PMSTPCOL PEmails

From: Govan, Tekia
Sent: Tuesday, October 13, 2009 10:50 AM
To: STPCOL
Subject: FW: Response to Request for Additional Information
Attachments: U7-C-STP-NRC-090170.pdf; U7-C-STP-NRC-090173.pdf

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From: Ballinger, Amy [mailto:aballinger@STPEGS.COM]
Sent: Tuesday, October 13, 2009 10:46 AM
To: Muniz, Adrian; Sosa, Belkys; Dyer, Linda; Wunder, George; Eudy, Michael; Plisco, Loren; Anand, Raj; Foster, Rocky; Joseph, Stacy; Govan, Tekia; Tai, Tom
Subject: Response to Request for Additional Information

Good morning,

Attached, please find a courtesy copy of the letters answering the NRC staff questions related to COLA , Part 2, Tier 2 Sections 2.5.4 and 3.11 in letter U7-C-STP-NRC-090170 and COLA Part 2, Chapters 11 and 12 in letter number U7-C-STP-NRC-090173.

The official copies will be mailed today according to the letter address list.

If you have any questions on Chapter 2, contact Dick Bense at 361-972-4802
Chapter 3, contact John Price at 361-972-4748
Chapters 11 & 12 contact Scot Stephens at 361-972-4789.

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October 12, 2009
U7-C-STP-NRC-090170

U. S. Nuclear Regulatory Commission
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South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Attached are the responses to the NRC staff questions included in Request for Additional Information (RAI) letter numbers 224 and 268 related to Combined License Application (COLA) Part 2, Tier 2, Sections 2.5.4 and 3.11, respectively. This submittal completes the response to each of these RAI letters.

Attachments 1 through 7 address the responses to the RAI questions listed below:

RAI 02.05.04-31
RAI 03.11-1
RAI 03.11-2
RAI 03.11-3
RAI 03.11-4
RAI 03.11-5
RAI 03.11-6

There are no commitments in this letter.

If you have any questions, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

STI 32548855

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10/12/09

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

jep

Attachments:

1. RAI 02.05.04-31
2. RAI 03.11-1
3. RAI 03.11-2
4. RAI 03.11-3
5. RAI 03.11-4
6. RAI 03.11-5
7. RAI 03.11-6

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RAI 02.05.04-31

QUESTION:

FSAR Table 3.0-11 of Part 9: ITAAC, "ITAAC For Backfill Under Category I Structures," (1) does not specify the inspections, tests, or analyses that will be used to ensure that the properties of the selected backfill meet the site-specific assumptions used in the static and dynamic analyses, (2) only commits to meeting minimum density values, and (3) does not provide specific acceptance criteria. 10 CFR 100.23 (d) (4) requires that "Each applicant shall evaluate all siting factors and potential causes of failure, such as the physical properties of the materials underlying the site …," and Regulatory Guide 1.206 section C.I.2.5.4.5, "Excavations and Backfill," states that the applicant should discuss "sources and quantities of backfill and borrow, including a description of exploration and laboratory studies and the static and dynamic engineering properties of these materials."

Please describe how you will ensure that the backfill placed below Category 1 structures meets or exceeds your design assumptions used in the site-specific static and dynamic analyses performed for STP Units 3 and 4, to include assumed shear wave velocity, compressibility properties and shear strength parameters for the backfill placed under Category 1 structures.

RESPONSE:

Quality control procedures to verify key parameters of the backfill material during placement were provided in the response to NRC RAI 14.03.02-6 (STPNOC letter U7-C-STP-NRC-090150 dated September 21, 2009, ML092660093) and are included in COLA Revision 3, Table 2.5S.4.5.3-1, "Quality Control Recommendations for Structural Fill." The response to NRC RAI 14.03.02-6 also proposed new ITAAC in COLA Part 9, Table 3.0-11, "Backfill under Category 1 Structures," to require testing and verification of shear wave velocity as compared to the value used in design analyses, along with the ITAAC previously proposed for verifying backfill compaction.

When the source of backfill material to be placed under Seismic Category I structures is identified, testing will be conducted to ensure that the backfill properties, such as compressibility and shear strength, are consistent with design inputs used in the analysis of these structures. This backfill material will also be characterized by key indicator parameters (i.e., gradation, moisture content, Atterberg limits, density) that will be used for field quality control of backfill placed. The relationship between these key indicator parameters and the design input parameters will be established to ensure that the backfill placed under Seismic Category I structures meets or exceeds the requirements of the design analyses.

No additional COLA change is required as a result of this RAI response.

RAI 03.11-1

QUESTION:

Provide or reference the following information, or indicate the status of and schedule for its availability, related to the environmental qualification (EQ) operational program for safety-related mechanical equipment for the STP Units 3 & 4 nuclear power plant, including (a) a description of the process to determine the suitability of environmentally sensitive mechanical equipment needed for safety-related functions and to verify that the design of such materials, parts, and equipment is adequate, such as (i) identifying safety-related mechanical equipment located in harsh environmental areas, (ii) identifying nonmetallic subcomponents of such equipment, (iii) identifying environmental conditions and process parameters for which this equipment must be qualified, (iv) identifying nonmetallic material capabilities, and (v) evaluating the environmental effects on the nonmetallic components of the equipment; and (b) a description of the approach to document the successful completion of qualification tests and/or analysis, and qualification status for each type of equipment.

Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," in the STP Units 3 & 4 3 FSAR incorporates by reference Section 3.11 of the ABWR DCD Tier 2, with supplemental information. The process for implementation of the provisions for environmental qualification of safetyrelated mechanical equipment (such as by procurement specifications) has not been described in the STP Units 3 & 4 COL application. Provide examples of the implementation for environmental qualification of safety-related mechanical equipment or provide a schedule when the implementation will be available for an NRC on-site review.

RESPONSE:

The STP Units 3 and 4 Equipment Qualification Program ("the Program") is currently being developed. It includes the operational program for environmental qualification (EQ) for safety-related mechanical and electrical equipment. The STP Units 3 and 4 environmental qualification of safety-related mechanical and electrical equipment is consistent with NEDE-24326-1-P (see Reference 3.11-2, COLA Part 2, Tier 2, Section 3.11.8), as reviewed in Section 3.11.2 of NUREG-1503, Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, dated July 1994. The Program will include a description of the process used to determine the suitability of environmentally sensitive mechanical equipment that performs safety-related functions and to verify that the design of such materials, parts, and equipment is adequate. The Program will address: (i) identifying safety-related mechanical equipment located in harsh environmental areas, (ii) identifying nonmetallic subcomponents of such equipment, (iii) identifying environmental conditions and process parameters for which this equipment must be qualified, (iv) identifying nonmetallic material capabilities, and (v) evaluating the environmental effects on the nonmetallic components of the equipment. The Program will also require documentation of the approach(s) allowed for the successful completion of qualification tests and/or analysis, and qualification status for each type of equipment.

The document described above will be used to determine the environmental qualification requirements for the STP Units 3 and 4 safety-related mechanical equipment. These requirements will be incorporated in the equipment purchase specifications. The response to RAI 03.10-1, Supplement 1, (see letter U7-C-STP-NRC-090160, dated October 5, 2009) provides a list of mechanical and electrical components that require seismic/dynamic qualification. The environmental qualification requirements for the mechanical items on that list will be specified in accordance with the Program.

The STP Units 3 and 4 Equipment Qualification Program will be available for review in the 2nd Quarter 2010.

No COLA change is required as a result of this RAI response.

RAI 03.11-2

QUESTION:

Discuss the plan for the implementation of the environmental qualification approach, including the application of industry standards.

Subsection 3.11.2 “Qualification Tests and Analyses,” of the ABWR DCD Tier 2 states that safety-related mechanical equipment that is located in a harsh environment is qualified by analysis of materials data which are generally based on test and operating experience. ABWR DCD Tier 2 Subsection 3.11.2 states that for safety-related equipment located in a mild environment, certificate of compliance shall be submitted certifying that the equipment has been qualified to assure its required safety-related function in its applicable environment. The STP Units 3 & 4 FSAR does not discuss the implementation of the environmental qualification approach required by the ABWR DCD.

RESPONSE:

The STP Units 3 and 4 Equipment Qualification Program will be used, as stated in the response to RAI 03.11-1. It includes the environmental qualification (EQ) approach, including the application of industry standards. The program incorporates the reference ABWR DCD approach for the safety-related mechanical equipment that is located in a harsh environment or a mild environment. COLA Part 2, Tier 2, Section 3.11.6S, Qualification of Mechanical Equipment, explains the approach. Thus, the DCD Tier 2, Section 3.11.2 requirements for qualification of equipment in harsh or mild environments will be a part of the equipment purchase specifications, as explained in the response to RAI 03.11-1.

No COLA change is required as a result of this RAI response.

RAI 03.11-3

QUESTION:

Describe the plan for the implementation of Toshiba Replacement EQ Program Document for environmental qualification of safety-related mechanical equipment at STP Units 3 & 4. Subsection 3.11.6S of the STP Units 3 & 4 FSAR states that the process for determining the suitability of environmentally sensitive soft parts in mechanical equipment has been established for all commodities and sub-components of mechanical equipment that perform a safety-related function by adherence to the requirements of Topical Report NEDE-24326-1-P "General Electric Environmental Qualification Program." As discussed in RAI 3.11-1, Toshiba will prepare a derivative document based on GE's EQ Program (Proprietary) topical report NEDE-24326-1-P, 1983.

RESPONSE:

As discussed in the response to RAI 03.11-1, the STP Units 3 and 4 environmental qualification of safety-related mechanical and electrical equipment is consistent with the requirements of NEDE-24326-1-P. There is no replacement document. The process for determining the suitability of environmentally sensitive soft parts in mechanical equipment will be included in the implementation program, as discussed in the responses to RAIs 03.11-1 and 03.11-2.

RAI 03.11-1 does not discuss a derivative document. Issues related to derivative documents should be addressed through the assessment of the STPNOC due diligence, which is outside the scope of the COLA RAIs.

No COLA change is required as a result of this RAI response.

RAI 03.11-4

QUESTION:

Operating experience from nuclear power plants has revealed the potential for adverse flow effects during normal plant operation that can impact safety-related components (such as safety relief valves). As a result, equipment qualification programs need to address these adverse flow effects to provide confidence in the capability of safety-related equipment to be capable of performing their safety functions. Please provide additional details how STP Units 3 and 4 plan to implement the DCD provisions for equipment qualification to address the effects of flow induced vibration.

RESPONSE:

The STP Units 3 and 4 Equipment Qualification Program will be used, as stated in the response to RAI 03.11-1. It will include the operational program for seismic and dynamic qualification (DQ) for safety-related mechanical and electrical equipment, and will address the potential vibratory effects from instabilities or rapid changes of the flow in the piping during normal and anticipated plant operation. The effect of the specified non-seismic related vibration due to normal and transient plant operating conditions and in-plant (suppression pool hydrodynamic) vibration will be accounted for as a portion of the seismic tests. The vibration events will be specified based upon potential system operating cycles (see DCD Tier 2, Table 3.9-1, items 14 and 15, and Table 3.9-2, items 2(a), 2(b), 5, 6, 7 and 9 as well as the second sentence of Note (5) and Note (10)). BWR operating experience provides a basis for determining the operating events. The requirement to account for the vibratory effects will be a part of the purchase specifications via incorporation of the program requirements, as explained in the response to RAI 03.11-1.

Adverse piping vibration may occur due to disturbances or instabilities of the flow in the piping, depending upon the as-built piping configuration including supports, and the operating (e.g., pumps, valves and SRVs) and non-operating (e.g., pressure reducing devices and flow restrictors) components in the system. DCD Tier 2, Section 3.9.2.1.1 includes requirements for pre-operational and initial start-up testing for piping vibrations. During this testing, piping vibration is corrected if it does not meet the acceptance criteria.

In summary, the safety related equipment is required to be qualified, via purchase specifications, for dynamic conditions, events and loads as addressed in DCD Tier 2, Sections 3.9 and 3.10.

No COLA change is required as a result of this RAI response.

RAI 03.11-5

QUESTION:

Clarify the plans for the commencement of the Environmental Qualification Program and its transition into the site-specific operating reactor program as described in Section 3.11.7 of the STP Units 3 & 4 FSAR for both mechanical and electrical/I&C equipment.

Implementation of the environmental qualification program, including development of the plant specific Equipment Qualification Document (EQD), will be in accordance with the milestone defined in FSAR Section 13.4S “Operational Program Implementation.” STP Units 3 & 4 FSAR Section 13.4S indicates that FSAR Table 13.4S-1, “Operational Programs Required by NRC Regulations and Program Implementation,” lists each operational program, the regulatory source for the program, the FSAR section in which the operational program is described, and the associated implementation milestones. FSAR Table 13.4S-1 specifies the implementation milestone for the Environmental Qualification Program as “fuel load.” This milestone is not sufficiently clear to establish the commencement of the Environmental Qualification Program and its subsequent transition to an ongoing program during plant operation. For example, will commencement of this program be tied to the completion of construction activities for the component, system, or elevation? What will be the process for turnover of the EQ program to plant operations staff? Discuss development and turnover of the preventive maintenance, surveillance, and periodic testing programs identified in Section 3.11.7 of the FSAR.

RESPONSE:

The steps/chronology in support of the “Fuel Load” milestone will be as follows:

1. As stated in the response to RAI 3.11-1, the STP Units 3 and 4 Equipment Qualification Program includes the operational program for environmental qualification (EQ) for safety-related mechanical and electrical/instrumentation and control (I&C) equipment. The procurement specifications incorporate the applicable requirements from the program, as noted also in the response to RAI 3.11-1.

2. A specification is attached to the purchase specifications, which provides the equipment vendors with the guidance/direction to prepare test plans, to perform the environmental qualification and submit the results of the testing in a structured EQ report for equipment. An environmental data sheet summarizing the environmental conditions that the equipment must be qualified to is also attached to the purchase specifications. These data sheets are prepared based on the equipment location in the plant, and the environmental data for that location as documented in the program. Both of these attachments to the procurement documents become a requirement for the vendors to demonstrate suitability of the supplied equipment.

3. The EQ reports, as noted in (2) above, will be reviewed, as they become available. The review ensures that the vendor’s EQ meets the procurement specification requirements,

which include qualified life based on the environmental conditions, items/materials that may have a shelf life issue and items that must be replaced to maintain their qualification, when disturbed in the field or during normal maintenance/troubleshooting in the plant, such as o-ring replacement when a cover on a transmitter is removed.

4. The Environmental Qualification Document (EQD) will be prepared summarizing the qualification results for all safety-related electrical and mechanical equipment located in harsh environments. The EQD will include the following: (a) The test environmental parameters and the methodology used to qualify the equipment located in harsh environments will be identified, and (b) A summary of environmental conditions and qualified conditions for the safety-related equipment located in a harsh environment zone will be presented in the system component evaluation work sheets.

5. The approved records and reports from (3) above and the EQD will be entered into electronic searchable databases. These databases provide basis for the maintenance activities and insure that the equipment is identified that requires replacement based on shelf life, qualified life and maintenance activities.

6. The EQ program will be implemented/utilized during construction, and will be completed for turnover to STPNOC by fuel load as described in the response to RAI 3.11-6. Also, the preventive maintenance, surveillance, and periodic testing programs are discussed in the response to RAI 3.11-6.

No COLA change is required as a result of this RAI response.

RAI 03.11-6

QUESTION:

The applicant is requested to fully describe the proposed site-specific operational EQ program (based on STP 1 & 2) in Subsection 3.11.7 of the STP Units 3 & 4 FSAR and note any differences with the mechanical environmental qualification program as approved by the NRC in NUREG-1503 and NEDE-24326-1-P, 1983. For mechanical components, also describe the qualification methods and record keeping requirements for the site-specific operational program. Also, state if this program will include electrical/I&C equipment and, if so, fully describe the program with respect to electrical/I&C equipment.

Subsection 3.11.7 of the STP Units 3 & 4 FSAR provides a site-specific supplement for the operational description of the STP Units 3 & 4 Environmental Qualification (EQ) Program and states that the EQ Program for STP Units 3 & 4 will be consistent with the STP Units 1 & 2 Program, taking into consideration the appropriate differences between new and existing units. The FSAR references the STP 1 & 2 EQ Program without sufficient detail.

RESPONSE:

The following provides the requested information:

1. The STP Units 3 and 4 Equipment Qualification Program will be used as stated in the response to RAI 03.11-1. It includes the operational program for environmental qualification (EQ) for safety-related mechanical and electrical equipment, including instrumentation and control (I&C) equipment. The program is consistent with NEDE-24326-1-P, 1983, as reviewed in Section 3.11.2.2 of NUREG-1503 for program requirements for mechanical environmental qualification. The EQ program is also consistent with the EQ descriptions contained in DCD Tier 2, Section 3.11 and COLA Part 2, Tier 2, Section 3.11. The COL License Information that is described in COLA Part 2, Tier 2, Sections 3.11.6 and 3.11.6S will be included in the EQ program. The administrative and process management requirements of the STP Units 1 and 2 EQ Program will be merged, as described below, with the technical requirements of the STP Units 3 and 4 Equipment Qualification Program for implementation during the operation.

2. As described in the response to RAI 03.11-5, the vendors are required to provide the EQ information that will be needed during construction and subsequent operation of STP Units 3 and 4. The STP Units 1 and 2 EQ program includes programs for preventive maintenance, surveillance, and periodic testing, which provide for replacement of parts and equipment prior to the end of qualified life. These programs will be included into the STP Units 3 and 4 EQ program, before fuel load, as part of the EQ Program, Item 3 of COLA Part 2, Tier 2, Table 13.4S-1.

3. The STP Units 1 and 2 EQ program includes specific administrative and quality assurance activities, such as design changes, procurement, work control, and maintenance. It also

administers procedural controls for evaluating changes, preparing documentation, maintaining databases, calculating qualified life of components, performing various technical evaluations, and reviewing equipment purchase specifications. For planning of such procedural activities during operation of the STP Units 3 and 4 units, the STP Units 1 and 2 activities will be used as guidelines. Documentation of these procedural activities will be prepared, before the fuel load, as part of the STP Units 3 and 4 EQ Program, Item 3 of COLA Part 2, Tier 2, Table 13.4S-1.

No COLA change is required as a result of this RAI response.

Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

October 12, 2009
U7-C-STP-NRC-090173

U. S. Nuclear Regulatory Commission
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South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Attached are responses to NRC staff questions included in Request for Additional Information (RAI) letter numbers 145, 263, 264, 265, 269, and 270, related to Combined License Application (COLA) Part 2, Tier 2, Sections 11.2, 11.3, 11.4, and 12.2. This submittal completes the responses to the letters referenced above.

Attachments 1-6 provide responses to the RAI questions listed below:

11.02-6	11.03-7	11.04-5
12.02-4	12.02-9	12.02-10

Attachment 4 is a supplemental response to RAI 12.02-4, originally addressed in letter U7-C-STP-NRC-090113, dated August 20, 2009. Attachment 7 supplies the Cost Benefit Analysis Calculation information referred to in the responses to RAI questions 11.02-6 and 11.03-7.

When a change to the COLA is indicated, it will be incorporated in the next routine revision of the COLA following the NRC acceptance of the RAI response.

There are no commitments in this letter.

If you have any questions regarding these responses, please contact me at (361) 972-7136 or Bill Mookhoek at (361) 972-7274.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10/12/09

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

scs

Attachments:

1. Question 11.02-6
2. Question 11.03-7
3. Question 11.04-5
4. Question 12.02-4, Supplemental Response
5. Question 12.02-9
6. Question 12.02-10
7. Cost Benefit Analysis Calculation

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RAI 11.02-6

QUESTION:

Please provide all plant- and site-specific cost-benefit analysis parameters used to determine compliance with Reg Guide 1.110 as referenced in FSAR Section 11.2.1.2, Table 11.2-7 and Table 11.2-8 for the Liquid Waste Management System. Provide all specific information for the staff to evaluate the bases and assumptions used in the analysis and to conduct an independent confirmation of compliance with NRC regulations and guidance.

RESPONSE:

FSAR Section 11.2.1.2 states, in part:

> "To demonstrate compliance with Section II, paragraph D of Appendix I, a cost-benefit analysis was performed in accordance with the guidance of Regulatory Guide 1.110. . . The total annual costs associated with implementing the three augments to the LWMS and the corresponding benefit-cost ratio are determined using the methodology prescribed in Regulatory Guide 1.110, the cost data provided in Table 11.2-7 . . . The total annual cost of each augment to the LWMS and the associated benefit cost ratio are summarized in Table 11.2-8. These results demonstrate that the total annual cost associated with each augment to the LWMS, including the least cost option is substantially larger than the benefit derived from each augment. The cost-benefit numerical analysis, required by 10 CFR 50 Appendix I Section II Paragraph D, demonstrates that the addition of items to the LWMS of reasonably demonstrated technology will not provide a favorable cost benefit. Therefore the STP 3 & 4 prescribed LWMS meets the numerical guides for dose design objectives."

The STP 3 & 4 cost benefit analysis calculation includes the calculations, approaches and means of arriving at the conclusions presented in FSAR Subsection 11.2.1.2, Table 11.2-7 and Table 11.2-8. In addition, the Notes section of FSAR Table 11.2-7 provides specific information for the staff to evaluate the bases and assumptions used in the analysis.

The cost-benefit analysis calculation is provided as an attachment to the package transmitting this RAI.

No COLA change is required as a result of this response.

RAI 11.03-7

QUESTION:

FSAR Section 11.3.11.1

Please provide all plant- and site-specific cost-benefit analysis parameters used to determine compliance with Reg Guide 1.110 as referenced in FSAR Section 11.3.11.1 and Table 11.3-5 for the Gaseous Waste Management System. Provide all specific information for the staff to evaluate the bases and assumptions used in the analysis and to conduct an independent confirmation of compliance with NRC regulations and guidance.

RESPONSE:

FSAR Section 11.3.11.1 states, in part:

> "To demonstrate compliance with Section II, paragraph D of Appendix I, a cost-benefit analysis was performed in accordance with the guidance of Regulatory Guide 1.110. . . The total annual costs associated with implementing the augment to the GWMS and the corresponding benefit-cost ratio are determined using the methodology prescribed in Regulatory Guide 1.110, the cost data provided in Table 11.3-5 . . . The total annual costs of the augment to the GWMS and the associated benefit cost ratio are in Table 11.3-6. These results demonstrate that the total annual cost associated with the augment to the GWMS is substantially larger than the benefit derived from the augment. The cost-benefit numerical analysis, required by 10 CFR 50 Appendix I Section II Paragraph D, demonstrates that the addition of items to the GWMS of reasonably demonstrated technology will not provide a favorable cost benefit. Therefore the STP 3 & 4 prescribed GWMS meets the numerical guides for dose design objectives."

The above segments provide the requirements of compliance with NRC regulations and guidance regarding the cost-benefit analysis calculation. The STP 3 & 4 cost benefit analysis calculation includes the calculations, approaches and means of arriving at the conclusions presented in FSAR Subsection 11.3.11.1, Table 11.3-5 and Table 11.3-6. In addition, the Notes section of FSAR Table 11.3-5 provides specific information for the staff to evaluate the bases and assumptions used in the analysis.

The cost-benefit analysis calculation is provided as an attachment to the package transmitting this RAI.

No COLA change is required as a result of this response.

RAI 11.04-5

QUESTION:

NRC review of STP Candidate Change Number 2007011, STD DEP 11.4-1 found that STP did not adequately evaluate whether ABWR DCD Tier 2 Departure 11.4-1 (Solid Waste Management System or SWMS) question 7 and 9 "could" either increase the consequences of a system malfunction, or cause a malfunction with a different result.

NRC Staff concluded that this departure "could" either impact system malfunctions due to the addition of a new Backwash Receiving Tank and components with an additional source term of activity located in the radwaste building, or cause a malfunction with a different result due to increased retention of radionuclides in tanks or skid-mounted components in the mobile dewatering processing subsystem due to increased decontamination factors.

STP should re-evaluate their initial departure evaluation and determine whether this departure "would" impact a system malfunction IAW 10 CFR52 Appendix A analysis. The evaluation results should either be provided to the staff, or the departure should be submitted for NRC review and approval.

RESPONSE:

Re-evaluation of Question 7

Question 7 of the 10 CFR 52 Review is:

> “Could the proposed change result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific DCD?”

The SWMS described in the COLA replaces the SWMS described in the DCD. The significant changes to the SWMS as described in the COLA are:

- Removal of the dryer and solidification systems.
- Removal of the incinerator and compactor.
- The addition of a Liquid Waste (LW) backwash receiving tank to collect backwash from the Liquid Waste Management System (LWMS) modular processing units for transfer to the phase separators.
- The addition of a second spent resin storage tank to allow the separation of low activity condensate polishing resin from LWMS resin.

The DCD does not contain an evaluation of the consequences of a malfunction in the SWMS. The SWMS is located in the Radwaste Building, and the consequences of the limiting fault in the Radwaste Building are evaluated in DCD Section 15.7.3 as a LWMS tank failure. The discussion in the DCD indicates that the consequences of all other faults, including equipment malfunctions, are bounded by the tank failure and therefore the consequences of equipment malfunctions are not evaluated. Since some components of the SWMS are removed (dryer and solidification systems), more activity will processed by the dewatering system. In addition, a new tank is added (LW backwash receiving tank) that could not have been considered in the DCD evaluation. As a result of this RAI an evaluation was done to determine if the change would affect the consequences of an equipment malfunction.

EVALUATION

Although the components of the SWMS described in the COLA are not exactly the same as the components described in the DCD, no fundamentally different processes or equipment are being introduced by the changes to the SWMS. Specifically, the permanently installed volume reduction equipment (incinerator and dryer systems) and solidification system described in the DCD are removed from the SWMS. In the SWMS described in the COLA, all wet wastes are processed using the mobile dewatering system, which is the same as the mobile dewatering system described in the DCD. Since components which contain concentrated radionuclides at high temperatures are removed, the potential for malfunctions involving these components is also removed. The only new component that is added to the SWMS is the LW backwash receiving tank. This tank is used to accumulate the backwash from the filters and reverse osmosis units in the LWMS, and replaces the concentrated waste tanks that were associated with the dryer and solidification system. An additional spent resin storage tank is also added to separate the condensate demineralizer resin from the LWMS resin.

The current bounding consequence analysis in the DCD for failures in the radwaste system (Section 15.7.3) is a complete failure of a radwaste system component that leads to a release of liquid containing radioactivity from the component. Two pathways to the environment are addressed: liquid and gaseous. Releases through the liquid pathway are not considered in Section 15.7.3 because the Radwaste Building tank cubicles are lined with steel, precluding the release of any liquid to the environment. The source term is limited to the iodine activity in the LWMS (DCD Table 12.2-13), and it is assumed that 10% of the iodine activity becomes airborne and is released from the Radwaste Building.

As part of the evaluation of the hydrological characteristics of the plant site, the consequences of a release to the groundwater are evaluated in COLA FSAR Section 2.4S.13. This groundwater evaluation uses the bounding liquid concentrations from the reactor coolant or the Low Conductivity Waste (LCW) collector tank. The activity used in the consequence analyses in the DCD and COLA is from the LWMS. The LWMS provides the feed material to the SWMS and is not affected by the changes to the SWMS. Therefore, the consequences of the radwaste system failures currently evaluated in the DCD and COLA are not affected by the change to the SWMS.

The components in the SWMS all contain a large inventory of solid material, either particulate matter, filter media or spent resins. The radioactivity in these components is generally attached to the solid material and, as such, is much less mobile than the radioactivity in the LWMS. The radioactive inventory in some SWMS components in the Radwaste Building (e.g., the phase separator), as shown in DCD and COLA Table 12.2-15, is larger than the inventory in the LWMS components used to evaluate the consequences of failures in the radwaste system.

However, the failure of the LWMS components is considered bounding because the radioactive inventory in the SWMS is relatively immobile.

The change in the configuration of the SWMS includes the addition of a LW backwash receiving tank. This tank is used to accumulate the backwash from the filters in the LCW and High Conductivity Waste (HCW) modular systems, and the reject from the reverse osmosis (RO) units in the HCW system. The contents of the LW backwash receiving tank is sent to the phase separators, where it is decanted prior to processing by the mobile dewatering system. The contents of the LW backwash receiving tank will have a high percentage of particulate matter and filter media, and essentially all of the radioactive inventory will be attached to the solid material. Therefore, the activity in the LW backwash receiving tank will be essentially immobile compared to the activity in the LWMS, and the failure analysis in the DCD and COLA will remain bounding.

The change in the configuration of the SWMS to eliminate the dryer and solidification systems results in more activity processed through the mobile dewatering system. In this system, the water is removed from the solid media by natural evaporation, and all of the radioactive inventory remains attached to the solid media in the system. Although the total activity processed may increase so that the activity in the dewatering system may be larger, the activity is immobile compared to the activity in the LWMS. Therefore, the failure analysis in the DCD and COLA remains bounding.

Conclusion

The changes to the SWMS will add one new tank containing high activity to the radwaste building and potentially increase the amount of activity in the mobile dewatering system. However, the activity in these components is immobile compared to the activity in the LWMS, and the failure analysis in the DCD and COLA remain bounding. The change to the SWMS will not increase the consequences of an equipment malfunction and therefore prior NRC approval is not required.

Re-evaluation of Question 9

Question 9 of the 10 CFR 52 Review is:

> "Could the proposed change create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific DCD?"

The proposed change to the SWMS involves the removal of permanently installed volume reduction equipment (incinerator, dryer) and the removal of the solidification system. In addition, the LW backwash receiving tank is added to collect the backwash from the filters and RO in the LCW and HCW modular systems, and a second spent resin storage tank is added to separate low activity condensate polisher resin from LWMS resin.

The DCD does not contain an evaluation of the consequences of a malfunction in the SWMS. The consequences of the limiting fault in the Radwaste Building are evaluated in DCD Section

15.7.3 as a LWMS tank failure. The discussion in the DCD indicates that the consequences of all other faults, including equipment malfunctions, are bounded by the tank failure and the consequences are not evaluated. An evaluation was done to determine if the changes made to the SWMS would result in a malfunction with a different result.

EVALUATION

The current bounding analysis in the DCD for failures in the radwaste system (Section 15.7.3) is a complete failure of a radwaste system component that leads to a release of liquid containing radioactivity from the component. Releases to the environment are limited to airborne activity consisting of 10% of the iodine in the liquid. No liquid releases are anticipated since the Radwaste Building is constructed such that all liquid releases will be retained in the building.

The limiting fault evaluated in the DCD is the complete failure of a component that causes the release of all the contaminated liquid in the component. The mechanism for the failure is not specified. This change to the SWMS involves the removal of active equipment (incinerator, dryer and solidification system), and the addition of two new tanks. The tanks that are added contain solid particulate matter, filter media or ion removal media. These new tanks are similar to the tanks that already are located in the Radwaste Building, so no fundamentally new processes or equipment are being introduced by the changes to the SWMS. Since no new failure mechanisms are introduced by the proposed change, the limiting fault (or malfunction) for the new equipment would also be a complete failure that causes the release of all the contaminated liquid or media in the component. Therefore, this change does not lead to the possibility of a malfunction that is different from malfunctions that have already been considered.

The result of the radwaste system malfunctions evaluated in the DCD is the airborne release of 10% of the iodine activity in the liquid in the failed component. Liquid releases are not considered because the liquid will be contained in the Radwaste Building. The new tanks will be located in the Radwaste Building basement in steel lined rooms so any liquid leakage from the tanks will be contained within the Radwaste Building. Since the activity in the tanks will be bound to the solid material in the tanks, it will be essentially immobile, and the amount of activity that will become airborne will be substantially less than 10%. Therefore the results of the radwaste system malfunction evaluated in the DCD will not be affected by this change.

Conclusion

Based on this evaluation and the design of the Radwaste Building, the proposed change would not create the possibility for a malfunction of an SSC important to safety with a different result than evaluated previously in the DCD, and therefore prior NRC approval is not required.

No COLA change is required as a result of this response.

RAI 12.02-4:

QUESTION:

RG 1.206, Part C.I.12.2.1, Contained Sources, states that the applicant should describe the sources of radiation, during normal plant operations and accident conditions, that are the bases for the radiation protection design and that the sources should be described in the manner needed for input to the shield design calculation.

In accordance with RG 1.206, include radiation source information in FSAR Table 12.2-5a for the skid mounted Low Conductivity and High Conductivity Waste (LCW and HCW) filter/demineralizer systems that will be utilized in the STP 3 & 4 radwaste building.

SUPPLEMENTAL RESPONSE:

This supplemental response provides the information needed for input to shield design calculations for the new modular components be placed in the COLA. To provide this information a “typical” filter/demin skid model was used to specify the source geometry, activity inventory and required shielding to maintain exposures to personnel ALARA. This is the same type of methodology used in the DCD and approved by the FSER. The shielding ITACC will verify the DAC that the shielding is sufficient to attain the desired radiation zones.

The primary components of the filter/demin skid model are the physical dimensions and the operating characteristics. The operating characteristics determine the amount of activity accumulated on the filter/demin skids. To conservatively estimate the maximum amount of activity on the skids, it is assumed that the filter/demin beds are used to process the defined input streams for a period of one year before replacement. The skids are assumed to be 100% efficient for the removal of all nuclides in the input streams. For the LCW filter/demin skid the inputs are the equipment drains and the decantate from the phase separators. For the HCW filter/demin skid, the input stream is the floor drains.

It is expected that the filter/demin skids will contain filter and demineralizer vessels that are similar to the ones in use at power plants today. To establish the physical dimensions of the source model, it was assumed that all of the activity accumulated on the filter/demin skids was accumulated on a single, cylindrical vessel with a volume of 50 ft^3. A diameter of one meter was assumed to establish the height of the vessel. Calculations were then performed to determine the minimum shield thickness to reduce the dose rate from the filter/demin skids to below 5 mrem/hr, which is the dose rate limit specified for the operating area of the Radwaste Building.

The following pages contain updates to tables in the COLA to incorporate the new information developed as a result of this response. Specifically, the LCW and HCW filter/demin skid entries in Tables 12.2-5a, 12.2-5b and 12.2-5c were updated to include the shielding information. Tables 12.2-13b and 12.2-13f were added to document the activity inventory on the filter/demin skids used for the shielding analysis.

Table 12.2-5a Radiation Sources – Radiation Sources

Source Table	For	Drawing		Approximate Geometry
12.2-13b	LCW Filter/Demin Skid**	12.3-39		**Vendor Provided**Rt cylndr (r=0.5m, l=1.8m)
12.2-13f	HCW Filter/Demin Skid**	12.3-39		Vendor Provided Rt cylndr (r=0.5m, l=1.8m)

** LCW and HCW Filter/Demin Skid are identified as "LRW System Skids" and are to be Vendor Provided

Table 12.2-5b Radiation Sources – Source Geometry

Component	Assumed Shielding Source Geometry
LCW Filter/Demin Skid	**Vendor Provided Equipment**Homogeneous source over volume of skid
HCW Filter/Demin Skid	**Vendor Provided Equipment**Homogeneous source over volume of skid

Table 12.2-5c Radiation Sources – Shielding Geometry in Meters

Component	Room Dimensions			Wall Thickness in Meters					
	Length	**Width**	**Height**	**East**	**West**	**North**	**South**	**Floor**	**Ceiling**
LCW Filter/**Demin Skid *****	10	8	3	0.8	0.8	0.8	0.8	0.8	0.8
HCW Filter/Demin Skid ***	10	8	3	0.3	0.3	0.3	0.3	0.3	0.3

*** The LCW and HCW Filter Demineralizer Skids, identified as “LRW System Skids”, are vendor provided. They will be located on the ground floor elevation, 10700 (See Fig. 1.2-23C). The vendor will provide the skids with shielding adequate to maintain the Room, 6381, as a Radiation Zone C. The room dimensions provided are approximate since the shield walls will be movable and the final arrangement will depend on the equipment provided.

Table 12.2-13b ~~Not Used~~Liquid Radwaste Component Inventories-LCW Filter/Demin Skid

Source Volume		1.42 m^3					
Total MBq		**6.52E+06**					
Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	3.64E+05	Rb-89	1.39E+03	Y-91	3.20E+04	Na-24	6.69E+04
I-132	7.31E+04	Sr-89	4.14E+04	Y-92	3.02E+04	P-32	2.56E+04
I-133	2.79E+05	Sr-90	1.36E+04	Y-93	2.03E+04	Cr-51	1.48E+06
I-134	5.55E+04	Y-90	1.36E+04	Zr-95	4.12E+03	Mn-54	9.25E+04
I-135	1.65E+05	Sr-91	1.94E+04	Nb-95	6.09E+03	Mn-56	1.02E+05
		Sr-92	2.24E+04	Ru-103	6.51E+03	Co-58	1.09E+05
		Mo-99	4.79E+04	Rh-103m	6.52E+03	Co-60	7.36E+05
		Tc-99m	4.70E+04	Ru-106	4.30E+03	Fe-55	1.71E+06
		Te-129m	1.13E+04	Rh-106	4.30E+03	Fe-59	1.12E+04
		Te-131m	1.13E+03	La-140	5.22E+04	Ni-63	1.89E+03
		Te-132	2.84E+02	Ce-141	8.48E+03	Cu-64	1.68E+05
		Cs-134	2.94E+04	Ce-144	3.93E+03	Zn-65	2.42E+05
		Cs-136	1.36E+03	Pr-144[2]	3.93E+03	Ag-110m	1.19E+03
		Cs-137	9.41E+04			W-187	2.79E+03
		Ba-137m	8.79E+04				
		Cs-138	5.62E+03				
		Ba-140	4.63E+04				
		Np-239	1.71E+05				
TOTAL	**9.37E+05**	**TOTAL**	**6.55E+05**	**TOTAL**	**1.83E+05**	**TOTAL**	**4.75E+06**

Table 12.2-13f ~~Not Used~~Liquid Radwaste Component Inventories-HCW Filter/Demin Skid

Source Volume		1.42 m^3					
Total MBq		**2.02E+04**					
Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	1.04E+03	Rb-89	1.80E+00	Y-91	1.05E+02	Na-24	1.76E+02
I-132	1.08E+02	Sr-89	1.34E+02	Y-92	6.03E+01	P-32	7.44E+01
I-133	7.71E+02	Sr-90	4.60E+01	Y-93	4.77E+01	Cr-51	4.45E+03
I-134	6.94E+01	Y-90	4.60E+01	Zr-95	1.32E+01	Mn-54	3.16E+02
I-135	3.36E+02	Sr-91	4.52E+01	Nb-95	2.02E+01	Mn-56	1.55E+02
		Sr-92	3.44E+01	Ru-103	2.05E+01	Co-58	3.60E+02
		Mo-99	1.45E+02	Rh-103m	2.06E+01	Co-60	2.47E+03
		Tc-99m	1.40E+02	Ru-106	1.46E+01	Fe-55	5.69E+03
		Te-129m	3.54E+01	Rh-106	1.46E+01	Fe-59	3.59E+01
		Te-131m	3.20E+00	La-140	1.51E+02	Ni-63	6.40E+00
		Te-132	8.34E-01	Ce-141	2.64E+01	Cu-64	4.27E+02
		Cs-134	1.53E+02	Ce-144	1.34E+01	Zn-65	8.21E+02
		Cs-136	6.13E+00	Pr-144[2]	1.34E+01	Ag-110m	4.10E+00
		Cs-137	4.81E+02			W-187	7.97E+00
		Ba-137m	4.49E+02				
		Cs-138	7.34E+00				
		Ba-140	1.33E+02				
		Np-239	5.09E+02				
TOTAL	**2.32E+03**	**TOTAL**	**2.37E+03**	**TOTAL**	**5.21E+02**	**TOTAL**	**1.50E+04**

RAI 12.02-9

QUESTION:

A review of the response to RAI 12.02-2 revealed that the MPC value from 10 CFR Part 20, Appendix B, Table 2, Column 2 for Promethium-143 was listed as 2.00E-5 instead of 7.00E-5 uCi/ml, or 1.89E-3 MBq/ml. The resultant overall Unity summation calculation was not altered by correcting the submitted table in response to RAI 12.02-2. Accordingly, the staff requests that the applicant submit a corrected table for accuracy.

RESPONSE:

As noted in the RAI, the table in the RAI 12.02-2 response incorrectly used an allowable concentration value of 2.00E-5 μCi/ml instead of the correct value of 7.00E-5 μCi/ml, which is 2.59E-06 MBq/ml. In addition, as discussed in the response to RAI 12.02-10, COLA Revision 3 used an incorrect value for the Ag-110m concentration. The resulting change in the fraction of allowable concentration is provided below.

Nuclide	Annual Release MBq/yr	Concentration MBq/ml	Allowable Concentration (MBq/ml)*	Fraction of Allowable Concentration
I-131	3.35E+02	1.75E-13	3.70E-08	4.73E-06
I-132	7.15E+01	3.75E-14	3.70E-06	1.01E-08
I-133	1.38E+03	7.23E-13	2.59E-07	2.79E-06
I-134	4.22E+00	2.21E-15	1.48E-05	1.49E-10
I-135	4.03E+02	2.11E-13	1.11E-06	1.90E-07
H-3	2.96E+05	1.55E-10	3.70E-05	4.19E-06
C-14	0.00E+00	0.00E+00	1.11E-06	0.00E+00
Na-24	1.87E+02	9.78E-14	1.85E-06	5.29E-08
P-32	2.10E+01	1.10E-14	3.33E-07	3.30E-08
Cr-51	6.30E+02	3.30E-13	1.85E-05	1.78E-08
Mn-54	1.47E+02	7.68E-14	1.11E-06	6.92E-08
Mn-56	7.55E+01	3.95E-14	2.59E-06	1.53E-08
Co-56	0.00E+00	0.00E+00	2.22E-07	0.00E+00
Co-57	0.00E+00	0.00E+00	2.22E-06	0.00E+00
Co-58	3.10E+02	1.62E-13	7.40E-07	2.19E-07
Co-60	5.69E+02	2.98E-13	1.11E-07	2.68E-06
Fe-55	3.50E+02	1.83E-13	3.70E-06	4.95E-08
Fe-59	8.24E+01	4.31E-14	3.70E-07	1.16E-07
Ni-63	6.29E+01	3.30E-14	3.70E-06	8.92E-09
Cu-64	4.67E+02	2.45E-13	7.40E-06	3.31E-08
Zn-65	1.63E+01	8.53E-15	1.85E-07	4.61E-08
Rb-89	0.00E+00	0.00E+00	3.33E-05	0.00E+00
Sr-89	1.16E+01	6.08E-15	2.96E-07	2.05E-08
Sr-90	9.92E-01	5.19E-16	1.85E-08	2.81E-08
Y-90	0.00E+00	0.00E+00	2.59E-07	0.00E+00
Sr-91	4.64E+01	2.43E-14	7.40E-07	3.28E-08
Y-91	8.70E+00	4.55E-15	2.96E-07	1.54E-08
Sr-92	1.64E+01	8.58E-15	1.48E-06	5.80E-09
Y-92	6.27E+01	3.28E-14	1.48E-06	2.22E-08

Nuclide	Annual Release MBq/yr	Concentration MBq/ml	Allowable Concentration (MBq/ml)*	Fraction of Allowable Concentration
Y-93	5.05E+01	2.64E-14	7.40E-07	3.57E-08
Zr-95	4.10E+01	2.14E-14	7.40E-07	2.89E-08
Nb-95	1.16E+01	6.08E-15	1.11E-06	5.48E-09
Mo-99	9.66E+01	5.06E-14	7.40E-07	6.84E-08
Tc-99m	2.10E+02	1.10E-13	3.70E-05	2.97E-09
Ru-103	1.21E+01	6.34E-15	1.11E-06	5.71E-09
Rh-103m	0.00E+00	0.00E+00	2.22E-04	0.00E+00
Ru-106	3.29E+02	1.72E-13	1.11E-07	1.55E-06
Rh-106	0.00E+00	0.00E+00	no limit	0.00E+00
Ag-110m	4.44E+01	2.32E-14	2.22E-07	1.04E-07
Sb-124	0.00E+00	0.00E+00	2.59E-07	0.00E+00
Te-129m	3.12E+00	1.63E-15	2.59E-07	6.29E-09
Te-131m	3.10E+00	1.63E-15	2.96E-07	5.51E-09
Te-132	5.00E-01	2.62E-16	3.33E-07	7.87E-10
Cs-134	4.18E+02	2.19E-13	3.33E-08	6.58E-06
Cs-136	2.78E+01	1.46E-14	2.22E-07	6.58E-08
Cs-137	6.57E+02	3.44E-13	3.70E-08	9.30E-06
Cs-138	2.96E-02	1.55E-17	1.48E-05	1.05E-12
Ba-140	6.23E+01	3.26E-14	2.96E-07	1.10E-07
La-140	0.00E+00	0.00E+00	3.33E-07	0.00E+00
Ce-141	1.10E+01	5.74E-15	1.11E-06	5.17E-09
Ce-144	1.44E+02	7.56E-14	1.11E-07	6.81E-07
Pr-143	3.00E+00	1.57E-15	2.59E-06	6.06E-10
Nd-147	7.40E-02	3.87E-17	7.40E-07	5.23E-11
W-187	8.24E+00	4.32E-15	1.11E-06	3.89E-09
Np-239	3.51E+02	1.84E-13	7.40E-07	2.49E-07
			Total:	3.42E-05

*Maximum allowable concentrations derived from 10 CFR 20, Appendix B.

RAI 12.02-10

QUESTION:

1. That staff has noted that the quantities of radionuclides listed in the ABWR DCD Table 12.2-22 and the FSAR Table 12.2-22 are not consistent because the lists of radionuclides between the two tables differ. For example, the ABWR DCD does not have Nd-147 and the FSAR does not have Ag-110m and Sb-124. The staff requests that the applicant provide the basis for the differences in these two tables and identify the set of radionuclides used in the liquid pathway analysis.

2. In response to RAI 12.02-2 the applicant provided a table of average annual liquid releases in order to show compliance to the 10 CFR 20 Unity Rule. However, this table did not include Ag-110m and Sb-124 as listed in the STP DCD Table 12.2-22. The staff requests for the applicant to revise this table to contain these two radionuclides and include their contribution to the calculation of the 10 CFR 20 MPC Fraction of Liquid effluents released to the environment accordingly.

RESPONSE:

1. In the response to Environmental Report RAI 05.04.01-2, STPNOC stated that COLA Part 2, Tier 2 Table 12.2-22 would be revised to include radionuclides Ag-110m and Sb-124 in a future revision. These values have been included in the table in STP 3&4 COLA, Revision 3. The response to the Environmental Report RAI 05.04.01-2 further stated that all normal radiological release liquid pathway analyses were initially based on DCD Table 12.2-22. After the initial analyses, the annual average liquid releases were revised based on use of the GALE computer code, with Nd-147 included. The revised values are given in COLA Part 3, Table 3.5-1 and COLA Part 2, Tier 2, Table 12.2-22. All nuclides in COLA Part 3, Table 3.5-1, including Ag-110m and Nd-147 (nuclides with zero source term such as Sb-124 were not included in the input file), were included in the analysis.

2. The table of average annual liquid releases, including radionuclides Ag-110m and Sb-124, was provided in the RAI 12.02-9 response to support staff review of Part 2, Tier 2, which demonstrates compliance with the unity rule (Note 4) of 10 CFR 20, Appendix B. The dilution factor to calculate the Ag-110m concentration was inadvertently not used for COLA Rev. 3 Table 12.2-22. The concentration will be corrected in a future COLA revision as shown by the gray shading in Table 12.2-22, below.

Table 12.2-22 Average Annual Liquid Releases

Nuclide	Annual Release MBq/yr	Concentration MBq/ml
I-131	3.35E+02	1.75E-13
I-132	7.15E+01	3.75E-14
I-133	1.38E+03	7.23E-13
I-134	4.22E+00	2.21E-15
I-135	4.03E+02	2.11E-13
H-3	2.96E+05	1.55E-10
C-14	0.00E+00	0.00E+00
Na-24	1.87E+02	9.78E-14
P-32	2.10E+01	1.10E-14
Cr-51	6.30E+02	3.30E-13
Mn-54	1.47E+02	7.68E-14
Mn-56	7.55E+01	3.95E-14
Co-56	0.00E+00	0.00E+00
Co-57	0.00E+00	0.00E+00
Co-58	3.10E+02	1.62E-13
Co-60	5.69E+02	2.98E-13
Fe-55	3.50E+02	1.83E-13
Fe-59	8.24E+01	4.31E-14
Ni-63	6.29E+01	3.30E-14
Cu-64	4.67E+02	2.45E-13
Zn-65	1.63E+01	8.53E-15
Rb-89	0.00E+00	0.00E+00
Sr-89	1.16E+01	6.08E-15
Sr-90	9.92E-01	5.19E-16
Y-90	0.00E+00	0.00E+00
Sr-91	4.64E+01	2.43E-14
Y-91	8.70E+00	4.55E-15
Sr-92	1.64E+01	8.58E-15
Y-92	6.27E+01	3.28E-14
Y-93	5.05E+01	2.64E-14
Zr-95	4.10E+01	2.14E-14
Nb-95	1.16E+01	6.08E-15
Mo-99	9.66E+01	5.06E-14
Tc-99m	2.10E+02	1.10E-13
Ru-103	1.21E+01	6.34E-15
Rh-103m	0.00E+00	0.00E+00
Ru-106	3.29E+02	1.72E-13
Rh-106	0.00E+00	0.00E+00
Ag-110m	4.44E+01	~~2.56E-09~~ **2.32E-14**
Sb-124	0.00E+00	0.00E+00
Te-129m	3.12E+00	1.63E-15
Te-131m	3.10E+00	1.63E-15
Te-132	5.00E-01	2.62E-16
Cs-134	4.18E+02	2.19E-13
Cs-136	2.78E+01	1.46E-14
Cs-137	6.57E+02	3.44E-13

Nuclide	Annual Release MBq/yr	Concentration MBq/ml
Cs-138	2.96E-02	1.55E-17
Ba-140	6.23E+01	3.26E-14
La-140	0.00E+00	0.00E+00
Ce-141	1.10E+01	5.74E-15
Ce-144	1.44E+02	7.56E-14
Pr-143	3.00E+00	1.57E-15
Nd-147	7.40E-02	3.87E-17
W-187	8.24E+00	4.32E-15
Np-239	3.51E+02	1.84E-13

STP Nuclear Operating Company

Calculation Cover Sheet
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Calculation No.: 2008-09731 **Revision:** 1

Title: Cost Benefit Analysis for the Liquid and Gaseous Radwaste Systems

Unit No: 3 ☐ 4 ☐ 3 & 4 ☒	**Nuclear Safety Classification:**
System Code:	☐ **Safety-Related**
Equipment No:	☒ **Non-Safety Related**
Project No.: 12188-043	
Status: Draft	

Does this Calculation contain Unverified Inputs or Assumptions? **Yes** ☒ **No** ☐ **Action Tracking #** 4

This Calculation Supersedes:

Description of Revision (list affected pages for partials)**:** Add Cost-Benefit analysis for the Gaseous Radwaste System (1, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21)

	Print Name	Sign Name	Date
Preparer:	Robert A. Nelson	[signature]	06/24/008
Preparer:			

Method of Review: **Detailed Review** ☒ **Alternate Calculations** ☐ **Testing** ☐

	Print Name	Sign Name	Date
Reviewer:	Anthony G. Klazura	[signature]	06/24/2008
Reviewer:			
Approver:	W. J. Johnson	[signature]	6/24/2008

Sargent & Lundy LLC

STP Units 3 & 4
Project No(s): 12188-043

Sargent & Lundy LLC

Calculation No:2008-09731
Revision: 1

CERTIFICATION OF CALCULATION
FOR
STP UNITS 3 & 4

I hereby certify that this Calculation was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Texas.

Sargent & Lundy, LLC Texas Board of Professional Engineers registration number is F-2202.

Imprint PE SEAL(s) here
Signature & Date each seal

SEAL(s)

:

Revision:	Certified By:	Date

STP Units 3 & 4

Sargent & Lundy LLC

Calculation No: 2008-09731
Project No(s): 12188-043
Revision: 1

CALCULATION
ISSUE SUMMARY

Rev.	Purpose of Issue	Sections Affected
0	Initial Issue	All
1	Add Cost-Benefit Analysis for Gaseous Radwaste System	Title, 1.1, 1.2, 3.5, 3.11, 3.12, 3.13, 4.1, 4.2, 5.1, 5.1.1, 5.1.2, 5.2, 6.0, 7.0 and Attachment B

Rev.	Approved Date	Prepared By	Reviewed By	Approved By
0	05/21/2008	Barry C. Schwartz	Anthony G. Klazura	W. J. Johnson
1		Robert A. Nelson	Anthony G. Klazura	

Table of Contents

1.0 Purpose and Scope

1.1 Purpose

The purpose of this calculation is to provide a cost benefit analysis for providing (1) a number of augments to the Liquid Radwaste System and (2) one augment to the Gaseous Radwaste System currently described in the Construction and Operating License Application in order to meet the requirements of 10 CFR 50 Appendix I.

The objective of this calculation is to provide a basis for the cost benefit conclusion utilizing the process design diagram in Section 11.2 of the South Texas Project (STP) 3 & 4 FSAR [Reference 7.1], the Collective Total Body 50 Mile Population Doses in Section 5.4 of the STP 3 & 4 Environmental Report [Reference 7.2] and the methodology described in USNRC Regulatory Guide 1.110 [Reference 7.3].

1.2 Scope

This calculation is applicable to South Texas Project Units 3 and 4.

The Collective Total Body 50 Mile Population Doses are calculated on a per-station basis.

This analysis is limited to providing a cost benefit analysis for augments to the STP 3 & 4 Liquid and Gaseous Radwaste Systems. The block flow diagram of the STP 3 & 4 Liquid Radwaste System is provided in Attachment A. The block flow diagram of the STP 3 & 4 Gaseous Radwaste System is provided in Attachment B to this calculation. The process flow diagram for the STP 3 & 4 Liquid Radwaste System is provided in Figure 11.2-1 and the process flow diagram for the STP 3 & 4 Gaseous Radwaste System is provided in Figure 11.3-1 of the ABWR DCD [Reference 7.5]

2.0 Design Input

The specific input used for this calculation is summarized in this section.

A list of acronyms used in this calculation follows.

Acronyms

AFC - Annual Fixed Cost
ALC - Adjusted Labor Cost
AMC - Annual Maintenance Cost
AOC - Annual Operating Cost
CRF - Capital Recovery Factor
DCEM- Direct Cost of Equipment and Maintenance
DLC- Direct Labor Cost
GWMS - Gaseous Waste Management System
HCW – High Conductivity Waste
HSD – Hot Shower Drains
ICF- Indirect Cost Factor
LCCF- Labor Cost Correction Factor
LCW – Low Conductivity Waste
LWMS - Liquid Waste Management System
STP – South Texas Project
TAC- Total Annual Cost
TCC- Total Capital Cost
TDC- Total Direct Cost

2.1 The Collective Total Body Doses within a 50 Miles radius are taken from Table 5.4-9 of the STP 3 & 4 Environmental Report [Reference 7.2] **(UNVERIFIED)**

Table 2-1 The Collective Total Body Doses within 50 Miles (person-rem per year)				
	STP 3 & 4		STP 1 & 2	
	Liquid	Gaseous	Liquid	Gaseous
Noble gases	0	0.11	0	0.0018
Iodines and particulates	0.0030	0.14	0.00076	0.00043
Tritium and C-14	0.0000056	0.32	0.00068	0.017
Total	0.0030	0.58	0.0014	0.019
Natural background (1)	1.85E5		1.85E5	
Notes: (1) The natural background dose is based on a dose rate of 360 mrem/person/yr and an estimated 2060 population of 514,003.				

2.2 Codes and Standards for Design of Radwaste System Components

USNRC Regulatory Guide 1.110, "Cost Benefit Analysis For Radwaste Systems For Light-Water-Cooled Nuclear Power Reactors", March 1976 (For Comment)

USNRC NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants"

3.0 Assumptions

3.1 Differences between total values reported in tables of this analysis and total values obtained by summing the values presented in the table are due to round off.

3.2 It is assumed that the Liquid Radwaste System (i.e., the Liquid Radwaste System components) described in Section 11.2 of the STP FSAR [Reference 7.1] and the process block diagram shown in Attachment A and the process flow diagram shown in FSAR Figure 11.2-1 are representative of the Liquid Radwaste System that will be installed at STP 3 and 4.

A description of the assumed Liquid Radwaste System follows.

Liquid radwaste at STP 3 & 4 will be processed using a low conductivity waste (LCW) and a high conductivity waste (HCW) mobile processing system, and a strainer for hot shower and detergent waste (HSD) that consists of the following units:

Table 3-1
LCW Mobile System for LCW Processing
• LCW Filter A
• LCW Filter B
• LCW Reverse Osmosis Unit
• LCW Demineralizer
HCW Mobile System for HCW Processing
• HCW Filter A (Charcoal)
• HCW Filter B
• HCW Reverse Osmosis Unit
• HCW Demineralizer
Strainers
• HSD strainer

3.3 The cost benefit analysis only utilizes the HCW and LCW process streams. Based on industry experience, the HSD process stream is usually released through a filtered pathway to the environment without additional processing. This indicates radioactivity in the HSD release stream is substantially below that of the HCW and LCW process streams.

3.4 It is assumed that any proposed modifications to the “already established” radwaste system will eliminate all radioactivity in the process stream, reducing the 50 mile collective population dose from STP 3 & 4 radwaste sources to zero.

3.5 The costs for the liquid and gaseous radwaste augments are provided in Regulatory Guide 1.110 [Reference 7.3]. These include the Annual Operating Costs (AOC), Annual Maintenance Cost (AMC), Direct Cost of Equipment and Materials (DCEM) and Direct Labor Cost (DLC)

3.6 A plant life of 60 years is assumed for this analysis.

3.7 The Capital Recovery Factor (CRF) is taken from Table A-6 of Regulatory Guide 1.110 and reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year is assumed in this calculation, consistent with this table [Reference 7.3].

3.8 Indirect Cost Factor (ICF) – This factor takes into account whether the radwaste system is unitized or shared (in the case of a multi-unit site). It is assumed that the radwaste system in this analysis for STP 3 & 4 is a unitized system at a 2-unit site although the current design is independent for each unit.

3.9 Labor Cost Correction Factor (LCCF) – This factor takes into account the differences in relative labor costs between geographical regions. A factor of 1 (the lowest value) is assumed in this analysis.

3.10 As directed in Regulatory Guide 1.110, the value of one person-rem is $1000 in 1975 dollars.

3.11 For the purposes of this evaluation, the collective total body doses of 0.003 person-rem per year for radioactivity releases in liquid effluent and 0.58 person-rem per year for radioactivity releases in gaseous effluents (Table 2-1 of this calculation) within a 50 mile radius of STP 3 & 4, due to radioactivity releases in liquid effluents, is are assumed to be attributed to a single reactor unit. This assumption is conservative when determining the cost-benefit relationship of Liquid Radwaste System augments because it maximizes the effective benefit.

3.12 It is assumed that the Gaseous Radwaste System (i.e., the Gaseous Radwaste System components) described in Section 11.3 of the ABWR DCD [Reference 7.5] and the process block diagram shown in Attachment B to this calculation and the process flow diagram shown in ABWR DCD Figure 11.3-1 are representative of the Gaseous Radwaste System that will be installed at STP 3 and 4.

A description of the assumed Gaseous Radwaste System follows.

Gaseous radwaste at STP 3 & 4 will be processed using a system that consists of the following units:

Table 3-2
Gaseous Radwaste System
• Steam Jet Air Ejectors
• Interstage Condenser
• Offgas Preheater
• Hydrogen Recombiner
• Offgas Condenser
• Cooler Condenser
• Guard Bed
• Activated Charcoal Delay Beds
• HEPA Filter
• Offgas Vacuum Pump

3.13 The gaseous radwaste cost benefit analysis only utilizes the Main Condenser off-gas process streams. Based on industry experience, the Main Condenser off-gas process stream is usually released through a hydrogen recombiner, activated charcoal delay, and HEPA filter pathway to the environment without additional processing.

4.0 Methodology and Acceptance Criteria

4.1 Methodology

The methodology utilized for calculating the cost benefit for modifying an "already established" liquid radwaste design with augments is described in the USNRC Regulatory Guide 1.110 [Reference 7.3]. In accordance with Regulatory Position C.3 of Regulatory Guide 1.110, all costs are given in 1975 dollars (as is the $1000 per person-rem cost) and there is no allowance for inflation after 1975.

For this analysis, the proposed modifications are (1) the addition of one new demineralizer, or one new evaporator, or the addition of one 10,000 gallon hold-up tank to the Liquid Radwaste System effluent stream prior to entry into the discharge canal and (2) a 3-ton Charcoal Adsorber to the Gaseous Radwaste System.

The following methodology was extracted from Regulatory Guide 1.110 and appropriately edited:

The total annual cost of each augment considered is determined as follows:

a. The Total Direct Cost (TDC):

(1) The direct cost of equipment and materials is obtained from Table A-1 of Regulatory Guide 1.110.

(2) The direct labor cost obtained from Table A-1 of Regulatory Guide 1.110 is multiplied by the appropriate labor cost correction factor from Table A-4 of Regulatory Guide 1.110 to obtain the corrected labor cost for the geographical area from Figure A-1 of Regulatory Guide1.110, in which the plant is to be built.

(3) The costs obtained from steps (1) and (2) are added to obtain the Total Direct Cost.

b. The appropriate Indirect Cost Factor (ICF) is obtained from Table A-5 of Regulatory Guide 1.110 or the associated formula provided.

c. Total Capital Cost (TCC) is determined by using the equation:

$$TCC = TDC \times ICF$$

d. The appropriate Capital Recovery Factor (CRF) is obtained using the formula in Table A-6 of Regulatory Guide 1.110.

e. The Annual Fixed Cost (AFC) is determined by using the equation:

$$AFC = TCC \times CRF$$

f. The Annual Operating Cost (AOC) and the Annual Maintenance Cost (AMC) are determined from Tables A-2 and A-3 of Regulatory Guide 1.110. For multi-unit sites using shared radwaste systems the AOC is multiplied by the number of reactors sharing the augment.

g. The Total Annual Cost (TAC) is determined by using the equation:

$$TAC = AFC + AOC + AMC$$

4.1.1. The "benefit" of each augment is determined by multiplying the calculated dose reduction by $1000 per man-rem and/or $1000 per man-thyroid-rem, as appropriate.

4.1.2. The system should be augmented with any items for which the TAC from Item 4.1.g above is less than the value calculated in item 4.1.1, in the order of diminishing cost-benefit.

4.2 Acceptance Criteria

The following was extracted from the USNRC NUREG-0800 Chapter 11.2 SRP Acceptance Criteria 1B:

"The LWMS should include all items of reasonable demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return for a favorable cost-benefit ratio, can effect reductions in doses to the population reasonably expected to be within 80 kilometers (km) (50 miles (mi)) of the reactor. Regulatory Guide 1.110 provides an acceptable method for performing this analysis."

The following was extracted from the USNRC NUREG-0800 Chapter 11.3 SRP Acceptance Criteria 1.D:

"In addition to 1.A. 1.B, and 1.C, above, the GWMS should include all items of reasonably demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return, for a favorable cost-benefit ratio, can effect reductions in dose to the population reasonably expected to be within 80 km (50 mi) of the reactor."

The methodology as described in Regulatory Guide 1.110 is used in this cost benefit analysis.

The following was extracted from NUREG-0800 Chapter 11.2 Evaluation Findings Item 2:

"The applicant has met the requirements of Section II.D of Appendix I to 10 CFR Part 50 with respect to meeting the ALARA criterion. The staff has considered the potential effectiveness of augmenting the proposed LWMS using items of reasonably demonstrated technology and has determined that further effluent treatment will not effect reductions in cumulative population doses reasonably expected within an 80-km (50-mi) radius of the reactor at a cost of less than $1000 per man-rem or man-thyroid-rem."

The following was extracted from NUREG-0800 Chapter 11.3 Evaluation Findings Item 2.C:

"Regarding Section II.D of Appendix I we have considered the potential effectiveness of augmenting the proposed GWMS using reasonably demonstrated technology and determined that further gaseous effluent treatment will not effect reductions in the cumulative population doses within an 80 km (50-mi) radius of the reactor at a cost of less than $1,000 per man-rem or $1,000 per man-thyroid-rem."

5.0 Calculations

5.1 Postulated Liquid Radwaste System Augmentations

5.1.1 Postulated Liquid Radwaste System Augmentations

As previously stated, this cost benefit analysis postulates the following Liquid Radwaste System augments:

- The addition of one low capacity evaporator to the liquid discharge stream, or
- The addition of the lowest capacity demineralizer to the liquid discharge stream, or
- The addition of one 10,000 gallon Holdup Tank to the liquid discharge stream.

5.1.2 Postulated Gaseous Radwaste System Augmentations

As previously stated, this cost benefit analysis postulates the Gaseous Radwaste System augment to be the addition of a 3-ton Charcoal Adsorber:

5.2 In Plant Specific Factors

The Indirect Cost Factor takes into account whether the radwaste system is shared by the two units or whether each unit has its own stand alone radwaste system. In the case of STP 3 & 4, it is assumed that the radwaste system is unique to each unit, i.e. n = 2 (Assumption 3.8). Using the formula provided in Table A-5 of Regulatory Guide 1.110 [Reference 7.3]

$$ICF = \frac{(1.75 + (n-1) \times 1.5)}{n} = \frac{(1.75 + ((2-1) \times 1.5))}{2} = 1.625$$

The Capital Recovery Factor is determined using the equation from Table A-6 in Regulatory Guide 1.110 [Reference 7.3] and reflects the cost of money for capital expenditures. A cost-of-money value, i, of 7% per year is assumed for this calculation (Assumption 3.7) with an assumed plant life of 60 years (Assumption 3.6).

$$CRF = \frac{i(1+i)^{60}}{(1+i)^{60} - 1} = \frac{0.07(1+0.07)^{60}}{(1+0.07)^{60} - 1} = 0.0712 = 7.12\%$$

Using the methodology described in Section 4.0, the Total Annual Cost of the proposed three (3) Liquid Radwaste System augments and one (1) Gaseous Radwaste System augment were calculated and are provided in Table 5-2.

Table 5-1 REGULATORY GUIDE 1.110 DATA

COST BENEFIT PARAMETER	15 gpm Radwaste Evaporator	Regulatory Guide 1.110 Value (1000s of 1975 dollars)	50 gpm Demineralizer BWR 2nd Waste Demineralizer in Series	Regulatory Guide 1.110 Value (1000s of 1975 dollars)	10,000 gal Tank	Regulatory Guide 1.110 Value (1000s of 1975 dollars)	3-Ton Charcoal Adsorber	Regulatory Guide 1.110 Value (1000s of 1975 dollars)
Equipment/ Material Cost	Table A-1	386	Table A-1	43	Table A-1	55	Table A-1	53
Direct Labor Cost (DLC)	Table A-1	201	Table A-1	29	Table A-1	43	Table A-1	14
Labor Cost Correction Factor (LCCF)	Table A-4	1 (1)	Table A-4	1 (1)	Table A-4	1 (1)	Table A-41 (1)	1 (1)
Annual Operating Cost (AOC) Per Unit	Table A-2	20	Table A-2	15	Table A-2	1	Table A-2	Neg.
Annual Maintenance Cost (AMC)	Table A-3	30	Table A-3	5	Table A-3	2	Table A-3	Neg.

Notes:
(1) The lowest Labor Cost Correction Factor was used (Assumption 3.9).

TABLE 5-2 TOTAL ANNUAL COST OF LIQUID AND GASEOUS RADWASTE SYSTEM AUGMENTS (1)

Augments	Equipment/ Material Direct Cost (DCEM) (2)	Direct Labor Cost (DLC)(2)	LC Correction Factor (LCCF) (2)	Adjusted Labor Cost (ALC)(3)	Total Direct Cost (TDC)(4)	Indirect Cost Factor (ICF) (5)	Total Capital Cost (TCC) (6)	Annual Fixed Cost (AFC) (7)	Annual Operating Cost (AOC) Per Unit (8)	Annual Maintenance Cost (AMC) (9)	Total Annual Cost per Unit (TAC) (10)
15 gpm Radwaste Evaporator	386	201	1	201	587	1.625	953.9	67.94	20	30	117.94
50 gpm Demineralizer BWR 2nd Waste Demineralizer in Series	43	29	1	29	72	1.625	117.0	8.33	15	5	28.33
10,000 gal Tank	55	43	1	43	98	1.625	159.3	11.34	1	2	14.34
3-Ton Charcoal Adsorber	53	14	1	14	67	1.625	108.9	7.75	Neg.	Neg.	7.75

Notes:
(1) All dollar values are in terms thousands of 1975 dollars.
(2) Values are from Table 5-1 of this calculation.
(3) Adjusted Labor Costs are obtained by multiplying the Direct Labor Costs in column 3 by the LC Correction Factor in column 4.
(4) Total Direct Cost (TDC) is the sum of the DCEM in column 2 and the Adjusted Labor Cost in column 5. For the 10,000 gal Tank, TDC = 55 + 43 = 98.
(5) The Indirect Cost Factor is calculated in Section 5.2 of this calculation.
(6) The Total Capital Cost (TCC) is the product of the TDC in column 6 and the ICF in column 7. For the 10,000 gal Tank, TCC = 98 x 1.625 = 159.3.
(7) The Annual Fixed Cost (AFC) is the product of the TCC in column 8 and the Capital Recovery Factor (CRF) of 0.0712 that is calculated in Section 5.2 of this calculation. For the 10,000 gal Tank, AFC = 159.3 x 0.0712 = 11.34.
(8) The Annual Operating Costs (AOC) per unit are from Table 5-1.
(9) The Annual Maintenance Costs (AMC) are from Table 5-1.
(10) The Total Annual Cost (TAC) is the sum of the Annual Fixed Cost (AFC) from column 9, the Annual Operating Cost (AOC) from column 10, and the Annual Maintenance Cost (AMC) from column 11. For the 10,000 gal Tank, TAC = 11.34 + 1 + 2 = 14.34.

TABLE 5-3 RESULTANT BENEFIT OF PROPOSED RADWASTE AUGMENTS

Radwaste System Augment Equipment	Total Annual Cost (TAC) of Radwaste System Augment (1000s of 1975 Dollars) (1)	Collective 50 Mile Total Body Dose Saved per Year (Person-Rem) (2)	Benefit in 1975 Dollars (3)
15 gpm Radwaste Evaporator	117.94	0.003	3.00
50 gpm Demineralizer BWR 2nd Waste Demineralizer in Series	28.33	0.003	3.00
10,000 gal Tank	14.34	0.003	3.00
3-Ton Charcoal Adsorber	7.75	0.58	580

Notes:
(1) TAC dollar values are from column 12 of Table 5-2.
(2) The collective 50 mile total body dose saved per year (i.e., 0.003 rem for the liquid radwaste releases and 0.58 rem for the gaseous radwaste releases) is from Table 2-1 of this calculation. It is assumed the dose of 0.003 rem is attributed to liquid radwaste releases from a single reactor unit and the dose of 0.58 rem is attributed to gaseous radwaste releases from a single reactor unit (Assumption 3.11) and that the proposed augments to the Liquid Radwaste System eliminates all Liquid Radwaste System radioactivity releases and proposed augments to the Gaseous Radwaste System eliminates all Gaseous Radwaste System radioactivity releases (Assumption 3.4).
(3) The benefit in 1975 dollars is obtained by multiplying the collective dose saved per year from column 3 by the value of one person-rem (i.e., $1000 per Assumption 3.10).

TABLE 5-4 PROPOSED RADWASTE AUGMENTS BENEFIT COST RATIO

Radwaste System Augment Equipment	Benefit Cost Ratio (1)
15 gpm Radwaste Evaporator	2.54E-05
50 gpm Demineralizer BWR 2nd Waste Demineralizer in Series	1.06E-04
10,000 gal Tank	2.09E-04
3-Ton Charcoal Adsorber	7.48E-02

Notes:
(1) The Benefit Cost Ratio is the ratio of the Benefit in 1975 Dollars value from column 4 of Table 5-3 divided by 1000 times the Radwaste System Augment TAC Dollars from column 2 of Table 5-3. A factor of 1000 is applied to the values in column 2 of Table 5-3 since the units of column 2 are in thousands of dollars.

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6.0 Results and Conclusions

Comparing the Total Annual Costs of the three (3) proposed Liquid Radwaste System augments and the proposed Gaseous Radwaste System augment presented in Table 5-2 with the Benefits presented in Table 5-3, both in 1975 dollars, shows that the annual costs of the augments exceeds the cost associated with the benefits (i.e., the benefit cost ratio is substantially less than one (1) as shown in Table 5-4). Therefore, the Total Annual Cost of the augments is substantially more than the value derived. The proposed Liquid Radwaste System and Gaseous Radwaste System for STP 3 & 4 meet the numerical guides for dose design and objectives. Augments to the proposed Liquid Radwaste System and Gaseous Radwaste System would not be cost effective.

7.0 References

7.1 STP 3 & 4 Final Safety Analysis Report Revision 01, January 15 2008.

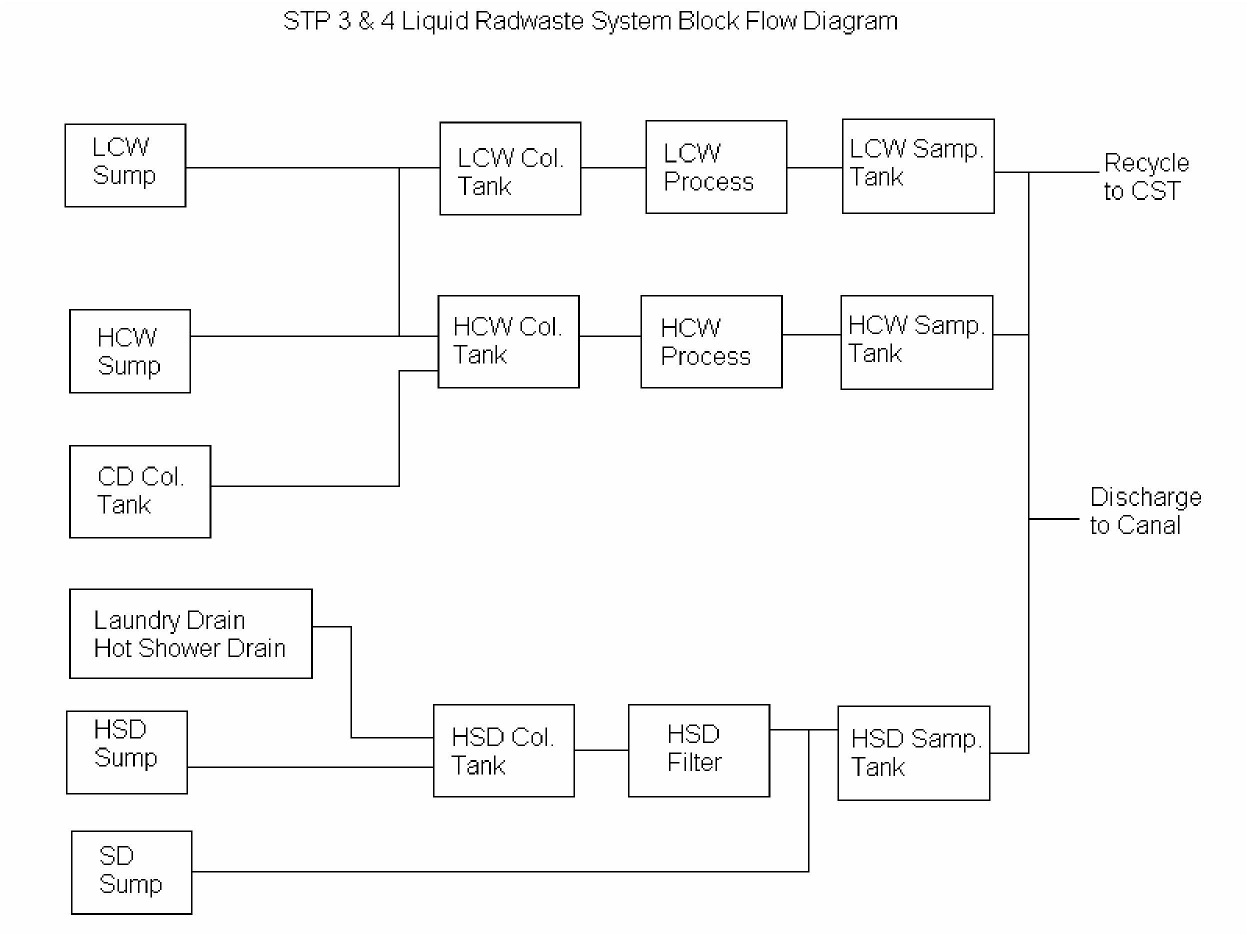
7.2 STP 3 & 4 Environmental Report, Revision 01, January 15 2008

7.3 USNRC Regulatory Guide 1.110, “Cost-Benefit Analysis For Radwaste Systems For Light-Water-Cooled Nuclear Power Reactors,” March 1976 (For Comment)

7.4 USNRC NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants”

7.5 USNRC Issued Design Certification, ABWR, Design Control Document/Tier 2, Chapter 11, Rev. 0 http://www.nrc.gov/reactors/new-licensing/design-cert/abwr/dcd/tier-2/ch-11.pdf

Attachment A



Attachment B

STP 3 & 4 Gaseous Radwaste System Block Flow Diagram