Nuclear Operating Company

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

December 9, 2009
U7-C-STP-NRC-090223

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 Requests for Additional Information

Attached are responses to NRC staff questions included in Request for Additional Information (RAI) letter numbers 274 and 284, related to Combined License Application (COLA) Part 2, Tier 2, Sections 11.4, 12.3, and 12.4.

The Attachments provide responses to the RAI questions listed below:

RAI 11.04-6
RAI 12.03-12.04-10

The response to RAI 12.03-12.04-10 is a supplement to the response originally submitted October 26, 2009, in letter number U7-C-STP-NRC-090186, ADAMS Accession number ML093030296.

Where a revision to the COLA is required, it 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 Bill Mookhoek at (361) 972-7274.

D091
NRO

STI 32588341

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 11.04-6
2. Question 12.03-12.04-10

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

Director, Office of New Reactors
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, Texas 76011-8064

Kathy C. Perkins, RN, MBA
Assistant Commissioner
Texas Department of Health Services
Division for Regulatory Services
P. O. Box 149347
Austin, Texas 78714-9347

Alice Hamilton Rogers, P.E.
Inspections Unit Manager
Texas Department of Health Services
P. O. Box 149347
Austin, Texas 78714-9347

C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

*Steven P. Frantz, Esquire
A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Ave. NW
Washington D.C. 20004

*George F. Wunder
*Raj Anand
*Michael Eudy
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852

(electronic copy)

*George F. Wunder
*Raj Anand
*Michael Eudy
Loren R. Plisco
U. S. Nuclear Regulatory Commission

Steve Winn
Joseph Kiwak
Eli Smith
Nuclear Innovation North America

Jon C. Wood, Esquire
Cox Smith Matthews

J. J. Nesrsta
Kevin Pollo
L. D. Blaylock
CPS Energy

RAI 11.04-6

QUESTION

DCD COL License Information Items for Chapter 11 are listed in Chapter 1.9, Table 1.9-9.

COL License Information Items 11.1 and 11.3 are not delineated in the COLA Sections as "COL License Information Items" as are COL License Information Items 11.2, and 11.4-8.

Please add similar verbage to the appropriate COLA sections to identify these two items.

RESPONSE

The heading and numbering for COLA FSAR Subsection 11.2.5 will be revised as requested to address COL License Information Item 11.1, as shown below:

11.2.5 COL License Information

11.2.5.1 Plant-Specific Liquid Radwaste Information

The following site-specific supplement addresses COL License Information Item 11.1.

The heading and numbering for COLA FSAR Subsection 11.4.3 will be revised as requested to address COL License Information Item 11.3, as shown below:

11.4.3 COL License Information

11.4.3.1 Plant-Specific Solid Radwaste Information

The following site-specific supplement addresses COL License Information Item 11.3.

RAI 12.03-12.04-10

QUESTION:

During the radwaste system audit completed by the NRC in July 2009, NRC staff noted that several radiation shielding computer codes being utilized by STP are not described in the ABWR DCD or the STP COL. STP indicated that following transfer of the design from GEH to Toshiba, MicroShield 5 and a proprietary computer code named 'Digester' have been used to verify shielding design calculations in the redesigned radwaste building. However, Section 12.3.2.2.2 of the ABWR DCD, which is incorporated by reference in the STP FSAR, states that QADF, GGG, and DOT4.4 are the computer programs used for the ABWR DCD shielding design. The STP FSAR does not contain any supplemental information concerning radiation shielding computer codes being utilized to support the STP COLA.

RG 1.206 Section C.I.12.3.2 and SRP Chapter 12.3-12.4, Section I.2.B contains the radiation shielding information that is to be included in the FSAR. The information to be provided includes: description of the methods used to determine the shield parameters, as well as pertinent assumptions, codes, and techniques used, or to be used, in the calculations.

In order to make a determination of reasonable assurance of the adequacy of STP 3 and 4 radiation shielding, the staff requests that the applicant provide the following additional information concerning the radiation shielding computer codes being utilized by STP and their subcontractors to support the STP COLA, including all departure evaluations from the ABWR DCD that could affect radiation doses to workers and the public:

1) Specify if there are any radiation shielding computer codes, not previously identified in the ABWR DCD, now being relied on to demonstrate compliance with any portion of the licensing basis. In addition, include a discussion of the impact accordingly.

2) Specify if any radiation shielding reviews and evaluations performed by STP, including any that could affect radiation doses to workers and the public, result in a departure from the ABWR DCD per 10 CFR 52, Appendix A. In addition, provide the 10 CFR 52 evaluation results if completed.

3) Since MicroShield 5 is not available from the Radiation Safety Information Computational Center (RSICC), describe or provide the information to ensure the quality assurance of the computer code as it is used in STP 3 and 4 shielding and dose rate calculations.

4) Provide a basic description of the Digester code and describe how, and for what locations, it is being used to support STP 3 and 4 shielding and dose rate calculations. Identify any restrictions or limitations of the Digester code.

5) Identify the STP 3 and 4 locations in the plant layout where MicroShield 5, or other radiation shielding computer codes not previously identified in the ABWR DCD, have been, or may be, used to analyze dose rates or radiation shielding. In addition, provide a description of the basis for use of the code(s) at these locations.

6) MicroShield 5 code is an early version of a commercially available program. Later versions of MicroShield have been developed but are not used or described in the STP 3 and 4 FSAR. Provide justification for not using an updated version of the code.

7) Revise the STP 3 and 4 FSAR to include the information provided in the response to items 1 through 6 above and provide a markup of the proposed FSAR changes in the response.

SUPPLEMENTAL RESPONSE:

DCD Section 12.3.2.2.2, Method of Shielding Design, contains information related to the determination of the amount of shielding required to meet ALARA design objectives for the ABWR. The information provided in this section addresses the source terms used in the shielding analysis, the analytical techniques used to calculate dose rates (which are generally referred to as radiation transport methods), and the data used in the shielding calculations. The information includes general description of the methods or data and references to specific computer codes and data libraries used in the analyses. The development of radiation transport techniques and data is an ongoing process in the nuclear industry. The computer codes and data in common use today reflect the advances in computational techniques and updated information that has become available through this process. The following is a brief summary of the transport methods and data described in the DCD and a comparison with the methods and data available for use today.

A. Point Kernel. Pure gamma sources, which constitute the bulk of the sources requiring shielding (tanks, pipes, etc.), are modeled using the point kernel codes identified in the DCD as QADF and GGG. The first major implementation of the point kernel method was the ISOSHLD code developed at Battelle Northwest Laboratories in 1966. A direct descendent of the ISOSHLD code is the MicroShield code, a commercially available code that is updated on a regular basis. This code has become widely used, compared to ISOSHLD, because it is Windows based with a graphical user interface. QAD was also developed initially at a national laboratory (Los Alamos in 1967), and differs from ISOSHLD in that it uses a generalized geometry package to model the source/shield configuration rather than a limited number of fixed source/shield configurations. This code has also gone through a number of developmental improvements, and there are currently nine different versions available from RSICC. The most commonly used version of QAD is probably QAD-CGGP, which incorporates the combinatorial geometry package and the geometric progression buildup factors. GGG (which was initially developed at Los Alamos in 1973) combines the point kernel method with the albedo scattering method to estimate the effects of surface scattering. The version of this code that uses the geometric progression buildup factors is G33-GP. All of the current versions of these codes incorporate data from ANSI/ANS 6.4-3 for linear attenuation coefficients and buildup factors based on the geometric progression method.

B. Discrete Ordinates. The DCD identifies the discrete ordinates method (ANISN/DOT4.4) as the method that is used when shielding is required for combined gamma and neutron sources. ANISN is one of the first transport codes implemented on a computer platform. DOT is a two dimensional extension of the ANISN methodology, and the latest version of this code is DORT. The DCD also references cross section libraries that would be used with these codes based on various versions of the evaluated nuclear data file (ENDF/B-III and ENDF/B-IV). The current libraries available from RSICC (e.g., BUGLE96) are based on later versions of the cross section data (ENDF/B-VI).

C. Monte Carlo. The Monte Carlo method, as implemented in a code such as MCNP, is a generalized stochastic method with three dimensional modeling capabilities that can treat both neutron and gamma transport. This method is not discussed in the DCD, but has become the preferred method for radiation transport analyses as indicated in Regulatory Guide 1.69. The codes based on this method can be computationally intensive. However, for situations that involve neutron transport or complex scattering geometries, the Monte Carlo method would provide a more accurate analyses compared to approximate methods such as GGG or ANISN.

The computer codes used for shielding analysis to support the design of STP 3&4 are maintained and controlled under the QA programs for the organizations performing the analyses. The radiation transport methods and data described above, which include the methods and data described in the DCD and improved methods and data that are currently available, are used in the final shielding design and verification activities. This will be clarified by adding text to the COLA, as indicated below, to identify typical computer codes used in the analyses.

The responses to the specific requests are summarized below.

1) As described in the DCD, the analysis of gamma only sources is performed using the point kernel methodology. In addition to the use of the QAD/GGG computer code, other point kernel codes that may be used include updated versions of QAD (e.g., QAD-CGGP, QAD-CGGP-A), ISOSHLD, MicroShield and G33-GP. In addition to codes based on the point kernel, Monte Carlo codes, such as MCNP, and discrete ordinates codes, such as DORT, may be used to analyze complex geometries or situations involving gamma and neutron transport.

2) DCD Section 12.3.2.2.2 states that "radiation shield wall thicknesses are determined using basic shielding data and proven shielding codes." The shielding analyses performed for STP all continue to use basic shielding data and proven shielding codes, although the data may be more current and the shielding codes based on the latest and most effective transport methodologies. To date, the only changes to the shielding

requirements are those related to the change in the equipment in the radwaste systems, as described in STD DEP 11.2-1 and 11.4-1. Since the acceptance criteria for the shielding design, as incorporated in the radiation zone maps, are not changed by the selection of data or methods, the use of the latest data and updated methods will not affect the doses to the workers or the public. Also, DCD Tier 1, Table 3.2a, includes a set of design acceptance criteria (DAC) that if met will verify the adequacy of the ABWR shielding design.

3) All shielding computer codes used in analyses that support STP 3&4 are controlled within the QA program for the implementing organization. The MicroShield computer code was procured by Sargent & Lundy (S & L) from Grove Engineering and validation and verification was completed in accordance with the S&L QA program prior to the use on STP 3&4.

4) The DIJESTER computer code is a code developed by S&L to assist in the determination of the activity in the components of a radwaste system. The code was validated and verified in accordance with the S&L QA program prior to the use on STP 3&4. It is basically a book keeping program, which keeps track of each nuclide as it is processed through the pipes, tanks, filters, demineralizers, evaporators, etc., that make up the radwaste system. It couples the rate equations that govern the operation of the various components of the radwaste system with radionuclide decay chains to model the buildup and decay of the radionuclide activity in each component. This is not a shielding design code of the types described in the DCD and is not used to calculate dose rates. Its purpose is limited to determining the source in the components of the radwaste system, and the use of the code is consistent with the description of the source term in the DCD.

5) The MicroShield code has been used by S&L for the design of the shielding in the Radwaste Building for STP 3&4. The sources in the Radwaste Building consist of tanks, pipes, processing equipment (filters, demineralizers, dewatering system), and solid waste packages that contain gamma emitting fission and activation products. Since the shielding in the Radwaste Building is for gamma only sources, the use of the point kernel method is appropriate and consistent with the description in the DCD. In addition, the configurations of the source/shield geometries involve cylindrical or rectangular sources with concrete slab shields, which are the configurations that MicroShield is designed to analyze. Therefore, the use of MicroShield for shielding design in the Radwaste Building is appropriate. For the final design, additional computer codes such as QAD-CGGP and MCNP may be used to analyze more complex geometries, such as penetrations or labyrinth entrances.

   The Reactor Building contains neutron sources associated with the reactor, and the computer codes DORT and MCNP are used to design the shielding where neutrons or coupled neutron-gamma sources are important. For gamma only sources, point kernel codes such as MicroShield and QAD-CGGP are used for the shielding analyses.

6) As discussed above, MicroShield is a commercial code obtained by S&L and then incorporated into the S&L QA program using the appropriate validation and verification process. Because it is a commercial product, the code is frequently updated for various reasons. S&L has actually validated three versions of the MicroShield code (4.10, 5.05 and 7.0). The computational methods in all versions are very similar, to the point where they produce identical results. The reasons for each of the revisions are to update various features of the code without changing the basic computational method. For example, Version 4.10 was a DOS based program, whereas Version 5.05 was rewritten for Windows. Version 7.0 was obtained by S&L because it was recompiled as a 32 bit application, and because it was designed to interface more easily with other applications such as Microsoft Word and Excel. The interfacing with other applications is sensitive to the type of operating system and versions of the applications used. This feature has never worked well on the S&L computer systems. Therefore, since the computational results are identical, S&L has continued to use Version 5.05. The current version of MicroShield available from Grove Engineering is Version 8.02. This version was created to be compatible with the Vista operating system and to add the conversion coefficients from ICRP-74. Since S&L does not use the Vista operating system or ICRP-74, and since the computational method was not changed for Version 8.02, the continued use of Version 5.05 does not affect the accuracy of the results of the analyses.

7) A markup of the proposed revision to the FSAR is provided below.

References:

1. R. L. Engle, J. Greenborg, and N. M. Hendrickson, "ISOSHLD – A Computer Code for General Purpose Isotope Shielding Analysis," BNWL-236 (1966)
2. R. E. Malenfant, "QAD: A series of Point Kernel General-Purpose Shielding Programs," LA-3573 (April 1967)
3. R. E. Malenfant, "G^3: A General Purpose Gamma-Ray Scattering Code," LA-5176 (1973)
4. MicroShield® User's Manual, Version 7, Grove Software, Inc. (2005)
5. X-5 Monte Carlo Team, "MCNP – A General Monte Carlo N-Particle Transport Code, Version 5 – Vol. I: Overview and Theory," LA-UR-03-1987 (2008)
6. ANSI/ANS-6.4.3-1991: "Gamma-Ray Attenuation Coefficients & Buildup Factors for Engineering Material"
7. D. T. Ingersoll, et. al., "Production and Testing of the Revised VITAMIN-B6 Fine-Group and the BUGLE-96 Broad-Group Neutron/Photon Cross-Section Libraries Derived from ENDF/B-VI.3 Nuclear Data," NUREG/CR-6214, Revision 1 (1995)
8. K. A. Litwin, I. C. Gauld, G. R. Penner, "Improvements to the Point Kernel Code QAD- CGGP: A Code Validation and User's Manual," RC-1214, COG-94-65, AECL Research (August 1994)

The following site-specific information will be added to the COLA in a future revision:

12.3.2.2.2 Method of Shielding Design

The following site specific supplement provides information to address the methods used to determine shield parameters:

As provided in Tier 1 ITAAC Table 3.2a, commonly accepted shielding codes using nuclear properties derived from well known references shall be used to model and evaluate plant radiation environments.

The DIJESTER computer code is used to assist in determination of the activity in the components of the radwaste system. It is basically a bookkeeping program which keeps track of each nuclide as it is processed through the pipes, tanks, filters, demineralizers, etc., that make up the radwaste system. It couples the rate equations that govern the operation of the various components of the radwaste system with radionuclide decay chains to model the buildup and decay of the radionuclide activity in each component. This is not a shielding design code of the types described in the DCD and is not used to calculate dose rates. Its purpose is limited to determining the source in the components of the radwaste system, and the use of the code is consistent with the description of the source term in the DCD.

Per Section 12.3.2.2.2.2 of the reference ABWR DCD, pure gamma dose rate calculations are conducted using point kernel codes. The point kernel codes used are those that are presently widely used in the nuclear industry and include codes such as QAD-CGGP, QAD-CGGP-A, MicroShield, ISOSHLD and G33-GP. For combined gamma and neutron shielding situations, discrete ordinates or Monte Carlo techniques are applied. Typical codes used for this application include the discrete ordinates code DORT and the Monte Carlo code MCNP. Where shielded entries to high radiation areas such as labyrinths are required, a gamma ray scattering code such as G33-GP or a Monte Carlo code such as MCNP is used to confirm the adequacy of the labyrinth design. These computer codes, along with the computer codes identified in the DCD and, when they become available, updated computer codes using similar techniques, are used to design the shielding for STP 3 & 4.