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Post-Fukushima Emergency Response and Environmental Monitoring at Bruce Power

Enhanced Data Management and Program Support

RETS/REMP Conference

June 2014

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Topics for Discussion

- Provide an update on post-Fukushima initiatives related to environmental monitoring.
- Share with you a project nearing completion in Canada that implements enhancements to off-site monitoring in direct response to lessons learned from Fukushima.
- Highlight the step-change made possible by technical improvements enabling integration among data collection, emergency response, and multi-party collaboration.
- Make you aware of the direct applicability of these technical improvements to routine environmental monitoring for both radiological and non-radiological monitoring.

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Fukushima Daiichi Situation

Chaos → **Facts** → **Understanding** → **Communication**

- In the immediate aftermath of the Fukushima Daiichi accident, TEPCO was unprepared to provide reliable radiation exposure data on which to make critical decisions.
- Despite having world-class systems, their ability to make sense of the data for themselves and for the public and other businesses operating in the area proved inadequate. What prevailed was:
  - Information Chaos. Gaining a coherent and credible understanding of the facts was very difficult in the first weeks of the event because there was no consolidated, authoritative source of information.
  - Lack of Direction. Government officials, news outlets, and the public were citing disparate bits and pieces of information leading to misunderstanding, misinformation, confusion, and rumors.
  - Response Area Expansion. The restricted zone extended to 80 km (50 miles), which substantially exceeded the scope of the pre-planned emergency response.
- Consequently, TEPCO, the Japanese government, and the nuclear industry generally suffered substantial reputation damage and lack of public confidence in the industry's emergency response capabilities – no firm wants to be in this situation.

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North American Response

The North American Nuclear establishment has recognized the need to enhanced monitoring capability for nuclear facilities.

- United States
  - NEI Way Forward (Goal #8)
    - Develop accident response procedures for controlling, monitoring, and assessing radiation ingestion pathways during and following an accident together with timely communication of accurate information.
    - [ref. The Way Forward, U.S. Industry Leadership in Response to the Events as the Fukushima Daiichi Power Plant, June 2011].
- Canada
  - Canadian Nuclear Safety Commission (Recommendation 5c).
    - …verify or develop tools to provide off-site authorities with an estimate of the amount of radioactive material that may be released and the dose consequences, including the installation of automated real-time station boundary radiation monitoring systems with appropriate backup power…
    - [ref. CNSC Fukushima Task Force Report, INFO-0824, October 2011].

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- Formed in 2001, Bruce Power is Canada's only private-sector nuclear generator and operates the largest nuclear generating facility in the world, producing 6,300 MW, or more than one-quarter of Ontario's electricity.
- In 2012, successfully restarted Units 1 and 2 bringing the site to eight operating nuclear reactors.
- Located in southwest Ontario, 250 km northwest of Toronto.

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Objectives and Scope

- Improve the off-site radiological monitoring capacity and readiness by improving:
  - Monitoring network
  - Monitoring equipment
  - Data management and analytics
  - Emergency response procedures

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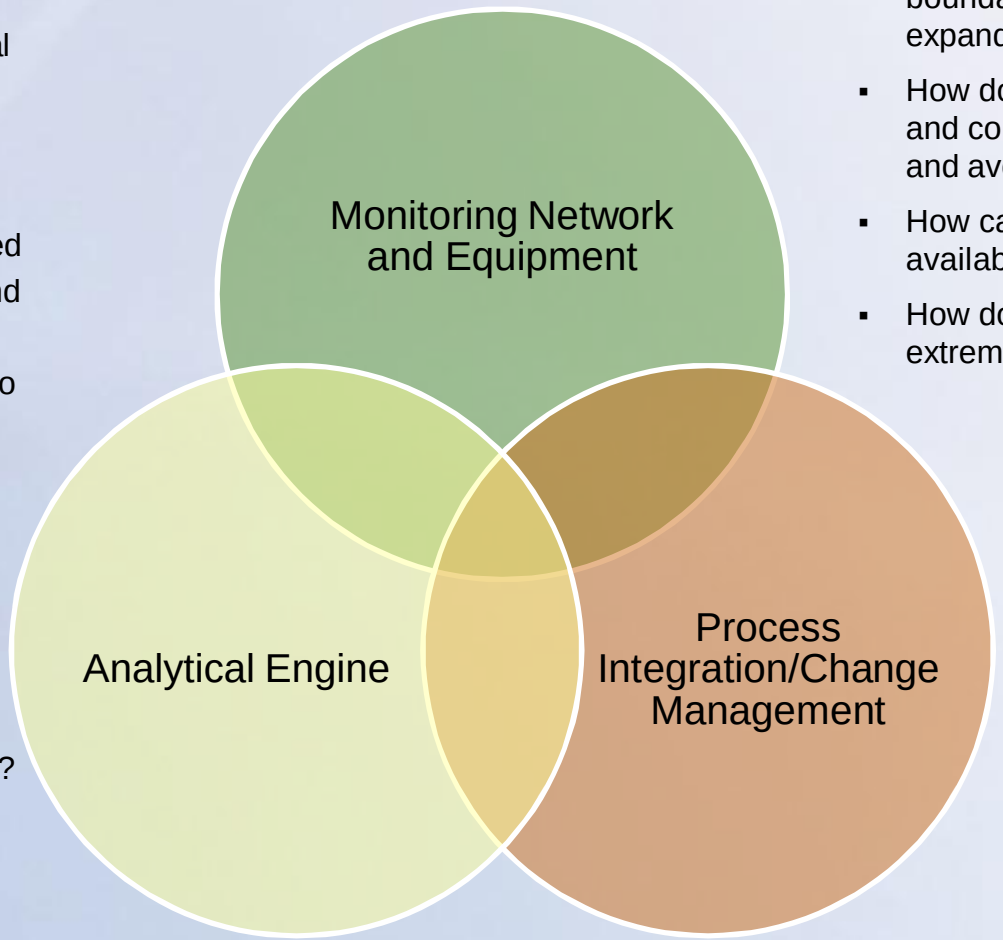
Key Components of the Solution

- How can we provide a reliable link to radiological and environmental data remotely without reliance on station infrastructure?
- What analytics are needed by safety section chief and how do we automate calculations and reports to speed workflow and minimize potential for human error?
- How do we integrate the disparate organizations and functions into an efficient work flow and decision support process?



- What network is required for boundary monitoring and expandable for a BDBE?
- How do we operate without power and communication infrastructure and avoid single point of failure?
- How can we make field data available in real time?
- How do we ensure operation in extreme weather conditions?

- What procedures need to be updated to incorporate enhanced monitoring data and to train/exercise personnel?
- What approvals from federal/provincial authorities on process updates and field configuration are needed?

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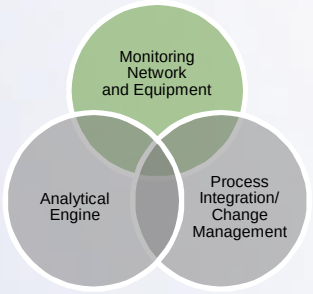
Preplanned Monitoring Network and Equipment

- Monitoring network:
  - Near and far boundary monitoring network with fixed gamma monitors.
  - Expand the spatial coverage beyond near and far boundary monitoring to include fixed points across the 10 km primary zone.
  - Deployable gamma monitors with isotopic data capability augment fixed monitoring equipment for possible expanded area.
- Monitoring equipment:
  - Deploy gamma monitors with isotopic data allowing for detailed spectral analysis at fixed secure monitoring locations.
  - Instrumentation operates in extreme weather conditions, uses standalone power, and provides cellular or satellite communication.
  - Add automated air samplers to provide iodine and air particulate data.



Example Gamma Monitors and Air Samplers

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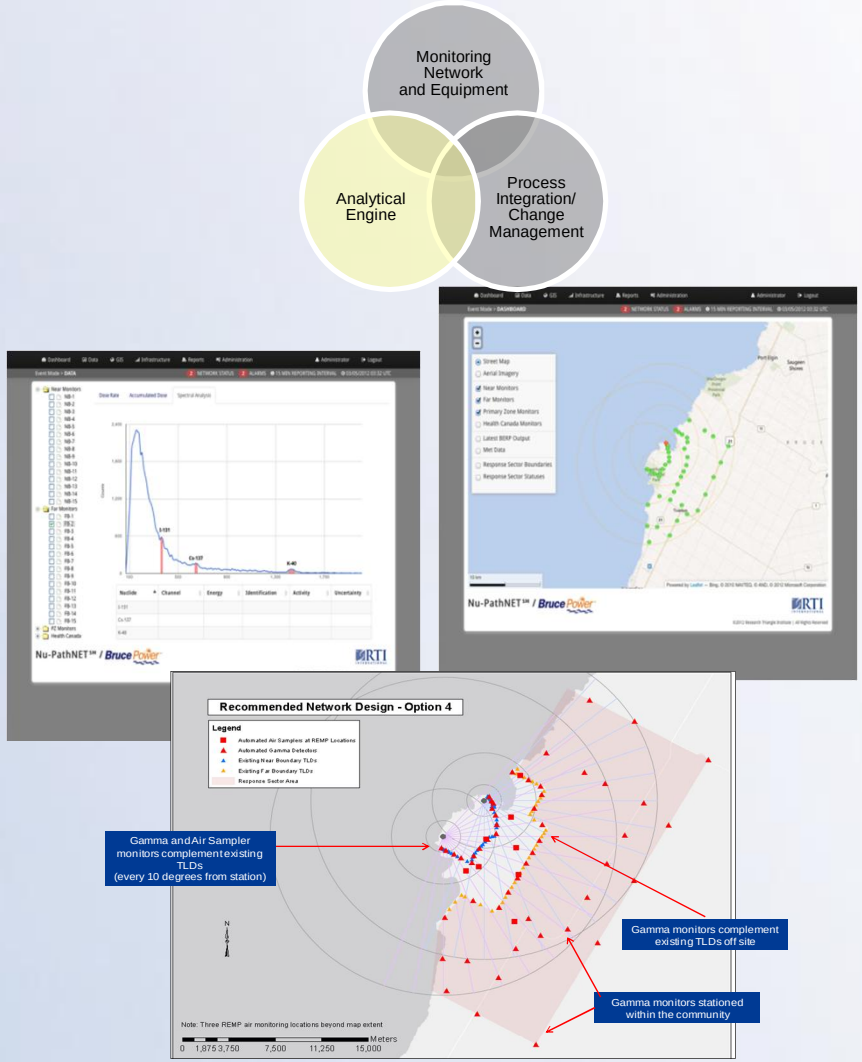
Analytics for Coordinated Event Management

- Deploy Nu-PathNET^{SM} analytical engine to enhance emergency management response collaboration and decision support by integrating operations functions and across internal and external stakeholders.
- Provide immediate access to radiological monitoring data from automated monitoring, manual field sampling, and HP laboratory analyses results.
- Provide simulator functions in drill mode for training, exercises, and drills for better emergency preparedness.



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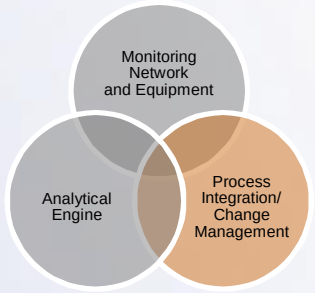
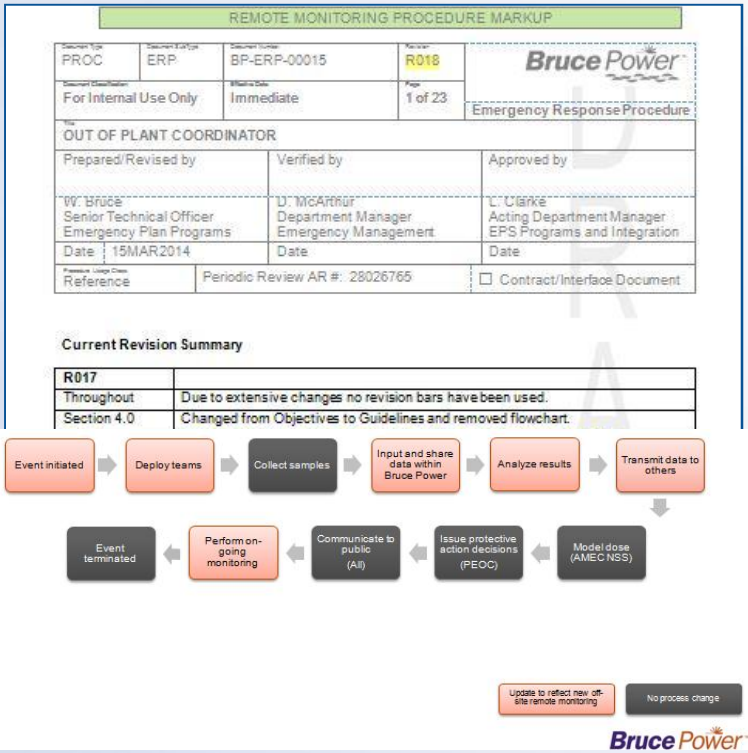
Process Integration

- Procedures:
  - Update EP procedures to account for availability of automated monitoring information
  - Integrate new analytical software into emergency response so reporting can be streamlined
  - Roles and responsibilities are defined and documented
  - Ensure review and approval of updated procedures and plans and compliance with cyber-security requirements
- Readiness:
  - Conduct table-top exercises and education sessions with organization to ensure performance of enhanced procedures, equipment, and software




REMOTE MONITORING PROCEDURE MARKUP

PROC	ERP	BP-ERP-00015	R018	Bruce Power
For Internal Use Only		Immediate	1 of 23	Emergency Response Procedure

OUT OF PLANT COORDINATOR

Prepared/Revised by	Verified by	Approved by
W. Bruce Senior Technical Officer Emergency Plan Programs	D. McArthur Department Manager Emergency Management	L. Clarke Acting Department Manager EPS Programs and Integration
Date 15MAR2014	Date	Date

Reference | Periodic Review AR #: 28026765 | ☐ Contract/Interface Document

Current Revision Summary

R017	
Throughout	Due to extensive changes no revision bars have been used.
Section 4.0	Changed from Objectives to Guidelines and removed flowchart.

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Key Benefits of the Integrated Event Management Solution

1. Emergency Management Center has a “single version of the truth.”
   - Able to sort through the information chaos.
   - Experts are able to focus on assessing off-site conditions rather than searching for facts.
   - Streamlined data flows provide accurate data from field, lab, instruments (metrological and radiological) and model outputs.
2. Shared understanding of the situation by all stakeholders.
   - Utility and Federal/l Provincial entities see the same data in a common framework.
   - Communications are supplied via real-time internet vs. faxed paper reports.
3. Information system eliminates single point failure vulnerabilities.
   - Battery and solar powered hardware.
   - Redundant data communication (cell and satellite).
   - Data center are housed off-site; mirrored in multiple locations.
4. Leaner and “smarter” EP work processes.
   - Automated reporting of field data.
   - Eliminated manual error likely calculations/steps.
   - Quality of data transmission through an industry-leading cyber-security pathway.
5. Less reliance on manual surveys; reducing radiological exposure for workers.

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Applicability of EP Enhancements to REMP

EP Benefits

1. Emergency Management Center has a “single version of the truth”
2. Shared understanding of the situation by all stakeholders
3. Information systems eliminates single point failure vulnerability
4. Leaner and “smarter” EP work processes
5. Less reliance on manual surveys; reducing radiological exposure for workers

REMP Benefits

1. Single data repository of environmental site conditions
2. Common understanding of environmental conditions across environmental program areas
3. Reliable enterprise infrastructure
4. Leaner and “smarter” REMP work processes

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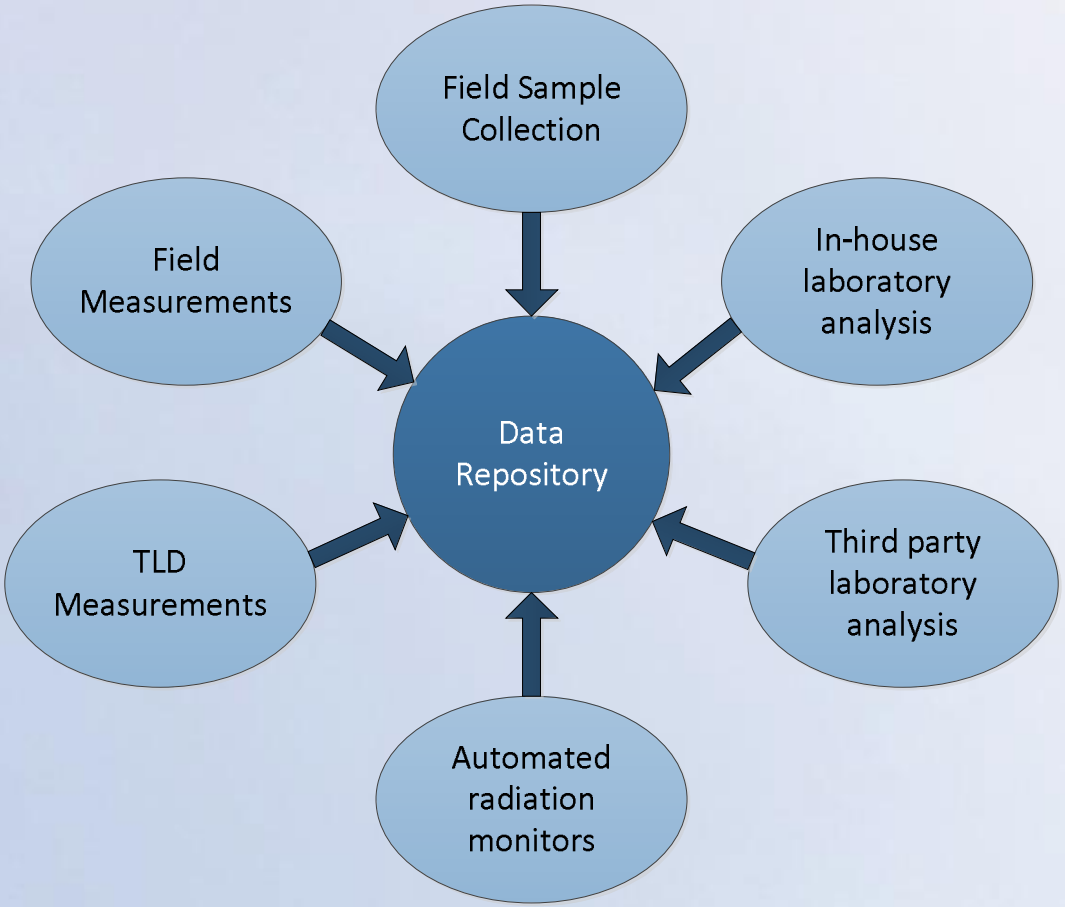
Data Repository is the Foundation of an Industry-Leading REMP Program

The “single version of the truth” starts with a reliable enterprise data repository



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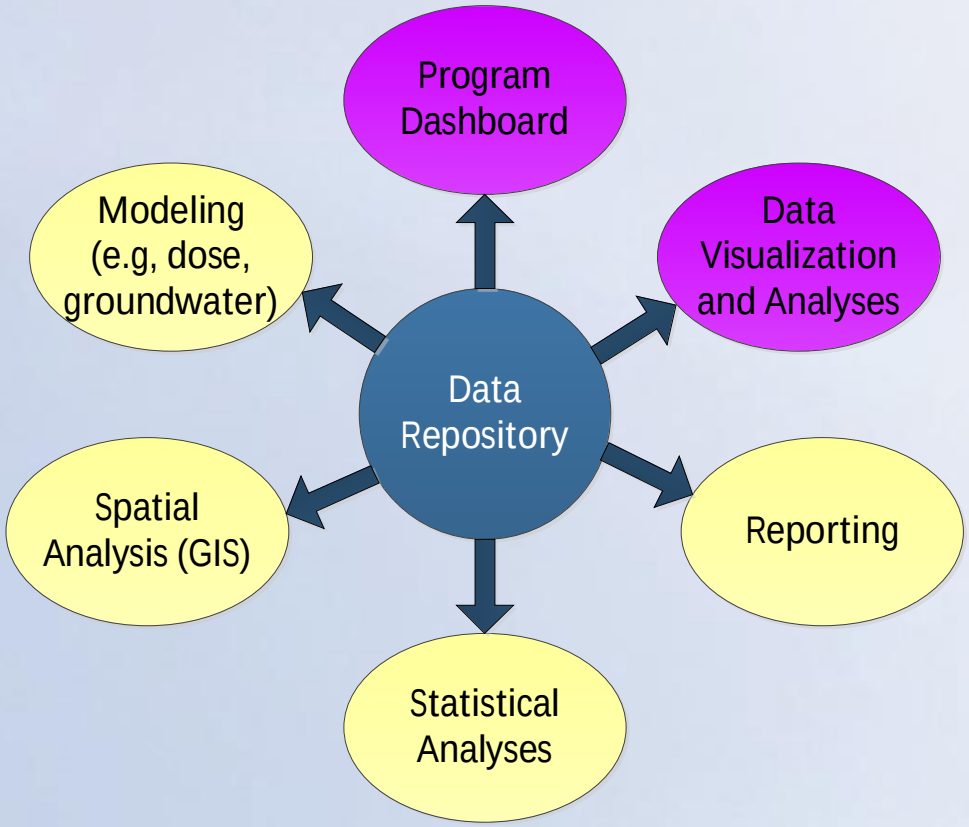
Programmatic Benefits from Data Repository

Data repository enables the common understanding of environmental conditions across environmental program areas with leaner and "smarter" REMP work processes

Common Understanding

Leaner and Smarter Work Processes



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Why Is Change Necessary?

- Objectives of Change:
  - Upgrade and centralize routine environmental monitoring programs to reduce costs, achieve consistency in methods and reporting across the nuclear fleet.
  - Improve quality, ensure compliance with regulatory requirements, and optimize management oversight and time.
- Drivers of Change:
  - Aging workforce.
  - Competing priorities for resources.
  - Outdated environmental monitoring technologies and methods.

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Questions and Discussion

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