TMI-2 Recovery Project
Critical Lessons

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The TMI-2 Accident – in Brief

- The Plant
  - Three Mile Island Unit 2, a one-year old B&W 900MWe PWR
- Initiating Event
  - March 28, 1979 - Secondary plant malfunction, causing turbine trip, then Reactor scram
- The situation unravels

  During post- scram RCS pressure transient, PORV sticks open;
  - Operators misinterpret plant condition, fail to recognize ongoing SBLOCA – they throttle, then secure HPSI
  - Core overheats, then clad failure, then major core melt

Actions / Consequences

- Ad hoc emergency response:
  - Damage to equipment, and the unprecedented / misunderstood conditions, impede progress at every turn
- For the public, a life-changing event
  - Uncertainty, fear, traumatic ‘precautionary’ evacuation
- No injuries, minimal environmental effects
  - Containment really works
- Takes months to achieve adequate plant control and stability

The Recovery Program

- TMI-2 cleanup and deactivation
  - a ~$1billion, 12 year project
- The full extent of core damage was not known for about two years.
- Six years to restart of the undamaged TMI-1
- TMI-2 ultimately placed in post-Defueling Monitored Storage (PDMS)
  - Safe, stable and monitored
  - Final disposition when TMI-1 is decommissioned

Recovery Challenges

- Inaccessible Reactor Building (RB)
  - Uncertain condition/reliability of systems
  - Flooded RB basement, ~600,000 Cs-137 Ci I
  - Hi rad, hi contamination
- Core melt
  - Uncertainty of location/condition of damaged fuel
  - Fuel retrieval, handling and disposition
- Waste management
  - Processing and disposal of contaminated water

TMI-2 Lessons

- There are compelling lessons relating to the TMI-2 accident and emergency response
  - But not the subject of this presentation
- Recovery Lessons
  - Among many, five selected for discussion today

Public Trust

- **Lesson 1**: Public trust is an essential component of a successful recovery project

  The full set of stakeholder - public, regulators, government, media – is an interactive and influential force.

- **Corollary**: When your world turns brown, it is too late to begin to establish public trust

- **Principles**:

  - Public acceptance is based on **trust**, and is central to long term nuclear viability
  - It's personal: Focus is on people, not technology

End States, End States, End States

- **Lesson 2**: Begin – and proceed – with the end in mind
- TMI-2 **Example:** Year 1 Wheel spinning
- It is necessary to define, secure approval (as applicable), and communicate:
  - Plant/site ultimate end state

    and
  - Interim states/milestones to achieve that ultimate condition

End States (continued)

- End State definition must be:
  - In depth, covering all plant spaces, systems, components
  - Based on need, not opportunity (i.e., linked to such factors as public and worker safety, downstream access requirements, etc.)
  - Quantitative and realistically achievable
- Prioritized, sequenced interim end states form the basis of project schedule and cost.

Characterization

- **Lesson 3:** Hard fact trumps theory – every time
- TMI-2 **Example:** TMI-2 De-fueling Concept
- **Key points**:
  - Characterization is the bedrock of technical decision making, planning and engineering
  - Where it is most difficult, it's usually most important
  - Knowledge gained is never perfect – key is to get enough information to proceed
  - It's an iterative, ongoing process – think military 'recon'
  - Key follow-on task is data management: compiling, organizing and disseminating technical data.

Flexible, Adaptable Methods

- **Lesson 4:** In the land of surprises, flexibility and adaptability carry the day
- TMI-2 **Example:** Remote-manual defueling system and tools
- **Key points**:
  - This is a key to technical/programmatic risk management
  - Adapting proven technology beats invention
  - Avoid unnecessary complexity (the 'KISS' principle)

Protecting Workers

- **Lesson 5:** Radiological recovery work challenges worker safety, every day
- TMI-2 **Example**: In-containment work
- Key Challenge is the **composite** effect of radiological and industrial hazards:
  - High Radiation (and related stay time constraints)
  - Issues re: congestion / accessibility / visibility / heights / enclosed space / etc.
  - High surface and airborne contamination (and required protective clothing)

In Summary

- TMI-2 Recovery and Clean-up was different in many respect from current and future such projects

  Improvements in understanding, technology, tools, preparedness, etc.

- Compared to Fukushima Dai-ichi, our job was easy

- BUT, much was learned – and the fundamentals will always apply

Thank You!