

June 29, 2007

Mr. Robert E. Brown  
Senior Vice President, Regulatory Affairs  
GE-Hitachi Nuclear Energy Americas LLC  
3901 Castle Hayne Rd MC A-45  
Wilmington NC 28401

SUBJECT: ECONOMIC SIMPLIFIED BOILING WATER REACTOR (ESBWR) CHAPTER 11  
OPEN ITEMS

Dear Mr. Brown:

As you are aware, the U. S. Nuclear Regulatory Commission staff is preparing the safety evaluation report (SER) for the ESBWR design certification application submitted by GE-Hitachi Nuclear Energy Americas LLC (GHNEA) on August 24, 2005. The staff has identified 25 open items for SER Chapter 11, "Radiation Waste Management," which are enclosed for your information. The staff is prepared to review your responses to the open items and have conference calls and meetings with your staff, as appropriate, to resolve these open items to support issuance of the SER.

This open item letter is based on the staff's review of the ESBWR Design Control Document (DCD) Revision 3, Request for Additional Information (RAI) responses and other submittals received to date. The staff will continue its review as additional RAI responses and other deliverables are submitted, including future DCD Revisions. The staff will inform cognizant GHNEA staff of any resulting changes to the status of Chapter 11. If you have any questions, please contact Amy Cabbage at (301) 415-2875 or [aec@nrc.gov](mailto:aec@nrc.gov) or Andrea Johnson at (301) 415-2890 or [axj2@nrc.gov](mailto:axj2@nrc.gov).

Sincerely,

*/RA/*

Mohammed A. Shuaibi, Chief  
ESBWR/ABWR Projects Branch 1  
Division of New Reactor Licensing  
Office of New Reactors

Docket No. 052-010

Enclosure:  
As stated

cc: See next page

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As stated

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ADAMS ACCESSION NO. ML071770108

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**GE-Hitachi Nuclear Energy Americas LLC (GHNEA)**  
**ESBWR Preliminary Open Items**  
**Chapter 11**  
**Radiation Waste Management**

**Supplemental RAI's:**

**RAI 11.2-4 Supplement No. 1, 6/6/07, ML071570346**

In RAI 11.2-4, the staff requested that the applicant revise Table 11.2-1 of the DCD Tier 2, to reflect the guidance of RG1.143, Revision 2, for atmospheric tanks. In its response, the applicant agreed to revise the table in accordance with RG 1.143. The staff reviewed the revised table attached to the applicant's response letter, and in Revision 3 of the DCD Tier 2. The staff found that the applicant retained a footnote that adds the use of fiberglass reinforced tanks that are constructed in accordance with the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) Section X. This is not consistent with the guidance in RG1.143. BPVC Section X does not have any specific guidance on the use of fiberglass tanks in radiation zones or for the retention of radioactive liquids. 10 CFR 50.34(h)(3) states that the applicant must present justification for deviation from the established review criteria, as published in the applicable SRP section. Therefore, the staff requests that the applicant either provide documentation to demonstrate that the use of fiberglass reinforced plastic tanks for retention of liquids containing radioactive waste is acceptable, that this will not pose a risk to the health and safety of the public or the plant workers; or that the provision to use fiberglass reinforced plastic tanks be removed.

*Status: GHNEA has committed to a due date of 10/5/2007.*

**RAI 11.2-5 Supplement No. 1, 6/6/07, ML071570346**

In RAI 11.2-5, the staff requested that the applicant revise Table 11.2-1 to reflect the guidance of RG 1.143, Revision 2 for tanks rated in the 0-15 PSI range. In its response, the applicant agreed to revise the table to comply with the RG. The staff reviewed the revised table attached to the applicant's response letter, and Revision 3 of the DCD Tier 2. The staff found that the applicant retained a footnote that adds the use of fiberglass reinforced tanks which are constructed in accordance with the requirements of ASME BPVC Section X. Based on the same reasons discussed in the above evaluation for the RAI 11.2-4 response, the staff finds RAI 11.2-5 response not acceptable.

*Status: GHNEA has committed to a due date of 10/5/2007.*

**RAI 11.2-11 Supplement No. 1, 6/6/07, ML071570346**

In RAI 11.2-11, the staff requested that additional detail be provided for Figure 11.2-1, "Liquid Waste Management System Process Diagram." For example, the diagram did not show sufficient detail to identify all sources of liquid input volumes, the points of collection of liquid waste, the flow paths of liquids through the system including all bypasses, and the specific point of release of liquid effluents to the environment. The level of details should be sufficient to allow staff review in accordance with the guidance of SRP Section 11.2, Rev. 2, July 1981, Review Criterion III.1. In its response the applicant stated that DCD Tier 2 would be revised to

include a new Figure 11.2-2, "Liquid Waste Management System Process Stream Information Directory." Additionally, a description of Figure 11.2-2 was added in Section 11.2. The staff reviewed the revised figures in Revision 3 of the DCD Tier 2, and still could not find the specific point(s) of release of liquid effluents to the environment (e.g., interfacing with the circulating water system).

*Status: GHNEA has committed to a due date of 8/3/2007.*

RAI 11.2-13 Supplement No. 1, 6/6/07, ML071570346

In RAI 11.2-13, the staff asked the applicant to describe how the classifications and design criteria applied to the liquid radioactive waste management system (including piping, tanks, and structures used to contain leakage) and how the criteria satisfies the requirements of GDC 61 with respect to designing radioactive waste systems to assure adequate safety under accident conditions. In its response, the applicant stated that the LWMS was designed to Quality Group D and modified by RG 1.143, Revision 2, Section 7 and Table 1. Referring to the response to RAI 11.2-9 and RAI 11.2-10, compliance with RG 1.143 guidance was addressed for the LWMS. The staff reviewed the response to RAI 11.2-13, and previously reviewed the responses to RAI 11.2-6 through 11.2-10 relating to the LWMS being consistent with RG 1.143 Revision 2. Based on SRP Section 11.2, the compliance with RG 1.143 forms the bases for satisfying GDC 61. A COL applicant referencing the ESBWR certified design should describe the quality assurance (QA) program for design, fabrication, procurement, construction of structures, and installation of permanent or mobile LWMS systems and components in the plant in accordance with its overall QA program. However, DCD Rev. 3, Section 11.2.6 does not commit the COL applicant to conform with the QA guidance specified in Regulatory Guides 1.21, 1.33, and 4.15.

*Status: GHNEA has committed to a due date of 8/3/2007.*

RAI 11.2.3-1 Supplement No. 1, 6/6/07, ML071570346

In RAI 11.2.3-1, 11.2.3-2, and 11.2.2-4, the staff requested that the applicant clarify the basis of the decontamination factors (DF) listed in DCD Tier 2, Rev. 1, Table 11.2-3, and their applications in deriving the estimated radioactive liquid effluent source term identified in DCD, Rev. 3, Section 12.2.2.3. DCD Rev. 3, Table 12.2-3 presents updated decontamination factors assigned by types of liquid wastes and groupings of radionuclides. The revised DFs are consistent with those presented in NUREG-0016 for general purpose ion-exchange and adsorbent media and filtration systems. However, DCD Rev. 3, Section 11.2.6 does not commit the COL applicant to the description and performance of installed mobile processing equipment with that described in DCD Tier 2, Rev. 3, Tables 11.2-2c and 11.2-3. For example, a COL applicant referencing the ESBWR certified design should identify ion-exchange and adsorbent media and filtration systems it plans to use depending upon the expected characteristics of liquid process and effluent streams.

*Status: GHNEA has committed to a due date of 8/3/2007.*

RAI 11.3-3 Supplement No. 1, 6/6/07, ML071570346

In RAI 11.3-3, the staff requested that the applicant describe how the OGS design pressure of the components was selected to provide the capability to withstand an internal hydrogen explosion. In addition, the staff asked that the applicant provide numerical performance criteria for the hydrostatic test demonstrating this capability. In its response the applicant stated that the ESWR offgas system design used the methodology outlined in GE report, NEDE-11146 "Pressure Integrity Design Basis for New Gas Systems," to establish hydrogen explosion pressure integrity in offgas piping. NEDE-11146 has been previously submitted and approved by the NRC to evaluate and establish design pressure integrity for the Grand Gulf offgas system during internal hydrogen explosions. The staff finds this methodology to be adequate, and Section 3.2.2 of DCD Tier 2, Revision 3, does reference the NEDE report. In addition, the applicant identified a COL Item in Section 11.3.8 of the DCD Tier 2, Revision 2. The OGS design parameters, major equipment items as well as other system data, as shown in DCD Tier 2, Table 11.3-2, are to be defined by the COL applicant. This COL Action Item addressed a portion of the RAI, and was identified as "COL Information" item 11.3.8-1. Based on the methodology and COL action item, RAI 11.3-3 was resolved. However, in Revision 3 of the DCD Tier 2, "COL Information" item 11.3.8-1 was removed. The removing of this COL item is not acceptable.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.4-15 Supplement No. 1, 6/6/07, ML071570346

The staff reviewed the applicant's response to RAI 11.4-15, and finds the response not acceptable. The safety significance of the SWMS is at the same level as the liquid waste management system and gaseous waste management system. The level of detail for the SWMS in ITAAC should be similar to the liquid waste management system and gaseous waste management system, which include an ITAAC table to describe "design commitment," "inspection, tests, and analyses," and "acceptance criteria," and a process diagram.

*Status: GHNEA has committed to a due date of 10/5/2007.*

RAI 11.4-6a-c Supplement No. 1, 6/6/07, ML071570346

RAI 11.4-6a - A review of the system components listed in DCD Rev. 3, Table 11.4-1 and Figure 11.4-1 indicates that the "HIC Return Pumps" and "Sorting Table" are not shown in Figure 11.4-1. Accordingly, update the table and figure to indicate where in the SWMS these components are located.

RAI 11.4-6b - A review of the estimated radwaste inventories listed in DCD Rev. 3, Table 11.4-2 indicates that the amount listed for the "Wet Solid Waste Total" is inconsistent with each of the listed waste streams comprising this total. Accordingly, update the value of the total waste estimate.

RAI 11.4-6c - A review of DCD Rev. 3, Table 11.4-2 indicates that the last footnote refers to the use of evaporation as a means of achieving waste volume reduction for concentrated wet wastes. However, the use of evaporators is not discussed in DCD Rev. 3, Section 11.4.2. Accordingly, revise the footnote to eliminate "evaporation" as a waste reduction method or add

the use of this type of waste processing technology to DCD Section 11.4.2 and update the associated DCD tables and Figure 11.4-1.

*Status: GHNEA has committed to a due date of 10/5/2007.*

RAI 11.5-5 Supplement No. 2, 6/6/07, ML071570346

In RAIs 11.5-5, 11.5-11, 11.5-12, 11.5-13, 11.5-16, 11.5-17, 11.5-20, 11.5-21, and 11.5-22, as they relate to DCD Tier 2, Rev. 1, Sections 11.5.3 and 11.5.4, the staff requested that the applicant provide elaborations and address the requirements of Regulatory Guides 1.21 and 4.15 on sampling requirements for batch and continuous releases, sampling and analyses frequencies, types of radionuclides or radionuclide groupings for which analyses are required, and PRMS subsystem calibration and maintenance. In DCD Rev. 3, Sections 11.5.3 and 11.5.4, the applicant corrected these inconsistencies. Therefore, these RAIs are resolved, with the exception of RAI 11.5-5. In Revision 3 of the DCD Tier 2, Sections 11.5.2, 11.5.4, and 11.5.5 the applicant does not indicate whether the design of the process and effluent sampling systems follows the guidance of IE Bulletin 80-10 "Contamination of Non-radioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment" and whether the design avoids interconnections with non-radioactive systems that could become radioactive through improper interfaces with radioactive systems. Similarly, the applicant does not indicate whether the design of the process and effluent sampling systems complies with the requirements of 10 CFR 20.1406, as it relates to the design and operational procedures to minimize contamination and minimize the generation of radioactive wastes. While DCD Rev. 3, Section 12.6 addresses some requirements associated with Part 20.1406, the discussions of DCD Section 12.6 are broadly generic and do not focus on specific design issues for the PRMS.

*Status: GHNEA has committed to a due date of 8/21/2007.*

RAI 11.5-6 Supplement No. 2, 6/6/07, ML071570346

In RAI 11.5-6, as it relates to DCD Tier 2, Rev. 1, Sections 11.5.3 and 11.5.4, the staff requested that the applicant describe how the Reactor Building HVAC Exhaust system captures discharges from the Isolation Condenser Vent exhaust. In Revision 3 of the DCD Tier 2, Section 11.5.3.1.5, the discussion about the air exhaust from the atmospheric area above each condenser pool is incomplete. Although the exhaust is monitored by the Isolation Condenser Vent Exhaust RMS, it is not clear from this discussion and information presented in DCD Rev. 3, Sections 5.4.6.5 and 5.1.2 and Figure 5.1-3, what design features are provided to prevent the exhaust from the atmospheric area above each condenser pool from becoming an uncontrolled and unmonitored release to the environment.

*Status: GHNEA has committed to a due date of 8/21/2007.*

RAI 11.5-8 Supplement No. 2, 6/6/07, ML071570346

In RAI 11.5-8, as it relates to DCD Tier 2, Rev. 1, Sections 11.5.3 and 11.5.4, the staff requested that the applicant address inconsistencies in addressing competing objectives of Regulatory Guides (RG) 1.21 and 1.97 in describing dynamic response ranges and expected activity levels. The specific information is presented in DCD Rev. 1, Tables 11.5-1, 11.5-2, 11.5-4, and 11.5-9. In Revision 3 of the DCD Tier 2, Section 11.5.2.1 and Table 11.5-9, the

applicant states that the PRMS dynamic instrumentation response ranges are consistent system designs and qualifications under the provisions of RG 1.97. A review of DCD Rev. 3, Section 7.5 indicates that the instrumentation design requirements are based on Rev. 4 of RG 1.97. A review of Rev. 4 of the RG indicates that it does not provide criteria for instrumentation variables as does Revision 2 or 3 of the same guide. In Rev. 4 of the guide, the basis and numerical values for instrumentation are to be established in the "licensing basis documentation," which is non-existent at this time. The discussion in DCD Rev. 3, Section 11.5.2.1 and basis for the chosen dynamic response ranges listed in DCD Rev. 3, Table 15.5-9 reflect adoption of the design and qualification criteria and instrumentation variables of Tables 1 and 2 of RG 1.97, either as Revision 2 or 3. DCD Rev. 3, Section 7.5.1, discussing conformity with RG 1.97, states that "compliance cannot be specified at this time" and that "compliance to these requirements is [to be] addressed during the detailed design phase." However, DCD Rev. 3, Sections 7.5.7 and 11.5.7 (COL Information) do not identify this issue as COL action items. Accordingly, the inconsistency in confirming compliance with either Revision 2/3 or Revision 4 of RG 1.97 for accident monitoring instrumentation described in DCD Rev. 3, Sections 7.5.1 and 11.5.2 is left for the applicant to resolve.

*Status: GHNEA has committed to a due date of 8/21/2007.*

RAI 11.5-9 Supplement No. 1, 6/6/07, ML071570346

In RAI 11.5-9, as it relates to DCD Tier 2, Rev. 1, Sections 11.5.3 and 11.5.4, the staff requested that the applicant address inconsistencies in describing the display RMS channel ranges, dynamic response ranges, and expected activity levels. The specific information is presented in DCD Rev. 1, Tables 11.5-1, 11.5-2, 11.5-4, and 11.5-9. A review of these sections and tables of DCD Rev. 3 revealed the following inconsistencies. DCD Rev. 3, Table 11.5-1 describes the responses of PRMS subsystems using two radiological units, dose rates (mSv/h) and concentrations (MBq/m<sup>3</sup>). The subsystems with dynamic ranges described as radiation exposure rates include the Reactor Building HVAC Exhaust, Refuel Handling Area HVAC Exhaust, Control Building Air Intake HVAC, LCW Drywell Dump Discharge System, Fuel building General Area HVAC, Isolation Condenser Vent Exhaust, Containment Purge Exhaust, Fuel Building Fuel Pool HVAC, Turbine Building Normal Ventilation System, Turbine Building Compartment Area Air HVAC, Offgas Pre-treatment System, Charcoal Vault Ventilation, and Technical Support Center HVAC Air Intake. Since these subsystems are installed to measure radioactivity in process and effluent streams and air intakes, the units need to be expressed in radiological units that are consistent when measuring liquid and gaseous concentrations. In DCD Rev. 3, Table 11.5-9, the basis for the dynamic ranges of the same PRMS subsystems are expressed in units defined in terms of concentrations (MBq/m<sup>3</sup>) and not in units of dose rates (mSv/h). A review of the dynamic detection ranges listed in DCD Rev. 3, Tables 11.5-2 and 11.5-4 are also inconsistent with those listed in DCD Rev. 3, Table 11.5-9.

*Status: GHNEA has committed to a due date of 12/31/2007.*

RAI 11.5-23 Supplement No. 1, 6/6/07, ML071570346

In Revision 3 of DCD, Tier 2, Section 12.2.1.3 fails to refer to the use of a specific computer code used to calculate doses.

A review of the applicant's response to RAI 11.5-23 and revised text in Rev. 3 DCD Section 12.2.1.3 indicates that of the two computer codes used to calculate doses at and beyond the EAB, one is not included in DCD Table 12.3-1. Accordingly, the applicant should revise Table 12.3-1 to include the "SKYIII-PC" computer code along with all other listed codes.

*Status: GHNEA has committed to a due date of 8/10/2007.*

RAI 11.5-24 Supplement No. 1, 6/6/07, ML071570346

In Revision 3 of the DCD, Tier 2, the applicant proposed responses refer to a non-existent DCD section and incomplete NRC regulations.

In its response to RAI 11.5-24, the applicant refers to specific sections of the DCD where information may be found on PASS. Among several citations, the response refers to a non-existent section of the DCD, namely Sect. 7.9.2.5. Accordingly, the applicant should revise its response by referring to the proper DCD section.

In its response to the RAI and proposed revised text for Rev. 3 DCD Section 9.3.2 (p.9.3-1), the applicant refers to an incomplete citation of Part 20, namely "Part 20.20 & 20.1101(b)". Accordingly, the applicant should update the text in its RAI response and DCD Section 9.3.2 for the purpose of citing the correct section of 10 CFR Part 20.

*Status: GHNEA has committed to a due date of 8/10/2007.*

**New RAI's:**

RAI 11.5-37, RAI Letter No. 100, 5/30/07, ML071490166

In DCD Tier 2, Rev 3, Sections 11.5.2.1 and 11.5.2.2, one of the design criteria has been eliminated from the list. The deleted criterion, as a functional requirement of the PRMS, states that the instrumentation registers full-scale output if radiation detected exceed full scale. The staff does not agree with the deletion of this criterion in both subsections of the DCD. Accordingly, update these sections of the DCD.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-38, RAI Letter No. 100, 5/30/07, ML071490166

In DCD Tier 2, Rev 3, Section 11.5.3.2.3, the discussion about the display ranges of the Offgas Post-Treatment RMS is inconsistent. The low end of the stated range should be reviewed and confirmed as to whether the instrumentation can detect the stated levels of radioactivity. Accordingly, update this section of the DCD.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-39, RAI Letter No. 100, 5/30/07, ML071490166

In DCD Tier 2, Rev 3, Section 11.5.8, the citations of ANSI N13.10-1974 and ANS/IEEE N42-18-1990 should be combined as one and be referred to its current reaffirmation status as ANSI N42-18-2004. Accordingly, update the stated reference in the DCD.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-40, RAI Letter No. 100, 5/30/07, ML071490166 (7/27/2007)

In DCD Tier 2, Rev 3, Table 11.5-2, the stated operational response range for the Offgas Pre-Treatment RMS is improperly characterized for Cs-137. Accordingly, update the entry in this DCD table.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-41, RAI Letter No. 100, 5/30/07, ML071490166

In DCD Tier 2, Revision 3, Table 11.5-5, footnotes 3 and 4 commit the COL applicant to specific requirements. However, these requirements are not identified in DCD Rev. 3, Section 11.5.7, "COL Information." Accordingly, update that section of the DCD to include these items.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-42, RAI Letter No. 100, 5/30/07, ML071490166

In Revision 3 of the DCD Tier 2, Table 11.5-8, the third footnote lists a non-existent radionuclide. Accordingly, update the footnote in this DCD table.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-43, RAI Letter No. 100, 5/30/07, ML071490166

In Revision 3 of DCD Tier 2, Figure 11.5-1, a place holder for footnote (No. 3) is identified for FB Building Exhaust, but the legend for the footnote is not included in the figure. Accordingly, provide the missing legend in that DCD figure.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-44, RAI Letter No. 100, 5/30/07, ML071490166

A COL applicant referencing the ESBWR certified design should describe the quality assurance (QA) program for design, fabrication, procurement, and installation of PRMS subsystems and components in the facility in accordance with its overall QA program. However, DCD Rev. 3, Section 11.5.7 does not commit the COL applicant to conform with the QA guidance specified in RGs 1.21, 1.33, and 4.15. Accordingly, update that section of the DCD to include this COL information item.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-45, RAI Letter No. 100, 5/30/07, ML071490166

DCD Tier 2, Rev. 3, Sections 11.5.3.1.3 and 11.5.3.2.13 describe the design of the PRMS subsystems used to monitor the air intakes of the control building (CB) and technical support center (TSC), respectively, as being compliant with GDC 19 of Appendix A to 10 CFR Part 50. Each RMS subsystem includes provisions to initiate the isolation of the outside air intake and exhaust dampers and startup of the emergency air filtration system when doses to control room operators and occupants of the technical support center are expected to exceed 0.05 Sv (5 rem) during a postulated accident. However, DCD Tier 2, Rev. 3, Section 11.5.7 does not commit the COL applicant to establish operational set-points of the associated radiation monitoring systems for CB air intake HVAC RMS and TSC HVAC air intake RMS. Accordingly, update this section of the DCD to include this COL information item.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-46, RAI Letter No. 100, 5/30/07, ML071490166

DCD Tier 2, Rev. 3, Section 11.5.7 should commit the COL applicant to establish operational procedures for the associated post-accident radiation monitoring systems. DCD Tier 2, Rev. 3, Sections 11.5.1, 11.5.4, and 11.5.5 describe operational requirements of the post-accident sampling system and operational range of each process radiation monitoring system (PRMS) to ensure that they are consistent with the requirements of 10 CFR Parts 50.34(f)(2)(viii), 50.34(f)(2)(xvii), 50.34(f)(2)(xxvii), and 50.34(f)(2)(xxviii), and guidance of RG 1.97 and NUREG-0737 TMI-related Item II.F.1 (Attachments 1 and 2). However, DCD Rev. 3, Section 11.5.7 does not commit the COL applicant to establish operational procedures for the associated radiation monitoring systems. Accordingly, update this section of the DCD to add this COL information item.

*Status: GHNEA has committed to a due date of 7/27/2007.*

RAI 11.5-47, RAI Letter No. 100, 5/30/07, ML071490166

In DCD Rev. 3, Chapter 11, GE identified COL holder items encompassing Operational Program including: Offsite Dose Calculation Manual (ODCM), Process Control Program (PCP), Radiological Environmental Monitoring Program (REMP), radiological effluent technical specifications (RETS), and standard radiological effluent controls (SREC). In accordance with SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," dated

October 28, 2005, COL applicants should fully describe these operational programs in their COL application and should propose implementation milestones (license conditions) for staff review. Accordingly, revise the DCD to include COL applicant items rather than COL holder items for these operations programs.

*Status: GHNEA has committed to a due date of 7/27/2007.*

cc:

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