

December 16, 2005

U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852-2738

Attn: Document Control Desk

Subject: Submittal of Supplemental Information for the MAGNASTOR System  
Application (TAC No. L23764)

Docket No. 72-1031

- References:
1. MAGNASTOR System – Application for Approval, NAC International, August 31, 2004
  2. Acknowledgment Review of the MAGNASTOR System Application, U.S. Nuclear Regulatory Commission (NRC), November 1, 2004
  3. Request for Additional Information for the Review of the NAC MAGNASTOR System Application, U.S. Nuclear Regulatory Commission (NRC), May 23, 2005
  4. Responses to Request for Additional Information on the NAC MAGNASTOR System Application, NAC International, September 29, 2005
  5. NRC/NAC Meeting on the MAGNASTOR System RAI Responses, October 19, 2005
  6. NRC/NAC Conference Call on the MAGNASTOR System RAI Responses, October 26, 2005

NAC International, Inc. (NAC) herewith provides supplemental information related to the MAGNASTOR System application in response to ongoing discussions and questions during and subsequent to the NRC/NAC meeting on October 19, 2005 (Reference 5). This submittal includes four copies of the NRC questions/comments with the NAC responses presented in the standard NAC response format and four copies of the MAGNASTOR Safety Analysis Report (SAR), Revision 05B, changed pages.

Consistent with NAC administrative practice, all SAR pages changed in this submittal are uniquely identified as Revision 05B. Revision bars in the page margin mark each change on the page. A detailed list of the changes in the SAR is provided in Attachment 1. Changes in the chapter table of contents, list of figures, list of tables, and in text flow are not marked with revision bars. Also, for editorial convenience, where a new operating step is inserted, the remaining renumbered steps do not have revision bars. This revision enhances electronic navigability throughout the chapter. Upon final approval, the SAR will be reformatted, assigned the next appropriate revision number, and issued as the NAC MAGNASTOR FSAR.

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Six NAC drawings have been revised in conjunction with these responses. These drawings are all included in Chapter 1 of the SAR. A detailed list of the drawing changes is provided in Attachment 2.

Included in this submittal is NAC Calculation Package 71160-2018, "Structural Evaluation for Basket Pin-Socket Connections for Cask Tip-over Accident," Revision 0, consisting of one copy of the calculation and eight (8) CDs containing data input and output files all separately packaged and identified as proprietary information. The calculation package is provided to the NRC as NAC Proprietary Information. In accordance with 10 CFR 2.390, the supporting Proprietary Information Affidavit executed by Thomas A. Danner, NAC Vice President, Engineering, is enclosed.

A total of 17 responses are provided for questions discussed during the Reference 5 meeting and the Reference 6 conference call.

The MAGNASTOR System is currently being considered by three U.S. utilities for near-term implementation at their operating reactor sites. Therefore, NAC requests that the NRC complete the review and approval of the MAGNASTOR System to support these anticipated utility needs. Any additional information requested will be promptly provided.

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

Sincerely,

A handwritten signature in black ink that reads "Anthony L. Patko".

Anthony L. Patko  
Director, Licensing  
Engineering

MAGNASTOR Affidavit  
Attachment 1, List of SAR Changes  
Attachment 2, List of Drawing Changes

Enclosures

**NAC INTERNATIONAL  
AFFIDAVIT PURSUANT TO 10 CFR 2.390**

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Thomas A. Danner (Affiant), Vice President, Engineering, of NAC International, hereinafter referred to as NAC, at 3930 East Jones Bridge Road, Norcross, Georgia 30092, being duly sworn, deposes and says that:

1. Affiant has reviewed the information described in Item 2 and is personally familiar with the trade secrets and privileged information contained therein, and is authorized to request its withholding.
2. The information to be withheld includes the following NAC calculation packages that are being provided in support of the technical review of NAC's request for approval of the NAC MAGNASTOR System.
  - 71160-2018, "Structural Evaluation for Basket Pin-Socket Connections for Cask Tip-over Accident," Revision 0. (One (1) Copy, including eight (8) CDs containing input and output data files)
  - Fuel Assembly Hybrid Development from NAC Calculation 71160-6001, Revision 0, "NewGen Transfer and Storage Criticality Analysis" (One (1) Copy)

The subject calculation packages include detailed analysis methods and results that have been developed or that have been obtained under proprietary agreement by NAC and are being used for the NAC MAGNASTOR System.

NAC is the owner of the information in the calculation packages. Thus, all of the above identified information is considered NAC Proprietary Information.

3. NAC makes this application for withholding of proprietary information based upon the exemption from disclosure set forth in: the Freedom of Information Act ("FOIA"); 5 USC Sec. 552(b)(4) and the Trade Secrets Act; 18 USC Sec. 1905; and NRC Regulations 10 CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial financial information obtained from a person, and privileged or confidential" (Exemption 4). The information for which exemption from disclosure is herein sought is all "confidential commercial information," and some portions may also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4.
4. Examples of categories of information that fit into the definition of proprietary information are:
  - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by competitors of NAC, without license from NAC, constitutes a competitive economic advantage over other companies.
  - b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality or licensing of a similar product.
  - c. Information that reveals cost or price information, production capacities, budget levels or commercial strategies of NAC, its customers, or its suppliers.
  - d. Information that reveals aspects of past, present or future NAC customer-funded development plans and programs of potential commercial value to NAC.

**NAC INTERNATIONAL  
AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)**

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- e. Information that discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information that is sought to be withheld is considered to be proprietary for the reasons set forth in Items 4.a, 4.b, and 4d.

5. The information to be withheld is being transmitted to the NRC in confidence.
6. The information sought to be withheld, including that compiled from many sources, is of a sort customarily held in confidence by NAC, and is, in fact, so held. This information has, to the best of my knowledge and belief, consistently been held in confidence by NAC. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements, which provide for maintenance of the information in confidence. Its initial designation as proprietary information and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in Items 7 and 8 following.
7. Initial approval of proprietary treatment of a document/information is made by the Vice President, Engineering, the Project Manager, the Licensing Specialist, or the Director, Licensing – the persons most likely to know the value and sensitivity of the information in relation to industry knowledge. Access to proprietary documents within NAC is limited via “controlled distribution” to individuals on a “need to know” basis. The procedure for external release of NAC proprietary documents typically requires the approval of the Project Manager based on a review of the documents for technical content, competitive effect and accuracy of the proprietary designation. Disclosures of proprietary documents outside of NAC are limited to regulatory agencies, customers and potential customers and their agents, suppliers, licensees and contractors with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
8. NAC has invested a significant amount of time and money in the research, development, engineering and analytical costs to develop the information that is sought to be withheld as proprietary. This information is considered to be proprietary because it contains detailed descriptions of analytical approaches, methodologies, technical data and evaluation results not available elsewhere. The precise value of the expertise required to develop the proprietary information is difficult to quantify, but it is clearly substantial.
9. Public disclosure of the information to be withheld is likely to cause substantial harm to the competitive position of NAC, as the owner of the information, and reduce or eliminate the availability of profit-making opportunities. The proprietary information is part of NAC’s comprehensive spent fuel storage and transport technology base, and its commercial value extends beyond the original development cost to include the development of the expertise to determine and apply the appropriate evaluation process. The value of this proprietary information and the competitive advantage that it provides to NAC would be lost if the information were disclosed to the public. Making such information available to other parties, including competitors, without their having to make similar investments of time, labor and money would provide competitors with an unfair advantage and deprive NAC of the opportunity to seek an adequate return on its large investment.

NAC INTERNATIONAL  
AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)

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STATE OF GEORGIA, COUNTY OF GWINNETT

Mr. Thomas A. Danner, being duly sworn, deposes and says:

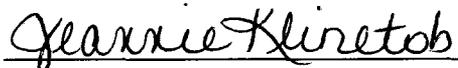
That he has read the foregoing affidavit and the matters stated herein are true and correct to the best of his knowledge, information and belief.

Executed at Norcross, Georgia, this 16<sup>th</sup> day of December 2005.

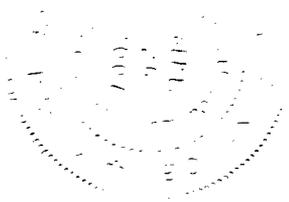
  
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Thomas A. Danner  
Vice President, Engineering  
NAC International

Subscribed and sworn before me this 16<sup>th</sup> day of December, 2005.

  
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Notary Public



**Attachment 1**

**List of SAR Changes for the  
MAGNASTOR Storage System, Revision 05B,  
in Response to the  
NRC/NAC Meeting on 10/19/05 &  
NRC/NAC Conference Call on 10/26/05**

**NAC International**

**December 2005**

**List of MAGNASTOR SAR Changes, Revision 05B, in Response to the  
NRC/NAC Meeting on 10/19/05 &  
NRC/NAC Conference Call on 10/26/05**

Chapter/ Page/ Figure/ Table	Description of Change
<b>Note:</b> The Chapter Table of Contents, List of Figures and List of Tables have been revised accordingly to reflect the list of changes detailed below.	
<b>Chapter 1</b>	
Page 1.3-2	4 <sup>th</sup> paragraph, 3 <sup>rd</sup> sentence – changed “The closure lid and closure ring are” to “The closure lid, closure ring and port covers are”
Page 1.8-1	Section 1.8, changed six drawing revision levels as follows: Drawing number 71160-551, rev. 3; 71160-575, rev. 4; 71160-585, rev. 3; 71160-591, rev. 3; 71160-599, rev. 3; 71160-600, rev. 1
<b>Chapter 2</b>	
Page 2.1-2, Table 2.1-1	Revised the criteria for the maximum fuel cladding temperature parameter
Page 2.2-1	Section 2.2.1, 2 <sup>nd</sup> paragraph – added new 6 <sup>th</sup> , 7 <sup>th</sup> , 8 <sup>th</sup> & 9 <sup>th</sup> sentences to more clearly identify/present the fuel types and data
Page 2.2-2	Continuation of 9 <sup>th</sup> sentence added above. Section 2.2.2, 2 <sup>nd</sup> paragraph – added new 4 <sup>th</sup> , 5 <sup>th</sup> , 6 <sup>th</sup> & 7 <sup>th</sup> sentences to more clearly identify/present the fuel types and data
Page 2.2-6, Table 2.2-1	Added “Base Fuel Type” row & footnote “a”
Page 2.2-7, Table 2.2-2	Added “Base Fuel Type” row & footnote “a”; also added footnotes “b” & “d” (Note: Previous footnote “a” became footnote “c”)
<b>Chapter 3</b>	
Page 3.8-3	2 <sup>nd</sup> paragraph, 6 <sup>th</sup> sentence – changed “13.0 × 10 <sup>6</sup> psi” to “12.1 × 10 <sup>6</sup> psi”
Page 3.8-4	Section 3.8.2, last 4 rows of table, 4 <sup>th</sup> column – changed “Zirc-4” to “Zirc-2”
Page 3.9-2	Replaced previous reference no. 27 with new reference no. 27
Pages 3.10.8-1 thru 3.10.8-4	Section 3.10.8 – added new section titled “Basket Pin-Socket Connection Evaluation for Concrete Cask Tip-Over Accident Condition” & new Figures 3.10.8-1 & 3.10.8-2
<b>Chapter 6</b>	
Page 6.2-3, Table 6.2-1	Added “Base Fuel Type” row & footnote “a”
Page 6.2-4, Table 6.2-2	Added “Base Fuel Type” row & footnote “b”
Page 6.2-5, Table 6.2-2	Added “Base Fuel Type” row & footnote “b” (Note: Previous footnote “b” became footnote “c” & previous footnote “c” became footnote “d”)
Page 6.4-8, Table 6.4-2	Added footnote “a” (Note: Previous footnote “a” became footnote “b”)

Chapter/ Page/ Figure/ Table	Description of Change
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<b>Chapter 7</b>	
Page 7.1-1	Section 7.1.1, 3 <sup>rd</sup> paragraph, 1 <sup>st</sup> sentence – changed “a closure ring” to “the Type 304 stainless steel closure ring”
Page 7.1-2	1 <sup>st</sup> paragraph – revised throughout; 4 <sup>th</sup> paragraph, last sentence – changed “are inspected by PT examination” to “are PT examined”
Page 7.1-3	1 <sup>st</sup> paragraph, 1 <sup>st</sup> sentence – changed “port cover weld” to “port cover welds”
<b>Chapter 8</b>	
Page 8.10-5	Section 8.10.3.1, 1 <sup>st</sup> paragraph, 1 <sup>st</sup> sentence – added “(approximately 70 gallons are removed)”; added new 2 <sup>nd</sup> sentence
Page 8.11-1	Section 8.11, 3 <sup>rd</sup> paragraph, last sentence – deleted “, for transport and ultimate disposal, as required”; added new 4 <sup>th</sup> paragraph
Page 8.11-2	Continuation of new paragraph from previous page & new text throughout page
Page 8.11-3	Continuation of new text from previous page & revised last paragraph
<b>Chapter 9</b>	
Page 9.1-5	Item 40 – added new 2 <sup>nd</sup> Note; Item 42, Note – deleted “air”
Page 9.1-6	Item 52 – revised throughout; 1 <sup>st</sup> Note following Item 52 – added “to remove residual moisture”; added new 2 <sup>nd</sup> Note following Item 52; Item 54 – revised throughout
Page 9.1-7	Item 55 – revised throughout; Item 57 – added “At the option of the user,”
Page 9.1-8	Item 65 – deleted 2 <sup>nd</sup> sentence; Item 66 – deleted 2 <sup>nd</sup> sentence; added new Items 67 & 68 & renumbered subsequent Items
<b>Chapter 10</b>	
Page 10.1-12	Section 10.1.6.4.5 – added new 2 <sup>nd</sup> paragraph & bullets
Page 10.1-15	Section 10.1.6.4.6 – added new 2 <sup>nd</sup> paragraph & bullets
<b>Chapter 13</b>	
Page 13A-23	Section 4.1.1 – added a new note “b)” following table (Note: Previous note “b)” became note “c)”); added new Sections 4.1.2, “Alternatives to Neutron Absorber Material Testing” and 4.1.3, “Fuel Cladding Integrity”
Page 13A-28	Section 5.1.2 – added new 5 <sup>th</sup> bullet

**Attachment 2**

**List of Drawing Changes**

**for**

**the MAGNASTOR Storage System Application**

**Revision 05B**

**NAC International**

**December 2005**

### **Drawing 71160-551, Revision 3 – Fuel Tube Assembly, MAGNASTOR – 37 PWR**

- Revised dimension on sheet 2, zone F7 to cover edge to edge: IS)  $9.76 \pm .03$  Typ; WAS) (9.26) Typ, measured from center to center.
- Deleted dimension (9.26) Typ on sheet 2, zone F2.
- Deleted dimension (8.86) Typ on sheet 2, zone E2 & C4.
- Revised dimension on sheet 2, zone C5/D5: IS)  $13.10 \pm .03$ ; WAS)(13.10).
- Deleted dimension (.03) Typ on sheet 2, zone C1.
- Revised dimension on sheet 2, zone B1/B2: IS) .13 Min Typ; WAS) (.13) Typ.

### **Drawing 71160-575, Revision 4 – Basket Assembly, MAGNASTOR – 37 PWR**

- Added Delta Note to read: “Tube and developed cell openings to be gaged after final assembly. Gage to be 8.75 inches square  $\times$  12 feet long. Weight less than or equal to 200 pounds. Insertion/removal force not to exceed 50 pounds.” Added Delta Note graphics on sheet 2 to View A-A – one at  $235^\circ$  on the outermost tube and the other one at  $90^\circ$  pointing at developed cells.
- Added note to read: “ $1/32$ ” max gap over 24” allowed between corner flats.”
- Removed reference dimensions in the center of View A-A on sheet 2, D7/E7.
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### **Drawing 71160-585, Revision 3 – TSC Assembly, MAGNASTOR**

- Revised Delta Note 4 to read: “PT final surface. Examine per ASME Section V, Article 6. Acceptance per ASME Section III, Article NB-5350.”

### **Drawing 71160-591, Revision 3 – Fuel Tube Assembly, MAGNASTOR – 87 BWR**

- Revised dimension on sheet 2, zone F7 to cover edge to edge: IS)  $6.59 \pm .03$  Typ; WAS) (6.18) Typ, measured from center to center.
- Deleted dimension (6.18) Typ on sheet 2, zone F4/E4.
- Deleted dimension (5.86) Typ on sheet 2, zone E4 & E2.
- Revised dimension on sheet 2, zone E3/F3: IS)  $8.74 \pm .03$ ; WAS) (8.74).
- Deleted dimension (.03) Typ on sheet 2, zone C3.
- Revised dimension on sheet 2, zone B3: IS) .13 Min Typ; WAS) (.13) Typ.

**Drawing 71160-599, Revision 3 – Basket Assembly, MAGNASTOR – 87 PWR**

- Revised Delta Note 1 to read: “Tube and developed cell openings to be gaged after final assembly. Gage to be 5.75 inches square × 12 feet long. Weight less than or equal to 200 pounds. Insertion/removal force not to exceed 50 pounds.” Added Delta Note graphics to View A-A on sheet pointing to fuel tube and developed cells.
- Added note to read: “1/32” max gap over 24” allowed between corner flats.”
- Removed reference dimensions in the center of View A-A on sheet 2, D7.

**Drawing 71160-600, Revision 1 – Basket Assembly, MAGNASTOR – 82 BWR**

- Revised Delta Note 1 to read: “Tube and developed cell openings to be gaged after final assembly. Gage to be 5.75 inches square × 12 feet long. Weight less than or equal to 200 pounds. Insertion/removal force not to exceed 50 pounds.” Added “Typ” to Delta Note graphics on sheet 2 for View A-A.
- Added note to read: “1/32” max gap over 24” allowed between corner flats.”
- Removed reference dimensions in the center of View A-A on sheet 2, D7.

**NAC INTERNATIONAL**

**RESPONSE TO THE**

**UNITED STATES**  
**NUCLEAR REGULATORY COMMISSION**

**QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC MEETING – OCTOBER 19, 2005**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**MAGNASTOR SYSTEM**

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

**DECEMBER 2005**

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC MEETING – OCTOBER 19, 2005**

**NRC Comment/Question:**

1. The fuel tube drawings do not contain the details of the pins, sockets, corner curvature/flats, and assemblies to establish the bases for the basket stability evaluation. Detailed dimensions with tolerances should be added to the PWR and BWR fuel tube drawings.

**NAC International Response**

The NAC MAGNASTOR license drawings – 71160-551, 71160-575, 71160-591, 71160-599 and 71160-600 – are revised to include detailed dimensions with tolerances for the fuel tubes, pins, sockets, and corner curvature/flats. These dimensions establish the bases for the basket structural analyses and the basket stability evaluations.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC MEETING – OCTOBER 19, 2005**

**NRC Comment/Question:**

2. NAC should submit the LS-DYNA and ANSYS input files for the canister and fuel basket evaluations to help the NRC to better understand the analyses performed. The primary concern is the potential instability of the tube socket material at the interface with the pin, i.e., material yielding such that the tubes could be dislodged.

**NAC International Response**

As requested, additional analyses have been performed and are provided in this submittal. NAC proprietary Calculation Package number 71160-2018, Rev. 0, "Structural Evaluation for Basket Pin-Socket Connections for Cask Tip-Over Accident" is included. In addition, Section 3.10.8, "Basket Pin-Socket Connection Evaluation for Concrete Cask Tip-Over Accident Condition," has been added to the MAGNASTOR SAR.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC MEETING – OCTOBER 19, 2005**

**NRC Comment/Question:**

3. The qualification and acceptance testing described in SAR Section 10.1.6, which is based on the draft ASTM Specification WK936, is not “controlled” by the Technical Specifications – thus, as currently proposed, the testing could be changed via the 10 CFR 72.48 process without NRC review. The NRC must have some assurance that the neutron absorber material qualification and acceptance testing described in SAR Section 10.1.6 will not be changed without NRC review and acceptance of the change(s).

The currently proposed MAGNASTOR Technical Specifications, SAR Revision 05A, do include in Section 4.1.1(a) the minimum  $^{10}\text{B}$  loading in the neutron absorber material, which lists the three neutron absorber types – borated aluminum alloy, borated MMC, and Boral – along with the required minimum effective areal density, the percent credit used in the criticality analyses, and the required minimum actual areal density for each type for both PWR and BWR fuel.

**NAC International Response**

Based upon a conference call held on November 17, 2005, NAC has prepared SAR Revision 05B changed pages for SAR Sections 10.1.6 (10.1-12 and 10.1-15) and 13A-4.1 (13A-23).

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC MEETING – OCTOBER 19, 2005**

**NRC Comment/Question:**

4. It is evident from the ongoing discussions that one or more supplements to the RAI responses will be forthcoming. This will extend the time required for the NRC review of the MAGNASTOR application. Thus, the schedule for the preparation of the draft CoC and preliminary SER will be affected. NAC should expedite the preparation and submittal of these supplements in order to minimize the delay in completion of the approval of the application.

**NAC International Response**

Per the NRC letter of December 2, 2005, based upon NAC's planned submittal of the supplemental information for the MAGNASTOR by December 16, 2005, the NRC will propose a new schedule and complete the technical review of the MAGNASTOR application.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

1. Studies have shown that exposure of spent fuel to air may result in a loss of integrity of spent fuel rods due to swelling of the fuel pellets. NAC should ensure that the MAGNASTOR System does not expose fuel rods to air or assure that there are no cladding breaches that will expose the fuel to air or show by analysis that a gross cladding breach will not occur. Particular attention should be paid to fuel loading, canister closure operations and canister unloading operations. Control of fuel exposure to air should be addressed in the MAGNASTOR Technical Specifications.

**NAC International Response**

Based upon the conference call discussions, NAC has prepared draft SAR Revision 05B changed pages 9.1-5 and 9.1-6 to revise Steps 40, 42 and 52 of the operating procedures to incorporate the requirement that fuel rods shall not be exposed to air during canister closure or unloading operations. Section 13A-4.1.3, page 13A-23, Fuel Cladding Integrity, has been inserted in the proposed Technical Specifications to state: "The licensee shall ensure that fuel oxidation and resultant consequences are precluded during canister loading and unloading operations." Section 8.10.3.1, page 8.10-5, has also been revised to incorporate the requirement that fuel rod cladding will not be exposed to an air environment.

Additionally, editorial changes were made to page 9.1-7, Steps 55 and 57.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

2. The last phrase of the third paragraph in SAR Section 8.11 should be rewritten or deleted to eliminate the reference to transport and ultimate disposal.

**NAC International Response**

SAR Revision 05B page 8.11-1 has been revised to delete the words “, for transport and ultimate disposal, as required” from the end of the third paragraph in accordance with the stated request.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

3. The fuel rod buckling evaluation in SAR Section 3.8 should incorporate the modulus of elasticity for irradiated zirconium alloy cladding from the PNNL paper by Geelhood and Beyer.

**NAC International Response**

SAR Revision 05B page 3.8-3 has been revised to state: “The analysis contained in Reference 27 used an elastic modulus of  $12.1 \times 10^6$  psi, which is bounded by the above value.”

Reference 27 on SAR Revision 05B page 3.9-2 has been replaced with: “Mechanical Properties for Irradiated Zircaloy,” K.J. Geelhood and C.E. Beyer, Pacific Northwest National Laboratory, Richland, WA. This is the correct reference for the stated elastic modulus of the irradiated zirconium alloy cladding.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

4. The reflood analysis provided in the RAI 8-3 response should be incorporated into SAR Section 8.11.

**NAC International Response**

SAR Revision 05B Section 8.11 (pages 8.11-1 through 8.11-3) has been revised to incorporate the reflood analysis that was provided in the response to RAI 8-3.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

5. The criteria for maximum fuel cladding temperature in SAR Table 2.1-1 should be corrected to indicate that the allowable temperature for off-normal conditions and for accident conditions is 1058 deg-F (570 deg-C).

**NAC International Response**

SAR Revision 05B Table 2.1-1 on page 2.1-2 has been corrected to show that the allowable maximum fuel cladding temperature is 1058°F (570°C) for off-normal and accident conditions.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

6. It is difficult to correlate the fuel data provided in the RAI 8-5 response to the data in Calculation package EA792-5001. NAC should clarify and provide guidance on how to cross-reference the fuel data presented.

**NAC International Response**

The following clarification of the fuel types and fuel data included in the MAGNASTOR SAR has been prepared to guide the reviewer in cross-referencing the fuel data.

During the construction of the SAR Chapter 6 table, an error was made in the column heading information which was pointed out in RAI 6-18. Headers were corrected as part of the RAI 6-18 response. The data listed in the tables was correct and was employed consistently with the corrected headers.

Fuel mass (MTU) in EA792-5001 calculation summary tables (Tables 5-1 and 5-2) and in SAR Tables 6.1-1, 6.1-2, 6.2-1 and 6.2-2 are calculated values based on the pellet OD, active fuel height, number of rods, and a fuel theoretical density. The fuel mass in the reference calculation (EA792-5001) was based on a 95% theoretical density as stated in Section 5.2 of the calculation (preceding the summary tables). The criticality calculations for MAGANASTOR were based on 96% theoretical density (Section 6.3-2) to provide a more bounding estimate and to reduce client questions (and NUREG concerns about fuel density impacts on criticality evaluations) about fuel material slightly above a 95% level. The increased density resulted in increased fuel mass and bounds all contained in the application.

The base fuel data from EA792-5001 was grouped in the criticality calculation to form the listed hybrids in Chapter 6. To provide the link between hybrids and base fuel types, a copy of the criticality calculation fuel data files is provided. (See Fuel Assembly Hybrid Development from NAC proprietary Calculation 71160-6001, Rev. 0, "NewGen Transfer and Storage Criticality Analysis" separately packaged in an envelope identified "NAC Proprietary Information.")

In addition, SAR Revision 05B pages 2.2-1, 2.2-2, 2.2-3, 2.2-6, 2.2-7, 6.2-3, 6.2-4, 6.2-5 and 6.4-8 have been changed to more clearly identify/present the fuel types and data. These changes also respond to Comment/Question No. 7.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

7. SAR Section 2.2 should be revised to identify the fuel types for the spent fuel to be stored by manufacturer and array size. The design basis fuel for shielding and criticality should be identified.

**NAC International Response**

Refer to the response to Comment/Question No. 6.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

8. The NRC is reviewing ISG-18, which currently only addresses the leak testing of the canister closure lid weld, for possible revision to include a requirement for leak testing of the port cover welds. NAC should address the feasibility of leak testing the MAGNASTOR port covers.

**NAC International Response**

NRC action is ongoing with respect to the revision of ISG-18. In accordance with preliminary guidance provided by the NRC, the MAGNASTOR System design and application are revised as follows.

- An editorial clarification is made in SAR Section 1.3.1.1, Page 1.3-2.
- Delta Note 4 on SAR Drawing 71160-585 is revised to add the examination and acceptance criteria for the PT examination of the port cover final weld surface.
- Pages 7.1-1 through 7.1-3, SAR Section 7.1.1 are revised to state that upon completion, the inner port cover welds at the vent port and the drain port are helium leak tested and then the final weld surface is PT examined. Also, upon completion, the final surface of the outer port cover welds at the vent and drain ports are PT examined.
- Pages 9.1-8 and 9.1-9, SAR Section 9.1.1, loading procedure Steps 65 and 66 are revised and new Steps 67 and 68 are inserted to state that the inner port cover welds at the vent port and the drain port are helium leak tested and then the final weld surface is PT examined. The remaining steps are renumbered to be Steps 69 through 76.
- Page 13A-28, SAR Section 5.1.2, a new fifth bullet is inserted to state: “The inner port cover welds to the closure lid at the vent port and at the drain port shall be qualified in accordance with the procedures in Section 9.1.1.”

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

9. Refer to Item 3 in the previous list for the October 19, 2005, meeting – i.e., providing the NRC “control” of neutron absorber material testing.

**NAC International Response**

Refer to the response to Comment/Question No. 3 from the October 19, 2005, meeting.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

10. Refer to Item 2 in the previous list for the October 19, 2005, meeting – i.e., providing LS-DYNA and ANSYS input files to the NRC to support their application review activities.

**NAC International Response**

Refer to the response to Comment/Question No. 2 from the October 19, 2005, meeting.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

11. Refer to Item 4 in the previous list for the October 19, 2005, meeting – i.e., the effects of the ongoing response activities on the NRC's schedule for completion of the review.

**NAC International Response**

Refer to the response to Comment/Question No. 4 from the October 19, 2005, meeting.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

12. For the seven cases evaluated in the fuel basket stability sensitivity analyses (SAR Section 3.10.6, Table 3.10.6-1), NAC should clarify the location of the connector pin welds to the fuel tubes.

**NAC International Response**

The response to this comment was initially provided to the NRC reviewer during the discussion.

The detailed analysis model(s) and the parameters used in each of the seven cases that were evaluated for the MAGNASTOR fuel basket stability are presented in SAR Revision 05A, Section 3.10.6, as provided to the NRC in conjunction with the RAI responses on September 29, 2005.

**NAC INTERNATIONAL RESPONSE  
TO  
NRC QUESTIONS ON MAGNASTOR RAI RESPONSES**

**NRC/NAC TELECON – OCTOBER 26, 2005**

**NRC Comment/Question:**

13. NAC should correct SAR Page 3.8-4, i.e., the cladding material for the last 4 fuel assemblies listed should be Zirc-2 (not Zirc-4, as shown).

**NAC International Response**

SAR Revision 05B page 3.8-4 has been corrected to show that the cladding material is Zirc-2 for all of the fuel assemblies listed in Section 3.8.2.