POLICY ISSUE
NOTATION VOTE

July 9, 2009 SECY-09-0101

FOR: The Commissioners

FROM: R. W. Borchardt
Executive Director for Operations

SUBJECT: LICENSING OF A BABCOCK AND WILCOX MEDICAL ISOTOPE PRODUCTION SYSTEM

PURPOSE:

To provide the Commission the staff's review of licensing and waste issues identified by Babcock and Wilcox (B&W) regarding a Medical Isotope Production System (MIPS) and recommend that the enclosed letter be sent to B&W providing these conclusions. The paper does not address issues beyond those for which B&W requested NRC's views. Any such issues will be provided to the Commission in a timely manner as they are identified.

SUMMARY:

This paper provides the Nuclear Regulatory Commission (NRC) staff's review and recommended response to B&W on several key issues concerning the licensing of its MIPS. B&W notified the Commission of its intent to seek a license to construct and operate the MIPS by letter dated December 13, 2007, as updated by letter dated February 12, 2009. B&W indicated that it had requested the NRC's views regarding several issues before B&W completed its license application. These issues concern the licensing process for the MIPS and the classification of wastes from the MIPS.

BACKGROUND:

By letters dated December 13, 2007, and February 12, 2009, B&W notified the Commission of its intent to submit a license application for its proposed MIPS. B&W notified the Commission of key issues involving the MIPS in a letter dated October 2, 2008. B&W sent two additional letters to the Executive Director for Operations (EDO) dated October 3 and 6, 2008, detailing its positions on the key issues associated with the licensing process for the MIPS and the

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classification of wastes that the MIPS would generate. B&W requested NRC's position on these issues before it completed the license application. This paper provides the staff's technical and legal analysis of these issues and recommends that the enclosed letter be sent to B&W providing these conclusions.

The MIPS would consist of aqueous homogenous reactors (AHRs) fueled with low-enriched uranium, and it would include an extraction and purification system for the purpose of producing molybdenum-99 (^{99}Mo) as a medical isotope. This facility would provide the United States with a domestic source of this radioisotope using low-enriched uranium. Currently, the United States relies on foreign reactors using highly enriched uranium targets for ^{99}Mo, and shutdowns and process issues at foreign reactors have previously and currently created shortages of this important medical isotope.

The MIPS could consist of 4 AHRs operating at a maximum power of 200 kilowatts (kW) each or 16 AHRs operating at a maximum power of 50 kW each, resulting in a total power of 800 kW. The reactors would be fueled with low-enriched liquid uranyl nitrate solution, which generates ^{99}Mo in the reactor as a fission product during operation. The entire fuel solution for each of the reactors would subsequently be removed and ^{99}Mo chemically extracted in a co-located facility. Once the ^{99}Mo is removed, the fuel would be returned to the reactors for subsequent operation.

The staff understands that the Department of Energy (DOE), as part of their DOE high-enriched uranium (HEU) minimization policy, has a cost-sharing initiative to develop ^{99}Mo production using low-enriched uranium (LEU). B&W is one of the three entities that DOE has approached as part of this initiative. The goal of the DOE initiative is to have approximately 30-50% of the US ^{99}Mo demand (3,000 6-day Ci per week) in production through one or more of these facilities by December 31, 2013.

LICENSING ISSUES:

In its October 3, 2008, letter to the EDO, B&W proposed the following for the licensing of the MIPS:

- The NRC should agree that the MIPS is not a power reactor.
- The MIPS license should be designated as a Class 103 license under Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.23, "Construction Permits."
- The NRC should determine that the extraction portion of the facility is not a production facility.
- The NRC should issue a single license for the MIPS (i.e., for the reactors and extraction and purification portions of the system) under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," with incorporation of other parts as necessary; and
- The NRC should issue a combined construction permit (CP) and operating license (OL) under 10 CFR 2.105(c).

Based on the information provided to the staff by B&W, the staff agrees that the proposed MIPS would produce medical isotopes for commercial use. It would not be used for the production of heat or electrical energy. The staff notes that the reactor portion of MIPS is a utilization facility, whereas the remaining portion of MIPS is a production facility (see below). With regard to the reactor portion of the MIPS, the staff agrees with B&W that it is a non-power reactor intended for commercial purposes. As such, it could be licensed under section 103 of the Atomic Energy Act of 1954, as amended (AEA).

With regard to the question of whether the extraction and purification portions of MIPS constitutes a "production facility," the staff concludes that the extraction and purification portions of the MIPS facility do fall within the definition of production facility. It meets the third criterion of the production facility definition in 10 CFR Sec. 50.2, "Definitions" (i.e., it is a facility designed or used for the processing of irradiated materials containing special nuclear material) and based on the staff's understanding of the B&W proposal, none of the exceptions listed in that definition apply to this application. B&W noted that MIPS would process irradiated materials containing special nuclear material that does not meet any of the exceptions in the production facility definition (i.e., therefore B&W acknowledged that MIPS meets the production facility definition). B&W did not provide a compelling explanation or analysis of how it reached the conclusion that, based on the intended use of the MIPS, it should not be considered a production facility. The staff notes that it may be possible for B&W to operate the MIPS in a manner that enables the facility to meet the exception portion of the production facility definition by limiting process batches to less than 100 grams of uranium enriched in uranium-235 with not more than 15 grams of any other special nuclear material, but the B&W proposal did not indicate an intent to operate the MIPS in this manner.

The NRC staff examined whether it is legally feasible to issue one 10 CFR Part 50 operating license for the entire MIPS system that incorporates both the utilization and extraction/purification portions of the facility. Although not explicitly mentioned in the B&W proposal, the B&W proposal would result in the licensing of numerous reactors and one or more production facilities at one site. Therefore, the B&W proposal implicitly raises the question of whether the NRC can issue a single license for this type of facility. The MIPS could consist of up to 16 reactors (utilization facilities) with one or more chemical extraction and purification facilities (production facilities). The staff concludes that there is no legal impediment under section 161.h of the AEA to issuing one 10 CFR Part 50 operating license for the entire MIPS facility (i.e., numerous reactors and one or more production facilities). However, since such an approach would be a change from the previous 10 CFR Part 50 licensing practice, the staff concludes that this authority should be limited and that it should be granted on an individual site-specific basis, via Commission order. Additionally, the staff notes that a single license for the entire MIPS facility would present challenges, in terms of practical implementation, for day-to-day interactions regarding licensing or technical issues related to different portions of the facility. These challenges would need to be addressed as part of the license submittal, and they may involve restrictions such as requiring the individual reactors to be identical with common technical specifications and license conditions.

The letter from B&W did not indicate any role for the Commonwealth of Virginia (as an Agreement State) in the licensing or regulation of this proposed facility. It is the staff's

understanding that the material produced at the proposed facility under the Part 50 license would be shipped to another licensee (Covidian, the former Mallinckrodt) which would then manufacture the generators under its Part 30 license.

In its proposal, B&W indicated that it plans to submit documentation for issuance of a combined CP and OL under 10 CFR 2.105(c) that follows the format of NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," issued February 1996. There are two different regulatory processes that could be used for the licensing of MIPS. The first process would use the current 10 CFR Part 50 licensing process, while the second process would involve use of a Commission order to authorize a combined license. Both approaches are discussed below.

A combined CP and OL is not authorized under 10 CFR Part 50. For licensing under AEA section 103, section 189 of the AEA requires that the NRC hold a hearing at the CP stage and offer a hearing at the OL stage of the process. Notice for the mandatory CP hearing is governed by 10 CFR 2.104. However, under 10 CFR 2.105(c) if the applicant files an application that is complete enough to permit all evaluations necessary for issuance of the CP and OL, the notice of proposed issuance of the CP may provide that upon completion of construction and inspection, the OL will be issued without further prior notice. If the application is complete and no hearing is requested and ordered for the OL, the OL could then be issued without a hearing.

Another regulatory process that could be applied to MIPS is for the Commission to issue an order authorizing a combined CP and OL proceeding. Such an order would need to address the matter of hearings on the combined CP/OL and the identification of, and findings on, inspections, tests, analyses and acceptance criteria (ITAAC). This would likely be a complex order, and the associated infrastructure (e.g., ITAAC) for such an approach is not developed. When compared to the use of the current Part 50 licensing process, the staff concludes that the order approach would offer very little advantage, and some disadvantages, from a licensing perspective if B&W were to submit a complete application as discussed above.

The staff recognizes the applicability of NUREG-1537 to the licensing of non-power reactors, but it notes that for this MIPS application it may be necessary to utilize a site-specific review plan for some aspects of the review (i.e., adapt NUREG-1537 to fit this application) because at the time the agency prepared NUREG-1537 none of the liquid homogeneous research reactors that the NRC licensed were in operation.

<u>WASTE ISSUES</u>:

In its October 6, 2008, letter to the EDO, B&W provided a proposal for the consideration of waste that would be generated by the MIPS facility. B&W indicated that success for the MIPS project depends on the classification of MIPS-generated waste, noting that wastes considered to be other than low-level waste (LLW) presently have no commercial pathway for disposal. B&W requested clarification and resolution with regard to the classification of waste from two different waste streams:

1. Used liquid fuel (ULF), which is the waste liquid fuel that remains at the end of the MIPS liquid fuel core's useable lifetime after many cycles of ^{99}Mo extraction; and,

2. Fuel cleanup liquid waste (FCLW), which is the waste generated during the periodic cleanup of the MIPS liquid fuel to remove fission products and small quantities of transuranic (TRU) isotopes.

The B&W position, in its letter dated October 6, 2008, is that the NRC should regard both of these waste streams as LLW. Since the definition of LLW is a legal definition that defines LLW by what it is not (i.e, not high-level waste (HLW), not spent nuclear fuel, not 11 e.(2) byproduct material), the B&W proposal addresses each aspect of the definition to support its conclusion.

Regarding the classification of ULF and FCLW, B&W argued that both may be classified and managed as LLW for the following reasons:

- ULF and FCLW do not meet the 1982 Nuclear Waste Policy Act (NWPA) definition for HLW since they are not highly radioactive materials resulting from the reprocessing of spent nuclear fuel and because they do not meet any other Commission definition of highly radioactive material.

- ULF and FCLW are not TRU waste since they do not exceed the TRU threshold criteria in Table 1 of 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," and will not contain elements with greater than atomic number 92 in concentrations of more than 100 nanocuries per gram.

- ULF and FCLW are not byproduct material as defined in section 11e.2 of the AEA.

- FCLW results from periodically removing fission products and small amounts of TRU radionuclides from the liquid fuel and returning the liquid fuel to the reactor to be reused. Therefore, it can be argued that FCLW does not constitute spent nuclear fuel.

- B&W acknowledges that ULF meets the legal definition of spent nuclear fuel. However, it argues that application of the NWPA definition of spent nuclear fuel to AHR is sufficiently ambiguous to provide the Commission with flexibility. Therefore, technically ULF could be classified as LLW since it would be processed such that it would meet the 10 CFR Part 61 Class C waste concentration requirements for LLW.

The staff reviewed these arguments to determine whether the MIPS waste can be classified as LLW against the criteria in the definition of "waste" in 10 CFR 61.2, "Definitions," which provides that "[f]or the purposes of this definition [of waste under Part 61] low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material, as described in paragraphs (2), (3), and (4) of the definition of Byproduct material set forth in § 20.1003 of this chapter." The staff reached the conclusions described below.

ULF cannot legally be classified as LLW since it meets the definition of spent nuclear fuel. The MIPS ULF is the spent core fuel left over at the end of core life when operation with this core

fuel load is no longer feasible. It would include low-enriched uranium, fission products, activation products, decay products, corrosion products, and a small quantity of TRU. As a combination of fissile elements and fission products, the ULF satisfies the standard definition of spent nuclear fuel. The AEA references the 1982 NWPA to define spent nuclear fuel. The NWPA defines spent nuclear fuel as "fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing." As a result, the staff concludes that B&W would be required to handle the disposal of ULF under 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," and 10 CFR Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada," as HLW, rather than under 10 CFR Part 61 as LLW.

Though ULF is SNF, ULF would be substantially less hazardous than typical SNF generated at commercial light water power reactors. For this reason, in order to better understand the safety significance of ULF, staff evaluated how ULF would be classified as LLW under 10 CFR Part 61, were it not SNF. For example, based on the staff's evaluation of information provided by B&W in its October 6, 2008 letter, if B&W were to subject liquid fuel to the proposed fuel cleanup process before any such fuel is declared ULF, and solidify it in accordance with the requirements of 10 CFR Part 61, then the staff believes that such "cleaned" solidified ULF could probably be classified as Class A LLW, were it not SNF. If, for some reason, liquid fuel had not been subject to the fuel cleanup process after its last 5-day irradiation cycle before being declared ULF, then the uncleaned ULF would probably be Class B LLW, as a result of the accumulation of fission products (e.g., strontium-90) within the fuel. Since fission products, activation products and transuranic (TRU) radionuclides would continue to accumulate in liquid fuel with each irradiation cycle for which fuel cleanup is not performed, the waste classification of ULF could also be Class C or even greater-than-Class-C, if a large number of irradiation cycles (e.g., 6 months or more) were to elapse between the last fuel cleanup and the designation of liquid fuel as ULF.

FCLW can be classified as LLW. The staff concludes that FCLW does not result from the reprocessing of spent nuclear fuel; instead, it results from the cleanup of irradiated reactor fuel. Therefore, FCLW is not HLW, as defined in the NWPA. The staff found that FCLW is not spent nuclear fuel because FCLW is derived from uranium fuel that is not "withdrawn from" the MIPS reactor as that phrase is properly understood in the context of the NWPA. FCLW is not byproduct material as defined in paragraphs (2), (3), and (4) of 10 CFR Sec. 20.1003 (i.e., Part 61 states that radioactive waste can be considered LLW for the purposes of Part 61 if it does not meet the noted portions of the § 20.1003 byproduct material definition). Specifically FCLW is not: (1) tailings or wastes produced by the extraction or concentration of uranium or thorium from ore, (2) any discrete source of radium-226, (3) any material that has been made radioactive by use of a particle accelerator, or (4) any discrete source of naturally occurring radioactive material.

With regard to whether FCLW may have TRU radionuclide concentrations consistent with LLW classification, the staff evaluated whether solidified FCLW could be disposed of as LLW subject to the restrictions of Table 1 of 10 CFR Part 61. As noted in Attachment 2 to B&W's letter of October 6, 2008, B&W estimated the concentration of alpha-emitting TRU radionuclides, with half-life greater than 5 years (in approximately 260 liters of waste solution), to be 0.357 microcuries per milliliter assuming that fuel cleanup occurs after 52 5-day reactor burn cycles.

For the purposes of determining whether such waste, when solidified for disposal, would be LLW, the NRC staff assumed that FCLW would be solidified in concrete in order to meet 10 CFR Part 61 or equivalent Agreement State LLW disposal requirements. The staff estimated the final solid concentration of TRU radionuclides, assuming that an equal volume of dry concrete ingredients would be added to FCLW to create a solid waste suitable for disposal. The staff estimates that the solid TRU radionuclide concentration would be approximately 80 nanocuries per gram. Based on this estimate, the staff concludes that it is feasible to dispose of FCLW consistent with Table 1 of 10 CFR Part 61. Therefore, it is likely that FCLW can be managed as LLW.

RECOMMENDATION:

Based on its review of the B&W proposal, the staff recommends that the enclosed letter containing the following conclusions be sent to B&W:

- The reactor portion of the MIPS is a nonpower reactor that can be licensed under section 103 of the AEA;

- It is feasible to grant a single 10 CFR Part 50 license for the entire MIPS facility. Such an approach would present challenges that the licensing application would need to address since this license would cover numerous reactors and one or more production facilities. If this approach is taken, then the staff concludes that the details and procedures should be mandated via a Commission order;

- B&W cannot apply for a combined CP and OL for a AEA section 103 facility under 10 CFR Part 50. While it is legally feasible for the NRC to issue an order for a combined CP and OL MIPS license, the staff concludes that such an approach would offer very little advantage for B&W from a licensing perspective;

- The MIPS reactor may constitute a utilization facility, however, the extraction and purification portions of the MIPS facility would fall under the 10 CFR 50.2 definition of a production facility;

- Although NUREG-1537 contains general guidance applicable for licensing the MIPS reactors, it may require adaptation to apply to liquid homogeneous reactors for some aspects of the review;

- Based on the information currently available, the FCLW waste stream can be considered as LLW since it meets the criteria in 10 CFR 61.2; and

- The ULF waste stream cannot be considered LLW. Instead, ULF must be handled as HLW since it meets the definition of spent nuclear fuel. Therefore, ULF must be managed for disposal as HLW in accordance with 10 CFR Part 60 and 10 CFR Part 63.

RESOURCES:

[This section redacted.]

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

This paper contains resource information currently in the budget review process; therefore we request it not be made publicly available.

/RA Bruce S. Mallett for/

R. W. Borchardt
Executive Director
for Operations

Enclosure:
Letter to B&W

W.E. Reynolds, MIPS Program Manager
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2016 Mt. Athos Road
Lynchburg, VA 24505-5447

Dear Mr. Reynolds:

The Nuclear Regulatory Commission (NRC) is writing in response to your letters dated October 3, 2008, and October 6, 2008, in which Babcock and Wilcox (B&W) seeks prelicensing guidance from the NRC on potential policy issues associated with B&W's intent to request a license for and to operate a Medical Isotope Production System (MIPS). In your letters, you state that the purpose of the letters was to provide B&W's understanding of the NRC's authorizing legislation and NRC regulations, and to propose a path forward on the license review of the MIPS.

As the agency recently stated in its March 26, 2009, letter to Mr. Cochran of B&W, the NRC staff performed a comprehensive analysis of the prelicensing issues raised in your letters. This letter provides the results of the staff's analysis, including the staff's position on the path forward proposed by B&W.

In the October 3, 2008, letter, B&W proposed the following:

1. A single license for the MIPS that is issued under [Title 10 of the *Code of Federal Regulations* Part 50, "Domestic Licensing of Production and Utilization Facilities"] 10 CFR 50 with incorporation of other parts of 10 CFR as necessary;
2. A NRC determination that the initial extraction portion of the facility will not be classified as a Production Facility
3. NRC agreement that the MIPS is a non-power reactor under 10 CFR 50; and,
4. Designation of the MIPS license as Class 103 under 10 CFR 50.23 ["Construction Permits"].

With regard to whether the NRC could issue a single license for the MIPS under 10 CFR Part 50, with incorporation of other parts of 10 CFR as necessary, the staff agrees that there is no legal impediment under section 161.h of the Atomic Energy Act of 1954, as amended (AEA), to issuing one 10 CFR Part 50 operating license for the entire MIPS facility (i.e., numerous reactors and one or more production facilities). However, since such an approach would be a change from the previous 10 CFR Part 50 licensing practice, the NRC would, upon proper findings, grant such a license on an individual site-specific basis, via Commission order. Additionally, the staff notes that a single license for the entire MIPS facility would present challenges, in terms of practical implementation, for day-to-day interactions related to licensing or technical issues regarding different portions of the facility. These challenges would need to be addressed as part of the license submittal and may involve

restrictions such as requiring the individual reactors to be identical with common technical specifications and license conditions, as well as requiring common technical specifications and license conditions for the production facilities.

In your letter dated October 3, 2009, you stated that the MIPS will process irradiated materials containing special nuclear material that does not meet any of the three exceptions described in criterion (3) of the definition of production facility in 10 Sec. 50.2, "Definitions." B&W also cited verbatim the definition of "production facility" in the AEA but provided no compelling explanation or analysis of how B&W reached its conclusion that "Based on the definition in the Atomic Energy Act and the intended use of the MIPS, B&W believes that it should not be considered a production facility." Accordingly, the staff finds that, on the basis of information provided by B&W, the MIPS would, in fact, be a production and utilization facility (i.e., the reactor portion of MIPS is a utilization facility, whereas the remaining portion of MIPS is a production facility). The staff notes that it may be possible for B&W to operate the MIPS in a manner that enables the facility to meet the exception portion of the production facility definition by limiting process batches to less than 100 grams of uranium enriched in uranium-235 with not more than 15 grams of any other special nuclear material, but your proposal did not indicate an intent to operate the MIPS in this manner.

The NRC staff agrees that the proposed MIPS would be used to produce medical isotopes for commercial use and would not be used for production of heat or electrical energy. Therefore, the reactor portion of the MIPS is a non-power reactor used for commercial purposes and can be licensed under Section 103 of the Atomic Energy Act, as amended.

In your October 3, 2008, letter, B&W stated that it plans to submit an application for a combined construction permit (CP) and operating license (OL) following the guidance provided in NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," issued February 1996. However, 10 CFR Part 50 does not authorize a combined CP and OL for a Class 103 license. For Class 103 licensing, section 189 of the AEA requires that NRC hold a hearing at the CP stage and offer a hearing at the OL stage of the process. Notice for the mandatory CP hearing is governed by 10 CFR 2.104. However, 10 CFR 2.105(c) would be applicable if the applicant files an application that is complete enough to permit all evaluations necessary for issuance of the CP and OL. The notice of proposed issuance of the CP may provide that upon completion of construction and inspection, the OL will be issued without further prior notice.

In the October 6, 2008, letter, B&W requested an "NRC determination that the ULF [used liquid fuel] and/or FCLW [fuel cleanup liquid waste] from this type of a reactor that, by concentration, meets the Class C definitions, can be classified and disposed of as LLW [low-level waste] in light of the definitions in the Nuclear Waste Policy Act of 1982 (NWPA)." The NRC staff evaluated B&W's request and has determined, for the reasons described below, that FCLW could be managed as LLW, but that ULF is spent nuclear fuel and must be managed as high-level waste (HLW).

The definition in 10 CFR 61.2, "Definitions," provides that "[f]or the purpose of this definition [of "waste" under Part 61] low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material, as

described in paragraphs (2), (3), and (4) of the definition of Byproduct material set forth in § 20.1003 of this chapter." Therefore, in order for the NRC staff to conclude that FCLW meets the definition of LLW, it evaluated whether FCLW is HLW, transuranic (TRU) waste, spent nuclear fuel, or byproduct material, as described in paragraphs (2), (3), and (4) of the definition of byproduct material set forth in 10 CFR 20.1003, "Definitions."

The staff concludes that FCLW does not result from reprocessing spent nuclear fuel, but rather from the cleanup of irradiated reactor fuel. Therefore, FCLW is not HLW, as defined in the NWPA. The staff found that FCLW is not spent nuclear fuel because FCLW is derived from uranium fuel that is not "withdrawn from" the MIPS reactor as that phrase is properly understood in the context of the NWPA. FCLW is not byproduct material as defined in paragraphs (2), (3), and (4) of 10 CFR Sec.20.1003 (i.e., Part 61 states that radioactive waste can be considered LLW for the purposes of Part 61 if it does not meet the noted portions of the § 20.1003 byproduct material definition). Specifically FCLW is not: (1) tailings or wastes produced by the extraction or concentration of uranium or thorium from ore, (2) any discrete source of radium-226, (3) any material that has been made radioactive by use of a particle accelerator, or (4) any discrete source of naturally occurring radioactive material.

With regard to whether FCLW may have TRU radionuclide concentrations consistent with LLW classification, the staff evaluated whether solidified FCLW could be disposed of as LLW subject to the restrictions of Table 1 of 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste." As noted in Attachment 2 to your letter of October 6, 2008, you estimated the concentration of alpha-emitting TRU radionuclides, with half-life greater than 5 years (in approximately 260 liters of waste solution), to be 0.357 microcuries per milliliter assuming that fuel cleanup occurs after 52 5-day reactor burn cycles. For the purposes of determining whether such waste, when solidified for disposal, would be LLW, the NRC staff assumed that FCLW would be solidified in concrete, in order to meet 10 CFR Part 61 or equivalent Agreement State LLW disposal requirements. The staff estimated the final solid concentration of TRU radionuclides, assuming that an equal volume of dry concrete ingredients would be added to FCLW to create a solid waste suitable for disposal. The staff estimates that the solid TRU radionuclide concentration would be approximately 80 nanocuries per gram. Based on this estimate, the staff concludes that it is feasible to dispose of FCLW consistent with Table 1 of 10 CFR Part 61. Therefore, it is likely that FCLW can be managed as LLW.

With regard to ULF, the NRC staff understands that ULF may be generated periodically at the end of useful liquid fuel "load" life. After processing to remove medical isotopes and after fuel cleanup, the low-enriched ULF will still contain some residual fission and activation products, including TRU radionuclides. The ULF, therefore, is "fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing." For this reason, ULF is spent nuclear fuel and must be managed for disposal as HLW in accordance with 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," or 10 CFR Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

Please contact me or Timothy A. Reed (301-415-1462) of my staff if you have any questions regarding NRC's responses to B&W's proposed path forward.

Sincerely,

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation