



**ACRS MEETING WITH
THE U.S. NUCLEAR
REGULATORY
COMMISSION**

March 5, 2015



Overview

John W. Stetkar

Accomplishments

- **Since our last meeting with the Commission on October 2, 2014, we issued 8 Reports**
- **Topics:**
 - **Watts Bar Unit 2 Operating License**
 - **Draft Branch Technical Position 8-9 on Open Phase Conditions in Electric Power Systems**
 - **Assessment of the Quality of Selected NRC Research Projects – FY 2014**

- **Topics (cont.):**
 - **Report on the Safety Aspects of the Nuclear Innovation North America, LLC Combined License Application for South Texas Project Nuclear Station, Units 3 and 4**
 - **Report of the Safety Aspects of the License Renewal Application of the Callaway Plant, Unit 1**

- **Topics (cont.):**
 - **Commission Paper, “Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards”**
 - **Standard Review Plan Chapter 19 and Section 17.4**
 - **Draft Generic Letter 20XX-XX, “Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities”**

Ongoing / Future Reviews

- **New Plants**

- **Design Certification Application for US EPR**
- **Reference COLA for US EPR (Calvert Cliffs)**
- **Subsequent COLAs for AP1000 (Levy) and ESBWR (North Anna)**

Ongoing / Future Reviews

- **PSEG Early Site Permit**
- **Small Modular Reactors (NuScale)**
- **SHINE Medical Radioisotope Production Facility**
- **License Renewal**
 - **Sequoyah**
 - **Byron/Braidwood**
 - **Seabrook**
 - **Davis-Besse**
 - **Indian Point**

Ongoing / Future Reviews

- **Technical Issues for Subsequent License Renewal**
 - **Concrete Structures**
 - **Reactor Vessel and Internals**
 - **Electrical Cables**
 - **Others as Identified**
- **Risk-Informed Resolution of GSI-191, “Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation”**

Ongoing / Future Reviews

- **Fukushima Proposed Rulemaking**
 - **Mitigation Strategies for Beyond-Design-Basis External Events**
 - **Interim Staff Guidance in Support of Order EA-13-109 (Reliable Hardened Vents) Phase 2**
 - **Containment Protection and Release Reduction for BWRs with Mark I and Mark II Containments**

Ongoing / Future Reviews

- **Grand Gulf MELLLA+**
- **Nine Mile Point Unit 2 MELLLA+**
- **Topical Report NEDE-33766P, “GEH Simplified Stability Solution (GS3)”**
- **Westinghouse Realistic Full Spectrum LOCA Methodology**

Ongoing / Future Reviews

- **Risk Prioritization Initiative / Cumulative Effects of Regulation**
- **Risk Management Regulatory Framework**
- **Updated Regulatory Analysis Guidance**
- **Level 3 PRA**
- **Human Reliability Analysis Methods**



Review of TVA Operating License Application for Watts Bar Nuclear Plant, Unit 2

Harold B. Ray

Background

- **Watts Bar Unit 2 (WBN 2) is the second unit of a dual-unit plant**
- **Part 50 construction permit for both units issued in 1973**
- **Watts Bar Unit 1 (WBN 1) began operation in 1996**
- **Construction of WBN 2 was suspended 1985 – 2006**
- **SRM in 2007 affirmed that the licensing basis for WBN 2 would be the same as WBN 1, consistent with prior dual-unit plants**

Background (cont.)

- **TVA submitted the operating license application for WBN 2 in 2009**
- **ACRS has held 10 subcommittee meetings between March 2009 and January 2015**
- **An interim letter was issued in November 2013**
- **The interim letter listed specific issues for further ACRS review**

Final letter in February 2015 reflected our completed review including:

- **Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors”**
- **GSI-191 issues, including in-vessel effects, resolved based on low latent debris levels**

Final letter in February 2015 reflected our completed review including: (cont.)

- **Compliance with General Design Criterion 5 concerning shared systems**
- **Cyber security design and confirmatory testing**

February 2015 ACRS letter reflected further review of specific issues (cont.):

- **Calculation of core fuel temperature**
- **Site licensing basis hydrology**
- **Fire protection related to operator manual actions**
- **Operational readiness preparations**

Our conclusion:

- **There is reasonable assurance that WBN 2 can operate as the second unit of the dual unit Watts Bar Nuclear Plant without undue risk to the health and safety of the public**
- **The operating license for WBN 2 should be approved following completion of remaining staff inspections and closure of remaining open items**

- **The revised Watts Bar site licensing basis reflects a deterministically established Probable Maximum Flood, consistent with current practice**
- **We discussed with NRC staff the development of a Probabilistic Flooding Hazard Analysis methodology for future use**
- **Staff has a 5-year research plan; we support this effort and welcome engagement with the staff**



Assessment of the Quality of NRC Research Projects

Michael L. Corradini

Background

- **Throughout its history, an essential activity of the ACRS has been reviewing the research sponsored by the NRC. Currently, such review includes:**
 - **Review of research conducted in support of specific regulatory activities**
 - **Episodic review of particularly important ongoing research**
 - **Biennial review of the overall reactor safety research program**
 - **Research Quality Reviews**

Motivation for Quality Review

- **Independent evaluation of the quality and utility of research programs**
- **GPRRA requirement**
- **ACRS agreed to undertake this task in partial fulfillment of the Commission direction for ACRS to assume role previously performed by NSRRC**

Quality Review Process

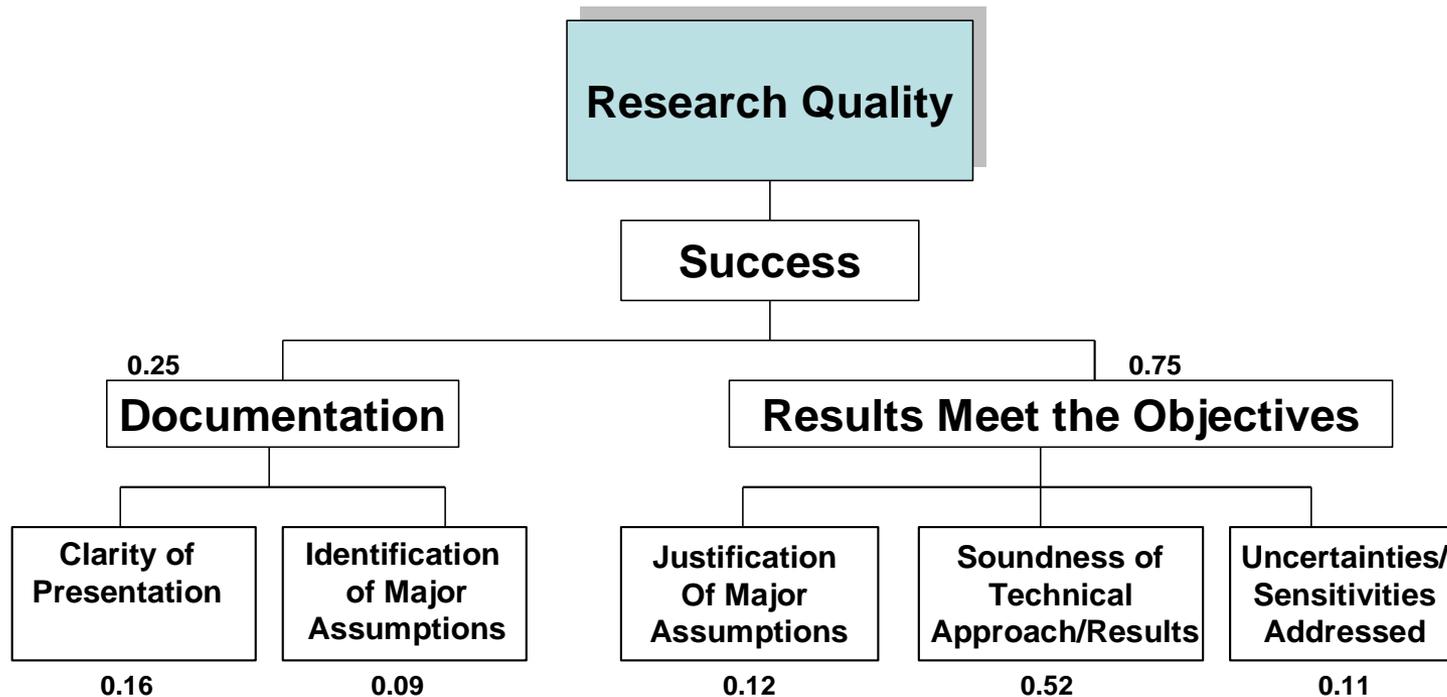
- **Review criteria originally developed by ACRS & RES**
- **ACRS typically selects two or three Projects from a list proposed by RES**
- **A panel of three ACRS members assigned to each project to do an in-depth review**

Quality Review Process (cont.)

- **Meet with RES and sponsoring program offices to better understand project scope and user need**
- **ACRS three-member panel presents oral and written report to entire committee for peer review**
- **Quality rating is finalized by whole committee**
- **Annual report to RES director**

Evaluation Criteria and Weights

The Value Tree for Finished Projects



Quality Review Issues

- **Are research objectives adequately defined?**
- **Has an adequate technical approach been pursued?**
- **Do results satisfy regulatory objectives?**
- **Are uncertainties characterized?**
- **Is documentation adequate?**

Scoring System

SCORE	RANKING	INTERPRETATION
10	Outstanding	Creative and uniformly excellent
8	Excellent	Important elements of innovation or insight
5	Satisfactory	Professional work that satisfies research objectives
3	Marginal	Some deficiencies identified; marginally satisfies research objectives
0	Unacceptable	Results do not satisfy the objectives or are not reliable

Research Quality Reviews **Completed in FY 2014**

- **NUREG/CR-7143: Characterization of Thermal-Hydraulic and Ignition Phenomena in Prototypic, Full-Length Boiling Water Reactor Spent Fuel Pool Assemblies After a Postulated Complete Loss-of-Coolant Accident**
- **NUREG/CR-7148: Confirmatory Battery Testing: The Use of Float Current Monitoring to Determine Battery State-of-Charge**

Biennial Review of Research Program

- **ACRS will soon initiate its biennial review of NRC Safety Research Program**
- **Considers the programmatic justification for the research as well as the technical approaches and progress of the work**
- **Identifies research crucial to the NRC missions**
- **Will report to Commission in March 2016 and the final report will be issued as NUREG-1635, Vol. 12**

Biennial Review of Research Program

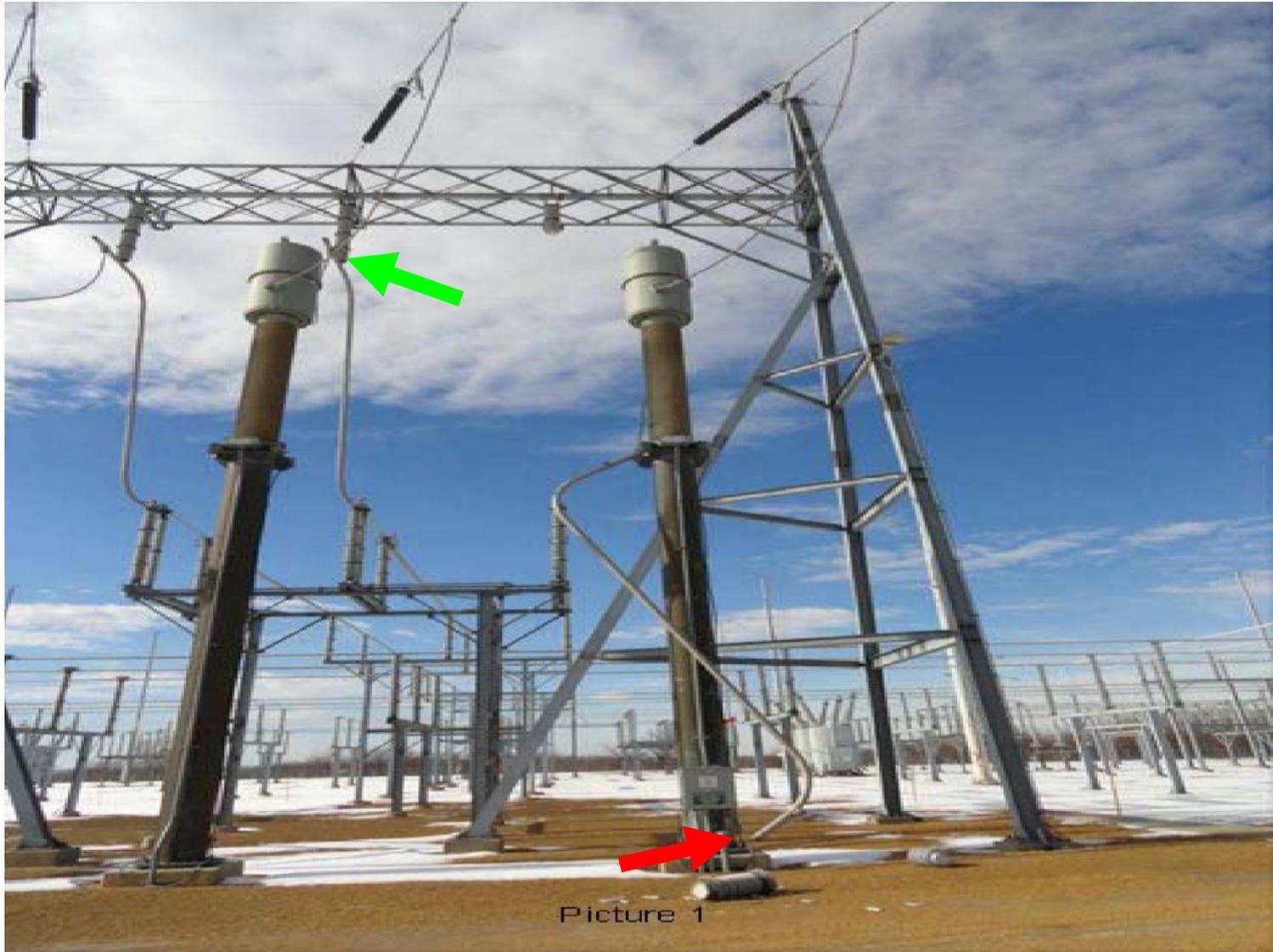
- **General Observations and Recommendations**
- **Special Topic of Current Interest**
- **Advanced Reactor Designs**
- **Digital Instrumentation and Control Systems**
- **Fire Safety**
- **Reactor Fuel**
- **Human Factors and Human Reliability**
- **Materials and Metallurgy**
- **Neutronics and Criticality Safety**
- **Operational Experience**
- **Probabilistic Risk Assessment**
- **Radiation Protection**
- **Nuclear Materials and Waste**
- **Seismic and Structural Engineering**
- **Severe Accidents and Source Term**
- **Thermal Hydraulics**



Draft Branch Technical Position 8-9 on Open Phase Conditions (OPC) in Electric Power Systems

Dennis Bley

What Is An Open Phase Condition?



Picture 1

Byron Station OPC 2012

- **Operators notice pumps tripping**
- **RCP trip caused reactor trip**
- **Concealed cause – not diagnosed for 8 minutes**
- **Loss of RCP seal cooling for 8 minutes**
- **Unbalanced three-phase currents can damage plant equipment**

Information Notice & Bulletin

- **Information Notice 2012-03 and Bulletin 2012-01, “Design Vulnerability in Electric Power System”**
- **To gather information from licensees on the potential design vulnerability and to determine whether additional actions are needed**

OPC Events Do Happen

- **Eleven OPCs at ten operating plants in fourteen years**
- **OPC can be difficult to detect, and can damage equipment**
- **Some of these events went undetected for several weeks**

BTP 8-9 Requires

- **Detection of single- and double-phase faults**
- **Alarms to alert the operators**
- **Actuation circuits to separate the faulted source from the plant and to transfer safety-related loads to an alternative source**
- **Draft was further clarified in a staff letter to NEI dated Nov. 25, 2014**

Also:

- **Draft BTP requirements clearly defined and well supported**
- **Automatic actuation required only when OPC signal coincident with a plant accident signal**

ACRS Recommendation

- **BTP 8-9 should require similar protection for onsite power connections to the high voltage side of a plant transformer, unless the circuit is fully contained in an isolated-phase bus**
- **Staff agreed**

Industry Initiatives

- **EPRI, licensees, and vendors have developed methods for detecting a wide variety of fault conditions**
- **Licensees are developing procedures to assist operators in identifying and isolating faults**
- **NEI reported that their guidance specifies actuation on the open phase signal alone, if a transformer supplies more than one safety bus**

Abbreviations

ABWR	Advanced Boiling Water Reactor	MELLLA+	Maximum Extended Load Line Limit Analysis
AC	alternating current	NEI	Nuclear Energy Institute
ACRS	Advisory Committee on Reactor Safeguards	NRC	Nuclear Regulatory Commission
APWR	Advanced Pressurized Water Reactor	NSRRC	Nuclear Safety Research Review Committee
AP1000	Advanced Passive 1000	NUREG/CR	NRC technical report designation/contractor report
BWR	Boiling Water Reactor	OL	operating license
BTP	Branch Technical Position	OPC	open phase conditions
COLA	Combined License Application	PRA	Probabilistic Risk Assessment
CPRR	Containment Protection and Release Reduction	PSEG	Public Service Electric & Gas Company
EA	enforcement action	RCP	reactant coolant pump
EPR	Evolutionary Power Reactor	RES	Office on Nuclear Reactor Research
ESBWR	Economic Simplified Boiling Water Reactor	SER	Safety Evaluation Report
EPRI	Electric Power Research Institute	SHINE	SHINE Medical Technologies, Inc.
FY	Fiscal Year	SRM	staff requirements memorandum/memoranda
GEH	General Electric Hitachi	TVA	Tennessee Valley Authority
GL	generic letter	US	United States
GSI	Generic Safety Issue		
GPRA	Government Performance and Results Acts of 1994		
LOCA	loss-of-coolant accident		