Saint Lucie Units 1 and 2
Subsequent License Renewal Application

Pre-Application Meeting
April 21st, 2021

Draft Application Materials Subject to Change

Agenda

- Saint Lucie Units 1 and 2 (PSL) Subsequent License Renewal (SLR) Project Team
- PSL Background
- General Topics
- Scoping and Screening
- Aging Management Programs (AMPs)
- Time-Limited Aging Analyses (TLAAs)
- Topics of Interest
- Questions
- Action Items

PSL SLR Project Team

Florida Power & Light (FPL)

William Maher, Senior Project Director

Michael Friedman, Engineering Lead

Basil Pagnozzi, Engineering

Rick Orthen, Environmental Licensing Lead

Steve Franzone, Licensing Manager

Paul Atkinson, Site SLRA Lead

ENERCON

James Wicks, Senior Project Manager

Jack Hoffman, Project Design Lead

Steve Hale, Technical Lead

Jeffrey Head, Mechanical Lead

Jim Hamlen, Electrical Lead

Bruce Beisler, Civil Lead

PSL Background

Original license renewal application (LRA) approved on October 2, 2003

- Current license expiration dates, 3/1/2036 (Unit 1), 4/6/2043 (Unit 2)
- Based on draft NUREG-1801, Generic Aging Lessons Learned (GALL)
  - 10 programs were updated to NUREG-1801, Generic Aging Lessons Learned (GALL), Rev 0 as part of the application review process
- Inspection Procedure (IP) 71003 inspection completed 11/20/2015 (Unit 1) & 10/20/2017 (Unit 2)
- Unit 1 entered PEO 3/1/2016 and Unit 2 will enter PEO 4/6/2023
- NEI 14-12 AMP effectiveness review completed 1/25/2021
- Phase 4 post-approval site inspection for license renewal TBD

Licensed core power history, Units 1 and 2

- 2560 MWt, initial license
- 2700 MWt, Stretch Power uprate(U1-1981 & U2-1985)
- 3020 MWt, 11% Extended Power Uprate (EPU) (2012)

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General Topics

- Submittal schedule
- ePortal Folder Structure
- Operating Experience (OE) including Keywords
- Application Development Procedures
- Application of lessons learned
  - Handling of Proprietary Information
- Incorporation of New ISGs

General Topics

- Submittal schedule
  - Third Quarter of 2021
- ePortal Folder Structure
  - Folder for each AMPs
  - Added folders for Instructions, References, Special Topics
- Operating Experience (OE) including Keywords
  - Latest available keywords utilized (198 total)
  - The AR search covered the period from 10/01/2010 to 10/01/2020
    - -- 78,000 initial hits screened, over 1500 identified for further review
  - Experience based interviews, in accordance with EPRI TR-110089, "*Experience-based Interview Process for Power Plant Management*," conducted with AMP owners on-site and at the home office
  - No new aging effects identified
- Application Development Procedures
  - Application developed under Vendor QA program

General Topics

Application of Lessons Learned

- Senior, LR/SLR experienced engineers in key positions
- Benchmarking against other successful SLR/LR utilities
- Review and incorporation of industry LR operating experience including implementation
- Incorporated lessons learned from NextEra fleet experience
- Review and incorporation of previous RAIs including Turkey Point, Peach Bottom and Surry SLRA reviews
    - Including RAI cross reference table
    - Will be available in ePortal as a reviewer's aid
- Handling of Proprietary Information
    - Minimized in Application
    - Developing Cross-Reference Matrix
    - Discuss Reports under TLAAs

General Topics

- Application will incorporate:
  - SLR-ISG-2021-02-MECHANICAL, Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance, (ML20181A434)
  - SLR-ISG-2021-04-ELECTRICAL, Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance, (ML20181A395)
  - SLR-ISG-2021-03-STRUCTURES, Updated Aging Management Criteria for Structures Portions of Subsequent License Renewal Guidance ISG, (ML20181A381)
  - SLR-ISG-2021-01-PWRVI, Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized-Water Reactors, (ML20217L203)

Scoping and Screening

- Approach to 10 CFR 54.4(a)(2)
  - Nuclear Energy Institute (NEI) 17-01 Guidance
    - -- Applicant should rely on the plant's current licensing basis (CLB), plant-specific and industry OE, as appropriate, and existing plant-specific engineering evaluations
    - -- Refers to Appendix F of NEI 95-10, Rev. 6, for industry guidance
    - -- Refers to SRP-SLR Report (NUREG-2192), Table 2.1-2 regarding hypothetical failures

Scoping and Screening

- Approach to 10 CFR 54.4(a)(2)
  - NEI 95-10, R6, App. F Guidance
    - -- NRC staff position on 54.4(a)(2) scoping criterion taken from Grimes (NRC) to Nelson (NEI), dated March 15, 2002
    - -- Non-nuclear safety related (NNS) systems, structures and components (SSCs) meeting the scoping criterion of 54.4(a)(2) fall into 3 categories
      - A plant's CLB (missiles, cranes, flooding, high energy line break (HELB))
      - NNS SSCs directly connected to SR SSCs (piping systems)
      - NNS SSCs not directly connected to safety related (SR) SSCs
        - » Mitigative Option
        - » Preventive Option – PSL approach

Aging Management Programs

- AMP Summary
- AMPs with exceptions to GALL
- Results of AMP effectiveness review

Aging Management Programs

Consistency with NUREG-2191

- AMRs (SLRA Section 3)
  - Very consistent, >98% A through E notes (~2500-line items)
  - No new aging effects
- AMPs (Appendix B)
  - Goal is to maximize consistency
  - Includes aging management effectiveness review of current LR AMPs

AMP Category		AMPs Consistent with GALL	AMPs Consistent with Enhancement	AMPs with Exception	AMPs with Exception and Enhancement	Plant Specific AMPs
Existing	**36**	**4**	**27**	**0**	**4**	**1**
New	**12**	**12**	**0**	**0**	**0**	**0**
Total AMPs	**48**					

Turkey Point, Surry, Peach Bottom RAIs addressed

- Separate section in each AMP basis document summarizes how the RAIs were addressed
- AMP basis documents will be available to reviewers on ePortal

Aging Management Programs

AMPs with exceptions to GALL

- XI.M3, Reactor Head Closure Stud Bolting
  - -- Current bolting is high strength
- XI.M30, Fuel Oil Chemistry
  - -- Some fuel oil tanks do not allow for internal inspection, complete draining and/or cleaning
- XI.M31, Reactor Vessel Material Surveillance
  - -- Revision to capsule removal schedule
- XI.S3, ASME Section XI, Subsection IWF
  - -- High strength bolting is utilized in some applications

Aging Management Programs

Saint Lucie AMP effectiveness review, evaluated all AMPs – Completed

- Performed in accordance with NEI 14-12, Aging Management Program Effectiveness, in 2021
- Review concluded that all AMPs continue to be effective with no failed elements

Time-Limited Aging Analyses

- List, including vendor support
  - No Topical Reports
- Fluence Methodology
- Reactor Vessel Embrittlement
  - Impact on surveillance capsule removal schedule

Time-Limited Aging Analyses

TLAA Description	Resolution [10 CFR 54.21(c)(1) Section]	Vendor	Section
REACTOR VESSEL NEUTRON EMBRITTLEMENT			4.2
Neutron Fluence Projections	(iii) the effects of aging on the intended function will be adequately managed for the SPEO	Westinghouse	4.2.1
Pressurized Thermal Shock	(ii) projected to the end of the SPEO	Westinghouse	4.2.2
Upper-Shelf Energy	(ii) projected to the end of the SPEO	Westinghouse	4.2.3
Adjusted Reference Temperature	(ii) projected to the end of the SPEO	Westinghouse	4.2.4
Pressure-Temperature Limits and LTOP Setpoints	(iii) the effects of aging on the intended function will be adequately managed for the SPEO	Westinghouse ENERCON	4.2.5
METAL FATIGUE			4.3
Metal Fatigue of Class 1 Components	(iii) the effects of aging on the intended function will be adequately managed for the SPEO	Westinghouse ENERCON Structural Integrity Associates Framatome	4.3.1
Metal Fatigue of Non-Class 1 Components	(i) remains valid for the SPEO	ENERCON	4.3.2
High-Energy Line Break Analyses	(i) remains valid for the SPEO	ENERCON	
Environmentally Assisted Fatigue	(iii) the effects of aging on the intended function will be adequately managed for the SPEO	Westinghouse ENERCON Structural Integrity Associates Framatome	4.3.3

Time-Limited Aging Analyses

TLAA Description	Resolution [10 CFR 54.21(c)(1) Section]	Vendor	Section
ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRICAL EQUIPMENT	(iii) the effects of aging on the intended function will be adequately managed for the SPEO	ENERCON	4.4
CONCRETE CONTAINMENT TENDON PRESTRESS	Not Applicable		4.5
CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE	(i) remains valid for the SPEO	ENERCON	4.6
OTHER PLANT-SPECIFIC TLAAS			4.7
Leak-Before-Break of Reactor Coolant System Loop Piping	(ii) projected to the end of the SPEO	Westinghouse	4.7.1
Alloy 600 Instrument Nozzle Repairs	(ii) projected to the end of the SPEO	Westinghouse	4.7.2
Unit 1 Core Support Barrel Repair Plug Preload Relaxation	(ii) projected to the end of the SPEO	Westinghouse	4.7.3
Flaw Tolerance Evaluation for CASS Piping	(ii) projected to the end of the SPEO	SIA	4.7.4
Reactor Coolant Pump Flywheel	(i) remains valid for the SPEO	ENERCON	4.7.5
Reactor Coolant Pump Code Case N-481	(ii) projected to the end of the SPEO	Westinghouse	4.7.6
Crane Load Cycle Limits	(i) remains valid for the SPEO	ENERCON	4.7.7

Time-Limited Aging Analyses

- Fluence Methodology
  - Neutron transport followed the guidance of Regulatory Guide 1.190, Calculational and Dosimetry Methods for Determining Pressure Vessel
  - NRC approved methodology described in WCAP-18124-NP-A, Fluence Determination with RAPTOR-M3G and FERRET
- Methodology has been generically approved for calculations of exposure of the reactor pressure vessel (RPV) beltline
- Exposure Projections
  - Based on 72 EFPY
  - 10% positive bias on peripheral assembly power for projected cycles

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Time-Limited Aging Analyses

- Reactor Vessel Embrittlement – Impact on surveillance capsule removal schedule
  - Current approved withdrawal of capsules
    - -- Unit 1 - Two capsules schedule for testing (~ 38 EFPY & 45 EFPY)
      - Unit 1 limiting weld material is not in the program. However, we have embrittlement data > 72 EFPY fluence from a sister plant
      - Standby capsule is damaged. FPL plans to revise schedule to include either damaged capsule (if tooling can be developed) or scheduled capsule as both have the same lead factor
    - -- Unit 2 - One scheduled capsule that leads vessel. Remaining standby capsules have a lead factor of <1
      - Unit 2 limiting material is plate and all materials are low copper
  - Similar to Turkey Point & Point Beach, an incremental adjustment to the approved withdrawal schedule will allow sufficient material data and dosimetry for the end of the subsequent period of extended operation (SPEO)

Topics of Interest

- Reactor Vessel Internals
- Irradiation of Concrete
- Irradiation of Reactor Vessel (RV) supports

Topics of Interest – Reactor Vessel Internals

Reactor Vessel Internals (RVI) Gap Analysis for SLR

- Existing PSL RVI AMP based on the Materials Reliability Program: Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines (MRP-227-1-A)
- GALL-SLR Report (NUREG 2191) allows use of the existing RVI AMP if supplemented by a 60 to 80 Year gap analysis with MRP-227-A as the starting point
- SLR-ISG-2021-01-PWRVI will be incorporated into the PSL application
  - Permits the use of MRP-227-1-A as the starting point for the Gap Analysis
- PSL RVI Gap Analysis for SLR will use MRP-227-1-A as the starting point
  - Will utilize joint industry issue program documents to perform this analysis
    - MRP-191 Rev 2
    - MRP-2018-022
  - Gap Analysis will consider all relevant industry OE
- FPL will continue to actively participate in the joint industry issue programs regarding RVI and update the program, as needed

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Topics of Interest – Irradiation of Concrete

Design configuration

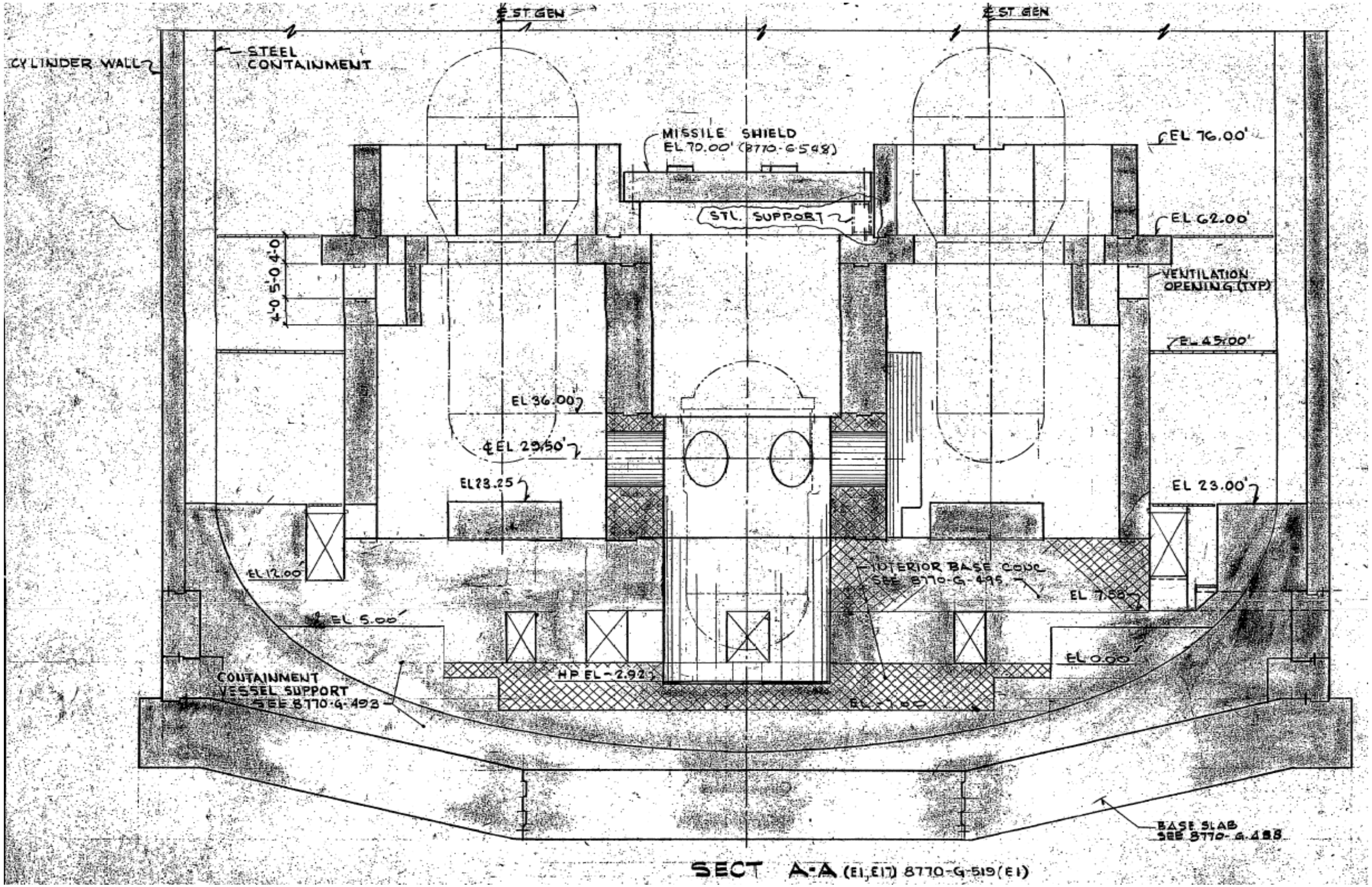
- The PSW is a 7.25 ft thick cylindrical reinforced concrete wall and surrounds the RPV
- Both Unit 1 and Unit 2 PSWs have the same dimensions and the same concrete properties.
- Unit 2 PSW has slightly less vertical reinforcement steel than Unit 1 PSW
  - However, Unit 2 PSW has Grade 60 reinforcement steel whereas Unit 1 PSW has Grade 40 steel.
- 5000 psi concrete

Topics of Interest – Irradiation of Concrete

Design configuration

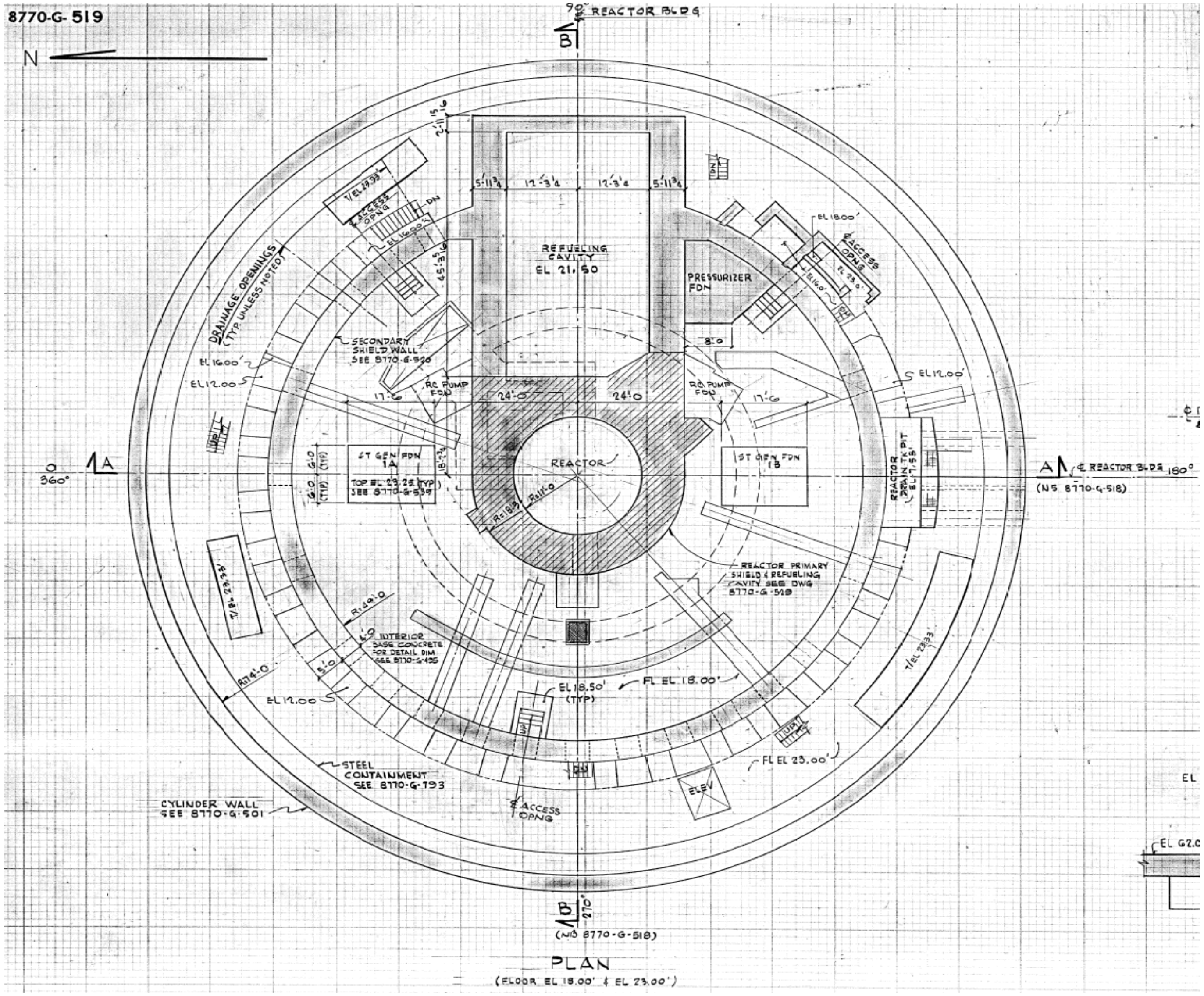
- The RPV is supported at three points on three steel beam-column assemblies within the reactor cavity.
- The beams are embedded in the PSW approximately 6 ft on each end
- The column is bolted to the underside of the girder and to the reactor cavity floor
- Load transfer between the RPV system and the RPV support occur between the support shoe which is welded to the reactor nozzle and steel bearing plates designed into the top of the steel support beam

Topics of Interest – Irradiation of Concrete



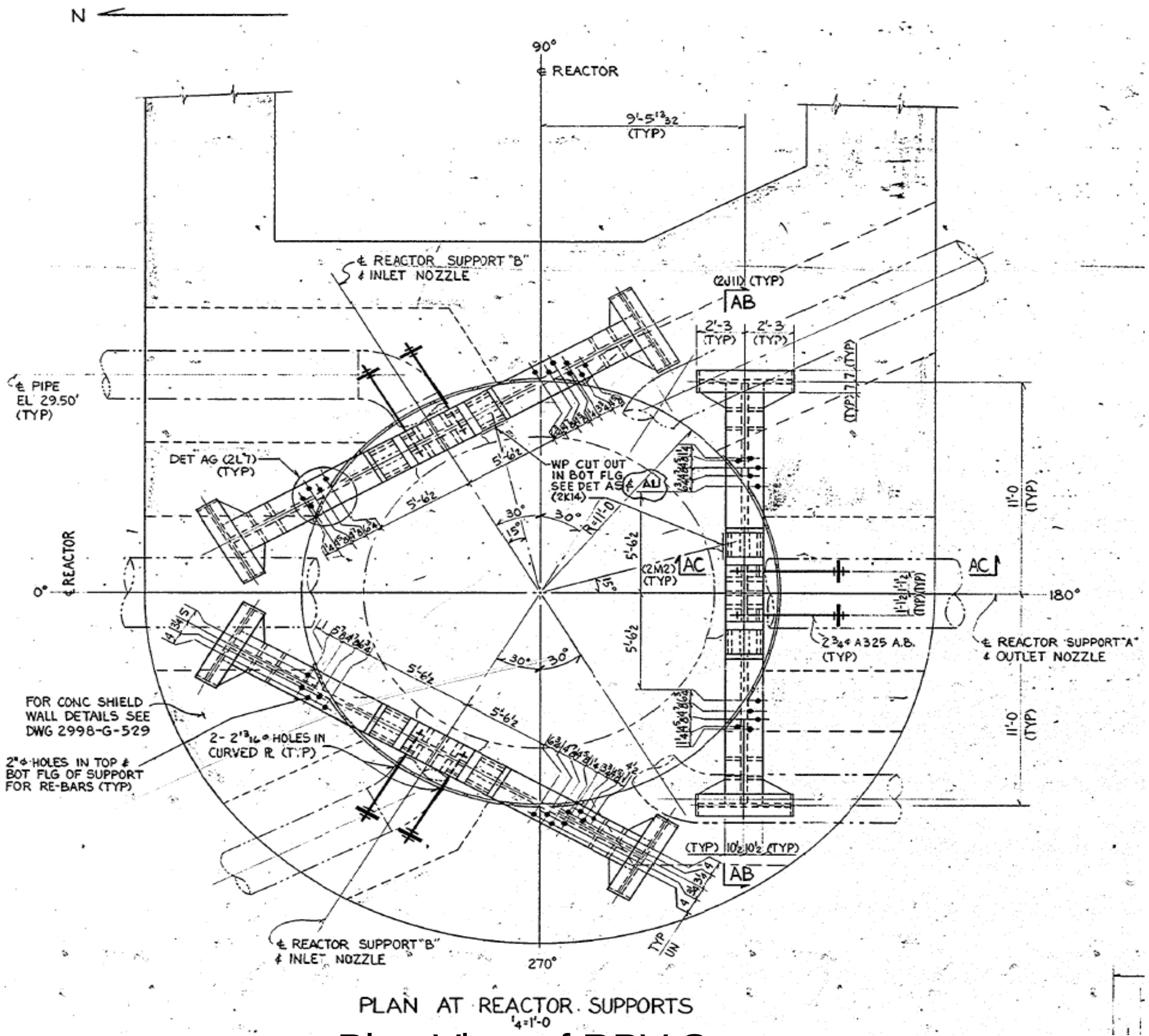
Elevation View of the Reactor Building, Section A-A of Plan View

Topics of Interest – Irradiation of Concrete



Plan View of the Reactor Building at Elevation 18 ft

Topics of Interest – Irradiation of Concrete



Plan View of RPV Supports

Topics of Interest – Irradiation of Concrete

- Maximum exposures on the inner surface of PSW at the end of the SPEO (72 EFPY) based on very conservative UFSAR numbers (PSL2 bounding)
  - Neutron fluence E > 0.1 MeV – 7.0 x 10^{19} n/cm^2
  - Gamma dose – 3.2 x 10^{10} rads
- PSW exposures result in an assumed loss of strength as follows
  - 100% strength loss for first 4.5” due to neutron fluence and radiation induced volumetric expansion (RIVE)
  - 25% strength loss for an additional 25.5” for a total of 30”
- Evaluation demonstrates PSW maintains its structural integrity under CLB loading

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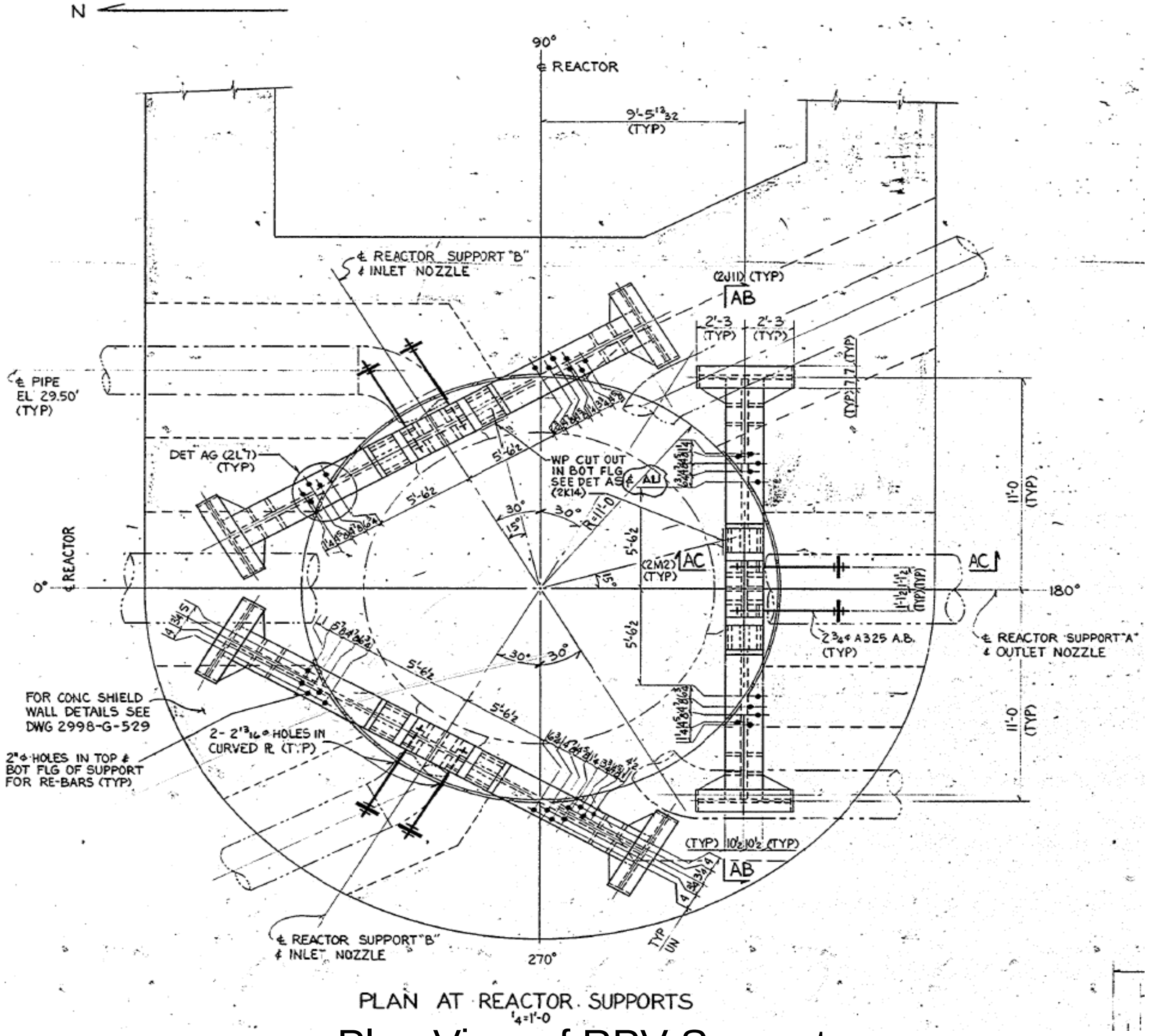
Topics of Interest – Irradiation of RV Supports



Plan View of RPV Supports

Topics of Interest – Irradiation of RV Supports

Topics of Interest – Irradiation of RV Supports

- FPL will perform a qualitative assessment of the PSL Units 1 & 2 reactor pressure vessel (RPV) supports, as it pertains to the irradiation aging effects for the SPEO
- This assessment will provide the technical basis to support an inspection-based approach
- The assessment has two (2) elements:
    - Qualitative comparison of the technical attributes
    - Inspection-base attributes

Topics of Interest – Irradiation of RV Supports

Assessment topic areas include:

- Compare Geometry & Materials
  - Identify analogous components between PBN and PSL
  - Compile all material types for downstream evaluation
- Compare Fracture Toughness
  - Consider CMTRs and industry guidance as applicable
  - Compare K_{IC} at critical locations
- Compare Stresses
  - Develop stresses from plant specific model
  - Compare stress at critical locations
- Validate Inspection Plan
  - Review current inspection capability
  - Utilize above comparisons to evaluate RPV Inspection Program

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Questions

Action Items