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Attached are my comments on the proposed SFR Design Criteria.
James J. Sienicki

Comments on SFR Design Criteria Released for Public Comment by the U.S. NRC

by

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The author is commenting on his own behalf on the SFR Design Criteria released for public comment by the U.S. NRC. The author has been and is responsible for the formulation of Principal Design Criteria for a passively safe metallic-fueled SFR design. The author has worked on the designs of several similar passively safe metallic-fueled SFRs and is familiar with the earlier CRBR, FFTF, PRISM, and SAFR designs. The author is familiar with the SFR Design Criteria recommended by the DOE Team and transmitted to the U.S. NRC on December 8, 2014.

Comments are provided below only for specific criteria. The draft proposed U.S. NRC criterion is presented first. The red print that indicates changes from the General Design Criterion in 10 CFR 50 Appendix A is retained. The NRC rationale is provided next followed by the author's comments. Finally, the author's recommendation for the SFR Principal Design Criterion that is identical to the previously recommended criterion by the DOE Team and transmitted to the NRC on December 8, 2014 is provided.

Criterion 17—Electric power systems. *An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor primary coolant ~~pressure~~ boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.*

The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.

Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and *the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the ~~reactor~~ primary coolant ~~pressure~~ boundary are not exceeded. One of these circuits shall be designed to be available within a few seconds following a postulated loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.*

Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

NRC Rationale - The requirements for offsite power are being retained for defense-in-depth considerations. This position was reinforced by a letter from the NRC to Dale Atkinson, Chief Operating Officer, NuScale Power, September 15, 2015 (ML15222A323). At the September 24, 2015 meeting of the Advisory Committee for Reactor Safeguards subcommittee on advanced reactor designs, this subject came up again and the subcommittee was supportive of keeping offsite power requirements in GDC 17 for the NuScale design.

“Reactor coolant pressure boundary” has been relabeled as “primary coolant boundary” to conform to standard terms used in the LMR industry. The use of the term “primary” indicates that the SFR-DC is applicable to the primary cooling system, not the intermediate cooling system.

Comments – The proposed criterion modified by the NRC retains language from 10 CFR 50 Part A for LWRs with active safety systems and does not acknowledge that SFR passive systems important to safety do not need electric power to perform their safety functions and are not reliant on reliable electric power distribution. The previous language recognized that SFR passive systems important to safety do not need electric power to perform their safety functions and are not reliant on reliable electric power distribution. Providing for reliable electric power distribution will not enhance the performance of such SFR passive systems important to safety.

Recommended Criterion Previously Recommended by the DOE Team – Criterion 17—Electric power systems. *Electric power systems shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for the systems shall be to provide sufficient capacity, capability, and reliability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor primary coolant boundary are not exceeded as a result of anticipated operational occurrences and (2) vital functions that rely on electric power are maintained in the event of postulated accidents.*

The onsite electric power systems shall have sufficient independence, redundancy, and testability to perform their safety functions, assuming a single failure.

Criterion 34—Residual heat removal. *A system to remove residual heat shall be provided. For normal operations and anticipated operational occurrences, the ~~The~~ system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core to an ultimate heat sink at a rate such that specified acceptable fuel design limits and the design* *conditions of the ~~reactor~~ primary coolant boundary are not exceeded.*

During postulated accidents, the system safety function shall transfer heat from the reactor core at a rate such that fuel and clad damage that could interfere with continued effective cooling is prevented, sodium boiling is precluded, and the design conditions of the primary coolant boundary are not exceeded.

Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

A passive boundary shall separate primary coolant from the working fluid of the residual heat removal system and any fluid in the residual heat removal system that is separated from the primary coolant by a single passive barrier shall not be chemically reactive with the primary coolant. In addition, the working fluid of residual heat removal system shall be at a higher pressure than the primary coolant system.

NRC Rationale - SFR-DC 34 incorporates the postulated accident residual heat removal requirements contained in GDC 35.

"Ultimate heat sink" has been added to clarify that if SFR-DC 44 is deemed not applicable to the design, the RHR system is then required to provide the heat removal path to the ultimate heat sink.

"Reactor coolant pressure boundary" has been relabeled as "primary coolant boundary" to reflect that the SFR primary system operates at low-pressure and to conform to standard terms used in the LMR industry. The use of the term "primary" indicates that the SFR-DC is applicable to the primary cooling system, not the intermediate cooling system.

The second paragraph was added to clarify that the safety function of the residual heat removal system during postulated accidents is to provide continuous effective core cooling. For SFRs, that cooling is provided at a rate sufficient to prevent propagation of fuel failures. The last phrase was added to the paragraph to assure that residual heat removal capability is sufficient to maintain the integrity of the primary coolant boundary during postulated accidents.

A paragraph from NUREG- 1368 (page 3-41) was added describing the characteristics of the residual heat removal working fluid and its associated operating pressure. A single passive barrier is adequate defense in depth when the residual heat removal working fluid is not chemically reactive with the primary coolant. If chemically reactive at least two passive barriers must separate the two systems. The higher pressure requirement is to ensure any leakage in the interface between the two systems does not result in a release of radioactive primary coolant to the non-radioactive part of the heat transport system.

Comments - The modified NRC criterion adds the words, "*sodium boiling is precluded*," that are too restrictive. There might be situations in which localized boiling of subcooled sodium occurs without any detrimental consequences. It would be better not to mention sodium boiling at all.

The modified NRC criterion adds the words, "*any fluid in the residual heat removal system that is separated from the primary coolant by a single passive barrier shall not be chemically reactive with the primary coolant*," that are too restrictive. Not all chemical reactions have potentially negative attributes. It would be better to say that the fluid in the residual heat removal system is compatible with the primary coolant.

Recommended Criterion Previously Recommended by the DOE Team - Criterion 34—Residual heat removal. *A system to remove residual heat shall be provided. The system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core to an ultimate heat sink at a rate such that specified acceptable fuel design limits and the design conditions of the reactor primary coolant boundary are not exceeded under all plant shutdown conditions following normal operation, including anticipated operational occurrences, and to provide continuous effective core cooling during postulated accidents.*

Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that the system safety function can be accomplished, assuming a single failure.

Criterion 35 - Emergency core cooling. *If the system as described in ARDC 34 does not provide continuous effective core cooling during postulated accidents and does not assure that the design conditions of the reactor coolant boundary are preserved; then a system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant such that continuous effective core cooling is maintained.*

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

NRC Rationale - In most advanced reactor designs, residual heat removal is addressed by ARDC 34. If the design is such that ARDC 34 is not adequate to ensure residual heat removal under normal operations and postulated accidents then additional system(s) are required and would be addressed by this ARDC 35 to ensure continuous effective core cooling.

Comments – The criterion proposed by the NRC is illogical. If the system described in Criterion 34 were inadequate, then the designer would modify the design to make it adequate. Therefore, there would not be a need for an additional system as described in the proposed Criterion 35.

Recommended Criterion Previously Recommended by the DOE Team – The criterion was eliminated.

Criterion 38—Containment heat removal. *A system to remove heat from the reactor containment shall be provided as necessary The system safety function shall be to maintain reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature within acceptable limits following following any loss-of-coolant postulated accidents. and maintain them at acceptably low levels.*

Suitable redundancy in components and features, including electric power systems, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

NRC Rationale - "…as necessary…" is meant to condition ARDC 38 application to designs requiring heat removal for conventional containments which are found to require heat removal measures.

LOCA reference has been removed to provide for any postulated accident that might affect the containment structure.

Containment structure safety system redundancy is addressed in second paragraph.

Comments - The criterion modified by the NRC adds the words, "including electric power systems," that do not recognize that electric power is not needed for SFR passive design features that control fission products and other substances. Providing for reliable electric power distribution will not enhance the performance of such SFR passive systems.

Recommended Criterion Previously Recommended by the DOE Team - Criterion 38—Containment heat removal. *A system to remove heat from the reactor containment shall be provided as necessary to maintain the containment pressure and temperature within acceptable limits following postulated accidents.*

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that the system safety function can be accomplished, assuming a single failure.

Criterion 41—Containment atmosphere cleanup. *Systems to control fission products hydrogen, oxygen and other substances which may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained.*

Each system shall have suitable redundancy in components and features, including electric power systems, and suitable interconnections, leak detection, isolation, and containment capabilities to assure that that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power *is not available) its safety function can be accomplished, assuming a single failure.*

NRC Rationale - Advanced reactors offer potential for reaction product generation that is different from that associated with clad metal-water interactions. Therefore, the terms “hydrogen” and “oxygen” are removed while “other substances” is retained to allow for exceptions.

Comments – The criterion modified by the NRC adds the words, “including electric power,” that do not recognize that electric power is not needed for SFR passive design features that control fission products and other substances. Providing for reliable electric power distribution will not enhance the performance of such SFR passive systems.

Recommended Criterion Previously Recommended by the DOE Team - Criterion 41 - Containment atmosphere cleanup. *Systems to control fission products, and other substances which may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained.*

Each system shall have suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities to assure that its safety function can be accomplished, assuming a single failure.

Criterion 70—Intermediate coolant systems. *An intermediate cooling system shall be provided. A single passive barrier shall separate intermediate coolant from primary coolant; at least a single passive barrier shall separate the energy conversion system coolant from intermediate coolant. The intermediate coolant shall be chemically nonreactive with sodium. A pressure differential shall be maintained across the primary to intermediate barrier such that any coolant barrier leakage would flow from the intermediate coolant system to the primary coolant system. The intermediate coolant boundary shall be designed to permit the conduct of a surveillance program and inspection in areas where intermediate coolant leakage out of the intermediate coolant system, or energy conversion system coolant leakage into the intermediate coolant system, may hinder or prevent a structure, system, or component from performing any of its intended safety functions.*

NRC Rationale - The NRC considered the DOE’s proposed SFR-DC 70 and made changes based on the “Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 8-11).

NUREG-1368 (page 3-57) (ML063410561) Section 3.2.4.5 suggested the need for a separate criterion for the intermediate coolant system. Also separate criteria were included in NUREG-0968 (ML082381008) (Criterion 31– Design of Intermediate Cooling System and Criterion 33– Inspection of Intermediate Cooling System).

Comments – The criterion proposed by the NRC mandates that there shall be an intermediate cooling system. This is too restrictive. There are conceivable SFR designs that could be practical and safe without an intermediate cooling system.

The PRISM design referred to in NUREG-1368 had an intermediate cooling system with a unique safety function particular to the PRISM design. For other SFR designs, the intermediate cooling system does not have such a safety function.

The criterion modified by the NRC adds the words, "*The intermediate coolant shall be chemically nonreactive with sodium.*" that are too restrictive. Not all chemical reactions have potentially negative attributes. It would be better to say that "*the intermediate coolant shall be compatible with sodium if it is separated from the reactor primary coolant by a single passive barrier.*"

Recommended Criterion Previously Recommended by the DOE Team - Criterion 70—Intermediate coolant systems. *If an intermediate coolant system is provided, the intermediate coolant shall be compatible with sodium if it is separated from the reactor primary coolant by a single passive barrier. Where a single barrier separates the reactor primary coolant from the intermediate coolant, a pressure differential shall be maintained such that any leakage would flow from the intermediate coolant system to the reactor primary coolant system unless other provisions can be shown to be acceptable. The intermediate coolant boundary shall be designed to permit inspection and surveillance in areas where leakage can affect the safety functions of systems, structures and components.*

Criterion 72—Sodium heating systems. *Heating systems shall be provided for systems and components important to safety, which contain or could be required to contain sodium. These heating systems and their controls shall be appropriately designed to assure that the temperature distribution and rate of change of temperature in systems and components containing sodium are maintained within design limits assuming a single failure. If plugging of any cover gas line due to condensation or plate out of sodium aerosol or vapor could prevent accomplishing a safety function, the temperature control associated with that line shall be considered important to safety.*

NRC Rationale - The NRC considered the DOE's proposed SFR-DC 72 and made changes based on the "Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 13-14)

NUREG-1368 (page 3-56) (ML063410561) Section 3.2.4.2 suggested the need for a separate criterion for sodium heating system. Also, a separate criterion was included in NUREG-0968 (ML082381008) (Criterion–7 Sodium Heating Systems).

Comment – The criterion proposed by the NRC adds the words, "*If plugging of any cover gas line due to condensation or plate out of sodium aerosol or vapor could prevent accomplishing a safety function, the temperature control associated with that line shall be considered important to safety.*" This sentence implies that the heating system for the subject cover gas line as well as the temperature control system would need to be safety grade and would therefore need diversity, redundancy, and testability. This might be awkward or impractical with existing heater technology.

Recommended Criterion Previously Recommended by the DOE Team - Criterion 72—Sodium heating systems. *Heating systems shall be provided as necessary for systems and components important to safety, which contain or could be required to contain sodium. These heating systems and their controls shall be appropriately designed to assure that the temperature distribution and rate of change of temperature in systems and components containing sodium are maintained within design limits assuming a single failure.*

Criterion 73 - Sodium leakage detection and reaction prevention and mitigation. *Means to detect sodium leakage and to limit and control the extent of sodium-air and sodium-concrete reactions and to extinguish fires resulting from these sodium-air and sodium-concrete reactions shall be provided to assure that the safety functions of structures, systems and components important to safety are maintained. Special features such as inerted enclosures or guard vessels shall be provided for systems containing sodium.*

NRC Rationale - NRC considered the DOE's proposed SFR-DC 73 and made changes based on the "Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 15-16).

NUREG-1368 (page 3-56) (ML063410561) Section 3.2.4.1 suggested the need for a separate criterion for protection against sodium reactions. Also, a separate criterion was included in NUREG-0968 (ML082381008) (Criterion–4 Protection against Sodium and NaK reactions).

Comments - The criterion modified by the NRC adds the words, "*and to extinguish fires resulting from these sodium-air and sodium-concrete reactions,*" that are unnecessary and do not recognize current state-of-the-art sodium fire suppression approaches. For example, one SFR design feature is to provide a sodium catch pan fire suppression deck to reduce the burning rate of a sodium pool by limiting the rate of oxygen transport to the pool surface. Another related SFR design feature is to collect sodium leaking from a pipe inside the surrounding insulation and drain it through piping onto a sodium catch pan fire suppression deck. The resulting slow sodium burning rate limits the pressure and temperature increases inside of the containment or compartment housing sodium components. Ultimately, the flowpaths for air through the sodium catch pan fire suppression deck will plug with reaction products extinguishing the fire, or the oxygen inside of the compartment will be depleted extinguishing the fire. Immediately extinguishing a sodium fire such as with the release of fire extinguisher powder may not be part of the approach.

The words, "*to limit and control the extent of sodium-air and sodium-concrete reactions,*" are sufficient.

Recommended Criterion Previously Recommended by the DOE Team - Criterion 73—Sodium leakage detection and reaction prevention and mitigation. *Means to detect sodium leakage and to limit and control the extent of sodium-air and sodium-concrete reactions shall be provided as necessary to assure that the safety functions of structures, systems and components important to safety are maintained. Special features such as inerted enclosures or* *guard vessels shall be provided as appropriate for systems containing reactor primary sodium coolant.*

Criterion 74—Sodium/water reaction prevention/mitigation. *Structures, systems, and components containing sodium shall be designed and located to limit the adverse effects of chemical reactions between sodium and water on the capability of any structure, system, or component to perform any of its intended safety functions. Means shall be provided to limit contact between sodium and water such that chemical reactions between sodium and water will not affect the capability of any structure, system, or component to perform any of its intended safety functions.*

To prevent loss of any plant safety function, the sodium-steam generator system shall be designed to detect and contain sodium-water reactions and limit the effects of the energy and reaction products released by such reactions, as well as to extinguish a fire as a result of such reactions.

NRC Rationale - NRC considered the DOE's proposed SFR-DC 74 and made changes based on the "Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 16-18) NUREG-1368 (page 3-56) (ML063410561) Section 3.2.4.1 suggested the need for a separate criterion for protection against sodium reactions. Also, a separate criterion was included in NUREG-0968 (ML082381008) (Criterion–4 Protection against Sodium and NaK reactions). Fire considerations are added for consistency with SFR-DC 73.

Comments - The criterion modified by the NRC adds words, "*as well as to extinguish a fire as a result of such reactions,*" that are unnecessary and do not recognize current state-of-the-art sodium fire suppression approaches. For example, one SFR design feature is to provide a sodium catch pan fire suppression deck to reduce the burning rate of a sodium pool by limiting the rate of oxygen transport to the pool surface. Another related SFR design feature is to collect sodium leaking from a pipe inside the surrounding insulation and drain it through piping onto a sodium catch pan fire suppression deck. The resulting slow sodium burning rate limits the pressure and temperature ncreases inside of the containment or compartment housing sodium components. Ultimately, the flowpaths for air through the sodium catch pan fire suppression deck will plug with reaction products extinguishing the fire, or the oxygen inside of the compartment will be depleted extinguishing the fire. Immediately extinguishing a sodium fire such as with the release of fire extinguisher powder may not be part of the approach.

Hydrogen is a potential product of sodium-water reactions. One SFR design feature is to deliberately burn hydrogen collected by a Sodium-Water Reaction Pressure Relief System as it exits from a stack with a hydrogen igniter. Extinguishing such a hydrogen fire is illogical. It would be better to delete the words, "*as well as to extinguish a fire as a result of such reactions.*"

Recommended Criterion Previously Recommended by the DOE Team - Criterion 74 - Sodium/water reaction prevention/mitigation. *Structures, systems, and components important to safety containing sodium shall be designed and located to limit the consequences of* *chemical reactions between sodium and water on the safety functions of any systems, structures, and components. Means shall be provided as appropriate to limit possible contacts between sodium and water.*

If necessary to prevent loss of any plant safety function, the sodium-steam generator system shall be designed to detect and contain sodium-water reactions and limit the effects of the energy and reaction products released by such reactions.

Criterion 75 - Quality of the intermediate coolant boundary. *Components which are part of the intermediate coolant boundary shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.*

NRC Rationale - This criterion is unique to the SFR design because, based on the information available to the staff, it is the only nuclear plant design for which there is an intermediate coolant loop. This criterion is identical to GDC 30 in 10 CFR 50, Appendix A, and is intended to ensure that, similar to the reactor coolant pressure boundary, the intermediate coolant boundary is designed, fabricated, and tested using quality standards and controls sufficient to ensure that failure of the intermediate system would be unlikely.

Comments – There was no such criterion. It can be speculated that it was added by the NRC probably because of the PRISM design. An intermediate cooling system is not necessarily a feature of all SFR designs. The intermediate cooling system may not have any safety functions. In that case, failure of the intermediate coolant system can be tolerated.

Recommended Criterion Previously Recommended by the DOE Team - *There was no criterion.*

Criterion 76 - Fracture prevention of the intermediate coolant boundary. *The intermediate coolant boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.*

NRC Rationale - This criterion is unique to the SFR design because, based on the information available to the staff, it is the only nuclear plant design for which there is an intermediate coolant loop. This criterion is identical to GDC 31 in 10 CFR 50, Appendix A, and is intended to ensure that, similar to the reactor coolant pressure boundary, the intermediate coolant boundary is designed to avoid brittle and rapidly propagating facture modes.

Comments – There was no such criterion. It can be speculated that it was added by the NRC probably because of the PRISM design. An intermediate cooling system is not necessarily a feature of all SFR designs. The intermediate cooling system may not have any safety functions. In that case, failure of the intermediate coolant system can be tolerated. One design feature may be to incorporate double-walled intermediate sodium piping inside of the containment to prevent the release of intermediate sodium following an intermediate cooling system main pipe failure, for example.

Recommended Criterion Previously Recommended by the DOE Team - *There was no criterion.*

Criterion 77 - Inspection of the intermediate coolant boundary. *Components which are part of the intermediate coolant boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leaktight integrity, and (2) an appropriate material surveillance program for the intermediate coolant boundary. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of coolant leakage.*

NRC Rationale - This criterion is unique to the SFR design because, based on the information available to the staff, it is the only nuclear plant design for which there is an intermediate coolant loop. This criterion is identical to GDC 32 in 10 CFR 50, Appendix A, and is intended to ensure that, similar to the reactor coolant pressure boundary, the intermediate coolant boundary is designed to avoid brittle and rapidly propagating facture modes.

Comments – There was no such criterion. It can be speculated that it was added by the NRC probably because of the PRISM design. An intermediate cooling system is not necessarily a feature of all SFR designs. The intermediate cooling system may not have any safety functions. In that case, failure of the intermediate coolant system can be tolerated. One design feature may be to incorporate double-walled intermediate sodium piping inside of the containment to prevent the release of intermediate sodium following an intermediate cooling system main pipe failure, for example.

Recommended Criterion Previously Recommended by the DOE Team - *There was no criterion.*