SCHEDULING NOTE

Title: **MEETING WITH ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (Public)**

Purpose: Semi-annual meeting with the NRC's independent Advisory Committee on Reactor Safeguards (ACRS) for the ACRS to provide their views to the Commission on several significant issues recently reviewed by the Committee.

Scheduled: **April 6, 2017**
10:00 a.m.

Duration: Approx. 1.5 hours

Location: Commissioners' Conference Room, 1st fl OWFN

Participants: **Presentation**

ACRS Members **50 mins.***

Dennis Bley, Chairman

Topic:
- Overview

Dana Powers, ACRS Member

Topic:
- Review of SECY-16-0106, Proposed Final 10 CFR Part 61, "Low-Level Radioactive Waste Disposal"

Ronald Ballinger, ACRS Member

- Interim Letter: Chapters 2, 5, 8, 10, and 11 of the NRC Staff's Safety Evaluation Report with Open Items Related to the Certification of the APR1400 Design

Peter Riccardella, ACRS Member

Topic:
- Revision of Regulatory Guidance for Evaluating the Effects of Light-Water Reactor Water Environments in Fatigue Analysis of Metal Components

John Stetkar, ACRS Member

Topic:

- Draft Final Rule 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events" and Associated Regulatory Guidance

John Stetkar, ACRS Member

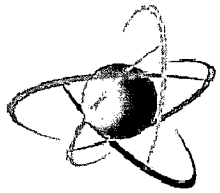
Topic:

- Closure of Fukushima Recommendations Related to Evaluation of Natural Hazards other than Seismic and Flooding, Periodic Confirmation of Natural Hazards, and Real-Time Radiation Monitoring

Commission Q & A **30 mins.**

Discussion – Wrap-up **5 mins.**

*For presentation only and does not include time for Commission Q & A's



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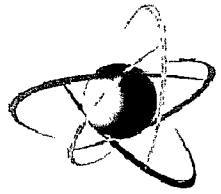
ACRS MEETING WITH THE U.S. NUCLEAR REGULATORY COMMISSION

April 6, 2017



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Overview

Dennis C. Bley

Accomplishments

Since our last meeting with the Commission on October 6, 2016, we issued 14 Reports

- **Review of SECY-16-0106, "Proposed Final 10 CFR Part 61, 'Low-Level Radioactive Waste Disposal'"**
- **Review of Safety Evaluation Reports with Open Items for the APR1400 Design Certification (Chapters 2, 5, 8, 10 and 11) and Topical Reports**

Reports

- **Revision of Regulatory Guidance for Evaluating the Effects of Light Water Reactor Water Environments in Fatigue Analyses of Metal Components**
- **Draft Final Rule 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events" and Associated Regulatory Guidance**

Reports

- **Closure of Fukushima Recommendations Related to Evaluation of Natural Hazards other than Seismic and Flooding, Periodic Confirmation of Natural Hazards, and Real-Time Radiation Monitoring**
- **COLA**
  - **North Anna Unit 3**

Reports

- **License Renewal Application**
  - **Grand Gulf Nuclear Station Unit 1**
- **Guidance and Bases**
  - **Proposed Revision to NUREG-1530, "Reassessment Of NRC's Dollar Per Person-Rem Conversion Factor Policy"**
  - **Review of RG 1.26, Revision 5, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants"**

Reports

- **Monticello Nuclear Generating Plant Licensing Amendment Request for Operation in the Extended Flow Window Domain**
- **Non-LWR Vision & Strategy-Near Term Implementation Action Plans and Advanced Reactor Design Criteria**
- **Assessment of the Quality of Selected NRC Research Projects**

Ongoing / Future Reviews

- **Design Certification**
  - **APR 1400**
  - **NuScale topical reports**
- **Construction Permit**
  - **Northwest Medical Isotopes (Mo99 production)**
- **Power Uprate**
  - **Browns Ferry Power Uprate**

Ongoing / Future Reviews

- **License Renewals**
  - **South Texas Project Units 1 and 2**
  - **Seabrook**
  - **Waterford Unit 3**
- **AP1000**
  - **WCAP Related to GSI-191 Debris Issues**

Ongoing / Future Reviews

- **Guidance and Bases**
  - **Subsequent License Renewal**
  - **Review of NUREG/BR-0058, Rev. 5, NRC Guidance for Cost-Benefit Analyses**
- **Metallurgy and Reactor Fuels**
  - **Consequential Steam Generator Tube Rupture**
  - **Consolidation of Dry Cask and Dry Fuel Storage Standard Review Plans**

Ongoing / Future Reviews

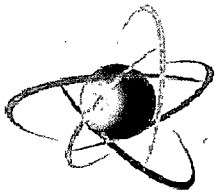
- **Digital I&C**
  - **Fuel Cycle Facilities Cyber Security Rule**
  - **10 CFR 50.59 Guidance**
  - **Diversity and Defense-in-Depth against Common Cause Failure**

Ongoing / Future Reviews

- **Reliability and PRA**
  - **Level 3 PRA**
  - **Human Reliability Analysis Method Development**
  - **Westinghouse PWR Reactor Coolant Pump Shutdown Seal**

Ongoing / Future Reviews

- **Thermal-Hydraulic Phenomenology**
  - **Aurora B Transient Code Suite**
  - **PAD5: Westinghouse Performance and Design Model**
  - **GSI-191**
    - **PWR Owners Group In-vessel Debris Test Results**
    - **South Texas Project Risk-Informed License Amendment Request**



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Revision of 10 CFR Part 61, "Low-Level Radioactive Waste Disposal"

Dana A. Powers

Low-level Waste Disposal in Shallow Facilities

- **Originally for short lived radionuclides**
  - **Institutional control for 100 years**
  - **Evaluation for periods after lapse of institutional controls when nearly all radioactivity had disappeared by decay**
- **Motivation for regulatory change is disposal of depleted U**
  - **Order of 1 million tons**

Heroic Efforts by Staff to Accommodate Many Stakeholders

- Dose limit – consistent with latent cancer fatality safety goal
- Time frames
  - 1000 years
  - 10,000 years
- Inadvertent intruder
- Waste Acceptance Criteria – site specific
- Pre-existing Waste

ACRS Recent Letter

- Revised rule will provide adequate protection of public health and safety
- Would prefer more use of performance assessment to assure requirements are risk informed
- Pre-existing waste should be treated on a case-by-case basis

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Review of Safety Evaluation Reports with Open Items for the Advanced Power Reactor 1400 (APR1400) Design Certification and Topical Reports

Ronald G. Ballinger

Background

- **Korea Hydro & Nuclear Power Company, Ltd., (KHNP) submitted a design certification application for the APR1400 on December 23, 2014**
- **The application included the design control document and associated topical and technical reports**

Chapter Reviews

- The staff has provided SERs for Chapters 2, 5, 8, 10, and 11 with open items and two topical reports for our review
- The staff's SER and our review of these chapters addressed DCD, Rev. 0 and supplemental material, including KHNP responses to staff requests for additional information

Chapter Reviews Conclusion to Date

- **Our reviews to date have not identified any significant issues**

Chapter Reviews Recommendations

- The design certification should be explicit that it is for a single unit plant with base load operation
- The staff should confirm that a shutdown cooling pump can provide automatic containment spray flow during conditions when the suction paths for the associated containment spray pump are isolated

Topical Reports
Fluidic Device

- **Fluidic Device Design**
  - **The safety injection tank with a fluidic device differs from current designs**
  - **The topical report describes the safety injection tank fluidic device design, its principles of operation, and important design features, as well as full-scale experiments confirming its performance**

Topical Reports Fluidic Device Conclusion

- **Fluidic Device Design**
  - **The safety injection tank fluidic device design, testing, and evaluation are acceptable and conform to the specified design and performance requirements**

Topical Reports
Critical Heat Flux Correlation

- **KCE-1 critical heat flux correlation**
  - **The topical report justifies the use of the KCE-1 critical heat flux correlation for PLUS7 fuel**

Topical Reports
Critical Heat Flux Correlation
Conclusion

- **There is reasonable assurance that the use of the KCE-1 critical heat flux correlation is acceptable in calculating the critical heat flux for the PLUS7 fuel design, provided the conditions and limitations identified by the staff are met**

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Environmental Effects in Fatigue Analysis of LWR Metal Components

Pete Riccardella

Background

- **ASME Boiler and Pressure Vessel Code design fatigue curves developed in late 1960s /early 1970s**
  - **Insufficient data at that time to address effects of reactor coolant environment**
  - **Substantial safety factors included (factor of 2 on stress or 20 on cycles, whichever is greater)**

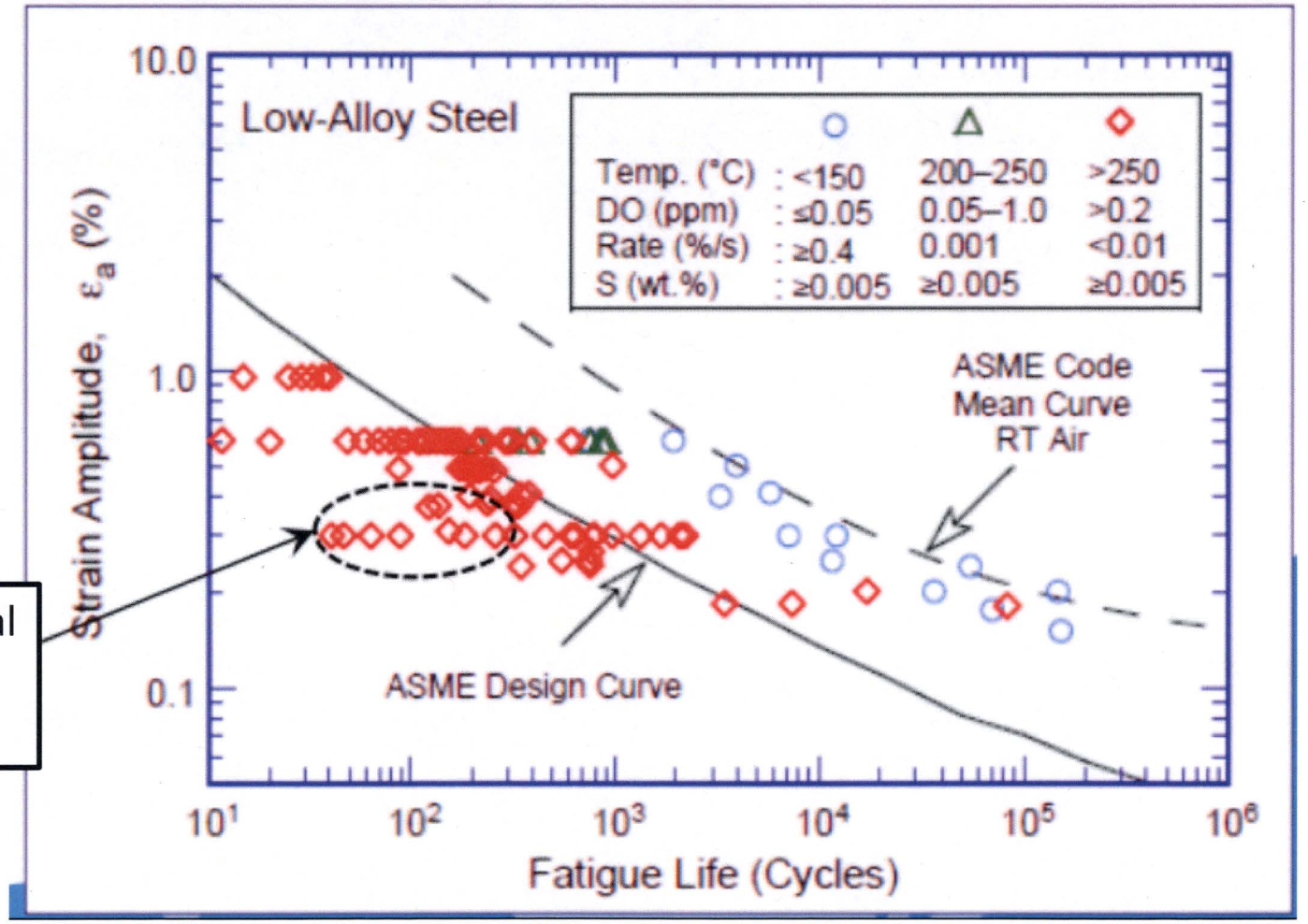
Background

- **NUREG/CR-6909, Rev 0 (Circa 2007)**
  - **Code design curves did not adequately bound fatigue life in reactor water**
  - **Proposed an Environmental Fatigue Adjustment Factor F_{en}**

Background

- **RG 1.207, Rev 0 issued simultaneously, based on NUREG**
  - **Applicable to new plants only**
  - **Operating plants under license renewal addressed via GALL report**
  - **Operating plants do not need to address during original license period**

Background



Some environmental data fall below design curve

Background

Cumulative Usage Factor (CUF)

$$CUF = \sum_{i}^{Z} \frac{n}{N} = U_1 + U_2 + U_3 + \ldots + U_Z < 1.0$$

where: n *is the applied number of cycles for load* i
N *is the allowable number of cycles for the stress*
Z *is the number of applied loads*

Environmental Fatigue Factor (F_{en})

$$F_{en} = N_{air}/N_{water}$$

$$CUF_{en} = U_1 F_{en,1} + U_2 F_{en,2} \ldots\ldots U_Z F_{en,Z}$$

NUREG/CR-6909 Rev. 1 (2017)

- Includes more recent fatigue test data since original report
- Also incorporates updates to address technical issues with original F_{en} equations
- Validates methodology through comparison to experimental data sets that simulated actual plant conditions

RG 1.207, Rev. 1 (2017)

- F_{en} equations revised based on stakeholder feedback and updated research in NUREG/CR-6909, Rev 1
- Made applicable to both new plants and operating plants under license renewal
- Applicability expanded to all metal components that have CUF calculation as part of current licensing basis

Public Comment Period

- **Drafts of NUREG and RG (DG-1309) issued for public comment in 2014**
- **Comments received from a wide variety of knowledgeable subject matter experts**
- **Staff addressed each comment and incorporated numerous changes to the two documents**

ACRS Recommendations

- **Revisions 1 of RG 1.207 and NUREG/CR-6909 should be issued**
- **Staff should continue to participate in ASME Committee efforts to incorporate environmental fatigue effects via Code Case N-792**

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10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events," and Associated Regulatory Guidance

John W. Stetkar

ACRS Engagement

- **Seven Subcommittee meetings, November 2014 - November 2016**
- **Three ACRS letters**
  - **April 22, 2015 – Draft SECY paper on proposed rulemaking**
  - **December 6, 2016 – Draft final rule and regulatory guidance**
  - **February 14, 2017 – Response to staff feedback on December 6, 2016 letter**

ACRS Recommendations

- **Draft final rule 10 CFR 50.155 should be issued after consideration of the following recommendation:**

  Equipment capability requirements and communications requirements should apply for all mitigation strategies, including those to cope with loss of a large area of the plant due to explosions or fire

ACRS Recommendations

- **Draft final Regulatory Guide 1.227, "Wide-Range Spent Fuel Pool Level Instrumentation," and draft final Regulatory Guide 1.228, "Integrated Response Capabilities for Beyond-Design-Basis Events," should be issued**

ACRS Recommendations

- **Staff should review the mitigating strategies and FLEX Support Guidelines to ensure they contain contingency actions for loss of DC power supplies, instrumentation, and associated equipment operating practices**

ACRS Recommendations

- **The risk-informed assessment process endorsed by draft final Regulatory Guide 1.226, "Flexible Mitigation Strategies for Beyond-Design-Basis Events," should be revised to omit the overall seismic risk screening criteria recommended in NEI 12-06, Revision 3**

ACRS Recommendations

- **Regulatory Guide 1.226 and Interim Staff Guidance JLD-ISG-2012-01, Revision 2, should contain guidance that is functionally equivalent and applied consistently for all licensees**

- **Draft final Regulatory Guide 1.226 should not be issued until it is reconciled with the final guidance in JLD-ISG-2012, Revision 2**

Capability and Communications Requirements

- 10 CFR 50.54(hh)(2) will be sunset as part of this rulemaking
- Equipment capability and communications attributes are addressed in guidance for that rule
- Operating reactors follow that guidance

Capability and Communications Requirements

- All new reactor licensees will need to comply with paragraphs (b)(1) and (b)(3) of the rule

- To provide regulatory clarity and ensure consistent integration of mitigation strategies developed by future licensees, the requirements should apply to all strategies required by the rule

Seismic Risk Screening Criteria

- **Staff will examine seismic capacities of FLEX equipment and structures during reviews of seismic risk assessments submitted in response to NTTF Recommendation 2.1**

- **To better understand site-specific evaluations, ACRS requests briefings on staff reviews of those seismic risk assessments for two or three sites**

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Closure of Fukushima Near-Term Task Force Tier 2 and 3 Recommendations

John W. Stetkar

Issues

- **Natural hazards other than seismic and flooding (ACRS recommendation)**
- **Periodic reconfirmation of natural hazards (NTTF Recommendation 2.2)**
- **Real-time radiation monitoring onsite and in Emergency Planning Zone (NTTF Recommendation 11.3)**

SECY-15-0137, Enclosure 1 Other Natural Hazards Tasks

1. Define hazards; determine if any are sufficiently important to be reviewed generically

2. Develop and apply screening criteria to hazards retained from Task 1

3. Perform technical evaluation of hazards not screened out in Task 2

4. Determine if additional regulatory actions are needed

ACRS Letter – May 17, 2016

- Staff evaluations through Task 2
- Concur with Task 1 and Task 2 conclusions for most hazards
- Additional Task 3 evaluations of high winds and snow loads are warranted
- ACRS will review analyses that support Task 2 screening of selected hazards
  - Downstream dam failures
  - Low intake water level due to seiche

ACRS Letter – May 17, 2016

- **Issues that merit additional staff attention**
  - **Intake water quality**
  - **Ventilation and combustion air quality**
- **Staff should continue involvement in multi-agency assessments of severe geomagnetic storms**

ACRS Letter – December 13, 2016

- **Enhanced support for Task 2 conclusions; completion of Task 3 evaluations**
- **Additional regulatory actions cannot be justified for:**
  - **High winds and wind-driven missiles**
  - **Snow and ice loads**
  - **Failures of downstream dams**
  - **Low intake water level due to seiche or tsunami**
  - **Degraded intake water quality**
  - **Degraded ventilation or combustion air quality**

ACRS Letter – December 13, 2016

- **Staff should ensure FLEX strategies contain guidance to trip affected equipment and reduce major heat loads if the plant experiences loss of all cooling water with continued availability of AC power**

- **At sites vulnerable to adverse intake water quality, staff should ensure FLEX strategies provide alternative sources of clean water or adequate filtration capabilities**

ACRS Letter – December 13, 2016

- **At sites vulnerable to extended periods of adverse air quality, staff should ensure FLEX strategies provide needed building ventilation and emergency generators have adequate filtration capabilities**

ACRS Letter – December 13, 2016 NTTF Recommendation 2.2

- **Proposed resolution should be modified**
  - **Scope of hazards assessed by External Hazards Center of Expertise should include man-made hazards, except intentional acts**
  - **Periodic reporting of staff's state of knowledge about all external hazards**

ACRS Letter – December 13, 2016 NTTF Recommendation 11.3

- **Regulatory requirements for fixed-station real-time radiation monitoring onsite and within the Emergency Planning Zone are not warranted**

- **Decisions regarding augmentation of current monitoring capabilities are best left to licensee, local, and state authorities most directly involved with emergency response plans**

ACRS Evaluation of Staff Responses – January 17, 2017

- **Understand staff's assumptions and rationale regarding FLEX strategies for cooling water supplies and air quality**

- **Disagree with rationale for excluding assessment of man-made hazards from scope of External Hazards Center of Expertise**

Abbreviations

AC	Alternating Current
ACRS	Advisory Committee on Reactor Safeguards
APR1400	Advanced Power Reactor 1400
ASME	American Society of Mechanical Engineers
CFR	*Code of Federal Regulations*
COLA	Combined License Application
CUF	Cumulative Usage Factor
DC	Direct Current
DCD	Design Control Document
FLEX	Diverse and Flexible Coping Strategies
GALL	Generic Aging Lessons Learned
GSI	Generic Safety Issue
I&C	Instrumentation and Control
JLD-ISG	Japan Lesson Learned Directorate-Interim Staff Guidance
LWR	Light-Water Reactor
Mo99	Molybdenum 99
NEI	Nuclear Energy Institute
Non-LWR	Non-Light Water Reactor
NTTF	Near-Term Task Force
NUREG/BR	NRC Technical Report Designation/Brochure
NUREG/CR	NRC Technical Report Designation/Contractor Report
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
RG	Regulatory Guide
SECY	Secretary of the Commission, Office of the (NRC)
SER	Safety Evaluation Report
U	Uranium