ENCLOSURE 2 (CD-ROM #2)

MFN 12-015

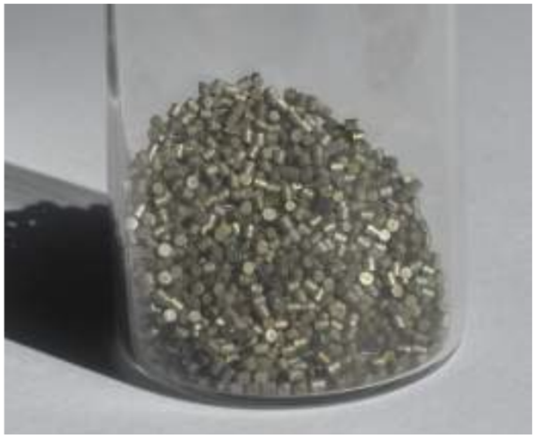
2011 Technology Update Presentation

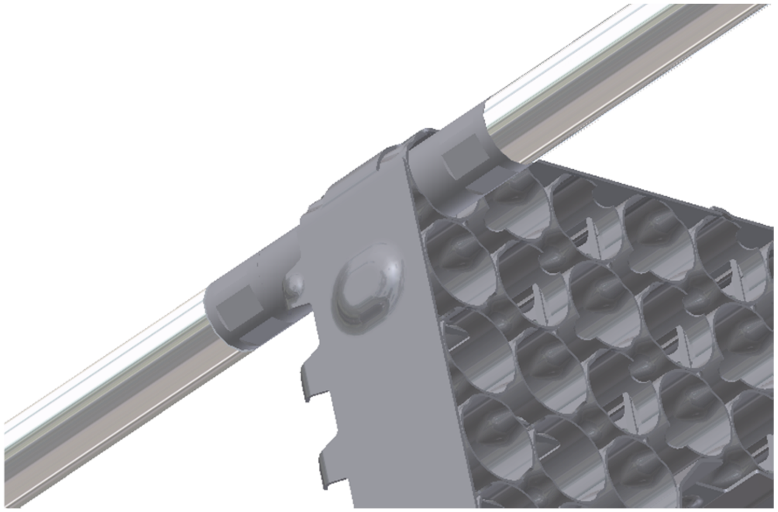
Non-Proprietary Information – Class I (Public)

IMPORTANT NOTICE

Enclosure 2 is a non-proprietary version of the 2011 Technology Update Presentation from Enclosure 1, which has the proprietary information removed. Portions that have been removed are indicated by open and closed double brackets as shown here [[ ]].

Technology Update for the US NRC
June 2011





GE14i Isotope Test Assemblies

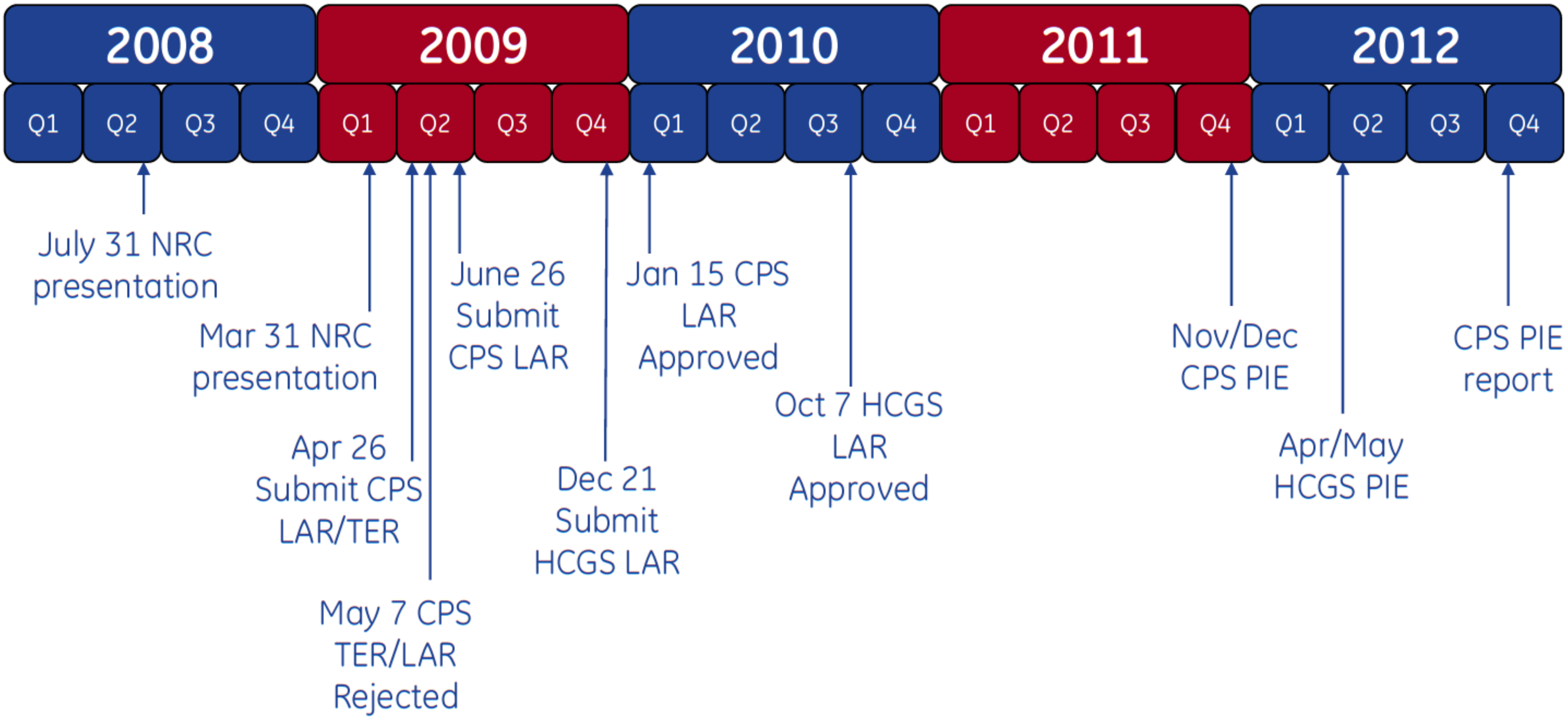
Brad Bloomquist

HITACHI

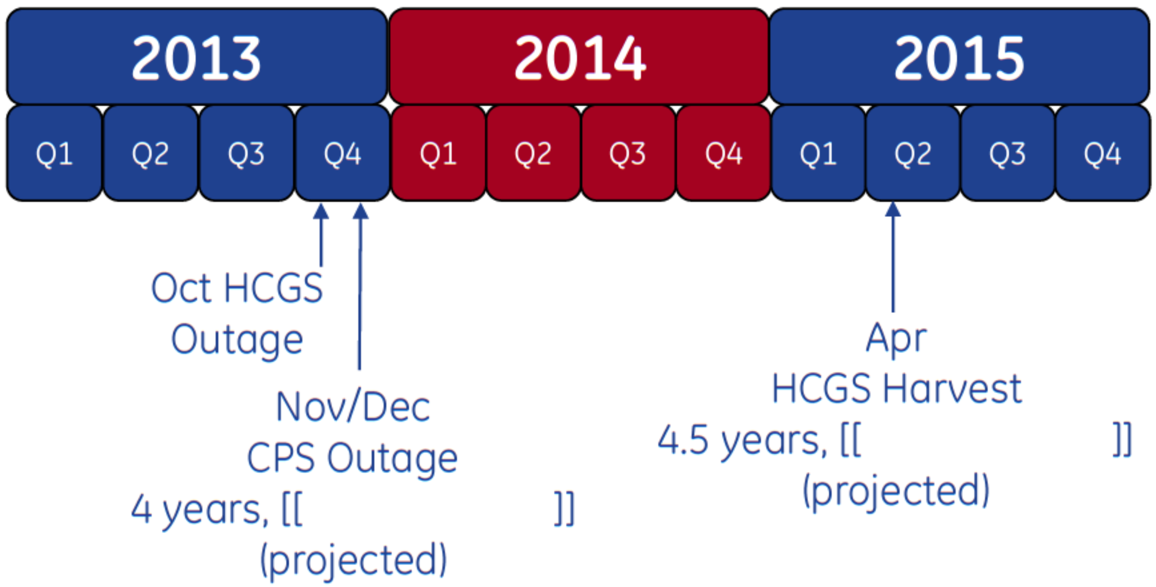
Clinton and Hope Creek Paths

- Close involvement with utility teams
- 50.59 exercise with utility
- Early technical presentation to the NRC
- Agree on licensing basis for LUAs
- LUA Technical Evaluation submitted
- License Amendment Request submitted
- LUA Technical Evaluation rejected
- GE14i licensed as a new fuel type
- Safety Analysis Report on GE14i
- License Amendment Request
- NRC Audit and review of supporting analyses
- Full NRC review and approval process

Project Timeline



Project Timeline

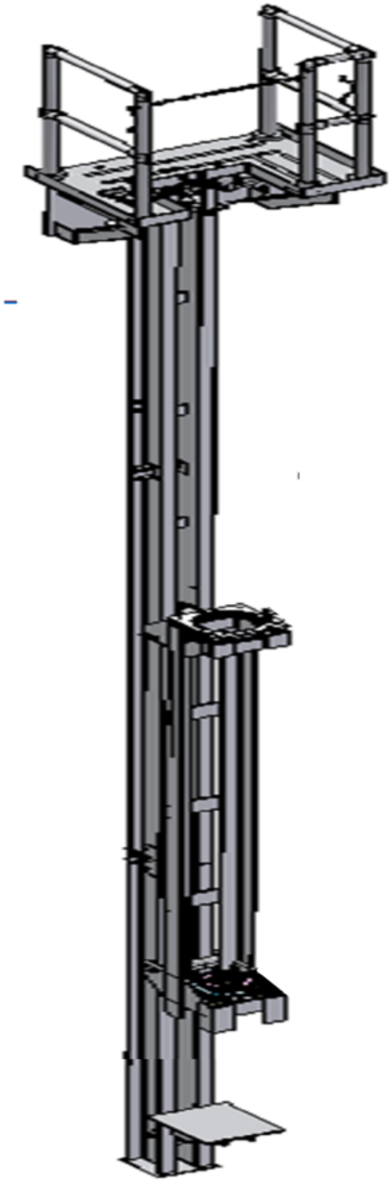


HITACHI

CPS Inspection and Post Irradiation Exam

Following first cycle of irradiation at CPS (22 mo, [[ ]]) - one GE14i bundle removed from core

- Visual exam of external components to confirm mechanical adequacy
- COINS to examine rod profilometry and oxide layer to confirm mechanical adequacy and corrosion characteristics
- Gamma scan cobalt rods to confirm activation calculations
- Gamma scan local fuel rods to confirm power suppression magnitude and population of rods surrounding cobalt rods are appropriate
- Single rod harvest and off site shipment for destructive exam to confirm mechanical adequacy
- Single rod replaced with fresh cobalt segmented rod and bundle reinserted in same outage for continued operation



HITACHI

HCGS Inspection and Post Irradiation Exam

Following first cycle of irradiation at HCGS (18 mo, [[ ]]) – one GE14i bundle removed from core

- Visual exam of external components to confirm mechanical adequacy
- Single rod harvest and off site shipment for destructive exam to confirm mechanical adequacy
- Single rod replaced with fresh cobalt segmented rod and bundle reinserted in same outage for continued operation

Project Benefits

- Fostering positive perception of commercial nuclear power
- Illustrating power generating reactors have other uses
  - Supporting medical and industrial communities
- Ensuring supply of ^{60}Co
  - Prevent disruptions in global isotope supply
- Nuclear Energy Institute Top Industry Practice for Vision and Leadership

HITACHI

Non-Proprietary Information – Class I (Public)

Technology Update for the US NRC
June 2011

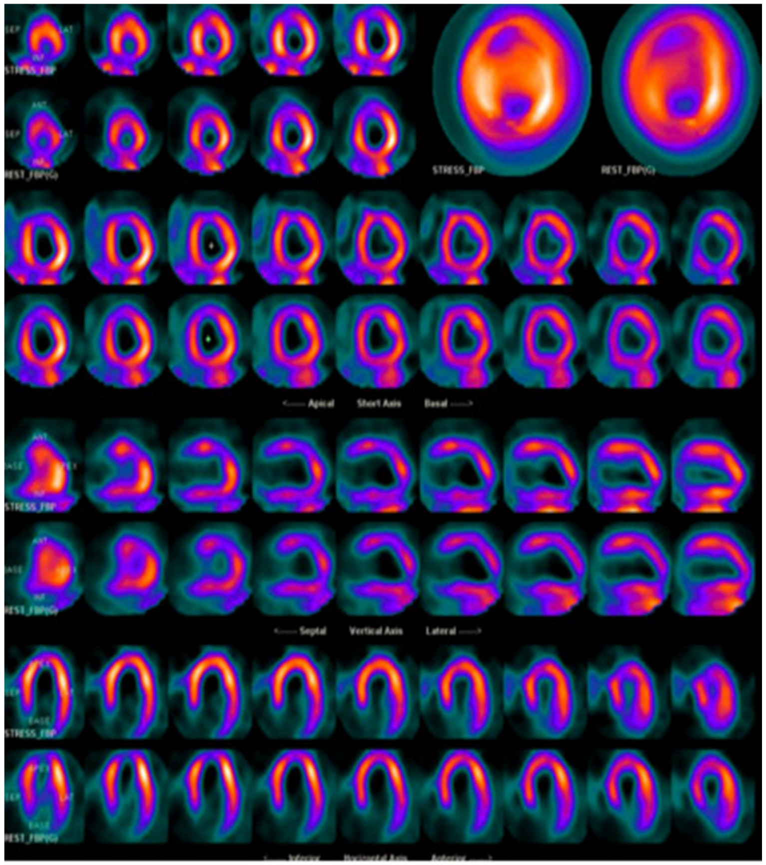
Moly-99 Project

John Berger

HITACHI

What is molybdenum-99?

- Used in approximately 85% of all nuclear medicine procedures …brain, heart, thyroid, lungs, liver, kidneys, skeleton, blood and tumors.
- Rapid uptake by target organ…is bound to another drug that transports it to the organ of interest
- Decay results in relatively low energy gamma…easily detected providing accurate imaging
- Short half-life results …allows for quick scans and lower patient dose, also lends BWRs to being ideal for activation



Myocardial perfusion SPECT – stress/rest

Myocardial perfusion SPECT- stress/rest scan in a patient with dilated cardiomyopathy.

Current isotope production

- **Aging & obsolete production facilities**…54 year old Canadian reactor and HFR for Mo-99 experienced extended shutdowns.
- **Isotopes from nuclear fuel**…Mo-99 is obtained mostly from HEU targets
- **Shortage resulting in high visibility in Washington**…DOE awards grants to solve shortage crisis with reliable, domestic supply of ^{99}Mo w/o HEU use and NRC working group devoted to project

	Typical
Canada NRU – 1957 HEU Targets	40%
Netherlands HFR – 1961 HEU Targets	25%
Belgium BR-2– 1961 HEU Targets	20%
South Africa Safari – 1965 HEU Targets	10%
France Osaris– 1966 HEU Targets	5%
Australia Opal– 2008 HEU Targets	N/A

HITACHI

GEH's ^{99}Mo production system concept

[[

]]

HITACHI

Moly-99 Project – Analyses

Heat Generation Analysis…calculated heat generation of moly targets in instrument tube due to gamma and neutron interactions as well as decay

[[

]]

Activation Analysis…calculated activation in BWR instrument tube

[[

]]

Target and TIP Tube Thermal Analysis…calculated temperature profiles of targets and dry tube's interaction

[[

]]

Future/Current Analyses…work scheduled to be performed in the near future

- Determination on LPRM effect
- Stress analysis on TIP tube
- Impact on core power during insertion and removal
- Local reactivity and pin power effects

HITACHI

Design considerations for operations

- Containment Isolation…System modifies spare containment penetrations that require isolation systems. [[
  ]]
- Dose to Personnel…Dose one meter from outside of desired cask is [[ ]]
- Schedule and Personnel…Unloading and loading of system required once a week. [[
  ]]
- Process Upsets…Molybdenum-99's short half ensures dose is manageable for hands on work after only a few weeks of decay
- Fuel Cycle…Molybdenum project will have a imperceptible impact on the fuel cycle
- TIP Operations…Molybdenum activation system and TIP system will be independent, but may have to be scheduled appropriately. Do not run the TIP system when Molybdenum Activation System is expected to undergo a 'load/unload' event and vice versa. Schedule TIP runs during the middle of a molybdenum irradiation cycle.

HITACHI

Benefits of ^{99}Mo project

- Saves lives…Consistently supply important medical isotope for the USA
- National Security…Allows White House to achieve their goal of producing molybdenum-99 without the use of HEU
- Environmentally Favorable…System can generate the U.S.A.'s medical isotope supply without creating HLW
- Asset Utilization…Provides important medical isotope without the need for new reactors, while leveraging proven and licensed equipment

HITACHI

Non-Proprietary Information – Class I (Public)

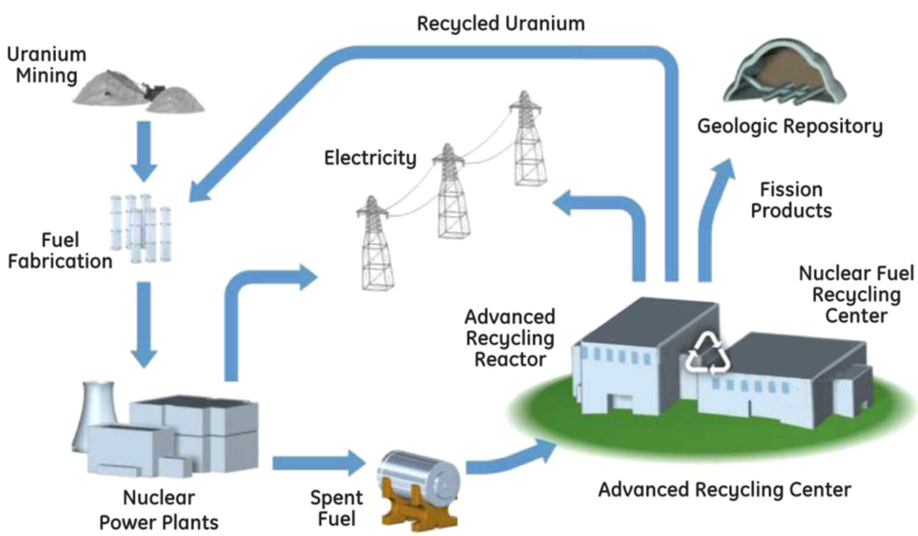
Technology Update for the US NRC
June 2011

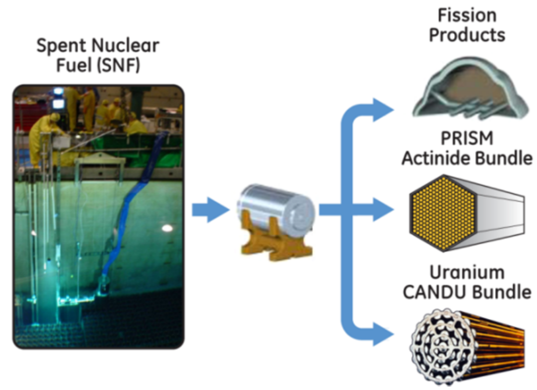
PRISM & Advanced Recycling

Eric P. Loewen Ph.D.

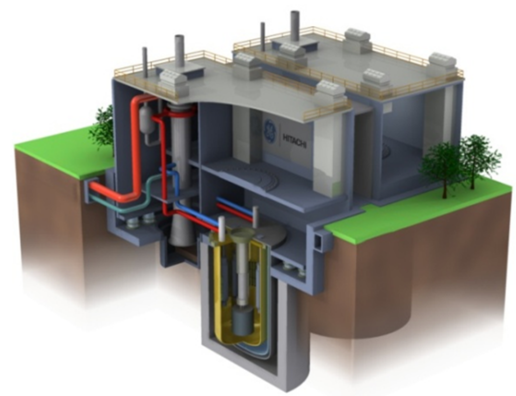
HITACHI

Advanced Recycling Center - Closes the Nuclear Fuel Cycle





NFRC - Electrochemical

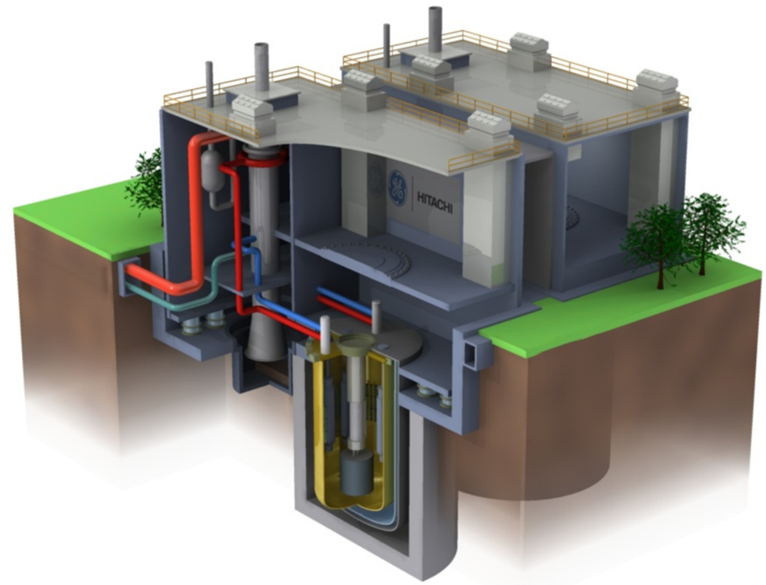


Advanced Recycle Reactor - PRISM

HITACHI

Reactor Technology

Recycling Reactor: PRISM



✓Advanced Conceptual Design
- Already paid for by USG
- Available today

✓NRC "...no obvious impediments to licensing..."
- Prudent starting point

1981-1984 GE Program
- GE funded
- Innovative design approaches

1985-1987 PRISM
- DOE funded $30M
- Competitive LMR concepts

1988 PRDA
- DOE funded $5M
- Continuing trade studies

1989-1995 ALMR
- DOE funded $42M
- Preliminary design
- Regulatory review
- Economics
- Utility advisory board
- Commercialization
- Tech development ($107M additional)

1995-2002 S-PRISM
- GE Funded
- Improved economics
- Actinide burning scenarios

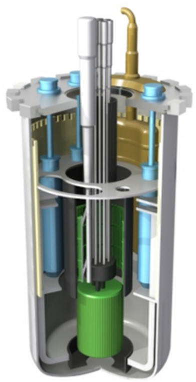
2007-2009 GNEP
- Demo reactor
- Actinide burning
- Commercial
- Best practices
- Advanced power conversion cycle

HITACHI

Reactors: sodium and water cooled

PRISM

- Consume “waste”
- Consume U235
- ~400 w/cm³
- ~300 w/cm



LWR

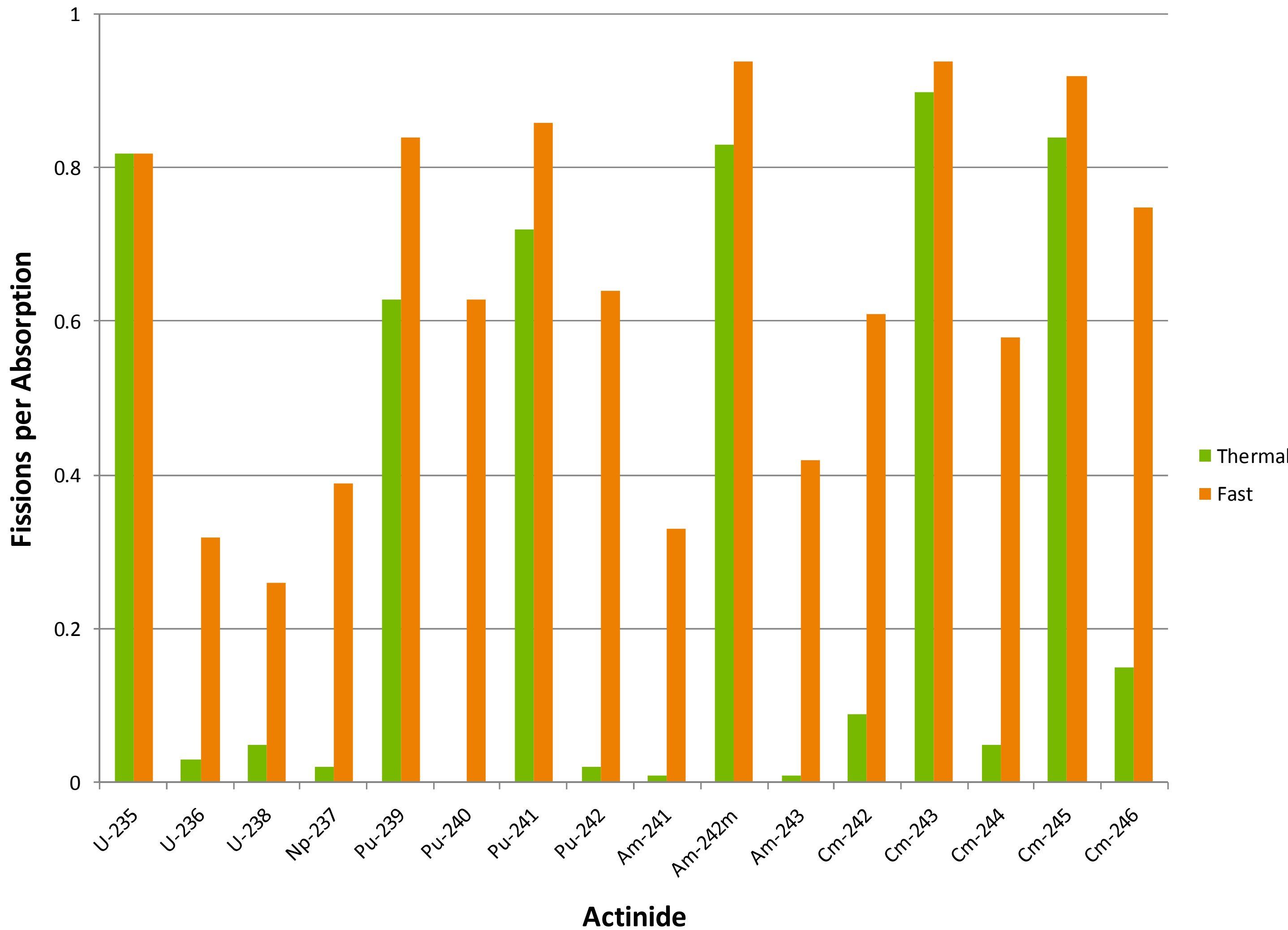
- Produce “waste”
- Consume U235
- ~60 w/cm³
- ~200 w/cm

Should not be an “either/or”

Two reactor system affords better resource utilization: uranium reuse and waste-to-watts

HITACHI

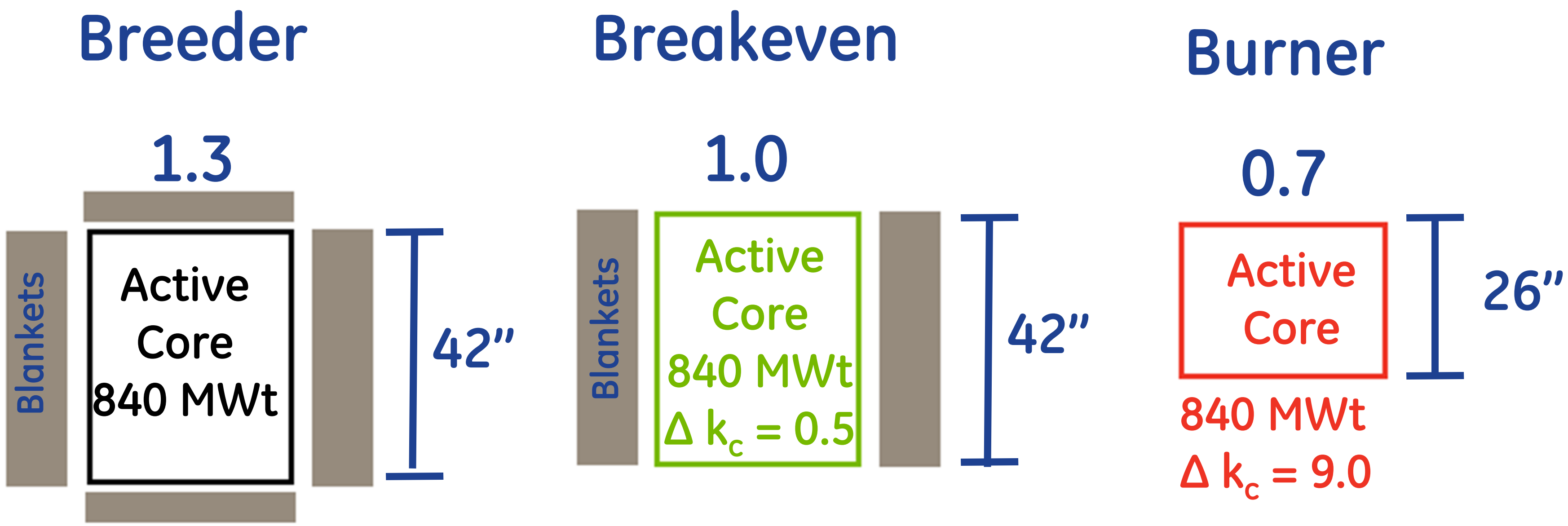
Why a fast spectrum? (a catalyst to shorter decay)



HITACHI

Transuranics fission in fast spectrum (higher energy neutrons)

Burners versus breeders



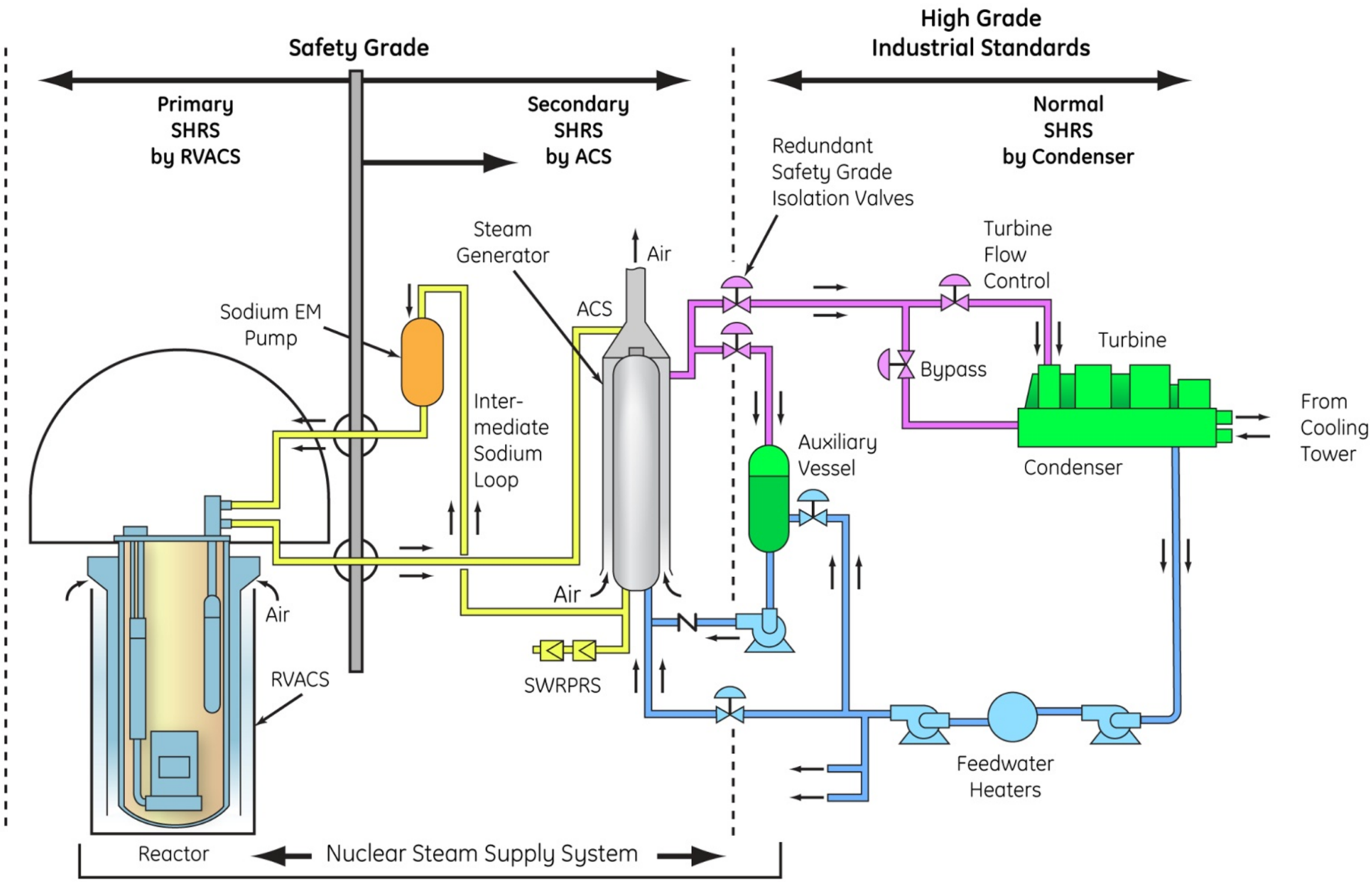
Blankets: Depleted or natural uranium

No loss of coolant with a "pool"

[[

]]

PRISM power extraction cycle



HITACHI

Licensing the first recycling reactor

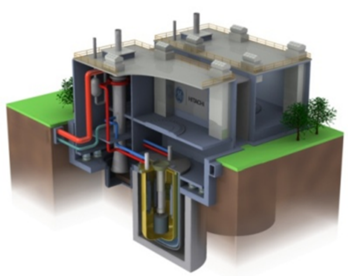
3 Paths
Working Together

Engineering Design

Status: 30%

Design: Hybrid

- ✓ PRISM based design
- ✓ S-PRISM adv. features
  - ➢ Seismic isolation
  - ➢ Containment
  - ➢ HCSG Relief System



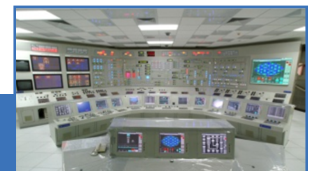
HITACHI

Path 1

Licensing

- ➢ Update Licensing Strategy
- ➢ Start Pre-Application Meetings
- ➢ Submit a PSER or DCD

Path 2

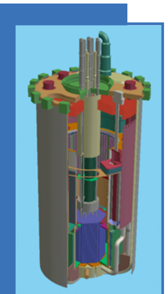


Simulation

- ➢ Build Analytical Simulator
- ➢ Start Design Optimization
- ➢ Select Component Scale Model Testing

Path 3

Component Testing



- ➢ Fabricate Select Components
  - ❖ Reactor Vessel (USA Built!)
  - ❖ Fuel Handling Equipment
  - ❖ EM Pump
- ➢ Test Components

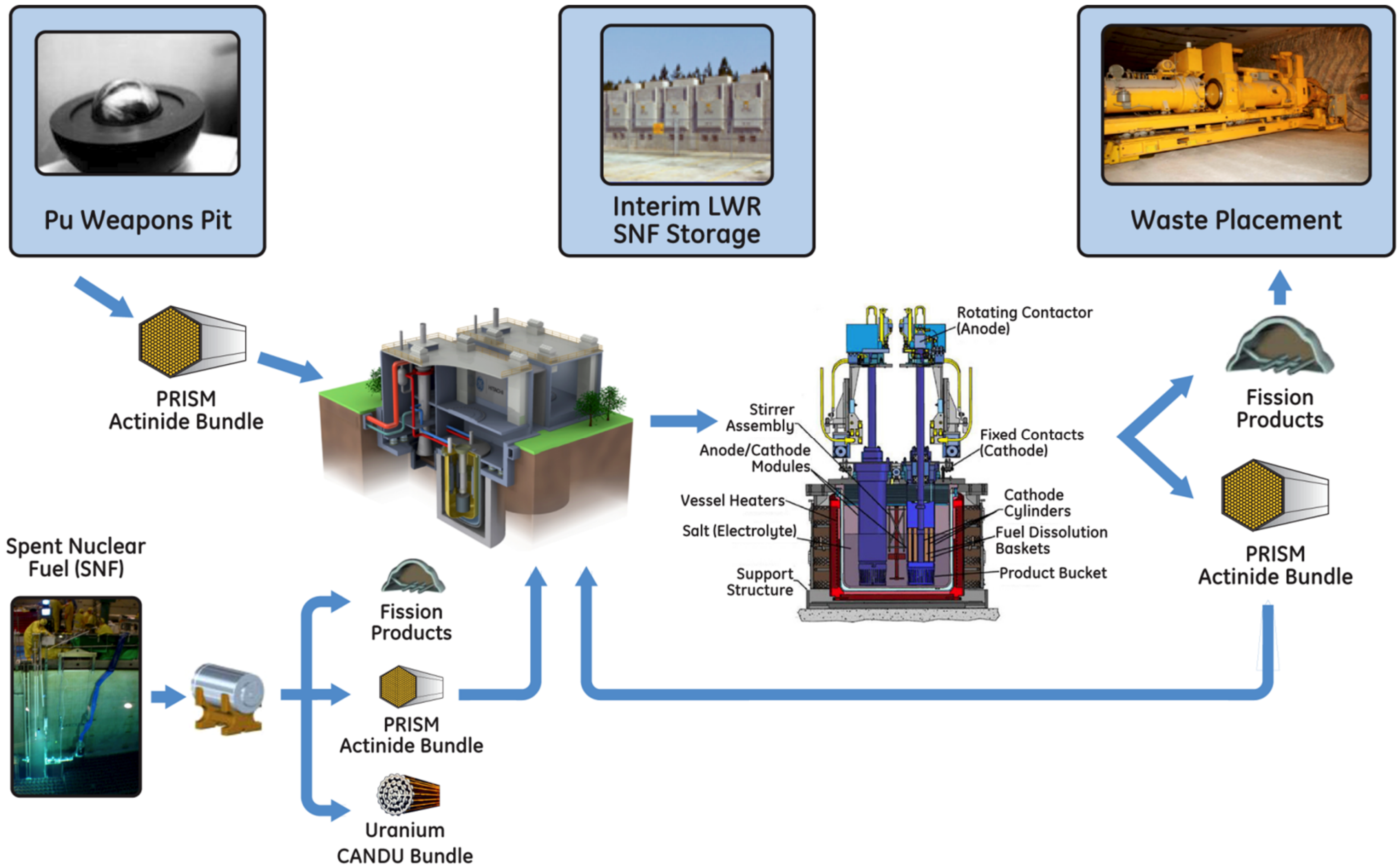
Recycling Reactor Deployment

- Integrate simulation into design process
- Optimize, validate, and iterate prior to construction

Benefits:
- Reduced time to deploy prototype
- Take advantage of existing LWR processes
- Optimize design through iteration

Separations Technology

Solving used nuclear fuel issues with today's technology



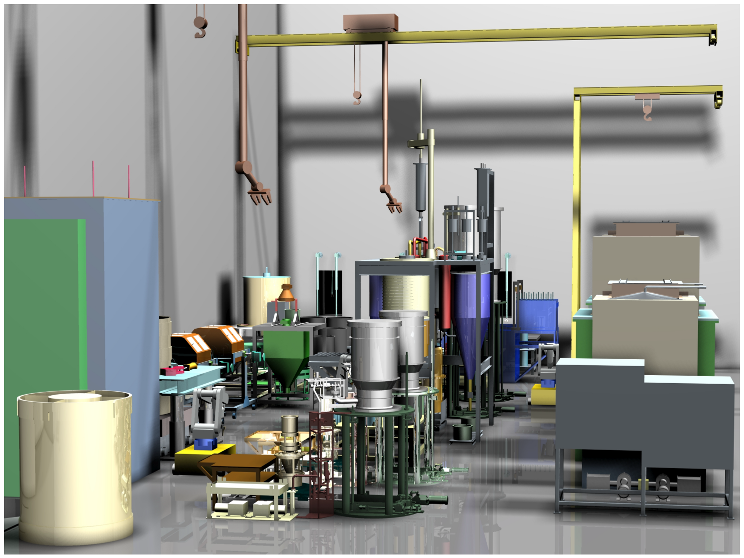
HITACHI

Electrochemical conceptual flowsheet – Integral Fast Reactor (IFR) program

[[

]]

Electrometallurgical development



✓ NAS Committee Findings

- No technical barriers for electrometallurgical processing of EBR-II fuel
- DOE should seriously consider continued development as an alternative to aqueous treatment of uranium oxide spent nuclear fuel

✓ Prudent GNEP starting point

- Domestic solution available today

1964-1969 Melt Refining
- AEC Funded
- Innovative design approaches

1984 IFR Program
- DOE funded
- Prove metal fuel

~1990 Japan
- Japanese Support
- Contributed $40M
- Committed $60M
- Contributed $6M for LWR oxide reduction

1989-1995 IFR Ends
- Program Terminated
- EBR-II shut down
- EBR-II 30 years of successful operation

1995-1999 EBR-II Fuel
- EBR-II Fuel Treatment
- Requires treatment
    - ➢Enrichment
    - ➢Na bond
    - ➢Pyrophoric
    - ➢RCRA
- DOE ROD
- NAS review

2000-2007
- EIS completed
- Processing EBR-II fuel currently
- 3T processed
- Best practices

HITACHI

Robust wastes for disposal

Metallic

99Tc is in the metal waste form

Ceramic

Cs and Sr are in the ceramic waste form

Performance data already produced for YMP

Electrochemical vs. Aqueous technologies

	Electrochemical	Aqueous
Purpose	Use chemical and electrochemical processes to separate components of UNF	Use chemical processes to separate components of UNF
Process Media	Molten Salts (solid at room temperature)	Acids, bases and other liquid aqueous reagents
TRU Recovery Method	TRU elements are recovered together in common step	TRU elements recovered separately and retroactively mixed
Process Neutron Spectrum	Fast spectrum – no moderator	Thermal spectrum – aqueous moderators
Process Control	Most process steps are e-chem controlled, can be stopped immediately	No "stop" button, process will continue until completion
Waste Stream	No liquid organic waste, stable FP waste forms for disposal	Continuous discharge of aqueous organic waste, stable waste forms for disposal
Fuel Type	Metal fuel, easier to fabricate in a remote environment and less steps	Oxide fuel, more difficult and costly to fabricate remotely

HITACHI

Licensing objective

Risk-based technology neutral regulation consistent with current regulations

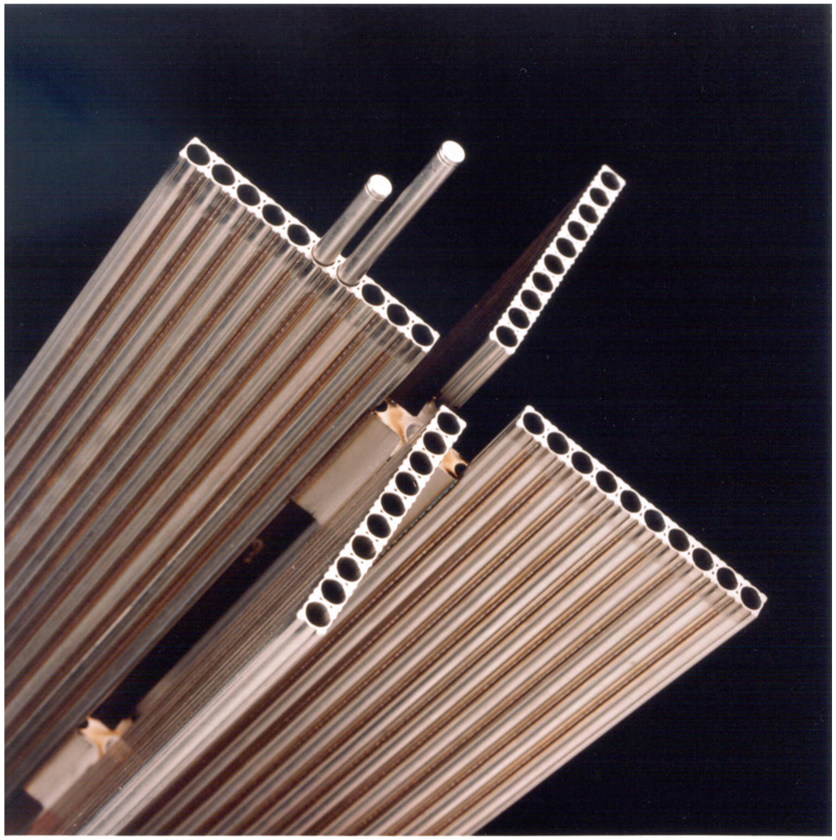
26 GEH Advanced Recycling Centers will consume all of the US used nuclear fuel

26 ARCs solve the UNF issue

[[

]]

Technology Update for the US NRC
June 2011



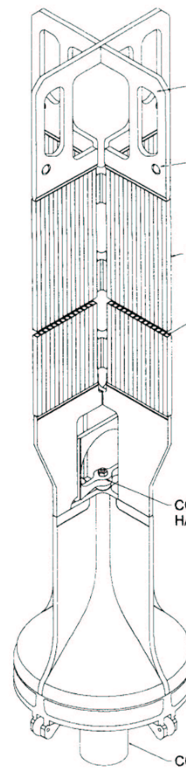
Control Rods

Scott Nelson

HITACHI

Marathon Control Rod Description

- B_4C powder capsule within a 'square' absorber tube.
- Provides a gap between capsule and absorber tube to accommodate irradiated B_4C swelling and helium release.
- [[ ]]



[[ ]]

Timeline – Failure Analysis

- May 2010 – Issued Marathon Surveillance Report 0000-0071-8269-R2
- 8/24/10 – Cracks observed in 4 of 4 Marathon control rods inspected at "Plant O".
- 8/24/10 – Initiated Part 21 evaluation, initiated GEH corrective action process and formed a 'war room' action team.
- 9/3/10 – Issued RICSIL 091.
- 10/20/10 – Issued Safety Communication SC 10-14 as the 60 day Part 21 interim notification.
- 11/17/10 – Held teleconference with BWR Owner's Group
- 11/18/10 – Held teleconference with NRC
- 12/1/10 – Issued Safety Communication SC 10-19 providing additional interim recommendations and guidance.
- 2/15/11 – Issued Safety Communication SC 11-01 (MFN 11-023) concluding Part 21 is reportable, with recommended reduced lifetimes for D and S lattice Marathon control rods.
- June 2011 – Issued Updated Marathon Surveillance Report 0000-0071-8269-R3, and updated GE BWR Control Rod Lifetime Document (NEDE-30931P).

Inspection Summary

- [[

]]

Current Inspection Results

[[

]]

Failure Investigation Summary

[[

]]

Failure Investigation Summary

[[

]]

Causal Factors

1. [[

2.

]]

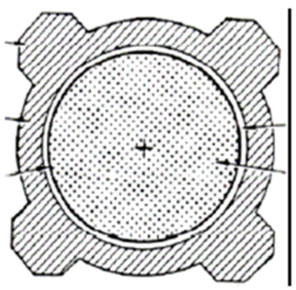
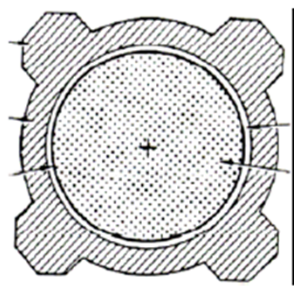
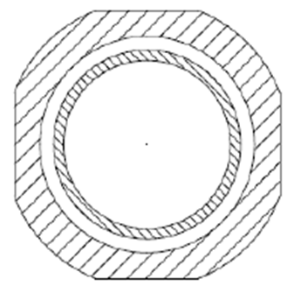
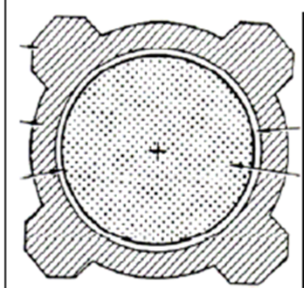
Contributing Factor

- [[
-

]]

Affected Population

- Affects D and S lattice, original design Marathon control rods only.
- Does not affect:
  - C lattice
  - Marathon Ultra
  - ABWR/ESBWR

Parameter	Marathon D/S	Marathon C	New Designs **(Marathon Ultra MD, Marathon Ultra HD, ABWR, ESBWR)**	New Designs **(ESBWR)**
Absorber Tube				

[[

]]

'New' Square Absorber Tube

- Introduced beginning in 2006.
- [[ ]]
- [[ ]]
- [[ ]]

[[

]]

Corrective Action – Marathon Lifetime Reduction

- Reduced lifetime, based on fleet-wide inspection results.

Case	Local B-10 Depletion Limit	Basis for Local Depletion Limit	D Lattice ¼ Segment Limit	S Lattice ¼ Segment Limit
'Old' Tube Lifetime Limit	[[			
'New' Tube Lifetime Limit				
Original Lifetime				]]

Preventive Action –> Marathon Ultra

[[

]]

•Licensed in 1991 via NEDE-31758P-A

•Over 2000 Delivered Worldwide

[[

]]

•Licensed by NEDE-33284P-A: June 2009

•2 LUAs installed in a US BWR (Fall 2009)

•4 LUAs installed in a European BWR (Summer 2009)

•Additional CRBs delivered beginning in 2010

[[

]]

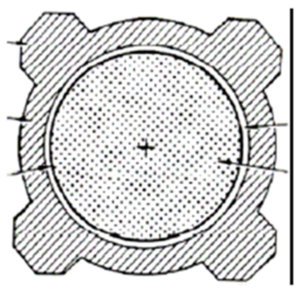
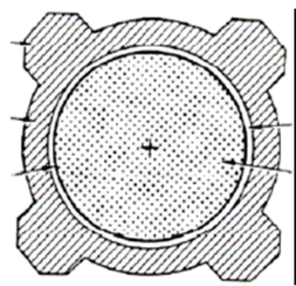
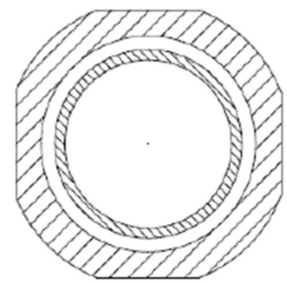
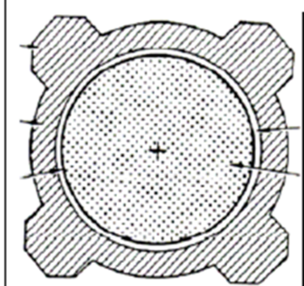
•LTR Submitted to US-NRC: NEDE-33284P Supplement 1: 2/2/2010

HITACHI

Preventive Action – Transition to Marathon Ultra

- [[

]]

Parameter	Marathon D/S	Marathon C	New Designs (Marathon Ultra MD, Marathon Ultra HD, ABWR, ESBWR)	New Designs (ESBWR)
Absorber Tube				

[[

]]

Planned Inspections

Plant	Square Tube Type*	Control Rod Type	Planned Inspection Date	Number of CRBs to be Inspected	Approx. Fluence (snvts)	¼-Segment B-10 Depletion (%)	Peak Local Depletion (%)
Plant N (International BWR)	D/S	Marathon Ultra MD (Marathon-5S)	Summer 2011	[[			
Plant M (US BWR/4)	D/S	Marathon Ultra MD (Marathon-5S)	Fall 2011				
Plant M (US BWR/4)	D/S	Marathon	Fall 2011				
Plant A (US BWR/4)	D/S	Marathon	Summer 2011				]]

GE Hitachi Nuclear Energy

GEH/GNF 50.46 (b) Changes Progress & Plans

Kurshad Muftuoglu

06/20/11

HITACHI

Outline

Outline

- Overview of Fleet Margin
- Recent Margin Evaluation Results
- Transition Plans

Margin Overview

Margin Overview

- BWRs are operated within MAPLHGR limits.
- MAPLHGR limit ensures that all (current) 50.46 criteria are met any time in fuel bundle's life.
- Basically, there are 3 different types of MAPLHGR curves:
  - Curve for non LOCA-limited plants
  - Curve for LOCA-limited only at low exposures
  - Curve for LOCA-limited plants at most of fuel life.

Margin Overview

- For non LOCA-limited plants (BWR/4-6): a constant, high kW/ft up to a knee point, then limited by T/M [[
- Highest transient oxidation at the knee point: 1 to 2 % ECR.
- At highest exposures: zero transient ECR.

]]

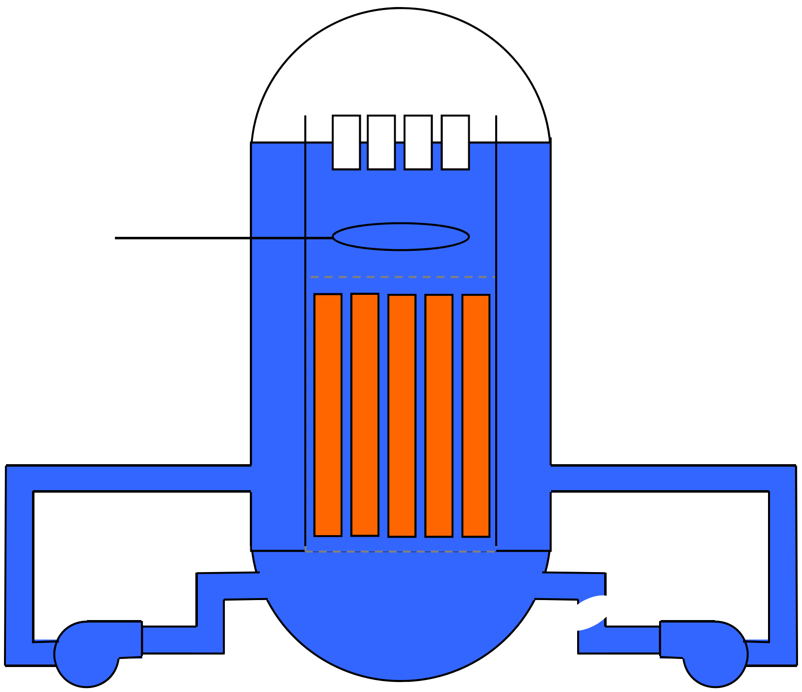
Margin Overview

- For BWR/3, and some /4s: [[
a setdown is driven by PCT before the knee point.
- Oxidation varies 3 to 8% ECR.
- At higher exposures, insignificant oxidation due to low LHGR.

]]

HITACHI

BWR/2 – LOCA Response



The BWR/2s have five external recirculation loops with a recirculation pump in each loop.

There are no jet pumps in the downcomer.

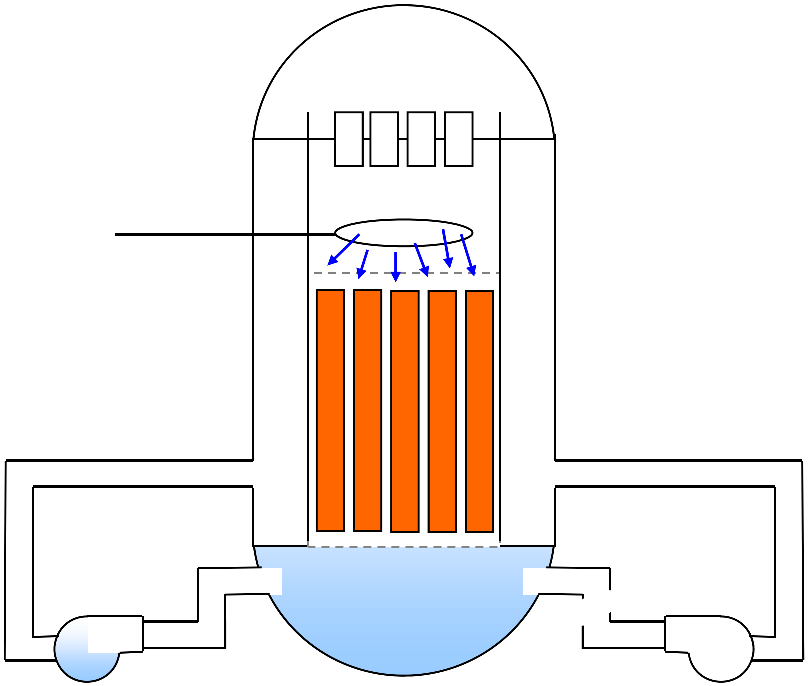
A large break in one of the loops will result in almost immediate stagnation of the core flow, followed by flow reversal as the pumps in the unbroken loops coast down.

The power/flow mismatch results in a boiling transition in the high power portion of the core.

The ECC systems available in the BWR/2 consist of two low pressure core sprays.

HITACHI

BWR/2 – LOCA Response (cont.)



The emergency condensers and ADS systems are of little significance in a large bottom break scenario.

The core continues to heat up from the decay heat under the mitigating influence of spray cooling and steam cooling.

The amount of core spray water reaching the high power bundles is a key parameter.

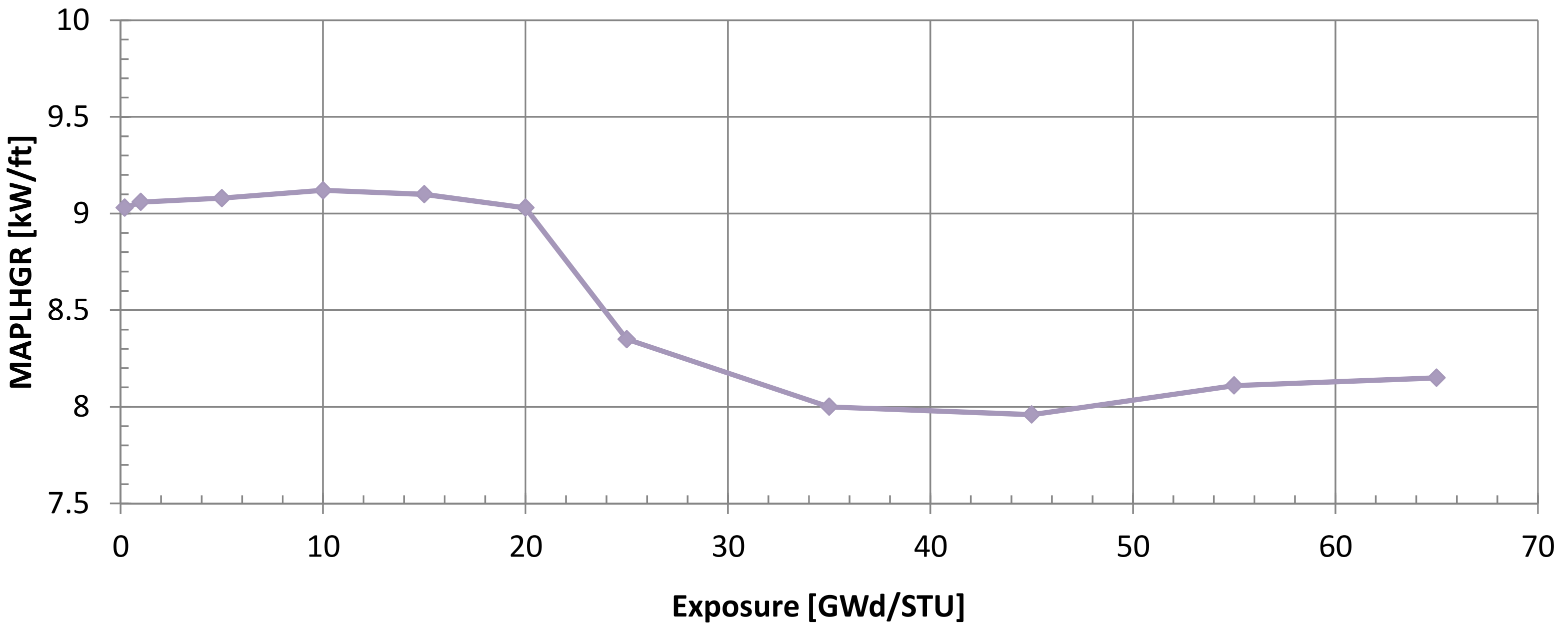
The fuel channels rewet because of the spray water descending into the fuel channel and forming a film on the channel wall.

HITACHI

Margin Overview

In case of LOCA, the external pump plants are cooled using CS. They are LOCA-limited plants:

- PCT-limited at low exposures
- ECR-limited at high exposures



HITACHI

Recent Margin Evaluation Results

Margin Evaluation Results

- GEH supported BWROG for the Margin Assessment work.
- Results indicate that using the nominal FRAPCON3.3 hydrogen model, all U.S. BWRs have positive margin to the proposed criteria.
- All units show positive margin without any adjustments or credits other than use of Cathcart-Pawel correlation as demanded by the 'GL Elements' memo.

Transition Plans

Transition Plans

- Current BWR Analyses for GNF-fueled jet-pump plants can be demonstrated to meet the revised and new criteria. Key elements are:
  - Acceptable Hydrogen model
  - Plant-specific evaluations
- Demonstrate that of 33 (~1/3 of U.S. reactors) jet-pump BWRs into compliance as soon as practically possible.

Transition Plans

- Depending on the final rule and acceptable hydrogen model, BWR/2s will need additional treatment for compliance demonstration.
- In any condition, a new set of MAPLHGR limits can be calculated using SAFER/CORCL methodology for these units by setting the oxidation limit to allowable ECR at given exposures.
- TRACG LOCA provides additional technical rigor and valuable margin for BWR/2 units.
- Timely approval of TRACG LOCA will be essential to support BWR/2 units' transition.

HITACHI

2011 Technology Update

Shutdown Margin

(Tech Spec Update for SDM - Most Reactive Temperature)

Gary Galloway

June 2011

HITACHI

GNF2 Core & Fuel Design SDM Impact

- SDM has historically been most reactive at 68°F
- Evolutionary fuel products (larger water rods, more PLRs) have produced designs with more tendency towards positive moderator temperature coefficients.
- GNF2 is our first BWR/2-6 fuel product to have SDM characteristics where the most reactive temperature can be > 68°F for late-in-cycle exposures
- BWROG effort underway to modify the Standard Tech Specs from 68°F to most reactive temperature

HITACHI

Typical GNF2 SDM Behavior

[[

]]

SDM Design & Licensing Calculations

- Since the introduction of GNF2 our technical design procedures (TDPs) have recognized this phenomenon.
- The SDM TDP requires that calculations for GNF2 be performed over a temperature span that ensures the minimum SDM has been determined.
- Information provided to the utilities for the BOC SDM demonstration include any impact of temperature dependency on SDM and its associated "R" value.

GDC 26 & Tech Spec Interpretations

- General Design Criteria 26 states:

  "{the reactivity control system} shall be capable of holding the reactor core subcritical under cold conditions."
- Many Tech Specs have interpreted this cold condition to be 68°F - the lowest temperature that the reactor might normally encounter.
- Implicit in this specification is that the lowest temperature will always be the most reactive for SDM.

HITACHI

Standard BWR Tech Spec Wording

- Current wording in both BWR/4 and BWR/6 Standard Tech Specs (Section 1) state the definition of SDM to be:

  "SDM shall be the amount of reactivity by which the reactor is subcritical or would be subcritical assuming that:

  a. The reactor is xenon free

  b. The moderator temperature is 68°F, and

  c. All control rods are fully inserted except for the single control rod of highest reactivity worth, which is assumed to be fully withdrawn. ..."

HITACHI

Revised BWR Tech Spec Wording

- The Licensing Committee of the BWROG/RACMC is drafting a revision to the Standard Tech Spec wording
- Revised wording will address the issue that the most reactive SDM temperature can be > 68°F
- Targeted to present revised Tech Spec wording to NRC in late June of 2011.
- Utilities to submit corresponding plant Tech Spec changes after NRC approval of the Standard Tech Spec wording changes.

Conclusions

- New fuel products (i.e., GNF2) have the potential for the most reactive SDM temperature to be greater than 68°F for late-in-cycle exposures.
- Our SDM calculations take this into account for all core design and reload licensing applications by requiring multi-temperature calculations for GNF2 fuel.
- Tech Specs which specify a discrete value for the most reactive SDM temperature (68°F) should be updated to specify a more generic "most reactive temperature".

2011 50.46 Error Notice Summary – Domestic Plants

David S Knepper
Technical Leader – Fuels & NPP
LOCA & Containment Analysis

HITACHI

2011-01

- CORCL IPOW=0 programmed incorrectly
- The IPOW=0 option adjusts power for PLRs
- Evaluated CORCL hot bundle power too low
- Erroneously high MAPLHGR limits
- GE11 bundles in BWR/2 only
- Preemptively addressed during GNF2 NFI
- IPWOW=1 was always correct & now used

2011-04

- Incorrect CORCL VOIDC input
- VOIDC is a droplet distribution multiplier
- VOIDC array dimensioned for 8x8 fuel
- CORCL default values completed array
- Radiative heat xfer may be artificially high
- MAPLHGR limits may be erroneously high
- BWR/2 only - GE11 & GNF2 bundles

2011-05

- CORCL code version change – now 7E3
- Implements PRIME, new IPOW option, and minor enhancements
- 50.46 change notice required
- Previously planned for PRIME introduction
- Affects the BWR/2 plants

2011-02

- Bundle database error for 10x10 designs
- Energy deposited in fuel was too low
- Erroneously high MAPLHGR limits
- Affects all GE14 & GNF2 for all customers (except NMP1 GNF2)
- BWR/2-E impact assessment is complete
- Database corrected for all future analyses

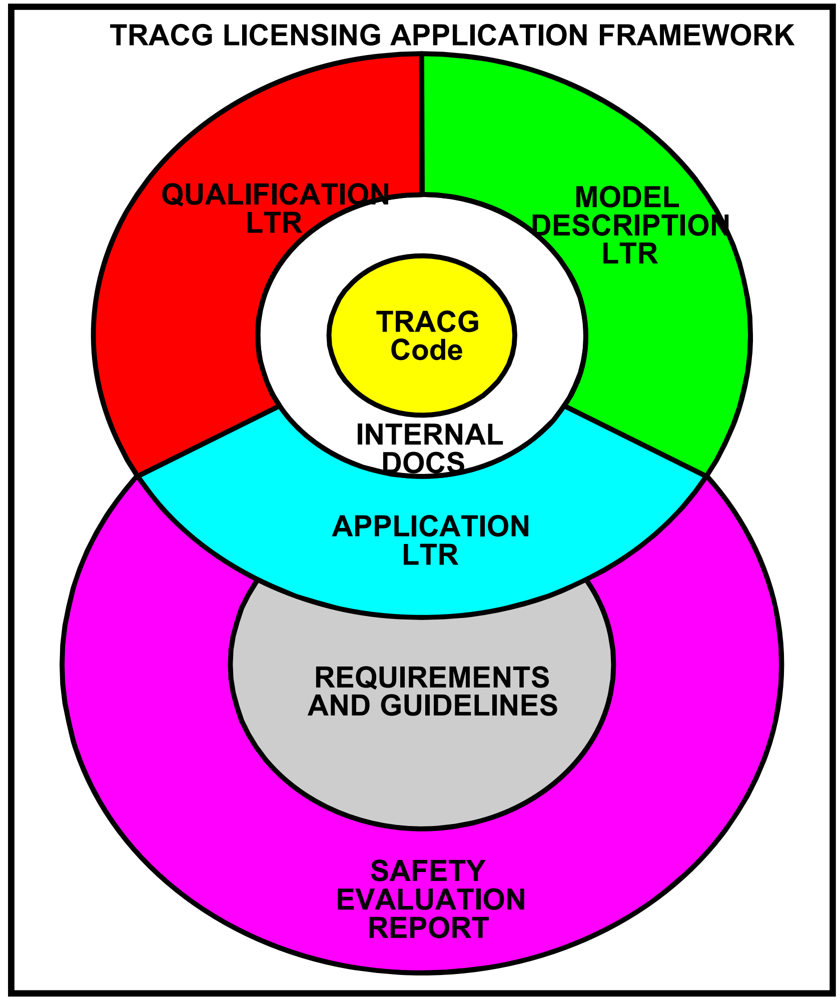
2011-03

- Discovered during 2011-02 investigation
- SAFER input maximized energy in fuel
- Input not consistent with LTR
- Hot bundle power inadvertently reduced
- Can produce erroneous MAPLHGR limits
- Affects all GE14 & GNF2 for all customers
- Input now in conformance with LTR

Effects - General

- Difficult to isolate single effects
- The effects can be a function of exposure
- The errors affect BWR/2 PCT and MLO
- 50.46 reporting focuses upon PCT
- Latent errors dating to 1986 and 1993
- Engineers applied TRACG LOCA experience
- Root cause analysis is ongoing

Technology Update for the US NRC
June 2011



TRACG ATWS Methods Status

Mike Cook

HITACHI

TRACG ATWS LTR Scope

- Applicable to BWR/2-6 and EPU/M+ operation for ATWS long-term and ATWS with Instability (ATWSI)
- Follow SRP 15.8 guidance and acceptance criteria
- Follow previous ATWS CSAU based applications: ESBWR ATWS (NEDE-33083P-A S2) and BWR/2-6 ATWS Overpressure LTRs (NEDE-32906P-A S1)

TRACG ATWS CSAU Methodology

- Overall CSAU approach consistent with NUREG/CR-5249
- [[

]]

TRACG ATWS CSAU Method Status

- ATWS long-term scenario specification (ELTR1 (NEDC-32424P-A) & M+ LTR) (Completed)
  - Main Steam Isolation Valve Closure (MSIVC)
  - Pressure Regulator Failure Open (PRFO)
  - Loss of Offsite Power (LOOP) if reduced RHR heat removal capacity
- ATWSI scenario specification (NEDO-32047-A & M+ LTR) (Completed)
  - Turbine Trip with Bypass (TTWBP)
  - Recirculation Pump Trip (RPT)

TRACG ATWS CSAU Method Status Continued

- Nuclear power plant selection set in scope (Complete)
- Phenomena Identification and Ranking Table (PIRT) (Complete)
- Frozen Code Version Selection (TRACG04) (Complete)
- TRACG04 Documentation (Complete)
  - Users Manual
  - Model Description LTR
  - Qualification LTR (Except boron transport qualification)

HITACHI

TRACG ATWS CSAU Method Status Continued

- Determination of TRACG Applicability
  - Build on previous applications (Complete)
    - AOO LTR (NEDE-32906P-A)
    - ATWS Overpressure LTR (Approved)
    - ESBWR ATWS LTR (Approved)
    - DSS-CD LTR (NEDE-33147P, Submitted)
    - LOCA LTR (NEDE-33005P, Submitted)
  - BWR/2-6 Boron Transport not addressed in previous TRACG applications
    - Benchmark boron transport model to Vallecitos and UCSB boron injection tests (80% Complete)
    - Update Qualification LTR (Not started)

TRACG ATWS CSAU Method Status Continued

- Establish TRACG Assessment Matrix (90% Complete)
  - Established in previous applications
  - Address boron transport with update to qualification LTR
- NPP Nodalization Definition
  - Nodalization sensitivity to support (20% Complete)
- Definition of TRACG experimental accuracy
  - Phenomena uncertainty established in previous applications
  - Address boron transport uncertainty (20% Complete)
- Determination of effect of scale
  - Scale established in previous applications
  - Address boron transport scale (80% Complete)

TRACG ATWS CSAU Method Status Continued

- Determination of effect of reactor input parameters and state
  - Performed ranking similar to PIRT (Complete)
  - High and medium ranked parameters addressed by bounding input, sensitivity evaluation or in Monte Carlo evaluation
- Performance of NPP sensitivity calculations
- Determination of combined bias and uncertainty
  - Follow ATWS Overpressure LTR method
- Determination of total uncertainty
  - Follow ATWS Overpressure LTR method

ATWSI Analysis Approach

- Obtain approval for generic ATWSI analysis to eliminate plant specific ATWSI limitation (M+ SE Limitation and Condition 12.19)
- Create limiting plant(s) and define key phenomena, plant initial conditions and plant parameters to develop a bounding generic analysis
- Update analysis basis to TRACG04 and include GNF2
- Define a process to address fuel design changes, operating domain changes and plant changes

TRACG ATWS Submittal Plan

- CSAU material and ATWS long-term demonstration analysis submittal in one LTR
  - Planned submittal in [[ ]]

- Separate Submittal for ATWSI generic evaluation
  - Planned submittal in [[ ]]

2011 Technology Update

Planned Submittals

Jim Harrison
June 21, 2011

HITACHI

GESTAR II Submittals

- NEDC-33270P Revision 4 (PRIME Downstream) 11-3Q
  GNF2 GESTAR II Compliance
- NEDC-32868P Revision 4 (PRIME & Downstream) 11-3Q
  GE14 GESTAR II Compliance
- NEDE-24011P - Amendment 35 11-3Q
  Correct References, Clarifications, & Approved TRs

Methods LTR

- NEDC-33173P Sup 1 — In-Review
  Void Fraction Error Based on 10x10 Pressure Drop Data
- NEDC-33173P Sup 2 — ACRS
  Power Distribution Uncertainties
- NEDC-33173P Sup 3 — -A Version
  GNF2 Supplement for Interim Methods
- NEDC-33173P Sup 4 — Final SE
  PRIME Implementation Plan

Advanced Nuclear Methods

- NEDC-33376P In-Review
  LANCR02 Lattice Physics Model Description
- NEDC-33377P In-Review
  LANCR02 Lattice Physics Qualification

[[•

]]

Fuel Improvements and Methods

• Ziron Cladding	10-4QA
• Additive Fuel	In-Review

[[

]]

Stability Solutions and Methods

- NEDE-33147 Rev 3 11-1QA
  TRACG04 for DSS-CD Application
- NEDC-33075 Rev 7 11-2QA
  DSS-CD Revision using TRACG04
- TRACG04 Supplement for NEDO-32465 11-4Q

Other Methodology

- **TRACG LOCA Application Methodology 11-1QA**

[[

]]