ATTACHMENT (2)

AGING MANAGEMENT PROGRAMS

A1.1 INTRODUCTION

This appendix is a summary of the activities that manage the effects of aging for subcomponents that have been identified in the license renewal application as being subject to aging management review (AMR). The following aging management programs (AMPs) have been credited for the Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI):

- Dry Shielded Canister (DSC) External Surfaces Aging Management Program
- Horizontal Storage Module (HSM) Aging Management Program
- Transfer Cask Aging Management Program
- Transfer Cask Lifting Yoke Aging Management Program
- Cask Support Platform Aging Management Program
- High Burnup Fuel Aging Management Program

Each of these AMPs is discussed in Subsections A1.3 through A1.8. These subsections provide a description of the AMP which includes an introduction, an evaluation of the AMP in terms of the attributes of an effective AMP, and a summary.

Each AMP manages the aging effects, or the relevant conditions that could lead to the aging effects, applicable to a subcomponent, and provides reasonable assurance that the integrity of the subcomponent will be maintained under current licensing basis conditions during the renewed license period.

A1.2 AGING MANAGEMENT PROGRAM ELEMENTS

The structure of the AMPs is consistent with the 10 program elements described in NUREG-1927 (Reference 1), as follows:

(1) Scope of the program: The scope of the program should include the specific structures and components subject to an AMR.

(2) Preventive actions: Preventive actions should mitigate or prevent the applicable aging effects.

(3) Parameters monitored or inspected: Parameters monitored or inspected should be linked to the effects of aging on the intended functions of the particular structure and component.

(4) Detection of aging effects: Detection of aging effects should occur before there is a loss of any structure and component intended function. This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new or one-time inspections to ensure timely detection of aging effects.

(5) Monitoring and trending: Monitoring and trending should provide for prediction of the extent of the effects of aging and timely corrective or mitigative actions.

(6) Acceptance criteria: Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the particular structure and component intended

functions are maintained under the existing licensing-basis design conditions during the period of extended operation.

(7) Corrective actions: Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation process: The confirmation process should ensure that preventive actions are adequate and appropriate corrective actions have been completed and are effective.

(9) Administrative controls: Administrative controls should provide a formal review and approval process.

(10) Operating experience: Operating experience involving the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

A1.3 DSC EXTERNAL SURFACES AGING MANAGEMENT PROGRAM

The ISFSI provides for long-term dry interim storage for irradiated fuel assemblies until such time that the irradiated fuel assemblies are shipped off site for final disposition. The fuel assemblies are confined in DSCs. This program is intended to ensure that the pressure/confinement boundary intended function of those DSCs is maintained for the period of extended operation.

A1.3.1 Materials

The DSC subcomponents described in Section 3.3.1 of Reference 2 that are subject to this aging management program are as follows:

- DSC Shell with Bottom Shield Plug
- DSC Cover Plates (Top and Bottom)

All DSC designs presently in use at Calvert Cliffs (NUHOMS-24P and NUHOMS-32P DSC) and future designs (NUHOMS-32PHB DSC) will be covered by this program. As described in Table 3.3-1 of Reference 2 these components are fabricated of stainless steel. While the bottom shield plug contains lead, that material is not exposed to the external environment of concern and does not support the pressure/confinement boundary intended function of the subcomponent.

A1.3.2 Environments

As described in Table 3.3-1 of Reference 2, the DSC is positioned for long term storage inside of the Horizontal Storage Module (HSM), which is considered a sheltered environment. The internal environment is helium. The external environment is ambient air at a temperature ranging from ambient (70°F normal with a range of -3°F to 103°F) to 60°F above ambient (T/S 3.4.1.1 maximum air temperature rise). Average ambient relative humidity is 77% in the morning and 55% in the afternoon (Reference 3, Table 1-10). The June 2012 Lead Canister Inspection (Reference 4) also determined that there are deposits on the upper surface of the DSC shell. Samples of these deposits were collected and analyzed by two separate labs (Reference 5

Enclosure 1 and Reference 6 Appendix D). The deposits were found to be composed of large particles (20-40 µm) which were primarily pollen and quartz and finer particles (< 5 µm) that consisted of soluble salts and insoluble minerals (silicates and oxides). The salts were dominantly gypsum and appeared to be continental rather than marine in origin. The predominant elements include silicon, calcium, and iron with somewhat lesser amounts of aluminum and magnesium. The major anion species are sulfate and nitrate. The major cation species are Ca^{2+} with somewhat less amounts of K^{+}, Na^{+}, and Mg^{2+}. The iron is likely from the scraping process used to collect the deposits from the DSC and the calcium is partially due to the high calcium content in the HSM concrete. Chlorides were relatively rare, and the highest surface concentration indicated by any of the samples was 5.2 mg/m^2.

Reference 7 Enclosure 1 provides a thermal analysis to determine temperatures on the outer surface of the Calvert Cliffs NUHOMS-24P and NUHOMS-32P DSCs for various heat loads, to identify the heat load at which the confinement weld temperatures on the outer surface of the DSCs is at 80°C. Dry shielded canisters may be susceptible to CISCC initiation between 30 and 80°C (The basis for this range is discussed in Reference 7 Enclosure 3). The evaluation was done for the design basis normal ambient condition of 70°F. The thermal evaluation shows that at least one portion of the longitudinal weld located close to the top cover plate, which faces the back wall of the HSM, remains below 80°C for all heat loads between 2 kW and 19 kW. The temperature at this location is 80°C for a heat load of approximately 23.9 kW based on the linear fitting of the data. The maximum design basis heat loads of the DSCs in use at Calvert Cliffs are 15.84 kW for the 24P DSC, and 21.12 kW for the 32P DSC. Even maximum DSC shell temperatures fall below 80°C for the highest heat load 24P DSC in service at Calvert Cliffs (Loading 48 in 2005) after 19.5 years of storage, and after 35.5 years of storage for the highest heat load 32P DSC in service to date (Loading 66 in 2010).

A1.3.3 Aging Effects Requiring Management

As discussed in Section 3.3.6 of Reference 2, the Aging Management Review of the DSC in the sheltered air environment inside the HSM did not identify any aging effects/mechanisms that could lead to a loss of intended function. However, it is recognized that since that review, operating experience (Reference 8 and research (References 9 – 11) have surfaced indicating that stress corrosion cracking of stainless steel components can occur in humid air environments at specific temperature ranges and surface chloride concentrations. While it appears that the DSCs are presently below the lowest surface chloride concentrations discussed in the above research, it appears prudent to establish a program to monitor the DSCs for the following aging effects associated with stress corrosion cracking:

- Loss of material due to corrosion (e.g., crevice corrosion and/or pitting that may be a precursor to stress corrosion cracking).
- Cracking due to stress corrosion cracking (SCC).

A1.3.4 Program Description

The purpose of the DSC aging management program is to manage the aging effects on the external surfaces of the DSC shell assembly subject to aging effects that need to be managed for the period of extended operation. The program manages aging effects through inspection of

external surfaces for evidence of loss of material due to corrosion, pitting (e.g., crevice corrosion and pitting), and cracking due to SCC.

A1.3.5 <u>Evaluation of Technical Basis</u>

A1.3.5.1 Scope

The scope of the DSC aging management program involves monitoring of the exterior surfaces of the DSC shell and cover plate for the effects of aging associated with stress corrosion cracking. The first DSC examined in June 2012 was DSC-6 in HSM-15, which was loaded in November 1996 and contained the "lead canister" identified to have the highest integrated neutron, gamma, and thermal exposure at the time of the inspection (Reference 12) as required by the draft NUREG-1927 Appendix E requirements. The second DSC inspected in June 2012 was DSC-11 in HSM-1 which was loaded in November 1993 (the first loading) and represents one of the lowest heat load canisters ever loaded. Calvert Cliffs may add additional DSCs for subsequent inspections if the HSM AMP requires internal inspections of modules other than those inspected in 2012 (it is expected that the integrated thermal and radiological source terms of the more recently loaded NUHOMS-32P canisters will surpass that of the June 2012 "lead canister" before the next inspection). The population DSCs for each subsequent inspection shall always include the DSCs examined in previous inspections for trending purposes.

A1.3.5.2 Preventive Actions

The DSC External Surfaces Aging Management Program consists of condition monitoring to confirm there is no degradation of the DSC shell or cover plates that would result in a loss of the pressure/confinement boundary intended function. No new preventive or mitigating attributes are associated with these activities.

A1.3.5.3 Parameters Monitored or Inspected

The DSC External Surfaces Aging Management Program provides visual inspections to monitor for signs of material degradation on the external surfaces of the DSC shell assembly and cover plate. The visual inspection is intended to identify the following parameters that could be precursors to, or actual signs of, the effects of stress corrosion cracking:

- Crevice and pitting corrosion (loss of material)
- Surface cracking

In addition to visual examination, the aging management program will continue to collect samples of surface deposits on selected DSCs to allow for trending of surface chloride concentration with visual results from inspections at Calvert Cliffs and other sites. Selection of DSCs for surface deposit collection will be done considering the age of the DSC (with preference for the oldest in the population inspected), the availability of access to undisturbed deposits on the surface of the DSC, the personnel dose required to retrieve the samples, and visual examination results (priority may be given to deposit collection on DSCs failing to meet visual acceptance criteria).

A1.3.5.4 Detection of Aging Effects

Aging effects due to loss of material from crevice and pitting corrosion, and cracking due to SCC of stainless steel will be managed using visual inspection in accordance with ASME Section XI and performed by site qualified individuals.

The DSC External Surface Aging Management Program will be based on proven technology reasonably available at the time the inspection is conducted which is capable of meeting the physical access and environmental constraints of the HSM interior. The June 2012 visual inspection was conducted by remote and direct means with a GE Everest Ca-Zoom 6.2 PTZ100, which is a remote controlled high definition pan-tilt-zoom (PTZ) camera system with a 100mm head. The remote inspection was performed by lowering the camera through the HSM rear outlet vent which allowed for viewing of the majority portion of the DSC, its support structure, and the interior surfaces of the HSM. The direct inspection was performed through the partially open door by mounting the camera on a pole. Based on manufacturer specifications, this camera is capable of handling dose rates up to ~1000 R/hr, which limits its physical location to the plane of the rear outlet vent based on the dose fields calculated for the HSMs inspected to date (Reference 12). This inspection system and delivery method will be treated as the baseline for the purposes of developing this AMP.

Based on the location, lighting and resolving power of the baseline inspection system discussed above, and the known presence of deposits on the shell upper surface, Calvert Cliffs will commit to performing the inspection of the DSC to ASME Section XI Article IWA-2210 VT-3 standards. Based on ASME Section XI IWA-2213 the VT-3 examination is suitable for determining general mechanical and structural condition of components, including signs of corrosion. Based on ASME Section XI Table IWA-2210-1, the VT-3 method must demonstrate capability to resolve characters that are 2.7 mm in height. Based on this it is judged to be suitable for identifying signs of heavy pitting corrosion that are considered pre-cursors to stress corrosion cracking. The condition of the DSC shell at the support rail contact region will be accessed based on the appearance of the visible regions immediately adjacent to the crevice location.

At the discretion of the inspector, unless required by the results of a prior inspection, the inspection of selected areas on the DSC may be upgraded to the standards of ASME Section XI Article IWA-2210 VT-1 if access, dose, lighting and camera resolution allow. The VT-1 examination is specifically conducted to detect cracks per ASME Section IWA-2211, and is capable of resolving characters that are 1.1 mm in height. Based on the baseline inspection system and delivery method discussed above, potential candidate areas for this enhanced inspection for DSCs located in an HSM of the design inspected in June 2012 are the DSC top cover plate and closure weld, the section of the longitudinal weld nearest the top end of the DSC shell, the grapple ring, and portions of the DSC bottom shield plug facing the HSM door.

The qualification of inspection personnel shall be accomplished in accordance with site procedures for the type of inspection conducted, and shall meet the requirements of ASME Section XI Article IWA-2300.

The frequency of the inspection shall be as determined by the monitoring/trending discussed in Section A1.3.5.5 and inspection acceptance criteria discussed in Section A1.3.5.6.

A1.3.5.5 Monitoring and Trending

The inspection required by the DSC External Surfaces AMP is performed at intervals defined by the toll gate assessments described in Table A1.3-1. The inspection may be completed within a time period of one year before or after the date indicated in Table A1.3-1. The June 2012 inspection is considered to be the baseline inspection for the DSC-6 and DSC-11, and the first inspection of any additional DSC added to the inspection population will be considered the baseline for that DSC. As discussed in Section A1.3.5.1, the population DSCs for each subsequent inspection shall always include the DSCs examined in previous inspections for trending purposes. Trends to be considered include:

- DSC surface chloride concentration.
- Changes in DSC surface appearance with emphasis on increases in area covered by stains/discolorations or corrosion pits compared to the baseline.

This trending information will feed both the toll gate assessments discussed in Table A1.3-1 and the acceptance criteria discussed in Section A1.3.5.6.

Table A1.3-1, DSC External Surfaces AMP Toll Gate Assessments

Toll Gate	Year	Assessment
1	2017	Starting in this year, perform inspections of the identified population of Calvert Cliffs DSCs. Inspection will be performed at 5-year intervals unless changed by the 2nd toll gate assessment.
2	2022	Following the 2022 DSC external surfaces inspection, evaluate information obtained from Calvert Cliffs DSC inspections, and information from any other inspections of NUHOMS DSCs at other sites, if available. Also review any new research on minimum chloride concentrations required to initiate SCC on stainless steel in atmospheric environments. IF no acceptance criteria have been failed in prior inspections at Calvert Cliffs, AND DSC surface chloride concentration trends indicate they would remain below threshold values necessary to initiate SCC for the next 10 years, the interval between subsequent inspections may be increased to 10 years. If ANY acceptance criteria of subsequent inspections are failed, the inspection interval will be reduced back to
3	2032	Evaluate any other new information to determine if changes to

Toll Gate	Year	Assessment
		program frequency or inspection methods are warranted.

A1.3.5.6 Acceptance Criteria

The acceptance criteria for the DSC External Surface Aging Management Program are defined to ensure that the need for corrective actions will be identified before loss of intended functions. Visual examination via the use of remote digital camera is based on ASME VT-3 examination or equivalent (ASME Section XI Table IWA-2211-1). Inspection acceptance criteria are as follows:

- Indications of crevice corrosion or heavy pitting corrosion are absent, or have not increased in size from the previously evaluated baseline.
- Discoloration or stains identified in baseline inspections have not increased in size, and new areas of discoloration or staining have not appeared since the prior inspection.
- Cracks are absent within the material.

Based on the inspection, the DSC is determined to be either Acceptable, Acceptable with Defects, or Unacceptable. The following describes conditions that could lead to each determination and the appropriate response:

- Acceptable signifies that a component is free of significant deficiencies or degradation that could lead to the loss of intended function. No further action is required prior to the next inspection.
- Acceptable with Defects signifies that a component contains deficiencies or degradation but will remain able to perform its design basis function until the next inspection. Signs of new or increased areas of pitting, crevice corrosion, or staining, or could lead to such a determination. A condition report will be initiated in the site corrective action program to document this evaluation and determine if the subject location should be inspected to ASME Section XI VT-1 standards during the next regularly scheduled AMP inspection.
- Unacceptable signifies a component contains deficiencies or degradation that either prevents (or could prevent prior to the next inspection) the ability to perform their design basis function. An example would be positive identification of the presence of cracks on the DSC surface. A condition report will be initiated in the site corrective action program to drive further evaluation, characterization, and other actions as needed to preserve the DSC intended function. Timing of these actions shall be as described in Section A1.3.5.7.

Acceptance of any degraded condition for continued service is in accordance with facility procedural requirements, includes an engineering evaluation using plant design procedures, industry codes and standards, and conforms to site license.

A1.3.5.7 Corrective Actions

Corrective actions, including apparent or root cause determinations are performed in accordance with the 10 CFR Part 50 Appendix B Program and site corrective action procedures. Corrective actions are taken in a timely manner commensurate with the significance of the defect. Deficiencies are either corrected or are evaluated to be acceptable for continued service through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis conditions.

In the event that a stress corrosion crack is determined to be present on a DSC, corrective actions necessary to ensure intended function is maintained or restored shall be completed within 5 years from the time of discovery, provided the DSC heat load at the time of discovery is less than 5 kW for a 24P DSC or 6 kW for a 32P DSC. The basis for this is the analysis provided in Enclosure 5 of Reference 7, which indicates that there would be substantial margin to the time required for fuel damage to occur on air exposure at this heat load (> 35 years). Response times for higher heat load DSCs requiring corrective action shall be determined based on the above mentioned analysis to ensure that fuel damage due to air exposure does not occur.

A1.3.5.8 Confirmation Process

Activities initiated in accordance with the implementing procedures for the DSC aging management program, such as corrective actions, are subject to Quality Assurance Program controls. Thus, the effectiveness is monitored using Corrective Action Program procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Use of these procedures, processes, and controls ensures that corrective actions are taken and are effective.

A1.3.5.9 Administrative Controls

The DSC External Surfaces Aging Management Program is subject to Corrective Action and Quality Assurance procedures, review and approval processes, and administrative controls. These are implemented in accordance with site procedures and the requirements of 10 CFR Part 50, Appendix B, and will continue to be adequate for the renewed license (extended storage) period.

A1.3.5.10 Operating Experience

The Calvert Cliffs ISFSI has been in operation since 1992. As discussed in Section 3.1.5 of Reference 2, plant-specific and industry operating experience, as well as a review of ISFSI files, did not indicate any aging related deficiencies with the DSC components. Future examinations and inspections are performed in accordance with plant procedures and repetitive maintenance tasks. Operating Experience from other sites will be obtained via the INPO OE database, NRC Information Notices, EPRI Reports and/or participation in industry groups such as the TransNuclear Users Group and reviewed in accordance with site Operating Experience review procedures for applicability to the Calvert Cliffs ISFSI.

A1.3.6 Conclusion

The DSC External Surfaces Aging Management Program provides reasonable assurance that the aging effects will be managed, such that the intended functions of the DSC will be maintained under current licensing basis conditions for the period of extended operation.

A1.4 HSM AGING MANAGEMENT PROGRAM

The ISFSI provides for long-term dry interim storage for irradiated fuel assemblies until such time that the irradiated fuel assemblies are shipped off site for final disposition. The fuel assemblies are confined in stainless steel canisters. Each canister is protected and shielded by a concrete HSM and rests on a steel support rail assembly that is anchored to the walls of the storage module and restrained inside the storage module. Other steel components provide heat shielding, screens, and attachments, both inside and outside the modules. The HSM AMP includes the following:

A1.4.1 Materials

HSM structural components subject to AMR are as follows:

- Reinforced concrete
- Carbon steel members
- Stainless Steel
- Aluminum

A1.4.2 Environments

HSM structural components subject to AMR are exposed to the following environment:

- Internal (sheltered)
- External
- Embedded (steel)

A1.4.3 Aging Effects Requiring Management

The following aging effects require management:

- Cracking or loss of material (spalling, scaling) or corrosion of steel due to moisture, chemical attack and leaching.
- Cracking of concrete due to settlement, loss of bond with reinforcing steel.
- Cracking or loss of material (spalling, scaling) due to freeze-thaw degradation.
- Irradiation (concrete and steel).
- Increase in porosity/permeability and loss of strength due to leaching of $Ca(OH)_2$.

A1.4.4 Program Description

The purpose of the HSM AMP is to:

- Ensure that no significant degradation to the HSMs occurs
- Maintain the air inlets and outlets free from obstructions

A description of the HSM AMP is provided below using the program elements of an effective AMP as listed in Section A1.2.

A1.4.5 Evaluation of Technical Basis

(1) Scope

The scope of the HSM AMP for external and internal surfaces program includes visual inspection of accessible concrete and steel components including HSM walls, roof, and floor slab, HSM access door, DSC support structure and rail assembly, heat shields, air inlet and outlet vents, embedments and anchorages (i.e., structural connections including anchor bolts, cast-in-place bolts, thru-bolts, and mounting hardware).

The program consists of periodic visual inspections by personnel qualified to monitor structures and components for applicable aging effects, such as those described in the American Concrete Institute (ACI) Standards 349.3R-02, ACI 201.1R, and American National Standards Institute/American Society of Civil Engineers Standard (ANSI/ASCE) 11.

For coated HSM carbon steel subcomponents, no credit is taken for coating for the prevention of aging effect from the AMR. However, this AMP will manage loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage.

(2) Preventive Actions

The AMP is primarily a condition monitoring program. With the exception of daily surveillances to ensure HSM inlets and outlets are not obstructed, no preventive actions are performed. Maintaining the inlets and outlets free from obstruction ensures temperatures are not elevated for prolonged periods, the concrete is not subject to related damage, and overheating of the components inside an HSM is prevented.

(3) Parameters Monitored or Inspected

Consistent with the current Nuclear Regulatory Commission position relative to including concrete in an AMP, the accessible concrete is visually examined for indication of surface deterioration. Degradation could affect the ability of the concrete to provide support to the DSCs, to provide radiation shielding, to provide missile shielding, or to provide a path for heat transfer. The above-grade exterior concrete is accessible. The below-grade exterior concrete surfaces are inaccessible. Interior concrete is accessible for remote exams. The above-grade exterior concrete is a leading indicator for the interior concrete.

ACI 349.3R-02 and ANSI/ASCE 11 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete and steel structural elements.

a) Above Ground Concrete

Steel on the external surface of the HSMs which is subject to wetting/moisture is visually examined for the aging effect of loss of material (corrosion). This aging effect could affect the ability of the steel to perform its intended function.

The initial stage of corrosion often produces cracking, spalling and staining in the surrounding concrete. The visual survey should identify the source of any staining or corrosion-related activity and the degree of damage. Exposed steel reinforcement, corroded anchorages and embedments, severe staining, or loss of monolithic behavior should be evaluated with other nondestructive examination (NDE) methods to be determined and inspected by a qualified structural engineer.

Surveillances of area radiation levels are made and compared to established limits. Levels exceeding limits are investigated for potential degradation of the HSM components. Increased levels could indicate a reduction in the ability of the concrete and steel to provide adequate radiation shielding, or could indicate a breach in the containment function of the DSC or irradiated fuel assemblies. Dose rates are measured at predetermined locations on the HSMs.

Daily surveillances are performed by security personnel to ensure the air inlets and outlets are free from obstructions, thereby preventing reduced air flow and potential overheating of the components located inside an HSM. Plant procedures are in place for these inspections and surveillances.

A monitoring and trending program will be established under the CAP for degradations that meet the ACI 349.3R-02 Tier 2 and 3 criteria.

b) Below Ground Concrete:

Exposure of concrete to penetrating water can result in the leaching of salts and chlorides producing a loss of mechanical properties. Because exposure to moisture is required to produce leaching, the concrete below ground is susceptible. To help monitor the condition of below ground concrete in the ISFSI area, groundwater sampling will be performed at a minimum of three locations every five years in order to trend the potential for corrosive environment existing in the area of the ISFSI. The site will use a tollgate approach to this monitoring so that the results after several performances of this monitoring will be used to determine subsequent frequency of the monitoring.

c) Reinforcing Steel and Embedments

The visual survey should identify the source of any staining or corrosion-related activity and the degree of damage. The visual survey is performed in accordance with Calvert Cliffs site procedure MN-1-319, Attachment 4 (concrete structure walkdown checklist). Observance of exposed steel reinforcement, corroded anchorages and embedments, severe staining, or suspected loss of monolithic behavior would be entered into the

site's CAP for further evaluation with other testing methods as determined by an authorized structural engineer.

d) Inlet and Outlet Vents

A daily surveillance performed by security personnel ensures that the inlet and outlet vents are free from obstruction consistent with the ISFSI Technical Specifications.

The in-service HSMs (#1 through #72) have embedment around the vent areas to which the vent screens are bolted. The new modular HSMs have structural mounting bolts attaching the outlet vent modules. To date there has been no "Freeze-Thaw" degradation on either the in-service or new HSMs.

e) Interior Concrete and Rails

Visual inspections can be conducted by remote and direct methods using high-resolution remote pan-tilt-zoom camera that is capable of detecting age-related degradation such as loss of material due to corrosion, and cracking of metallic components. Remote inspection is conducted using a camera and/or fiber-optic technology through openings, such as HSM air inlets and outlets. The HSM access door can be removed for direct inspection of the DSC bottom end for signs of aging degradation.

(4) Detection of Aging Effects

The first examination was performed on the selected HSM in June 2012. The HSM selected for inspection was one that contained a DSC which had the longest time in service, and/or other parameters that contributed to degradation. Results of this inspection were provided in Reference 13. This inspection provides baseline information that will be used during subsequent examination of the same HSM(s) for trending purposes.

The examination method used for the accessible concrete and steel is primarily a visual examination at an established frequency. Refer to Table A1.4-1 for inspection details.

The visual examination involves monitoring the interior and exterior surfaces of the HSMs, including visual inspection of the accessible concrete, any exposed steel subcomponents, embedments, and attachments, and the lightning protection system. Interior inspections are performed on the HSMs prior to cask loadings in accordance with the applicable plant procedure. Exterior inspections are conducted yearly.

(5) Monitoring and Trending

The HSMs are inspected annually for above ground concrete structures. This includes aging mechanisms surveillance tests for monitoring radiation and contamination that could identify a crack in the shielding or a loss of the containment function. This surveillance is performed monthly per the Radiological Environmental Monitoring Program to monitor the ISFSI dose. If any pre-established limits are exceeded, site engineering is required to be notified and the issue would be entered into the site's CAP.

As previously discussed, the below ground concrete is monitored by the periodic ground water sampling.

(6) Acceptance Criteria

A set of inspection attributes and acceptance standards for steel and concrete that is commensurate with industry codes, standards, and guidelines has been established. American Concrete Institute Standard 349.3R-02 includes a quantitative three-tier acceptance criteria for visual inspections of concrete surfaces, namely (1) acceptance without further evaluation, (2) acceptance after review, (3) acceptance requiring further evaluation. Acceptable signifies that a component is free of significant deficiencies or degradation that could lead to the loss of structural integrity. Acceptable after review signifies that a component contains deficiencies or degradation but will remain able to perform its design basis function until the next inspection or repair. Acceptance requiring further evaluation signifies that a component contains deficiencies or degradation that could prevent (or could prevent prior to the next inspection) the ability to perform their design basis function.

Degradations or conditions meeting the ACI 349.3R-02 Tier 2 and 3 criteria will be entered into the site's CAP for evaluation and resolution.

Technical justification shall be provided for any deviation from ACI 349.3R-02 acceptance criteria.

a) Concrete

The loss of material due to age-related corrosion of carbon steel components in the HSM shall be evaluated by a Structural Engineer in accordance with ACI 349.3R-02. A technical basis will be provided for any deviation from ACI 349.3R-02 acceptance criteria.

Acceptance Criteria for the HSM AMP for both stainless and carbon steel components shall be based on the design methodologies defined in CCNPP ISFSI USAR Section 4.2.1.1.

Calvert Cliffs ISFSI USAR Section 4.2.1.1 references "American Institute of Steel construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"' 8th Edition.

A professional Structural Engineering firm conducted an evaluation of selected HSMs in June 2012. This evaluation consisted of up-close visual survey and hammer sounding of selected units. The scope of evaluation included locations where degradation was previously identified in CAP. Results of the evaluation indicated HSMs structures are in good condition.

b) Inlet and Outlet Vents

A daily surveillance performed by security personnel ensures that the inlet and outlet vents are free from obstruction consistent with the ISFSI Technical Specifications. Any blockage would be removed and the issue would be captured in the site's CAP.

c) Corrective Actions

Degradations or conditions meeting ACI 349.3R-02 Tier 2 or Tier 3 acceptance criteria will be entered into the site's CAP. Corrective actions undertaken to resolve the degradation and condition could require (i) a modification to the existing AMP, and/or (ii) official notification to the Nuclear Regulatory Commission (NRC).

Corrective actions are taken in a timely manner commensurate with the significance of the defect. Deficiencies are either promptly corrected or are evaluated to be acceptable through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis conditions.

d) Confirmation Process

Activities initiated in accordance with the implementing procedures for the HSM AMP, such as corrective actions, are subject to Quality Assurance Program controls. Thus, the effectiveness is monitored using CAP procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Use of these procedures, processes, and controls ensures that corrective actions are taken and are effective.

e) Administrative Controls

The HSM AMP is subject to the site's Corrective Action and Quality Assurance procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B, and will continue to be adequate for the renewed license (extended storage) period.

f) Operating Experience

<u>Calvert Cliffs Operating Experience</u>

The ISFSI has been in operation since 1992. Since that time Calvert Cliffs has conducted examinations and inspections performed in accordance with plant procedures and repetitive maintenance task. Deficiencies when noted have been entered into our CAP for evaluation. While our operating experience has not indicated any significant degradation to any of the HSM component, several minor degradations on external concrete surfaces have been noted. To provide a current assessment of these external degradations Calvert Cliffs, engaged in June 2012, a licensed structural engineering firm to perform a cursory visual inspection of all in use HSMs and an up-close visual survey and hammer sounding of selected HSM units, including those for which earlier minor degradation had been noted. In all cases the crack widths noted during this inspection were less than 0.04 inches and hammer soundings in their vicinity indicated sound concrete in the area. Based on their findings, the structural engineering firm

indicated the HSM structures were in good condition and did not identify any issues that currently warranted further evaluation. In addition the structural engineering firm also recommended continued monitoring and inspections in accordance with ACI 349.3R-02.

Also in June 2012, Calvert Cliffs performed an inspection of the interior HSM structure of two HSMs in conjunction with an inspection of the exterior surface of the DSC. Overall the visually accessible surfaces of the HSM concrete walls, roof and floor all appeared to be in good condition with little to no signs of spalling or cracking. There was evidence of localized water intrusion to the interior of the HSM as indicated by a few concrete stalactites. These stalactites were seen only in the vicinity of the rear outlet vents. This suggests the source of the water intrusion came from the outlet vent stack. Broken stalactite debris was also observed on the surface of the heat shields. Water was observed to flow inward along concrete surface cracks. The pure white color of the stalactites observed indicated that water had not penetrated to the rebar. A condition report was initiated to evaluate the possible implications this could have on the HSM capability to perform their function in later years.

A coating of dust/dirt was present on the floors of each HSM but no debris or standing water was observed. In both HSMs the DSC structural support beams and rails were in good condition, with coating intact in most areas. There were no signs of loose or missing bolts or fasteners. There was some general surface corrosion noted on the carbon steel surface and bolting hardware. This general surface corrosion was limited and does not represent a current challenge to the capability of the DSC structural supports to perform their function.

These inspections have served to provide a baseline status that will be used in future periodic inspections to trend HSM material conditions. This will help ensure that accelerated degradation will be detected before the HSM structures are unable to perform their design function and that appropriate corrective actions can be implemented.

Industry Operating Experience

Industry operating experience for the ISFSI is conducted in accordance with site's Operating Experience Program. The Operating Experience program reviews issues identified from a variety of sources including NRC, Institute of Nuclear Power Operations, Industry Owner groups, etc.. Issues are evaluated and can result in the issue being entered into the CAP and evaluated for whether there is a need for modifying the AMP.

One significant industry operating experience involved Three Mile Island HSMs. In 2000 cracks were noted in the HSMs and the cracks were considered cosmetic and insignificant. However in 2007 the licensee observed continued cracking, crazing, and spalling as well as increased efflorescence on the HSM surfaces. An evaluation was performed which indicated the HSMs were still capable of performing their design basis

function. In 2008 it was noted that 28 of 30 HSMs had cracks of which most were emanating from the anchor bolt blockout holes. At this point it was determined the HSMs were prematurely deteriorating and that continued crack growth could affect the HSMs ability to perform their design basis function for the duration of their service life. It was concluded that the cracks were the result of water entering the anchor bolt blockout holes on the roof of the HSMs. Subsequent freeze and thaw cycles initiated the crack formation.

To date Calvert Cliffs has not experienced any cracking that is due to freeze thaw cycles. Although this has not occurred, the lessons learned from this issue will be factored into our visual inspections of the HSM structures including that personnel performing the inspections or evaluations will meet the qualification requirements of ACI 349.3R-02 and that the visual inspections will be performed in accordance with the requirements of ACI 349.3R-02 and ACI 201.1R-08.

A1.4.6 Learning AMP

The HSM AMP is a "learning" AMP. This means that this AMP will be updated, as necessary, to incorporate new information on degradation due to aging effects identified from plant-specific inspection findings, related industry operating experience, and related industry research. Future plant-specific and industry operating experience is captured through the site's operating experience review process following the regulatory framework for the consideration of operating experience concerning aging management and age-related degradation in LR-ISG-2011-05.

The ongoing review of both plant-specific and industry operating experience will continue through the period of extended operation to ensure that the program continues to be effective in managing the identified aging effects. Calvert Cliffs reviews of operating experience in the future may identify areas where AMPs should be enhanced or new programs developed.

Calvert Cliffs maintains the effectiveness of this AMP under our quality assurance programs used to meet the criteria of 10 CFR Part 72, Subpart G, and 10 CFR Part 50, Appendix B, respectively.

A1.4.7 Conclusion

A review of industry operating experience identified a large number of events related to dry storage. Many of these were event-driven incidents, and most were not related to aging management. However for the incidents that involved aging mechanisms, barrier analyses were conducted to assess Calvert Cliffs' susceptibility to these mechanisms. Our review indicated the aging mechanisms are bounded by the AMR performed for the Calvert Cliffs SSCs.

Operating experience to date has not indicated any significant degradation to any of the HSM components. Inspections and surveillances that would identify any deficiencies continue to be conducted. A CAP is in place to track and correct deficiencies in a timely manner. Continued implementation of the ISFSI AMP provides reasonable assurance that the aging effects will be managed, such that the intended functions of the HSM components, particularly the structural

concrete and steel of the HSMs, will be maintained under current licensing basis conditions for the renewed license period.

Table A1.4-1

Program	Frequency	Inspection
HSM Aging Management	Every 10 years	• The first examination was performed on the selected DSC in June 2012. The HSM/DSC selected for inspection was one that had the longest time in service, and/or other parameters that contributed to degradation. Results were provided in Reference 4. All subsequent examinations must also be performed within 2 years before or after the date of the 10-year interval. The same HSM/DSC(s) shall be used for each subsequent examination for trending.
	Every 5 years	• Groundwater sampling of poured in place HSMs in a minimum of 3 locations every 5 years to trend potential for corrosive environment. • Visual inspections by personnel qualified to monitor structures and components for applicable aging effects, such as those described in the ACI Standards 349.3R-02, ACI 201.1R, and ANSI/ASCE Standard 11. • ACI 349.3R-02 and ANSI/ASCE 11 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete and steel structural elements.
	Annually	• To perform HSM rebar inspection and looking for spalled and cracking concrete. • For coated HSM carbon steel subcomponents, no credit is taken for coating for the prevention of aging effect from the AMR. However, this AMP will manage loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage.
	Daily	• Daily surveillances are performed by security personnel to ensure the air inlets and outlets are free from obstructions, thereby preventing reduced air flow and potential overheating of the components located inside an HSM.
	Prior to Loading Cask	• Inspect in accordance with plant procedures.

A1.5 <u>TRANSFER CASK AGING MANAGEMENT PROGRAM</u>

The transfer cask is used to transport the DSCs containing the irradiated fuel assemblies from the spent fuel pool to the corresponding HSMs (and back as necessary). The transfer cask subcomponents, materials, environments and aging effects requiring management are described in Attachment (1) Section 3.5 of Reference 2.

The purpose of the transfer cask AMP is to ensure that no significant degradation to the transfer cask occurs, with the focus being on the frequently wetted surfaces, as well as carbon steel surfaces, prior to its use for future retrieval of a DSC from the corresponding HSM.

A description of the transfer cask AMP is provided below using the program elements of an effective AMP as listed in section A1.2.:

A1.5.1 Materials

The transfer cask AMP is applicable to the transfer cask and subcomponents. The focus of this AMP is on the stainless steel subcomponents that have frequently wetted surfaces and, conservatively, those external surfaces exposed to outdoor conditions and intermittent wetting. It also conservatively includes carbon steel subcomponents that are exposed to weather and other forms of moisture (e.g., humidity).

The program performs visual inspections of the exterior surfaces.

A1.5.2 Environments

Transfer cask structural components subject to AMR are exposed to the following environments:

- Sheltered
- External
- Borated Water in SFP

The transfer cask and lifting yoke are stored in a dry inside environment while not in use for fuel moves. During fuel moves the cask and yoke are washed down with demineralized water upon removal from the pool water. These steps are contained within the site procedure covering the loading and transfer of a DSC from the spent fuel pool.

A1.5.3 Aging Effects Requiring Management

The following aging effects associated with the TC structural components require management:

- Loss of material due to general corrosion
- Loss of material due to pitting and crevice corrosion

Loss of material due to wear.

A1.5.4 Program Description

The objective of the program is to manage the aging effects of loss of material due to general, pitting, and crevice corrosion of the external surfaces of the components in the transfer cask. The transfer cask AMP is based on visual inspections. This program consists of visual inspections of the components of transfer cask and subcomponents. The program manages aging effects through visual inspection of external surfaces of the transfer cask and subcomponents are intact and free from loss of material due to general, crevice or pitting corrosion for intermittent wetted surfaces and loss of material due to wear. Liquid penetrant exams will be performed on

the cask trunions including all welds to the trunions and approximately 2" on the cask surface. If a weld on the trunions show defects an ultrasonic examination shall be performed.

A1.5.5 Evaluation and Technical Basis

(1) Scope

This program visually inspects and monitors the transfer cask and subcomponents to ensure that they are intact and free from loss of material due to general, crevice, or pitting corrosion for intermittent wetted surfaces.

The program performs visual inspections of the cask exterior to prevent the corrosion of exposed surfaces. The program also performs PT exams on the trunion welds including 2" on the cask surface.

(2) Preventive Actions

The transfer cask AMP includes guidance and direction for maintaining a suitable environment that precludes the onset or propagation of a loss of material due to crevice or pitting corrosion for continuously wetted surfaces.

The parameter inspected by the transfer cask AMP is visual evidence of degradation of external surfaces of the transfer cask.

Visual inspections of external cask and cask lid surfaces are performed every 5 years or prior to moving a DSC (if no other inspection has been performed), to ensure that the intended function of the cask subcomponents are not compromised. Visual inspections look for signs of deterioration (corrosion). In accordance with ASME Section XI IWA-2211, the VT-1 visual examination is conducted to detect discontinuities and imperfections on the surface of components, including such conditions as cracks, wear, or corrosion in order to provide confidence the transfer cask remains able to perform its intended function.

Penetrant testing will be performed on the four transfer cask trunnions and 2" on cask surface. The repetitive task is performed once every 5 years or prior to moving a DSC. It includes examination of the entire trunnion surface including 2 inches on the cask surface.

(3) Parameters Monitored or Inspected

Visual aging management inspections of external cask, upper and lower trunnion assembly, and cask lid surfaces are performed at least once every five years or prior to each use, to ensure that the intended function of the pertinent cask subcomponents are not compromised. Visual inspections look for signs of deterioration (corrosion) and wear.

(4) Detection of Aging Effects

Loss of material for stainless steel subcomponents due to crevice and/or pitting corrosion in wetted locations and for carbon steel subcomponents due to general corrosion in moist atmospheric environments is an aging effect that is managed by the AMP. The transfer cask

AMP relies upon a visual inspection to determine the physical condition of the exterior surfaces of the transfer cask and lid, prior to its use for DSC transfers. These inspections check for loss of material (corrosion).

(5) Monitoring and Trending

Visual inspections will determine the existence of loss of material on the external surfaces of the transfer cask, and observations regarding the material condition are recorded in accordance with inspection procedures and are corrected or evaluated as satisfactory before use of the transfer cask. These inspections are either performed periodically or during the preparations for retrieval of a DSC from the corresponding HSM.

- VT-1 examination or equivalent IAW ASME XI Table 2211-1 for visual evidence of degradation of external surfaces of transfer cask once every five years or prior to each use.
- PT examination of trunions and 2” on cask surface once every five years or prior to each use. PT examination IAW ASME III Div. 1 1986 and ANSI N14.6 1978

Evaluation of this information during the preparations for DSC retrieval and transfers provides adequate predictability and allows for corrective action prior to the need for the intended function of the component to be performed.

(6) Acceptance Criteria

The transfer cask AMP acceptance criteria for exterior surfaces are no unacceptable loss of material that could result in a loss of component intended function(s).

- Acceptance criteria not met if corrosion is observed.
- CAP relies on engineering evaluation for further action up to and including NDE inspection.

Unsatisfactory degradation is entered in the CAP for evaluation and resolution.

(7) Corrective Actions

Corrective actions, including root cause determinations are performed in accordance with the CAP. Corrective actions are taken in a timely manner commensurate with the significance of the defect. Deficiencies are either promptly corrected or are evaluated to be acceptable through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis conditions. Each of the implementing procedures associated with the transfer cask AMP is within the scope of the CAP.

(8) Confirmation Process

Activities initiated in accordance with the implementing procedures for the transfer cask AMP, such as corrective actions, are subject to Quality Assurance Program controls. Thus,

the effectiveness is monitored using CAP procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Use of the procedures, processes, and controls ensures that corrective actions are taken and are effective.

(9) Administrative Controls

The transfer cask AMP is subject to Corrective Action and Quality Assurance Program procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B, and will continue to be adequate for the renewed license (extended storage) period.

(10) Operating Experience

The ISFSI has been in operation since 1992. The transfer cask has been in use since the initial loading of the ISFSI.

Inspections have been performed on the transfer cask prior to each movement to the ISFSI. These examinations and inspections are currently performed in accordance with a combination of procedures. The overall effectiveness of these inspections in maintaining the condition and functionality of the cask is confirmed by the continued use of the cask. Any deficiencies identified are promptly corrected prior to moving fuel. This same process will be followed, as applicable, for moving the DSCs from the HSM back to the Calvert Cliffs spent fuel pool.

A discussion of pertinent operating experience is contained in Section 3.1.5 of Reference 2. Furthermore, the lack of identification of cask degradation through the existing inspections is evidence that transfer cask activities have been effective in maintaining its condition and functionality.

A review of the operating experience provided objective evidence that the effects of aging have, and will continue to be, adequately managed during the extended period of operation.

A1.5.6 <u>Learning AMP</u>

The transfer cask AMP is a “learning” AMP. This means that this AMP will be updated, as necessary, to incorporate new information on degradation due to aging effects identified from plant-specific inspection findings, related industry operating experience, and related industry research. Future plant-specific and industry operating experience is captured through the licensee’s operating experience review process following the regulatory framework for the consideration of operating experience concerning aging management and age-related degradation in LR-ISG-2011-05.

The ongoing review of both plant-specific and industry operating experience will continue through the period of extended operation to ensure that the program continues to be effective in managing the identified aging effects. Reviews of operating experience by the licensee in the future may identify areas where AMPs should be enhanced or new programs developed.

Calvert Cliffs maintains the effectiveness of this AMP under our quality assurance programs used to meet the criteria of 10 CFR Part 72, Subpart G, and 10 CFR Part 50, Appendix B, respectively.

A1.5.7 Summary

The transfer cask AMP is credited for the management of conditions that could lead to degradation of transfer cask subcomponents from the aging effects and mechanisms shown in Table 3.5-1 in Attachment (1) of Reference 2, and for the management of actual degradation. Based on the above, the continued implementation of the transfer cask AMP activities shown in Table A1.5-1 will provide reasonable assurance that aging effects will be managed, such that the transfer cask subcomponents within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis throughout the renewed license period.

Table A1.5-1

Transfer Cask Aging Management	Every 5 years and prior to each use IAW ANSI/ASME III Div. 1 1986 and ANSI N14.6 1978	• To perform visual inspection of transfer cask exterior surfaces and of carbon steel bolts/washers looking for signs of significant degradation (corrosion) every 5 years as a minimum and before every fuel move. • To perform PT examination on trunions and all attachment welds to trunions including 2” on the cask surface and follow up with UT examination if indications are found.

A1.6 TRANSFER CASK LIFTING YOKE AGING MANAGEMENT PROGRAM

The transfer cask lifting yoke is used to move the transfer cask between the spent fuel pool and the transport trailer. The transfer cask lifting yoke, materials, environments and aging effects requiring management are described in Attachment (1), Section 3.6, of Reference 2.

The purpose of the transfer cask lifting yoke AMP is to ensure that no significant degradation to the transfer cask lift yoke occurs, with the focus being on the repeatedly and intermittently wetted surfaces prior to its use for movement of the transfer cask.

A description of the transfer cask lifting yoke AMP is provided below using the program elements of an effective AMP as listed in Section A1.2.

A1.6.1 Materials

Transfer cask lifting yoke structural components subject to AMR are constructed of the following material:

- Carbon Steel
- Stainless Steel

A1.6.2 Environments

Transfer cask lifting yoke structural components subject to AMR are exposed to the following environments:

- Sheltered
- Treated water (borated water Spent Fuel Pool)

The transfer cask and lifting yoke are stored in a dry inside environment while not in use for fuel moves. During fuel moves the cask and yoke are washed down with demineralized water upon removal from the pool water. These steps are contained within the site procedure covering the loading and transfer of a DSC from the spent fuel pool.

A1.6.3 Aging Effects Requiring Management

The following aging effects associated with the Transfer Cask lifting yoke structural components require management:

- Loss of material due to general corrosion from wetting
- Loss of material due to pitting and crevice corrosion from wetting
- Cracking of material due to stress/strain from lifting

A1.6.4 Program Description

The objective of the program is to manage the aging effects of loss of material due to the consequences of wetting and cracking of the yoke due to imposed strains during lifting of the cask. The transfer cask lifting yoke AMP is based on visual inspections and volumetric exams. This program consists of visual inspections of the yoke and volumetric exams. The program manages aging effects through visual inspection of external surfaces of the transfer cask lifting yoke and subcomponents are intact and free from loss of material due to corrosion for intermittent wetted surfaces and strain of material due form lifting of the cask.

A1.6.5 Evaluation and Technical Basis

(1) Scope

The transfer cask lifting yoke AMP is applicable to the transfer cask lifting yoke. The focus of this AMP is on the components that have external surfaces exposed to intermittent wetting and critical lifting components subject to strain.

The program performs visual inspections of the exterior surfaces due to wetting.

(2) Preventive Actions

The transfer cask lifting yoke AMP includes guidance and direction for maintaining a suitable environment that precludes the onset or propagation of a loss of material due to corrosion for intermittently wetted surfaces.

The parameter inspected by the transfer cask lifting yoke AMP is visual evidence of degradation of external surfaces of the transfer cask lifting yoke.

Visual inspections of transfer cask lifting yoke are performed annually or prior to moving a DSC (if no other inspection has been performed), to ensure that the intended function of the pertinent subcomponents are not compromised. Visual inspections look for signs of deterioration (corrosion).

(3) Parameters Monitored or Inspected

The transfer cask lifting yoke is monitored through.

- Performance of NDE Inspections IAW ANSI/ASME III Div. 1 1986 and ANSI N14.6 1978 (refer to MPM10151G-Hook and Yoke Baseline data).
- Performance of MT IAW ANSI/ASME Section III Div. 1, 1986 PAR. NF 5340.

The inspection consists of both magnetic particle testing and visual testing of the transfer cask lifting yoke. This repetitive task is performed annually. As part of the inspection, yoke dimensions are checked and areas of flaking paint are identified and repainted. During this latest inspection no issues that would impact the ability of the transfer cask lifting yoke to perform its intended function were identified.

(4) Detection of Aging Effects

Loss of material due to corrosion in wetted locations or due to general corrosion in moist atmospheric environments is an aging effect that is managed by this AMP. The transfer cask lifting yoke AMP relies upon a visual inspection to determine the physical condition of the exterior surfaces of the transfer cask lifting yoke, prior to its use for transfers. These inspections check for loss of material due to corrosion.

(5) Monitoring and Trending

Visual inspections will determine the existence of loss of material on the external surfaces of the transfer cask lifting yoke, and observations regarding the material condition are recorded in accordance with inspection procedures. These issues are corrected or evaluated as satisfactory before use of the transfer cask lifting yoke. These inspections are either performed periodically or during the preparations for movement of the transfer cask.

Evaluation of this information during the preparations for DSC retrieval and transfers provides adequate predictability and allows for corrective action prior to the need for the intended function of the component to be performed.

(6) Acceptance Criteria

The acceptance criteria for the transfer cask lifting yoke AMP for exterior surfaces is no unacceptable loss of material that could result in a loss of component intended function(s).

- Perform NDE Inspections IAW ANSI/ASME III Div. 1 1986 and ANSI N14.6 1978 (refer to MPM10151G-Hook and Yoke Baseline data).
- Perform MT IAW ANSI/ASME Section III, 1986 PAR. NF 5340.

Unsatisfactory results in accordance with baseline data and Code requirements will be entered in the CAP for evaluation and resolution.

(7) Corrective Actions

Corrective actions, including root cause determinations and prevention of recurrence, are performed in accordance with the CAP. Corrective actions are taken in a timely manner commensurate with the significance of the defect. Deficiencies are either promptly corrected or are evaluated to be acceptable through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis conditions. Each of the implementing procedures associated with the transfer cask lifting yoke AMP is within the scope of the CAP.

(8) Confirmation Process

Activities initiated in accordance with the implementing procedures for the transfer cask lifting yoke AMP, such as corrective actions, are subject to Quality Assurance Program controls. Thus, the effectiveness is monitored using CAP procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Use of the procedures, processes, and controls ensures that corrective actions are taken and are effective.

(9) Administrative Controls

The transfer cask lifting yoke AMP is subject to Corrective Action and Quality Assurance Program procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B, and will continue to be adequate for the renewed license (extended storage) period.

(10) Operating Experience

The ISFSI has been in operation since 1992. The transfer cask lifting yoke has been in use since the initial loading of the ISFSI.

Inspections are performed on the transfer cask lifting yoke annually. These examinations and inspections are currently performed in accordance with a combination of procedures. Any deficiencies identified are promptly corrected prior to shipping fuel.

A discussion of pertinent operating experience is contained in Section 3.1.5 of Reference 2. Furthermore, the lack of identification of transfer cask lifting yoke degradation through the existing inspections is evidence that transfer cask lifting yoke activities have been effective in maintaining the condition and functionality of the transfer cask lifting yoke.

A review of the operating experience provided objective evidence that the effects of aging have, and will continue to be, adequately managed during the extended period of operation.

A1.6.6 Learning AMP

The Transfer Cask Lifting Yoke AMP is a "learning" AMP. This means that this AMP will be updated, as necessary, to incorporate new information on degradation due to aging effects identified from plant-specific inspection findings, related industry operating experience, and related industry research. Future plant-specific and industry operating experience is captured through the licensee's operating experience review process following the regulatory framework for the consideration of operating experience concerning aging management and age-related degradation in LR-ISG-2011-05.

The ongoing review of both plant-specific and industry operating experience will continue through the period of extended operation to ensure that the program continues to be effective in managing the identified aging effects. Reviews of operating experience by the licensee in the future may identify areas where AMPs should be enhanced or new programs developed.

Calvert Cliffs maintains the effectiveness of this AMP under our respective quality assurance programs used to meet the criteria of 10 CFR Part 72, Subpart G, and 10 CFR Part 50, Appendix B, respectively.

A1.6.7 Conclusion

The transfer cask lifting yoke AMP is credited for the management of relevant conditions that could lead to degradation of transfer cask lifting yoke subcomponents from the associated aging effects/mechanisms as shown in Table 3.6-1 of Reference 2, and for the management of actual degradation. Based on the above, the continued implementation of the transfer cask lifting yoke AMP activities shown in Table A16-1 will provide reasonable assurance that aging effects will be managed, such that the transfer cask lifting yoke subcomponents within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis throughout the renewed license period.

Table A1.6-1

Transfer Cask Lifting Yoke Aging Management	Annually	• To perform visual inspection focusing on subcomponents that which external surfaces are exposed to intermittent wetting.
		  • Loss of material due to pitting and crevice corrosion from wetting
		• Cracking due to stress/strain from lifting
		  • Perform NDE Inspections IAW ANSI/ASME III 1986 and ANSI N14.6 1978 (refer to MPM10151G-Hook and Yoke Baseline data).
		  • Perform MT IAW ANSI/ASME Section III, 1986 PAR. NF 5340.

A1.7 CASK SUPPORT PLATFORM AGING MANAGEMENT PROGRAM

The cask support platform sits in the spent fuel pool cask loading pit area which positions the transfer cask at the appropriate elevation for loading irradiated fuel assemblies into the DSC.

The cask support platform materials, environments and aging effects requiring management are described in Attachment (1), Section 3.7 of Reference 2.

The purpose of the cask support platform AMP is to ensure that no significant degradation occurs while the cask support platform is in the borated water environment of the spent fuel pool.

A description of the cask support platform aging management is provided below using the program elements of an effective AMP as listed in section A1.2.

A1.7.1 Materials

- Stainless Steel

A1.7.2 Environments

- Borated water in the Spent Fuel Pool

The chemistry of the spent fuel pool is maintained to control leachable chlorides and fluorides in order to maintain a non-corrosive environment for the stainless liner, fuel racks, and components and cask support platform and other structures stored in the pool.

A1.7.3 Aging Effects Requiring Management

The Cask Support Platform AMP is a “learning” AMP. This means that this AMP will be updated, as necessary, to incorporate new information on degradation due to aging effects identified from plant-specific inspection findings, related industry operating experience, and related industry research. Future plant-specific and industry operating experience is captured through the licensee’s operating experience review process following the regulatory framework for the consideration of operating experience concerning aging management and age-related degradation in LR-ISG-2011-05.

The ongoing review of both plant-specific and industry operating experience will continue through the period of extended operation to ensure that the program continues to be effective in managing the identified aging effects. Reviews of operating experience by the licensee in the future may identify areas where AMPs should be enhanced or new programs developed.

Calvert Cliffs maintains the effectiveness of this AMP under our quality assurance programs used to meet the criteria of 10 CFR Part 72, Subpart G, and 10 CFR Part 50, Appendix B, respectively.

A1.7.4 Program Description

The cask support platform AMP credits the Chemistry Control Program which monitors chlorides in the spent fuel pool water.

A1.7.5 Evaluation and Technical Basis

(1) Scope

The cask support platform AMP is applicable to the cask support platform and the pertinent subcomponents. The focus of this AMP is on the stainless steel subcomponents that are continuously exposed to borated water.

The cask support platform AMP credits the Chemistry Control Program which monitors chlorides in the spent fuel pool water.

(2) Preventive Actions

(3) Parameters Monitored or Inspected

The cask support platform AMP includes guidance and direction for maintaining a suitable environment that precludes the onset or propagation of a loss of material and cracking due to pitting and/or stress corrosion for stainless steel components in the spent fuel pool.

The parameter inspected by the cask support platform AMP is the chloride concentration in the spent fuel pool water. Samples are taken on a monthly basis.

The Cask Support Platform AMP relies on our Chemistry Control Program to monitor chloride levels in the spent fuel pool to ensure conditions that would be conducive to the onset or propagation of loss of material and cracking due to pitting and/or stress corrosion in this stainless steel platform do not occur. Under our Chemistry Control Program, a chloride sample of the spent fuel pool water is taken monthly and compared to the target threshold value (<100 ppb). The target value selected by Calvert Cliffs is more conservative than the target recommendation specified in the Electric Power Research Institute (EPRI) PWR Primary Guidelines of <150 ppb.

January 2010 - June 2011 Spent fuel pool chloride data: Spent fuel pool chloride ranged from less than 5.0 ppb to 13.1 ppb. 5.0 ppb corresponds to the limit of detection. Spent fuel pool chloride average for this period is 5.8 + 1.7 ppb.

A review of the spent fuel pool chloride sample values taken during the last three years showed no instances where our conservative threshold value was exceeded. Furthermore, the spent fuel pool ion exchanger effluent is sampled and analyzed once a month. Trending is routinely performed to identify any degrading trends. The spent fuel pool ion exchanger resin is replaced annually prior to the refueling outage to ensure adequate cleanup capacity exists.

(4) Detection of Aging Effects

Loss of material and cracking for stainless steel subcomponents, due to pitting and/or stress corrosion in borated water, and for stainless steel subcomponents, is an aging effect that is managed by this AMP. The cask support platform AMP relies upon chloride sampling of the spent fuel pool water to ensure favorable conditions for this aging effect do not develop.

(5) Monitoring and Trending

Chloride sampling will determine whether conditions favorable for development of this aging effect have developed. In that event, additional inspections would be required before use of the cask support platform.

(6) Acceptance Criteria

The acceptance criterion for the cask support platform AMP is spent fuel pool chlorides within acceptable limits.

Unsatisfactory degradation is entered in the CAP for resolution.

(7) Corrective Actions

Corrective actions, including root cause determinations and prevention of recurrence, are performed in accordance with the CAP. Corrective actions are taken in a timely manner commensurate with the significance of the defect. Deficiencies are either promptly corrected or are evaluated to be acceptable through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis conditions. Each of the implementing procedures associated with the cask support platform AMP is within the scope of the CAP.

(8) Confirmation Process

Activities initiated in accordance with the implementing procedures for the cask support platform AMP, such as corrective actions, are subject to Quality Assurance Program controls. Thus, the effectiveness is monitored using CAP procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Use of the procedures, processes, and controls ensures that corrective actions are taken and are effective.

(9) Administrative Controls

The cask support platform AMP is subject to Corrective Action and Quality Assurance Program procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B, and will continue to be adequate for the renewed license (extended storage) period.

Since initial operation, and continuing through present day operation, Calvert Cliffs has maintained a well-defined Chemistry Control Program for fluid systems. A key aspect of the Chemistry Control Program is the sampling and analysis of fluid systems to determine the concentration of chemical impurities and chemical additives. Fluid systems at Calvert Cliffs are sampled and analyzed by procedure. Parameters monitored, frequency of sampling, acceptance criteria (i.e., specifications), and corrective actions for out-of-specification results are similarly addressed by procedure. Chemistry data for monitored parameters is routinely trended to identify subtle trends in the data which may be indicative of an underlying operational problem. In many cases, this allows correction prior to a parameter becoming out-of-specification.

(10) Operating Experience

A review of plant operating experience for the cask support platform was conducted as part of our license renewal application. This review did not identify any occurrences of unsatisfactory degradation associated with the cask support platform. These results further support that maintaining and monitoring of the spent fuel pool water conditions provides reasonable assurance that the cask support platform will be able to continue to perform its intended function throughout the license renewal period.

A1.7.6 Learning AMP

The Cask Support Platform AMP is a "learning" AMP. This means that this AMP will be updated, as necessary, to incorporate new information on degradation due to aging effects identified from plant-specific inspection findings, related industry operating experience, and related industry research. Future plant-specific and industry operating experience is captured through the licensee's operating experience review process following the regulatory framework for the consideration of operating experience concerning aging management and age-related degradation in LR-ISG-2011-05.

The ongoing review of both plant-specific and industry operating experience will continue through the period of extended operation to ensure that the program continues to be effective in managing the identified aging effects. Reviews of operating experience by the licensee in the future may identify areas where AMPs should be enhanced or new programs developed.

Calvert Cliffs maintains the effectiveness of this AMP under our quality assurance programs used to meet the criteria of 10 CFR Part 72, Subpart G, and 10 CFR Part 50, Appendix B, respectively.

A1.7.7 Summary

The overall effectiveness of the chemistry program is supported by the excellent operating experience for those systems, structures, and components influenced by the Chemistry Control Program.

The cask support platform AMP credits the Chemistry Control Program for the management of relevant conditions that could lead to degradation of cask support platform subcomponents from the associated aging effects/mechanisms as shown in Table 3.7-1 of Reference 2, and for the management of actual degradation. Based on the above, the continued implementation of the cask support platform AMP activities shown in Table A1.7-1 will provide reasonable assurance that aging effects will be managed, such that the cask support platform subcomponents within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis throughout the renewed license period.

Cask Support Platform Aging Management	Monthly	• The Chemistry Control Program monitors chloride concentration in spent fuel pool to ensure favorable conditions for stress corrosion/ pitting do not occur.

A1.8 HIGH BURNUP FUEL AGING MANAGEMENT PROGRAM

The Calvert Cliffs ISFSI provides for long-term dry fuel interim storage for high burnup spent fuel assemblies, i.e., fuel assemblies with discharge burnups greater than 45 GWD/MTU, until such time that the spent fuel assemblies may be shipped off-site for final disposition.

A1.8.1 Materials

As discussed in Section 3.2.2. of Reference 2, the materials of construction for the subcomponents of each irradiated fuel assemblies that are subject to AMR are zirconium-based alloy (presently Zircaloy-4 or Zirlo), stainless steel, and nickel-based alloy (Inconel). This program will also be designed to cover future NUHOMS-32PHB DSC loadings (Reference 15) which may also include fuel assemblies using the zirconium-based alloy M5.

A1.8.2 Environments

The environments normally experienced by the irradiated fuel assembles while in the DSCs are described in Section 3.2.3 of Reference 2.

External Environment

For irradiated fuel assemblies, external environment refers to the internal DSC atmosphere. The internal DSC atmosphere is predominantly helium with trace amounts of water vapor and air. The DSC External Surfaces AMP (see section A1.3) provides for the maintenance of the DSC intended function of confinement, thereby ensuring that this environment is maintained during the period of extended operation.

Additionally, residual boron may coat the irradiated fuel assemblies surfaces since they were exposed to a borated water environment in the SFP prior to storage. Any boric acid residue remaining on the irradiated fuel assemblies will have no deleterious effects due to the minimal amount of water present in the storage atmosphere and the materials of construction for the irradiated fuel assemblies.

Temperatures experienced by fuel assembly cladding materials during loading and transfer operations are below the 752°F (400°C) temperature limit for high burnup fuel recommended in Interim Staff Guidance (ISG)-11 Revision 3 (Reference 14), and repeated thermal cycling of the fuel does not occur. Following initial cask loading, the temperature of the fuel cladding was limited to less than 635°F (335°C) for normal storage conditions (ISFSI USAR Table 1.2-1). Fuel cladding temperature will then decrease over time while in dry storage.

Internal Environment

For irradiated fuel assemblies, internal environment refers to the fuel rod interior. The fuel rods were pressurized with helium during manufacturing. The fuel rod internal environment is a combination of the original helium fill gas and fission products produced during reactor operation.

A1.8.3 Aging Effects Requiring Management

As discussed in Section 3.2.6 of Reference 2, the AMR of the spent fuel assemblies in a dry inert environment did not identify any aging effects/mechanisms that could lead to a loss of intended function. However, it is recognized that there has been relatively little operating experience, to date, with dry storage of high burnup fuel. Reference 16 provides a listing of a significant amount of scientific analysis examining the long term performance of high burnup spent fuel. These analyses provide a sound foundation for the technical basis that long term storage of high burnup fuel, i.e., greater than 20 years, may be performed safely and in compliance with regulations. However, it is also recognized that scientific analysis is not a complete substitute for confirmatory operating experience. This AMP will provide confirmatory data needed to validate these analyses for high burnup fuel in a manner similar to the way that References 17 and 18 provided data to confirm that low burnup fuel (≤45 GWd/MTU) would maintain its integrity in dry cask storage over extended time periods.

A1.8.4 Program Description

A description of the High Burnup Fuel AMP is provided in Section A1.8.5 below. Although the program is a confirmatory program, the description below uses each attribute of an effective AMP as described in NUREG-1927 for the renewal of a site-specific Part 72 license to the extent possible.

A1.8.5 Evaluation of Technical Basis

A1.8.5.1 Scope

The High Burnup Fuel AMP relies upon the joint EPRI and Department of Energy "High Burnup Dry Storage Cask Research and Development Project" (HDRP) or an alternative program meeting the guidance in ISG-24, Reference 19, as a surrogate program to monitor the condition of high burnup spent fuel assemblies in dry storage.

The HDRP is a program designed to collect data from a spent nuclear fuel storage system containing high burnup fuel in a dry helium environment. The program entails loading and storing a TN-32 bolted lid cask (the Research Project Cask) at Dominion Virginia Power's North Anna Power Station with intact high burnup spent nuclear fuel (with nominal burnups ranging between 53 GWd/MTU and 58 GWd/MTU). The fuel assemblies to be used in the program include four different kinds of cladding (Zircaloy-4, low-tin Zircaloy-4, Zirlo, and M5), which cover the range of fuel cladding materials in use at Calvert Cliffs (discussed in Section A1.8.1). The Research Project Cask is to be licensed to the temperature limits recommended in Reference 14, and loaded such that the fuel cladding temperature is as close to the limit as practicable. Aging effects will be determined for material/environment combinations per Reference 19 or the "High Burnup Dry Storage Cask Research and Development Project" (HDRP).

The Calvert Cliffs ISFSI Technical Specification 3.1.1(3) limits the maximum assembly average burnup to 47 GWd/MTU for the NUHOMS-24P DSC and 52 GWd/MTU for the NUHOMS-32P DSC. As can be seen in Figure 1-1 of Reference 5, the majority (99.7%) of fuel assemblies loaded in the NUHOMS-24P DSCs have assembly average

burnups below 45 GWd/MTU, and would therefore be considered low burnup fuel. The four assemblies which have burnups above 45 GWd/MTU, exceed this value by only 0.09 to 0.82 GWd/MTU, and can essentially be considered low burnup fuel as well. The 24 NUHOMS-32P DSCs loaded as of November 2012 do however contain significant amounts of high burnup fuel. As can be seen in Figure 1-2 of Reference 5, ~49% of the fuel stored in these NUHOMS-32P DSCs exceeds 45 GWd/MTU, and every DSC contains at least one assembly in this range. However, 98.7% of the fuel stored in the NUHOMS-32P DSCs has a burnup less than 49 GWd/MTU, and only one assembly exceeds 50 GWd/MTU (50.564 GWd/MTU specifically). No fuel exceeding 46.25 GWd/MTU was loaded prior to the September 2010 approval of License Amendment 9 which increased the burnup limit for the NUHOMS-32P DSC from 47 to 52 GWd/MTU. Therefore, the HDRP will be representative of the assembly average burnup of high burnup fuel in dry storage at Calvert Cliffs.

Fuel to be loaded in the future NUHOMS-32PHB DSCs will also be covered by this AMP upon NRC approval of that License Amendment Request. While the NUHOMS-32PHB will have an assembly average burnup limit of 62 GWd/MTU (Reference 15) the 10 CFR Part 50 license conditions of the plant limit the peak rod burnup to less than 62 GWd/MTU. This means that actual assembly average burnups will be less than the 58 GWd/MTU burnup being loaded in the HDRP.

A1.8.5.2 Preventive Actions

The High Burnup Fuel Monitoring Program consists of condition monitoring to confirm there is no degradation of a high burnup fuel assembly that would result in a loss of intended function(s). No new preventive or mitigating attributes are associated with these activities.

However, the existing design limits placed on loading operations constitute preventative actions against aging of high burnup fuel assemblies. During the initial loading operations of the DSCs in use at Calvert Cliffs, the design and ISFSI Technical Specifications require that the fuel be stored in a dry inert environment. Technical Specification 2.2.1, “DSC Vacuum Drying,” demonstrates that the cask cavity is dry by maintaining a cavity absolute pressure less than or equal to 3 torr for a 30 minute period with the cask isolated from the vacuum pump. Per ISFSI USAR Section 4.3.1, when the pressure can be held at 3 torr for at least 30 minutes, this indicates that all liquid water has evaporated in the DSC cavity, and that the resulting inventory of oxidizing gases is less than 0.25% (Vol%). Technical Specification 2.2.2, “DSC Helium Backfill Pressure,” requires that the cask then be backfilled with helium. These two Technical Specifications requirements ensure that the high burnup fuel is stored in an inert environment thus preventing cladding degradation due to oxidation mechanisms.

Furthermore, the actual conditions of loading and storage also constitute actions to prevent age-related degradation of high burnup fuel cladding. As described in Section A1.8.2, design basis calculations demonstrate that peak cladding temperatures (PCTs) are maintained below the Reference 14 recommended limit of 400°C

established to protect high burnup fuel cladding from aging mechanisms such as creep or embrittlement due to redissolution and precipitation of hydrides in a radial orientation. In practice, the actual 32P loadings at Calvert Cliffs have generally maintained substantial additional margin to the 400°C PCT limit due to less than design basis heat loads, milder ambient conditions than design basis, and the limited durations of the loading and transfer stages. As described in Reference 5, it is estimated that 96% of the NUHOMS-32 DSCs (which are the only DSCs loaded with high burnup fuel to date at Calvert Cliffs) have maintained at least 50°C margin to the Reference 14 limit during the loading and transfer process, and over half have maintained greater than 100°C of margin. The margin afforded by these lower PCTs in terms of the degree of radial hydride precipitation was evaluated in detail during the period 2000 to 2002 as a result of interactions between Nuclear Energy Institute, EPRI, and the NRC. These evaluations are compiled in Reference 20, and eventually were used as part of the supporting basis for the 400°C limit that first appeared in Reference 14. One of the principal developments of Reference 20 was a radial hydride precipitation model as a function of cladding hoop stress and PCT at the beginning of storage. Reference 21, Table 2-2, provides the latest analyses using that model, and indicate that the concentration of radial hydrides for a given cladding hoop stress is a factor 4 times lower than the 400°C value with 50°C of margin, and almost a factor of 10 times lower with 100°C of margin. It is expected that the high burnup fuel AMP will provide positive confirmation of the effectiveness of this preventative measure during the renewal period.

A1.8.5.3 Parameters Monitored or Inspected

Either the surveillance demonstration program as described in the HDRP or an alternative program should meet the guidance of Reference 19.

A1.8.5.4 Detection of Aging Effects

Either the surveillance demonstration program as described in the HDRP or an alternative program should meet the guidance of Reference 19.

A1.8.5.5 Monitoring and Trending

As information/data from a fuel performance surveillance demonstration program becomes available, Calvert Cliffs will monitor, evaluate, and trend the information via its Operating Experience Program and/or the CAP to determine what actions should be taken to manage fuel and cladding performance, if any.

Similarly, Calvert Cliffs will use its Operating Experience Program and/or CAP to determine what actions should be taken if it receives information/ data from other sources than the demonstration program on fuel performance

Formal evaluations of the aggregate feedback from the HDRP and other sources of information will be performed at the specific points in time during the period of extended operation delineated in the Table A1.8-1 below. These evaluations will

include an assessment of the continued ability of the high burnup fuel assemblies to continue to perform their intended function(s) at each point.

The Table A1.8-1 assessments are not, by definition, stopping points. No particular action, unless noted in this AMP, other than performing an assessment is required to continue cask operation. To proceed, an assessment of aggregated available operating experience (both domestic and international), including data from monitoring and inspection programs, NRC-generated communications, and other information will be performed. The evaluation will include an assessment of the ability of the high burnup fuel assemblies to continue to perform their intended function(s).

Table A1.8-1. High Burnup Fuel AMP Toll Gate Assessments

Toll Gate	Year*	Assessment
1	2028	Evaluate information obtained from the HDRP loading and initial period of storage along with other available sources of information. If the HDRP NDE (i.e., cask gas sampling, temperature data) has not been obtained at this point and no other information is available then Calvert Cliffs has to provide evidence to the NRC that no more than 1% of the HBF has failed.
2	2038	Evaluate, if available, information obtained from the destructive (DE) and non-destructive (NDE) examination of the fuel placed into storage in the HDRP along with other available sources of information. If the aggregate of this information confirms the ability of the high burnup fuel assemblies to continue to perform intended function(s) for the remainder of the period of extended operations, subsequent assessments may be cancelled. If the HDRP DE of the fuel has not been examined at this point and no other information is available then Calvert Cliffs has to provide evidence to the NRC by opening a cask or single effects surrogate experiments that the fuel performance acceptance criteria 1-4 in Section A1.8.5.6 continue to be met.
3	2048	Evaluate any other new information.

* Assessments are due by April 4 of the year identified in the table.

A1.8.5.6 Acceptance Criteria

- The HDRP or any other demonstration used to provide fuel performance data should meet the acceptance criteria guidance of Reference 19.
- If any of the following fuel performance criteria are exceeded in the HDRP or alternative program, a corrective action is required:
  1. Cladding Creep: total creep strain extrapolated to the total approved storage duration based on the best fit to the data, accounting for initial condition uncertainty shall be less than 1%
  2. Hydrogen – maximum hydrogen content of the cover gas over the approved storage period shall be extrapolated from the gas measurements to be less than 5%

3. Drying – The moisture content in the cask, accounting for measurement uncertainty, shall indicate no greater than one liter of residual water after the drying process is complete
4. Fuel rod breach – fission gas analysis shall not indicate more than 1% of the fuel rod cladding breaches

- While it is not a fuel performance criteria, the spatial distribution and time history of the cladding temperature must be known to evaluate the relationship between the performance of the rods in the HDRP and the HBF rod behavior expected in the DSCs in use at Calvert Cliffs. If the results of the HDRP or other any other demonstration used to provide data are found to be not representative of the temperature history of high burnup fuel in storage at Calvert Cliffs, a corrective action will be initiated to drive an update to the aging management approach for this subset of the high burnup fuel population.

A1.8.5.7 Corrective Actions

The Calvert Cliffs CAP commensurate with 10 CFR 50, Appendix B will be followed.

In addition, at each of the assessments in Section A.1.8.5.5, the impact of the aggregate feedback will be assessed and actions taken when warranted. These evaluations will address any lessons learned and take appropriate corrective actions, including:

- Perform repairs or replacements
- Modify this confirmatory program in a timely manner
- Adjust age-related degradation monitoring and inspection programs (e.g., scope, frequency)
- Actions to prevent reoccurrence
- An evaluation of the DCSS to perform it's safety and retrievability functions
- Evaluation of the effect of the corrective actions on this component to other safety components.

A1.8.5.8 Confirmation Process

The confirmation process is part of the Calvert Cliffs CAP and ensures that the corrective actions taken are adequate and appropriate, have been completed, and are effective. The focus of the confirmation process is on the follow-up actions that must be taken to verify effective implementation of corrective actions. The measure of effectiveness is in terms of correcting the adverse condition and precluding repetition of significant conditions adverse to quality. Procedures include provisions for timely evaluation of adverse conditions and implementation of any corrective actions required, including root cause evaluations and prevention of recurrence where appropriate. These procedures provide for tracking, coordinating, monitoring, reviewing, verifying, validating, and approving corrective actions, to ensure effective corrective actions are taken.

A1.8.5.9 Administrative Controls

The Calvert Cliffs Quality Assurance Program, associated formal review and approval processes, and administrative controls applicable to this program and Aging Management Activities, are implemented in accordance with the requirements of the Calvert Cliffs Quality Assurance Topical Report and 10 CFR Part 50, Appendix B. The administrative controls that govern aging management assests at Calvert Cliffs are established in accordance with Exelon Fleet Procedures.

A1.8.5.10 Operating Experience

Surrogate surveillance demonstration programs with storage conditions and fuel types similar to those in the dry storage system that satisfies the acceptance criteria recommended in ISG-24 are a viable method to obtain operating experience. Calvert Cliffs intends to rely on the information from the HDRP with similar types of HBU fuel. The HDRP is viable as a surrogate surveillance program. Additional data/research to assess fuel performance from both domestic and international sources that are relevant to the fuel in the Calvert Cliffs DSCs will also be used.

A1.8.6 Conclusion

The High Burnup Fuel AMP is a "Learning AMP" that is designed to update/revise the approach to aging management of high burnup fuel to reflect the findings of the HDRP as they become available, as well as incorporate other sources of operational experience and research conducted by industry, Department of Energy, or NRC. A summary description of this AMP will be included in the ISFSI USAR so that any significant updates to the AMP approach, as determined by the 10 CFR 72.48 process, will be subject to NRC inspection.

A1.9 REFERENCES

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