U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

COMMISSION MEETING WITH THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

June 7, 2024

Agenda

- **Overview**
  - Walt Kirchner, Chair
- **ACRS Improvements to Effectiveness and Efficiency**
  - Greg Halnon, Vice-Chair
- **Practical Applications of Committee Improvements**
  - Dave Petti, Member-at-Large
- **Reports on the Safety Aspects of Recent License and Subsequent License Renewals: St. Lucie, Comanche Peak, and Monticello Nuclear Power Plants**
  - Matt Sunseri, Member
- **Integrated Low-Level Radioactive Waste Disposal Proposed Rule (Part 61)**
  - Ron Ballinger, Member

Overview and Summary of Recent ACRS Activities

Walt Kirchner, Chair

Overview

Issued 16 reports since the last meeting with the Commission in June 2023

- One license renewal application and two subsequent license renewal applications
  - Providing an additional twenty years of operation and ~5000 MWe capacity
- NuScale Design Standard Design Approval Application (SDAA)
  - First phase SDAA Chapters completed
  - Second phase SDAA Chapters on schedule for August
  - Expect to complete review in early 2025

Overview (Cont'd)

- Operating Reactors
  - WCAP on Incremental High Burnup Extension
  - Vogtle Unit 2 Use of Accident Tolerant Fuel Lead Test Assemblies (6% enrichment)
  - Regulatory Guide 1.183 - Alternative Radiological Source Terms
  - Electric Power Research Institute Topical Report (TR) on Measurement Uncertainty Recapture
- Advanced Reactor Review Activities
  - Kairos 2 Construction Permit (ongoing)
  - Terrapower Natrium Principal Design Criteria (PDC), Fuel/Control, and Volcanic Hazards TRs (ongoing)
  - General Atomics Fast Modular Reactor PDC TR
  - Reviewed status of Non-Light Water Reactor Computer Code Development and Validation

Overview (Cont'd)

- Other reviews
  - Level 3 Probabilistic Risk Assessment (L3PRA)
  - Framatome TR Integrated Transient Analysis Methodology
  - Final proposed revision to Branch Technical Position (BTP) 7-19 regarding diversity and defense-in-depth against common cause failure in digital instrumentation and control systems
- Advanced Reactor Regulatory Infrastructure
  - Advanced Reactor Content of Application Project (ARCAP/TICAP)
  - Micro-Reactor Fuel Loading and Testing at a Factory
- Report on International Meeting of Nuclear Regulatory Advisory Committees

Committee Activities

- Revised ACRS Subcommittee (SC) structure and assignments to respond to anticipated workload
  - Design centered review subcommittees formed as needed for each advanced reactor application
  - Six core subcommittees of approximately 5 to 6 members each, with members each serving on three subcommittees
  - Topics assigned to SCs aligned by member expertise
  - Focus time and resources on important technical and significant safety aspects (not attendance)
  - Improve quality and efficiency of work
- ACRS continuing improvements – Greg and Dave

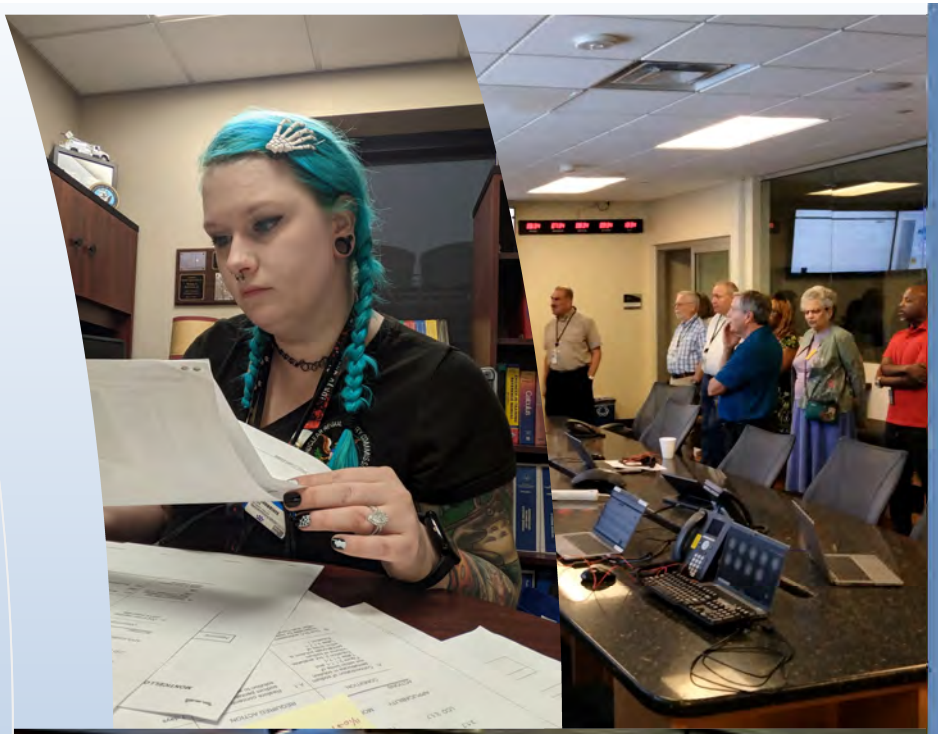
Committee Membership

- Current workload being met
  - Since last meeting Members Rempe and Brown completed their service; Member March-Leuba will go off this month
  - Two new members coming on board this summer will complement current membership by adding strong nuclear reactor analysis and nuclear industrial engineering skills and experience
- Future Recruiting
  - Seeking expertise in nuclear reactor systems and structural/seismic design
  - Welcome the support of the Commission

ACRS Efficiency and Focus

Advanced Reactor Review Guidance and Practices

Greg Halnon,
Vice Chair



Value of ACRS Process

- Mindful of our statutory requirement to focus on safety
- New nuclear technologies being proposed
- Numerous process enhancements
- New scheduling tool for ACRS staff and Members
- Increase efficiency of reviews

Improving Efficiency

- Areas of Improved Efficiency
  - Subsequent License Renewals
  - Part 53 parallel reviews
  - Subcommittee structure and membership
  - Design-Centered Review improvements
- Learning from recent reviews

Lessons Learned from SHINE and NuScale Reviews

- **Effective practices that provide early identification of significant technical issues**
  - Early submission and review of significant Topical Reports
  - Member review assignments
  - Member chapter memoranda
  - Focus and Cross Cutting areas
- **Learnings**
  - Issues of lower significance need to be raised and resolved early
  - Changing Committee membership
- **Issued Design-Centered Review Guidance**

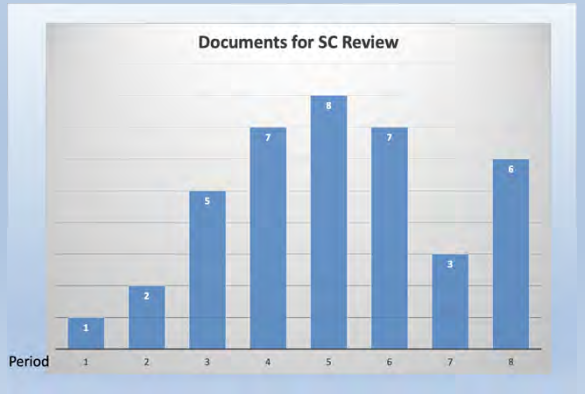
Design-Centered Subcommittee Review Guidance

- Documents best practices for lead members
- Transparent to all stakeholders
  - Provides for efficient NRR staff communications
  - Process consistency and performance
- Main Topics Addressed:
  - Committee Engagement Plans
  - Member review expectations
  - Final Letter Template – topics to address

Committee Engagement Plan and Timing of Reviews

- Committee Engagement Plans: A simple spreadsheet with every license application document and schedule
- Expectation to focus during meetings with NRR Project Manager (PM)
- Applicant Informational Meetings
- Timeline of reviews – guidance on how and when to:
  - Schedule subcommittee meetings
  - Organize chapter reviews

Design Center	Document Description	Document Date In ADAMS	ADAMS Accession	Formal Review of TR/SER Y/N	Date draft SER in SP	Start Review	Review Weeks	Date of SC Mtg	Date of FC Mtg	Comments (reschedule reasons, review expectations, etc)
Company XYZ	Topical Report, "Rod Ejection Methodology"	12/17/21	MLXXXXXXXX1	Y	07/14/23	06/01/23	11.86	8/23/23	9/6/23	
Company XYZ	XYZ Topical Report, "Analysis Supplement"	12/13/22	ML22347A314	Y	06/16/23	02/01/23	29.00	8/23/23	9/6/23	
Company XYZ	XYZ SDA Lower Effort Chapter Evaluations (2, 10, 17 except 17.4, 19.4, 19.5)	01/01/23	Various	Y	02/20/24	10/01/23	24.43	3/20/24	4/5/24	
Company XYZ	XYZ SDA Medium Effort Chapter Evaluations (3 except 3.7-3.8, 7, 8, 9, 11, 12, 13, 14, 18)	01/01/23	Various	Y	06/20/24	02/01/24	24.29	7/20/24	9/5/24	
Company XYZ	XYZ SDA Higher Effort Chapter Evluauations (1, 3.7, 3.8, 4, 5, 6, 15, 16, 17.4, 19 except 19.4-19.5)	01/01/23	Various	Y	10/20/24	06/01/24	24.57	11/20/24	12/5/24	
Company XYZ	XYZ White Paper on Treatment of QUALITY	12/2/22	ML22336A125	N	NA	3/1/23		TBD	NA	
Company XYZ	XYZ Tech Report Transient Analysis	12/31/22	ML23001A018	N	NA	5/1/23		TBD	NA	



Example of Guidance

- Construction Permit Applications
  - Need to manage our interests:
    - Intense desire for more detailed information
    - Interest and the desire to help design the plant
  - Depth and breadth of review needs to be commensurate with the type of application
  - Focus on safety significance of information provided

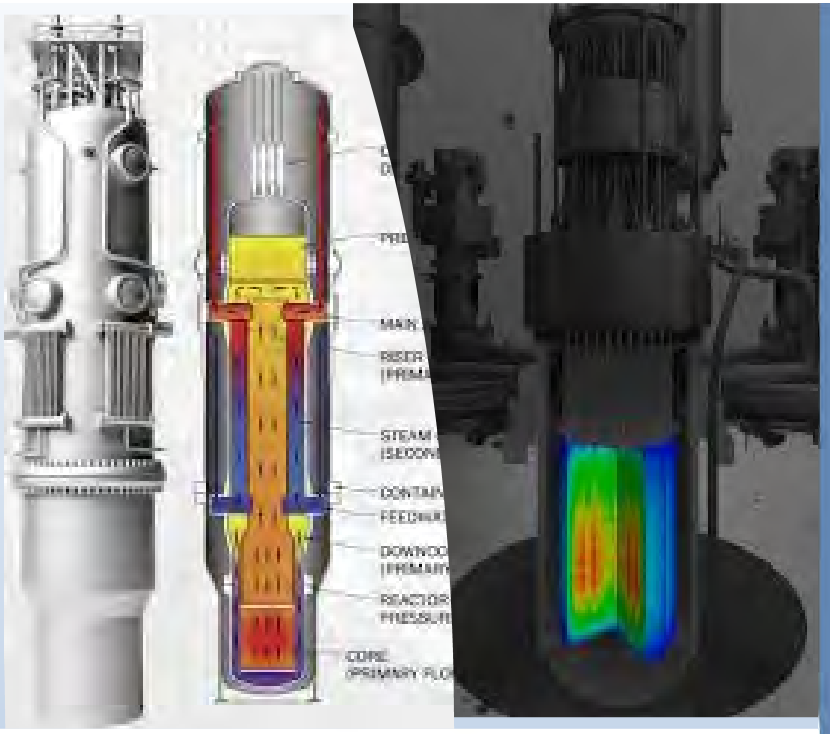
Additional Enhancements

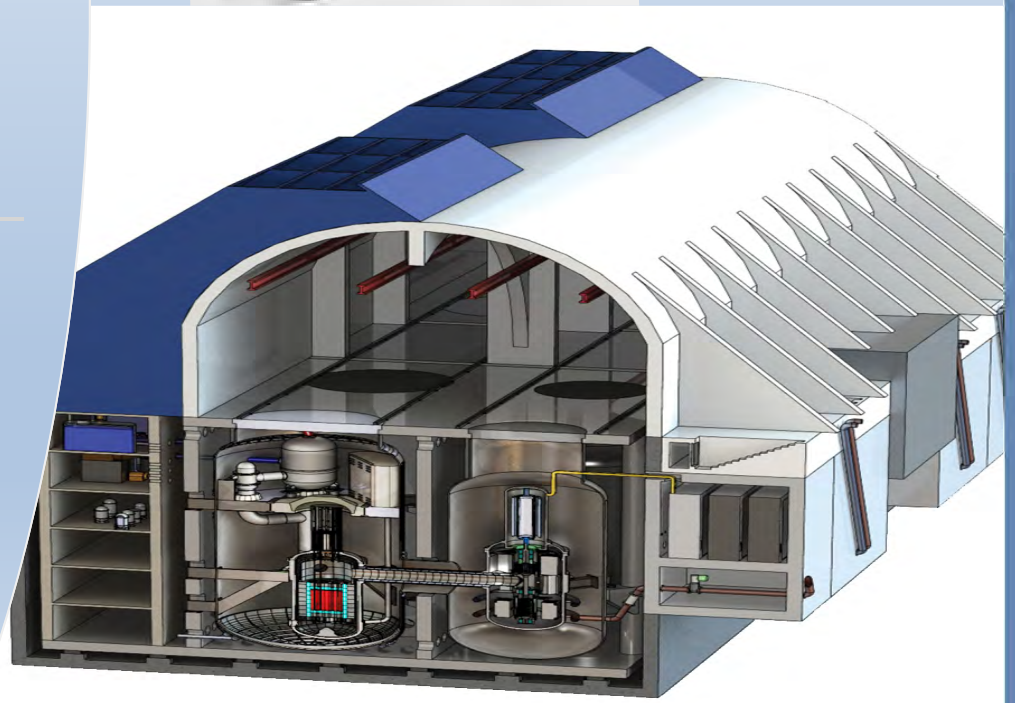
- Knowledge Management portal on Sharepoint
- Follow-up of additional punch list items from self-assessment
- Continuous learning and ongoing self-assessment of performance
- Develop approach to Nth-of-a-Kind reviews (from Kairos Review)

Summary

- New guidance captures best practices from previous reviews
- Early communication of issues of interest/concern
- Final Letter Report process streamlined
- Guidance is in a continuous learning mode – will modify as warranted
- Areas to Watch:
  - Timing of early informational meetings and pre-application engagements
  - Prepare for many reactor reviews that could span beyond member terms
  - Future landscape of reviews can now be seen; high volume periods can be planned

Practical Applications of Committee Improvements





David Petti,
Member-At-Large

Areas of Improvements

- Reviewing Topical Reports and safety analysis reports (SARs)
- Organization of the ACRS Letter for Design Centered Reviews

Improved Topical Report and SAR Review Process

- Review TRs first in advance of PSAR/FSAR
  - Designers are using TRs to establish key aspects of the safety case
  - TRs provide the foundation of the technology upon which the SAR is built
    - Principal Design Criteria are almost always the first to be reviewed
    - Fuels, materials, source term and analytical methods description, validation, and verification are also critical

Improved Topical Report and SAR Review Process (cont.)

- Chapter by chapter review of SAR with no open items from the staff
  - Summary memos are prepared by a lead member and discussed with entire committee during a SC meeting on the specific design
  - Specific items that need discussion with staff and applicant identified
  - Review sessions on cross-cutting issues and safety focus areas
  - Preparatory work for the final letter in a subcommittee meeting to get consensus early
- ACRS is looking for places where safety issues could arise in submittals and were missed in staff review
  - ACRS integrated review vs. staff's chapter by chapter review
- Used efficiently during ACRS reviews of SHINE and Kairos
- Currently being used for safety review of NuScale SDAA (underway)

Improved Outline for the ACRS Letter

- Top-down approach that focuses on important safety aspects of the design
  - Novel features and new source terms
  - Key safety functions: what are they, how are they implemented, how do they work and how they might fail
  - Principal design criteria; structures, systems and components (SSC) classification; and Defense in Depth
  - Postulated event selection, safety analysis and safety margin
  - Technology development required
- Used successfully for Kairos Hermes safety review
- Will be used for other non-LWR advanced designs
- Operating License (OL) reviews are expected to take more time than Construction Permit (CP) reviews.
  - Approach should be the same, but review time will depend on the quality of the application and completeness of the design

Hermes 2 Construction Permit:
A Window Into an Nth-of-a-Kind Review?

- Significant overlap with Hermes 1 but with some important new systems added
- Applicant provided a red-line strikeout SAR compared to Hermes.
  - Extremely useful to enhance focus in reviewing the document
- All chapters are reviewed by a member with relevant expertise
- Communicate to the overall lead if there is a safety issue
- Memo is only written if there is a safety issue that requires deeper review

Hermes 2 Construction Permit:
A Window Into an Nth-of-a-Kind Review? (cont.)

- ACRS review is focused on answering the following high-level questions:
  - Do the design changes affect the safety functions identified in the design? Do they change the SSCs that implement those safety functions?
  - Do the changes affect the list of items that need to be confirmed prior to issuance of an OL (the staff's appendix A)?
  - Do the changes impact source terms for the design?
  - Do the design changes introduce new accident sequences changing the Maximum Hypothetical Accident?
  - Are the co-location effects of Hermes and Hermes 2 accounted for?
  - Do the design changes influence waste streams?
- Review is still in-progress

Summary

- ACRS continues to look for novel ways to accomplish the safety reviews in the most time efficient manner possible
- These new approaches sharpen the focus on safety relevant issues and novel design features

Recent License Renewal Reviews

Matt Sunseri, Member

Safety Review Initial and Subsequent Renewals

- We have completed three safety reviews for renewed licenses:
  - St. Lucie Plant, Units 1 and 2
  - Monticello Nuclear Generating Station
  - Comanche Peak Nuclear Power Plant, Units 1 and 2
- In each case the established programs and commitments made by the applicants to manage age-related degradation provide confidence that these reactors can be operated without undue risk to the health and safety of the public.

First Subsequent License Renewal Application Reviewed by ACRS in 2019

- Original process had two steps: Subcommittee Review/Discussion followed by Full Committee Meeting and letter report preparation
- Involved about a day and a half of interaction between applicant and NRC staff in addition to our review time
- Two months of calendar duration from the start of review to letter report prepared

Since 2019 - 8 Subsequent License Renewal and One Initial License Renewal Applications Completed

The ACRS has evolved and modified our approach:

- Reduced applicant and staff interaction to ½ day during Full Committee
  - Applicant and staff interaction time shortened to 1/3 of prior
  - Eliminated 50% of applicant travel (100% if applicant choses to participate remotely)
- Letter report prepared during the same week
  - About a month after receiving review material

Quality of ACRS Review Not Compromised

- Subcommittee still performs full review of application, staff safety evaluation, relevant inspections and audits
- Still having direct interaction with applicant and staff (including resident inspectors)
- Quality of applicants' submittals improved due to repetitive nature of License Renewal and robust sharing of lessons learned between previous applicants and interactions with ACRS

Summary

- Applicants continue to demonstrate renewed licenses are justified based on safely managing the effects of aging
- Many renewal applications are already in the queue with more being added
- We expect to continue to satisfy our statutory obligation while maintaining the quality of our reviews in addition to timely completion schedules
- Opportunity to apply learnings to Nth-of-a-kind applications where the repetition of submittals allows for greater quality and proficiency

Integrated Low-Level Radioactive Waste Disposal - Proposed Rule 10 CFR Part 61

Ron Ballinger, Member

Background

- Revisions to Part 61 have been an ongoing process
- Original Rule promulgated in 1982
- Numerous ACRS SC and Full Committee meetings
- Five previous Letter Reports (2010, 2011, 2013, 2014 and 2016)
- Latest Letter Report - February 26, 2024

History

- Based on anticipated low-level radioactive waste (LLRW) streams from reactors and other generators at the time
- NRC developed classification system for LLRW based on potential hazards.
- Class A, B and C of LLRW
  - Progressively longer “decay” times for radioactive material
    - A, B - 100 Years to “harmless”, C - 500 years to “harmless”
    - Isotope specific, depth specific
    - < 100 nanoCuries/gram of transuranic waste
  - Increased levels of stability/intruder restrictions, etc.
- Greater-Than-Class C (GTCC) has historically not been acceptable for near-surface shallow disposal.

History (cont.)

- Generation and required disposal of several new or altered waste streams has occurred:
  - Depleted Uranium
  - Mixed LLRW
  - Fuel Reprocessing
  - Radium-bearing
  - Transuranic (>100 nanoCuries/gram transuranic elements with > 20-year half-life)

Latest Proposed Draft

- Includes all new Waste Streams
  - Consolidates and integrates criteria for GTCC and Part 61 Rulemaking
- Introduces site-specific, performance based, analyses for all waste streams:
  - Performance Assessment
  - Allows for a Site-Specific Intruder Assessment
- Specifies compliance periods for analyses:
  - 1,000 Years (No long-lived radionuclides present)
  - 10,000 Years (Long-lived radionuclides present)
- Added performance analyses beyond 10,000 years for sites accepting long-lived radionuclides

Proposed Draft (continued)

- Disposal facility can opt to meet current Part 61 requirements if not accepting long-lived nuclides (GTCC)
- Introduces option to develop site-specific waste acceptance criteria
- Design features to prevent criticality for Special Nuclear Material wastes
- Annual dose limits updated
  - 25 mrem for member of the public within compliance period
  - 500 mrem for inadvertent intruder within compliance period

Proposed Draft (continued)

- Special requirements for Agreement State sites (GTCC Waste)
  - Near-surface disposal requires 5M depth and Intruder barrier
  - 10,000 nanoCurie/gram Threshold
  - Criticality Analysis
- Defense-in-Depth requirements
- Proposed changes are consistent with domestic and international practice

ACRS Comments

- Proposed Rule is a significant improvement
- Inclusion of newest LLRW streams with long-lived radionuclides adequately addressed many previous concerns:
  - "OPT-Out" for Sites that will not accept GTCC
- ACRS agrees with NRC staff that quantification of uncertainties need not be the principal determinant of compliance and performance periods.
  - Mitigating design features and qualitative considerations provide adequate protection of public health and safety.

List of Acronyms

ACRS	–	Advisory Committee on Reactor Safeguards
ARCAP	–	Advanced Reactor Content of Application Project
BTP	–	Branch Technical Position
CP	–	Construction Permit
FSAR	–	Final Safety Analysis Report
GTCC	–	Greater-Than-Class C
L3PRA	–	Level 3 Probabilistic Risk Assessment
LLRW	–	Low Level Radioactive Waste
MWe	–	Megawatt (electric)
mrem	–	Millirem
NRR	–	Office of Nuclear Reactor Regulation
OL	–	Operating License
PDC	–	Principal Design Criteria
PM	–	Project Manager
PSAR	–	Preliminary Safety Analysis Report
SAR	–	Safety Analysis Report
SC	–	Subcommittee
SDAA	–	Standard Design Approval Application
SER	–	Safety Evaluation Report
SSC	–	Structures, Systems and Components
TICAP	–	Technology Inclusive Content of Application Project
TR	–	Topical Report