Revision 3 – 4/29/10

Summary of Telecon Internal to NRC staff 4/28/10

Attendees (please sent email to correct list if wrong):

Cahill, Christopher; Gray, Harold; Lupold, Timothy; Modes, Michael; OHara, Timothy; Pelton, David; Ennis, Rick; Conte, Richard, Manoly, Kamal, Tsao, John

Problem Summary:

As a result of implementation the PSEG buried pipe program, significant degradation of the No. 14 and 12 Auxiliary Feedwater Piping was identified – the yard section was replaced and the FHB section was abandoned in place with new piping routed above grade inside the FHB with code compliant pressure testing in each of the sections. Based on inspector questioning, PSEG wrote an internal notification reporting that the ASME code required pressure drop test for buried Class 3 piping (an inservice inspection) had never been done (IWA-5244 test). PSEG then entered a number of TS LCO for AFW and structural integrity (????) and the section 4.0 of the TS and starting developing operability determination for Unit 2 current operations and Unit from an historical viewpoint. See attachment 5 for development of facts on the issue.

More specifically, PSEG has developed an operability review for Unit 2 based on information in response to the noted unit 1 degradation on the corresponding headers in Unit 2 Nos. 24 and 21. They are also developing a past operability review for Unit which includes finite element analysis in order to assess the structural integrity of the AFW piping including a technical evaluation to support a new minimum wall thickness based on a new pressure rating.

For Unit 1, the apparent cause is little to no coating application of the yard section of buried piping. An extent of condition was being developed as a part of a root cause report that will not be finalized until after the pending startup of Salem 1. Unit 2 is operating and has similar piping but the difference appears to be in the use of a better coating application based on 1994 information in the yard area and 2010 information based on a dig inside Unit 2 FHB to expose the upper header No. 24 and assess the coating and take some UT measurements.

Open Issues as discussed on April 28, 2010 conference call internal to NRC:

1. Staff view of Unit 1 yard section FEA and its applicability to Unit 2 – see below Unit 1 Operability Determination.

2. Staff view of analysis for reduced design pressure form 1950 to 1275 psi for Unit 1 past historical look – Lupold to get back to us, they claim they never saw it.

3. Adequacy on the use of the Unit 2 TS section 4.0.1 and 4.0.3 and 4.0.5 – see below on Unit 2 Operability Determination

4. Adequacy of Unit 2 Operability Determination

    a. There are no immediate safety issues.

    b. See O'Hara comments on draft document, should not be given to licensee at this time – attachment 4.

C/86

c. Staff needs to understand condition of Unit 2 FHB deep section as to coated or not and adequacy of intact portion with wetted sand conditions with no past pressure drop test – licensee information limited

d. Staff needs to understand condition of Unit 2 buried yard section with no past pressure drop test – licensee information limited.

e. In light of the limited information above, how can the final Operability Evaluation for the U2 AFW buried piping adequately use the known conditions of the U2 AFW pipe coating and the inputs from the U1 observations, measurements and analysis to do an **evaluation of structural integrity per code (NOT TS operability determination on AFW flow paths)** of the U2 AFW until the IWA-5244 tests are done at the next U2 RFO.

f. PSEG inappropriately entered TS 4.0.3 on missed surveillance on two counts:

   i. Based on a past TIA at Pilgrim dated December 31, 2008 (ml083660174), a missed surveillance is different from a surveillance never done. With a missed surveillance, one has a basis or starting point for satisfactory conditions assuming the test past. If the test was never done then what is the basis for satisfactory conditions (can't go on the hunch that it may pass – noted a not a staff position from an industry guidance document) – see Ennis email of 4/26/10 which sparked the conference call – attachment 3.

   ii. Based on a past TIA at Clinton (2010-001 dated April 19, 2010 (ml101100101)), there is separation of code ISI/IST from Surveillance testing. Salem Unit 1 and 2 TS 4.0.5 seems to define surveillance as ASME code ISI for components and IST for Pumps and Valves. Based on past practice and current TSB position, the code requirements should be separated from TS requirements. Per rule in 10CFr 50.55a section f and g, which make the above distinguish, any conflicts.Further by rule in these sections, if there is a conflict between TS and the applicable code, the TS are to be revised (10 CFR 50.55a f and g sections f (5) (ii) and g (5) (ii).

g. Although PSEG correctly interpreted the plain language of TS 4.0.5 as a surveillance test never done, the TS has to be read in the context of the rule and it is a subtle insight learned just recently by TIAs even though this is traditional understanding by code compliance personnel. The insight on TS 4.0.3 can also be viewed as recent and the licensee needs to be informed of both. The code overrules TS and the licensee, as a minimum, needs to do an evaluation of structural integrity per section xxxxxx of code. The extra information on AFW system or flow path operability and the associated risk assessment have informational value.

h. The issue of technical specification, ASME vs. surveillance, was resolved with the Tech Spec Branch on the line. ASME is invoked "in isolation" of the tech spec and does not connect to surveillance nor, in turn, LCO may warrant. There may be a need for generic communication or TIA.

i. We need to communicate issues on e and f above and the coating issue under questions related to the FEA for Unit 1 to PSEG in conference call.

5. Unit 2 Risk Assessment done per TS 4.0.3 – SRA Cahill reported being satisfied with the risk assessment done by PSEG. However inappropriate the entry to Ts 4.0.3 was, the risk assessment has information value and it supports a determination of a slight increase in risk (CCDP or delta CDF???) waiting for the next refueling outage for Unit 2 for a more thorough inspection of coating and pressure drop test be done on the Nos. 24 and 22 AFW headers.

6. Adequacy of Unit 1 Operability Determination

   a. Staff needs to understand condition of FHB deep section as to coated or not and adequacy of intact portion with wetted sand conditions) – licensee information limited - historical issue on significance for NRC identified finding of failure to conduct ISI (pressure drop test) per code.

   b. See O'Hara comments on draft document, should not be given to licensee at this time – attachment 1.

   c. Tsao comments on FEA being addressed:

      i. Page 4, last paragraph. The licensee stated that the worst wall thickness is 0.077 inch. Confirm that the minimum allowable pipe wall thickness is 0.190 inch as shown on page 5, second paragraph.
      ii. The stress analysis needs to include detailed pipe wall thickness measurements in all 5 subject AFW pipes so that the reviewer can understand the extent of the wall thinning

   d. Based on review with Kamal Monoly, we are going to engage the licensee technical staff on four residual questions since the FEA (see also Tsao questions in Attachment 2) appears to be a final document (answers may be addressed in the Unit 1 operability determination0.

      i. Was the seismic input considered in the structural integrity analysis?

         For the U1 structural integrity evaluation what is the contribution of seismic induced stresses? This is to establish the magnitude of the seismic stresses in comparison to the pressure induced stresses. It is expected that the pressure induced stresses will be the dominant stress source.

      ii. What was the basis for the averaging of loads on the piping analysis?

         For the U1 finite element analysis, confirm that the area of compensation for the missing material at the deepest pit (0.077") was within the Code calculation requirements.

      iii. What documented evidence can be supplied to show a coating of what type was applied to the Unit 2 AFW piping?

      iv. What does the supplier of the coating suggest is the life of the coating? How long was the coating expected to be effective?

e. With respect to d above, the results where conveyed to DRP BC who agreed with the stated position and agreed to assist in setting up a staff-to-staff discussion on the above points with PSEG.

The following are miscellaneous open AFW inspection questions as of mid week April 26, 2010, not discussed in detail on conference of April 28, 2010:

- Verify hydro/pressure test is code compliant – O'Hara, determined approach was acceptable, **received test records but still needs to verify test results. PSEG will also provide the leak check procedure by 4/27 am.**

- Smart samples
  - Verify repairs to the control air system elbow that was replaced (how will PSEG certify the repair) – **O'Hara, PSEG adding more detail to description of document, to provide by 4/27 PM**
  - Verify control air extent of condition – O'Hara
  - Backfill procedure reviews to verify coating and backfill cure times – **O'Hara, PSEG to provide by 4/27 pm**
  - Verify control air clamping material – **O'Hara, PSEG to provide supporting document 4/27 am**
  - AFW pipe weld records **- O'Hara, PSEG to assess status of documents by 4/27 pm**

- Design records for as installed AFW piping on Unit 1 & 2 not found

- Coating records and life expectance for Unit 2 – any issues with Unit 1 (coating cure time and reduced life expectancy.

- When are final documents to be done;
  - Tech Eval on reduced pressure rating
  - FEA should be final but will it be revised per comments from staff
  - Unit 1 Op. Det.
  - Unit 2 Op. Det.
  - Root Cause and extent of conditions review
  - 50.59 for mod in FHB – venting issue discussed on call.

- Exit Wednesday May 5, 2010 – are we ready?

- TIA and Generic Comms – where are we/

Attachment 1

T. O'Hara comments on the draft Unit 1 Operability determination/Evaluation.

(1) In general, the most glaring omission in the complete lack of discussion of the condition of the un-excavated piping in the fuel handling bldg. area (~80').

(2) No discussion or facts are provided about the environment which caused the observed corrosion. In fact, the background section says that the Unit 1 piping fill (in the trench area) was not a harsh environment. But something caused the degradation of the piping. Also, the environment of the soil/sand in the fuel handling building area is not described or discussed.

(3) The FEA follows the guidance of the ASME Code and is ok but again, it only covers the trench area. Verg little is know about the buried piping in the fuel handling building area and I don't see evidence that a convincing agrument is given that proves structural integrity in the fuel handling building area - especially the deep pipe runs.

(4) This Evaluation gives a summary of the worst case UT measurements, however, only about half of the buried piping was actually UT'd. Most of the piping in the fuel handling building area has not been excavated or examined.

(5) It should be noted that the 1" ID Control Air (CA) piping in the fuel handling building area was actually found to be leaking due to severe corrosion. This piping is safety related and has been repaired. No additional piping was excavated in this area which appears to be a harsh environment based upon the condition of the removed, damaged pipe. Additionally, there are 2 I" air headers and only one has been excavated to examine the condition in the fuel habdling building area. The easily accessible CA piping in the trench area was examined extensively, UT'd and re-wrapped before being buried.

(6) The FEA is well supported with real, qualified UT data. However, the FEA only covers the trench area - it does not include the buried piping in the fuel handling building area. So there is no convincing structural integrity analysis for the complete system including the fuel handling building area.

Attachment 2

Questions from Tsao, Lew interested in answers:

1.How can the licensee demonstrate the structural integrity of a buried pipe without performing a pressure test or NDE.

2.To demonstrate the structural integrity of a piping system, the licensee can perform a stress analysis which requires pipe wall thickness. How can the licensee verify the pipe wall thickness without actual measurements, giving the wall thinning issue in the unit 1 AFW pipe?

3.I understand that the licensee has measured pipe wall thickness at only one spot of the unit 2 AFW pipe and had performed some measurements in 1994? How many feet (or a percentage of the pipe length) of the buried AFW pipe that need to be measured for wall thickness and verified for proper coating before we have a reasonable assurance of its structural integrity?

4.How can the NRC staff verify the validity of the licensee's stress analysis if we and they do not know the unit 2 AFW pipe wall thickness?

Conte: In general the evaluation of structural integrity may not have all the detailed answers to these questions. They may well not have lost structural integrity at Unit 2 – they might argue that point.

Attachment 3

Ennis Summary of April 28, 2010

The following is a summary of the internal NRC call held on 4/27/10 to discuss issues associated with the Salem Unit 2 AFW piping. These issues were raised following licensee discovery of degradation of the Salem Unit 1 AFW buried piping and the subsequent extent of condition review.

1) The licensee has never performed the pressure testing required by paragraph IWA-5244 of Section XI of the ASME Code for the buried AFW piping. Technical Specification (TS) Surveillance Requirement (SR) 4.0.5 provides requirements regarding inservice inspection and inservice testing of ASME Code Class 1, 2, and 3 components. SR 4.0.5.d states that "[p]erformance of the above inservice inspection and testing activities shall be in addition to other specified Surveillance Requirements." Therefore, the testing required by IWA-5244 is considered a TS surveillance requirement.

2) SR 4.0.3 allows a delay in the performance of a SR when it is discovered that a surveillance was not performed within its specified frequency (i.e., missed surveillance). PSEG is currently invoking the provisions of SR 4.0.3 to justify not performing the IWA-5244 testing for the AFW piping until the next outage.

3) A Pilgrim TIA dated 1/23/09 (ML083660174) states that "the NRC staff's position is that a missed SR is different than an SR that was never performed." Some of the key points in the TIA supporting this position are as follows:

   a) Use of the word "frequency" [in SR 4.0.3] establishes an interval, a period of time, that includes an initial performance of the SR, and a specified time period to re-perform the SR thereafter, i.e., to repeat the surveillance.

   b) SRs are performed at frequencies that are more often than the mean-time to failure of particular systems. Thus, most SRs confirm that SSCs are operable given an operable finding at the previous testing interval.

   Based on the TIA, PSEG's use of SR 4.0.3 to justify a delay in performing a surveillance that never has been performed is contrary to the NRC staff's current interpretation on use of SR 4.0.3.

4) SR 4.0.1 states, in part, that "[f]ailure to perform a Surveillance within the specified frequency shall be failure to meet the Limiting Condition for Operation, except as provided in Specification 4.0.3. Since SR 4.0.3 is not applicable to surveillances that have never been performed, Salem Unit 2 does not meet LCO 3.4.11.1 which states "[t]he structural integrity of ASME Code Class 1, 2 and 3 components shall be maintained in accordance with Specification 4.4.11.1." Note, SR 4.4.11.1 references SR 4.0.5 as the surveillances required to demonstrate structural integrity of the ASME Code Class 1, 2 and 3 components. The AFW piping is Code Class 3. Action c in LCO 3.4.11.1 states that:

   > With the structural integrity of any ASME Code Class 3 component(s) not conforming to the above requirements, restore the structural integrity of the

affected component(s) to within its limit or isolate the affected component(s) from service.

The above Action Statement has no time limit.

5) The licensee is currently evaluating the structural integrity of the Salem Unit 2 AFW buried piping. If the licensee concludes that the structural integrity is acceptable, then Salem Unit 2 would no longer be in Action c of LCO 3.4.11.1 (i.e., structural integrity would be restored in accordance with Action c). If the licensee concludes that the structural integrity is not acceptable, they would need to isolate the affected components from service in accordance with Action c. Isolation of the affected AFW piping would put them in the Action b in LCO 3.7.1.2 for two inoperable AFW pumps. [Region I, please confirm number of AFW trains that would be inoperable] This would result in a plant shutdown.

6) Failure to perform the testing required by IWA-5244 is a violation of ASME XI. The licensee would not need to submit a relief request if they are planning to do the test the next outage.

7) The licensee believes that the Salem Unit 2 AFW buried piping is in better condition that the Unit 1 piping. Region I will continue to review the licensee's efforts on these issues. The NRC staff is not aware of any information at this point indicating a lack of structural integrity for the Salem Unit 2 AFW buried piping.

Attachment 4

T O'Hara comments on DRAFT of the Unit 2 Operability Evaluation 10-005 (Rev. 0). My comments are below:

(1) Guided Wave is referenced in several places. This undeveloped technology and its information is not appropriate for use in the way they are trying to use it. Guided Wave also did NOT reveal the thinest (0.077") reading on the Unit 1 trench piping. This spot was only located after performing almost 18,000 qualified UT readings. In 2010 there have been approximately 500 UT readings taken.

(2) PSEG has not presented QC documentation that the specified coating X-Tru-Coat was actually applied on Unit 2. However, it is highly likely that no coating was applied to the Unit 1 piping.

(3) This Unit 2 evaluation spends a lot of time talking about the Unit 1 piping condition, but does not provide much information about the actual Unit 2 piping condition.

(4) This eval. talks at length about the Unit 1 FEA and implies that it gives information about Unit 2's condition. However, to get an acceptable Unit 1 answer SIA had to lower the design pressure from 1950 to 1275 (the maximum operating pressure seen by unit 1) to be able to accept the degraded wall conditions. This has no bearing on the Unit 2 condition because Unit 2 will be using a design pressure of 1950 and will have to meet a min. wall of 0.278".

(5) The December 1994 inspections (16 years ago) did perform some UT measurements, from 2 areas, and showed no significant wall loss. There was a range in the sets of readings (grid pattern) of 0.035" and 0.048". The 1994 excavation was only approximately 15' X 3 areas for a total of approx. 45'. Only 2 of the 3 areas were actually documented in 1994. Sample size is very small. Total piping run is approx. 170' per header, or a total of 340'.

(6) We have asked several times "What was the design life of the Unit 1 and Unit 2 original coatings?". PSEG has not provided an answer for these questions.

(7) PSEG wants to use the Guided Wave in 2011 (next refueling outage on Unit 2) to target areas of interest for follow up UT. This did not work well at the recent Unit 1 excavation because several this areas were not located as aeas of interest by Guided Wave. Several areas were indicated by Guided Wave as areas of interest but turned out to have relatively larger wall thichness that indicated by Guided Wave.

(8) The flow tests info provided in this eval. may not meet the more exact test requirements of IWA-5244. PSEG was unable to confirm this when asked.

(9) Perhaps the most glaring problem is the sparse data from the piping (about 80') which is buried in the Unit 2 fuel handling area. Two grids on 1 elbow were tested with qualified UT. This area is relatively shallow. The piping goes down about 10-12 ft., makes a left turn and runs horizontally for almost 80' where it goes into the Auxiliary Building. So the total actual recent UT samples are only about 1-2 ft of the 170' run (fuel handling building ~80', and buried outside containment ~86'). Also, this piping was abandoned in place in Unit 1 rather than dug up and removed for inspection - so relatively little can be gleaned from the Unit 1 piping condition in this deep, buried pipe area.

There are numerous outstanding questions on the overall inspection which have not been addressed. PSEG has a nice list but I don't know what they plan on doing with them. I will explore this on Friday when I'm back on site.

NEEDS TO BE UPDATED

Attachment 5

Background/Facts:

Update - Salem Unit 1 Outage – AFW (headers 12 and 14) buried piping Issues
Over the weekend, the licensee replaced a large amount of the shallow section of the Unit 1 buried AFW piping for headers 12 and 14 (headers 11 and 13 are not buried). During the replacement operations, they discovered piping in the area of a support that was at .077 inch wall thickness (minimum required is .200). It is thought that this indication was masked during the guided wave examination by the pipe support. As a result, the licensee is expanding the scope of the piping to be replaced to include extensive amounts of the deep buried piping. All of the deep buried piping for the 12 & 14 headers will be replaced, and all but about 30 feet of shallow piping on the 12 header will be replaced. The piping not being replaced on header 12 will be fully characterized by the licensee. The piping to be replaced includes sections beneath the fuel handling building. Licensee is evaluating the impact to the outage schedule. Operability reviews and structural integrity reviews are expected to be completed early this week. Region I is performing an MD 8.3 evaluation

See attached for more details. The licensee has dug a trench along about one quarter of the southwest wall of the Unit 1 containment between the fuel handling building and the containment outer penetration building. Based on flow path, the AFW piping exits the fuel handling building and enters the outer penetration room to enter containment and feed the No. 14 and 12 Steam Generators. The piping also traverses in the fuel handling building under the fuel transfer canal from the mechanical penetration room and is surrounded by sand fill.

In the trench, PSEG is characterizing the level of degradation of the No. 14 and 12 headers based on UT information that is ASME code compliant. The licensee is also characterizing the level of degradation of piping in the fuel handling building – sand was removing exposing a portion of the AFW piping and other lines having service air and control air which also traverse the above noted trench.

Safety Significance:

AFW is safety related. AFW is also relied upon for normal startup and shutdown. In addition it is used to mitigate all internal initiating events with the exception of large and medium break LOCA's. AFW is also utilized to mitigate external initiators, such as fire and flooding

If the system is capable of performing it's safety function, there is no safety significance. The licensee continues to assess the structural integrity of as-found conditions.

Licensee Next Steps:

Repair:

The licensee is still investigating the level of degradation in the yard/trench area and in the area below grade in the fuel handling building.

Based on UT measurement they need to determine extent of repair based on revised analysis for minimum wall thickness based on a new design pressure rating. They are tentatively looking at replacing 50 feet of pipe below minimum wall of .260 inches (not clear yet reduced rated pressure) without additional UT characterization. The remaining piping will have the 1 inch by 1 inch grid characterization. Where the pipes enter the outer penetration room and the FHB in this trench, the penetrations are also in need of repair.

Some repair/coating or reapplication of coating in the FHB will be needed. They are apparently relying on intact coaling on vertical section of the riser in the FHB and assuming uniform condition for the buried section in the building. A hydrostatic post repair test is to include this section of piping. This area may be a significant challenge since it is an area of wetted sand and the coating can not have any imperfections with respect to above noted assumptions.

Output Analysis:

Operability to support startup of Unit 1

Operability determination to support past operations for Unit 1.

Finite Element Analysis on ASME qualified UT information (doing a 1inch by 1 inch template review similar to that done for flow accelerated corrosion measurements.

Root Cause and extent of condition review – final documentation after startup.

Potential design change package for reduced pressure rating of system from 1950 to 1275 psi.

Extent of Conditions:

Unit 1 other headers No. 11 and 13 as well as corresponding headers in Unit 2 – Not buried, no evidence of a problem.

Unit 2 buried headers: 1994 data and records suggestion acceptable coating; and where damage occurred due to digging, it was repaired.

Other Safety Related Piping - Control Air – with one exception in the fuel handling building, the condition of coating was acceptable and appears to have been properly applied. Repair to the exception in the fuel handling building will be made, apparent due to isolated mechanical damage.

Other Safety Related Piping – Service Water Nuclear Headers – different material, concrete inner and outer coating surrounding carbon steel

Notification to State of New Jersey: Inspector was onsite observing conditions as they occurred.

<u>NRC Staff Next Steps:</u>

The Region added an extra week to the ISI inspection in order for the inspector to continue to follow developments.

We continue to interface internal stakeholders on a periodic basis.

An IMC 309 review was being considered. Entry conditions have not been met due to lack of evidence related to structural integrity AFW.

A review of OpE had been started – other buried pipe AFW problems have been identified back to 2000 – draft IN has been in the works since Oyster Creek issue last year.

No inquiries to date from External stakeholders.

Industry Outreach:

PSEG is interfacing with INPO OpE.

Public Outreach:

None to date