TVA
Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

January 30, 2009

10 CFR 52.79

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

In the Matter of)
Tennessee Valley Authority)

Docket No. 52-014 and 52-015

BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – EMERGENCY PLANNING

Reference:
1) Letter from Brian C. Anderson (NRC) to Andrea L. Sterdis (TVA), Request for Additional Information Letter No. 122 Related to SRP Section 13.03 for the Bellefonte Units 3 and 4 Combined License Application, dated August 8, 2008
2) Letter from Andrea L. Sterdis (TVA) to Document Control Desk (NRC), Response to Request for Additional Information Letter No. 122, Bellefonte Combined License Application – Response to Request for Additional Information – Emergency Planning, dated September 8, 2008.
3) Letter from Andrea L. Sterdis (TVA) to Document Control Desk (NRC), Response to Request for Additional Information Letter No. 122, Bellefonte Combined License Application – Response to Request for Additional Information – Emergency Planning, dated September 22, 2008.
4) Letter from Andrea L. Sterdis (TVA) to Document Control Desk (NRC), Response to Request for Additional Information Letter No. 0122, Bellefonte Combined License Application – Response to Request for Additional Information – Emergency Planning, dated October 2, 2008.

In Reference 1, NRC provided to TVA Requests for Additional Information (RAIs) on the BLN Emergency Plan. As indicated in the attachment, responses were provided to the RAIs in References 2, 3, and 4. This letter provides TVA's supplemental response to selected NRC RAI items included in Reference 1.

If you should have any questions, please contact Tom Spink at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at tespink@tva.gov.

D085
NRO

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

Executed on this 30th day of Jan , 2009.

Jack A. Bailey
Vice President, Nuclear Generation Development

Enclosure
cc: See Page 3

cc: (w/Enclosure)
B.C. Anderson/NRC/HQ
J. P. Berger, EDF
E. Cummins, Westinghouse
S. P. Frantz, Morgan Lewis
M.W. Gettler, FP&L
R. C. Grumbir, NuStart
P. S. Hastings, NuStart
P. Hinnenkamp, Entergy
B. Hughes, NRC/HQ
M. C. Kray, NuStart
D. Lindgren, Westinghouse
G. D. Miller, PG&N
M. C. Nolan, Duke Energy
N. T. Simms, Duke Energy
K. N. Slays, NuStart
G. A. Zinke, NuStart

cc: (w/o Enclosure)
M. M. Comar, NRC/HQ
R. G. Joshi, NRC/HQ
R. H. Kitchen, PGN
M. C. Kray, NuStart
A. M. Monroe, SCE&G
C. R. Pierce, SNC
R. Reister, DOE/PM
L. Reyes, NRC/RII
T. Simms, NRC/HQ
J. M. Sebrosky, NRC/HQ

Enclosure
TVA letter dated January 30, 2009
RAI Response

Responses to NRC Request for Additional Information letter No. 122 dated August 8, 2008
(8 pages, including this list)

Subject: Emergency Planning in the Final Safety Analysis Report

RAI Number	Date of TVA Response
13.03-18A-E	September 8, 2008
13.03-19A-O	September 22, 2008
13.03-20A	September 22, 2008
13.03-20B, D, E	September 8, 2008
13.03-20C	October 2, 2008
13.03-21A-C	September 8, 2008
13.03-22A-C	September 8, 2008
13.03-22D	October 2, 2008
13.03-22E	September 22, 2008
13.03-23A-B	September 8, 2008
13.03-23C	October 2, 2008
13.03-24A, B, D	October 2, 2008
13.03-24C	September 22, 2008
13.03-25A, K, N, O, Q, R	September 22, 2008
13.03-25B, D, G-I, L, M, P	October 2, 2008
13.03-25C	September 8, 2008; September 22, 2008
13.03-25 E, F, S	September 8, 2008
13.03-25 J	September 22, 2008; Revised by this letter – see following pages
13.03-26A, C	October 2, 2008
13.03-26B, D-F	September 22, 2008
13.03-27A	September 8, 2008
13.03-27B-E	October 2, 2008
13.03-28A-F	September 22, 2008
13.03-29A-C	September 8, 2008
13.03-30A-D	September 8, 2008
13.03-31A-B	September 8, 2008
13.03-32A-B	September 22, 2008
13.03-33A-B	September 8, 2008
13.03-34	September 8, 2008

RAI Number	Date of TVA Response (cont'd)
13.03-35	September 8, 2008
13.03-36A-C	September 8, 2008
13.03-37	September 8, 2008
13.03-38A-B	September 22, 2008
13.03-39A-D, G	September 8, 2008
13.03-39E, F	September 22, 2008

Associated Additional Attachments / Enclosures	**Pages Included**
Attachment 13.03-25A	14 pages (including cover)

NRC Letter Dated: August 8, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 13.03-25

SITE-8: Emergency facilities and equipment

Basis: 10 CFR 50(b)(8), Appendix E.IV.E.4; 10 CFR 50, Appendix E.VI. Emergency Response Data System; 10 CFR 50.47(b)(8), 10 CFR 50.34(f)(2)(xxv), 10 CFR 50.55a(h); NUREG-0654/FEMA-REP-1; Evaluation Criterion H.4; Evaluation Criterion H.6; Evaluation Criterion H.9; Evaluation Criterion H.10; Evaluation Criterion H.11; and NUREG-0696 and Supplement 1 to NUREG-0737
SRP ACCEPTANCE CRITERIA: Requirements A and B; Acceptance Criteria 1, 2, 4, 5, and 12

A. – I. These subsections of the RAI were previously addressed.

J. In accordance with SRP Section 15.0.3 (Acceptance Criterion 3) the staff reviews whether the total calculated radiological consequences in the TSC for the postulated fission product releases fall within the exposure acceptance criteria specified in GDC 19 of 5 rem TEDE (0.05 Sv) for the duration of the design basis accidents (DBAs). Provide the radiological consequence analyses for the Bellefonte TSC for the postulated DBAs. The DBAs are listed and evaluated in Chapter 15 of the certified AP1000 DCD, Revision 15 and in the AP1000 Design Certification Amendment Application (AP1000 DCD, Revision 16). The radiological analyses should include, but are not limited to, the following parameters:

1. TSC ventilation air inlet and recirculation flow rates
2. HEPA filter and charcoal adsorber fission product removal efficiencies
3. TSC unfiltered air in-leakage rate
4. Atmospheric dispersion factors (χ/Q values) at TSC air intake
5. TSC occupancy factors
6. TSC free air volume
7. Occupant breathing rate
8. Description of the ventilation design

K. – S. These subsections of the RAI were previously addressed.

BLN RAI ID: 2530

BLN RESPONSE:

A. – I. These subsections of the RAI were previously addressed.

J. This supplemental response incorporate changes from the AP1000 DCD Revision 17, corrects the TSC HVAC description, and provides revised dose information. The associated attachment was revised only to correct minor grammatical errors.

Standard Review Plan 15.0.3 states that the radiation protection design of the Technical Support Center (TSC) is acceptable if the total calculated radiological consequences for the postulated fission product release fall within the 5 rem TEDE exposure acceptance criteria specified for the control room for the duration of the accident. Atmospheric dispersion factors (χ/Q) values are a required input to radiological evaluations. The response to RAI 02.03.04-05 (response to BLN-RAI-LTR-119) provides the description of the methodology, inputs, assumptions, and calculated atmospheric dispersion factors (χ/Q values) for the Bellefonte Units 3 and 4 TSC.

The radiological consequence calculation for the Bellefonte Units 3 and 4 TSC uses the methodology of Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," and the RADTRAD (Radionuclide Transport and Removal and Dose Estimation) 3.03 Code (NUREG/CR-6604 including Supplements 1 and 2). RADTRAD 3.03 calculates fission product transport and removal along with the resulting radiation doses at selected receptors.

As discussed in the response to RAI 02.03.04-05, the limiting AP1000 offsite radiological consequences are associated with the LOCA with core melt (AP1000 DCD, Table 15.6.5-3). Therefore a LOCA release from the containment shell is conservatively assumed in the TSC radiological analysis. The RADTRAD 3.03 input parameters used in the Bellefonte TSC radiological analysis are discussed below.

Core Source Terms and Releases

For an assumed LOCA with core melt at an AP1000, the release of activity to the containment consists of two parts. The initial release is the activity contained in the reactor coolant system. This is followed by the release of core activity. The reactor coolant is assumed to have activity levels consistent with operation at the Technical Specification limits of 280 μCi/gm dose equivalent Xe-133 and 1.0 μCi/gm dose equivalent I-131 (AP1000 DCD). Based on Regulatory Guide 1.183, for a plant using leak-before-break methodology, the release of coolant into the containment can be assumed to last for ten minutes. The AP1000 is a leak-before-break plant (AP1000 DCD); however, for simplicity, the delay of 10 minutes before reactor coolant system blow down into the containment is conservatively neglected in this analysis.

The release of activity from the fuel takes place in two stages. First is the gap release, which is assumed to occur at the end of the primary coolant release phase and to continue over a period of half an hour. The second stage is that of the in-vessel core melt, in which the bulk of the activity releases associated with the accident occur. The in-vessel release phase lasts for 1.3 hours.

Core inventories of fission products are from ORIGEN calculations for the AP1000 at end of the fuel cycle at 102-percent power, 3468 MWt (AP1000 DCD). The source term model applied in the RADTRAD 3.03 calculation is based on Regulatory Guide 1.183 guidance.

The RADTRAD 3.03 nuclide inventory is limited to sixty isotopes with decay and daughter data. The default PWR 60-isotope, 9-element NUREG-1465 nuclide data file was used in this analysis. Data from the RADTRAD 3.03 TID14844 default data file for the Xe131m and Xe133m isotopes was added in place of the data for Co58 and Co60 in order to better represent the AP1000 inventory. A normalized core power was assumed and the AP1000 inventory for each nuclide (AP1000 DCD, Table 15A-3) was substituted for the default inventory.

The guidance in Regulatory Guide 1.183, suggests the following chemical forms for the released iodine:

Species Distribution

Form	Fraction (%)
CsI as aerosol	95
Elemental	4.85
Organic	0.15

Assumptions regarding release fractions applied are consistent with Regulatory Guide 1.183.

PWR Core Inventory Fraction Released Into Containment

Group	Gap Release Phase	Early In-vessel Phase	Total
Noble Gases	0.05	0.95	1.0
Halogens	0.05	0.35	0.4
Alkali Metals	0.05	0.25	0.3
Tellurium Metals	0.00	0.05	0.05
Ba, Sr	0.00	0.02	0.02
Noble Metals	0.00	0.0025	0.0025
Cerium Group	0.00	0.0005	0.0005
Lanthanides	0.00	0.0002	0.0002

Containment Sump Iodine Re-evolution

If the pH is maintained above 7, very little (less than 1%) of the dissolved iodine is converted to elemental iodine (Regulatory Guide 1.183). The AP1000 passive core cooling system provides sufficient tri-sodium phosphate to the post-LOCA cooling solution to maintain the solution pH at 7.0 or greater following a LOCA (AP1000 DCD). As such, this analysis did not consider any impact to the TSC due to iodine re-evolution from the containment sump.

Dose Conversion Factors

The effective dose conversion factors for the TEDE calculations are based on Federal Guidance Report (FGR) 11 (1989) and FGR 12 (1993). In most cases, these DCFs are taken directly from FGR 11 and 12; however, in some cases, the DCFs applied include the DCFs of the isotope's decay products. This is consistent with the RADTRAD 3.03 code manual as noted in NUREG/CR-6604 Table 1.4.3.3-2.

Atmospheric Dispersion Factors

The TSC atmospheric dispersion factors were provided in response to NRC letter BLN-RAI-LTR-119, RAI 02.03.04-05.

Breathing Rate and Occupancy Factors

The breathing rates applied in the calculation of the inhalation dose were consistent with those reported for the control room in Section 4.2.6 of Regulatory Guide 1.183 and are given in the table below. The breathing rate used in the RADTRAD model is conservatively rounded up to 3.50E-04 m^3/s.

Breathing Rates (m^3/s)

Time Period	Control Room
0 to 8 hours	3.47E-04
8 to 24 hours	3.47E-04
1 to 30 days	3.47E-04

The TSC occupancy factors are consistent with those reported for the control room in Section 4.2.6 of Regulatory Guide 1.183 and are tabulated below.

Control Room Occupancy Factors

Time Period	Occupancy Factor
0 to 24 hours	1.0
1 to 4 days	0.6
4 to 30 days	0.4

In-Containment Activity Removal Processes

The AP1000 does not include active systems for the removal of activity from the containment atmosphere. The containment atmosphere is depleted of elemental iodine and of particulates as a result of natural processes within the containment. Appendix 15B of the AP1000 DCD provides a discussion of the models and assumptions used in calculating the AP1000 natural deposition removal coefficients. An elemental iodine deposition removal coefficient of 1.7 is determined. The removal coefficient for particulates is a function of time. The aerosol removal coefficients in the AP1000 containment following a design basis LOCA with core melt are given in Table 15B-1 of the AP1000 DCD. Since there is a limit of ten time intervals in the RADTRAD 3.03 input for aerosol removal coefficients, Table 15B-1 was simplified as given in the table below. Removal coefficients were rounded to two decimal places and then conservatively small removal coefficients were selected for ten time intervals ending at 24 hours.

Aerosol Removal Coefficients Following a Design Basis LOCA with Core Melt

Time Interval (hours)	Removal Coefficient (hr^{-1})
0 - 0.631	0.84
0.631 – 0.801	0.78
0.801 – 1.171	0.66
1.171 – 1.475	0.55
1.475 – 1.776	0.45
1.776 – 2.371	0.38
2.371 – 4.276	0.29
4.276 – 5.362	0.35
5.362 – 24.0	0.46
24 - 720	0.0

The AP1000 DCD identifies a maximum decontamination factor for elemental iodine of 200. An overall DF of 200 is achieved at 4.276 hours. Thus, at 4.276 hours the value of the elemental spray removal coefficient, λ_e, was set to zero.

TSC HVAC System

The design of the TSC and TSC ventilation system is described in the Technical Support Center Design Description Document (Attachment 13.03-25A). The volume of the TSC is given as a maximum of 35,700 ft^3. The TSC heating, ventilation and air conditioning (HVAC) system is manually isolated from the normal outdoor air intake when a high gaseous radioactivity concentration is detected in the TSC supply air duct. A maximum normal outside airflow of 1925 cfm is assumed for 30 seconds prior to initiation of supplemental air filtration units. One train of HVAC filter units is needed during emergency conditions. This train is designed to provide a total nominal flow (fresh air + recirculation) of 4,000 cfm to the TSC. Filtered fresh air is limited to 860 cfm. A positive pressure of at least 1/8 inch water gauge is maintained. It is assumed that 25 cfm is required to maintain this positive pressure. Unfiltered inleakage to the TSC is given as 90 cfm; therefore the leakage from the TSC to the environment would be 925 cfm (860 cfm fresh air supply + 90 unfiltered inleakage – 25 cfm pressurization). The TSC ventilation system includes high-efficiency particulate air (HEPA) filters and charcoal filters. Consistent with the main control room HVAC design, each charcoal adsorber has an efficiency of 90% for elemental and organic iodine and 99% for particulates.

Containment Release Pathways

The AP1000 containment release pathways to the environment are the containment purge line and containment leakage. During the initial part of the accident, before the containment is isolated, it is assumed that containment purge is in operation and that activity is released through this pathway until the purge valves are closed. No credit is taken for the filters in the purge exhaust line. The containment purge flow rate is 8800 cfm. It requires 30 seconds for isolation of the purge subsequent to an accident (AP1000 DCD).

The majority of the postulated AP1000 releases due to the LOCA are the result of containment leakage. The containment is assumed to leak at its design leak rate, 0.1 percent by volume per day, for the first 24 hours and at half that rate for the duration of the accident, 30 days. The volume of the containment is 2.06E+06 ft^3 (AP1000 DCD).

Consistent with the AP1000 DCD, it is assumed that core cooling is accomplished by the passive core cooling system, which does not pass coolant outside of containment. Therefore, no recirculation leakage path is modeled in the TSC radiological consequence analysis.

Other Sources of Radiation

The direct radiation and sky-shine doses for the control room (per the AP1000 DCD, Table 15.6.5-3) are assumed to also be applicable to the technical support center. This is a reasonable and conservative assumption given the proximity of the TSC to adjacent structures and the design of the TSC. The TSC boundary walls, floor, and ceiling are sized for a minimum thickness of 2'-6" solid concrete to be consistent with structural designs for the modules of the auxiliary building (Attachment 13.03-25A).

In addition, at the time the LOCA occurs, there is the potential for a coincident loss of spent fuel pool cooling with the result that the pool could reach boiling and a portion of the radioactive iodine in the spent fuel pool could be released to the environment. The control room dose for this scenario given in the AP1000 DCD, Subsection 15.6.5.3.8.2, is conservatively included in the TSC dose consequences.

TSC Radiological Consequences

The bounding technical support center (TSC) radiological consequences determined for a postulated LOCA with core melt at either Bellefonte Nuclear Plant Units 3 or 4 are given below. The TSC radiological consequences for the postulated accident fall within the GDC 19 exposure acceptance criteria; therefore, it can be concluded that the radiation protection design of the TSC is acceptable.

TSC Radiological Consequences of a LOCA with Core Melt

TSC Dose Contributor	TEDE Dose (rem)
Airborne Activity Entering the TSC	1.25
Direct Radiation from Adjacent Structures	0.15
Sky-shine	0.01
Spent Fuel Pool Boiling	0.01
Total	**1.42**

K. – S. These subsections of the RAI were previously addressed.

This response is PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION REVISIONS:

No COLA revisions have been identified associated with this response.

ASSOCIATED ATTACHMENTS/ENCLOSURES:

Attachment 13.03-25A Technical Support Center Design Description Document (Jan. 2009)

Attachment 13.03-25A

(14 pages including cover sheet)

TECHNICAL SUPPORT CENTER
DESIGN DESCRIPTION DOCUMENT

TECHNICAL SUPPORT CENTER

DESIGN DESCRIPTION DOCUMENT

January 2009

BELLEFONTE UNITS 3 AND 4

Bellefonte Nuclear Plant, Units 3 & 4
Technical Support Center
Design Description Document

Bellefonte Nuclear Plant, Units 3 & 4
Technical Support Center
Design Description Document

Introduction

This design description document provides the key design considerations established for the Technical Support Center supporting two Westinghouse AP1000 reactor plants at one site, which is a departure from the Design Control Document as noted in the BLN FSAR Section 18.8.

The information in this document shall not be used for procurement of equipment or construction.

1.0 General System Description

1.1. General Description

The Technical Support Center (TSC) is an onsite facility from which management and technical support is provided to control room (CR) personnel during emergency conditions, and is the primary onsite communications center for the plant during the emergency (Ref. 16.3.1, Section 2.1).

2.0 Functions

2.1. The functions of the TSC include the following:

- Provide plant management and technical support personnel (including the appropriate number of NRC personnel) to assist plant operations personnel located in the control room during any emergency. The Site Emergency Director (SED) and the NRC representative are located in the same general area to promote proper communications
- Relieve the reactor operators of peripheral duties and communications not directly related to reactor control
- Prevent congestion in the control room during emergencies
- Perform Central Emergency Control Center (CECC) functions until the CECC is operational
- Provide communications capabilities with the control room, other emergency response facilities (ERF), and offsite locations

(Ref. 16.3.1, Section 2.1)

2.2. The function of the TSC is to provide space, telephone communications, and administrative services for NRC personnel. (Ref. 16.2, II.C.1.c)

2.3. The TSC performs CECC functions for the Alert Emergency class and for the Site Area Emergency class and General Emergency class until the CECC is functional. (Ref. 16.3.2, Section 8.2.1.a)

3.0 TSC Availability

3.1. The TSC has an operational unavailability goal of 0.01 that is applicable when the reactor is above cold shutdown status. (Ref. 16.3.1, Section 1.5)

3.2. During startup of any unit, and during normal operation of any unit, the TSC is available for use.

3.3. In the event of an emergency, the TSC is activated in accordance with the Emergency Plan.

4.0 TSC Size, Layout and Location

4.1. The TSC is common to both AP1000 units on the site. It is designed to accommodate the required personnel to support an event on either unit.

4.2. The TSC is located in the BLN maintenance support building sited in the northwest corner of the site, just north of the BLN Unit 3, within the protected area.

4.3. The TSC provides working space, without crowding, for the personnel assigned to the TSC at the maximum level of occupancy. The working space is sized for a minimum of 25 persons. Minimum size of working space is approximately 75 ft^2 per person (Ref. 16.3.1, Section 2.4). For dose assessment purposes, the BLN TSC is limited to a maximum volume of 35,700 cubic feet. This is consistent with the volume requirements for the control room (Ref. 16.1.1, Tier 2, Table 15.6.5-2).

4.4. The TSC is equipped with the following miscellaneous equipment and materials:

- o Conference table with chairs consistent with occupancy loads
- o Chairs for panels and consoles associated with information display and communication equipment
- o Desks, benches, and chairs consistent with occupancy loads
- o Photographs, slides, and maps covering the site out to the emergency planning zone boundary.
- o Toilet/lavatory facilities

4.5. The TSC shall be as close as possible to the control room, preferably located within the same building. The walking time from the TSC to the control room shall not exceed two minutes. (Ref. 16.3.1, Section 2.2)

The BLN TSC is not located in the nuclear island, but is located in the maintenance support building to provide centralized response management oversight for the site. This is a departure from the DCD as noted in BLN FSAR Section 18.8. This design description document provides the justification for the TSC location and transit time:

> Exception to NUREG-0696 criteria section 2.2 that the TSC will be within a two minute walk from the control room. (Ref. 16.3.1).
>
> Departure from the DCD designating individual TSCs for each unit and their specified location in the Control Support Area. (Ref. 16.1.1, Tier 2, Section 18.8.3.5).

The ability to retrieve all plant data and displays available in the control room coupled with sophisticated communications systems preclude the need for frequent face-to-face interchange between the TSC and control room personnel. The additional benefit of managing licensee emergency response from a single TSC is a major consideration for this departure from the DCD.

NRC Staff approval is required prior to implementing a change in this information by relocating the TSC to an independent structure. NRC Staff approval of this change will be documented via NRC approval of the COL application.

5.0 TSC Staffing

5.1. The level of staffing of the TSC may vary according to the severity of the emergency condition. The staffing for each emergency class is fully detailed in the licensee's Emergency Plan. (Ref. 16.3.1, Section 2.3)

6.0 TSC Design

6.1. Consistent with NUREG-0737, the technical support center is nonsafety-related and is not required to be available after a safe shutdown earthquake. (Ref. 16.1.1, Tier 2, Section 18.8.3.5)

6.2. The TSC is able to withstand the most adverse conditions reasonably expected during the design life of the plant including adequate capabilities for earthquakes, high winds (other than tornadoes), and floods. (Ref. 16.3.1, Section 2.5)

6.3. The equipment and facilities comprising the TSC do not perform any safety-related function. The design ensures that any fault or malfunction of the TSC equipment does not compromise any safety-related structures, systems or components.

6.4. The maintenance support building housing the TSC has a nominal grade elevation above the design basis flood level for the site. To prevent flooding of the TSC due to localized events (heavy rain, tank/system failures) the basement walls are extended above grade and the grade sloped to drain water away from the building and into site drainage ditches.

6.5. The TSC need not meet seismic Category I criteria or be qualified as an engineered safety feature (ESF). Normally, a well-engineered structure will provide an adequate capability to withstand earthquakes. Winds and floods with a 100-year-recurrence frequency are acceptable as a design basis. (Ref 16.3.1, Section 2.5)

6.6. The TSC is designed for structural loads in accordance with the International Building Code (IBC), current edition.

6.7. In the event of an accident at one unit requiring activation of the TSC, safe operation or shutdown of the other unit is not jeopardized by activation of the TSC.

6.8. Consistent with the AP1000 DCD, Section 18.2.1.3, the AP1000 human factors engineering program is applied to the Technical Support Center as appropriate.

6.9. The design of the TSC structure includes provisions to minimize unfiltered leakage. This is accomplished by cast-in-place concrete construction for wall, floors, and ceilings with joints sealed to minimize leakage. Penetrations are sealed such that the HVAC system can maintain a positive pressure within the TSC during emergency operation. For dose assessment purposes, unfiltered leakage shall be a maximum of 90 cfm consistent with the assumptions for the control room and control support area. (Ref. 16.1.1, Tier 2, Table 15.6.5-2)

7.0 TSC Habitability

7.1. TSC shielding is sufficient to ensure that the total dose to occupants does not exceed the requirements of General Design Criterion 19 and Standard Review Plan 6.4 for the duration of the accident. The TSC boundary walls, floor, and ceiling are a minimum thickness of 2'-6" solid concrete, consistent with the structural designs for the modules of the auxiliary building. (Ref. 16.1.1, Tier 2, Section 3.8.4.1.2)

7.2. The TSC is provided with respiratory protective equipment and personnel protective clothing for staff that must travel between the TSC and the control room under adverse radiological conditions, and to allow personnel to continue to function during the presence of low-level airborne radioactivity or radioactive surface contamination. (Ref. 16.3.1, Section 2.6)

7.3. Provisions are made for the safe and timely movement of personnel between the TSC and the control room under emergency conditions. There are no major security barriers between these two facilities other than access control stations for the TSC and control room. (Ref. 16.3.1, Section 2.2)

7.4. Sufficient potassium iodide is provided for use by TSC personnel (Ref. 16.3.1 Section 2.6)

7.5. A TSC radiation monitoring system provides area radiation monitors and HVAC supply radiation monitors, and is separate from the AP1000 radiation monitoring system.

7.6. The TSC is designed to limit exposure of its occupants in accordance with the Emergency Plan. This is accomplished through a combination of shielding, filtering and carbon adsorption in the HVAC system.

7.7. The TSC is provided with radiological protection and monitoring equipment necessary to assure that radiation exposure to any person working in the TSC does not exceed 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. (Ref. 16.3.2, Section 8.2.1.f)

7.8. The TSC has the same radiological habitability as the control room under accident conditions (Ref. 16.3.1, Section 2.6).

7.9. To ensure adequate radiological protection of TSC personnel, installed or portable radiation monitoring systems are available to personnel in the TSC. These systems continuously indicate radiation dose rates and airborne radioactivity concentrations inside the TSC while it is in use during an emergency. These monitoring systems include local alarms with trip levels set to provide early warning to TSC personnel of adverse conditions that may affect the habitability of the TSC. Detectors are able to distinguish the presence or absence of radioiodines at concentrations as low as 10^{-7} microcuries/cc. (Ref. 16.3.1, Section 2.6)

8.0 TSC Communications

8.1. Communications in the TSC are provided consistent with the Emergency Plan and FSAR subsection 9.5.2.

8.2. The TSC has reliable voice communication equipment for communication with the control room, emergency operations facility, OSC, and the U.S. Nuclear Regulatory Commission (Ref. 16.1.1, Tier 1, Section 3.1, Item 2); and with the State and local operations centers (Ref. 16.2, Section II.H.1).

9.0 TSC Electrical

9.1. Sufficient alternate or backup power sources are provided to maintain continuity of TSC functions and to immediately resume data acquisition, storage, and display of TSC data if loss of the primary TSC power sources occurs. (Ref. 16.3.1, Section 2.8)

9.2. TSC power supplies need not meet safety-grade or Class 1E requirements. (Ref. 16.3.1, Section 2.8)

9.3. The TSC electrical subsystem is not a safety-related system, nor is it required for the safe shutdown of any unit.

9.4. The TSC is provided with a dedicated diesel powered backup generator. The required electrical capacity and fuel requirements will be determined during detailed design.

9.5. The TSC electrical distribution system includes the following equipment:

9.5.1. The normal maintenance support building AC power bus for non-vital TSC loads.

9.5.2. A TSC AC essential power bus with normal incoming service from the maintenance support building AC power bus and essential incoming service from the TSC diesel generator for vital TSC loads, which are supplied through motor control center breakers or starters, or through transformers for lower voltage equipment.

9.5.3. An Uninterruptible Power System (UPS) for vital 120 VAC loads.

9.5.4. Lighting and miscellaneous panel boards supplied from transformers provide non-vital and vital 120 VAC power.

9.6. The existing non-Class 1E, onsite AC electrical power system supplies the normal AC power to the TSC. In the event this source is lost, AC power for essential loads is supplied from the TSC diesel generator located adjacent to the maintenance support building housing the TSC.

9.7. The TSC is provided with reliable power and backup power sources. Lighting is powered by the normal and backup electrical supply system. An emergency battery operated lighting system is installed. Power for vital information systems is provided by reliable power sources including a battery backed uninterruptible power supply system (UPS).

9.8. An uninterruptible power supply system provides approximately two hours of backup power supply to the TSC displays should ac power become unavailable. (Ref. 16.1.1, Tier 2, Section 18.8.3.5)

9.9. The TSC electrical equipment load does not degrade the capability or reliability of any safety-related power source. Circuit transients or power supply failures and fluctuations do not cause a loss of any stored data vital to the TSC functions. Sufficient alternate or backup power sources are provided to maintain continuity of TSC functions and to immediately resume data acquisition, storage, and display of TSC data if loss of the primary TSC power sources occurs. (Ref. 16.3.1, Section 2.8)

9.10. The TSC vital 120 VAC Uninterruptible Power System (UPS) is powered from a 125 VDC to 120 VAC inverter supplied from a 125 VDC battery. The 125 VDC battery is sized to maintain vital AC power for 2 hours in the event of a loss of normal AC power; however the TSC diesel generator automatically starts and provides power in the event of a loss of normal AC power.

9.11. Vital 120 VAC Uninterruptible Power System (UPS) provides power for computers, display monitors, communication devices and other vital loads. The 120V UPS includes a DC to 120 VAC inverter, supplied from batteries.

10.0 TSC Lighting

10.1. Power for the normal lighting system is provided from the normal source of power for the TSC.

10.2. Essential lighting is provided and is integrated into the normal lighting pattern. Power for essential lighting is provided from a TSC diesel-generator-backed source.

10.3. Self-contained, battery-operated emergency lighting is provided as backup to the normal lighting. Battery capacity provides a minimum of 3 hours of continuous operation. Power for this emergency lighting is provided from a TSC diesel-generator-backed source.

11.0 TSC Instrumentation and Control

11.1. Instrumentation is provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Data originates from plant data utilized by the control room.

11.2. TSC instrumentation, data system equipment, and power supplies need not meet safety grade or Class 1E requirements. (Ref. 16.3.1, Section 2.8)

11.3. The TSC is equipped with a support equipment control panel. This panel contains, as a minimum, controls for the TSC HVAC system and alarms and indication for the following:

- HVAC equipment switches, valves and damper position switches, and indicator lights
- HVAC high filter differential pressure alarms and low airflow alarms.
- Area radiation monitors and alarms.

11.4. The radiation monitoring systems includes local alarms with trip levels set to provide early warning to TSC personnel of adverse conditions that may affect the habitability of the TSC (Ref. 16.3.1, Section 2.6)

12.0 TSC Technical Data System

12.1. The TSC technical data system receives, stores, processes, and displays information from both AP1000 units, as needed to perform the TSC function. (Ref. 16.3.1, Section 2.9)

12.2. As a minimum, the set of Type A, B, C, D, and E variables as defined in IEEE 497-2002 (Ref. 16.4.2); as specified by Regulatory Guide 1.97, Revision. 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants" are available for display and printout in the TSC for both units. (Ref. 16.3.1, Section 2.9)

12.3. Plant parameters listed in DCD Tier 1, Table 2.5.4-1, Data Display and Processing System, with a "YES" in the "DISPLAY" column can be retrieved in the TSC for both units. (Ref. 16.1.1, Tier 1, Section 3.1, Item 3).

12.4. The TSC is equipped with a computer system and equipment which provides source term, meteorological data and technical data displays to enable TSC personnel to perform detailed analysis and diagnosis of abnormal plant conditions, including assessment of any significant release of radioactivity to the environment.

13.0 TSC HVAC

13.1. The primary functions of the onsite technical support center (TSC) heating, ventilation, and air-conditioning (HVAC) system are to provide normal environmental control for personnel and computer operational requirements; and to provide environmental control for habitability through filtration of potentially radioactive particulates and adsorption of iodine during emergency conditions.

13.2. The TSC HVAC system does not have a safety-related function during normal and emergency plant operations. The HVAC system is designed so that failure of the system and/or components will not prevent safe reactor shutdown nor compromise operation of any safety-related systems.

13.3. The TSC HVAC is designed to satisfy the indoor temperature and humidity conditions as required for the CSA.

- TSC Temperature: 67°F – 78°F
- TSC Humidity: 25% – 60% RH

(Ref. 16.1.1, Tier 2, Sections 9.4.1.1.2) *[In order to design to comparable levels of habitability as the AP1000 Control Room, design factors for the Control Support Area (CSA) are incorporated into the design for the TSC.]*

13.4. The TSC HVAC System is designed to control exposures to occupants of the TSC in accordance with the Emergency Plan. (Ref. 16.2, Section II.H.1)

13.5. The design of the HVAC system incorporates the capability of filtering potentially contaminated outdoor air introduced for ventilation to the building following a post-accident radiological release.

13.6. The TSC HVAC isolates the TSC from the normal outdoor air intake and provides filtered outdoor air to pressurize the TSC to a positive pressure of at least 1/8 inch water gauge when a high gaseous radioactivity concentration is detected in the supply air duct. (Ref. 16.1.1, Tier 2, Section 9.4.1.1.2)

13.7. One train of filter units is provided for emergency conditions. This train is designed to provide a total nominal flow of 4,000 cfm to the TSC. Outside filtered air is limited to 860 cfm for dose assessment purposes. A maximum normal outside airflow of 1925 cfm is assumed for 30 seconds following initiation of the filter units in the dose assessment model. (Ref. 16.1.1, Tier 2, Table 15.6.5-2). This airflow bounds the maximum ventilation airflow of 17 cfm per person as required by ASHRAE Standard 62. (Ref. 16.4.1)

13.8. For dose assessment, each charcoal adsorber has an efficiency of at least 90% for elemental iodine and organic iodine. For particulate, the dose assessment efficiency is at least 99%. This provides consistency to the design assessment for the control room. (Ref. 16.1.1, Tier 2, Table 15.6.5-2)

13.9. The TSC HVAC system has a reliability such that the TSC has an operational unavailability of 0.01 when any of the reactors are above cold shutdown status. (Ref. 16.3.1, Section 1.5)

13.10. The TSC ventilation systems functions in a manner similar to the control room ventilation system. The TSC ventilation system need not be seismic Category I qualified, redundant, instrumented in the control room, or automatically activated to fulfill its role. The TSC ventilation system includes high-efficiency particulate air (HEPA) filters and charcoal filters (Ref. 16.3.1, Section 2.6).

13.11. Normal operation of the TSC HVAC system consists of a supply air unit that processes outdoor air and recirculated air for delivery through ducts to the conditioned spaces. The battery and toilet rooms are provided with separate exhaust fan systems. The TSC ventilation system is operated in accordance with approved procedures and is manually controlled from the TSC.

13.12. The TSC HVAC system enters an emergency mode of operation upon initiation of a manual isolation signal. The battery and toilet room fans are automatically de-energized. The outside air isolation damper to the supply unit closes. The isolation dampers in the toilet and battery room exhaust ducts also close, and the outside air damper to the filtration unit opens.

13.13. During the emergency mode of operation, all outside air passes through the preadsorber unit, then through the filtration unit mixed with return air from the building. The filtration unit is to process approximately 25 percent of the total air circulated by the supply system. A sufficient quantity of outside air is introduced to maintain the pressure 0.125-in water gauge above atmospheric pressure.

13.14. Riveted tray-type charcoal adsorber cells are not used, in order to conform to IE Bulletin 80-03 (Ref. 16.5.1).

14.0 TSC Fire Protection and Detection System

14.1. Fire protection and detection for the TSC is consistent with the BLN fire protection program.

15.0 TSC Records

15.1. The TSC has a complete and up-to-date repository of plant records and procedures at the disposal of TSC personnel to aid in their technical analysis and evaluation of emergency conditions. In particular, up-to-date as-built drawings of the plant systems are provided to diagnose sensor data, evaluate data inconsistencies, and identify and counteract faulty plant system elements. (Ref. 16.3.1, Section 2.10)

15.2. The TSC personnel have access to up-to-date records, operational specifications, and procedures. The documents maintained in the TCS include, but are not limited to:

- Plant technical specifications
- Plant operating procedures
- Emergency operating procedures
- Final Safety Analysis Reports
- System piping and ventilation diagrams and heating, ventilation, and air conditioning (HVAC) flow diagrams.
- Piping Area Drawings
- Records needed to perform the functions of the CECC when it is not operational
- Up-to-date, as-built drawings, schematics, and diagrams showing conditions of plant structures and systems down to the component level, and the in-plant locations of these systems.

In addition, copies of the above-listed documents and the following documents are available in BLN Document Control:

- Plant operating records
- Plant Review Board records and reports

(Ref. 16.3.1, Section 2.10)

The above records are updated as necessary to maintain currency and completeness. Operations at this facility are directed by the TSC Manager/Site Emergency Director when the TSC is operational.

15.3. Records viewing/reproduction equipment is available in the TSC.

16.0 References

16.1. Westinghouse Documents

16.1.1. APP-GW-GL-700, Revision. 16, "AP1000 Design Control Document"

16.2. Combined License Application Emergency Plan

16.3. NUREGS

16.3.1. NUREG-0696, "Functional Criteria For Emergency Response Facilities"

16.3.2. NUREG-0737, Supplement No. 1

16.4. Codes and Standards

16.4.1. ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality"

16.4.2. IEEE 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power generating Stations"

16.5. Others

16.5.1. IE Bulletin 80-03, "Loss of Charcoal from Type II, 2 inch, Tray Adsorber Cells"