Nuclear Operating Company

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

December 30, 2009
U7-C-STP-NRC-090219

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

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 number 267, related to Combined License Application (COLA) Part 2, Tier 2, Section 11.2. This submittal completes the response to letter 267. Attachments 1 through 3 contain revised responses to the RAI questions listed below:

11.02-7
11.02-8
11.02-9

These responses replace in entirety the responses submitted in letter U7-C-STP-NRC-090189, ADAMS Accession number ML093090633, submitted October 29, 2009.

When a change to the COLA is indicated, the change will be incorporated into the next routine revision of the COLA following 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 Coley Chappell at (361) 972-4745.

D091
NRO

STI 32587143

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

Executed on 12/3/09

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

scs

Attachments:

1. Question 11.02-7 Revised Response
2. Question 11.02-8 Revised Response
3. Question 11.02-9 Revised Response

cc: w/o attachment except*
(paper copy)

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RAI 11.02-7

QUESTION:

The Condensate Storage Tank (CST) is listed in FSAR Liquid Waste Management System (LWMS) Sections 11.2.1.2.4.2, 11.2.2, 11.2.2.1, 11.2.3, LWMS Table 11.5-4, shown in Figure 9.2-4, and denoted (to and from CST) on LWMS Figure 11.2-1. Staff could not evaluate the functions of the Condensate Storage Tank from the information provided throughout the FSAR. Please provide information concerning the Condensate Storage Tank radioactive source term, overall function and volume similar to all other associated LWMS tanks, and the method of containing the release of all the liquid radwastes to prevent the release of this radwaste to the environment. (Reference FSAR Section 15.7 and 2.4.13).

REVISED RESPONSE:

This response replaces in entirety the response submitted in letter U7-C-STP-NRC-090189, ADAMS Accession number ML093090633, submitted October 29, 2009.

Function of the CST

The Condensate Storage Tank (CST) is part of the Makeup Water-Condensate (MUWC) System as described in Section 9.2.9 of the DCD and shown in COLA Figure 9.2-4. DCD Section 9.2.9 is incorporated by reference in the COLA without any departures from the DCD.

The MUWC System provides condensate quality water for both normal and emergency operations when required. During normal operations, CST water is used for condensate makeup and to provide seal water to the Control Rod Drive (CRD) System. CST water is provided to the Reactor Building, Turbine Building and Radwaste Building as makeup water or for flushing systems. CST water is also provided to the suction of the High Pressure Core Flood, Reactor Core Isolation Cooling and Suppression Pool Cleanup pumps. The CST also provides a pathway for recycling treated water from the Liquid Waste Management System (LWMS) back to the Reactor Coolant System (RCS).

The CST is not part of the LWMS, but is addressed in COLA Section 11.2 because it is an alternative for the disposition of treated radioactive water. Since the CST is not part of the LWMS, the details of the system, including items such as function and volume, are not discussed in COLA Section 11.2. This is similar to the treatment of other potentially contaminated components, such as the Reactor Water Cleanup (CUW) Backwash Receiving Tank. Instead, these details are provided in the applicable sections of the COLA or DCD (i.e., DCD Section 9.2.9).

CST Source Term

In order to maintain the quality of the CST water, the inputs to the CST are limited. The primary makeup water is purified water from the Makeup Water Purified (MUWP) System. In addition to makeup water from the MUWP System, which contains no radioactivity, there are three inputs to the CST that are potentially contaminated.

- Recycled water from the CRD System is routed back to the CST. The design of the CRD System ensures that the recycle water is not contaminated by other water systems so that the recycled water is the same quality as the CST water.
- In the event that the water level in the condenser is too high, condensate reject will be sent back to the CST. The point at which condensate is transferred to the CST is located downstream of the condensate filters and demineralizers so that the water that is rejected to the CST has the same quality as the condensate demineralizer effluent.
- In order to minimize liquid releases from the plant, treated water from the LWMS may also be recycled to the CST.

Since the CRD System recycle has the same activity level as the CST, it will not affect the radioactivity in the CST. To estimate the maximum activity expected in the CST, both the condensate reject and the LWMS recycle were evaluated.

The condensate reject activity concentration was estimated by taking the reactor water source terms in DCD Section 11.1, except for noble gas and N-16, and adjusting them by the main steam carryover fractions and the condensate demineralizer removal parameters from DCD Table 11.1-7. This produces a conservative estimate of the condensate demineralizer effluent activity concentration, which is the same as the activity that would be returned to the CST. The transfer of condensate to the CST is only expected to occur if the water level in the condenser is too high, an infrequent occurrence. To be conservative, it is assumed that the concentration in the CST is the same as the concentration in the condensate demineralizer effluent. This approach is conservative because it does not account for decay that would occur as the CST is filled with condensate, producing an overestimation of short lived isotopes. It also does not account for the additional dilution due to makeup from the MUWP System.

The LWMS recycle activity in the CST is estimated by transferring the activity in the Low Conductivity Waste (LCW) Sample Tanks in COLA Table 12.2-13d to the CST at a rate of 55 m^3/day, which is the normal LCW System influent rate from COLA Table 11.2-2. The transfer was continued for a period of time long enough to ensure that equilibrium concentrations were reached in the 2110 m^3 CST.

Tritium activity was assumed to be 3.7E-04 MBq/g in accordance with DCD Section 11.1.2.3. This is conservative because it does not account for the dilution due to the makeup from the MUWP System.

To establish a bounding source term, the activity concentrations for each isotope for the condensate reject and the LWMS recycle were compared and the largest value selected as the bounding activity in the CST. The resulting activity concentrations were then multiplied by the volume of the CST, 2110 m^3, to obtain the total activity in the CST. The resulting activity for each isotope is shown in Table 1. Inspection of Table 1 indicates that tritium is the isotope with the largest total activity, which is a consequence of the assumption that the tritium activity in the CST is the same as the tritium activity in the reactor coolant. The isotopes of iodine are the isotopes with the next largest activity. These isotopes are primarily from condensate reject, and are actually expected to be much smaller because of decay and dilution in the CST. The calculated dose rate one foot from the CST for the activity concentrations in Table 1 is 14 μSv/hr (1.4 mrem/hr). The dose rate is low enough that no radiation shielding is required.

Releases from the CST

Water from the CST is not released to the environment during normal operation. Accidental releases to the environment are evaluated in COLA Section 2.4S.13 and DCD Section 15.7.3. The effect of the CST source term on these evaluations is addressed below.

Accidental releases of contaminated liquid to the groundwater are evaluated in COLA Section 2.4S.13 as part of the evaluation of hydrological conditions at the plant site. The plant is designed so that releases to the groundwater are very unlikely, so the evaluation in the COLA is focused on the properties of the site and the actual release is hypothetical. Section 2.4S.13.1.4 demonstrates that accidental releases result in activity concentrations in the groundwater at the nearest point offsite that are below the concentration limits in 10 CFR 20. The starting point for this evaluation is the assumed concentration in the liquid that is released, which is summarized in COLA Table 2.4S.13-1. These activity concentrations are determined by comparing the activity concentrations in the LCW Collection Tank to the activity concentrations in the Reactor Coolant (RC) System. Table 1 contains a listing by isotope of the concentrations in the CST and the concentrations used in the evaluation in COLA Section 2.4S.13.1.4. With the exception of tritium, the concentrations in the CST are at least a factor of 100 smaller than the LCW/RC concentrations. The tritium concentration in the CST is the same as the LCW/RC tritium concentration. This is because the limiting concentration of tritium was used to establish the CST concentration, and because no credit was taken for dilution by the MUWP System. It is expected that the tritium concentration will be significantly less than the concentration in the LWC/RC. Because all the other isotopic concentrations in the CST are bounded by the LWC/RC concentrations, the current evaluation in COLA Section 2.4S.13 is not affected by the CST source term.

The consequences of postulated releases due to a liquid radwaste tank failure are addressed in DCD Section 15.7.3. The analysis in DCD Section 15.7.3 assumes that the design of the radwaste system is such that releases of contaminated liquid to the groundwater and surface water from a tank failure are not possible. The discussion below describes the design features of the CST that will preclude releases of contaminated liquid to the groundwater or surface water if there is a failure of the CST. Since there are no liquid releases, the evaluation in DCD Section 15.7.3 is limited to the release of airborne activity. The iodine in the radwaste system is assumed to become airborne with a partition factor of 10%, resulting in offsite doses. To determine if the evaluation in DCD Section 15.7.3 is bounding for the CST, the potential releases from the CST are compared to the releases considered in the DCD. Table 2 contains a list of the iodine isotopes, 10% of the inventory in the CST, and the total releases considered in the DCD evaluation listed in DCD Table 15.7-6. Table 2 indicates that the DCD releases are fifty times the amount of activity that would be released from the CST. As described above, the bounding iodine concentrations for the CST are considered to be conservative because they do not consider the effects of decay in the CST. Therefore, the evaluation of the radwaste tank failure in the DCD is bounding for the CST source term.

CST Design Features to Mitigate Releases and Spread of Contamination

The CST has a capacity of 2110 m^3 and is located outside in the yard at STP 3&4. Specifically, it is located adjacent to and just north of the Radwaste Building and to the west of the Turbine Building (COLA Figure 1.2-37 – Plot Plan). The CST is provided with the following design features to ensure there are no releases to the environment and to prevent the spread of contamination:

- The CST is surrounded by a dike that is sufficient to hold the entire contents of the CST. The drain from the diked area is routed to the LWMS for processing, if required (COLA Section 11.2.1.2.4, Response to RAI 11.02-8). The use of a dike for outside tanks is consistent with the mitigating features for outside tanks identified in BTP 11.6 for ensuring there are no liquid releases to the environment.
- The CST is provided with high level alarms in the control room and the Radwaste Building (DCD Section 9.2.9.1) in order to prevent overflow. Any overflow that does occur is routed to the LWMS (DCD Figure 9.2-4).
- The MUWC System contains lines that are used to transfer condensate quality water between the CST and systems in the Radwaste Building, Turbine Building and Reactor Building. All of the piping is routed in trenches or tunnels (there is no buried pipe). These trenches and tunnels provide the capability to identify and collect any leakage from the lines handling CST water and to transfer this water to the LWMS for processing.

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

Table 1. Bounding Activity Inventory and Concentration in the Condensate Storage Tank (CST) Compared to the Concentration in the Low Conductivity Waste and Reactor Coolant

Nuclide	CST			LCW/RC
	Inventory (MBq)	Concentration (MBq/cc)	Concentration (μCi/ml)	Concentration (μCi/ml)
H-3	7.8E+05	3.7E-04	1.0E-02	1.0E-02
I-131	1.9E+03	8.8E-07	2.4E-05	1.6E-02
I-132	1.6E+04	7.8E-06	2.1E-04	1.4E-01
I-133	1.3E+04	6.2E-06	1.7E-04	1.1E-01
I-134	2.8E+04	1.3E-05	3.6E-04	2.4E-01
I-135	1.8E+04	8.5E-06	2.3E-04	1.5E-01
Rb-89	8.1E+02	3.9E-07	1.0E-05	2.1E-02
Cs-134	5.9E+01	2.8E-08	7.6E-07	8.9E-05
Cs-136	6.3E+00	3.0E-09	8.1E-08	5.9E-05
Cs-137	1.9E+02	8.8E-08	2.4E-06	2.4E-04
Cs-138	1.6E+03	7.6E-07	2.0E-05	4.1E-02
Na-24	2.7E+02	1.3E-07	3.5E-06	3.5E-02
P-32	1.3E+01	6.2E-09	1.7E-07	6.5E-04
Cr-51	8.1E+02	3.9E-07	1.0E-05	2.0E-02
Mn-54	3.0E+01	1.4E-08	3.9E-07	4.3E-04
Mn-56	1.4E+03	6.7E-07	1.8E-05	1.8E-01
Fe-55	1.4E+02	6.9E-08	1.9E-06	3.2E-05
Fe-59	5.6E+00	2.6E-09	7.1E-08	1.2E-04
Co-58	4.8E+01	2.3E-08	6.2E-07	8.6E-04
Co-60	2.1E+02	1.0E-07	2.8E-06	2.8E-03
Ni-63	5.9E-01	2.8E-10	7.6E-09	7.3E-03
Cu-64	7.8E+02	3.7E-07	1.0E-05	1.0E-01
Zn-65	8.5E+01	4.1E-08	1.1E-06	1.2E-03
Sr-89	2.1E+01	9.9E-09	2.7E-07	4.1E-04
Sr-90	4.1E+00	1.9E-09	5.2E-08	5.2E-05
Y-90	4.1E+00	1.9E-09	5.2E-08	5.2E-05
Sr-91	1.1E+02	5.3E-08	1.4E-06	1.4E-02
Sr-92	2.9E+02	1.4E-07	3.8E-06	3.8E-02
Y-91	3.0E+02	1.4E-07	3.9E-06	5.7E-03
Y-92	1.7E+02	8.1E-08	2.2E-06	2.2E-02
Y-93	1.1E+02	5.3E-08	1.4E-06	1.4E-02
Zr-95	5.9E+01	2.8E-08	7.6E-07	1.2E-03
Nb-95	7.4E+01	3.5E-08	9.5E-07	1.2E-03
Mo-99	5.2E+01	2.5E-08	6.7E-07	6.5E-03
Tc-99m	5.2E+01	2.5E-08	6.7E-07	6.5E-03
Ru-103	1.2E+02	5.8E-08	1.6E-06	2.7E-03
Rh-103m	1.2E+02	5.8E-08	1.6E-06	2.7E-03
Ru-106	3.7E+01	1.8E-08	4.8E-07	5.2E-04
Rh-106	3.7E+01	1.8E-08	4.8E-07	5.2E-04
Ag-110m	4.1E-01	1.9E-10	5.2E-09	5.8E-06
Te-129m	5.6E+00	2.6E-09	7.1E-08	1.4E-04

Table 1. Bounding Activity Inventory and Concentration in the Condensate Storage Tank (CST) Compared to the Concentration in the Low Conductivity Waste and Reactor Coolant (Continued)

Nuclide	CST Inventory (MBq)	CST Concentration (MBq/cc)	CST Concentration (μCi/ml)	LCW/RC Concentration (μCi/ml)
Te-131m	2.4E+00	1.1E-09	3.1E-08	3.2E-04
Te-132	6.3E-01	3.0E-10	8.1E-09	9.8E-05
Ba-137m	1.7E+02	8.3E-08	2.2E-06	2.4E-04
Ba-140	2.3E+01	1.1E-08	3.0E-07	1.3E-03
La-140	1.8E+02	8.5E-08	2.3E-06	3.6E-02
Ce-141	1.6E+02	7.8E-08	2.1E-06	3.9E-03
Ce-144	3.6E+01	1.7E-08	4.7E-07	5.1E-04
Pr-144	3.6E+01	1.7E-08	4.7E-07	1.0E-05
W-187	7.8E+00	3.7E-09	1.0E-07	1.0E-03
Np-239	2.1E+02	1.0E-07	2.7E-06	2.7E-02

Table 2. Comparison of Releases from the CST to the Releases in DCD Radwaste Tank Failure Evaluation

Isotope	10% of CST Inventory (MBq)	DCD Radwaste Tank Failure Release (MBq)
I-131	1.9E+02	1.9E+06
I-132	1.6E+03	1.3E+05
I-133	1.3E+03	1.1E+06
I-134	2.8E+03	7.0E+04
I-135	1.8E+03	4.4E+05
Total I	7.7E+03	3.6E+06

RAI 11.02-8

QUESTION:

Section 11.2.1.2.4 of the FSAR identifies several radwaste system design features that address 10 CFR 20.1406 requirements. However, design features identified in Section 11.2 of the ABWR DCD that address 10 CFR 20.1406 requirements applicable to the Condensate Storage Tank (CST) are not included in Section 11.2 of the FSAR. Specifically, the ABWR DCD states "The Condensate storage tank, which is located outdoors, has liquid level monitoring with alarms in the control room. The tank overflows, drains and sample lines are routed to the radwaste system. A dike is provided around the tank to prevent runoff in the event of a tank overflow. A drain within the dike is routed to the radwaste system." Additionally, Section 11.2.1.2 of the ABWR DCD appears to be the only documentation that states that the CST will be located outdoors.

Based on past and current industry experience with Boiling Water Reactor (BWR) condensate storage tanks, please provide the following additional information, and FSAR discussion, concerning the Condensate Storage Tank:

- Clarify if the CST's for STP 3 and 4 will be located outdoors.
- Clarify if any, or all, of the design features from the ABWR DCD (identified above) for the CST will be included in STP 3 and 4.
- Clarify if piping runs to and from the CST will be placed directly underground or located in trenches or tunnels, and include any design or programmatic considerations that will address 10 CFR 20.1406 requirements for the Makeup Water Condensate (MUWC) system.

REVISED RESPONSE:

This response replaces in entirety the response submitted in letter U7-C-STP-NRC 090189, ADAMS Accession number ML093090633, submitted October 29, 2009.

Subsection 11.2.1.2 of the ABWR DCD was replaced by Section 11.2 of the STP 3 & 4 COLA. The COLA does not include the discussion of the design provisions for the prevention of releases from the CST. A discussion similar to the discussion in the ABWR DCD will be added to COLA Subsection 11.2.1.2.4. A detailed evaluation of the CST as a radiation source, including the design features to mitigate release and prevent contamination, is provided in the revised response to RAI 11.02-7.

The following COLA change will be made as a result of this response.

11.2.1.2.4 Minimization of Contamination and Radwaste Generation

The LWMS radwaste system, including mobile units as applicable, is designed to minimize contamination of the facility and environment, facilitate decommissioning, and minimize the generation of radioactive waste, in compliance with 10 CFR 20.1406. The following radwaste system design features meet 10 CFR 20.1406 requirements:

- Leakage is controlled and collected to reduce contamination of building floors and interconnecting systems (by use of curbing, floor sloping to local drains, floor-to-floor seals over expansion joints, wall-to-floor joint seals, sheathed hoses, drip pans or containment boxes, backflow preventers, siphon breakers, self-sealing quick disconnects, etc.).

- The Condensate Storage Tank, which is located outdoors (Figure 1.2-37 – Plot Plan), has liquid level monitoring with alarms in the control room. The tank overflows, drains and sample lines are routed to the LWMS. A dike is provided around the tank to prevent runoff in the event of a tank overflow. A drain within the dike is routed to the LWMS.

- The radwaste system design minimizes embedding contaminated piping in concrete to the extent practicable.

RAI 11.02-9

QUESTION:

Section 9.2.9.1 and Table 11.5-4 of the ABWR DCD are incorporated by reference in the STP 3 and 4 FSAR. Section 9.2.9.1 of the ABWR DCD states "The condensate storage tank shall have a capacity of 2110 m3." and Table 11.5.4 of the ABWR DCD contains a requirement for a weekly sample of the CST for gross beta-gamma activity with minimum sensitivity of 3.7x10-5 MBq/L. Based on this information, the CST will contain a very large volume of low level radioactive water. However, the staff was unable to locate any discussion in the FSAR identifying the CST as a radiation source, maximum allowable activity concentration specification for the CST, or calculation of dose rates in the area surrounding the CST.

> Please provide additional information concerning the radioactive source term, maximum expected radioactivity concentration in the CST, and dose rate calculations for the CST similar to other LWMS tanks and components.

REVISED RESPONSE:

This response replaces in entirety the response submitted in letter U7-C-STP-NRC 090189, ADAMS Accession number ML093090633, submitted October 29, 2009.

The CST is part of the Makeup Water-Condensate (MUWC) and therefore is not addressed as part of the Liquid Waste Management System (LWMS). A detailed evaluation of the CST as a radiation source is provided in the revised response to RAI 11.02-7.

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