ELECTRIC POWER RESEARCH INSTITUTE

EPRI Fukushima Technical Evaluation Project

Fukushima Radiological Assessment Tool

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Objectives:
Fukushima Technical Evaluations Project

- Understand what occurred in order to prevent similar accidents.
- Establish a repository of critical event data, decisions and insights from the accident timeline
- Document the progression of events in the Fukushima Daiichi reactors, containments, reactor building and spent fuel pools
- Document the radiological plume dispersion and contamination in the vicinity of the Fukushima Daiichi Plant
- Produce a report to help identify potential improvements in plant design, operation, and mitigation strategies

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The Way Forward: Strategic Goal #8 Action Plan

Industry Issue: Learning from the Fukushima Accident

- The Fukushima Dai-Ichi Accident provides the nuclear power plant with experiences, lessons learned, and best practices for responding to nuclear power plant emergencies.

- July 2011, NRC Task Force Releases "Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-term Task Force Review of Insights from the Fukushima Dai-Ichi Accident"

- Includes observations and recommendations for enhancement of NRC policies and regulations related to emergency planning and response.

- ***The Way Forward: U.S. Industry Leadership in Response to Events at the Fukushima Daiichi Nuclear Power Plant***

Way Forward Strategic Goal #8

- "Accident response procedures for controlling, monitoring, and assessing potential radiation and ingestion pathways during and following and accident, including timely communication of accurate information."

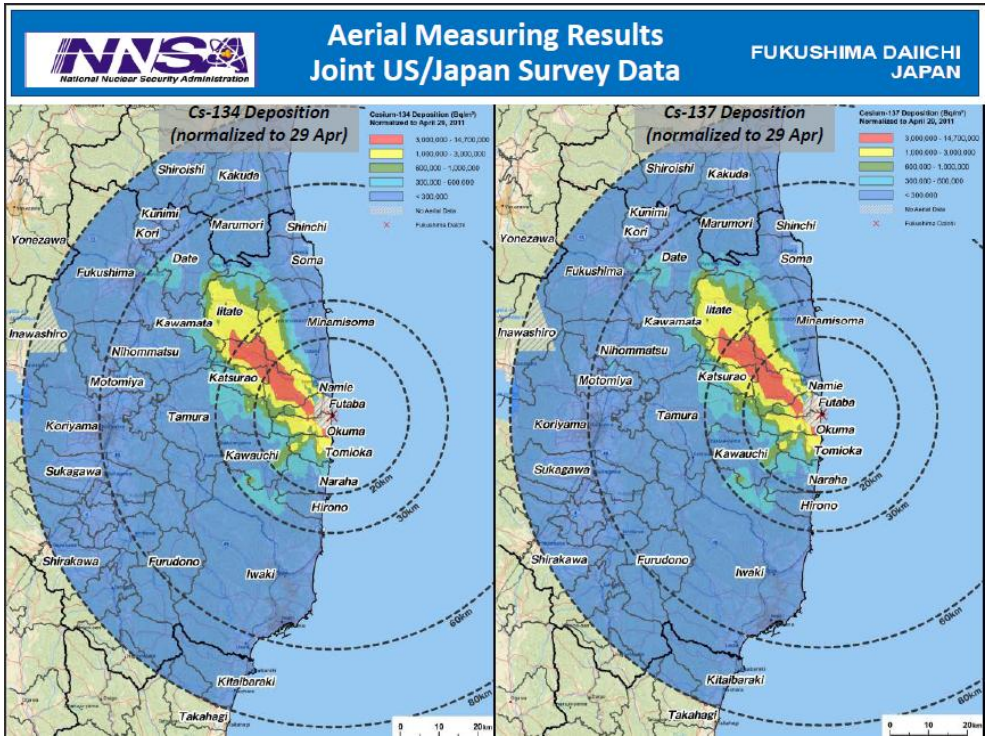
- Action Plan, Objective 1: "Radiological data (onsite and offsite) resulting from the accident at Fukushima should be placed in a technically accurate, publically available database."

First Research Task: Benchmarking of Radionuclide Dispersion / Dose Modeling Tools

Benchmarking of Radionuclide Dispersion / Dose Modeling Tools

- Opportunity to understand performance of the radionuclide dispersion / dose modeling tools.
  - Validate tools.
  - Support enhancements of tools, if needed.
  - Future input to emergency response and planning.

- Use data and benchmarked tools to better understand Fukushima Accident
  - Were there other plumes, e.g. out into the ocean?



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Objectives:
Fukushima Radiological Assessment Tool

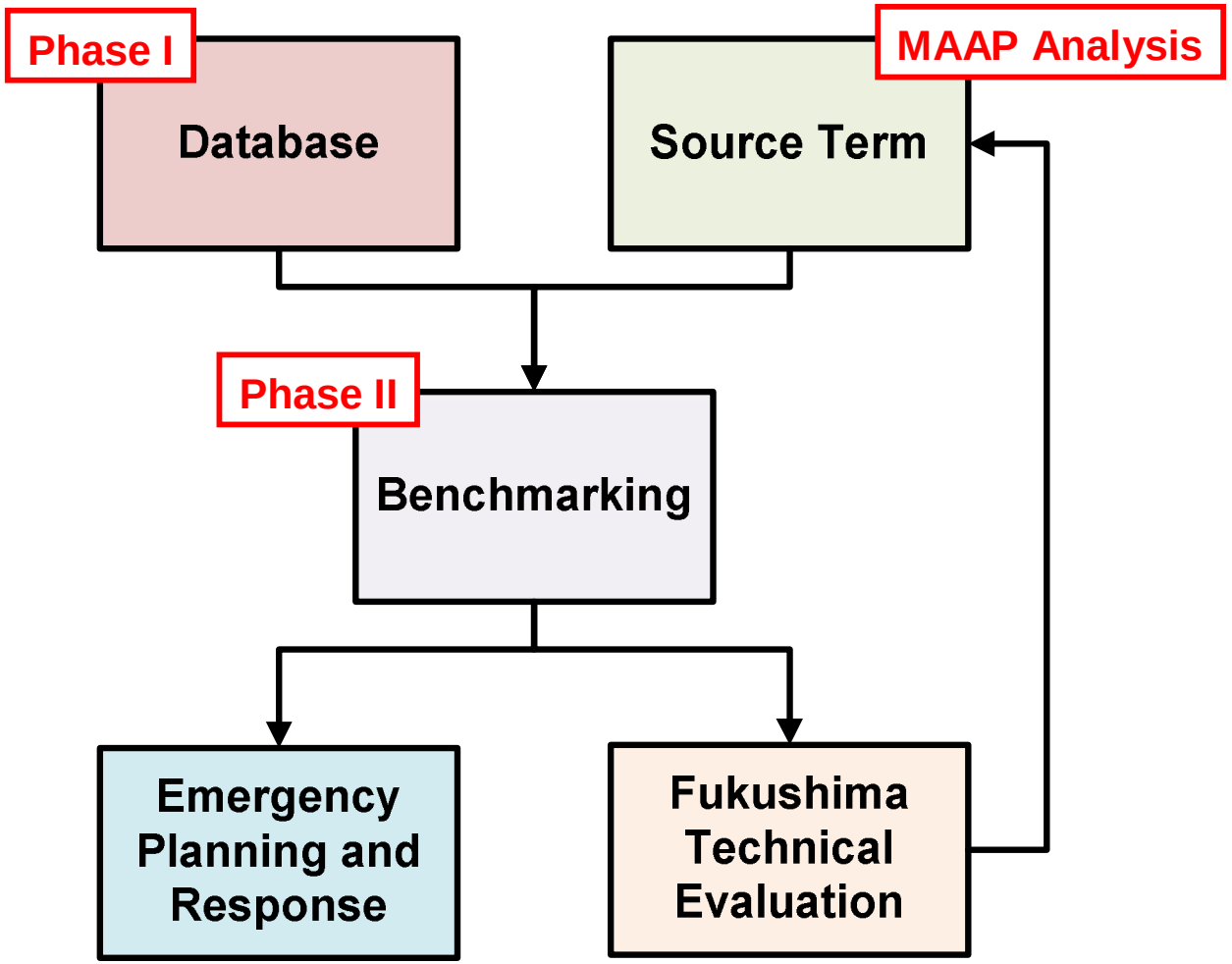
Develop a reliable and readily accessible tool that will house known and credible environmental data in a format that is conducive to analysis to support research by multiple organizations.

"Database"

- Document the radiological plume dispersion and contamination in the vicinity of the Fukushima Daiichi Plant
- Benchmark Industry Radionuclide Dispersion / Dose Modeling Tool (e.g. RASCAL, MIDAS, RADDOSE, etc.)

Fukushima Radiological Assessment Tool

Supports Technical Evaluation Project and Way Forward



Phase I: Database Development (2012)

- GEH and Research Triangle Institute (RTI) J-MARDIS Project
  - Database developed to support GEH response and operations during accident

- Identify and fill data gaps
  - Fully understand radionuclide dispersion modeling tools for inputs and outputs
  - Verify and ensure quality of data
  - Gather publically available data (e.g. MEXT, SPEEDI, etc.)
  - Collaborate with U.S. and International organizations
    - e.g. EPA, NRC, DOE, DOD, TEPCO, etc.

- Phase II: Analyze Data and Benchmark Tools (2012-2013)

Radionuclide Dispersion/Dose Modeling Tools (RASCAL, MIDAS, RADDOSE, etc.)

Tools	INPUTS	OUTPUTS
RASCAL Straight Line Gaussian and Granden Puff Model (Note: NRC has run RASCAL for the Fukushima Accident Scenario)	• Reactor Design – Generic or Plant Specific (U.S.) • Accident Scenarios – Reactor or Spent Fuel Pool • Radiation Monitors • Coolant Sample • Effluent Releases (radionuclide mixtures) • Basic Meteorological Information • Uses terrain information to calculate plume movement (but not impaction/deposition)	• Air dose rates • Ground deposition • Total Effective Dose Equivalent (TEDE), Committed Dose Equivalent (CDE) – Thyroid, Inhalation Commited Effective Dose Equivalent (CEDE) • Cloudshine
MIDAS Gaussian Model and Particle-in-a-Cell Model	• Each MIDAS is site specific for plant design • Multi-unit and multi-release analysis possible • Accident Scenarios – Design basis and Event tree (NUREG 1228) • Automatic and manual input of radiation monitor measurements (noble gases → isotope mix → accident scenario) and meteorological data • Field Measurements • Uses terrain information	• Air dose rates • Ground deposition • TEDE and CDE, Skin Dose Exposure (DE) • Ground and cloud shine
RADDOSE Puff Model	• Each RADDOS is site specific for plant design • Automatic and manual input of radionuclide releases from effluent monitors and meteorological data • Accident scenarios – Reactor or Spent Fuel Pool • Up to 5 release paths • Field Measurements	• Air dose rates • Ground deposition • TEDE, CDE-Thyroid due to inhalation • Cumulative doses

Summary of Input and Output Data Needed

- ***Input Data – (MAAP Analysis and INPO Timeline, etc.)***
  - Plant design
  - Accident progression and timeline
  - Release information
  - Meteorological Data

- ***Output Data – (Database)***
  - Air dose rates (in the plume)
  - Ground deposition of radionuclides (20-35 km, Feb-Apr 2011)

- ***Iterative / Back calculations*** to refine plume model and understanding of source term from MAAP analysis.

Collaboration to Date

- ANI
- Detroit Edison
- DOE (Chainbridge)
- Dominion
- Duke Energy
- EPA
- EPRI (ERIN Engineering)
- Exelon
- FPL
- GEH
- INPO
- NEI
- NRC
- OPG (AMEC)
- Progress energy
- RTI
- SCE
- SCE&G
- STP

Project Schedule and Deliverables

- ***Phase I – Develop Database***
  - Develop database – ONGOING
  - Committee Review of Database – July/August 2012
  - Database & Technical Report – November 2012

- ***Phase II – Analyze Data and Benchmark Tools***
  - Develop metrics for benchmarking radionuclide dispersion / dose modeling tools – Begins in June 2012
  - Benchmark Tools and Analyze Dispersion – Begins in Fall 2012
  - Technical Report – December 2013

Future Research Tasks for the Fukushima Radiological Assessment Tool

- Beyond EPRI Fukushima Technical Evaluation Project:
  - Run predictive analysis of plume dispersion to inform regulations and policy decisions (i.e. Emergency Planning Zone)
  - Accident Effects, Response, and Recovery
    - Remediation methods and technologies
      - Short term remediation and long term remediation
    - Long term dose pathways and mitigation (e.g. food, water, etc.)
  - Inform future research projects related to radiological effects on humans and biota from nuclear accidents (i.e. EPRI, NRC, NAS, universities, etc.)

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