Enclosure 2
Presentation Slides for the March 24, 2023
ACRS Kairos Power Subcommittee Meeting
(Non-Proprietary)

Hermes PSAR 4.3 Reactor Vessel System

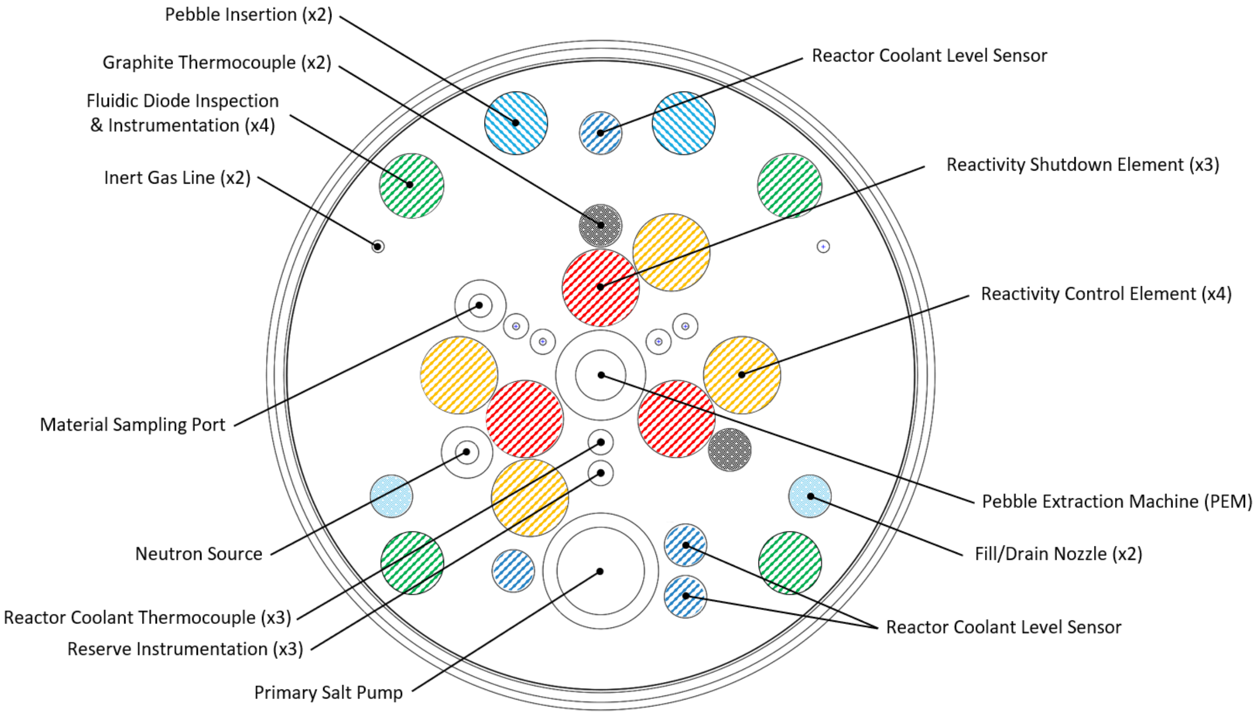
ODED DORON – SENIOR DIRECTOR, REACTOR SYSTEM DESIGN

ACRS KAIROS POWER SUBCOMMITTEE MEETING

MARCH 24, 2023

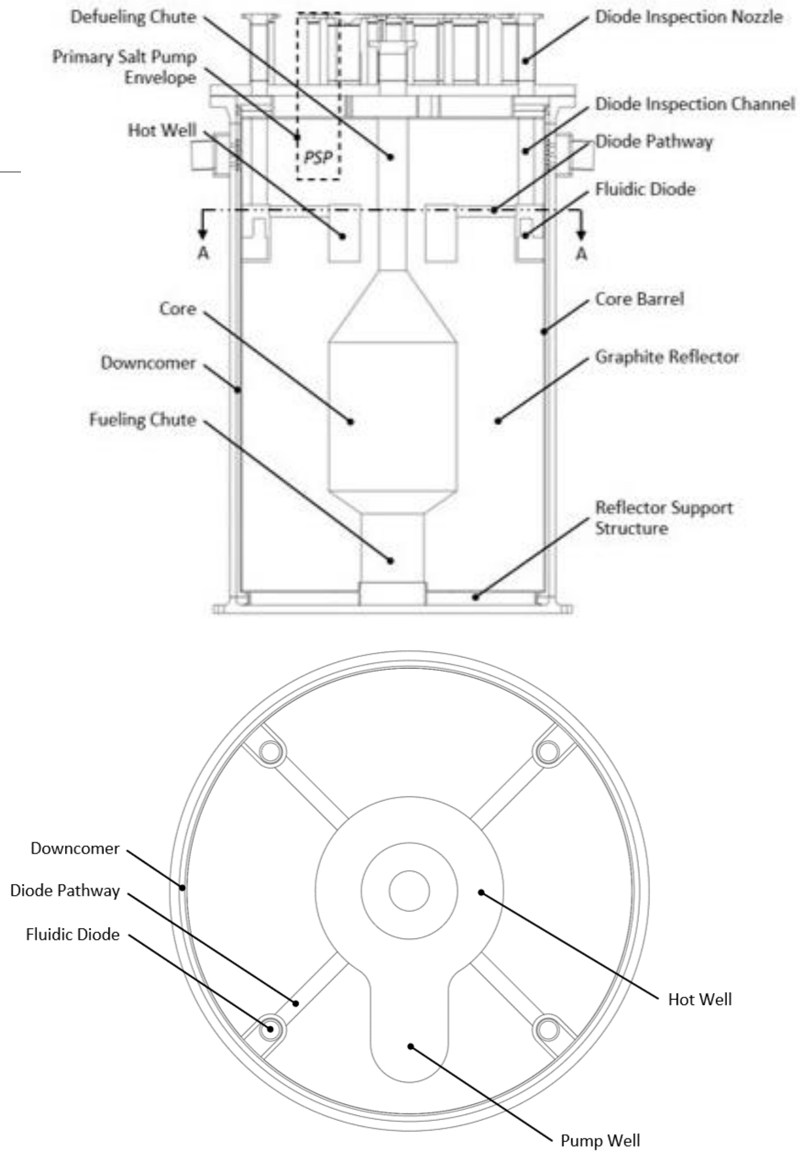
4.3 Reactor Vessel System

- 316H stainless steel reactor vessel bottom head, shell and top head
- Vessel material qualified per topical report "Metallic Materials Qualification for the Kairos Power Fluoride Salt-Cooled High-Temperature Reactor" (KP-TR-013)
- Reactor Vessel Top Head
  - Supports attachment of equipment and components
  - Bolted and flanged
  - Designed to be leak tight (not credited)
  - The head, nozzles, and attachments are seismically qualified
  - 316H SS hold-down provides structural support against upward buoyant loads
- Reactor Vessel Shell
  - Maintains reactor coolant boundary
  - Provides the geometry for coolant inlet and heat transfer surface for Decay Heat Removal System (DHRS)
- Reactor Vessel Bottom Head
  - Maintains the reactor coolant boundary
  - Provides flow geometry for low pressure reactor coolant inlet to the core



4.3 Reactor Vessel System: Reactor Vessel Internals

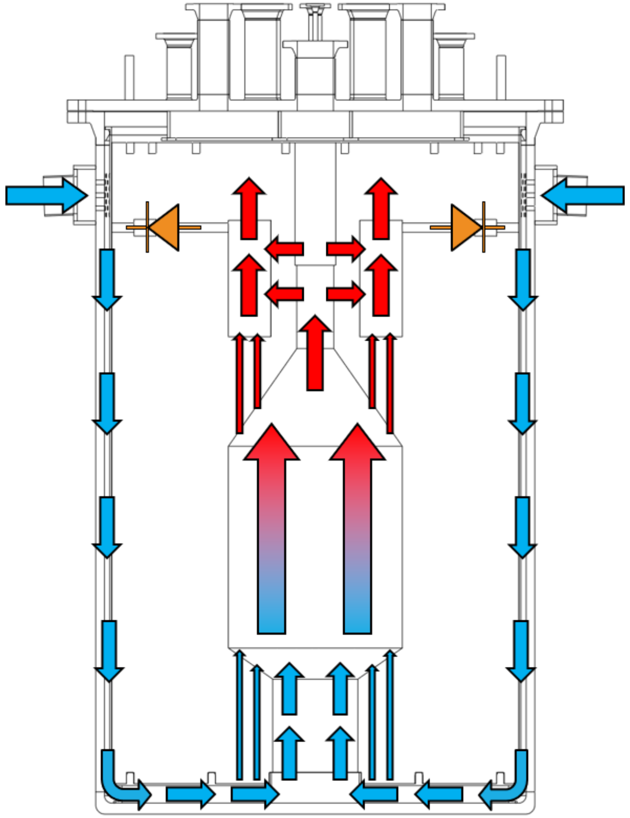
- Core Barrel
  - 316H Stainless Steel
  - Downcomer is part of the normal and natural circulation flow pathways
- Reflector Support Structure
  - 316H Stainless Steel
  - Defines the flow path into the core
  - Supports the reflector blocks
- Reflector Blocks
  - ET-10 Graphite
  - Qualified per topical report "Graphite Material Qualification for the Kairos Power Fluoride Salt-Cooled High Temperature Reactor" (KP-TR-014)
  - Forms the fueling chute, flow channels, core, upper plenum, hot well, pump well, defueling chute, and diode pathway
  - Part of the normal circulation flow pathway
  - Diode pathway in the reflector block and 316H SS fluidic diode within the reflector block are part of the natural circulation flow path
  - Secondary metallic hold-down structure precludes damage to the natural circulation flow path from a postulated air ingress event



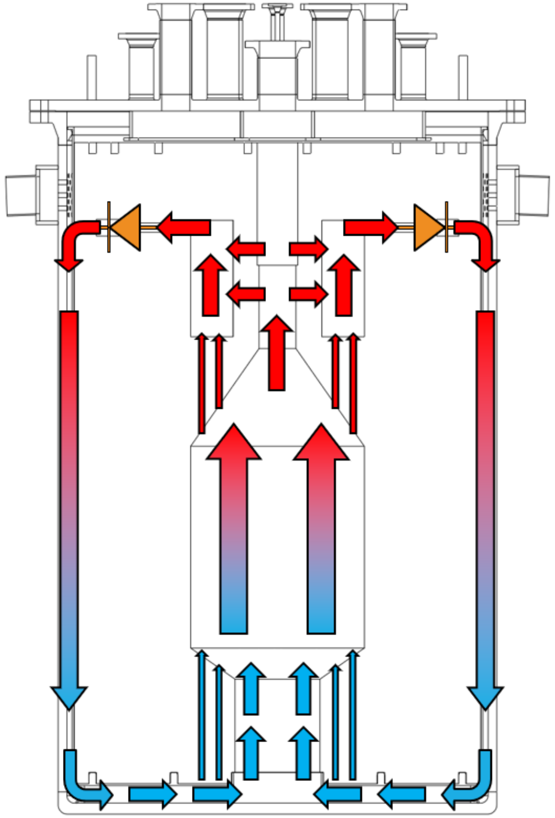
Section A-A

4.3 Reactor Vessel System: Flow Path

- Normal Circulation Flow Path (forced flow)
  - Cold leg (downcomer)
  - Reflector support structure
  - Reflector
    - Coolant inlet channels
    - Core
    - Coolant outlet channels and PEM
    - Hot well, pump well
  - Primary salt pump
  - Hot leg
  - Heat is removed by the heat rejection radiator
- Natural Circulation Flow Path (during postulated events)
  - Cold leg (downcomer)
  - Reflector support structure
  - Reflector
    - Coolant inlet channels
    - Core
    - Coolant outlet channels and PEM
    - Hot well, pump well
    - Natural circulation pathway
  - Fluidic diode
  - Cold leg (downcomer)
  - Heat is removed from the vessel wall by DHRS



(a) Normal Operation Coolant Flow Path



(b) Natural Circulation Coolant Flow Path

4.3 Reactor Vessel System: Design Basis

- Reactor vessel, reflector and 316H SS structures are designed, fabricated and tested consistent with ASME Section III, Division 5 standard (PDC 1)
- Reactor vessel, reactor vessel internals and vessel attachments are classified as SDC-3 per ASCE 43-19 to protect against failure during a design basis earthquake (PDC 2)
- Reactor vessel and vessel internals design accounts for environmental and dynamic effects like thermal expansion of vessel shell and bottom head, mechanical loadings from static weight and forces from the pebble bed, coolant and core components during start-up, normal operation and postulated events (PDC 4)
- The reflector block design maintain a geometry and coolant flow path to ensure the SARRDLs will not be exceeded by supporting coolant flow through the reflector via gaps and flow channels, thereby cooling the reflector and maintaining its structural integrity and the integrity of the coolant flow path (PDC 10)
- The reactor vessel is fabricated and tested to have an extremely low probability of abnormal leakage, rapidly propagating failure and gross rupture and the vessel material is qualified in accordance with the metallic materials qualification topical report. The vessel is operated within as-designed operational and transient conditions and monitored for changes during in-service inspection and testing (PDC 14)
- The reactor vessel is fabricated, and tested to ASME standards, the reactor vessel design supports pre- and in-service inspections, and catch basins with sensors are used to detect leakage (PDC 30)

4.3 Reactor Vessel System: Design Basis

- The reactor vessel design has margin to withstand stresses under operating maintenance, testing, and postulated events by precluding material creep, fatigue, thermal, mechanical and hydraulic stresses that would degrade the reactor coolant boundary. Stress rupture factors encompass transient conditions and leak tight design of reactor vessel head minimizes air ingress. The design prevents fracture of the reactor coolant boundary. (PDC 31)
- The reactor vessel design permits inspection and monitoring of the structural integrity and leak-tightness of the reactor coolant boundary using the material surveillance system (MSS) to confirm irradiation assisted stress corrosion cracking is non-existent or manageable (PDC 32)
- The core barrel design maintains reactor coolant inventory in the event of a break in the primary heat transport system using anti-siphon cutouts on both sides of the core barrel. (PDC 33)
- The flow path established by the design of the reactor vessel internals support the removal of residual heat from the core to ensure SARRDLs are not exceeded during normal operation and postulated events. The physical geometry and structure of the reactor vessel internals provide a pathway for forced flow and continuous natural circulation. (PDC 34)
- The fluidic diode, reflector blocks and downcomer are designed to maintain their structural integrity in order to establish a flow path for continuous natural circulation during a postulate event. The passive cooling of the reactor core prevents damage to the vessel internals due to overheating and therefore ensures the coolable geometry of the core is maintained. (PDC 35)
- The functional capability of the natural circulation flow path is confirmed during normal operation by temperature monitoring. Appropriate periodic inspections of the fluidic diode are performed via head penetrations. (PDC 36, PDC 37)
- The reflector is qualified to maintain its structural integrity to support residual heat removal in accordance with the graphite material qualification topical report. The reactor vessel is classified as SDC-3 and will maintain its geometry to support the insertions of shutdown elements. (PDC 74)

Hermes PSAR 4.4 Biological Shield

NADER SATVAT – SENIOR MANAGER, REACTOR CORE DESIGN

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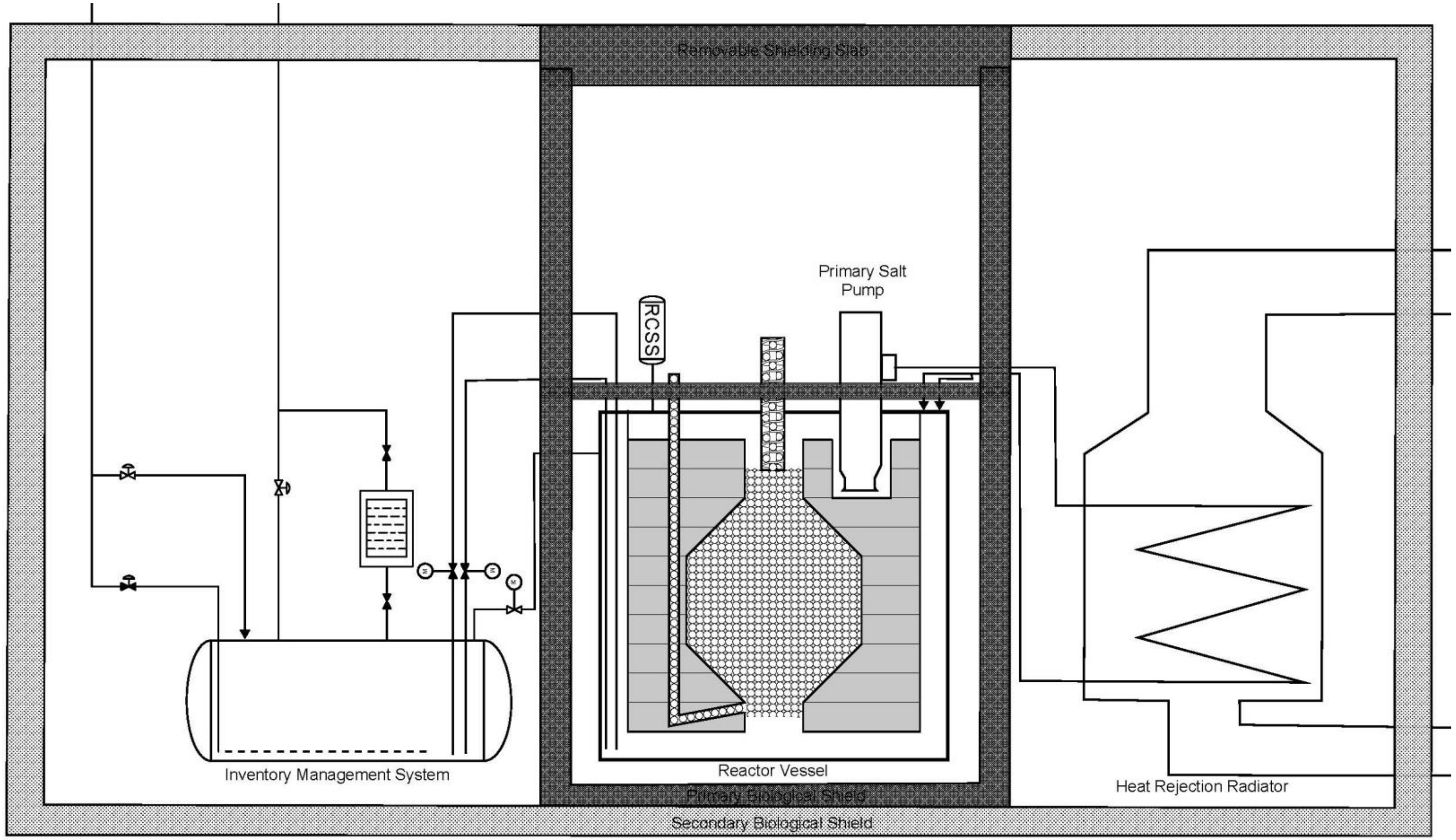
4.4 Biological Shield

- Protects workers and the public from radiation per 10 CFR 20
- Meets radiation exposure goals in PSAR Chapter 11
- Shield Design
  - Primary shield located just outside the reactor vessel
  - Secondary shield located outside the primary shield and contains the inventory management and primary heat transfer systems
  - Both shields are concrete
- Details on biological shield will be provided as part of the operating license application

4.4 Biological Shield



Hermes PSAR 4.6 Thermal Hydraulic Design

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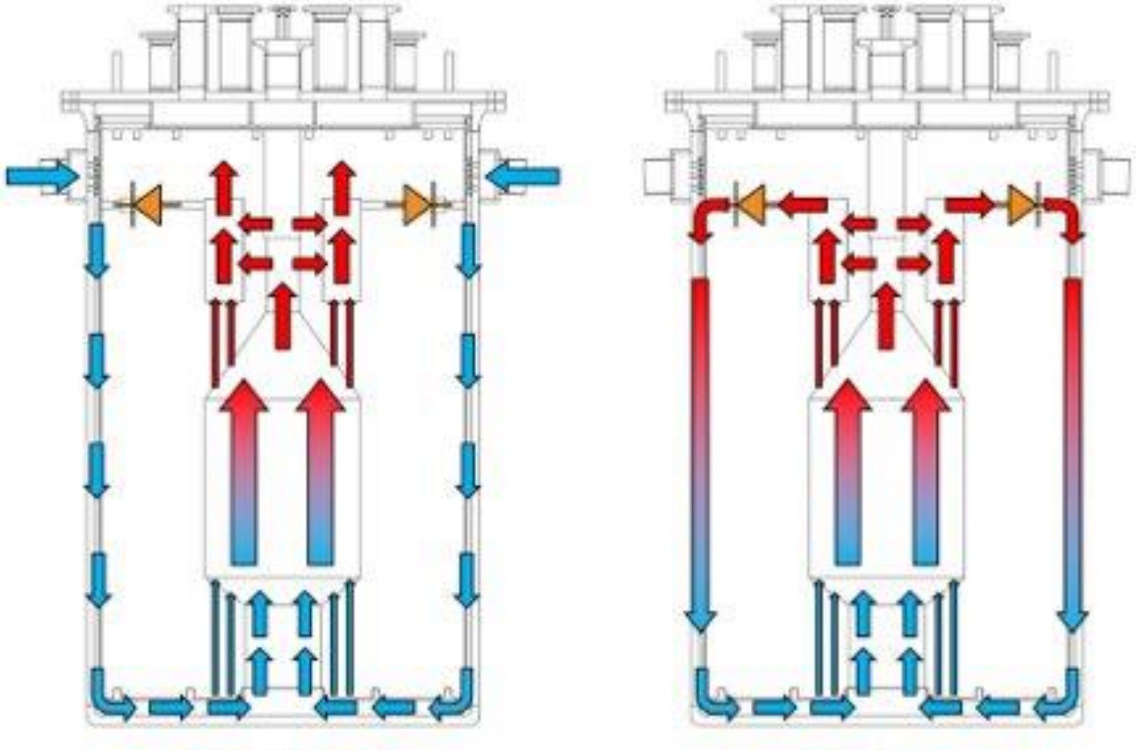
4.6 Thermal Hydraulic Design: Design Description

- The thermal hydraulic design is a combination of design features:
  - Pebble
  - Reactor coolant
  - Reactor vessel and internals
  - Primary heat transport system
- Thermal hydraulic design uses multiple heat transfer mechanisms between the reactor materials
- Thermal hydraulic design includes coolant flow path for normal operation and natural circulation
  - Natural circulation flow path uses a fluidic diode which minimizes reverse flow
  - Qualification or functional testing plans for fluidic diode and test results to validate performance will be available with the operating license
- STAR-CCM+ and KP-SAM computer codes are used in thermal hydraulic analysis of the design



(a) Normal Operation Coolant Flow Path

(b) Natural Circulation Coolant Flow Path

4.6 Thermal Hydraulic Design: Computer Codes and Models

- STAR-CCM+ is used to perform the thermal hydraulic analysis in the core design methodology
  - Steady state solver for heat transfer and fluid flow in the form of a 3-D porous media model
  - Calculates the core material temperatures used as input into the neutronics model
  - Discussed in KP-TR-017-P “KP-FHR Core Design and Analysis Methodology”, Revision 1
- KP-SAM is used to perform the thermal hydraulic analysis in the postulated event methodology
  - Simplifies models to represent the major physical components and describe major physical processes (i.e., fluid flow, heat transfer)
  - Used to analyze the progression of postulated events (i.e., insertion of excess reactivity, loss of forced circulation)
  - Discussed in KP-TR-018-P “Postulated Event Methodology”, Revision 2

4.6 Thermal Hydraulic Design: Design Basis

- The design provides adequate transfer of heat from the fuel to the coolant to ensure SARRDLs will not be exceeded during normal operation and postulated events (PDC 10)
- The thermal hydraulic design of the reactor system ensures that power oscillations that could result in conditions exceeding SARRDLs are not possible or can reliably and readily detected and suppressed (PDC 12)
- Residual heat is removed during normal operation and postulated events, such that SARRDLs and the design conditions of the safety-related elements of the reactor coolant boundary are not exceeded (PDC 34)
- The reactor transfers heat from the reactor core during postulated events such that fuel and reactor internal structural damage that could interfere with continued effective core cooling is prevented (PDC 35)

Hermes PSAR 4.7 Reactor Vessel Support System

ODED DORON – SENIOR DIRECTOR, REACTOR SYSTEM DESIGN

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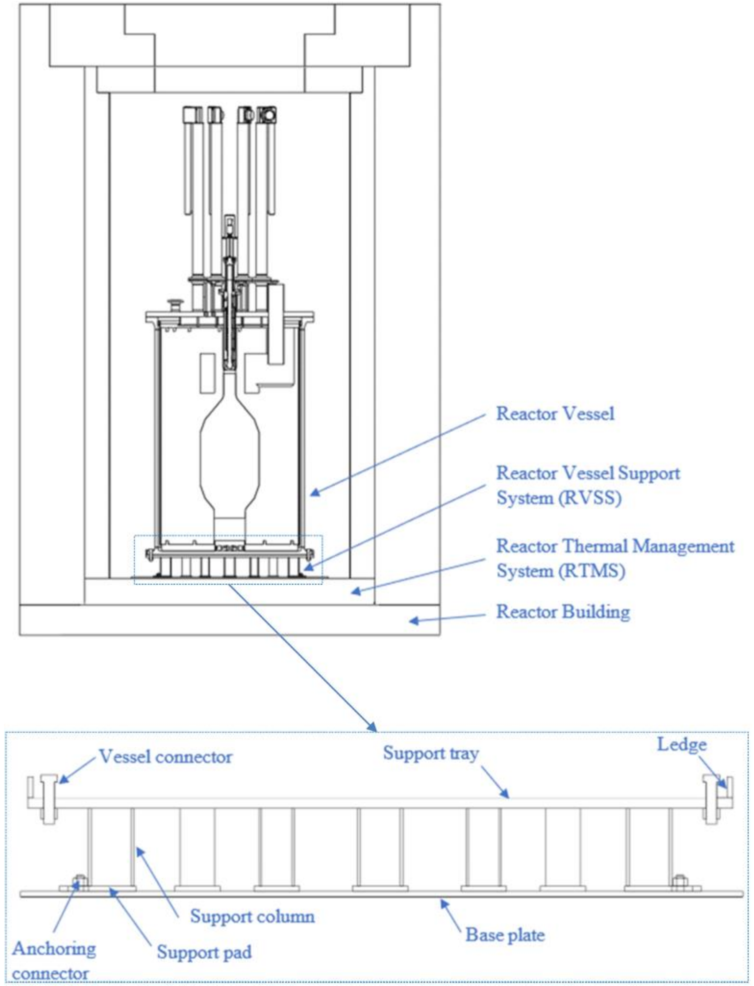
4.7 Reactor Vessel Support System

- Reactor vessel support system (RVSS) purpose:
  - Supports the weight of the reactor vessel with fuel, coolant, internals and attachments
  - Provides thermal management to support vessel expansion
- RVSS Bottom Support:
  - Includes a support tray, ledge, support columns, support pads, base plate, vessel connector, and anchoring connector
  - 316H stainless steel
  - Reactor vessel bottom head sits directly on the bottom support
  - Designed and fabricated using ASME Section III, Division 5
  - Vertically anchored to the reactor building foundation
- RVSS Thermal Management
  - Protects the reactor building cavity concrete from thermal effects
  - Thermal break provided by insulation ensures reactor building concrete integrity
- Reactor Building Seismic Isolation
  - Does not use lateral seismic restraints for the reactor vessel and head-mounted components. RVSS designed to keep reactor vessel from uplift and shear during seismic event.
  - Design leverages seismic isolation of the reactor building to reduce seismic effects on the vessel, RVSS, and head-mounted components



4.7 Reactor Vessel Support System: Design Basis

- RVSS is designed to withstand the effects of natural phenomena and support the reactor vessel in the event of an earthquake. The bottom support and connectors meet ASCE 43-19 and preclude linear buckling in the vessel support columns and provide lateral and uplift support. (PDC 2)
- RVSS is designed for the environmental conditions including temperature loading cycles in combination with mechanical loading cycles. Catch basins with sensors for leak detectors are used to preclude damage to the RVSS from primary coolant leaks. (PDC 4)
- The RVSS design ensures the integrity of the reactor vessel during postulated events to support the geometry for passive removal of residual heat from the core by removing heat from the reactor vessel via the reactor thermal management system, actively during normal operation and passively during postulated events. (PDC 74)
- The RVSS design removes heat from the vessel and ensures the integrity of the reactor vessel and reflector blocks, thereby permitting sufficient insertion of the control and shutdown elements providing for reactor shutdown. RVSS design ensures that ACI 349-13 is met to support maintenance and inspection of the vessel bottom head and shell weld and reactor cavity. (PDC 74)

Hermes PSAR Chapter 6 Engineered Safety Features

NICOLAS ZWEIBAUM – DIRECTOR, SALT SYSTEMS DESIGN

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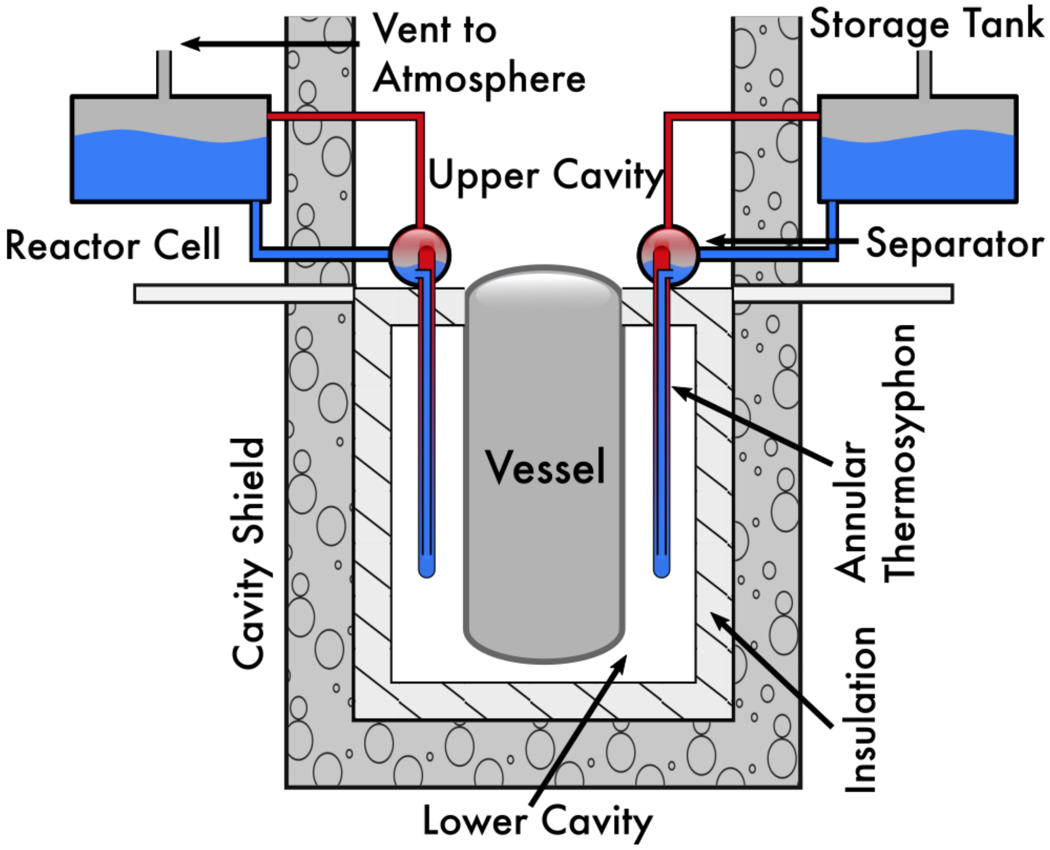
6.2 Functional Containment

- Functional containment is defined by the NRC in SECY-18-0096 as “a barrier, or set of barriers taken together, that effectively limits the physical transport of radioactive material to the environment”
- The functional containment for Hermes is made up of physical barriers, operating conditions, coolant design, and fuel form that limit the potential release of radioactive material
- Majority of radioactive material at risk for release is held within the design of TRISO fuel
  - Further discussion of TRISO fuel in PSAR Section 4.2
- Retention properties of Flibe act as an additional barrier for release of radionuclides for submerged fuel
  - Further discussion of the radionuclide retention capabilities of Flibe in PSAR Section 5.1
- Specified acceptable system radionuclide release design limits (SARRDLs) are met by controlling the reactor conditions (e.g., temperature and flux) that result in limiting allowable fuel conditions. Safety limits discussed in Chapter 14 will ensure SARRDLs are not exceeded, and potential dose consequences remain below dose targets.
  - SARRDLs and technical specifications will be described in the application for an operating license

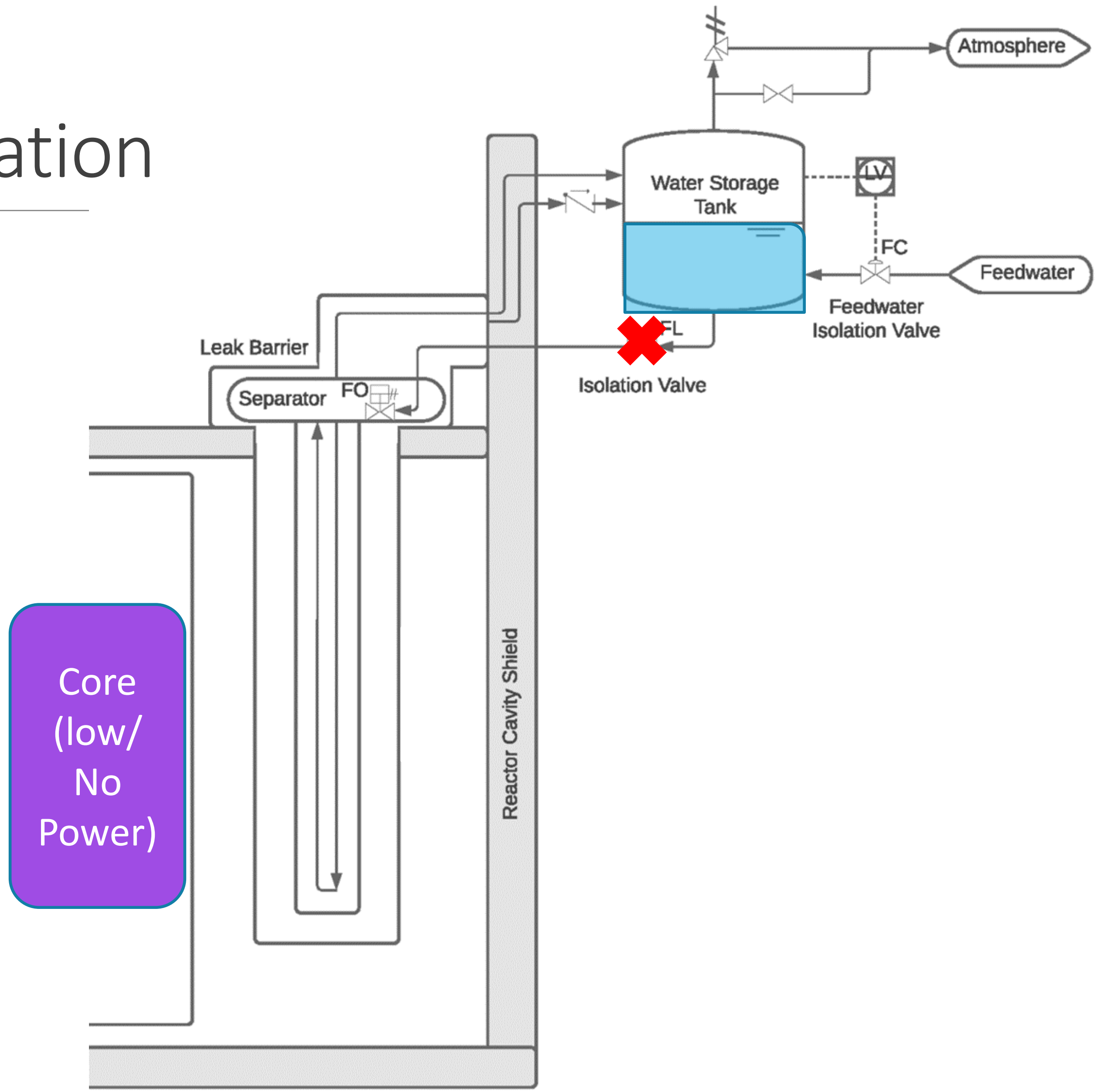
6.3 Decay Heat Removal System: Overview



- Purpose: Passive decay heat removal during postulated events when the primary heat transport system is unavailable
- Operation: DHRS is an ex-vessel system that continuously operates when the reactor is operating above a threshold power by removing energy from the vessel wall via thermal radiation and convective heat transfer to water-based annular thermosyphons (thimbles)
  - DHRS is shut off and isolated when reactor operates at low power levels (parasitic losses alone are sufficient for decay heat removal)
  - DHRS is activated when reactor starts operating above threshold power
  - No change of state when relied upon in response to postulated event
- Passive Feedback Mechanism
  - Heat removal rate is a direct function of vessel temperature due to physics of thermal radiation heat transfer

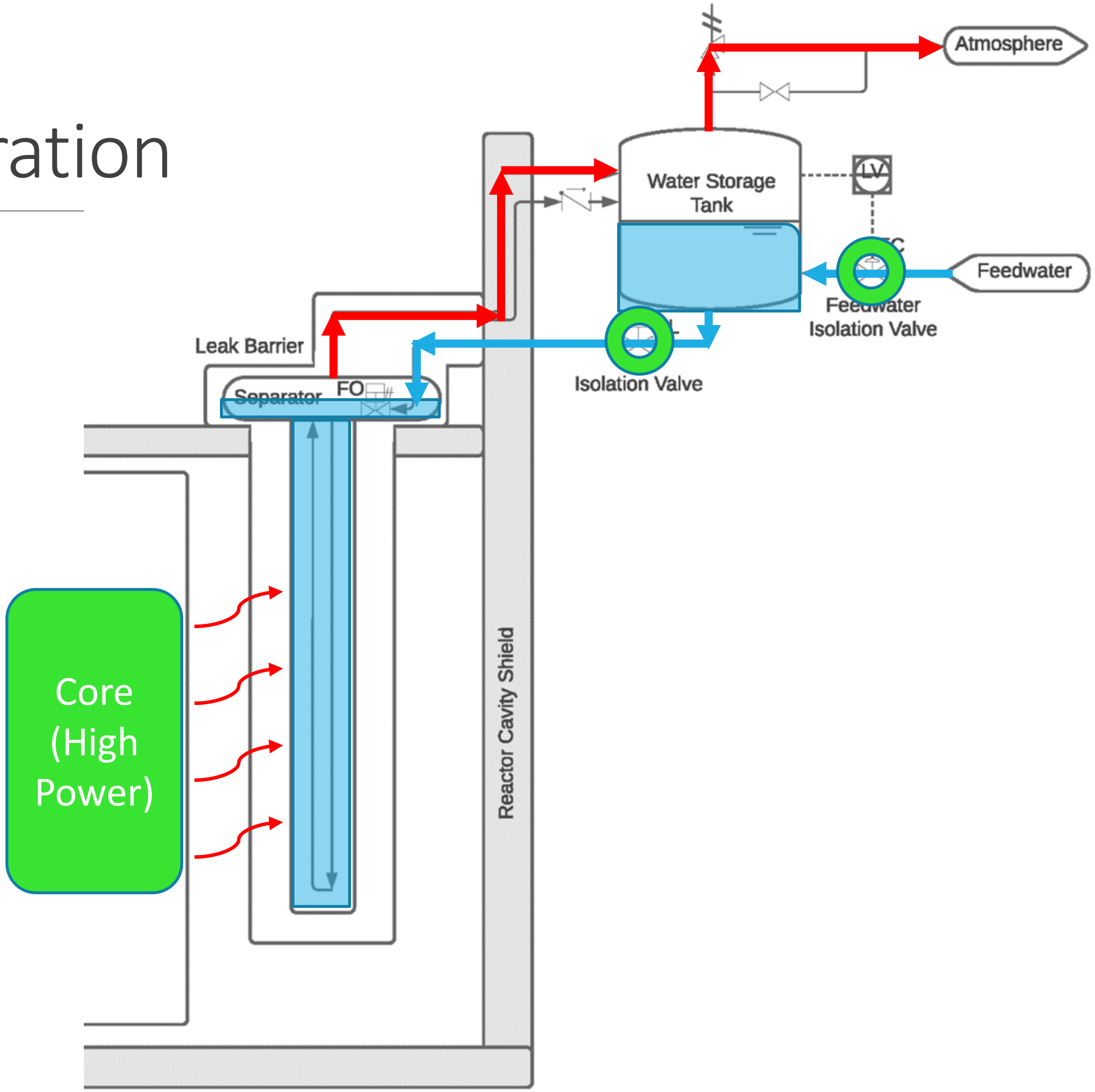
6.3 DHRS: Operation

Normal Operation
(DHRS deactivated)



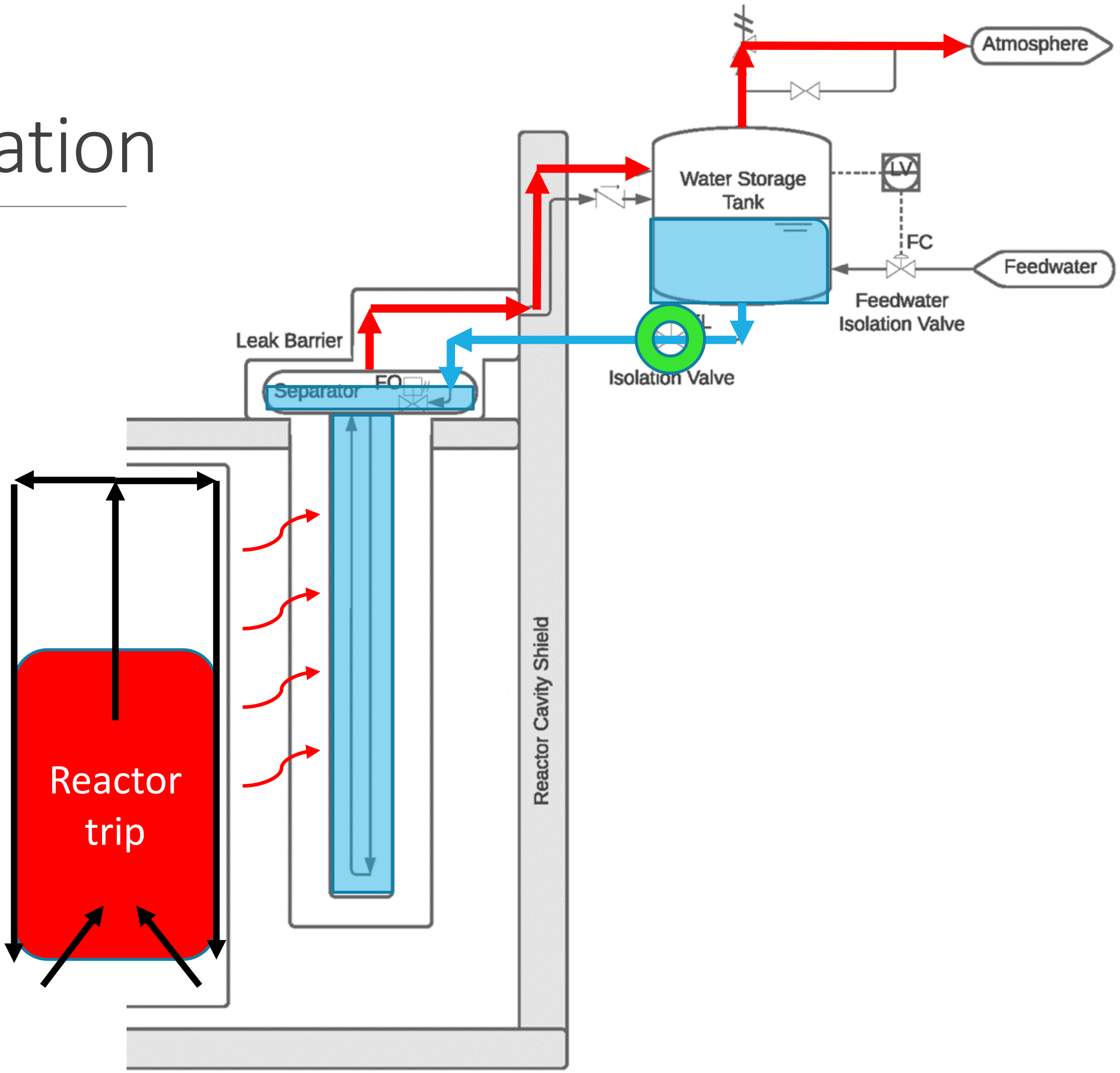
6.3 DHRS: Operation

Normal Operation

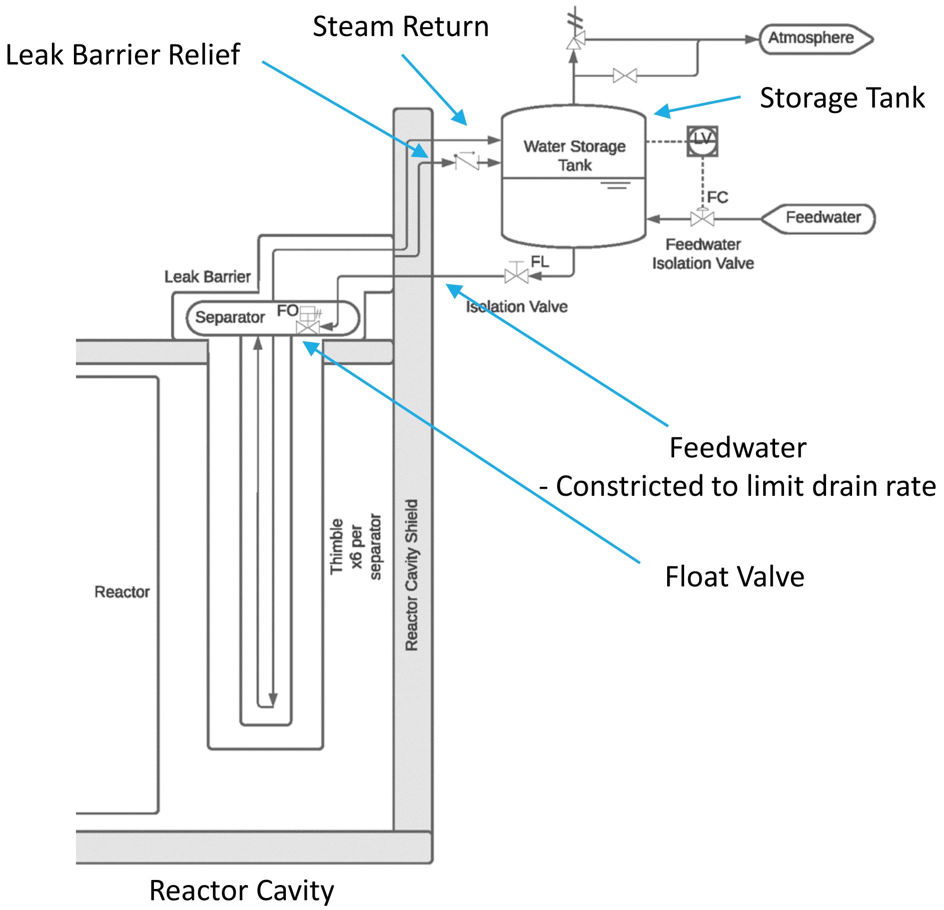


6.3 DHRS: Operation

Postulated Event
(e.g., loss of PHTS,
loss of electrical power,
loss of feedwater)



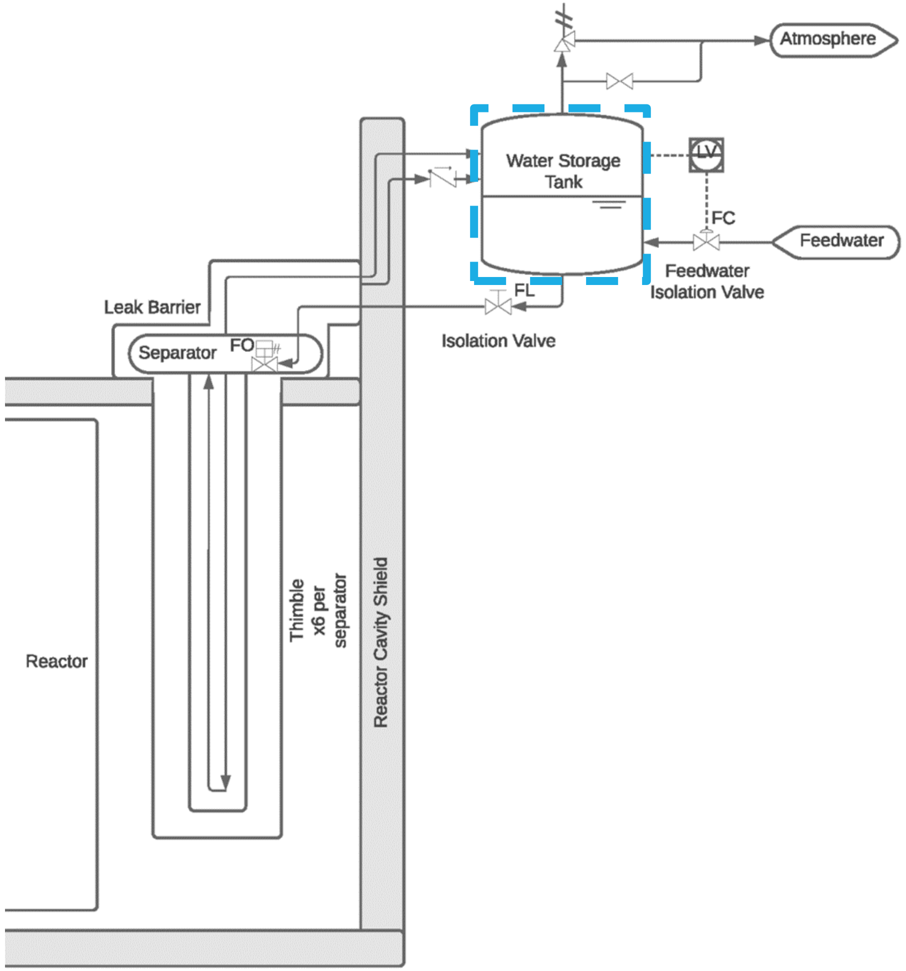
6.3 DHRS: Process Flow Diagram



- DHRS does not directly interact with reactor coolant
- No change of state on onset of postulated events
  - Always-on operation above set power levels
- Parallel and independent cooling pathways
  - Four independent cooling trains
  - Only three trains required to meet cooling demand
- Dual-walled for leak prevention and detection
  - Continued heat removal in the presence of a leak
- Active component (isolation valve) failures do not introduce failures in heat removal
  - Isolation valve fails in place (an operating system continues to operate)
  - Float valve fails open

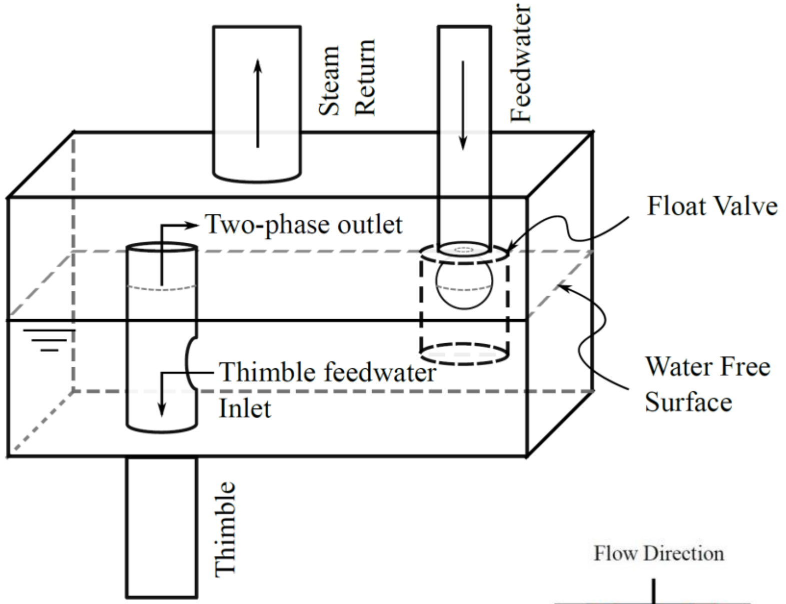
6.3 DHRS: Water Storage Tank

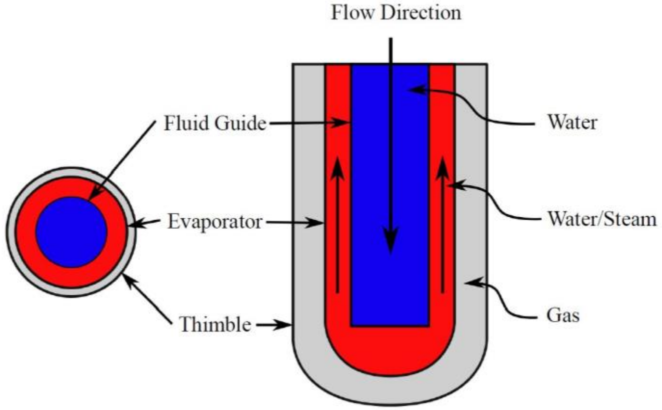
- Sizing
  - Sufficient inventory for up to 7 days of continuous operation to support heat removal to mitigate postulated events
- Location
  - Outside of reactor cavity
  - Higher elevation than other DHRS components
  - Gravity-driven flow of water to separator and thimbles
- Redundancy / Independence
  - 3 out of 4 tanks needed for adequate heat removal
  - Each tank is independent in its location and connection to thimbles



6.3 DHRS: Separator and Thimble

- Separator
  - Interface between water storage tank and thimbles
  - Float valve
    - When water level exceeds threshold value, the float valve blocks the feedwater line
    - When water level is below threshold value, the float valve allows for continuous flow
  - Passive operation and fail-open design
    - Floods separator
    - Does not affect the net heat removal performance of the thimbles
- Thimble
  - Annular thermosyphons located circumferentially around the outside of the reactor vessel
  - Guide tube located within evaporator tube
  - Leak barrier
    - Dual wall design – still can remove heat
  - Passive flow





6.3 Decay Heat Removal System: Design Basis

- Safety-related portions of DHRS are designed to ASME III Div. 5 Class B, ASCE 43-19, ASCE 4-16, and ACI 349-13 codes and standards (PDC 1)
- DHRS is primarily located in the safety-related portion of the reactor building, which is designed to protect safety-related components from external hazards. Failure of non-safety related DHRS components does not affect the performance of safety-related SSCs (PDC 2)
- DHRS is designed with low combustible materials and uses physical separation of the trains to minimize the probability and effect of fires and explosions (PDC 3)
- DHRS is designed with materials that will withstand the environmental conditions in the reactor cavity during normal operation, maintenance, testing, and postulated events. DHRS components are designed to preclude cascading failures and failures that could impact nearby safety systems (PDC 4)
- DHRS is capable of removing an adequate amount of decay heat to ensure that SARRDLs are not exceeded, and reactor vessel and fuel temperatures remain below their design limits (PDC 34 and 35)
- DHRS is designed to allow for periodic inspection and functional testing to ensure integrity, operability, and performance of the system (PDC 36 and 37)

Hermes PSAR Chapter 9 Auxiliary Systems

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MARCH 24, 2023

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MARGARET ELLENSON – MANAGER, NUCLEAR FACILITIES AND SAFEGUARDS AND SECURITY

9.1 Reactor Auxiliary Systems Overview

- The reactor coolant auxiliary systems are a collection of systems that provide support for the functionality and performance of Flibe:
  - Remove fission products, activation products, and other chemical impurities and particulates from the reactor coolant
  - Maintain the cover gas atmosphere (pressure and composition) in the head space above the core
  - Provide removal and storage of tritium
  - Control inventory, filling, and draining processes for systems containing reactor coolant, including transfer of coolant into the reactor
  - Provide active and passive thermal management to reactor system components
- These functions are implemented into the following reactor coolant auxiliary systems:
  - Chemistry control system
  - Inert gas system
  - Tritium management system
  - Inventory management system
  - Reactor thermal management system
- These systems are not credited with performing any safety-related functions

9.1.1 Chemistry Control System

- The CCS is not credited with performing any safety-related functions
- The CCS monitors primary coolant chemistry for compliance with Flibe specifications
- The CCS extracts coolant samples for an offline analysis of the Flibe chemistry
- Due to the proximity of the CCS to the reactor vessel, the CCS is designed so that seismic induced failure does not impact the reactor vessel system (PDC 2)
- Due to the proximity of the CCS to the reactor vessel, the CCS is designed so that adverse effects of postulated CCS failures do not impact the reactor vessel system (PDC 4)
- The CCS monitors the reactor coolant purity with offline sampling analysis to determine if the reactor coolant is within specified design limits (PDC 70)
- Consistent with 10 CFR 20.1406, the CCS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.1.2 Inert Gas System

- The IGS is not credited with performing any safety-related functions
- Provides inert argon gas as a purging flow to system components during normal operation and maintenance
- Removes impurities from the cover gas
- Provides reactor coolant motive pressure during filling and draining operations
- The IGS may be in proximity or connected to safety-related SSCs and may cross the seismic isolation moat. The IGS is designed so that seismic induced failure does not impact safety-related SSCs from performing their safety function (PDC 2)
- The IGS is a low-pressure system and precludes pipe whip. Nearby safety-related SSCs will not be affected by escaping inert argon gas (PDC 4)
- The IGS monitors radioactivity levels in the gas to support the evaluation of the radioactive material releases that might occur as a result of a system or fuel failure (PDC 64)
- Consistent with 10 CFR 20.1406, the IGS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.1.3 Tritium Management System

- The TMS is not credited with performing any safety-related functions
- TMS separates tritium from argon in the inert gas system and from dry air in the Reactor Building cells
- TMS collects and temporarily stores tritium for final disposition
  - In accordance with 10 CFR 71.51, Type A and Type B packaging canisters are used
- Due to the potential proximity of the TMS to the reactor vessel, the TMS is designed so that seismic-induced failure does not impact the reactor vessel system (PDC 2)
- Tritium monitoring sensors are selected to provide measurements over a range of anticipated tritium activities where measurements are needed (PDC 13)
- The TMS maintains a minimum level of overall tritium capture capacity in order to minimize tritium releases from the plant (PDC 60)
- Radiation monitoring is provided in the TMS for the evaluation of tritium levels in TMS subsystems in support of evaluation of radioactive material releases that might occur as a result of a system failure (PDC 64)
- Consistent with 10 CFR 20.1406, the TMS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.1.4 Inventory Management System

- The IMS is not credited with performing any safety-related functions
- The IMS maintains primary coolant level in the reactor vessel during normal operations
- The IMS fills and drains the reactor vessel and the primary heat transport system during start-up and shutdown operations
- The IMS maintains primary coolant purity by replacing circulating salt with new salt
- Due to the proximity of the IMS to the reactor vessel, the IMS is designed so that seismic-induced failure does not impact the reactor vessel system (PDC 2)
- Due to the proximity of the IMS to the reactor vessel, the IMS is designed so that adverse effects of postulated IMS failures do not impact the reactor vessel system (PDC 4)
- The IMS includes design features to limit the loss of reactor vessel coolant inventory in the event of breaks in the system (PDC 33)
- The IMS may be used to remove and replace a sufficient amount of reactor coolant to restore conformance to the Flibe specification (PDC 70)
- Consistent with 10 CFR 20.1406, the IMS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.1.5 Reactor Thermal Management System

- The RTMS is not credited with performing any safety-related functions
- Nearby safety-related SSCs are protected from RTMS failure in the event of an earthquake (PDC 2)
- The RTMS uses water cooling to transfer heat from SSCs to the ultimate heat sink during normal operation and maintains the operational temperature limits of concrete structures during normal operations (PDC 44)
- The system is designed to permit periodic appropriate inspections and testing to ensure integrity and capability to cool SSCs and to ensure adequate interface with other systems supporting heat transfer to the ultimate heat sink (PDC 45, PDC 46)
- RTMS is designed to pre-heat the reactor vessel and to ensure Flibe in the vessel is maintained above a minimum operating temperature (PDC 71)
- Consistent with 10 CFR 20.1406, the RTMS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

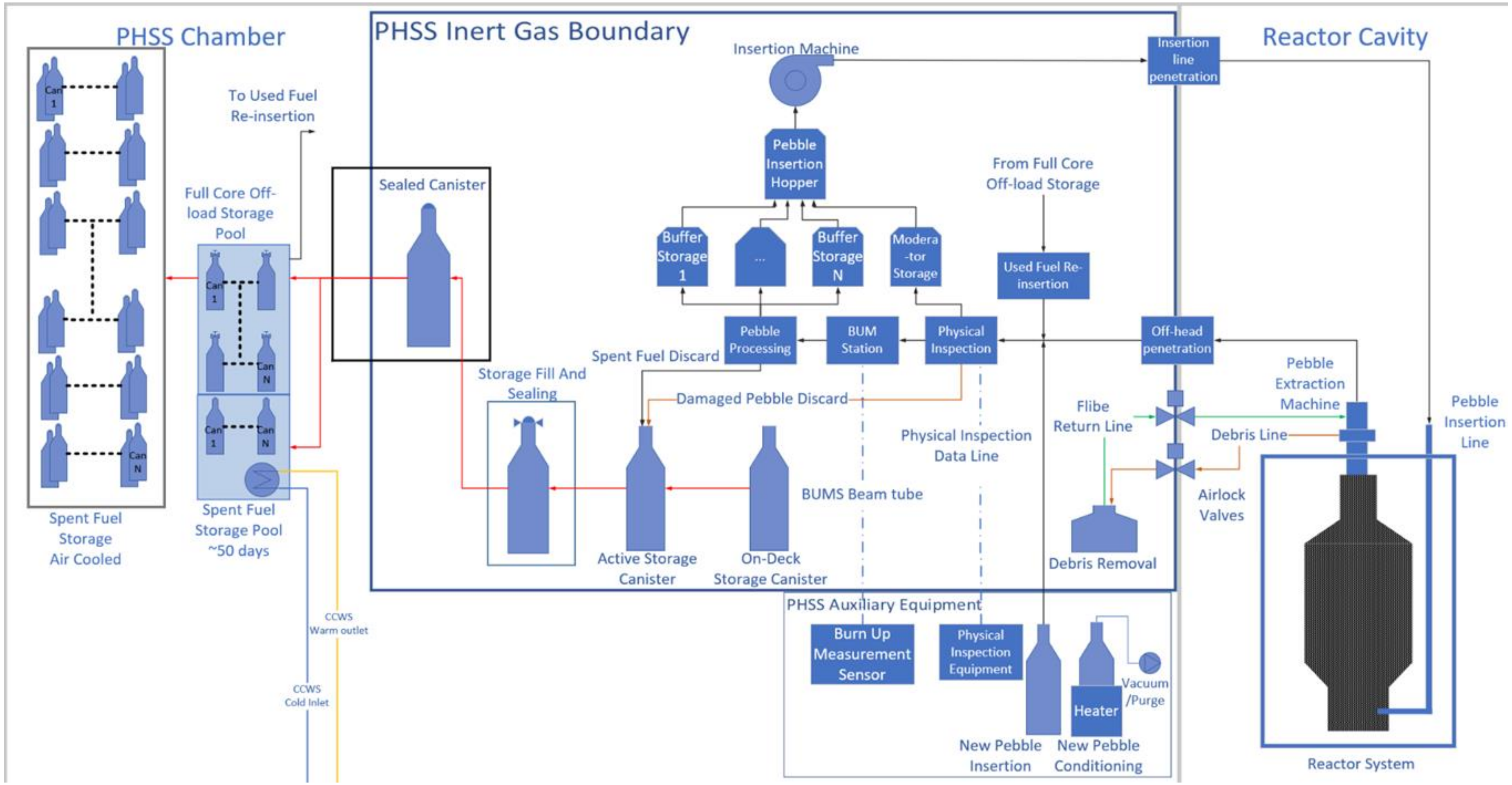
9.2 Reactor Building Heating, Ventilation, and Air Conditioning System

- The RBHVAC is not credited to perform any safety-related functions
- Reactor building heating, ventilation, and air conditioning system provides independent environmental control to the reactor building
  - The system is designed to ensure occupational dose does not exceed 10 CFR 20 limits
- Consistent with 10 CFR 20.1406, the RBHVAC is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning
- RBHVAC does not adversely affect safety-related SSCs located nearby (PDC 2)
- RBHVAC is designed to control the release of radioactive materials in gaseous effluents during normal operation (PDC 60)
- RBHVAC is designed to provide for monitoring of the RB effluent discharge paths for radioactivity that may be release during normal operation (PDC 64)

9.3 Pebble Handling and Storage System

- Responsible for handling of fuel in Hermes, from initial on-site receipt, in-process circulation, and final on-site storage
- Major components of the system:
  - Pebble Extraction Machine (PEM): Single screw mechanism removes pebbles from molten salt
  - Pebble Inspection: Performs flaw detection and burn-up measurement of removed pebbles
  - Processing: Sorts pebbles into appropriate buffer storage channel based on pebble type
  - Insertion: Stepper wheel feeder mechanism inserts pebbles into the reactor via an in-vessel insertion line
  - Storage Canister: Stores ~2,000 fuel pebbles in a non-critical configuration
  - Storage Cooling Area: In-building storage area for spent fuel canisters, capable of passive cooling during loss of power and other postulated events
  - New Pebble Introduction: Stores fresh fuel and prepares fuel for circulation via a high-temperature bakeout

9.3 Pebble Handling and Storage System



9.3 Pebble Handling and Storage System: Design Basis

- Storage bay, pool and support restraint structures in the pool are designed as seismic category SDC-3 to ensure geometry is maintained in the event of an earthquake (PDC 2)
- System limits grinding of pebbles and the accumulation of graphite dust to minimize the potential of fire and explosion (PDC 3)
- The canister design considers environmental conditions such as pressure accumulation of radionuclides and thermal loads; the canister interior accounts for radiolysis products. The system design accounts for complete submergence and internal flooding of the storage canisters in water. (PDC 4)
- An anti-siphon feature on the pebble insertion line limits inventory loss to primary salt pump elevation, the PEM is above the coolant free surface (PDC 33)
- The TRISO particle confines radioactive material rather than the PHSS and pebble loads do not introduce incremental particle failures thereby ensuring the PHSS does not act to confine or contain radioactivity (PDC 61)
- The design prevents criticality by controlling pebble removal rate. The system design precludes moisture intrusion and handling equipment maintains geometry via interlocks. (PDC 62)
- The inspection and sorting function ensures damaged pebbles are removed from use (PDC 63)

9.4 Fire Protection Systems and Programs

- The fire protection system is not credited with performing any safety-related functions
- Designed to detect and extinguish fires so that a continuing fire will not prevent safe shutdown (PDC 3)
- Noncombustible and fire-resistant materials are used whenever practical, particularly in locations with SSCs that are safety-related or required for safe shutdown (PDC 3)
- The fire protection system will conform to local building and fire codes, ANSI/ANS 15.17 “Fire Protection Program for Research Reactors,” NFPA 801, and Life Safety Code NFPA 101
- The system is designed so that seismic induced failure does not impact nearby safety-related SSCs (PDC 2)

9.5 Communication

- The communication system is not credited with performing any safety-related functions
- Composed of diverse and independent subsystems:
  - Plant radio
  - Public address and general alarm
  - Communication capability in the event of a loss of normal power
  - Distributed antenna
  - Security communication
  - In addition, diverse commercial communication systems will be utilized for on- and off-site communication
- Used for normal and emergency conditions to communicate between key areas of the facility
- Phone lines area available for off-site communication in the case of an emergency

9.6 Possession and Use of Byproduct, Source, and Special Nuclear Material

- Byproduct material is managed by compliance with 10 CFR Part 30 , by use of spent fuel canisters, by the tritium management system, and by the radioactive waste management program
- Source material is managed by compliance with 10 CFR Part 40, by use of fresh and spent fuel canisters, and by the nature of the pebble design, in which the source material is encapsulated in a graphite substrate
- Special nuclear material (SNM) is managed by compliance with 10 CFR Part 70, by the use of fresh and spent fuel canisters, by the pebble handling and storage system, which includes shielding, by the reactor vessel, and by the nature of the pebble design, in which the SNM is encapsulated in a graphite substrate
- Requests for materials licenses will be submitted at a future date

9.7 Plant Water Systems

- The water systems are not credited with performing any safety-related functions
- Service water system is the facilities main supply of water and provides water to the treated water system
- Treated Water System provides chemistry control of the service water and provides water to the component cooling water, chilled water, and decay heat removal systems
  - Treated water is designed to protect against design basis earthquake for nearby safety-related SSCs (PDC 2)
  - Nearby safety-related SSCs are protected from the effects of discharging fluid and missiles and precluded from pipe whip hazards by design (PDC 4)
- Component cooling water system provides water cooling for reactor building HVAC systems, the equipment and structural cooling system, spent fuel cooling system, and the inert gas system coolers and compressors
  - The system is designed to protect against design basis earthquake for nearby safety-related SSCs (PDC 2)
  - Nearby safety-related SSCs are protected from the effects of discharging fluid and missiles and precluded from pipe whip hazards by design (PDC 4)
  - The system is designed with the capability to isolate leaks, permit appropriate periodic inspection and testing to ensure the integrity and capability of the system to cool SSCs, and to adequately transfer heat to the ultimate heat sink (PDC 44, 45, and 46)
- Chilled water system provides cooling water for nonessential heat loads
- Consistent with 10 CFR 20.1406, the plant water systems that directly interface with the systems that contain radioactive material are designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.8.1 Remote Maintenance and Inspection System

- The remote maintenance and inspection system (RMIS) is not credited with performing any safety-related functions
- The RMIS can remotely handle components in the reactor system, PHTS, and PHSS
- RMIS supports the following maintenance activities:
  - Disassemble flanges and subassemblies
  - Remove subassemblies
  - Clear fuel and residual coolant before removal of SSCs for maintenance
  - Transport of equipment to hot maintenance cells (via use of shielded casks)
  - Activities performed in standalone hot cells
  - Use of through-wall electro-mechanical manipulators for hot cells
  - Use of cranes for hot cell and post-irradiation examination facilities
- Consistent with 10 CFR 20.1406, the RMIS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning
- The capabilities of RMIS will limit the personnel occupational exposures to below 10 CFR Part 20 limits

9.8.2 Spent Fuel Cooling System

- The spent fuel cooling system (SFCS) is not credited with performing any safety-related functions
- The SFCS provides forced air cooling for spent fuel storage canisters in the storage bay of the PHSS and recirculates water in the spent fuel pool
  - Consists of fans and piping that remove heat during normal operation
  - Maintains desired operational temperatures in the storage bay
- In the event normal power is not available, the SFCS is capable of passively cooling spent fuel storage canisters
- The system is designed to ensure nearby safety-related SSCs are protected from seismic-induced failure (PDC 2)
- Nearby safety-related SSCs are protected from dynamic effects such as missiles by design (PDC 4)
- Consistent with 10 CFR 20.1406, the SFCS is designed, to the extent practicable, to minimize contamination of the facility and the environment, and facilitate eventual decommissioning

9.8.3 Compressed Air System

- The compressed air system is not credited with performing any safety-related functions
- The compressed air system provides and distributes compressed air for maintenance and use in valve operation
- The system is designed so that a failure of the system does not interfere or preclude the ability of a safety-related system to perform its safety function
- The system does not directly interface with systems that contain or have the potential to contain radioactive materials

9.8.4 Cranes and Rigging

- The crane and rigging is not credited with performing any safety-related functions
- A crane and rigging are provided to lift and move equipment within the reactor building, facilitate receiving and shipping, and support maintenance activities
- The system is designed to ensure nearby safety-related SSCs are protected from seismic induced failure (PDC 2)
- Nearby safety-related SSCs are protected from dynamic effects by design, such as administrative controls and interlocks (PDC 4)
- Implements codes and standards from ASME B30.2-2016

9.8.5 Auxiliary Site Services

- Auxiliary site services is not credited with performing any safety-related functions
- The following services provide additional functions necessary to maintain and operate the plant:
  - Machine shop(s), which include radioactive and non-radioactive machining capabilities
  - Chemistry laboratory
  - Post-irradiation examination laboratory
  - Materials testing laboratory
  - Vents and drains for non-potentially contaminated facility compartments
  - Warehouse(s) for storage of spare equipment
  - Storage of contaminated equipment
  - Facility lighting, including emergency lighting
  - Non-hazardous waste management services
  - Firewater storage systems
  - Storm and sanitary sewers
  - Groundwater monitoring wells
- The system is designed to ensure nearby safety-related SSCs are protected from seismic induced failure (PDC 2)
- The capabilities of the Auxiliary Site Services will limit the personnel occupational exposures to below 10 CFR Part 20 limits
- Services that involve handling of radioactive material may include remote manipulation capabilities, as appropriate, to facilitate limiting personnel occupational exposures to below 10 CFR Part 20 limits