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Managing Aging Processes in Storage Report; Request for Comment on Draft NUREG

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Submitter Information

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Organization: Nuclear Energy Institute

General Comment

See attached file(s)

Attachments

12-21-17_NRC_NEI MAPS Letter v7

12-21-17_NRC_NEI Comments to Draft MAPS-Rev 5_Attachment

SUNSI Review Complete
Template = ADM – 013
E-RIDS= ADM-03
Add= J. Wise (SPW4)

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December 21, 2017

Mr. John Wise
Division of Spent Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001
Submitted via Regulations.gov

Subject: Submittal of NEI comments on draft NUREG-2214, "Managing Aging Processes in Storage (MAPS) Report," *82 Federal Register 49233*, 10/24/2017 (Docket ID: NRC-2016-0238)

Project Number: 689

Dear Mr. Wise:

On behalf of the nuclear energy industry, the Nuclear Energy Institute (NEI)[1] appreciates the opportunity to provide comments on the U.S. Nuclear Regulatory Commission's (NRC) draft report NUREG-2214, "Managing Aging Processes in Storage (MAPS) Report." Industry very much appreciates NRC's efforts to develop NUREG-2214 and continue the collaborative dialogue that has informed staff's efforts through our interactions on the detailed comments submitted herein.

These comments were developed by the industry to provide input that NRC may use to modify NUREG-2214 so that it will provide clearer guidance. Some of industry's most notable concerns are summarized below. The complete set of industry comments are delineated in the attachment to this letter.

One of industry's primary concerns is that NUREG-2214 includes guidance that focuses on types of corrosion that do not occur in an Independent Spent Fuel Storage Installation (ISFSI). Environmental or other factors prevent these types of corrosion from occurring in ISFSIs (e.g., comments #15-17, 20, 22, and 23).

Another concern is whether there should be an aging management program (AMP) for the fuel stored in the dry storage system (e.g., comments #105 and 106). It is suggested that the NRC focus should be on the aging of the dry storage system itself, which will ensure that the fuel remains safely stored.

[1] The Nuclear Energy Institute (NEI) is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations and entities involved in the nuclear energy industry.

The next concern of industry's is that the proposed implementation of the AMPs include specifications that are contrary to recent rulemaking at 82 Federal Register 57819 Renewal of Certificate of Compliance No. 1004 - TN Americas LLC, Standardized NUHOMS® Horizontal Modular Storage System (e.g., comments #150, 152, and 162). Moreover, some aspects of these AMPs are unnecessary and inconsistent with ALARA principles. For example, the inclusion of some of the radiation monitoring requirements in NUREG-2214 would increase exposure to station employees but provide no safety assurance benefit (e.g., comment # 146). Finally some of the AMP acceptance criteria are too prescriptive and would result in undue burden without commensurate safety benefit (e.g., comment # 149).

In addition to the above concerns we have one overall question; how will NUREG-2214 keep from becoming out of date given its many references to Interim Staff Guidance (ISG) when NUREG-2215 will be incorporating several of the ISGs directly into NUREG-2215 (e.g., comment # 1)?

Thank you again for the opportunity to comment on NUREG-2214. We look forward to working with the NRC on the implementation of this important component of a comprehensive regulatory framework. This guidance will facilitate sustained assurance of spent nuclear fuel in dry storage systems while improving efficiency in the preparation and review of licensing documents involving the dry storage of spent nuclear fuel.

NUREG-2214 is one of three pillars that will form the foundation for an adaptive aging management program. These programs will allow industry to address potential aging effects that have not yet been observed or identified by collecting, evaluating, and sharing information regarding future operating experience. This approach is already embodied in Revision 1 to NUREG-1927 "Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel," which NRC finalized in June 2016 (ML16179A148). For a learning approach to aging management to be fully realized, industry preparers of renewal applications must have tools equivalent to those provided to NRC reviewers by NUREG-1927. NRC endorsement of Revision 2 to NEI 14-03 "Format, Content and Implementation Guidance for Dry Cask Storage Operations-Based Aging Management" would make this possible. Industry's December 21, 2016 submittal of NEI 14-03 (ML16356A210) addresses staff feedback and should be suitable for endorsement in conjunction with the finalization of NUREG-2214.

In submitting these comments, NEI would also like to express our appreciation to Mr. Paul Plante of Maine Yankee Atomic Power Company who led the industry review team. If you have any questions, please contact me or Paul at pplante@3yankees.com or (207) 882-1320.

Sincerely,

Benjamin Holtzman

Attachment

c: Mike Layton, NMSS, NRC
Tony Hsia, NMSS, NRC
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May Ma, NMSS, NRC

NEI Comments to Draft NUREG NUREG-2214 MAPS Report

Comment #	Page #	Line #, Table #, Section #	Comment
1	General	For example: Lines 20 and 21, Section 3.6 & Table 6-6, Element 2, Preventive Actions	Since Interim Staff Guidance (ISG's) will be incorporated into the new, combined NUREG-2215 currently issued in draft and sunset as documents, how will this NUREG keep from being out of date with its many references to ISG's.
2	1-2	21	Suggest re-wording "contains one acceptable method" to "describe acceptable methods."
3	1-2	35	Suggest adding NUHOMS HD (CoC 1030)
4	2-2	Table 2-1	The definition of high burnup fuel embedded in the definition of Zirconium-based alloys seems odd. The burnup of the fuel is not a material. Suggest deleting and defining separately in the text.
5	2-1	Table 2-1	Suggest including Metamic-HT as it is a different material than the Metamic mentioned in the table with a different purpose, usage, and composition.
6	2-2	Table 2-1	Add definition of Metal Matrix Composite (MMC) to the list.
7	2-3	Table 2-2	Recommend expansion of Fully Encased (steel) (FE) to include neutron shielding and gamma shielding materials within sealed or welded steel enclosures such as the Transfer Cask Body and Shield Doors, and VCC Shield Plug and Lid. Currently some of these components are identified as embedded-NS or embedded-lead, which is not as good a description.
8	2-3	Table 2-2	For "OD," it is overly conservative to assume outdoor air for transfer casks subject to indoor air because the TCs are generally not exposed to precipitation, wind and salt-laden air for extended periods of time (if at all for many vertical systems). It would be more appropriate for a TC to be assigned the "SH" environment.
9	2-7	Table 2-3	Shrinkage cracking also occurs from sharp corner geometries in the design, such as on outlet vents. In these instances, once the crack forms, it is stress is relieved and the crack does not grow.
10	2-8	Table 2-3	It seems inappropriate to include wet corrosion and blistering as an aging mechanism for dry storage systems. The described phenomenon occurs during loading and drying, not storage operation, so it's not a mechanism that's possible in a dry storage cask over the PEO. Blistering, if it occurs, does not affect functionality of the material.
11	2-9	Table 2-4	"Loss of criticality control" is poor wording because it connotes a complete loss of criticality control or even a critical condition. Suggest using "Reduction in neutron attenuation" instead
12	2-9	Table 2-4	"Loss of bond" and "Loss of material" should include reference to these effects on coatings.
13	2-9	Table 2-4	Is it necessary to include "None"? Isn't it obvious that that's a choice?

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Comment #	Page #	Line #, Table #, Section #	Comment
14	3-5	Table 3-5	Differential settlement is not an aging mechanism associated with Air-Outdoor environment or Sheltered environment.
15	3-5	Table 3-5	It is hard to imagine what kind of environment would qualify as an aggressive chemical attack environment that would be associated with Outdoor Air for concrete. This table should delete this environment.
16	3-5	Table 3-5	Microbiological degradation of concrete is not a common mode of degradation and generally occurs in environments that are not typical of ISFSIs, such as seawater service and sewage treatment. Since OE indicates that it is not occurring in concrete in nuclear plant environments, there is insufficient justification for including it in MAPS. Even if it were to occur, it would produce similar results to aggressive chemical attack (it is indeed a form of that phenomenon) which is included. It should be classified as not credible.
17	3-5	Table 3-5	Salt scaling cannot happen below grade and hence the GW environment should be excluded. The "freeze line" NRC must be referring to is what is most commonly known as the "frost line" which is by definition, the depth below which soil does not freeze in the winter. Salt scaling, if it occurs, would only be above ground. Salts and thawing agents are generally prohibited from ISFSIs in plants subject to these conditions.
18	3-8	Line 18	Suggest adding a parenthetical definition of "deliquescence."
19	3-8	Line 35	Are there temperature-humidity combinations where general corrosion becomes life-limiting? Change wording to ".....to outdoor and sheltered environments are potentially present, but general corrosion, although plausible, will not propagate at rates sufficient to affect component intended function. Therefore aging management of general corrosion is not required during the 60 year time frame."
20	3-9	Line 23-25	Steel exposed to an embedded concrete environment should be protected and general corrosion is not expected. Only when the concrete becomes faulted and allows the rebar to be exposed to other environments does the possibility of corrosion occur. This document should not assume that the concrete will become compromised and the rebar exposed. Aging management of concrete should prevent this type of corrosion from occurring.
21	3-10	Line 40	Define the term "electroless."

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Comment #	Page #	Line #, Table #, Section #	Comment
22	3-10	Line 15-16, 21-23,	Steel exposed to an embedded concrete environment should be protected and pitting and crevice corrosion is not expected. Only when the concrete becomes faulted and allows the rebar to be exposed to other environments does the possibility of this corrosion occur. This document should not assume that the concrete will become compromised and the rebar exposed. Aging management of concrete should prevent this type of corrosion from occurring.
23	3-11 & 3-12	Section 3.2.1.4	This section discusses MIC, but does not justify the inclusion of steel embedded in concrete environments as a credible environment. It assumes that the concrete exposed to soil is in a sufficiently degraded condition to allow rebar to be exposed to microbes (if they are present and are of an aggressive type). We have not seen this kind of damage in nuclear plants which indicates that this scenario is highly unlikely and does not warrant inclusion. This document should not assume that the concrete will become compromised and the rebar exposed. There are more likely credible environments that will result in pad inspections without confusing the issue with improbable scenarios.
24	3-14	Line 10	What is "significant" creep? Undefined term casts doubt. Either define or delete. Delete "significant".
25	3-19	Line 4	The initiation of SCC requires the presence of stress, environment and susceptible material. Absent anyone of these, there is no SCC. What stresses are considered? Not stated here. Should be included with a comment on the magnitude relative to SCC susceptibility. Page 3-19 line 1 change to: ".....are known to be precursors to SCC in the presence of weld residual stresses of sufficient magnitude to initiate SCC."
26	3-22	1	What is meant by "indoor/outdoor environments"? Doesn't the outdoor part of this statement contradict the previous section? Shouldn't "Indoor Environment" be listed in Table 3-1?
27	3-22	28	Typo...Should be "subcomponents".
28	3-25	Line 1-27	In this section, thermal aging of 17-4 PH in a helium environment is deemed a credible aging mechanism based on experiences in the reactor coolant system which is a significantly different environment. The ASME temperature limits for this alloy seems to be a reasonable approach to take, so the recommended action from the users should entail demonstrating that it stays below this temperature limit or that the material meets the necessary material requirements if modelling shows it does not meet these temperature limits.
29	3-27	Line 35	Wording question? Maybe better to state "could occur in spite of the passive oxide layer on the surface of aluminum materials."

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Comment #	Page #	Line #, Table #, Section #	Comment
30	3-36	28	The corrosion damage calculated (0.6mm over 60 years), which is certainly conservative, is hardly concerning from a general corrosion standpoint and shows why copper is used all over the world in exposed application. General corrosion should not be credible. It should be the same as pitting and crevice corrosion.
31	3-49	Line 3, Section 3.3	Sentence should read as follows: "...materials. Hydrogen in the water reduces the energy..."
32	3-49	Line 4, Section 3.3	Please clarify what is meant by "possible relocation of shielding materials," Is this meant to be dislocation or cracking?
33	3-51	Lines 15 and 17, Section 3.3.2	Lines should begin with "EPRI."
34	3-51	Lines 32 and 35, Section 3.3.2	Lines should begin with "NRC."
35	3-52	Lines 1 and 3, Section 3.3.2	Lines should begin with "NRC."
36	3-54	Line 44, Section 3.4	Typo - The word "verticle" should be "vertical."
37	3-54	Line 23-25, Section 3.4.1.1	On page 3-54, line 23 and 24, it states that for borated stainless steel, "boron depletion is not considered to be credible, and therefore, aging management is not required during the 60-year timeframe." The next paragraph (i.e., Line 25) changes the language to "boron depletion in borated stainless steel is not generally considered to be a credible aging mechanism." The addition of "generally" is incorrect. It appears that the third paragraph in Section 3.4.1.1. is simply trying to say that any past boron depletion materials in the original application basis be treated in the renewal application (vs. ignoring it). The term "generally" may have been included based on past calculations by some vendors to determine the impact of potential boron depletion. The term should be depleted as these calculations were, and are still not necessary for this impact.
38	3-55	Section 3.4.2	This section does not appear to address Metamic-HT which is a different MMC than the Boral or Metamic described.

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Comment #	Page #	Line #, Table #, Section #	Comment
39	3-56	Line 43, Section 3.4.1.1	The following statement begins, "It is important to note that, because only a trace amount of water will be left in a dry storage cask after dehydration and helium backfill, the occurrence of wet corrosion and blistering will be minimal in a dry cask environment during the period of extended operation." This continues on page 3-57, line 3 which states: "corrosion and blistering will be minimal." This should also state that since DCS system temperature decays over time and there is a very small, finite source of water in a dried and sealed cask, the progression of any corrosion and blistering will be minimal during the period of extended operation.
40	3-57	Line 22-26, Section 3.4.2.4	Boron depletion, states that the generic evaluation does not identify Boron depletion as a significant aging mechanism, but depletion analyses (thus aging management work) is still needed? This seems inconsistent.
41	3-59	Line 11, Section 3.4.3	Reference is not used in the text.
42	3-59	Lines 26 and 29, Section 3.4.3	Lines should begin with "EPRI."
43	3-59	Line 34, Section 3.4.3	Reference is not used in the text.
44	3-60	Line 1, Section 3.4.3	Reference is not used in the text.
45	3-60	Line 15, Section 3.4.3	Line should begin with "NRC."
46	3-62	Line 27, 35, Section 3.5.1.1	There does not appear to be a "NRC 2012" reference.
47	3-62	Line 36-38 Section 3.5.1.1	One of the main ways to protect against freeze-thaw damage is to specify air-entrained concrete (your reference ACI 2008c). Utilities should be allowed to take credit for properly spec'd air entrained concrete if they are in a freeze-thaw zone as an alternative to conducting aging management for this degradation mode.
48	3-69	Line 35-37 Section 3.5.1.8 "Leaching of Calcium Hydroxide"	Your reference Sindelar 2011 concludes "The requisite conditions of refreshed water and the overall kinetics of the coupled processes involved in calcium leaching renders it an insignificant degradation mechanism for the concrete in the pad or cask of the DCSS for EST." This is consistent with industry observations. We believe that while it is observed, it does not require aging management. Also, this reference does not appear to be a "Draft Report" as stated in the reference section on page 3-83. The IAEA reference also supports this position.

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Comment #	Page #	Line #, Table #, Section #	Comment
49	3-72	Line 41-43, Sect. 3.5.1.12	It is for precisely this reason that this can be excluded from further consideration. ISFSI pads are constructed on pad bedding using high quality fill materials and not on polluted soils. Furthermore, there are embedded concretes elsewhere in the nuclear plant that are subjected to much more severe conditions (i.e. circulating water systems). The absence of OE for MIC on concrete in these areas further illustrates that this mechanism is not expected in this kind of service.
50		3.6.1	Of the 11 fuel cladding degradation mechanisms, 9 were determined not to be credible during a 60 year storage timeframe. It is not clear if the studies referenced considered effects of pinhole or hairline cracks in the cladding.
51	3-86	3.6.1.1	For hydride reorientation, dissolved hydrogen is associated with the high temperatures experienced during vacuum drying. Does this apply to systems that dry HBU fuel with forced helium dehydration?
52	3-86	Line 44, Section 3.6.1.1	Maximum dissolved hydrogen at 400 C is 200 ppm, but isn't this material dependent? Suggest qualifying the 200 ppm.
53	3-87	Line 8, Section 3.6.1.1	The statement is made that cladding with hydrides "...has been shown to have reduced ductility under pinch-load stresses...". Is this still true for cladding with fuel in it? Did the references test with fuel in the cladding?
54	3-87	3.6.1.1	Section discusses potential cladding failures when fuel is subject to pinch-load stresses. It's not apparent when a pinch-load can occur during normal storage, or how fuel pellet-cladding bounding is considered.
55	3-87	Line 19, Section 3.6.1.1	Sentence beginning on line 19 – Says HRO is driven by hoop stress which is determined by peak cladding temperature. This is overly pessimistic. The hydrides precipitate and potentially reorient as the cladding cools over time. The stress at the time the hydrides precipitate will be less than the peak stress at the time of peak cladding temperature.
56	3-88	Line 20, Section 3.6.1.1	Mentions the negative characteristic of RXA cladding in that it is more susceptible to HRO due to larger fraction of grain boundaries in the radial direction. The paragraph should include a counter to that in that RXA has lower hydride concentrations, so there are far fewer hydrides available to reorient.
57	3-88	Line 24, Section 3.6.1.1	Discusses the impact of cooling rate on HRO and concludes the slow cooling rate under actual dry storage conditions will not inhibit HRO. However, a key phenomenon that is ignored is the effect of annealing. Due to the slow cooling rate, the cladding remains at somewhat higher temperature for long periods. This time at temperature provides some annealing and repairing of irradiation defects. This needs to be included in the cooling rate discussion in this paragraph.

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Comment #	Page #	Line #, Table #, Section #	Comment
58	3-91	Line 31, Section 3.6.1.2	Editorial –add "to" after "expected"
59	3-98	Line 17, Section 3.6.1.9	Editorial– add a space between "350" and "degrees"
60	3-99	3.6.1.9	With regards to the statement that SCC of the cladding is not credible and aging management is not required during the 60 year storage timeframe, is this applicable to all cladding types? The evidence provided seems to focus on Zr-2 and Zr-4 versus the advanced alloys.
61	3-99	3.6.1.10	With regards to radiation embrittlement, the conclusion that embrittlement is not considered credible is based on a cumulative fluence (10^22 n/cm2) not expected during storage. However, in the second paragraph states that embrittlement of cladding is observed in reactor due to cumulative fast neutron exposure on the order of 10^22 n/cm2. Thus, as worded it appears that the cladding has already reached the necessary fluence for embrittlement before getting into dry storage.
62	4-1	Table 4-1	Add NUHOMS HD System to the evaluated Storage system design--NRC Docket Number 72-1030.
63	4-6	Section 4.2.3	HSM described, but heat shield not mentioned. It is part of the HSM, and is shown on page 4-41
64	4-10	Table 4-2	Listed in this Table are the AMR results of the subcomponents of all the NUHOMS DSCs certified in CoC 1004. However, the Report does not list the DSC Type associated with a specific subcomponent. For example. The first and second row lists the AMR results for Guide Sleeves and Over sleeves. It would be useful to add in the first Column "Spacer Disc Type DSC Basket" instead of "DSC Basket". The Standardized NUHOMS System provides for 2 alternate basket designs" spacer disc" and "Tube" type basket design. Further, the next line item lists the AMR results for Aluminum Plate. This subcomponent is only present in high heat load DSCs and not present in the earlier DSC designs. Hence, here also, it would add to the clarity of this Table if it is annotated that this subcomponent is only present in high heat load DSC designs. This is a generic change suggested for the entire Table 4-2.
65	4-33	Table 4-4	Listed in this Table are the AMR results of the subcomponents of all the NUHOMS HSMs certified in CoC 1004. However, the report does not list the HSM Type associated with a specific subcomponent. For example, the DSC Support Structure for HSM Model 80 is quite different from that provided for HSM-H or HSM-HS. Hence, it would be useful to annotate each row of Table 4-4 by adding the HSM Type in Column 1.

NEI Comments to Draft NUREG NUREG-2214 MAPS Report

Comment #	Page #	Line #, Table #, Section #	Comment
66	4-69	Table 4-6	Listed in this Table are the AMR results of the subcomponents of all the NUHOMS Transfer Casks. The Standardized NUHOMS System provides for 5 different TC Types: Standardized TC, OS197, OS197H, OS200 and OS197L. Each of these TCs has a unique design with materials of construction which differ from one TC Type to another. To avoid any confusion, it would be useful to annotate each row of Table 4-6 by adding the TC Type in Column 1.
67		Section 4.3	This section is limited to the HI-STORM 100 and its associated variants. Other Holtec dry cask storage systems, that have separate Certificates (HI-STORM FW and HI-STORM UMAX) have been placed into service and utilize larger capacity canisters.
68	4-91	Line 43	Fix typo ("HI-TORM 100")
69	4-94	Line 9	Recommend changing, "Boral and METAMIC" to "Either Boral or METAMIC" to make it clear that a given basket is comprised of only one type of neutron absorber.
70	4-94	Line 11	Recommend noting that the pocket enclosure for neutron absorbers does not apply to METAMIC-HT (MPC-68M) configuration.
71	4-94	Lines 23-24	The bolted on shield lid atop the MPC lid is not a standard configuration. In fact it was used one time at one site. MAPS should state this is not present on all MPCs. There is no further consideration for this shield lid in Table 4-7, or how if present can affect aging management of the MPC lid.
72	4-99	Section 4.3.5	It's not apparent why the Transfer Cask is being included for a document that is focused on extended storage.
73	4-104	Table 4-7	Boron depletion (under subsections for Metamic-HT, Boral and Metamic) is not an apparent aging mechanism for dry storage as there is practically no thermal neutron flux under the conditions for normal storage. Stating that a TLAA may be required should not be necessary.
74	4-110	Table 4-8	With regards to the items combined under "concrete shield", for those items that are fully encased in steel, including the reaction with aggregates as an aging effect should be a 'no', since these do not have the susceptibility mechanisms (for example large aggregate surface area for reaction or exposure to moisture) described in Section 3.5.1.3. Likewise these components do not relay on the concrete for structural strength.
75	4-111	Table 4-8	Should aging management of external vent screens be included with gamma shields, or can the condition of the vent screens be used as an indication of gamma shield aging?

NEI Comments to Draft NUREG NUREG-2214 MAPS Report

Comment #	Page #	Line #, Table #, Section #	Comment
76	4-132	Table 4-9	In the HI-STAR, the safety function of the neutron shield is only shielding. Thus, aging effects should not include structural related items (fracture toughness and loss of ductility). These aging effects refer to MAPS Section 3.3.1.2 which does not describe either of these. Additionally, these effects are covered under thermal aging, which describe the breakdown of polymers under elevated temperatures. It would seem that over an extended storage period, elevated temperatures should not be a concern.
77	4-140	Table 4-10	If aging management of the transfer cask is deemed necessary, then should lead shield material gapping or slumping be included as an aging mechanism?
78	4-142	Table 4-10	Should pool lid seals be included with the other related HI-TRAC components considered for aging effects
79		Section 4.3	A note should be added to the section stating that not all HI-STORM systems include all the SSCs provided in Tables 4-7 through 4-10
80	4-176	Table 4-12	Incorrectly identifies Structural Lid as exposed to a helium environment. The Structural Lid is installed above and encases the Shield Lid. Environment between the two lids would be indoor air.
81	4-177	Table 4-12	Leaves out Shield Lid, though shield lid support ring is identified. The Shield Lid (top) would be encased by the stainless steel Structural Lid and the interior surface exposed to the internal helium environment. Add immediately following Spacer Ring.
82	4-177 thru 4-178	Table 4-12	Port Covers are installed in the shield lid above the quick disconnect valved couplings and only underside of port covers would be potentially exposed to a helium environment. The top welded side of the Port Covers would be exposed to the encased indoor air environment.
83	4-185	Table 4-13	Reinforcing Steel environment is air-outdoor. These components are not exposed to groundwater, so this environment should be deleted.
84	4-186	Table 4-13	Inner Shell main safety functions are as a gamma shielding component and a heat transfer component, not structural, so intended safety function should be identified as "SH, TH", or "SH, TH, SR" not "SH, SR".
85	4-188 thru 4-189	Table 4-13	Outlet Vent hardware is defined as a structural component, but its main intended safety function is thermal (external protection of the outlet vent from entry and blockage of foreign materials), so intended safety function should be "TH, SH", not "SR".
86	4-188 thru 4-189	Table 4-13	The listing does not include the Inlet Vent Hardware, so Outlet Vent Hardware should be revised to be "Inlet and Outlet Vent Hardware".

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Comment #	Page #	Line #, Table #, Section #	Comment
87	4-188 thru 4-189	Table 4-13	Outlet Vent hardware is defined as a structural component, but its main intended safety function is thermal (external protection of the outlet vent from entry and blockage of foreign materials), so intended safety function should be "TH, SH", not "SR".
88	4-191	Table 4-13	The neutron shield materials contained in the Shield Plug should be defined as "Fully Encased (FE) (Steel)" rather than "Embedded (steel)".
89	4-195	Table 4-14	Why is Neutron Shield (Cask Body) identified as requiring a TLAA/AMP for Thermal Aging, whereas it is not identified as required for the Steel MAGNASTOR Transfer Cask, but is for the Stainless Steel MAGNASTOR Transfer Cask? Please clarify or correct.
90	4-194 thru 4-195	Table 4-14	NAC defines the Transfer Cask body and shield door neutron shielding and gamma shielding as Fully Encased (FE) (Steel) as these components are fully encased in steel components.
91	4-197	Table 4-14	Shield Door Rails, which are coated steel, are identified as requiring aging management by the Transfer Cask AMP for Galvanic Corrosion for loss of material when the doors rails are not connected to other non-carbon steel materials. Please clarify or delete.
92	4-206	Table 4-15	Fuel Basket Support Disk for all MPC TSCs is 17-4 stainless steel, identical to NAC-UMS PWR support disks. However, MPC TSC table requires aging management for thermal aging for the stainless-steel support disks although it is not required for the UMS stainless-steel support disks, only the steel support disks of the BWR fuel basket assembly. Please correct to delete the aging management requirement or clarify discrepancy.
93	4-215	Table 4-16	Inner Shell main safety functions are as a gamma shielding component and a heat transfer component, not structural, so intended safety function should be identified as "SH, TH", or "SH, TH, SR", not "SR".
94	4-220	Table 4-16, Lid Assembly, Concrete	Radiation Damage (both cracking and loss of strength) refers to TLAA or AMP but 3.5.1.9 says radiation damage to concrete is not credible. Aging management should therefore be "No".
95	4-224	Table 4-17	Why is Neutron Shield (Cask Body) identified as requiring a TLAA/AMP for Thermal Aging, whereas it is not identified as required for the Steel MAGNASTOR Transfer Cask, but is for the Stainless Steel MAGNASTOR Transfer Cask? Please clarify or correct.
96	4-223	Table 4-17	NAC defines the Transfer Cask body neutron shielding and lead gamma shielding as Fully Encased (FE) (Steel) as these components are fully encased in steel components. Correct "Gamma Shielding" to "Neutron Shielding" for NS-4-FR materials.

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Comment #	Page #	Line #, Table #, Section #	Comment
97	4-226	Table 4-17	Shield Door Rails, which are coated steel, are identified as requiring aging management by the Transfer Cask AMP for Galvanic Corrosion for loss of material when the doors rails are not connected to other non-carbon steel materials. Please clarify or delete.
98	4-239	Table 4-18	Under Damaged Fuel Can Screen also add Wiper to the list as the wiper extends out further than the screens and acts as the CO boundary between the DFC lid and DFC collar.
99	4-246	Table 4-19, Lid Assembly, Concrete	Radiation Damage (both cracking and loss of strength) refers to TLAA or AMP but 3.5.1.9 says radiation damage to concrete is not credible. Aging management should therefore be "No".
100	4-245 thru 4-247	Table 4-19	The Lid Assembly incorporates a concrete neutron shield embedded in concrete. It is not feasible for Reaction with Aggregates aging effects to be managed by an External Surfaces Monitoring of Metallic Component AMP. If aging management is required, a TLAA would be required. Please correct or clarify. Also, the environment should be Fully Encased (FE) (steel).
101	4-247 thru 4-248	Table 4-19	The Lid Anchor (standard and alternate configuration) steel components that are embedded in concrete cannot be monitored for aging management for General Corrosion or Pitting and Crevice Corrosion by an External Surfaces Monitoring of Metallic Component AMP. If aging management is required, a TLAA or the Reinforced Concrete Structures AMP would be appropriate. Please correct or clarify.
102	4-250 thru 4-251	Table 4-19	Inner Shell main safety functions are as a gamma shielding component and a heat transfer component, not structural, so intended safety function should be identified as "SH, TH", not "SR, SH, TH".
103	4-259	41	Replace "of the" with "adjacent."
104	4-292	Table 4-24	Differential settlement is not an aging mechanism associated with Air-Outdoor environment.
105	4-297	Section 4.8	From a fundamental standpoint, should there even be an AMP for fuel? It is the fuel we are trying to protect in the dry storage system. Rather than focusing on degradation of the fuel, instead, we should ensure that any impacts from accidents and aging of the dry storage system do not create an impact on the fuel that would create unacceptable consequences.
106	4-297	Section 4.8	How does this integrate with the revised definition of RETRIEVABILITY which allows for canister-based retrievability to meet this requirement?
107	4-297	Line 18, Section 4.8.2	Line reads "...neutron absorber rods and burnable poison rods..." These are the same thing. Maybe meant to say "control rods and burnable poison rods."

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108	4-297	Line 29, Section 4.8.2	Line should read as follows: ...rods. The fuel rods are hollow cladding tubes fabricated from Zircaloy-2 filled with uranium dioxide pellets."
109	4-297	Line 34, Section 4.8.2	Line should read as follows: ...channels). The channels..." Deleted text is repeated in previous paragraph.
110	4-297	Line 36, Section 4.8.2	Line should read as follows: ...levels. Both the upper and lower tie plates..."
111	4-300	Table 4-25, Aging Management	For Fuel rod cladding, Hydride-induced embrittlement Aging Mechanism, page 3-89, line 35 requires and AMP.
112	4-300	Table 4-25	Hydride-induced embrittlement should be "Hydride reorientation" per the title of Section 3.6.1.1. Also, Table 4-25 says no aging management, but Section 3.6.1.1 provides 2 approaches for aging management to address hydride reorientation: A defense in depth with consequence analysis or using results from a demo.
113	4-300	Table 4-25, Technical Basis (Section)	For Guide tubes (PWR) or water channels (BWR), the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.
114	4-300	Table 4-25, Technical Basis (Section)	For Guide tubes (PWR) or water channels (BWR), the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
115	4-301	Table 4-25, Technical Basis (Section)	For Spacer grids, Zirconium-based alloy, the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.
116	4-301	Table 4-25, Technical Basis (Section)	For Spacer grids, Zirconium-based alloy, the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
117	4-301	Table 4-25, Technical Basis (Section)	For Spacer grids, Inconel, the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.
118	4-301	Table 4-25, Technical Basis (Section)	For Spacer grids, Inconel, the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
119	4-301	Table 4-25, Technical Basis (Section)	For Lower and upper end fittings, Stainless steel, the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.
120	4-301	Table 4-25, Technical Basis (Section)	For Lower and upper end fittings, Inconel, the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
121	4-302	Table 4-25, Technical Basis (Section)	For Fuel channel (BWR), the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.

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Comment #	Page #	Line #, Table #, Section #	Comment
122	4-302	Table 4-25, Technical Basis (Section)	For Fuel channel (BWR), the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
123	4-302	Table 4-25, Technical Basis (Section)	For Poison rod assemblies (PWR), the reference for Radiation embrittlement should be 3.6.2.5 not 3.6.1.10.
124	4-302	Table 4-25, Technical Basis (Section)	For Poison rod assemblies (PWR), the reference for Fatigue should be 3.6.2.6 not 3.6.1.11.
125	4-303	Lines 6 and 8, Section 4.9	Lines should begin with "FuelSolutions."
126	4-303	Line 16, Section 4.9	Line should begin with "Holtec International."
127	4-303	Lines 21, 22 & 24, Section 4.9	Lines should begin with "NAC International."
128	4-303	Lines 30 and 32, Section 4.9	Lines should begin with "NRC."
129	5-1	4	After "design basis," insert "described in, or incorporated by reference in the ISFSI or cask FSAR."
130	6-1	Table 6-1	Suggest considering breaking section 6.7 into two separate AMPS. One for readily accessible, metallic, external surfaces exposed to outdoor atmospheres and one for sheltered, external metallic surfaces exposed to outdoor atmospheres. There will be different inspection programs, repairs, inspection frequencies, etc. for these two cases.
131	6-6	Table 6-2, Element 1, 3rd bullet	The scope of this bullet should be revised to "Known areas of the canister to which temporary supports or attachments..." . This would be based on document reviews and evidence of grind marks on the canister (though all grind marks do not necessarily indicate the presence of a location where temporary attachments were used.
132	6-6	Table 6-2 Element 1	Regarding this item: Effort should be made to identify and prioritize examinations of areas on canisters that have two or more of the above attributes (e.g., canister surface that is cold relative to average surface temperature and also has a weld or weld heat affected zone). Why prioritize any area that is not near a weld? What does "prioritize" mean relative to coverage area? Is canister removal from overpack expected? The actions and scope should be commensurate with the safety significance and this needs to be conveyed in the document.
133	6-7	Table 6-2 Element 4, Volumetric Inspection	The phrase "adequate cleaning" needs to be qualified. There is evidence of some canisters requiring cleaning to remove heavy deposits of pollen, but there is evidence of other canisters having bare metal surfaces that require no cleaning.

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Comment #	Page #	Line #, Table #, Section #	Comment
134	6-7	Table 6-2 Element 4, Volumetric Inspection	The phrase "For accessible areas where adequate cleaning should be performed...", "accessible" should be qualified as this is accessible by remote VT.
135	6-8	Table 6-2 Element 4, "Sample Size"	Please change the first phrase to "For sites conducting a canister inspection,"
136	6-10	Table 6-2, Element 6, 2nd and 3rd	Use of ASME Section XI acceptance criteria for RCS piping is inappropriate for this application involving low pressure canisters of ductile material. AMP as it is not based on the canister design. There is a significant difference in response to defects between the high temperature and pressure of RCS piping and the low temperatures and pressures of dry storage. Acceptance criteria have been identified in EPRI-3002008193 that are appropriate for this service and they should be for use in this AMP.
137	6-10	Table 6-2, Element 6, 4th	This removal of iron deposits and rust stains should be reserved for welds and their associated heat affected zones. While this section implies this, it is not clearly stated and the section should be revised accordingly.
138	6-10	Table 6-2, Element 6, 2nd bullet	What is the basis for the 1mm criteria? This appears to be the first use of this criteria and the basis for it has not been identified and justified for this application. In lieu of using this, acceptance criteria have been identified in EPRI-3002008193 that are appropriate for this service and they should be for use in this AMP.
139	6-10	Table 6-2 Element 6	The guidance is not clear on how indications may be dispositioned. The language provided indicates that these are not actually criteria for acceptance, rather criteria for doing additional evaluations. The referenced standards do not specifically address the question of confinement integrity. What are examples of indications that can be accepted for continued service? What indications cannot be accepted?
140	6-10	Table 6-2 Element 6	This blanket statement: *No indications of localized corrosion pits, etching, crevice corrosion, SCC, red-orange-colored corrosion products emanating from crevice locations, or red-orange-colored corrosion products in the vicinity of canister fabrication welds, closure welds, and welds associated with temporary attachments during canister fabrication.* May prevent any inspection from being acceptable without further evaluation. Consider using acceptance criteria provided in referenced document EPRI-3002008193.

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Comment #	Page #	Line #, Table #, Section #	Comment
141	6-11	Table 6-2 Element 7	*Canisters with localized corrosion or SCC that do not meet the prescribed evaluation criteria are not permitted to remain in service without an engineering analysis or mitigation actions.* – Is this referring to the acceptance criteria in element 6 or to some other prescribed evaluation criteria?
142	6-12	Table 6-2, Element 7, last	The phrase "are not permitted to remain in service" does not properly recognize the nature of passive dry storage systems. Suggest rewording this last sentence as follows: "Canisters with localized corrosion or SCC that do not meet the prescribed acceptance criteria shall be entered into the licensee's corrective action program as a condition adverse to quality to allow for appropriate evaluations and follow-up."
143	6-12	Table 6-2, Element 10, "Operating Power Reactors"	This section, the one that follows, and the end of Table 6-4 are the only places in MAPS that identifies crack growth rates. With the exception of the Kosaki reference, these crack growth rates are "apparent" crack growth rates that are empirically derived from operating data. The nature of these numbers is well explained in EPRI 3002002528 which is cited in the next paragraph. This data is useful, but appropriate qualifications should be identified where they are cited to ensure that this fact is understood. A follow-up EPRI report, EPRI 3002002785 "EPRI Public Flaw Growth and Flaw Tolerance Assessment for Dry Cask Storage Canisters" provides a more in-depth treatment of this area and may be a useful reference.
144	6-18	Table 6-3, Element 1, Section 2 and elsewhere in this AMP	Ground water monitoring as part of concrete aging management- This would be conducted when a pad is in scope and there is reason to believe that the ground water is conducive to applicable concrete degradation. If past characterization shows that the ground water is below the cited limits, then new additional characterization, new groundwater monitoring wells, or routine monitoring requirements should **NOT** be required. Ground water monitoring has shown little change over many years of trending when there are no new contributors to a site and this is not an insignificant expense.
145	6-18	Table 6-3, Element 1, Section 3 & Footnote 1 and elsewhere in this AMP	Radiation surveys as part of concrete aging management- Radiation surveys are initially conducted per Tech. Spec. requirements. Usually, this means the cask is surveyed and verified to meet requirements before it is allowed into storage. The need for follow-up surveys, as part of aging management, is unnecessary. Dry cask storage systems are routinely performed and evaluated IAW site approved procedures. This approach is more conservative and robust than an extra and unnecessary aging management driven survey process. This is not ALARA.

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Comment #	Page #	Line #, Table #, Section #	Comment
146	6-18	Table 6-3, Element 1, Item 3	Item 3 is not related to aging management. Sites are already required to perform periodic monitoring of boundary doses which are cited as sufficient to detect failed systems and abnormal conditions. Sufficient radiation monitoring will already be performed during execution of other aging management activities above and beyond surveys required by DSS and ISFSI TS requirements. A radiation monitoring requirement embedded in an AMP is not only not substantiated but it will cause undue work and exposure to station employees for no gained benefit (Not in keeping with ALARA principals). All other references to radiation surveys should be removed from Table 6-3.
147	6-18 Also 6-20	Table 6-3, Element 1, 4th bullet from the bottom and elsewhere in this AMP & Element 3	Leaching of calcium silicate and efflorescence as part of concrete aging management This statement should say "due to **excessive** leaching of calcium hydroxide". As discussed in NUREG CR-7116, NUREG CR-7153 and IAEA TECDOC-1025, calcium leaching is not considered a significant degradation mechanism and would not result in a significant impact to the safety functions of the concrete. There are many instances of leaching of calcium carbonate on dry storage canisters and most are self-limiting and benign. Only the more excessive ones with corresponding affected concrete needs to be tracked, evaluated and potentially remediated.
148	6-19	Table 6-3, Element 2	The first paragraph should be deleted. This paragraph is not substantiated by the MAPs document and is not related to or required to mitigate any aging management issues. TS monitoring requirements (via temperature monitoring or inlet/outlet inspections) are not changed during license renewal and will continue to be required on a more frequent basis than prescribed here. Any abnormal conditions identified by this already required monitoring will be corrected by licensee's corrective action program.
149	6-21	Table 6-3 Element 4, "Sample Size"	Table 6-3 references 100% inspection of all concrete structures. This overly prescriptive and should be an inspection based on sampling a few systems at 100% and a gross inspection of all other structures. Detailed inspection of a few systems will be sufficient to identify initiation of issues that would warrant increased inspections per licensee's CAP program (extent of condition evaluation). Performing 100% surface exam of all systems will result in undue work and exposure with no measureable benefit.

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Comment #	Page #	Line #, Table #, Section #	Comment
150	6-22	Table 6-3, Element 4, "Timing"	These types of inspections are conducted as required by the certificate or part 72 license for the period of initial operation (during the annual inspections). Therefore, the timing of the initial inspections required by the AMP should be after the period of initial operation, which is consistent with NRC language on prior renewals. NRC has allowed up to 300 days after the effective date of the renewal to implement the AMP. Initial inspection timing is driven by the AMP implementing documents. What is specified here is contrary to recent rulemaking at 82 Federal Register 57819 renewing certificate of compliance No. 1004 - TN Americas LLC, Standardized NUHOMS® Horizontal Modular Storage System.
151	6-30	Table 6-4, Element 4, "Readily Accessible Surfaces"	Too Prescriptive-While it may be important for canister walls with controlled thickness on the walls, it is not necessary to perform visual inspections of coated carbon steel surfaces to VT-3 and this will indeed cause hardship on ISFSI Only sites who do not have qualified personnel for this. There are numerous examples of rust spots in exposed carbon steel and this is readily detected by average inspections. Most coatings are NQ and do not perform a safety function on metallic dry storage components and do not require this level of inspection.
152	6-31	Table 6-4, Element 4, "Timing"	These types of inspections are conducted as required by the certificate or part 72 license for the period of initial operation (during the annual inspections). Therefore, the timing of the initial inspections required by the AMP should be after the period of initial operation, which is consistent with NRC language on prior renewals. NRC has allowed up to 300 days after the effective date of the renewal to implement the AMP. Initial inspection timing is driven by the AMP implementing documents. What is specified here is contrary to recent rulemaking at 82 Federal Register 57819 renewing certificate of compliance No. 1004 - TN Americas LLC, Standardized NUHOMS® Horizontal Modular Storage System.
153	6-31	Table 6-4 Element 4	Table 6-2 does not include a statement similar to this one: *The extent of inspection coverage should be specified and demonstrated to sufficiently characterize the condition of the metallic components.* It is unclear why this is applicable in Table 6-4 and not in Table 6-2.

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154	6-32	Table 6-4, Element 6, "Acceptance Criteria"	Too prescriptive- These acceptance criteria are impossibly restrictive. For instance, minor coating failures for structures that have been in service for 10+ years are common place. As most coatings on external surfaces are NQ, they have no impact on safety. Minor superficial rust in the areas of these coating failures is also evident. The first bullet here is fine as is the 4th bullet. The 2nd and 3rd bullets however, are unduly restrictive. This is important because of the corrective actions section. Failure to meet bullets 2 and 3 are not necessarily conditions adverse to quality and do not require apparent cause evaluations and root cause evaluations.
155	6-33	Table 6-4, Element 7, "Corrective Actions"	Too prescriptive- This section provides details that are in all licensee's corrective action programs and is unnecessary and may be counterproductive. For instance, based on the above comment, failure to meet bullets 2 and 3 are not necessarily conditions adverse to quality and do not require apparent cause evaluations and root cause evaluations. While such actions may be warranted on canister shells, they are not necessary on large, thick coated carbon steel structures, where unsatisfactory amounts of corrosion will be readily visible at inspection opportunities.
156	6-33	Table 6-4, Element 10, "Operating Experience"	The operating experience cited for this AMP has nothing to do with the issues addressed by this AMP. There is Op-Ex in the AMID database that applies to this AMP.
157	6-35	Section 6.8	This AMP is not necessary. The passive ventilation systems of dry storage systems are subject to daily tech. spec. verification and the structures associated with forming the passive ventilation system are addressed in other AMPS. By creating this AMP, a source of confusion, conflicting requirements, and unnecessary administrative requirements are also being created. We recommend deleting this AMP.
158	6-35	Section 6.8	This entire section should be deleted. Validation of ventilation acceptability is already required by DSS TS and is not specifically related to or required to mitigate any aging management condition. DSS TS already have a monitoring requirement sufficient to detect abnormal conditions. Any abnormal condition will then be entered into the licensee's CAP. This section will do nothing but provide additional administrative burden on the licensee.

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Comment #	Page #	Line #, Table #, Section #	Comment
159	6-37	Table 6-5, Element 4, "Operating Experience"	The statement "Temperature monitoring is performed with qualified and calibrated measurement devices or sensors that are maintained in accordance with the site QA program" is not generally true. As these sensors have no impact on safety and are generally very reliable and not subject to significant inaccuracy, they are not in scope and not subject to these requirement at most ISFSIs.
160	6-40	Table 6-5, Element 9, "Operating Experience	Same comment as above...this equipment is generally not calibrated. RTD's and T/C either operate or fail...failure is obvious based on the circuitry for these systems.
161	6-43	Section 6.9 and Table 6-6	Bolted cask seal leakage monitoring systems have a TS to ensure the pressure is not decreasing and to ensure the system is functioning properly. An AMP is not necessary and is not specifically related to or required to mitigate any aging management condition. DSS TS already have a monitoring requirement sufficient to detect abnormal conditions. Any abnormal condition will then be entered into the licensee's CAP. This section will do nothing but provide additional administrative burden on the licensee.
162	6-46	Table 6-6, Element 4, "Timing"	These types of inspections are conducted as required by the certificate or part 72 license for the period of initial operation (during the annual inspections). Therefore, the timing of the initial inspections required by the AMP should be after the period of initial operation, which is consistent with NRC language on prior renewals. NRC has allowed up to 300 days after the effective date of the renewal to implement the AMP. Initial inspection timing is driven by the AMP implementing documents. What is specified here is contrary to recent rulemaking at 82 Federal Register 57819 renewing certificate of compliance No. 1004 - TN Americas LLC, Standardized NUHOMS® Horizontal Modular Storage System.
163	6-53	Section 6.10	Some discussion should be added here that TCs would generally be considered tools and scoped out for aging management if they were not classified as important to safety. They are not in continuous service and play no role in storage operations at the ISFSI.
164	6-56	Table 6-7, Element 6, "Acceptance Criteria"	"No coating defects" is an impossible acceptance criteria for transfer casks. Coating defects should be identified, but do not necessarily need to be repair unless this is required by the corrective action program.
165	6-57	Table 6-7	Appears to be something missing in the second reference.

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Comment #	Page #	Line #, Table #, Section #	Comment
166	6-60	Table 6-8, Element 1, "Scope of the Program"	There should be a statement in the Scope that this AMP does not apply if the HBU fuel is canned or otherwise contained.
167	6-60	Table 6-8 Item 1	Says the scope is to provide a description of the design bases characteristics of the HBU fuel. You do not "design" HBU fuel. You design the DSS. Suggest changing "design bases characteristics" to something like "characteristics and properties assumed in the DSS design". This comment applies throughout Table 6-8 HBU Fuel AMP.
168	6-60	Table 6-8 Item 1	Nominal burnups in the HDRP are 50-55 GWD/MTU assembly average (not 53-58).
169	6-60	Table 6-8 Item 1	Change "is to be licensed" to "is licensed"
170	6-60	Table 6-8 Item 1	Last paragraph in Item 1 says to justify the surrogate demonstration program is applicable by demonstrating it is bounding for the specific licensee. Suggest adding language to justify use of the demonstration program if it is not bounding, similar to language from ISG-24 – e.g. "...that the demonstration fuel is reasonably characteristic of the stored fuel and the added burn-up will not change the results determined by the demonstration."
171	6-61	Table 6-8, Element 6, "Acceptance Criteria"	Do these three bullets/acceptance criteria make sense? Do they have a safety basis?