

From: [Gambrell, Reese" V](#)
To: [Guzman, Richard](#); [Hall, Randy](#)
Cc: [Brown, Timothy D](#); [Baxter, David A](#); [Newman, Stephen](#); [Park, Allen D](#); [Sumpter, James R](#)
Subject: PSW - Auxiliary Building Heat Up GOTHIC Analysis
Date: Wednesday, April 09, 2014 3:50:27 PM
Attachments: [RAI Response Template - Rev 0.docx](#)

Rich,

Attached are the RAI Responses to the email we received from you on 3/28/14 requesting clarification/confirmation for questions related to Calculation Number OSC-7934, Revision 1.

If you have any questions, please call Tim Brown at 864-873-3952 or me at 864-873-5558.

Thanks,

Reene Gambrell
PSW Licensing Team

NRC Question 1:

Section 1. "Introduction and Background" second paragraph first sentence states: *"Each of the 7 cases listed below are provided for scoping purposes and none are intended to define the design basis of the plant."*

- (a) Since none of the 7 cases analyzed represent the final design basis analysis, please explain what is meant by "scoping purposes".
- (b) What changes are anticipated for the final design basis analysis?
- (c) At what stage the final design analysis will be complete?

Response to Question 1, part (a):

The GOTHIC model utilized in OSC-7934 (NAI-1652-002) was developed from the GOTHIC base case and used to evaluate different scenarios or cases. Case specific heat sources, boundary conditions, initial conditions and other scenario specific parameters such as fan/cooler operation and opening of doors are included in the cases evaluated with the model. These cases were used to determine design configurations that appeared to provide acceptable environmental conditions to support Protected Service Water (PSW) equipment operation. These scoping cases indicate that Case 7, which credits restoration of cooling to the Auxiliary Building and Control Complexes, represents the needed configuration to maintain the required environmental conditions. Case 7 is the basis for which the Alternate Chilled Water (AWC) system is being designed.

Response to Question 1, part (b):

Since plant design changes are still being designed/implemented, changes to OSC-7934 are possible until the design has been implemented. See item (c).

Examples of further changes in progress or anticipated:

- 1) Control Complex testing is being performed to refine the heat sinks and/or heat loads for the Control Rooms, Cable Rooms and Equipment Rooms. These refinements are anticipated to demonstrate additional available time for plant operators to restore cooling equipment (fans, coolers, chillers) to support these areas.
- 2) Revision to add heat exchanger inputs for Units 1 and 2 Cable Room cooling units that are being installed by engineering changes.
- 3) Revision of passive heat loads to address concerns of Oconee PIP O-14-01399 / Zachary Nuclear Non-Conformance Report (NCR) 1652-NCR-2014-001 which documents a problem with passive heat load conductor initialization.

Response to Question 1, part (c):

The final design analysis will be complete when all required design changes for the AWC System are complete and installed as designed.

During the installation process, changes to the design may be needed for a number of reasons, including scope changes, design improvements, interferences identified during

construction, as-tested performance not meeting design requirements, operational input/changes, etc.

The final design analysis must reflect the final design of the system.

The final design is not complete until the design has been installed, tested, and ready to be accepted by the operational control group. However, the final design will be completed and installed to meet the design criteria set forth within the response to RAI 170 (dated June 28, 2013).

Final designs and implementation of phases 1 and 2 cooling are required to meet Milestones 4 and 5, respectively, of the July 1, 2013, Notice of Violation and Confirmatory Order related to a Fire Protection Program License Condition. Milestones 4 and 5 must be completed by June 3, 2015 and February 4, 2016, respectively.

NRC Question 2:

Section 6.3.3 states: "Supply BCs are given a conservative temperature of 90°F while exhaust BCs are given a temperature of 120°F as discussed in Input 4.19." Please explain the basis for assigning 120°F to the exhaust air?

Response to Question 2:

For most of the Auxiliary Building, boundary conditions are used to supply and remove air from the rooms. GOTHIC requires that temperature and steam volume fraction (or humidity) be provided for all boundary conditions. For fluid boundary conditions that remove fluid from a volume, the fluid properties are not used to determine the properties of the fluid being removed. From Section 17.1.2 (page 17-4) of the GOTHIC 8.0 user manual (Reference 1), "Fluid properties specified for a boundary condition are used only if flow is from the boundary condition to a volume. By contrast, if fluid is flowing from a volume to a boundary condition, then the fluid conditions are those of the fluid in the volume rather than those specified for the boundary condition. However, the solver still requires that reasonable conditions be specified for outflow boundaries." Assumption 4.17 of Numerical Applications Calculation NAI-1652-002, Revision 2, Oconee Nuclear Station Units 1, 2 and 3 Auxiliary Building GOTHIC Heat Up Analysis – PSW Event Cases (OSC-7934, Auxiliary Building Heat Up Analysis For Protected Service Water (PSW) Events: PSW Event Cases) discusses the supply and exhaust temperatures and humidity used. The exhaust humidity was calculated at an exhaust temperature of 120°F to determine reasonable values to enter into GOTHIC. The temperature of 120°F was chosen as a reasonable temperature for the building exhaust, given a 90°F supply. A reasonable value is required, but the analysis is not sensitive to this value.

NRC Question 3:

Section 6.4.2.6 states that for case 5, the control complex heat load is reduced by multipliers given in Table 6-6. This is also reflected in forcing functions 55T, 56T, and 57T in the GOTHIC electronic file submitted for Case 7. Are these forcing functions also applied for case 7, if so please justify the heat load reduction.

Response to Question 3:

Forcing functions (FF) 55, 56, and 57 are used with Surface Options 37, 38, and 39 to apply a reduction in the Control Rooms and cable rooms heat loads after 30 minutes for

Case 5. Case 6 restored the Case 1 heat loads, as modified for the revisions to the heat load calculations and Case 7 built on Case 6, so there is no discussion of this change under Case 7. Page 36 of the cases calculation (OSC-7934) states that the heat loads for the control complex in Case 6 are restored to Case 1 heat loads. The next paragraph provides the control complex heat loads for case 7, which do not include reductions.

In the case 7 model, the heat loads for the control room and cable rooms are in conductors 2195, 2196, 2205, 2221, 2240 (Table 4-2 of the calculation lists these conductor numbers among others). In the model or in Attachment Q, pages 185 and 186, which list the model input, the Surface Option types assigned to these conductors are 26 and 27. Neither of these surface options uses FF 55, 56, or 57.

Note that the computer room heat loads (Rooms 513 and 554) are reduced and then restored to full heat load through Surface Option 43 and FF 67.

NRC Question 4:

Please confirm that all operator actions credited in the GOTHIC analysis which includes opening and closing of doors, operating AHUs at appropriate times and others will be included in the plant abnormal operating procedures for the PSW event mitigation.

Response to Question 4:

In order to assure that changes made to the station are properly documented and communicated to appropriate station personnel, Duke Energy utilizes Engineering Directives Manual (EDM) 601, "Engineering Change Manual." As described in this manual, proposed changes to the station require a design evaluation, then processes within the Engineering Change Program are used to ensure that the final design is prepared and documented appropriately in design deliverable documents. Design deliverable documents are necessary to communicate changes to the station or station procedures resulting from the changes. The design changes are required to be transmitted to the appropriate station group through a formal process.

As added assurance that the operator actions credited in the GOTHIC analysis calculation are captured in applicable operations procedures, e.g., opening and closing of doors, operating AHUs at appropriate times etc., this activity has been included in the station's corrective action program (Ref. PIP O-14-03313, corrective action #2).

NRC Question 5:

Please confirm that all calculations, including inputs, walkdown data collection, and independent verification were performed according to the requirements of 10 CFR 50 Appendix B.

Response to Question 5:



Zachry Nuclear Engineering, Inc.

INTEROFFICE MEMORANDUM

FILE NO. 909QAD/M14015

DATE: April 4, 2014

TO: File

FROM: Don Wiwczar

A handwritten signature in dark ink, appearing to read "D. Wiwczar", is written over the printed name.

SUBJECT: Duke Oconee Protected Service Water Project

The purpose of this memorandum is to confirm the use of an approved 10 CFR 50 Appendix B program when supporting Duke-Oconee's Protected Service Water Project.

To fulfill Duke-Oconee's request to produce a GOTHIC model of the Oconee Aux building in support of the Protected Service Water project, Zachry produced the following calculations and engineering evaluation:

Document number	Revision	Type
12-101 (OSC-7931)	2	Calculation
12-071 (OSC-7932)	2	Calculation
12-336 (OSC-7935)	0	Calculation
13-270	0	Calculation
13-170	1	Calculation
13-E05	1	Engineering Evaluation
13-E07	0	Engineering Evaluation
12-E20	0	Engineering Evaluation
NAI-1652-001 (OSC-7933)	0	Calculation
NAI-1652-002 (OSC-7934)	2	Calculation
NAI-1652-003	0	Calculation
NAI-1727-001 (OSC-10972)	0	Calculation
NAI-1727-002 (OSC-10973)	0	Calculation

All calculations and Engineering Evaluations including inputs, walk down data collection, and independent verification were performed using the Zachry Nuclear Inc. Nuclear Quality Assurance Program, which meets the requirements of 10 CFR 50 Appendix B. The Zachry Nuclear Quality Program has successfully passed NUPIC Audits, with the scope covering all activities used in this project.

This memorandum is intended for use by the Zachry project manager and does not serve as the certification of conformance to Duke Energy required by the terms of the project contracts.