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Your ref: Docket No. 52-006  
Our ref: DCP\_NRC\_002753

January 27, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 7)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 7. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP7.7-ICE-01 R2

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

  
Robert Sisk, Manager  
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/Enclosure

1. Response to Request for Additional Information on SRP Section 7

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 7

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-SRP7.7-ICE-01  
Revision: 2

### **Question:**

Demonstrate what actions, or outputs, are generated when one or more signals disagree or fall outside a defined parameter field for a given set of inputs (e.g. temperature, pressure, flux) to the Signal Selector Algorithms within the Plant Control System. For example, what alarm, control or indication outputs are processed based upon the logic contained within the Signal Selector Algorithms once a signal originating from the PMS is flagged as "bad" quality?

### **Westinghouse Response:**

This RAI was discussed with the NRC at the January 30, 2009 technical review meeting at the WEC Rockville office. The following response (Rev 1) has been revised to include the discussions at the January meeting.

Signal selector algorithms are utilized as a functional means to perform signal validation and increase fault tolerance within the Plant Control System (PLS). The nature of the signal validation is contingent on the redundancy available in the various process measurements. The signal selection algorithms are able to identify invalid inputs on the basis of the deviation between the redundant measurements. The signal selection algorithms provide at least two levels of warning. The first level shall alert the operator to a measurement deviation that is approaching the point at which the signal would be identified as invalid. A final level of warning shall alert the operator to the failure of the signal selection process.

A first stage operator notification is provided to alert operators that there are input channel deviations or quality issues, but the output value is still valid. A second stage operator notification is provided to alert operators that there are more significant input deviations or quality issues and the output value is no longer considered valid. The Plant Control Systems' identification of first stage operator notification or second stage operator notification does not result in any feedback to the PMS or DAS from PLS.

Coincident with the second level alert the analog output value is flagged as having "bad quality". Control functions shall monitor the quality of the output value and appropriate control action shall be taken. In the case of "closed loop controls" the affected modulating valve controller shall automatically be switched into the manual mode of operation. This automatic action prevents plant transients or upsets from occurring in response to a failed input sensor, and the PLS control action does not impact PMS or DAS from performing their safety functions. The operator is able to control the outputs manually and can return to the automatic mode once the fault condition has been repaired and returned to normal. An alarm is provided to indicate that a controller is switched to manual as a result of a "bad quality" input.

## AP1000 TECHNICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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Anywhere the output value of the signal selector algorithms is used for indication on a graphical display, the signal quality will also be indicated. When the value is “flagged” as having bad quality, the output value which is shown on the graphical display will also indicate the bad quality, through the usage of a single quality character made available to the operator in the form of a color change. This quality character is located immediately to the right of the displayed analog output value.

#### **Question: OI-SRP-7.7-ICE-01**

##### **7.7.3 Signal Selector Algorithms**

The applicant has not demonstrated what specific actions are taken by the signal selector algorithms in the event that one of the multidivisional or multichannel inputs is deemed faulty or of “bad” quality. The staff requires all outputs of the device, whether they are in the form of control, alarm, interlock, or indications, to be identified and addressed. The staff issued this request to WEC as RAI-SRP7.7-ICE-01. WEC responded to the RAI in a letter, “AP1000 Response to Request for Additional Information (SRP 7),” dated July 7, 2008 (ADAMS Accession No.ML081910138); however, the staff found the response inadequate. For example, WEC used the term “notifications” versus alarms and discussed control actions taken by the signal selector algorithms. WEC did not address what, if any, effect would be felt by either the PMS or DAS. The issue was originally included in RAI-SRP7.7-ICE-01. **The NRC staff identified this as OI-SRP-7.7-ICE-01.**

##### **7.7.4 Evaluation Findings and Conclusions**

Overall, the staff finds the conclusions described in NUREG-1793 still valid, based on the staff’s review of the changes proposed in Revision 17 of the AP1000 DCD. However, the staff did find that it needed additional information regarding the impact of the signal selector algorithms described in Section 7.7.3 of this FSER supplement. Specifically, the staff requires additional information on how the signal selector algorithms would affect the PMS and the DAS. Information on such impacts could affect the degree of independence between the control system and the protection system, as required in GDC 24. Also, such impacts could affect the degree of diversity and quality of the DAS as required in GDC 22. **The NRC staff identified this as OI-SRP-7.7-ICE-01.**

#### **Westinghouse Response: OI-SRP-7.7-ICE-01**

The staff issued a request to WEC as identified as OI-SRP-7.7-ICE-01. In the request the staff indicated that they found the WEC response to as RAI-SRP7.7-ICE-01 as inadequate. The following additional information is submitted which together with original response addresses their request for clarification.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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In the event that one of the inputs is deemed faulty or of "bad quality" the signal selections function will 1) invalidate the suspect input and use only the remaining "good" inputs to calculate a validated output value, and 2) alert the operators to the occurrence of a sensor deviation (first stage alert).

Use of the term "notifications" is achieved by the alarming system. The alarm system will be used to notify operators of both a first and second stage sensor deviation.

Signal Selection Algorithms described in RAI-SRP7.7-ICE-01 are performed in the Plant Control System and consumers of the function are limited to plant controls (PLS), alarm system, and non-safety displays. The outcome of the Signal Selection Algorithm is entirely independent of and has no impact to the performance, controls or displays associated with the PMS and the DAS.

Revision 18 of the DCD will state that the Signal Selection Algorithm is executed in the PLS and the results are not available to PMS or DAS. Therefore, PMS and DAS performance, controls and displays are independent of the Signal Selector Algorithm.

### Design Control Document (DCD) Revision:

None

Modify Section 7.1.3.2, "Signal Selector Algorithms" as follows:

(3 paragraphs unchanged)

For the logic values received from the protection and safety monitoring system, such as permissives, two-out-of-four (2/4) voting is used to provide a valid logic value to the plant control system.

The Signal Selection Algorithm is executed in the PLS and the results are not available to PMS or DAS. Therefore, PMS and DAS performance, controls and displays are independent of the Signal Selector Algorithm.

### PRA Revision:

None

### Technical Report (TR) Revision:

None