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August 6, 2007

U.S. Nuclear Regulatory Commission
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Attn: Document Control Desk

Subject: Resubmittal of NAC MAGNASTOR System Application for Approval
Docket No. 72-1031 (TAC No. L23764)

Reference:
1. MAGNASTOR System – Application for Approval, NAC International, August 31, 2004
2. Withdrawal of NAC MAGNASTOR System Application, NAC International, January 26, 2007
3. NRC Letter – Review Status of NAC International MAGNASTOR System Application, US Nuclear Regulatory Commission, February 15, 2007
4. NAC International MAGNASTOR Spent Fuel Storage System - Preliminary Staff Evaluation, US Nuclear Regulatory Commission, July 24, 2007

NAC International (NAC) herewith resubmits the NAC MAGNASTOR Spent Fuel Storage System Application for a Certificate of Compliance (CoC) in accordance with 10 CFR Part 72.

An application for the MAGNASTOR system was originally submitted via Reference 1 and subsequently withdrawn via Reference 2. The NRC acknowledged NAC's withdrawal via Reference 3 in which the review status and outstanding issues were summarized. Later, a preliminary staff evaluation was issued (Reference 4) to formally address most of the technical areas analyzed in the MAGNASTOR Safety Analysis Report (SAR) and to identify the open issues where the NRC staff was unable to make a technical and safety finding based on the information previously submitted.

The MAGNASTOR SAR, Revision 1, has been developed in response to References 3 and 4. It addresses all the open issues identified by the NRC staff. In addition, NAC has identified some other topics that were the subject of various meetings/conference calls between NAC and NRC personnel and/or have been presented in industry conferences or in trade publications.

In order to best assist the NRC staff with its review, the following attachments are provided with the application:

1. NAC Response to NRC Staff Open Issues
2. List of SAR Changes for the MAGNASTOR Storage System, Rev. 1
3. List of Effective Pages

The NAC Response to NRC Staff Open Issues document has been prepared to summarize open issues and revised materials addressed in the MAGNASTOR SAR, Revision 1 application. Each open issue identified in Reference 3 and/or 4 is presented with a discussion on how the item has been addressed in the revised SAR, with specific sections of the SAR referenced where the new or revised documentation is incorporated. In addition to the discussion of these issues, a summary table has been included highlighting the different SAR sections that have been revised as a result of an issue.

NMSS01

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The document also includes a section titled "Other NAC-Identified Issues" to highlight issues that have been identified in NRC/NAC discussions about the MAGNASTOR application that were not detailed in References 3 and 4, or other project or industry materials, such as RIS 2007-09 or ISG-1, Revision 2. Each of the issues addressed in this section has been included in a table identifying the specific SAR sections that have been added or revised to address the specific issue.

In addition to the above guidance document, a detailed list of SAR changes has been prepared that identifies each page of the SAR that has been revised with the description of the specific changes that have been made.

The List of Effective Pages is provided as part of the MAGNASTOR SAR, Rev. 1 to account for each page of the document.

Each page of the MAGNASTOR SAR, Rev. 1, is identified in the header as a Revision 1 page. Revision bars are provided in the margin indicating all changed, additional or deleted information that has been incorporated in response to References 3 and 4 or was introduced as new information by NAC. None of the new analyses and/or revised or additional SAR information resulted in a hardware design change for the MAGNASTOR system. The previously proposed Pressurized Helium Drying System has been eliminated from the application.

Considering the limited number of open issues identified by the NRC staff that are required for completion of the technical review of the MAGNASTOR application, NAC requests completion of the draft CoC and SER for this application by October 30, 2007. NAC staff is available to meet with the NRC staff, should it be determined that face-to-face discussion of the submitted information would expedite the review and approval process. NAC looks forward to working with the Spent Fuel Storage and Transportation staff to successfully complete the licensing of this important advancement in spent fuel storage technology.

If you have any comments or questions, please contact me on my direct line at (678) 328-1274.

Sincerely,

Anthony L. Patko
Director, Licensing
Engineering

Attachment 1 – NAC Response to NRC Staff Open Issues
Attachment 2 – List of SAR Changes for the MAGNASTOR Storage System, Rev. 1

Enclosures

ATTACHMENT 1

NAC INTERNATIONAL

RESPONSE TO THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

SUMMARY OF NRC STAFF OPEN ISSUES DATED FEBRUARY 15, 2007

AND

PRELIMINARY STAFF EVALUATION DATED JULY 24, 2007

MAGNASTOR STORAGE SYSTEM, REVISION 1

(TAC NO. L23764, DOCKET NO. 72-1031)

JULY 2007

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1. Review Status of NAC International MAGNASTOR System Application (TAC No. L23764), U.S. Nuclear Regulatory Commission, February 15, 2007
2. NAC International MAGNASTOR Spent Fuel Storage System – Preliminary Staff Evaluation (TAC No. L23764) U.S. Nuclear Regulatory Commission, July 24, 2007
3. MAGNASTOR Safety Analysis Report, Revision 1, NAC International, July 2007
4. List of SAR Changes for the MAGNASTOR Storage System, Revision 1, NAC International, July 2007

NAC INTERNATIONAL RESPONSE
TO
SUMMARY OF NRC STAFF OPEN ISSUES

GENERAL DISCUSSION

This document has been prepared to serve as guidance summarizing open issues and revised information addressed in the MAGNASTOR SAR, Revision 1 application. Each open issue identified in the NRC letter dated February 15, 2007 and/or identified in the Preliminary Staff Evaluation, dated July 24, 2007, is presented with a discussion on how the item has been addressed in the resubmittal, with specific sections of the SAR referenced where the revised or new documentation is incorporated. In addition to the discussion of these issues, Table 1 has been prepared as an issues summary identifying the various SAR sections that have been revised as a result of an issue.

It is noted that none of the new analyses and/or revised or additional SAR information resulted in a hardware design change for the MAGNASTOR system. The previously proposed Pressurized Helium Drying System has been eliminated from the application.

In addition, a section titled "Other NAC Identified Issues" has been included in this document to highlight issues that have been identified in NRC/NAC discussions about the MAGNASTOR application and were not detailed in the above referenced NRC letter and report material, or other project or industry materials, such as RIS 2007-09 or ISG-1, Revision 2. Each of the issues addressed in this section has been included in Table 2 with identification of the specific sections that have been added or revised to address the specific issue.

In addition to this guidance document, a detailed list of SAR changes has been prepared that identifies each page of the SAR that has been revised with the description of the specific changes that have been made.

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STRUCTURAL ISSUES

NRC Stated Issue: Basket Structural Stability

The NRC summary of staff open issues states that the review staff has not been able to make a safety finding on the structural adequacy of the fuel basket during the cask tipover event. The staff believes that, when subject to the side impact g-loads of the non-mechanistic cask tipover event, the canister and basket cross-section will tend to ovalize, potentially resulting in geometric instability of the basket tube assembly and the collapse or reconfiguration of the basket tubes. Specific noted concerns are highlighted in the following:

1. Modeling the interaction of the basket with the canister shell using a distributed pressure over a 21° arc from the impact center line and along the canister circumferential direction may not provide realistic canister shell displacements to be used in the basket geometric stability analysis. Canister shell displacement must be conservatively estimated for evaluating the potential geometric instability of the fuel basket.
2. Additionally it is noted that because the fuel tubes and side/support weldments tend to deform laterally to result in further canister shell ovalization, NAC must also consider the basket deformation and its interaction with the canister shell as a basis for calculating the displacement boundary conditions suitable for evaluating geometric instability of the fuel basket.

In addition to the specific question of basket geometric stability items that have been noted as areas to be addressed as part of the resubmittal documentation, include replacement of Von Mises plastic stress summaries, clarify basis for different weld quality factors and editorial inconsistency between sections that have been identified by the staff as concerns.

Resubmittal Content

Geometric stability analyses of the basket structure have been revised to be completely responsive to the staff concerns relative to the calculation of the canister shell displacement resulting from the interaction with the basket mechanical assembly. Three-dimensional ANSYS models of both the PWR and BWR basket configurations have been created. These models capture each fuel tube, pin-slot interface, side and corner weldment with bolted interface with the adjacent fuel tubes, and top and bottom drive pins linking each fuel tube in the basket array. These three-dimensional basket models were then placed in the three-dimensional canister model with welded closure lid and base plate. Canister shell displacements were calculated for a statically applied side impact load that is 1.5 times the design basis loading for the cask tipover event factored by a DLF of 1.36. Demonstrating basket geometric stability by performing analyses with an applied loading that is 1.5 times the design basis validates a minimum factor of

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safety for basket geometric stability of 1.5 relative to the maximum design basis system load. Canister shell displacements were calculated for PWR basket orientation at 0°, 18°, 25.5°, 27°, 34°, and 45°; and BWR basket orientations of 0°, 22.5°, and 45°. Documentation of these new models and analyses has been added to the SAR in Section 3.10.9.

Maximum canister shell displacements calculated using the new three-dimensional canister model are used as boundary conditions in the time history analysis with the previously developed and staff reviewed three-dimensional periodic LS-DYNA model. The loading applied to the LS-DYNA periodic section model is representative of the load, factored by 1.5, at the axial location where the maximum shell displacement was calculated and imported as the displacement boundary condition for the LS-DYNA analysis. Results from these analyses show the dynamic response for each of the pin-slot interface locations. The three locations having the maximum displacements were summarized in the analyses results and show that both the PWR and BWR pin-slot interface remain in their engaged configuration following dynamic response to the tipover impact load. These results are presented in the revised SAR Section 3.10.6.

The BWR 22.5° configuration has resulted in the greatest pin-slot relative displacement for the tipover loading. Based on this maximum displacement, the BWR basket 22.5° model in the canister was placed in the transport cask model and subjected to the transport side drop loading. These results show the basket remains in a stable configuration with all pins engaged following the dynamic response to transport accident side drop loads demonstrating compliance with 10 CFR 72.236 requirements.

The MAGNASTOR basket is a robust structure as demonstrated by the extensive dynamic analyses performed using three dimensional basket and canister models. It is important to note that with all the detail modeled into the three dimensional basket and canister for the canister shell displacement calculation, the detail and structural stability captured in this model is not duplicated in the LS-DYNA periodic model calculating the basket dynamic response and relative pin-slot displacements. The periodic LS-DYNA model includes the significant conservative boundaries as noted below:

- The models neglect all restraint developed from the connector pin assemblies at basket top and bottom ends.
- The models neglect all restraint developed by neighboring pin-slot connections (axially) along the tube interface surface.
- The models incorporate beyond design basis maximum-minimum material conditions for the pin-slot interface. A conservative tube size reduction of 0.025 inch is used for the base cases for both the PWR and BWR basket models. The maximum specified design assembly gap is 0.016 inch, and the prototype fabrication has shown the gap is significantly less than 0.016 inch. This boundary introduces a 56% larger gap at the modeled tube interface than that permitted by the design.

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- The models consider the maximum displaced canister shell to be constant over the impact time history. This is also conservative because the canister shell displacement will be reduced significantly (providing more constraint to limit basket deflection) after the peak of the impact.
- The model also considers the maximum displaced canister shell to be constant over the length of the basket, neglecting bottom plate and closure lid control of the shell displacement as captured in the ANSYS model that influences tighter control for the integrated response of the basket assembly.

In addition to the extensive analysis that has been performed to address the staff concerns related to basket structural stability, other Chapter 3 enhancements include the following:

- Removed Von Mises stress summaries and consistently presented stress intensity results.
- Where weld quality factors are used in the structural evaluation of a specific weld location, the applicable inspection criteria has been noted to provide the basis for the noted quality factor.
- Concrete cask lifting with the use of air pallets has been addressed.
- High burnup fuel rod structural analysis has been revised.
- Edits have been performed to enhance clarity and consistency.

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THERMAL ISSUES

NRC Stated Issue: Thermal Cycling During Vacuum Drying

NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems," Section 4.0, "Thermal Evaluation," specifies the review criteria to be used by NRC staff in performing technical evaluations of applications under 10 CFR Part 72. The NRC reviewer must confirm that the application provides sufficient assurance that the cask system is designed to prevent fuel cladding degradation under normal, off-normal and accident conditions. Interim Staff Guidance document ISG-11, Revision 3, provides more specific guidance on the analysis of fuel cladding temperature limits for all conditions of cask loading and storage.

The staff has determined that the applicant has not demonstrated that the temperature differential criterion of ISG-11, Revision 3, will be met for all operating conditions described in the MAGNASTOR SAR.

Resubmittal Content

NAC agrees with the staff comment that the initial MAGNASTOR SAR did not contain detailed analyses demonstrating system performance to defined operational limits. The intended documentation and technical specification presented in the initial submittal implemented standardized technical specification content.

Documentation presented in this resubmittal defines operational limits and the thermal transient analysis of the system operational configurations validating that defined fuel cladding temperature limits are met. It is noted that the application includes the definition of a thermal cycle during the system closure and loading operations as a temperature change in the fuel cladding that is greater than 65°C (117° F). Basis for this definition is included in Section 8.11 Cladding Integrity. The procedure for loading MAGNASTOR, Section 9.1, and Technical Specifications, Section 13A, have been revised to be consistent with the details validated by the analyses presented in Sections 4.4.1 and 4.4.3.

It is noted that the normal operation of the MAGNASTOR system during drying operations may introduce one thermal cycle depending on canister heat loads and operational times required to complete vacuum drying, helium backfill and port cover welding followed by transfer to the concrete cask. The MAGNASTOR basket and canister design minimizes retention of water during the canister draining operation. In a similar application of a canister based dry storage system, the NAC-UMS® tube and disk basket design permitted approximately 19 gallons of water to be retained on the top surfaces of the support disks, heat transfer disks, and top and bottom weldments. Operational experience with the NAC-UMS® and similar MPC systems has demonstrated vacuum drying times in the range of 15 to 25 hour. Removing flat surfaces from

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the basket where water may collect during system draining and addition of a drain sump in the canister bottom plate minimizes free water from the initially drained MAGNASTOR canister. Based on the operational experience with these other systems it is fully anticipated that the MAGNASTOR canisters will be dry to defined criteria with a vacuum drying period in the range of 8 to 12 hours.

It is noted that if system cooling is required to ensure fuel clad temperatures do not exceed 400°C, 10 system cooling cycles are acceptable where the actual change in fuel clad temperature is greater that 65°C. This system limit is defined in Section 5.2.c to the Technical Specification and represents an alternative to ISG-11, Revision 3 guidance. The alternative criteria to the ISG guidance recognizes that a thermal cycle as a temperature change greater than 65°C, rather then limiting thermal cycles to 10 cycles less than 65°C. The basis for this definition of criterion to assure high burnup fuel is not subject to hydride reorientation during the system loading and processing operations is validated by the experimental work performed by Westinghouse in the ISG-11, Revision 3 referenced publication as summarized below.

> Verification that hydrogen transfer will not be introduced into the fuel rod cladding to a level that would impact structural performance is based on the physical testing performed and reported by B.F. Kammenzind, B. M. Berquist and R. Bajaj in their publication entitled "The Long Range Migration of Hydrogen Through Zircaloy in Response to Tensile and Compressive Stress Gradients," investigating hydrogen transfer in stressed and thermally cycled test specimens. Test results show:
>
> - Zero hydrogen transfer for test specimens subject to 25 thermal cycles between 260°C and 50°C at a stress level of 160 MPa.
> - Zero hydrogen transfer for test specimens subject to 10 thermal cycles between 260°C and 50°C at a stress level of 241 MPa.
> - Test results for temperature cycles to maximum temperatures of 316°C and 371°C show small levels of hydrogen transfer (i.e., 2.7 to 7.2 ppm) for 10 and 25 thermal cycles.
>
> This data, as referenced by ISG-11, Revision 3, indicates that the minimum temperature difference used in the test program, 210°C (260°C -50°C), which is significantly greater than the 65°C limit defined as ISG guidance, does not introduce hydrogen transfer. Thus, the stored fuel and its cladding remain undamaged and may be retrieved using normal means of handling.

This basis for the MAGNASTOR drying and thermal cycling criteria for high burnup fuel relative to fuel rod cladding structural integrity has been added to SAR Section 8.11.

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NRC Stated Issue: Transfer Cask Heat-up Rate

Section 4.4.1.5 of the MAGNASTOR SAR describes the applicant's thermal evaluation for moving the loaded canister from the transfer cask to the storage cask. The SAR indicates that during this phase, operations are time-limited, as only natural convection is relied upon to ensure that the fuel cladding is maintained at acceptable temperatures. The applicant compares this phase to the case of the canister in the concrete storage cask, with all vents blocked, and indicates that the peak fuel clad temperature calculated for the latter case is bounding for the canister in the transfer cask.

The NRC staff finds that the applicant has not sufficiently demonstrated that the results of the concrete storage cask blocked-vent configuration conservatively represent the heat-up rate of spent fuel for all cases during transfer of the TSC from the transfer cask into the storage cask.

Resubmittal Content

NAC has performed detailed analysis of the TCS transfer operations for both PWR and BWR system configurations. These analyses are presented in SAR Sections 4.4.1.5 and 4.4.1.6. It is noted that the transfer operation for the MAGNASTOR system is similar to the canister transfer operation for the NAC-UMS® system currently being loaded at utility sites. Actual times for the NAC-UMS® canister transfer demonstrate that the calculated operational window for the MAGNASTOR canister transfer with design basis heat load can be placed into the concrete cask without challenging system thermal limits.

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NRC Stated Issue: Drying Criteria and Bases for MAGNASTOR Drying Systems

In conjunction with the two previous issues, the SAR needs to be revised to clarify the bases for (1) the vacuum drying pressure criteria; (2) the helium drying dew point and temperature criteria; (3) the Pressurized Helium Drying System function description and acceptance testing. NAC provided an information supplement on November 28, 2006, that generally addressed these issues. The technical bases provided within this information supplement should be incorporated into the SAR, as appropriate.

Resubmittal Content

As stated above, the bases for system drying criteria, maintaining a pressure below 10 torr for 10 minutes, followed by lowering system pressure to 3 torr, followed by helium backfill, has been added to Section 8.11 Cladding Integrity.

The Pressurized Helium Drying System included as an alternative ancillary drying system in the initial MAGNASTOR application has been removed from the MAGNASTOR resubmittal application. This action is taken based on the results of the detailed vacuum drying transient analysis performed as part of the resubmittal and the operational history established for the vacuum drying system with both NAC-UMS® and MPC systems. The need for operational parameters and system functional descriptions for the Pressurized Helium Drying System has been eliminated.

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CRITICALITY ISSUES

Issues that have been addressed during previous licensing correspondence that has been identified by the review staff as needing to be reflected in the revised SAR to be provided as part of the resubmitted application are identified in the following discussion.

NRC Stated Issue: Fuel configuration is maintained

The SAR must demonstrate that the fuel assemblies will remain in their intact configuration under all normal, off-normal, and accident conditions. The structural analysis should show that the fuel assemblies do not bear any loading which could cause any deformation or damage. The configuration of the fuel in the accident analysis should be maintained and be consistent with the configuration assumed in the criticality model and analysis.

Resubmittal Content

MAGNASTOR criticality analyses rely on the fuel rod lattice to remain intact, and that no fuel rod breach occurs, during any normal, off-normal, or hypothetical accident event. In particular, this assumption requires that a fuel assembly does not bear any load beyond its own weight during any operating condition and event. Based on the MAGNASTOR basket design, this requires that fuel tubes remain in their pinned configuration, i.e., no basket collapse, and that no potential tube deformation (elastic or inelastic) does result in loading of the assembly.

Accident analyses in Section 3.7.2 – Figures 3.7.2-1 and 3.7.2-2 and Section 3.10.6, clearly demonstrate that the basket retains its structural configuration though all normal and accident events and that fuel assemblies are not loaded by any basket components. These analyses further demonstrate that after any design basis event the basket structure retains its pre-event configuration with maximum permanent deformation limited to <0.11 inch localized to areas for tubes on the periphery of the basket nearest the impact location. As this type of localized deformation has no effect on the overall location and spacing of the bounding (pushed-in) assembly and tube configuration, the structural analysis demonstrates that all criticality analysis conditions are met.

No SAR changes are made as a response to this open item beyond the structural evaluation revisions completed in response to the structural analysis open items.

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NRC Stated Issue: Provide analysis of most limiting configuration with input files

The SAR should verify that the specifications for the maximum allowed initial enrichment for each fuel assembly type were determined by calculations where the optional poison plates have been left out and the redesigned (increased) number of weld posts for mounting the poison plates has been included. Along with this verification, an input file should be formally submitted which shows how the revised modeling was performed.

Resubmittal Content

As a response to RAI-2, NAC recalculated maximum allowed enrichments for PWR and BWR systems using an MCNP calculation model that included both the optional absorbers on the basket periphery (i.e., a system with the optional peripheral absorber sheets removed or replaced by aluminum sheets) and the licensing drawing absorber attachment configuration (two columns of weld posts versus one in the initial analysis models). PWR SAR Sections 6.7.1 and 6.7.3 were modified for the RAI-2 response to state that the complete models, including optional absorbers and increased absorber attachments, were constructed and used to arrive at the enrichment limits. Similar modifications were made to the BWR Sections 6.7.4 and 6.7.6. The MCNP inputs included in Sections 6.7.1 (PWR) and 6.7.4 (BWR) were not modified as a response to RAI-2 as they represented nominal system configuration files.

To respond to the NRC concern on this issue, the SAR text in Sections 6.7.1 (PWR) and 6.7.4 (BWR) is modified to clarify that the combined optional absorber and increased attachment model is the basis for the enrichment limits. The normal basket configuration sample inputs, Figures 6.7.1-3 and -4 for PWR models and Figure 6.7.4-3 for the BWR model, are replaced with maximum reactivity configuration MCNP inputs. The maximum reactivity inputs include the minimum cell-to-cell pitch, the optional absorber configuration, and the full, redesigned, set of weld posts (two columns). The optional absorbers are modeled as aluminum sheet replacements. For the PWR system this configuration replaces borated water with a neutronically transparent material. The SAR PWR (Section 6.7.3) and BWR (Section 6.7.6) analyses demonstrate that there is no statistically significant difference between the aluminum replacement versus absorber removed models.

A second BWR figure is added, Figure 6.7.4-4, to show a sample input for the 82-assembly configuration. The 82-assembly configuration requires a different number of optional absorber sheets than the 87-assembly design.

The redesigned number of weld-posts is readily observable in Figure 6.7.1-3 (PWR model). Two columns of weld posts in MCNP Surfaces 107 to 142 are subtracted from the absorber MCNP Cell 101. The surface cards for the weld posts are symmetric off the center axis (versus a

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single column in the previous inputs on the axis). Similar surfaces, 107 to 134, and cell definitions are shown in the BWR MCNP input, Figure 6.7.4-3.

The optional absorber configuration significantly increases the size of the MCNP input file as peripheral tube definitions (Cell Cards) are needed for each basket quadrant. For the PWR input shown in Figure 6.7.1-3, Universes 3 to 7 contain the tube models assembled into a basket via Cells 401 to 422. Universe 7 contains absorbers on all four sides as shown by the use of Material 12 (boron carbide and aluminum mixture) in Cells 101, 103, 111, and 113. The remaining tube universes replace the absorber on two sides of the tube by aluminum (Material 7). In Universe 6 the material replacement may be seen in Cells 128 (+Y face absorber) and 138 (+X face absorber). Similar modifications are made to Universes 3 through 5 for the remaining peripheral tubes of the PWR basket.

The BWR models in Figures 6.7.4-3 and 6.7.4-4 are similarly constructed with differences limited to the increased number of universes required for modeling the 87-assembly peripheral absorbers (Universes 3 to 11). The fuel tubes are placed within the BWR basket in Cells 401 to 445. An example replacement of the absorber by aluminum in the peripheral tubes is seen in Universe 10, Cells 128 (+Y absorber face) and 138 (+X absorber face).

As seen in the SAR example, Figures 6.7.1-3, 6.7.1-4, 6.7.4-3 and 6.7.4-4, a complete basket model, including the optional absorber configuration and final, redesigned, absorber attachment (weld posts), is used to determine maximum allowed enrichments.

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NRC Stated Issue: Provide benchmark clarification

The SAR should justify the change in data used to establish the trends in the benchmark evaluation with respect to the nine different parameters. The response to RAI 6-6 in the second round of RAIs raises an inconsistency. The revised plots (Figures 6.7.7-1 through 6.7.7-9) of the benchmark data and linear fits to the data appear to show additional data points which were not present in the previous version of the figures, as well as some data points now missing that were in the previous figures. The list of benchmark data has not changed and the text states that only three points were deleted for the revised analysis. Clarification of the difference between the plots in the original SAR and the response to the second round of RAIs (beyond that supplied in the November 28, 2006 email from NAC) is needed. An indication of which data points were included in the trend analysis for each parameter and how the applicable points were determined should be provided.

Resubmittal Content

NRC RAI-2 requested additional calculations on the criticality bias for MCNP. In particular, the RAI requested all parameters to be considered in trending. NAC had previously followed the guidance in NUREG/CR-6361 by establishing bias based on the parameter with the highest correlation coefficient. As the correlation coefficients for all parameters are very low, and show no trending, NAC agreed to modify the SAR to include all parameters and modified the relevant SAR Sections (in particular Sections 6.5 and 6.7). NRC also requested that a select number of data points (three) be removed from the data set as they produced noticeably higher reactivities than the remaining data and therefore substantially influenced the line-fit correlations. NAC previously incorporated this request as a response to RAI-2.

The RAI-2 response revised Section 6.5.2 states that all 183 data points provided as experimental benchmarks (186 total data points within the experiment set listed in Section 6.7 minus the three outlying data points) were used to establish trends and bias for all parameters with the exception of the cluster spacing study (137 data points). As a number of experiments are single cluster benchmarks, they are not applicable to a parameter study of cluster spacing. To respond to this criticality item 3 issue, NAC modified the Section 6.5.2 text to explicitly list the experiments not included in the cluster spacing benchmark.

NRC questions the changes in the trends, and data plots, displayed in Section 6.7 with respect to all nine parameters that occurred during the RAI-2 response. NAC previously provided information to the NRC stating that previous benchmarks did not use all available data for each parameter. NAC limited data sets that went into the correlations prior to RAI-2. The intent of the limited data sets was to remove data from the experiment set that were likely to bias the outcome of the analysis, primarily due to an excess number of data points at one of the independent parameter values. For example, the soluble boron set was initially limited to 55 data

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points (the experiments contained in LEU-COMP-THERM sets 8, 11, 14, 35, 50 and 51) by removing all data points for experiment sets that contained zero (i.e., no) soluble boron in the individual evaluations. The choice as to which data points to include in a given parameters study was open to interpretation with engineering judgment being the driver in determining acceptability of a data point. This approach resulted in parameter studies that did not include all potentially relevant information. To remove engineering judgment from the analysis, and to include the comprehensive data set in Section 6.7, NAC chose to include all data points (with the listed exception for the cluster gap study) in the revised bias calculations provided in the RAI-2 response. It was noted that while changing the slope, and general look of the correlation, the additional data points did not significantly change the calculation bias.

SAR Section 6.5.2 is revised to clarify that all 183 data points are used for the parameters studies with the exception of cluster gap spacing which is limited to 137 data points as some experiments are single cluster benchmarks.

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NRC Stated Issue: Define control for minimum center-to-center fuel cell spacing

The SAR should show that the minimum center-to-center cell spacing will be maintained under normal and accident conditions, and should also confirm that the minimum center-to-center fuel cell spacing added to the Technical Specifications is the same as used in the criticality analysis. A minimum fuel cell spacing dimension has been added to the Technical Specifications as requested in RAI 13-1. The structural analysis should show that this minimum spacing is maintained under normal, off-normal, and accident conditions. The SAR states that the minimum spacing now in the Technical Specifications is consistent with the criticality analysis, but the details in the model provided in the example input files show a larger cell spacing. Verification that the minimum spacing was used in the calculations for determining the maximum allowed enrichments for each fuel type is needed. In addition, the input file provided via the November 28, 2006, NAC email has not been evaluated and needs to be submitted formally for review.

Resubmittal Content

As a response to RAI-2, NAC recalculated maximum allowed enrichments for PWR and BWR systems using an MCNP calculation model that applied the optional absorber configuration and a redesigned weld post configuration while retaining other maximum reactivity configuration elements such as the minimum center-to-center tube spacing allowed by the drawings and specified in the Technical Specifications (Appendix A Section 4.1.1). Criticality evaluations relied on structural evaluations in Chapter 3 to demonstrate that the tube configuration, in this context center-to-center tube spacing, is maintained through all normal, off-normal, and hypothetical accident conditions. Relevant structural analyses were already included in the MAGNASTOR SAR in Sections 3.7.2.1 to 3.7.2.2. The conclusions of these analyses clearly demonstrate that the basket retains the structure applied in the criticality analysis and that no collapse of the tube structure occurs.

As requested by NRC staff, the MCNP input files, included as SAR Figures 6.7.1-3 and 6.7.1-4 (PWR) and Figures 6.7.4-3 and 6.7.4-4 (BWR), are modified to include the minimum spacing inputs used to establish system enrichment limits. PWR minimum spacing can be readily observed in the revised input files by locating Cells 401 through 422 in the Figure 6.7.1-3 and 6.7.1-4 MCNP input files. These cells place the 21 tubes within the canister cavity. The basket is symmetric around Tube 11 (Cell 411) with adjacent tubes (Tubes 7, 8, 14, and 15 in Cells 407, 408, 414, and 415) offset 23.4925 cm (9.249 inches) in x and y-coordinates. This offset is identical to the minimum 9.249 inches in Technical Specifications, Appendix A Section 4.1.1.

Similar BWR information may be located within Figures 6.7.4 -3 and 6.7.4 -4 by taking the offset from Cells 417, 418, 428, and 429. The BWR offset is 15.6617 cm (6.166 inches), which is minimum spacing specified in Technical Specifications Appendix A Section 4.1.1.

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Offset calculations provide identical dimensions between any of the adjacent PWR or BWR fuel tubes.

The revised MCNP input files included as Figures 6.7.1-3, 6.7.1-4, 6.7.4-3, and 6.7.4-4 demonstrate that minimum tube center-to-center spacing is included in the evaluation model determining maximum system enrichment. Chapter 3 structural evaluations demonstrate that the configuration applied in the criticality analysis is maintained through all operating conditions.

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EDITORIAL ISSUES

NRC Stated Issue: Noted inconsistent page number format

Provide consistent page numbering for Appendix A to Chapter 1. In the response to RAI 1-1, it appears that to be consistent with the other parts of the SAR, the page numbers in Appendix A to Chapter 1 should follow the pattern 1A-1, 1A-2 and 1A-3, not A-1, A-2 and A-3.

Resubmittal Content

The referenced pages are renumbered as requested: 1A-1, 1A-2 and 1A-3.

NRC Stated Issue: Noted error in Table number reference

Correct the cross references in Section B2.1.1 of the proposed Technical Specifications. The response to RAI 13-3 missed correction of one cross reference. The cross references on page B2-1 of the Technical Specifications need to be changed from Tables 6.4-1 and 6.4-2 to Tables 1-A-1 and 1-A-2, respectively.

Resubmittal Content

In Section B2.1.1, "Tables 6.4-1 and 6.4-2" are changed to "Tables 1-A-1 and 1-A-2."

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OTHER NAC-IDENTIFIED ISSUES

Identified Issue – Item 1
Discussions with the NRC staff identified the need to provide analysis validating the MAGNASTOR basket maintained geometric stability when subjected to the most limiting transport drop accident load.

Resubmittal Content
Transport impact analysis has been performed for the most limiting basket configuration identified from the different basket orientation analyses performed for tipover accident loading. The analytical models representing BWR 22.5°basket orientation was placed in the transport cask model and subjected to a dynamic load representing the transport condition 30 foot side drop loading. Results from this analysis validate that the MAGNASTOR basket remains geometrically stable. Documentation of this analysis has been added to SAR Section 3.10.6.

Identified Issue – Item 2
Discussions with the NRC staff identified the need to define stability as it applies to the MAGNASTOR basket; define the criteria being evaluated and define why the criteria is adequate to assure the basket structural configuration is maintained for all loading

Resubmittal Content
Geometric stability of a structure in the universal sense is that the structure returns to its design configuration when displaced during response to a dynamic load. Relative to the MAGNASTOR basket, this performance characteristic is demonstrated when the fuel tube interface surfaces and pin-slot engagement is maintained following the dynamic response to storage tipover and cask transport side drop loads. The analysis methodology and analytical models developed to perform the evaluation of the basket response to these dynamic load conditions has been defined using a significantly conservative methodology that applies a bounding load to an analytical model that ignores structural stiffness of the assembled basket and limited displacement of interface surfaces. Performing analyses of different basket orientations, applied load and interface gap conditions provides a comprehensive evaluation of the basket robust performance and demonstrates that the basket remains stable when subject to worst case storage and transport impact loads. Complete discussion of the MAGNASTOR basket geometric stability analysis is presented in Sections 3.10.6 and 3.10.9

Identified Issue – Item 3
Provide evaluation and or discussion of the DLF that may be influencing the basket during tip over as it compares to the applied load in the structural stability analysis.

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Resubmittal Content

The method applied to develop the boundary conditions used in the basket geometric stability analysis combined canister shell displacements that were developed using a statically applied load to a three dimensional ANSYS model of the basket placed in the canister with bottom plate and closure lid. The load applied to this model, developed to calculate canister shell displacements to be used as a boundary condition for the basket stability analysis, is the result of an analysis of the concrete cask tipping over on to a concrete ISFSI pad. Since this shell displacement calculation is performed as a static load analysis, a dynamic load factor (DLF) is used to increase the previously calculated dynamic tipover time history as a conservative method to bound the influence of dynamic structural frequency responses. The factor representing the dynamic influence is calculated to be 1.36. Therefore, following the methodology where the applied load is increased to assure the basket remains stable for loading in excess of the design basis load, the design basis load has been increased by a chosen factor of 1.5 in order to demonstrate a minimum margin of safety for geometric stability of 50% relative to design basis loads. Multiplying the dynamic load factor 1.36 by 1.5 establishes the basis for demonstrating that the system safety factor results in a total increase in tipover loading of 2.04 (1.36 x 1.5). Discussion of this applied load is included in SAR Section 3.10.9.

Identified Issue – Item 4

Basket structural stability factor of safety is to be defined based on load criteria related to industry standard.

Resubmittal Content

The analysis method developed and implemented for the basket geometric stability evaluation adopts a minimum margin on load by incorporating a load factor of 1.5 on the design basis tipover load. Acceptance criteria is identified to be compatible with structural collapse criteria presented in ASME Code, Section III, Appendix F, where stress is limited to 0.9 S_u that implements an effective factor of safety of 1.1. Discussion of this basis has been added to SAR Section 3.10.6.

Identified Issue – Item 5

ISG-1, Rev 2 – Functional definition of damaged, undamaged and intact fuel has been adopted.

Resubmittal Content

ISG-1, Rev 2 has been issued between the time that the initial MAGNASTOR application was withdrawn and the resubmittal of this application. In order to maintain compliance with industry guidance and incorporate operational flexibility for the licensee, NAC has adopted this revised methodology for definition of damaged, undamaged and intact fuel. Revisions that have been made to the SAR include Chapter 1 and Technical Specification definitions for damaged fuel in addition to edits throughout the SAR text to maintain compatibility with the adopted definitions. Structural analysis of a fuel rod subject to impact load has been performed with a missing grid

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support in order to permit this specific fuel configuration to be defined as undamaged. It is noted that the material properties used in this fuel rod structural analysis are those provided by Pacific Northwest National Laboratory for burnup to 62 GWd/MTU. The fuel Rod buckling analysis is presented in Section 3.8.

Identified Issue – Item 6

Site boundary dose to be highlighted as a site specific limiting condition

Resubmittal Content

Discussions with the NRC staff have identified specific interest to highlight regulatory limits relative to site boundary dose and site specific radiological protection requirements. In order to be responsive to this issue Technical Specification 13A Section 5.5 has been added to the MAGNASTOR resubmittal emphasizing user need to ensure compliance with 10CFR50 and ALARA objectives.

Identified Issue – Item 7

RIS 2007-09 Issue - Leak test not performed on closure weld changes "Leak tight" to "No Credible Leakage" – edit fuel description throughout as appropriate.

Resubmittal Content

The MAGNASTOR design and application has incorporated the ISG-15 guidance and has limited leak testing during the canister closure operation to port cover welds. Based on information provided in RIS 2007-09, an edit has been performed of the entire SAR adopting the revised terminology of "no credible leakage" in place of "leak tight," as appropriate.

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Table 1 NRC Letter, Dated 2-15-07 and Preliminary Staff Evaluation Issues

Item	Issue Identified	SAR Section Reference
1	Structural stability - consider the basket deformation and its interaction with the canister shell as a basis for calculating the displacement boundary conditions suitable for evaluating geometric stability of the fuel basket. Revised analyses include detailed 3D ANSYS models for both PWR and BWR baskets with the TSC and concrete cask.	Section 3.10.6 Section 3.10.9
2	Replace Von Mises plastic stress summary for basket tube P_m at the middle of tube wall.	Section 3.7.2.1.2 Section 3.7.2.2.2 Section 3.10.1.4.3 Section 3.10.2.4.3
3	Explain weld quality factor differences.	Section 3.7.2.1.2 Section 3.7.2.2.2
4	Include analysis for concrete cask lifting with air pallets.	Section 3.4.3.1
5	Revise high burnup fuel rod structural integrity analysis.	Section 3.8 Section 8.3
6	Justify ISG 11, Revision 3 – 117°F thermal cycle.	Section 4.4.1.5 Section 4.4.3 Section 8.11 Section 9.1.1 Section 13A
7	Provide analysis of the transfer cask heat-up rate for transfer to concrete cask.	Section 4.4.1.5 Section 4.4.1.6 Section 8.11 Section 9.1.1 Section 9.1.2
8	Define the bases for the vacuum drying criteria. [Deleted Pressurized Helium Drying System]	Section 8.11 Section 9.1.1 Section 13A Section 13C

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Table 1 NRC Letter, Dated 2-15-07 and Preliminary Staff Evaluation Issues (Continued)

Item	Issue Identified	SAR Section Reference
9	Criticality Issues – demonstrate that the fuel assemblies remain intact and consistent with the configuration assumed in the criticality analysis.	Section 3.7.2 Section 3.10.6
10	Criticality analysis with input files are to reflect minimum poison sheet configurations.	Section 6.7.1 Figure 6.7.1-3 Figure 6.7.1-4 Figure 6.7.4-3 Figure 6.7.4-4
11	Clarify the difference between the plots in the original SAR and the response to the second RAI - beyond that supplied in the November 28, 2006 e-mail. (Added discussion on which data is used)	Section 6.5.2
12	Show that the minimum center to center cell spacing is maintained and that this minimum cell spacing is represented in the criticality analysis for maximum allowable enrichment.	Section 6.7.1 Section 6.7.4
13	Editorial Items, Appendix A to Chapter 1 and Technical Specification Section B2.1.1 references	Chapter 1 – Appendix A Section 13B 2.1.1

NAC INTERNATIONAL RESPONSE TO SUMMARY OF NRC STAFF OPEN ISSUES

Table 2 Other NAC-Identified Issues

Item	Issue Identified	SAR Section Reference
1	Staff comment relative to 72.236 (m) – Validate basket geometric stability when subject to most limiting transport loads.	Section 3.10.6
2	Define the definition of stability; what is the criteria being evaluated and why is it adequate to assure the basket structural configuration is maintained for all loading.	Section 3.10.6 Section 3.10.9
3	Provide evaluation and or discussion of the DLF that may be influencing the basket during tip over as it compares to the applied load in the structural stability analysis.	Section 3.10.6 Section 3.10.9
4	Basket structural stability factor of safety to be defined based on load criteria related to industry standard.	Section 3.10.6
5	Incorporate ISG-1, Rev 2 – definition of damaged, undamaged and intact fuel.	Section 1.1 Section 3.8 Section 8.11 Section 13A
6	Site boundary dose to be highlighted as a site specific limiting condition.	Section 13A 5.5
7	RIS 2007-09 Issue – Leak test not performed on closure weld changes "Leak tight" to "No Credible Leakage" – edit SAR throughout as appropriate.	Section 5.1.3 Section 5.5.4 Section 7.1.1 Section 7.3

ATTACHMENT 2

List of SAR Changes for the MAGNASTOR Storage System, Revision 1,

in Response to

NRC Letter, dated February 15, 2007 and Preliminary Staff Evaluation, dated July 24, 2007

NAC International

July 2007

List of SAR Changes for the MAGNASTOR Storage System, Revision 1

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Note: The affected Chapter Table of Contents, List of Figures and List of Tables have been updated without revision bars to reflect the list of changes detailed below.		
Chapter 1		
Page 1.1-1	ISG-1, Rev. 2	Section 1.1, Terminology – added definitions for Assembly Defect and Breached Spent Fuel Rod
Page 1.1-2	ISG-1, Rev. 2	Revised definition of Damaged Fuel
Page 1.1-3	ISG-1, Rev. 2	Continuation of revised definition of Damaged Fuel Added definition for Grossly Breached Spent Fuel Rod Revised definition of Intact Fuel (Assembly or Rod)
Page 1.1-4	ISG-1, Rev. 2	Added definition of Undamaged Fuel
Page 1.2-1	Editorial	Section 1.2, Introduction, 3rd paragraph, 3rd sentence – added "Appendix 1-A to this chapter and in"
Page 1.3-1	Editorial	Section 1.3, General Description of MAGNASTOR, 1st sentence – added "Appendix 1-A to this chapter and in" Section 1.3.1, MAGNASTOR Components, last paragraph – deleted "nitrogen gas supply"
Page 1.3-2	Editorial/NAC Correction	3rd paragraph, 13th sentence – changed "port cover welds" to "port cover weld"; 14th sentence – changed wording to eliminate "leaktight"
Page 1.3-6	NAC Correction	3rd full paragraph, 2nd sentence – changed "cooling water circulation" to "annulus circulating water cooling system"; 3rd sentence – revised throughout for clarity 4th full paragraph – changed "water circulation in the annulus" to "water flow into the annulus"
Pages 1A-1, 1A-2 & 1A-3	Editorial	Renumbered pages – changed from A-1, A-2 & A-3 to 1A-1, 1A-2 & 1A-3
Chapter 2		
Page 2-1	ISG-1, Rev. 2/ Editorial	Chapter 2, 2nd sentence – changed "intact" to "undamaged"; 3rd sentence – changed "for MAGNASTOR components" to "for the MAGNASTOR components"
Page 2.2-1	ISG-1, Rev. 2/Editorial	Section 2.2, Spent Fuel to be Stored, 2nd paragraph – changed "intact" to "undamaged" Section 2.2.1, PWR Fuel Evaluation, 1st paragraph, last sentence – changed "intact" to "undamaged"; 2nd paragraph, 5th sentence – changed "Table 6.4-1" to "Table 6.4.3-1"
Page 2.2-2	Editorial/ ISG-1, Rev. 2	1st partial paragraph, 4th full sentence – changed "Table 5.1-3" to "Table 5.1.3-1" Section 2.2.2, BWR Fuel Evaluation, 1st paragraph, 4th sentence – changed "intact" to "undamaged"; 2nd paragraph, 3rd sentence – changed "Table 6.4-2" to "Table 6.4.3-2"
Page 2.2-3	Editorial	1st partial paragraph, 1st full sentence – changed "Table 5.1-3" to "Table 5.1.3-1"
Page 2.2-6, Table 2.2-1	Editorial	Footnote, 2nd sentence – changed "Table 6.4-1" to "Table 6.4.3-1"; 3rd sentence – changed "Table 6.2-1" to "Table 6.2.1-1"
Page 2.2-7, Table 2.2-2	Editorial	Footnote a, 2nd sentence – changed "Table 6.4-2" to "Table 6.4.3-2"; 3rd sentence – changed "Table 6.2-2" to "Table 6.2.1-2"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Chapter 3		
Page 3.1-3	D. Tang Comment	Concrete Cask subsection, 1st paragraph, next-to-last sentence – deleted "nominal" & added "at ambient temperature"
Page 3.2-2, Table 3.2.1-1	NAC Correction	Row titled Transfer Cask, TSC, Basket, Lifting Yoke – Empty – corrected PWR weight from "151,000" to "141,000" and BWR weight from "152,500" to "143,000"
Page 3.4-2	D. Tang Comment	Section 3.4.3.1 – added new 2nd & 3rd sentences to provide analysis information for lifting the concrete cask with air pads
Page 3.4-4	D. Tang Comment/ Editorial	Concrete Anchor subsection, 1st paragraph, 2nd sentence – revised throughout for clarity; in f_c equation, changed "3800 psi" to "3,800 psi" and ", 300°F" to "at 300°F"
Page 3.4-7	Editorial	Pedestal Structural Evaluation subsection, 2nd sentence – changed "Section 3.1.1" to "Section 3.10.4"
Page 3.4-14	NAC Correction	TSC Lift Evaluation subsection, 1st paragraph, last sentence – deleted "nodal"; second column table heading – changed "Nodal Stress (psi)" to "Stress Intensity (psi)"; two equations – deleted "nodal" from both
Page 3.4-15	NAC Correction	Transfer Cask Body subsection, 1st paragraph, 3rd sentence – changed "maximum primary membrane, P_m" to "maximum primary membrane stress intensity, P_m" and "maximum primary membrane plus bending stress, $P_m + P_b$" to "maximum primary membrane plus bending stress intensity, $P_m + P_b$"
Page 3.4-16	NAC Correction/ Editorial	3rd paragraph, 2nd sentence – changed "The maximum bending plus membrane stress" to "The maximum membrane plus bending stress"; 3rd sentence – changed "Comparing the stress" to "Comparing this stress" Transfer Cask Shield Door Rails and Welds subsection – 2nd paragraph, last sentence – changed "Allowable stresses" to "Allowable stress"
Page 3.4-26, Tables 3.4.3-1 & 3.4.3-2	Editorial	In both table titles, changed "Stresses" to "Stress Intensity"; Note b – added "intensity" in 3 places; Note d – added "intensity"
Page 3.5-3	NAC Correction	L_{eff} equation – changed from "5.4 × = 10.8 inches" to "5.4 × 2 = 10.8 inches"
Page 3.5-6	Editorial	Footnote b – changed "component of stress are" to "components of stress are"
Page 3.5-10	D. Tang Comment/ Editorial	Added the following words to the factor of safety paragraph: "based on ASME Code, Section III, Subsection NB, Article NB-3230" Factor of safety equation – changed "S_{mBM}" to "S_{mbm}" in 2 places
Page 3.5-11	D. Tang Comment	Factor of safety equation – changed "0.35" to "wf"
Page 3.5-12	D. Tang Comment	Included weld quality factor definition to agree with previous equation
Page 3.5-24	Editorial	Section 3.5.3.1, Concrete Cask Thermal Stresses, 1st sentence – changed "Section 3.1.1" to "Section 3.10.4"
Page 3.5-25	Editorial	Section 3.5.3.3, Concrete Cask Combined Stresses, f_c equation – changed "3800 psi" to "3,800 psi" & "Compressive strength, concrete, 300°F" to "Compressive strength of concrete at 300 °F"
Page 3.6-7	Editorial	Section 3.6.2.2, BWR Fuel Basket, last paragraph, 2nd sentence – changed "Figure 3.10.2-13" to "Figure 3.10.2-14"
Page 3.6-12	Editorial	1st paragraph after analysis, 1st sentence – changed "Section 3.7.2.1" to "Section 3.7.2.2"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 3.7-10	NAC Correction/ D. Tang Comment	PWR Fuel Tube Evaluation subsection, 2nd paragraph, 2nd sentence – changed "nodal stresses" to "stress intensity"; 3rd paragraph, 3rd sentence – added "intensity"; 4th sentence – changed "The allowable primary stress intensity is $0.9S_u$" to "The allowable primary membrane plus bending stresses are $0.9S_u$"; 5th sentence – changed "1.34" to "1.16"; 4th paragraph, 2nd sentence – revised throughout; added new 4th sentence for clarity
Page 3.7-14	NAC Correction	PWR Corner Support Weldment Evaluation subsection, 2nd paragraph, 2nd sentence – changed "nodal stress" to "primary membrane plus bending stress intensity"; last sentence – changed "1.35" to "2.28"
Page 3.7-16	NAC Correction	PWR Side Support Weldment Evaluation subsection, 3rd sentence – changed "nodal stress" to "primary membrane plus bending stress intensity"
Page 3.7-23	Editorial	PWR Basket Displacement subsection – next-to-last sentence – changed "Table 3.7.2-1" to "Figure 3.7.2-1"
Page 3.7-24	Editorial	Section 3.7.2.2.1, 24-inch Concrete Cask End-Drop, 2nd paragraph, 1st sentence – changed "Figure 3.10.1-13" to "Figure 3.10.2-13"
Page 3.7-28	NAC Correction/ D. Tang Comment	BWR Fuel Tube Evaluation subsection, 1st partial paragraph, 1st partial sentence – changed "nodal stresses" to "stress intensity"; 1st full paragraph, 5th sentence – changed "1.29" to "1.12"; 2nd full paragraph, 2nd sentence – revised throughout; 3rd sentence – changed "primary stress intensity" to "membrane plus bending stress intensity"
Page 3.7-31	NAC Correction	BWR Corner Support Weldment Evaluation subsection – 2nd paragraph, 2nd sentence – changed "nodal stress" to "primary membrane plus bending stress intensity"; 3rd paragraph, 3rd sentence – changed "nodal stress" to "primary membrane plus bending stress intensity"
Page 3.7-32	NAC Correction	BWR Side Support Weldment Evaluation subsection -- 3rd sentence – changed "nodal stress" to "primary membrane plus bending stress intensity" and added "conservatively"
Page 3.7-36	Editorial	Middle of page, sentence starting "For the corner weldment boss …" – deleted "weld"
Page 3.7-42 Table 3.7.2-1	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")and revised columns 3 and 5 to reflect concrete cask tip-over analysis
Page 3.7-43 Table 3.7.2-2	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")
Page 3.7-43 Table 3.7.2-3	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity") and revised table contents to reflect concrete cask tip-over analysis
Page 3.7-43 Table 3.7.2-4	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")
Page 3.7-44 Table 3.7.2-5	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity") and revised columns 3 and 5 to reflect concrete cask tip-over analysis
Page 3.7-44 Table 3.7.2-6	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")
Page 3.7-44 Table 3.7.2-7	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")
Page 3.7-45 Table 3.7.2-8	NAC Correction	Revised table title (changed "Nodal Stresses" to "Stress Intensity")
Page 3.7-46	Editorial	Section 3.7.3.1, Concrete Cask Thermal Stresses – changed "Section 3.1.1" to "Section 3.10.4"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change

Page 3.7-48	Editorial	1st equation – for clarity, added "Conservatively defined as the concrete cask empty weight for evaluation of external loads."
Page 3.7-49	Editorial	Concrete Shell Local Damage (Penetration Missile) subsection, last line of equation – added "at conservative 300°F" for clarity
Page 3.7-56	Editorial	W_{cc} equation – added "Conservatively defined"
Page 3.7-63	Editorial	Section 3.7.3.7, 3rd paragraph, last sentence – changed "Section 3.1.1" to "Section 3.10.4"
Pages 3.8-1 – 3.8.3	NAC Addition	Section 3.8, Fuel Rods – changed "all conditions of storage" to "the storage conditions" Section 3.8.1 – added "Buckling" to section title and deleted 3.8.1.1 Section title. Section 3.8.1, PWR Fuel Rod Buckling, is revised throughout to address the buckling evaluation for MAGNASTOR high burnup PWR fuel
Pages 3.8-4 –	NAC Addition	Conclusion of revised Section 3.8.1 Section 3.8. 2 – added "Buckling" to section title; deleted Cladding Material, Pellet Diameter and Rod Length columns from table; revised the PWR fuel rod equation to show the largest ratio of unsupported length to radius of gyration of the cladding cross-section and also revised the BWR fuel rod equation.
Page 3.8-6, Figure 3.8.3-1	NAC Addition	Added new figure titled "Three-Dimensional Finite ANSYS Element Model for MAGNASTOR Fuel Rod" to support fuel rod buckling evaluation
Page 3.8-7, Figure 3.8.3-2	NAC Addition	Added new figure titled "Three-Dimensional LS-DYNA Model for MAGNASTOR Fuel Rod with a 1.23-inch Bow" to support fuel rod buckling evaluation
Page 3.8-8 Figure 3.8.3-3	NAC Addition	Added new figure titled "Detailed View of Three-Dimensional LS-DYNA Model for MAGNASTOR Fuel Rod" to support fuel rod buckling evaluation
Page 3.10.1-5	Preliminary Staff Evaluation/ Editorial	Table at top of page – changed dimension from 45" to 47" Section 3.10.1.3.3 Concrete Cask Tip-Over Accident Boundary Conditions, 3rd paragraph, 1st sentence – changed "Section 3.10.1.3.2" to "Section 3.10.1.2.3"
Page 3.10.1-7	NAC Correction	Section 3.10.1.4.3, Maximum Stresses for Concrete Cask Tip-Over Accident, 2nd & 3rd paragraphs – revised to reflect concrete cask tip-over stress intensity analysis; deleted 4th paragraph
Page 3.10.2-1	Editorial	Section 3.10.2.1, Load Path Description, 1st paragraph, 9th sentence – changed "Figure 3.10.2-1" to "Figure 3.10.2-2"
Page 3.10.2-4	Preliminary Staff Evaluation	Section 3.10.2.3.2, Thermal Stress Boundary Conditions, table – changed dimension from 45" to 43"
Pages 3.10.2-6 & 3.10.2-7	NAC Correction	Section 3.10.2.4.3, Maximum Stresses for Concrete Cask Tip-over Accident, 2nd & 3rd paragraphs – revised to reflect concrete cask tip-over stress intensity analysis; deleted 4th paragraph
Page 3.10.6-1	Response to 2/25/07 NRC Letter	Section 3.10.6, 2nd paragraph – deleted 1st sentence; split old 3rd paragraph into 3 new, revised paragraphs to address geometric stability of the basket in detail
Page 3.10.6-2	Response to 2/25/07 NRC Letter	Continuation of revised paragraph; added new 1st full paragraph to describe the PWR and BWR basket orientations considered in the analysis; last paragraph, last sentence – added "permitted during the basket assembly"
Page 3.10.6-3	Editorial/ NAC Correction	Model Description subsection – 1st paragraph, 1st sentence – changed "Figure 3.10.6-1 through Figure 3.10.6-8" to "Figure 3.10.6-2 through Figure 3.10.6-10"; 2nd paragraph, 6th sentence – revised throughout; deleted old last sentence

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 3.10.6-4	NAC Correction	2nd paragraph, 1st sentence – added "steel liner"; last sentence – revised throughout for clarity
Page 3.10.6-5	Response to 2/25/07 NRC Letter	Boundary Conditions subsection, 1st paragraph, 1st sentence – changed "the side and corner weldments" to "between the support weldments and the fuel tubes" for clarity; 2nd sentence – changed "Figure 3.10.6-1" to "Figure 3.10.6-2"; deleted remainder of this old paragraph; added new paragraph to address displacement boundary conditions suitable for evaluating the canister and the fuel basket
Page 3.10.6-6	Response to 2/25/07 NRC Letter	3 new paragraphs added to Boundary Conditions subsection to address canister shell displacement boundary conditions suitable for evaluating geometric stability of the canister and the fuel basket Load Cases subsection – revised throughout to describe the PWR and BWR load conditions evaluated for basket stability Model Conservatism in the Periodic LS-DYNA Models subsection – added new subsection to define LS-DYNA model conservatism
Page 3.10.6-7	Response to 2/25/07 NRC Letter	Continuation of the new Model Conservatism in the Periodic LS-DYNA Models subsection Post-Processing subsection – revised throughout to show the results of the basket structural analyses during and after impact
Page 3.10.6-8	Response to 2/25/07 NRC Letter/ Editorial	Post-Processing subsection continued – revised throughout to show the results of the basket structural analyses during and after impact and to correct figure numbers in last paragraph
Page 3.10.6-9	Response to 2/25/07 NRC Letter	Summary subsection – revised throughout to confirm that the PWR and BWR baskets maintain their configuration during a cask tip-over accident event
Page 3.10.6-10, Figure 3.10.6-1	Response to 2/25/07 NRC Letter	Inserted new figure titled "Basket Pin-Tube Slot Connections at Fuel Tube Corners"
Page 3.10.6-11, Figure 3.10.6-2	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-5)
Page 3.10.6-12, Figure 3.10.6-3	Response to 2/25/07 NRC Letter	Inserted new figure titled "PWR Basket Finite Model for Concrete Cask Tip-Over Accident – 18° Basket Orientation"
Page 3.10.6-13, Figure 3.10.6-4	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-7)
Page 3.10.6-14, Figure 3.10.6-5	Response to 2/25/07 NRC Letter	Inserted new figure titled "PWR Basket Finite Model for Concrete Cask Tip-Over Accident – 27° Basket Orientation"
Page 3.10.6-15, Figure 3.10.6-6	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-8)
Page 3.10.6-16, Figure 3.10.6-7	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-6)

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 3.10.6-17, Figure 3.10.6-8	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-1)
Page 3.10.6-18, Figure 3.10.6-9	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-3)
Page 3.10.6-19, Figure 3.10.6-10	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-2)
Page 3.10.6-20, Figure 3.10.6-11	Response to 2/25/07 NRC Letter	Inserted revised figure and added "Support " to figure title (formerly Figure 3.10.6-11)
Page 3.10.6-21, Figure 3.10.6-12	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-9)
Page 3.10.6-22, Figure 3.10.6-13	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-10)
Page 3.10.6-23, Figure 3.10.6-14	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-12)
Page 3.10.6-24, Figure 3.10.6-15	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-14)
Page 3.10.6-25, Figure 3.10.6-16	Response to 2/25/07 NRC Letter	Inserted revised figure (formerly Figure 3.10.6-13)
Page 3.10.6-26, Figure 3.10.6-17	Response to 2/25/07 NRC Letter	Inserted revised figure and added "Typical" to figure title (formerly Figure 3.10.6-15)
Page 3.10.6-27, Figure 3.10.6-18	Response to 2/25/07 NRC Letter	Inserted new figure titled "Time History of Maximum Gap Change at Fuel Tube Corner – PWR Basket 0° and 18° Orientation"
Page 3.10.6-28, Figure 3.10.6-19	Response to 2/25/07 NRC Letter	Inserted new figure titled "Time History of Maximum Gap Change at Fuel Tube Corner – PWR Basket 22.5° and 27° Orientation"
Page 3.10.6-29, Figure 3.10.6-20	Response to 2/25/07 NRC Letter	Inserted new figure titled "Time History of Maximum Gap Change at Fuel Tube Corner – PWR Basket 34° and 43° Orientation"
Page 3.10.6-30, Figure 3.10.6-21	Response to 2/25/07 NRC Letter	Inserted new figure titled "Time History of Maximum Gap Change at Fuel Tube Corner – BWR Basket 0° and 22.5° Orientation"
Page 3.10.6-31, Figure 3.10.6-22	Response to 2/25/07 NRC Letter	Inserted new figure titled "Time History of Maximum Gap Change at Fuel Tube Corner – BWR Basket 45° Orientation"
Page 3.10.6-32, Figure 3.10.6-23	Response to 2/25/07 NRC Letter	Inserted revised (formerly Figure 3.10.6-20)

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 3.10.6-33, Table 3.10.6-1	Response to 2/25/07 NRC Letter	Inserted revised table (formerly Table 3.10.6-2)
Page 3.10.6-34, Table 3.10.6-2	Response to 2/25/07 NRC Letter	Inserted revised table (formerly Table 3.10.6-1)
Page 3.10.6-35, Table 3.10.6-3	Response to 2/25/07 NRC Letter	Inserted new table titled "Summary of Maximum Gap Changes at Pin-Slot Connections for PWR Basket"
Page 3.10.6-36, Table 3.10.6-4	Response to 2/25/07 NRC Letter	Inserted new table titled "Summary of Maximum Gap Changes at Pin-Slot Connections for BWR Basket"
Page 3.10.8-1	NAC Correction	Section 3.10.8, Basket Pin-Slot Connection Evaluation for Concrete Cask Tip-Over Accident Condition, 2nd paragraph, 1st sentence – revised figure numbers; 3rd sentence – revised figure numbers; 5th sentence – added "(Figure 3.7.3-3)"
Pages 3.10.9-1 through 3.10.9-11	Response to 2/25/07 NRC Letter	Added new Section 3.10.9, TSC Basket Finite Element Models, along with Figures 3.10.9-1 through 3.10.9-7 and Tables 3.10.9-1 & 3.10.9.-2 to describe the TSC-Basket finite element models used to calculate the TSC shell displacements used as boundary conditions in the LS-DYNA basket stability evaluation
Chapter 4		
Page 4.1-1	NAC Correction/ Editorial	Section 4.1, Discussion, 2nd paragraph, deleted entire 3rd sentence; last sentence – changed "water, helium or vacuum" to "water or helium"; 3rd paragraph, 1st sentence – changed "must be transferred" to "is transferred"; 2nd sentence – changed "rely on all" to "use all"; 5th sentence – deleted "Since" & changed "it provides" to "that provide"
Page 4.1-2	NAC Correction/ Editorial	3rd full paragraph, 2nd sentence – added "neutron absorber"; 3rd sentence – added "finite element and" and changed "methodology" to "methodologies" Last paragraph, 2nd sentence – changed "Table 4.4-4 contains" to "Table 4.4.5 through Table 4.4-14 contain" and added "for the PWR and BWR cases"
Page 4.2-1	NAC Correction	Section 4.2, Thermal Properties of Materials, last sentence – added "neutron absorber"
Page 4.4-3	NAC Correction	Section 4.4.1.1, Two-Dimensional Axisymmetric Concrete Cask and TSC Models, 3rd paragraph, 1st sentence – added "the component temperature" 4th sentence – replaced "active fuel region" with "downcomer regions"
Page 4.4-7	NAC Correction	Modeling of the TSC subsection, 1st paragraph – added new 2nd sentence to state: "Circulating helium is modeled as laminar flow inside the TSC."
Page 4.4-9	Editorial	1st full paragraph, last sentence – changed "($k_f k_s$)" to "(k_f and k_s)"
Page 4.4-10	NAC Correction	Pressure of the Helium Backfill subsection, 5th sentence – changed "(0.763g/liter)" to "(0.76g/liter)"
Page 4.4-11	NAC Correction	1st paragraph, next-to-last sentence – added "for the design basis heat load"; added new last sentence to clarify evaluation results for helium backfill pressure
Page 4.4-12	NAC Correction	Section 4.4.1.2, Two-Dimensional Fuel Basket Models, 1st paragraph, 3rd sentence – changed "Three" to "Two" and deleted "vacuum"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 4.4-13	NAC Correction/ Editorial	1st full paragraph, 7th sentence – changed "in the inner surface" to "on the inner surface"; 8th sentence – changed "inner surface" to "adjacent surface" and "those fuel tubes" to "the interfacing fuel tubes"; 9th sentence – revised throughout to provide an option for maintaining thermal properties in the fuel baskets; deleted last two old sentences
Page 4.4-14	NAC Correction	Section 4.4.1.3, Two-Dimensional Fuel Assembly Models, 1st paragraph, 2nd sentence – deleted "vacuum" 2nd paragraph, 1st sentence – replaced "helium in the gap" with "a gap" 2nd sentence – deleted "vacuum"
Page 4.4-16	NAC Correction	Section 4.4.1.4, Two-Dimensional Neutron Absorber Models, 1st full paragraph, last sentence – changed "Three" to "Two" and deleted "vacuum"
Page 4.4-17	Response to 2/15/07 NRC Letter	Section 4.4.1.5 – added "for Operations Involving 24-Hour Cooling" to title; 1st paragraph, 2nd, 3rd & 4th bullets – revised throughout; remainder of text either new or revised extensively to provide detailed analysis of the TSC transfer operations for both PWR and BWR system configurations
Page 4.4-18	Response to 2/15/07 NRC Letter	Continuation of revised Section 4.4.1.5 Evaluation of the Water Phase subsection, 4th sentence – revised throughout; deleted old 5th sentence; revised new 5th sentence by adding "for the PWR configuration"; added new 6th sentence to address the BWR model
Page 4.4-19	NAC Correction/ Response to 2/15/07 NRC Letter	1st partial paragraph, 1st full sentence – deleted "inner shell"; 2nd bullet – changed "125°F" to "100°F"; 4th bullet – replaced in its entirety to reflect new thermal analysis Deleted subsection titled "Evaluation of the Drying Phase – Pressurized Helium Drying System. This system has been eliminated from the MAGNASTOR application. Evaluation of the Drying Phase – Vacuum Drying System subsection – revised throughout to clarify the drying phase evaluation for the Vacuum Drying System
Page 4.4-20	Response to 2/25/07 NRC Letter	Evaluation of the Drying Phase – Vacuum Drying System subsection continued – revised throughout to clarify the drying phase evaluation for the Vacuum Drying System
Pages 4.4-21	Response to 2/25/07 NRC Letter	Evaluation of the Drying Phase – Vacuum Drying System subsection continued – added diagram depicting temperature vs. time correlation during the drying cycle Evaluation of the Helium Phase subsection – revised throughout to identify heat loads for the helium phase
Page 4.4-22	Response to 2/25/07 NRC Letter	Evaluation of Moving the TSC into the Concrete Cask subsection – revised throughout to describe the evaluation of the thermal performance of the transfer cask for four conditions Section 4.4.1.6 – added new section titled "Two Dimensional Transfer Cask and TSC Model for Operations Involving Minimum Cooling Time and a Loading Time of Eight Hours" to provide detailed description of the analysis of the TSC transfer operations for both PWR and BWR system configurations
Page 4.4-23	Response to 2/25/07 NRC Letter	New Section 4.4.1.6 continued

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 4.4-24	NAC correction/ Response to 2/25/07 NRC Letter	2nd full paragraph, 1st sentence – changed "concrete TSC cask annulus" to "concrete cask to TSC annulus"; added new last two sentences for clarity Revised subsection title from "Transfer Condition" to "Transfer Condition for 24-Hour Cooling and Multiple Vacuum Drying Cycles" and revised subsection throughout to define operational limits and demonstrate that fuel cladding temperature limits are met
Page 4.4-25	Response to 2/25/07 NRC Letter	Continuation of revised subsection Added new subsection titled "Transfer Condition for Minimum Cooling Time and Eight Hours of Canister Transfer" to define operational limits and demonstrate that fuel cladding temperature limits are met
Page 4.4-26	Response to 2/25/07 NRC Letter	Continuation of new subsection
Page 4.4-27	Editorial	3rd full paragraph, 2nd sentence – added "Nominal" & changed "Table 4.4-5" to "Table 4.4-4"; 3rd sentence – revised throughout to eliminate the pressurized helium drying system; 4th sentence – changed "Either" to "This"
Pages 4.4-29	Response to 2/25/07 NRC Letter	Added new subsection titled "TSC Backfill Helium Tolerances" to describe the range of acceptable helium backfill density
Page 4.4-39, Figure 4.4-10	NAC Correction	Element Number 2 – deleted "vacuum"
Page 4.4-40, Figure 4.4-11	NAC Correction	Element Number 2, 4, 6 – deleted "vacuum"
Page 4.4-41, Figure 4.4-12	NAC Correction	Element Number 2 – deleted "vacuum"
Page 4.4-45, Figure 4.4-16	NAC Correction	Revised Figure title
Page 4.4-46, Figure 4.4-17	NAC Correction	Revised Figure title
Page 4.4-47, Figure 4.4-18	Response to 2/25/07 NRC Letter	Added new Figure titled "Three-Dimensional ANSYS Model of the BWR Canister for TFR Vacuum Drying Analyses"
Page 4.4-48, Figure 4.4-19	Response to 2/25/07 NRC Letter	Added new Figure titled "Detailed View of the Three-Dimensional ANSYS Model of the BWR Canister for TFR Vacuum Drying Analyses"
Page 4.4-50, Table 4.4-4	NAC Correction	Deleted old Table 4.4-4 & renumbered subsequent tables accordingly; revised Table 4.4-4 helium density information to show nominal, lower and upper bound values
Page 4.4-51, Tables 4.4-5 & 4.4-6	Response to 2/25/07 NRC Letter	Added two new tables: Table 4.4-5 titled "Maximum Fuel Temperature for Water Phase – PWR" and Table 4.4-6 titled "Maximum Fuel Temperature for Water Phase – BWR"
Page 4.4-52, Tables 4.4-7 & 4.4-8	Response to 2/25/07 NRC Letter	Added two new tables: Table 4.4-7 titled "Maximum Fuel Temperature for Helium Phase – PWR" and Table 4.4-8 titled "Maximum Fuel Temperature for Helium Phase – BWR"
Page 4.4-53, Tables 4.4-9 & 4.4-10	Response to 2/25/07 NRC Letter	Added two new tables: Table 4.4-9 titled "Durations and the Temperature at the End of the Duration for the First Vacuum Stage (PWR)" and Table 4.4-10 titled "Durations and the Temperature at the End of the Duration for the First Vacuum Stage (BWR)"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 4.4-54, Tables 4.4-11 & 4.4-12	Response to 2/25/07 NRC Letter	Added two new tables: Table 4.4-11 titled "Durations and the Temperature at the End of the Duration for the Second Vacuum Stage* (PWR)" and Table 4.4-12 titles "Durations and the Temperature at the End of the Duration for the Second Vacuum Stage* (BWR)"
Page 4.4-55, Tables 4.4-13 & 4.4-14	Response to 2/25/07 NRC Letter	Added two new tables: Table 4.4-13 titled "TFR to VCC (PWR) Transfer Times and Temperatures" and Table 4.4-14 titled "TFR to VCC (BWR) Transfer Times and Temperatures"
Page 4.4-56, Table 4.4-15	Response to 2/25/07 NRC Letter	Added new table titled "Durations Allowed and the Maximum PWR Fuel Clad Temperatures for the Operation Using Reduced Vacuum Times, Reduced Cooling Time and Eight Hours of Handling"
Page 4.4-57, Table 4.4-16	Response to 2/25/07 NRC Letter	Added new table titled "Durations Allowed and the Maximum BWR Fuel Clad Temperatures for the Operation Using Reduced Vacuum Times, Reduced Cooling Time and Eight Hours of Handling"
Page 4.6-1	NAC Correction	Section 4.6.1 – added "Ambient" to section title
Page 4.7-2	Response to 2/25/07 NRC Letter	Added new reference #27
Page 4.8.2-6, Figure 4.8-7	Response to 2/25/07 NRC Letter	Added new figure titled "Three-Dimensional FLUENT Model of a Fuel Assembly Grid"
Page 4.8.2-7, Figure 4.8-8	Response to 2/25/07 NRC Letter	Added new figure titled "Three-Dimensional FLUENT Quarter-Symmetry Model for the Flow Around the Grid"
Chapter 5		
Page 5.1-3	Response to 2/25/07 NRC Letter	Section 5.1.3, Offsite Dose Discussion and Results, 1st paragraph – replaced old 3rd & 4th sentences with 4 new sentences to change wording from "leaktight" to "no credible leakage"
Page 5.5-4	Response to 2/25/07 NRC Letter	Section 5.5.4, Offsite Particulate and Gas Release, 1st paragraph, 1st sentence – deleted "leaktight" and added "where no credible leakage of the TSC's radionuclide contents can occur"; deleted old 2nd sentence
Page 5.8.3-3	ISG-1, Rev. 2	Changed title of Section 5.8.3.3 from "Intact Fuel Transfer Cask Dose Rates" to "Undamaged Fuel Transfer Cask Dose Rates"
Page 5.8.9-1	Editorial	Section 5.8.9.1, PWR, 5th paragraph, 2nd sentence – changed "Tables 5.8.9-1 through 5.8.9-5" to "Table 5.8.9-3 through Table 5.8.9-5"
Chapter 6		
Page 6.2-3, Table 6.2.1-1	Editorial	Footnote a, 1st sentence – changed "Table 6.4-1" to "Table 6.4.3-1"
Page 6.2-4, Table 6.2.1-2	Editorial	Footnote b, 1st sentence – changed "Table 6.4-2" to "Table 6.4.3-2"
Page 6.2-5, Table 6.2.1-2	Editorial	Footnote b, 1st sentence – changed "Table 6.4-1" to "Table 6.4.3-2"; footnote c, 2nd sentence – changed "Figure 6.2-1" to "Figure 6.2.1-1"
Page 6.5-4	Response to 2/25/07 NRC Letter	Section 6.5.2, Results of Benchmark Calculations, 2nd paragraph – added new 4th sentence to list the experiments excluded from the cluster gap study; subsequent 5th sentence – added "evaluated for the remaining parameters"
Page 6.7.1-1	NAC Correction	Section 6.7.1.PWR Model Details, 4th paragraph, 1st sentence – added "initially"; 2nd sentence – added "increases the number of weld posts and"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 6.7.1-2	11/28/06 supplemental information	Last paragraph – revised throughout to define control for minimum center-to-center fuel cell spacing
Pages 6.7.1-5 – 6.7.1-20 Figure 6.7.1-3	11/28/06 supplemental information	Figure revised throughout to show revised sample input files for transfer cask model
Pages 6.7.1-21 – 6.7.1-37 Figure 6.7.1-4	11/28/06 supplemental information	Figure revised throughout to show revised sample input files for transfer cask model
Page 6.7.3-1	ISG-1, Rev. 2	Changed title of Section 6.7.3 from "PWR Intact Fuel Criticality Evaluation" to "PWR Undamaged Fuel Criticality Evaluation"
Pages 6.7.4-1 & 6.7.4-2	11/28/06 supplemental information	Section 6.7.4, BWR Model Details, 4th paragraph, 1st sentence – added "initially"; 2nd sentence – added "increases the number of weld posts and"; last paragraph revised throughout to describe sample input files for maximum reactivity configuration and minimum cell spacing
Pages 6.7.4-5 – 6.7.4-27 Figure 6.7.4-3	11/28/06 supplemental information	Figure revised throughout to show revised sample input files for transfer cask model – BWR 87-assembly basket
Pages 6.7.4-28 – 6.7.4-44 Figure 6.7.4-4	11/28/06 supplemental information	Added new figure titled "MCNP Transfer Cask Model – BWR 82-Assembly Basket" to include sample input files for transfer cask model – BWR 82-assembly basket
Page 6.7.6-1	ISG-1, Rev. 2	Changed title of Section 6.7.6 from "BWR Intact Fuel Criticality Evaluation" to "BWR Undamaged Fuel Criticality Evaluation"
Chapter 7		
Page 7.1-3	Response to 2/25/07 NRC Letter	1st paragraph, last part of sentence – changed "a leaktight configuration" to "having no credible leakage"; 2nd paragraph, last sentence – deleted "leaktight"
Page 7.3-1	Response to 2/25/07 NRC Letter	Section 7.3, 1st paragraph, 2nd sentence – revised throughout to change wording from "leaktight" to "no credible leakage"
Chapter 8		
Page 8.3-1	Response to 2/25/07 NRC Letter	Section 8.3, Material Properties – added new 2nd paragraph to clarify source of mechanical material properties for irradiated zircaloy cladding
Pages 8.11.1 – 8.11-4	Response to 2/25/07 NRC Letter	Section 8.11, Cladding Integrity – revised throughout to incorporate bases for system drying criterion and alternative to ISG-11, Revision 3 guidance
Page 8.12-3	Response to 2/25/07 NRC Letter	Added new references 35, 36, 37, 38, 39 and 40

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change

Chapter 9		
Page 9.1-1	Editorial/NAC Correction	Section 9.1, Loading MAGNASTOR, 4th paragraph, 5th sentence – changed "second confinement" to "redundant confinement"; last sentence – added "volumetrically" 5th paragraph, 1st sentence – deleted "either pressurized helium drying or"; 2nd sentence – added "high-purity"; 3rd sentence – revised throughout to describe operational steps; 4th sentence – changed "welds examined" to "dye penetrant examined"
Page 9.1-2	Editorial	Section 9.1.1,Loading and Closing the TSC, item 3 – deleted "to 25 (+10, -5) psig"; item 7 Note – added "per Section 4.3.1.f. of the Technical Specifications"
Page 9.1-3	Editorial	Item 12 – changed "of the upper" to "to the upper"
Page 9.1-4	NAC Correction	Item 24 – added "and allow annulus water to drain into the spent fuel pool" Item 27 – deleted "to 25 (+10, -5) psig" Item 28 – added "At the option of the user, based on TSC decay heat load" and new Note for clarity Item 29, 2nd sentence – added "a maximum" and deleted "(+25, -50°F)" Deleted old Item 30 and renumbered following items Note – added "cooling"
Page 9.1-5	NAC Correction/ Editorial	Continued Note at top of page – revised throughout to justify ISG 11, Revision 3 Added new Item 36 to verify position of the top of the closure lid Item 40, first Note – changed "since shielding is being removed" to "as shielding material is being removed"
Page 9.1-6	NAC Correction/ Editorial	Item 42 Note, 2nd sentence – revised throughout for clarity Item 43, 2nd sentence – added "and shims" Item 48 – added "welding through the completion of" Item 49 – changed "testing" to "test"; 49.a – changed "the pressure test system" to "a pressure test system"; 49.b – 3rd sentence – added "continuing"; 49.f – revised throughout for clarity Item 50 – changed "tack closure ring" to "tack the closure ring"
Page 9.1-7	NAC Correction	Item 52 – revised throughout clarifying options for water removal from the TSC; deleted 1st Note Item 54 – deleted "nitrogen or" and 2nd sentence Item 57, 1st sentence – added "helium"; 2nd sentence – added "approximately" and deleted "(+5, -10)"; added new last sentence to clarify vacuum drying time Item 59 – revised throughout & added new 1st Note to clarify vacuum drying methods Item 60 – deleted old line item 60 and renumbered subsequent items, making items a, b & c part of item 59 Item 59b. – changed "vacuum drying phase" to "vacuum drying cycle"
Page 9.1-8	NAC Correction	1st Note on page, 1st sentence – changed "vacuum drying times" to "vacuum drying cycle time as" & "12-hour" to "24-hour"; 3rd sentence – added "of Step 59.c" & deleted "Condition A"; added new last sentence Deleted 2nd Note Deleted previous Items 62 & 63 and renumbered subsequent items New Item 61 – revised throughout Reversed new Items 64 & 65 New Item 65 – added "to verify the absence of helium leakage past the inner port cover welds"

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 9.1-9	NAC Correction	New Item 69, 1st sentence – revised throughout; last sentence – added "water cooling" Note, 1st sentence – added "or completing the helium backfill if the annulus circulating water cooling system is not used"; changed "19 hours" to "the transfer time limits of Table 9.1-3"; 2nd sentence – changed "12 hours" to "24 hours"; 3rd sentence – revised throughout
Page 9.1-10	NAC Correction/ Editorial	Item 1 – added new 2nd Note for clarity Item 7 Note – added "per Section 4.3.1.f. of the Technical Specifications"
Page 9.1-11	Editorial	Item 16, 2nd Note – revised throughout for clarity
Page 9.1-12	Editorial	Item 38 – added "if applicable to the concrete cask design utilized" Item 41 – added "At the option of the user"
Page 9.1-13	Editorial	Vertical Cask Transporter subsection, Item 2, 2nd Note – added "per Section 4.3.1.h. of the Technical Specifications"
Page 9.1-15, Table 9.1-1	Editorial	Item – Annulus Fill System, 1st sentence – changed "circulates" to "supplies"; 2nd sentence – deleted "/overpressure" 3rd row – added "Cooling" to item name Item – Annulus Seals – changed "cooling system" to "circulating water cooling systems" Item – Bottom Protective Cover – changed "Optional stainless steel plate" to "Optional plate temporarily" Item – Cask Transporter , last sentence – changed "mobile frame" to "cask transporter"
Page 9.1-16, Table 9.1-1	Editorial/NAC Correction	Item – Drain and Blow Down System (DBS), 2nd sentence – added "helium cover gas supply" Item – Hydrogen Detection System – changed "any" to "increased" Deleted line item for Pressurized Helium Drying (PHD) System Item – Remote/Robotic Welding System, 2nd sentence – changed "includes" to "may include" Item – Vacuum Drying System (VDS) – changed item title to "Vacuum Drying and Helium Backfill System", 1st sentence – changed "Optional system that may be used instead of the PHD system" to "The system used"; 2nd sentence – changed "The VDS" to "The system"
Page 9.1-17, Table 9.1-2	NAC Correction	Changed Torque Value (ft-lb) for the Loaded TSC Handling from "840 (+40, -40) ft-lb" to "per hoist ring manufacturer's recommendation" Changed Threaded Component title from "Lift Lug Bolts" to "Concrete Cask Lift Lug Bolts" & Torque Value (ft-lb) from "550 (+25, -25) ft-lb" to "600 (+60, -60) ft-lb" Changed Threaded Component title from "Lid Lifting Hoist Rings (lid handling only)" to "Concrete Cask Lid Lifting Hoist Rings" & Torque Value (ft-lb) from "110 (+10, -10) ft-lb" to "Hand Tight"
Page 9.1-18, Table 9.1-3	Response to 2/25/07 NRC Letter	Replaced former Table 9.1-3 with a more comprehensive one titled "Initial Vacuum Drying Cycle Time with TSC Transfer Limits"
Page 9.1-19, Table 9.1-4	Response to 2/25/07 NRC Letter	Revised Table 9.1-4 throughout to show time limits for subsequent vacuum drying cycles

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change
Page 9.2-1	Editorial	Section 9.2, Removing the Loaded TSC from a Concrete Cask, Item 1 – added new Note for clarity; Item 8 – added new Note for clarity
Chapter 10		
Page 10-1	Editorial	Acceptance Criteria and Maintenance Program, 1st paragraph, last sentence – added "(SAR)" and "(CoC)"
Page 10.1-7	NAC Correction	Section 10.1.6, Neutron Absorber Tests, Note, last sentence – changed "two" to "three"; 1st paragraph, next-to-last sentence – deleted "of AAR Advanced Structures"
Page 10.1-13	Editorial	Yield Strength Testing section, 1st sentence – changed "ASME Test Method" to "ASTM Test Method"
Page 10.2-1	Editorial	Section 10.2, Maintenance Program, 1st paragraph, last sentence – added "programs and" Section 10.2.1, Structural and Pressure Tests, 2nd paragraph, 3rd sentence – changed "Annually, during periods of use or prior to returning to service" to "On a maintenance schedule established by the user"
Page 10.3-2	Editorial	Added footnote a to references 15 – 19 and inserted footnote at bottom of page Reference #17 – changed "ASME Standard" to "ASTM Standard" and deleted ASME information; Reference #18 – changed "ASME Standard" to "ASTM Standard" and deleted ASME information; Reference #19 – changed "ASME Standard" to "ASTM Standard" and deleted ASME information
Chapter 11 – No Changes		
Chapter 12		
Page 12.2-17	NAC Correction	Section 12.2.12.4, Analysis of TSC and Basket for Cask Tip-Over Event – revised table throughout to reflect structural evaluations for the TSC and basket for the cask tip-over event; also revised factors of safety in paragraph following table
Chapter 13		
Page 13A-1	ISG-1, Rev. 2	Section 1.1, Definitions – added definitions for Assembly Defect and Breached Spent Fuel Rod
Page 13A-2	ISG-1, Rev. 2	Revised definition of Damaged Fuel
Page 13A-3	ISG-1, Rev. 2	Added definition for Grossly Breached Spent Fuel Rod Revised definition of Intact Fuel (Assembly or Rod)
Page 13A-5	ISG-1, Rev. 2	Added definition of Undamaged Fuel
Page 13A-19	Response to 2/25/07 NRC Letter	Section 3.1.1, Condition, Item A – deleted "or demoisturizer exit gas temperature"
Page 13A-20	Response to 2/25/07 NRC Letter	SR 3.1.1.1 – deleted "OR" & following text SR 3.1.1.2 – deleted "OR" & following text
Page 13A-21, Table 3-1	Response to 2/25/07 NRC Letter	Table revised throughout to show helium density range

Chapter/ Page/ Figure/ Table	Reason(s) for Change	Description of Change

Page 13A-30	NAC change	Section 5.0, Administrative Controls and Programs, and Section 5.1, Radioactive Effluent Control Program – revised throughout; made two subsections, 5.1.1 and 5.1.2 Section 5.2 c – added new last sentence limiting thermal cycles Section 5.2 e – added "The integrity of" & changed "qualified" to "verified"
Page 13A-32	NAC change	Added new Section 5.5, Radiation Protection Program, to emphasize user need to ensure compliance with 10CFR50 and ALARA objectives
Page 13B-1	ISG-1, Rev. 2	Section 2.0, Fuel to be Stored in the MAGNASTOR System – changed "INTACT FUEL ASSEMBLIES" to "UNDAMAGED FUEL ASSEMBLIES" and "Tables 6.4-1 and 6.4-2" to "Tables 1-A-1 and 1-A-2"
Page 13B-2, Table 2-1	ISG-1, Rev. 2	Section I.A.1. – changed "PWR INTACT FUEL ASSEMBLIES" to "PWR UNDAMAGED FUEL ASSEMBLIES"; Section I.B. – changed "PWR INTACT FUEL ASSEMBLIES" to "PWR UNDAMAGED FUEL ASSEMBLIES"; Section I.C. – changed "PWR INTACT FUEL ASSEMBLIES" to "PWR UNDAMAGED FUEL ASSEMBLIES"
Page 13B-8	ISG-1, Rev. 2	Section I.A.1. – changed "BWR INTACT FUEL ASSEMBLIES' to "BWR UNDAMAGED FUEL ASSEMBLIES"; ; Section I.B – changed "BWR INTACT FUEL ASSEMBLIES" to "BWR UNDAMAGED FUEL ASSEMBLIES"
Page 13C-2	ISG-1, Rev. 2	Section 2.1, BACKGROUND, 1st paragraph, 1st sentence – changed "INTACT FUEL" to "UNDAMAGED FUEL"
Page 13C-10	Response to 2/25/07 NRC Letter	Section 3.1.1, Background, 1st paragraph, 7th sentence – added "while backfilling the cavity with helium; 8th sentence – deleted "or by pressurized helium drying"; 2nd paragraph, 1st sentence – deleted "or pressurized helium drying"; old 2nd sentence – deleted; deleted last 4 old sentences; 3rd paragraph, 1st sentence – deleted "or pressurized helium recirculation drying"
Page 13C-12	NAC Correction	Actions, A.1, 1st sentence – deleted "or the TSC exit gas dew point temperature limit"
Page 13C-13	Response to 2/25/07 NRC Letter	SR 3.1.1.1 and SR 3.1.1.2, 1st paragraph, 2nd sentence – changed "may be demonstrated" to "is demonstrated"; deleted "either"; deleted "or by the circulation … stored contents."
Page 13C-18	ISG-1, Rev. 2	Section 3.2.1, LCO, 2nd paragraph – changed "INTACT FUEL ASSEMBLIES" to "UNDAMAGED FUEL ASSEMBLIES"
<u>Chapter 14</u>		
Page 14.1-7, Figure 14.1-1	NAC Addition	Updated "NAC Functional Organization Chart" to reflect current management configuration
<u>Chapter 15 – No Changes</u>		