unfold
- Fixed and deployable monitoring equipment in the field that reliably pinpoints radiation pathways during and after an accident, enabling workers and community members to reduce radiological exposure

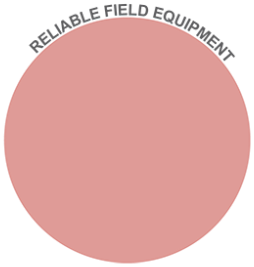
Elements of a World-Class Emergency Response Program Post-Fukushima

- Analytical Engine
  - Provides internal and external users access to real-time radiological and environmental data
  - Consolidates required information (e.g., meteorological conditions, field survey results, dose model outputs)
  - Enables the emergency management center to make decisions
  - Provides multiple-operating modes (e.g., event, drill)
  - Speeds understanding with automated radiological calculations



- Process Integration/Change Management
  - Updates procedures to integrate new monitoring capability
  - Trains personnel on updated procedures
  - Obtains approvals from regulators/provincial authorities
  - Permits field holders
  - Manages construction vendor
  - Performs safety analysis
  - Implements a preventive maintenance program

- Reliable Field Equipment
  - Delivers redundant communications (e.g., cellular, satellite, radio)
  - Provides gamma monitors and air samplers that measure possible radiological emissions with power backup
  - Transmits radiation measurements in real time
  - Secures the site physically
  - Withstands extreme weather



Analytical Engine to Provide Greater Visibility

ScottMadden and RTI developed a customized database and software application called Nu-

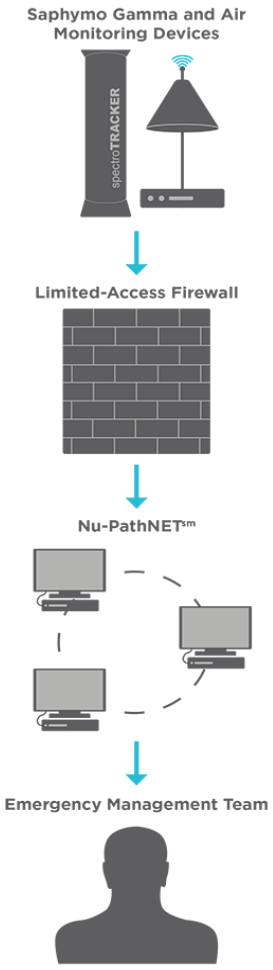
PathNET[SM], which provides unprecedented visibility into the effects of a radiological release on the surrounding community. The servers are located off site, so the system will be unaffected by events at the stations. The database consolidates critical data from radiological monitors, meteorological and environmental sources, dose models, etc. Then, because the software is integrated with a geographic information systems interface, it quickly displays how the plume will impact every road, stream, or home in the affected area. The level of granularity informs decision making.

Single Dashboard to Display Real-Time Data

The Nu-PathNET[SM] dashboard brings together the vital data emergency responders, health physicists, and decision makers need to act quickly and decisively as circumstances evolve. The dashboard provides information on environmental conditions (e.g., from which direction the wind is coming, whether the wind direction will change, if precipitation is impacting the area), levels of radiation concentration (in the air, on the ground, etc.), hot zones, and more. By allowing key stakeholders to access the same data and a single source of the truth, the Nu-PathNET[SM] analytical engine provides a single data set that can be used by multiple agencies during an emergency. This eliminates the risk of contradictory data as a result of collection-timing differences or differing equipment sensitivities.

Fixed and Deployable Tools to Monitor Conditions

ScottMadden and RTI designed a network of 44-fixed monitors in the field to measure emitted radiation or environmental data during an emergency. The team also developed an expandable network of deployable monitors that can be used in the event a plume expands beyond 10 km. This hardware can be dropped in front of the plume, protecting surveyors from taking "blind" measurements and minimizing exposure. The data is transmitted in real time over a redundant communication link (i.e., cellular and satellite).



Saphymo Gamma and Air-Monitoring Devices
Highly reliable gamma monitors allow you to collect radionuclide and air particulate data under any environmental condition from across the monitoring zone in real time to limit the dose exposure for field team survey members.

Limited-Access Firewall
A fully redundant data design allows for transmission of data across a cell phone or satellite network and hosted at multiple off-site physically secure warehouses. The network design also fully complies with all industry-specified cybersecurity regulations.

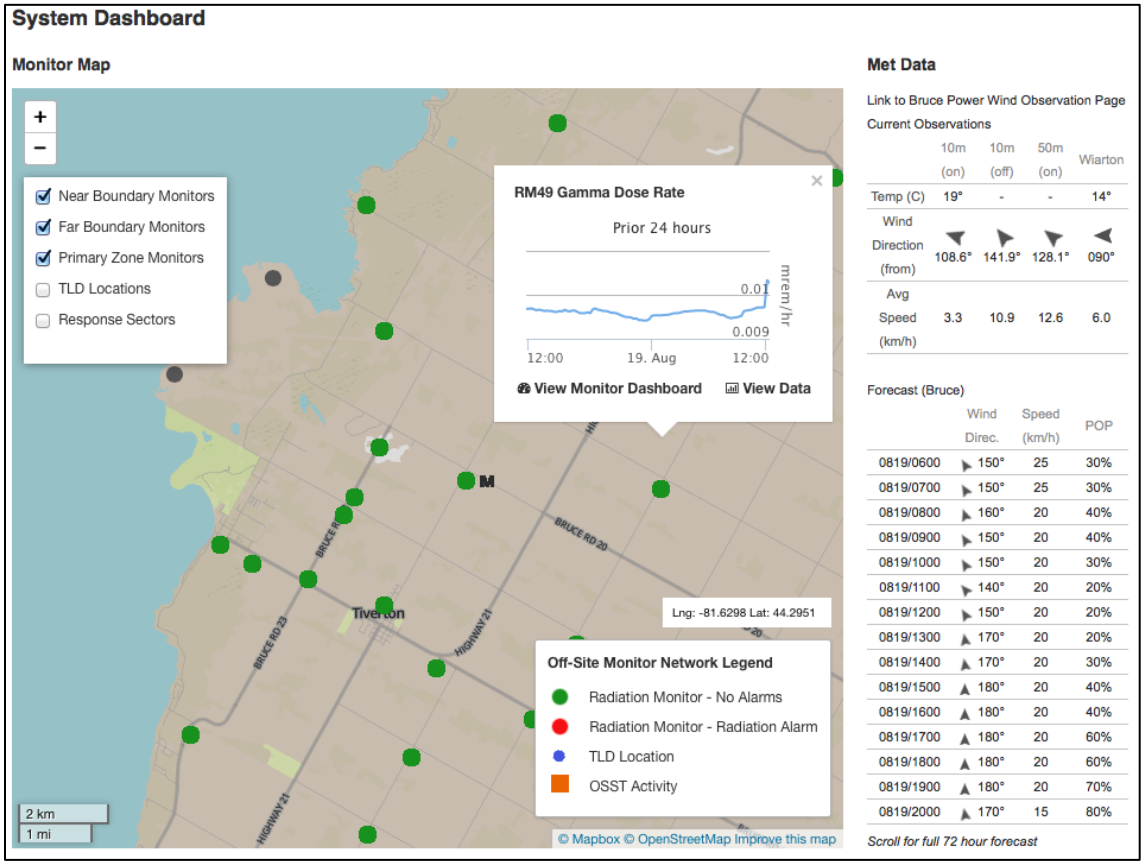
Nu-PathNET[SM]
Nu-PathNET[SM], a state-of-the-art analytical tool built specifically for the nuclear industry, enables you to compile and consolidate detailed information regarding off-site radiological conditions, including radiological measurements, meteorological data, dose model output, and field team survey measurements, so you can make the best decisions to protect the public.

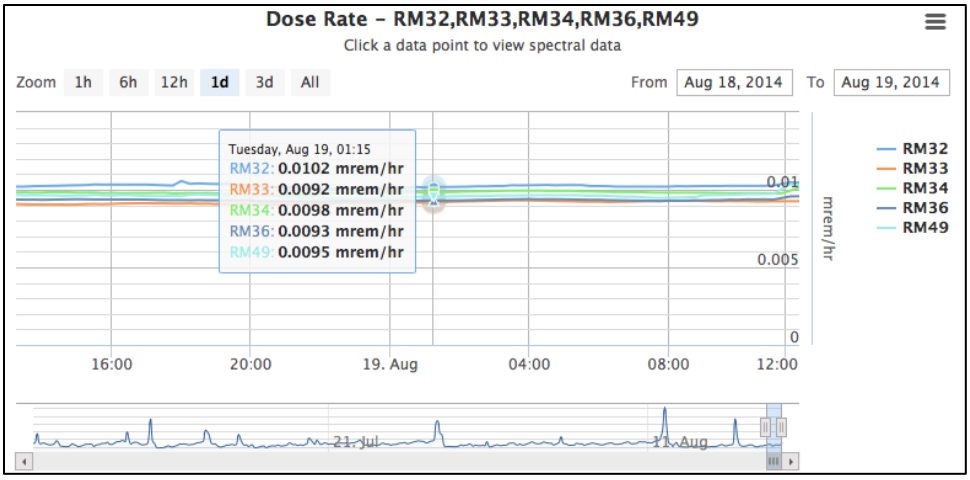
Emergency Management Team
To ensure optimal facility management, Nu-PathNET[SM] allows you to view data in real time, maintain all data pertaining to an event in a single analytical

framework, and immediately apply data visualization and analysis. The nature and extent of radiological conditions before, during, and after an event can be quickly understood and evaluated.

Results

Before deploying this new system, Bruce Power was required to send surveyors into the field within two hours of an emergency. The Canadian Nuclear Safety Commission (CNSC) has since determined that the new system is a game-changer for emergency response. Because the hardware and software provide reliable, real-time data in the immediate aftermath of an accident, Bruce Power expects that it will have more time to deploy emergency survey teams.





Because the new system provides highly granular data that informs emergency responders and civic leaders in real time, it benefits several external agencies as well. “This new analytical dashboard doesn’t just aid Bruce Power in an emergency,” said Frank Saunders, vice president, Nuclear Oversight and Regulatory Affairs at Bruce Power. “We are making it available to several key agencies in Ontario, so we all have access to the same information and can communicate effectively to protect the public during an emergency.”

ScottMadden and RTI also trained Bruce Power personnel on the new equipment, so the team is prepared for any contingency. “This new system puts our emergency management center team in the driver’s seat,” said Dan McArthur, manager, Emergency Management at Bruce Power. “Our employees will have all the information they need at their fingertips to make informed decisions that will keep our community and our workers safe.”

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