Nuclear Operating Company

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

May 12, 2010
U7-C-STP-NRC-100089

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 3 and 4
Docket No. PROJ0772
Response to Requests for Additional Information

References:
1. Letter from Tekia Govan to Mark McBurnett, "Request for Additional Information Re: South Texas Project Nuclear Operating Company Topical Report (TR) WCAP-17079-P Revision 0, Supplement 3 to Bison Topical Report RPA 90-90-P-A SAFIR Control System Simulator" (TAC No. RG0012), March 12, 2010 (U7-C-NRC-STP-100049)

2. Letter from Tekia Govan to Mark McBurnett, "Request for Additional Information Re: South Texas Project Nuclear Operating Company Topical Report (TR) WCAP-17079-P Revision 0, Supplement 3 to BISON Topical Report RPA 90-90-P-A SAFIR Control System Simulator" (TAC No. RG0012), March 12, 2010 (U7-C-NRC-STP-100048)

Attached are responses to NRC staff questions included the referenced letters. Attachments 1 through 23 address the RAI questions shown below:

RAI-1	RAI-17	RAI-37
RAI-2	RAI-21	RAI-38
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There are no commitments in this letter.

Responses to RAI questions 3, 15, 18, 19, 20, and 22 will be provided by June 1st.

D091
NRO

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

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

Executed on 5/12/10

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

jet

Attachments:

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cc: w/o attachment except*
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RAI-1

QUESTION:

Section 1 of WCAP-17079-P, "Supplement 3 to BISON Topical Report RPA 90-90-P-A SAFIR Control System Simulator," (hereafter Supplement 3) states:

> ...SAFIR is used in conjunction with BISON to model plant systems important to the balance-of-plant and thereby eliminate Condition 6 of the BISON topical report by demonstrating SAFIR is capable of modeling control systems consistent with the provisions of CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Fuel."

The staff interprets this statement to mean that SAFIR shall model control systems consistent with the provisions of CENPD-300-P-A. Please clarify if the staff interpretation is correct.

RESPONSE:

The staff interpretation is correct. (RE: CENPD-300-P-A SER dated May 24, 1996 Condition 1: "Acceptability of this topical report is subject to review findings of the other relevant topical reports cited in the topical report, and all conditions set forth therein are applicable to this topical report. Furthermore, acceptability of reload analysis is subject to conditions cited in the methodology topical reports.")

The purpose of WCAP-17079-P (Supplement 3) is to describe the process that is used to derive a plant control system model using SAFIR.

The intention here is to clarify that the control system model will be developed in the same way as any other plant system important to the balance of plant, and that SAFIR will be used to apply control systems to plant models according to the provisions of the NRC approved topical report methodology, for example, CENPD-300-P-A, Rev. 0, "Reference Safety Report for Boiling Water Reactor Reload Fuel."

Further, the addition of new modeling components are internally reviewed and approved in accordance with the Westinghouse Quality Management System and documented according to Westinghouse internal procedures.

The Westinghouse Quality Management System (QMS) has been reviewed and approved by the USNRC and meets all requirements of 10 CFR 50 Appendix B as well as ISO-9001. All analysis and internal calculations, or in this case the addition of a new component, must be done in accordance with the Westinghouse QMS.

RAI-2

QUESTION:

Supplement 3 describes a process whereby additional components can be added to the litany of SAFIR models. While the steps of verification and validation have been provided in the licensing topical report (LTR), there are not specific acceptance criteria specified. The Standard Review Plan Section 15.0.2 (SRP 15.0.2) subsection II.1.C directs the staff to review code assessment "success criteria." Please provide additional detailed information that describes the process by which a new component model is accepted.

RESPONSE:

A new component has to have an output signal that may be compared to an analytical solution or the component has to perform the same fundamental mathematical operation as the code compiler. For a new component the uncertainty in output is quantified and is taken into account in the overall model uncertainty following the current methodology in CENPD-300-P-A.

RAI-5

QUESTION:

SRP 15.0.2 subsection I.1 directs the staff to review the user's manual for transient analysis codes. Provide the SAFIR user's manual.

RESPONSE:

The SAFIR code is the control system model used within the BISON code, and therefore does not have its own user's manual. The BISON user's manual can be made available for NRC staff review at Westinghouse's Rockville, MD offices.

RAI-6

QUESTION:

SRP 15.0.2 subsection I.1 directs the staff to review the quality assurance program. Please provide additional details of the quality assurance program under which SAFIR was developed and maintained. Supplement 3 Sections 3, 4, and 5 refer to "Westinghouse standard quality assurance processes." Are these processes equivalent to procedures that have been approved or endorsed by the NRC staff as meeting the requirements of 10 CFR 50 Appendix B? In the –A version of the LTR, please add a clarifying statement to the effect that these processes must meet the requirements of 10 CFR 50 Appendix B.

RESPONSE:

All quality assurance processes for code development and maintenance which was recently audited by NRC in connection to the POLCA-T review for Stability and CRDA applications is equivalent to procedures approved under the requirements of 10 CFR 50 Appendix B. The –A version of the LTR will be updated to clarify by adding the text which states, "…Westinghouse standard quality assurance processes which meet the requirements of 10 CFR 50 Appendix B."

RAI-7

QUESTION:

Section 3.8 of Supplement 3 provides a specific example for the coupled use of SAFIR and BISON whereby certain outputs and inputs are communicated between the two. How often in terms of transient time steps in the transient code do these two codes interface. For example, is the SAFIR output updated every 10 transient time steps within BISON? For applications to other transient codes besides BISON please describe how an acceptable frequency of communication between the codes is determined and implemented.

RESPONSE:

The transient code will make a call to SAFIR for each transient time step.

The integration scheme between BISON and SAFIR is as follows.

The BISON code advances one time step to $t+\Delta t_{BISON}$ using a time step of Δt_{BISON}. SAFIR starts its own integration process by using each components sampling time (TS_n) and in the user supplied order of the components. Hence, component *n* updates its state if time $t+TS_n$ is less or equal to time $t+\Delta t_{BISON}$. The same thing applies to component *n+1*. This procedure continues until all components are updated and have advanced to time $t+\Delta t_{BISON}$.

A similar process will be analyzed for use with other transient codes during the licensing evaluation of those codes.

RAI-8

QUESTION:

Section 3.8 of Supplement 3 provides Table 3-1 that describes the Input/Output signal communication between BISON and SAFIR. The staff understands that SAFIR is compatible with other transient approved transient codes (e.g. POLCA-T). For the use of SAFIR within the context of other NRC-approved methods please describe how an equivalent table is generated.

RESPONSE:

SAFIR communicates with the transient codes via the input and output signals, but the model of the various control system components are independent of the transient code.
The input and output signal connections for other transient codes, such as POLCA-T, work in the same manner as the BISON SAFIR communication. An interface between the codes (in this case POLCA-T and SAFIR) is developed where the signals, such as shown in Table 3-1 of Supplement 3 but not necessarily limited to those listed in the table, are specified and translated into the corresponding POLCA-T signals. Hence, an equivalent table to Table 3-1 is generated by translating the BISON signals into POLCA-T signals.

RAI-9

QUESTION:

Section 3.11 of Supplement 3 states that a signal can only be connected to one single output. There may be measured plant signals for a plant-specific configuration that is used for multiple control system inputs. Please describe how such a configuration is modeled in SAFIR. As appropriate, please provide a specific example to assist the staff in understanding the approach taken.

RESPONSE:

A SAFIR component calculates an output signal that has to be unique within the SAFIR model, i.e. there may not be two identically named output signals. The signal flow is from an output connection to one or several input connections. An output signal may be connected to several input connections to components as shown in Figure 1 below. A signal may not be calculated by more than one component as shown in Figure 2.

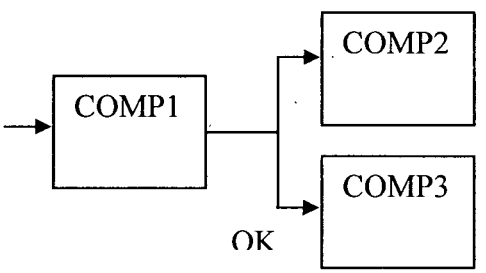

Figure 1 Examples of valid component connection

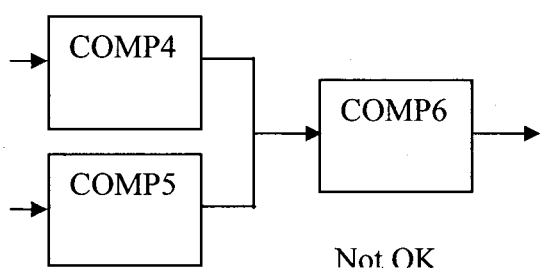

Figure 2 Example of invalid component connection

RAI-11

QUESTION:

Section 3.8 of Supplement 3 states that new input or output connectors may be added to the code using the standard code update procedures. Section 4.1 of Supplement 3 includes similar language for the addition of a new component. The staff requires clarification of this statement. First, do the referenced code update procedures meet the requirements of 10 CFR 50 Appendix B in terms of quality assurance? Second, please provide some details regarding the type of documentation required to implement a new connector and/or component and verify that this documentation is maintained in an auditable manner.

RESPONSE:

Westinghouse software is developed and maintained in accordance with the Westinghouse Quality Management System (QMS). The QMS meets the applicable requirements of the United States Code of Federal Regulations Title 10, Part 50 (10CFR50) Appendix B and ASME NQA-1-1994 Edition, Part 1 Supplement 11S-2 and Part II, Subpart 2.7.

The Westinghouse Quality Management System (QMS) has been reviewed and approved by the NRC and meets all requirements of 10 CFR 50 Appendix B as well as ISO-9001. All analysis and internal calculations, or in this case the addition of a new input or output connectors, must be done in accordance with the Westinghouse QMS.

RAI-17

QUESTION:

The last paragraph of WCAP-17079-P Section 2.2 states "In this case BISON is the transient code interacting with SAFIR, but other dynamic BWR codes that are approved for application by the NRC may be used provided the model development and verification and validation process is followed."

How would the approval of SAFIR by NRC for use with BISON impact the intended applications of SAFIR coupled with other dynamic BWR codes? Specifically, do you plan to submit for NRC review, the technical basis for application of SAFIR with other dynamic BWR codes? Please elaborate and identify the candidate codes.

RESPONSE:

The SAFIR code is developed as a generic tool and Westinghouse intends to use it for modeling control system and logical functions coupled to other dynamic codes that are approved by the NRC. SAFIR will be shown in future licensing submittals for the appropriate code to correctly interact with transient codes as defined in RAI-8.

One code we plan to submit for application with SAFIR is POLCA-T. The POLCA-T LTR Appendix C, planned for submittal in September of 2010, will include a description of connection between SAFIR and POLCA-T and will refer to BISON Supplement 3 for the description of SAFIR. Any additional codes in the future would be submitted for NRC approval.

RAI-21

QUESTION:

The existing reactor scram model in the BISON code simulates control rod insertion using one of the following two methods:

- A user-supplied input table for control rod position versus time, or
- The built-in model for the hydraulic insertion of control rods.

a) The ABWR control rod drive system includes a Fine Motion Control Rod Drive (FMCRD) mechanism. State whether the FMCRD is modeled in SAFIR for the set of scenarios that will be analyzed using BISON-SAFIR, and, if so, then describe its input model (e.g., control mechanism, actuator, etc.).

b) Scram signal is described as being both an input and an output from BISON, in Table 3-1 of WCAP-17079-P. Explain the meaning of this description, and elaborate upon how scram signal is calculated in the combined BISON-SAFIR.

RESPONSE:

The ABWR Fine Motion Control Rod Drive Run-in mechanism is modeled using a user-supplied input table for control rod positions versus time. The FMCRD Run-in can be activated by setting an explicit time for activation or when SAFIR determines that the activation setpoints are exceeded for a plant parameter as applicable.

a) Below is an overview of a typical transient scenario when SAFIR is used to model the logics for FMCRD Run-in activation.
   - BISON supplies SAFIR with current plant conditions (Average Power Range Monitor, Steam dome pressure etc)
   - SAFIR compares the data against specified setpoints and determines if any setpoints are exceeded.
   - If the FMCRD Run-in setpoint is exceeded, then SAFIR sends a signal to BISON to start the control rod insertion using the user-supplied table for control rod positions versus time. The control rod motion, such as FMCRD, is only modeled in BISON but can be activated by SAFIR or BISON

b) The scram signal (a Boolean function) is calculated by comparing the value of a certain parameter associated with the scram (pressure, APRM, etc) to the specified setpoint and can be calculated by either SAFIR or BISON. In the example above, SAFIR generates a signal that is transferred to the BISON Boolean scram signal to activate the BISON control rod insertion model.
   As described in RPA 90-90-P-A, the BISON code itself has the capability to model a simple reactor protection system to determine when the APRM or steam dome pressure, for example,

exceeds specific setpoints. In this latter case, the BISON Boolean scram signal is set by BISON when a reactor trip limit is reached. This Boolean scram signal from BISON can be used as an input to SAFIR to activate other plant features such as runback of Reactor Internal Pumps or Feedwater pumps. The connection referred to in Table 3-1 in Supplement 3 regarding scram is actually two parallel signals, one signal generated by SAFIR and transferred to BISON in order to activate the control rod insertion model and one signal generated by BISON at the activation of the control rod insertion model that may be used by SAFIR.

RAI-26

QUESTION:

The previous model of the Feedwater System in the BISON code solves the momentum balance equation for the feedwater and condensate system. The model describes the condensate and feedwater lines with respect to pressure losses, the feedwater and condensate pumps, and the control valves.

WCAP-17079-P does not clearly describe the implementation of the Feedwater System model in BISON-SAFIR. Table 3-1 in Section 3.8 of WCAP-17079-P indicates that the feedwater temperature and flow rate are input signals to BISON from SAFIR code.

a) Describe how the momentum balances equation for the feedwater and condensate system is solved using the SAFIR code.

b) Explain how feedwater temperature and flow rate can be both inputs to and outputs from BISON, as described in Table 3-1 of WCAP-17079-P.

RESPONSE:

a) The feedwater model described in RPA 90-90-P-A is unaffected by the introduction of SAFIR. SAFIR does not solve the momentum balances equations for the feedwater and condensate system (only BISON does).

b) BISON finds the steady-state solution before a transient is initiated. To find the steady state solution in BISON, the global reactor energy balance is used to calculate the stationary feedwater flow based on the thermal power and the associated feedwater temperature. The feedwater temperature (or enthalpy) is user specified as described in RPA 90-90-P-A. For the steady state solution it is assumed that the steam flow equals the feedwater flow to maintain the global reactor mass balance. For details please refer to RPA 90-90-P-A.

   One instance SAFIR may be used is to simulate the feedwater system response to a feedwater pump runout or a feedwater controller failure. The feedwater system response can also be given as input to BISON as boundary conditions for the system without using SAFIR.

   In the case that SAFIR is used to simulate the feedwater system response, the steady state feedwater temperature and flow rate (output from BISON) are used to initialize SAFIR's feedwater model (input to SAFIR). SAFIR calculates the system response to the feedwater controller failure for example, and after this time in the sequence of events, the feedwater temperature and flow rate are provided to BISON (input to BISON) from SAFIR (output from SAFIR). BISON no longer calculates either the feedwater flow or temperature and relies on SAFIR to supply those two boundary conditions to BISON transient simulation.

RAI-27

QUESTION:

RPA 90-90-P-A includes some statements and qualifications about the numerical stability of BISON with respect to certain input parameters and time step sizes. For example:

> *A large value of R [in Equation 3.4.3.18, describing bulk fluid evaporation] would give near complete thermal equilibrium, but stability considerations for the numerical integration method prevent the use of unlimited large values of R for reasonable time step values.*

and

> *For low void fractions rapid condensation may cause instability in the numerical time integration of the local mass balance equations.*

and

> *Numerical stability of the solution method is still limited by a material transport Courant limit...*

When the BISON equation set is coupled with equations in SAFIR that incorporate feedback from the control systems, it is possible that the stability limits of the coupled code could be adversely affected. Demonstrate that the ABWR models used with BISON-SAFIR do not have significantly more stringent stability limits, or that any such limits would not be of practical importance for the scenarios to be run using the ABWR model under BISON-SAFIR.

RESPONSE:

The use of SAFIR as a method to calculate dynamic boundary conditions to BISON does not affect the numerical stability limits in BISON. SAFIR calculates new boundary conditions to BISON to be used in the next time step. There is no iteration between BISON and SAFIR during a single time step and therefore the introduction of SAFIR does not affect the numerical stability limits in BISON. The BISON equation set is not coupled to SAFIR, the only communication is by boundary conditions as described in Table 3-1 in Supplement 3.

RAI-29

QUESTION:

Is the BISON-SAFIR model for ABWR nodalized in such a way that system quantities measured by modeled instrumentation are located exactly at BISON region/sub-region centers or edges? If not, then describe how quantities needed for SAFIR input signals are obtained (e.g., interpolation or approximation) given that the instrument locations and state variable locations may not coincide. Describe the impact any such approximations may have upon BISON-SAFIR results.

RESPONSE:

SAFIR will be able to provide delays and response time for measured signals based on physical parameter values simulated by BISON. The most common modeled instrumentation are steam dome pressure, turbine inlet pressure, Reactor Pressure Vessel(RPV) water level, steam flow and recirculation flow.

Steam dome pressure, turbine inlet pressure, steam flow and recirculation flow are calculated by BISON at a node boundary and no interpolation is needed.

The RPV water level is obtained based on the pressure difference of two nozzles.
To obtain the pressure at a nozzles location, BISON performs a linear interpolation of the pressure from the two adjacent nodes.
Assuming nozzle x is situated at height h_x between node n and n+1 at height h_n and h_{n+1}, all defined from an arbitrary reference level, the pressure at nozzle x can be written as

$$p(x) = p(n) + \frac{p(n+1) - p(n)}{h_{n+1} - h_n}(h_x - h_n)$$

The calculated nozzle pressure is provided to SAFIR as input. To obtain the measured water level, a model of level measurement system based on the SAFIR components can be built.

The impact of the above described interpolation is evaluated at the first time application for a specific model. This is normally done by studying the impact of the BISON nodalization on the model output. The level measurement model is thereafter tuned to conservatively predict the BISON calculated water level.

RAI-30

QUESTION:

Does the SAFIR code contain checking for run-time errors such as domain errors, division by zero, array out-of-bounds, etc.? Will the code stop or print warning messages for all such errors?

RESPONSE:

The error handling of invalid values occurs at several levels in SAFIR and in BISON. Array out-of-bounds are checked during input reading, where the code will stop and notify the user when arrays are out of bounds.

Additional checks are performed during the initialization part of SAFIR. The code verifies that the implemented SAFIR models are complete in terms of input and output signals, and that all used components are defined. The code will abort execution if a component description is missing or if a signal is generated by more than one component. Warnings will be issued if input values are missing or if a stationary solution is not obtained; unknown states will be set to zero.

During run-time, out of range error checking is performed on a SAFIR component. The error handling in BISON is very rigorous and numerous checks are also performed. So the error-handling is a two sided check to assure adequate error-handling in case of invalid values are passed to SAFIR from BISON.

Division by zero applies for the DIV component and is treated as a domain error whereas the user will be notified about division by zero, output will be set to largest allowed number. Moreover, checks are also performed for components such as INT, PI, etc. in order to prevent division by zero while evaluating the expressions as presented in Table 3-2 of Supplement 3.

RAI-32

QUESTION:

Among the available SAFIR components described in WCAP-17079-P Table 3-2 are ones labeled as PIP (Proportional Integrating Proportional) and PDP (Proportional Derivating Proportional). Are PIP and/or PDP controllers used in the SAFIR input model for ABWR? If so, then:

a) Are PIP and PDP controllers used in the SAFIR model of ABWR? If so, then provide a reference on the technical basis (i.e., theory) and application of these controller types.

b) Why does the SAFIR component list (i.e., Table 3-2 of WCAP-17079-P) not include a standard PID (Proportional-Integral-Derivative) controller? Are any PID controllers present in ABWR systems to be modeled using SAFIR? If so, then describe how they would be modeled in SAFIR.

RESPONSE:

The PIP and PDP controllers are standard lead and lag filters as described by the transfer function in Table 3-2 of Supplement 3. These controllers are used in the SAFIR control systems for ABWR.

The PID controller was not part of the selection of components during the development of SAFIR (based on a predecessors to the current Westinghouse Advant Controller family), and there has not been any request or need for a PID controller in any of the SAFIR models built as today. If a need for a PID function arises, the PID controller can be composed by combining the INT, AMP and DERIV components in SAFIR as shown in Figure 1.

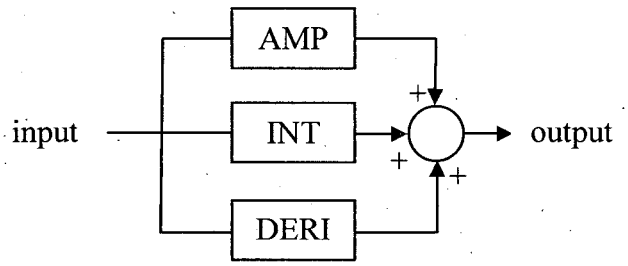

Figure 1 **PID controller composed of SAFIR AMP, INT and DERIV**

RAI-36

QUESTION:

WCAP-17079-P states in Section 3.10 that the "the available verified and validated basic components are listed in Table 3-2."

a) For each SSC identified in RAI-16(b), state whether non-SAFIR capabilities in BISON are being used to provide representation of that SSC.

b) For each SSC identified in response to RAI-16(b) that will be modeled using BISON-SAFIR, state whether the components listed in Table 3-2 are sufficient to build the applicable models with BISON-SAFIR. If not, provide a supplement to Table 3-2 listing all required components.

RESPONSE:

a) The control systems required for an application will be determined according to the methodology described in the Reference Safety Report (RSR, CENPD-300-P-A) at the time of the application in connection with a Licensing Amendment Request. See the answer to RAI-16 (Letter U7-C-STP-NRC-100095). Examples of SSCs that use a combination of BISON built-in functions and SAFIR models are Rod Control and Information System (RCIS), Steam Bypass and Pressure Control System (SB&PCS), Safety Relief Valve (SRV) and Reactor Internal Pumps (RIPs).

b) Westinghouse believes that the SAFIR components listed in Table 3-2 of Supplement 3 are sufficient to build an applicable ABWR model that can be used for licensing analysis of the transients as defined in the DCD.

RAI-37

QUESTION:

WCAP-17079-P provides the Westinghouse definitions of validation and verification in Sections 4.2 and 4.3.

a) Identify the extent to which the Westinghouse definitions comply with any national standards.

b) Identify on the list provided in response to RAI-16(b) which means (validation or verification) is used to assure the performance of each component listed.

c) In Section 1, the statement is made that "(t) the Westinghouse definition of validation is to show the behavior compared with reference data like e.g., measurement data." In Section 4.3 the statement is made: "validation will be performed using comparisons to measurement data." In Section 5.4 the statement is different: "Validation of models is performed against available data and code to code comparison". Describe consistently and completely what "Validation" is within the Westinghouse QAP. Identify changes that need to be made to the submittal to implement this consistent understanding of the process intended.

RESPONSE:

a) Consistent with SRP Section 15.0.2 which states that the code must be maintained under a quality assurance program that meets the requirements of 10 CFR 50 Appendix B, control system models derived using SAFIR will be developed and implemented in accordance with the Westinghouse Quality Management System (QMS) program. The Westinghouse QMS program describes computer software related requirements that include documentation of software requirements, computer software design, verification and validation (testing), configuration control, and error reporting and resolution. The Westinghouse QMS has been reviewed and approved by the NRC and meets all requirements of 10 CFR 50 Appendix B as well as ISO-9001.

b) As described in the response to RAI-16 (Letter U7-C-STP-NRC-100095), the scope of the LTR is to provide a description of the process used to develop and verify models of plant control systems used for transient analysis, rather than to provide a complete list of systems and components required for a specific application. The control system modeling required for an application will be determined at the time of the application and in connection to a plant specific License Amendment Request according to the methodology described in the Reference Safety Report (RSR per CENPD-300-P-A).

c) The definitions for validation and verification provided in the LTR are consistent with the requirements for computer software development described in Section 4.2 of the Westinghouse QMS. Functional requirements, design documents, test requirements, and test results are verified in accordance with written procedures. Verification is performed at the completion of each phase to ensure that the output of a given phase fulfills the requirements

established by previous phases. Validation is performed upon completion of software development to ensure that the code satisfies all identified requirements and produces correct results.

RAI-38

QUESTION:

In 10 CFR 50 Appendix B, Criteria III on Design Control, Criteria IV on Procurement Document Control, on Criteria VII Control of Purchased Material, Equipment, and Services, Criteria XVI on Corrective Action requirements have been established that would pertain to SAFIR.

a) Describe the organization from which SAFIR originated and the design interfaces established to facilitate using SAFIR in conjunction with to BISON.

b) If SAFIR was acquired as a commercial product, describe any processes used to bring it under the WQAP.

c) Describe the receipt inspection process employed to ensure that the SAFIR technology brought under the WQAP was in conformance with the procurement documents.

d) Describe any internal, external, or shared internal/external processes employed for the collection, evaluation, reporting and documenting of reported, suspected or actual conditions adverse to quality.

e) Describe processes and procedures employed to ensure that any conditions adverse to quality are reported in a timely manner to those affected including the means for informing licensees.

RESPONSE:

a,b,c) SAFIR is an internally developed Westinghouse code and therefore receipt inspections are not required. SAFIR was developed under the approved quality assurance program and has been updated in compliance with Westinghouse Quality Management System (QMS) policies and procedures. Therefore, these sections of the RAI are not applicable.

d,e) The process and procedures employed to document and report conditions adverse to quality and the means of informing licensees are governed by the Westinghouse QMS program.

RAI-39

QUESTION:

For the INT, PI, and PIP components in Table 3-2 and PI component used in Section 4.4 for Verification Example, there is lack of discussion on how to accommodate the integral windup. The applicant is requested to address this issue in the topical report.

RESPONSE:

Integral windup is an issue for the INT and PI components; not for the PIP and PDP components as these are filter functions that provide lead and lag abilities to the modeled system without any internal integral function. The method used within SAFIR to address integral windup is to initialize the components with desired values. This requires that the input and output signals are known during the stationary solution in SAFIR for INT and PI components. As stated in Section 3.7 of Supplement 3 all components that contain historical information require initialization to calculate the steady-state conditions. The technique used within SAFIR assigns a starting value for selected output signals so the historical value for the component can be calculated provided that the input signals to the component are known. In the case of INT and PI, the internal integral of the component will be assigned an initial value. Another design method used during modeling to deal with integral windup is to use the balancing (tracking) functionality with bumpless return to normal function in order to ensure correct initial conditions for the internal integral when the component is to be engaged.

RAI-41

QUESTION:

Section 3.1 in the SAFIR Topical Report states that the SAFIR code can be used to simulate most types of control systems or logical functions. The applicant is requested to list the control systems or logical functions which can not be simulated by the SAFIR.

RESPONSE:

SAFIR is able to model any control system that may be described by a combination of the basic components available within SAFIR. If new components are required to model a certain control- or logical system, Westinghouse will follow the process as described in the answers to RAI-12 and RAI-13 (Letter U7-C-STP-NRC-100078) depending on the nature of the new component.

Westinghouse has no knowledge of any control systems in the ABWR plant that cannot be modeled using SAFIR.

RAI-42

QUESTION:

Section 2.2 in the SAFIR Topical Report states that the SAFIR code is a generic tool which can be used with any type of simulation code for any type of plant. The applicant is requested to provide evidences or facts to support this kind of statement, otherwise, it's recommended to modify this statement because there are compatible issues between the SAFIR simulation system and other simulation codes which need to be addressed and tested.

RESPONSE:

This statement will be modified in the final version of the subject LTR WCAP 17079-P-A to: "..the SAFIR code is a generic tool which can be used with an NRC approved transient code with an NRC approved interface to SAFIR for plant and transient types that the approved NRC code is approved for."

New transient codes will be validated to be used with SAFIR as described in RAI-8.

RAI-43

QUESTION:

Section 6.1.2.5 in the SAFIR Topical Report states that only the 5 initial verification cases are presented in the report. The applicant is requested to provide reasons why the other four verification cases are not provided.

RESPONSE:

The purpose of Section 6.1 is to give some illustrative examples of the SAFIR model development process. The cases not presented do not provide any additional information on the model development process beyond the 5 cases presented.

RAI-45

QUESTION:

Section 1 in the SAFIR Topical Report states that the SAFIR is used in conjunction with BISON to model plant systems important to the balance-of-plant. The applicant is requested to provide a generic list of plant systems important to the BOP and their corresponding verification and validation should be presented as w ell in the topical report.

RESPONSE:

This statement will be modified in the final version of the subject LTR WCAP 17079-P-A to: "SAFIR is used in conjunction with BISON to model plant systems, structures and components (SSCs) required for a specific application."

The determination of the control system modeling required for an application will be determined at the time of the application and in connection to a plant specific License Amendment Request according to the methodology described in the Reference Safety Report (RSR per CENPD-300-P-A), also see the answer to RAI-16 (Letter U7-C-STP-NRC-100095).

The scope of the topical report is to provide a description of the process to develop and verify models of control systems, and not a complete list of systems required for a certain application.