March 21, 2022

TP-LIC-LET-0014
Project Number 99902100

U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Document Control Desk

Subject: TerraPower Functional Containment Presentation Material

This letter provides the TerraPower, LLC presentation material for the upcoming "Functional Containment" pre-application engagement meeting (Enclosures 2 and 3). The presentation material contains proprietary information and as such, it is requested that Enclosure 2 be withheld from public disclosure in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." An affidavit certifying the basis for the request to withhold Enclosure 2 from public disclosure is included as Enclosure 1. The proprietary material has been redacted from the presentation material in Enclosure 3.

This letter and enclosures make no new or revised regulatory commitments.

If you have any questions regarding this submittal, please contact Ryan Sprengel at rsprengel@terrapower.com or (425) 324-2888.

Sincerely,

Ryan Sprengel
License Application Development Manager
TerraPower, LLC

Enclosures:
1. TerraPower, LLC Affidavit and Request for Withholding from Public Disclosure (10 CFR 2.390(a)(4))
2. "Functional Containment" Presentation Material – Proprietary (Non-Public)
3. "Functional Containment" Presentation Material – Non-proprietary (Public)

cc: William (Duke) Kennedy, NRC
Mallecia Sutton, NRC

ENCLOSURE 1

TerraPower, LLC Affidavit and Request for Withholding from Public Disclosure (10 CFR 2.390(a)(4))

Enclosure 1
TerraPower, LLC Affidavit and Request for Withholding from Public Disclosure
(10 CFR 2.390(a)(4))

I, George Wilson, hereby state:

1. I am the Director of Regulatory Affairs and I have been authorized by TerraPower, LLC (TerraPower) to review information sought to be withheld from public disclosure in connection with the development, testing, licensing, and deployment of the Natrium™ reactor and its associated fuel, structures, systems, and components, and to apply for its withholding from public disclosure on behalf of TerraPower.
2. The information sought to be withheld, in its entirety, is contained in Enclosure 2, which accompanies this Affidavit.
3. I am making this request for withholding, and executing this Affidavit as required by 10 CFR 2.390(b)(1).
4. I have personal knowledge of the criteria and procedures utilized by TerraPower in designating information as a trade secret, privileged, or as confidential commercial or financial information that would be protected from public disclosure under 10 CFR 2.390(a)(4).
5. The information contained in Enclosure 2 accompanying this Affidavit contains non-public details of the TerraPower regulatory and developmental strategies intended to support NRC staff review.
6. Pursuant to 10 CFR 2.390(b)(4), the following is furnished for consideration by the Commission in determining whether the information in Enclosure 2 should be withheld:
    a. The information has been held in confidence by TerraPower.
    b. The information is of a type customarily held in confidence by TerraPower and not customarily disclosed to the public. TerraPower has a rational basis for determining the types of information that it customarily holds in confidence and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application and substance of that system constitute TerraPower policy and provide the rational basis required.
    c. The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR 2.390, it is received in confidence by the Commission.
    d. This information is not available in public sources.
    e. TerraPower asserts that public disclosure of this non-public information is likely to cause substantial harm to the competitive position of TerraPower, because it would enhance the ability of competitors to provide similar products and services by reducing their expenditure of resources using similar project methods, equipment, testing approach, contractors, or licensing approaches.

I declare under penalty of perjury that the foregoing is true and correct.

Enclosure 1
TerraPower, LLC Affidavit and Request for Withholding from Public Disclosure
(10 CFR 2.390(a)(4))

Executed on: March 21, 2022

George Wilson

George Wilson
Director of Regulatory Affairs
TerraPower, LLC

ENCLOSURE 2

"Functional Containment" Presentation Material

Proprietary (Non-Public)

ENCLOSURE 3

"Functional Containment" Presentation Material

Non-proprietary (Public)

TerraPower

NATRIUM

Functional Containment

a TerraPower & GE-Hitachi technology

NATD-LIC-PRSNT-0017

SUBJECT TO DOE COOPERATIVE AGREEMENT NO. DE-NE0009054

Portions of this presentation are considered proprietary and TerraPower, LLC requests it be withheld from public disclosure under the provisions of 10 CFR 2.390(a)(4).

Nonproprietary versions of this presentation indicate the redaction of such information using [[ ]]$^{(a)(4)}$.

Objectives

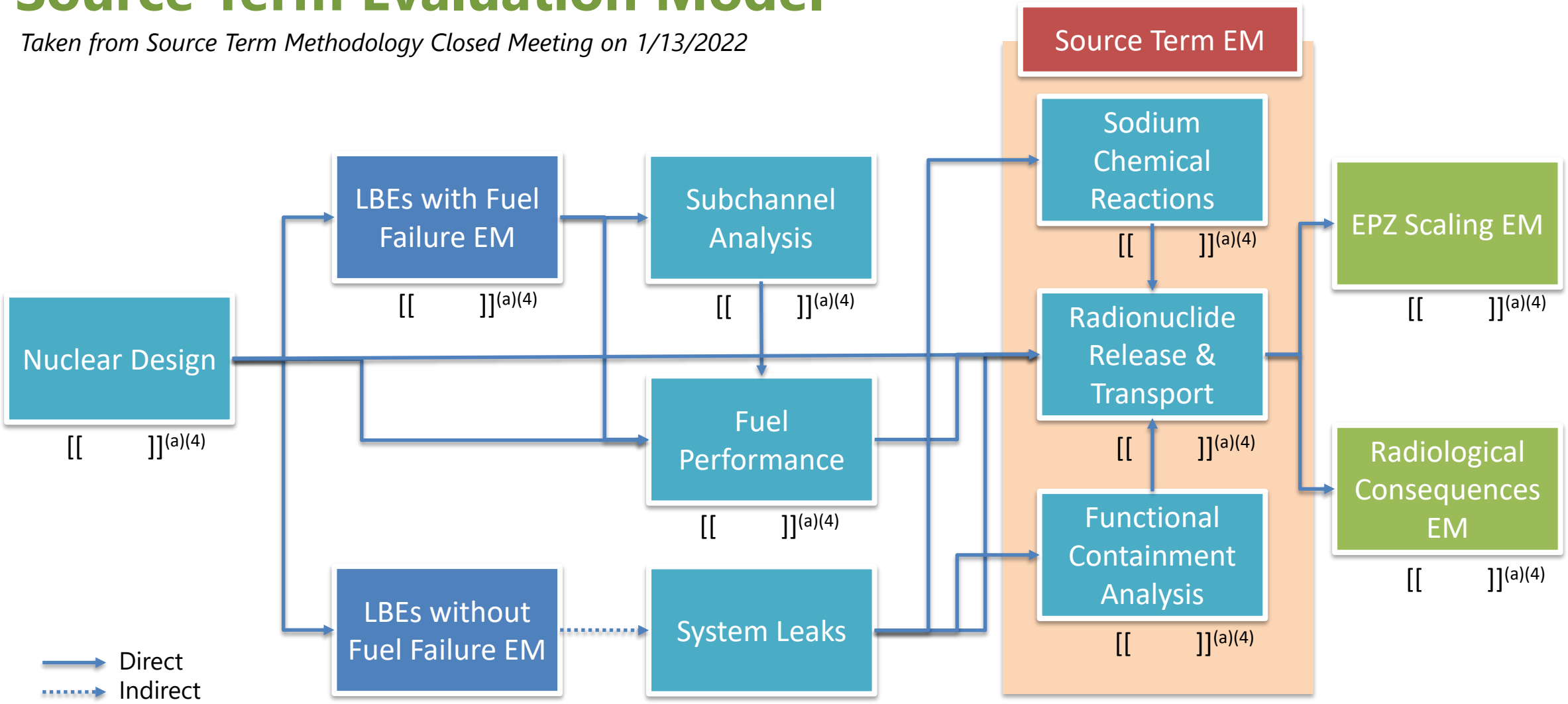
- Key Elements of Natrium™ Functional Containment
- Scope of Functional Containment Analysis in Source Term Methodology
- Proposed performance criteria for Natrium Functional Containment
- Examples of planned barriers and system boundaries
- Discussion of additional considerations:
  - Treatment of Barriers – testing and inspection
  - Treatment of Barriers – safety analyses
  - Analysis of severe event(s) which challenge containment

Functional Containment Strategy – Key Elements

- Plant Design (physical barriers and features)
- Event Classification (based on event frequencies)
- **Establish Functional Containment Performance Criteria**
- **Functional Containment Analysis**
- **Testing of Barriers**
- SSC Classification, informing:
  - Administrative/Procedural Controls (control the status of barriers)
  - Maintenance and Inspection (ensure barriers are in good working order)

Source Term Evaluation Model*

Taken from Source Term Methodology Closed Meeting on 1/13/2022



** Not a complete list, subject to change*

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Important Phenomena and Code Capabilities

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SECY 18-0096 Performance Criteria

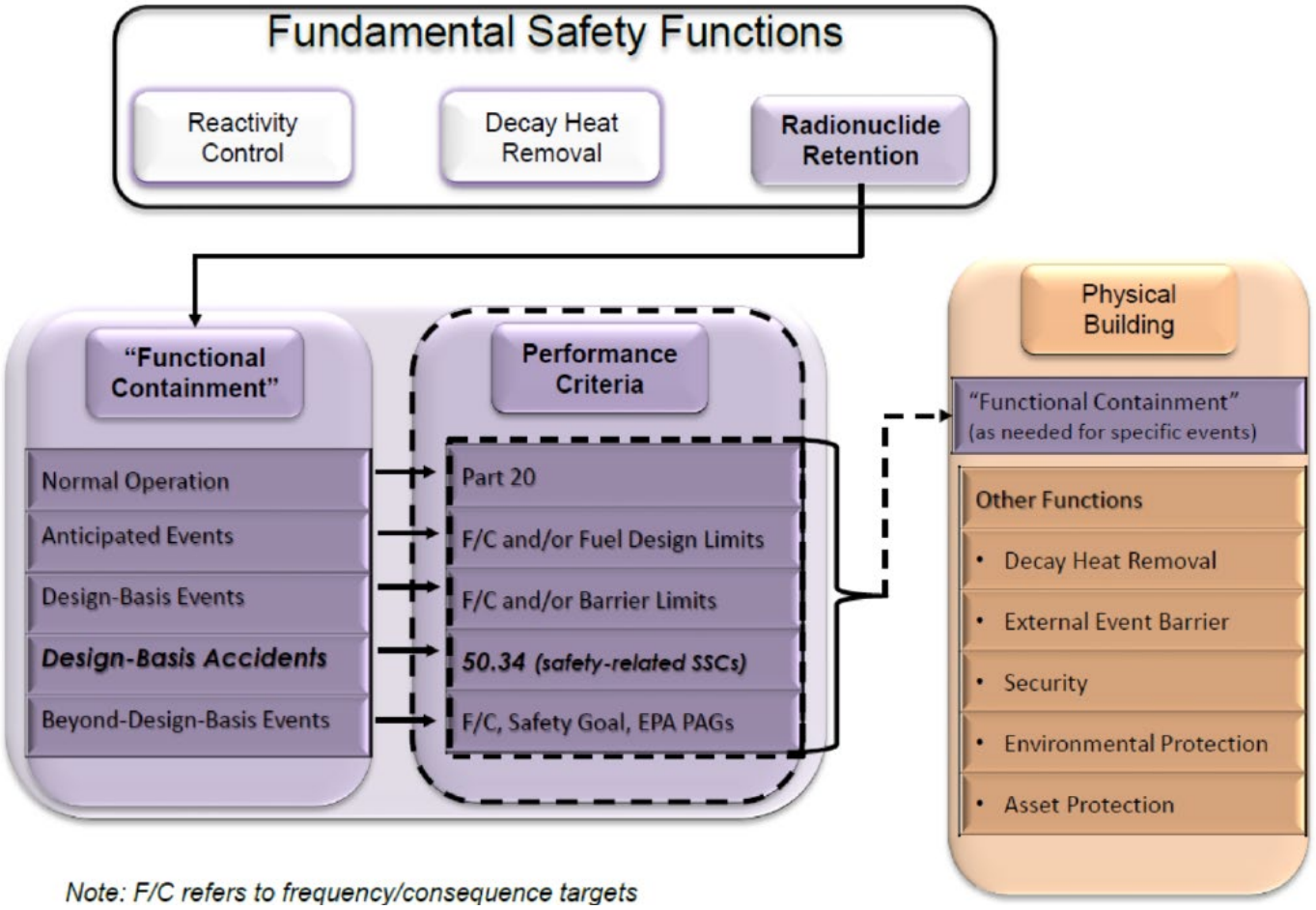

Figure 3 from SECY 18-0096 Enclosure 2

- Fundamental Safety Function is CONTAIN
- Graded criteria according to event category from the LMP process
- DBAs are chosen from DBE category
  - Credit only safety-related SSCs
  - Held to 10 CFR 50.34 requirements
  - DBAs historically used to define safety margins and LCOs
- "Other Functions" fall outside of Functional Containment but considered as part of the building design requirements

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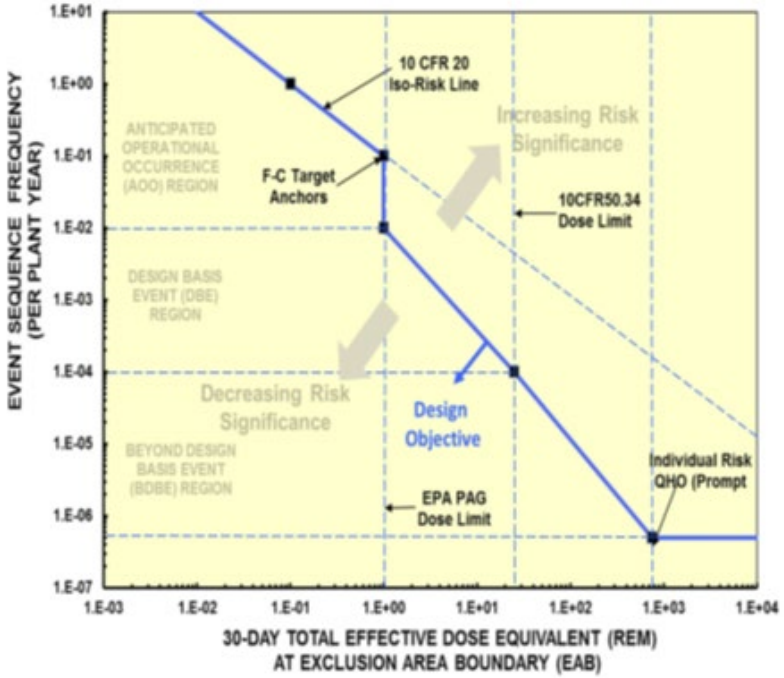
Proposed Natrium Performance Criteria

Event Categories	Governing Performance Criteria
Normal Operations	10 CFR Part 20, Subpart D (dose to the public) (e.g. 0.1 REM per year at the EAB)
Anticipated Operational Occurrences (AOOs)	**F/C target:** dose less than the 10 CFR 20 iso-risk line or 1.0 REM depending on event frequency System Criteria: SARRDLs
Design Basis Events (DBEs)	**F/C target:** dose less than 1.0 REM (preferred) or 25 REM depending on event frequency System Criteria: SARRDLs
Design Basis Accidents	10 CFR Section 50.34 (e.g. worst 2-hr dose at EAB < 25 rem TEDE)
Beyond-Design Basis Events	**F/C target:** with margin



Taken from NEI 18-04

Where the aggregate leakage across all Functional Containment barriers for an event is less than that leakage needed to meet the performance criteria for that event category.

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Primary Interfaces

[[

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Treatment of Barriers – Testing and Inspection

SSC Classification	Level of Testing and Inspection
Safety Related (SR)	• Will have a leak testing program • Testing options under consideration (App J Option B or other standards) • Tested leakage < required leakage needed to meet dose limit
Non-Safety Related with Special Treatment (NSRST)	• Programmatic/administrative controls • Rely on inspections (by procedure) • Option to test barrier within SR testing program
No Special Treatment (NST)	• General walkdowns and inspection

Treatment of Barriers – Safety Analyses

[[

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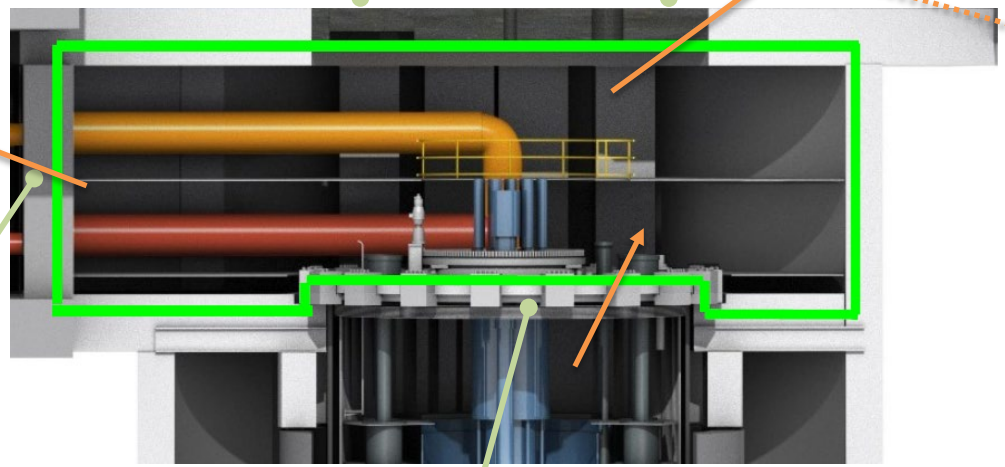
Treatment of Barriers
(example – Reactor Building)

Head Access Area

Reactor Building Floor Plugs
(in-place during operation)
[[ ]](a)(4)

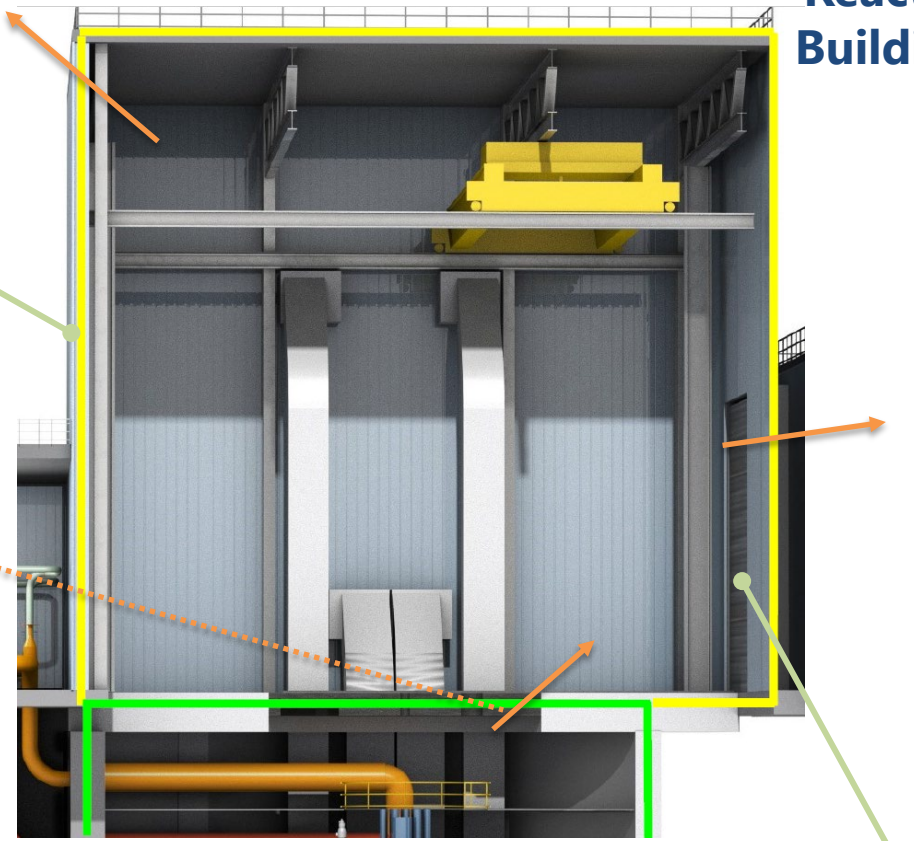


IHT Piping Penetrations
(to Reactor Aux Building)
[[ ]](a)(4)

Zero-Leakage Rx Vessel Head
[[ ]](a)(4)

Above-Ground
Structure
[[ ]](a)(4)

Reactor Building



Rollup Door to
Fuel Handling Building
[[ ]](a)(4)

Design Basis Analyses, LMP, and Major Accident

- An LWR would **analyze an MHA** (or MCA) with maximum source term per DG-1389 (RG 1.183) to meet 10 CFR 50.34(a)(1)(ii)(D) and Footnote 6.
  - DG-1389 is not applicable to the Natrium reactor.
  - A non-LWR equivalent of DG-1389 does not exist.

- Natrium Proposed Design Basis Analyses: 10 CFR 50.34(a)(1)(ii)(D)
  - **Design Basis Accidents** are constructed from the DBEs using conservative assumptions.
    - All severe events with multiple fuel failures and subsequent release fall below the minimum LBE frequency (<5x10-7/ plant year).
    - **No substantial fission product release to the public is expected for any DBA.**
  - Severe events are considered for cliff edge, input to EPZ, etc.
  - Sodium sprays, leaks, and chemical reactions analyzed where applicable.

- Footnote 6 of 50.34 requires an evaluation of a **major accident**.
  - The general assumption of a substantial meltdown is not credible for the Natrium SFR based on the integrated risk and inherent properties of the design.
  - The Natrium major accident will evaluate the **most likely severe event** with a fission product release **from the core to functional containment** with design leak rates. This accident type is **not a credible LBE nor DBA** as assessed by PRA (<5x10-7/ plant year).

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Acronym List

AOO – Anticipated Operational Occurrence
CFR – Code of Federal Regulations
DBA – Design Basis Accident
DBE – Design Basis Event
EBR – Experimental Breeder Reactor
EM – Evaluation Model
EPZ – Emergency Planning Zone
FFTF – Fast Flux Test Facility
HT9 – Martensitic Steel
IHT – Intermediate Heat Transport system
LBE – Licensing Basis Event
LCO – Limiting Condition of Operation
LMP – Licensing Modernization Project
LWR – Light Water Reactor
MCA – Maximum Credible Accident
MHA – Maximum Hypothetical Accident
MHTGR/HTGR – Modular High Temperature Gas Reactor
MST – Mechanistic Source Term
NSRST – Non-Safety-Related with Special Treatment
NST – Non-Safety-Related with No Special Treatment
PDC – Principal Design Criteria
PRISM – Power Reactor Innovative Small Module
PWR – Pressurized Water Reactor
RCS – Reactor Coolant System
RN - Radionuclide
SARRDL – Specified Acceptable system Radionuclide Release Design Limit
SFR – Sodium Fast Reactor
SSC – Structures, systems, and components
TREAT – Transient Reactor Test