Nuclear Safety Advisory Letter

Westinghouse

This is a notification of a recently identified potential safety issue pertaining to basic components supplied by Westinghouse. This information is being provided so that you can conduct a review of this issue to determine if any action is required.

1000 Westinghouse Drive, Cranberry Township, PA 16066

Subject: **Impact of Reactor Coolant Pump No. 1 Seal Leakoff Piping on Reactor Coolant Pump Seal Leakage During a Loss of All Seal Cooling**	Number: **NSAL-14-1**
Basic Component: No. 1 RCP Seal and Seal Leakoff Piping	Date: 02/10/2014

Substantial Safety Hazard or Failure to Comply Pursuant to 10 CFR 21.21(a)	Yes ☐ No ☒ N/A ☐
Transfer of Information Pursuant to 10 CFR 21.21(b)	Yes ☐
Advisory Information Pursuant to 10 CFR 21.21(d)(2)	Yes ☐

SUMMARY

This Nuclear Safety Advisory Letter (NSAL) is related to the reactor coolant pump (RCP) seal leakage, as affected by the piping configuration and components of the No. 1 seal leakoff (SLO) line, during events resulting in the loss of all seal cooling. The nominal RCP seal leak rate of 21 gallons per minute (gpm) for each RCP, as documented in WCAP-10541, Revision 2 (Reference 1), may not be applicable for all plants with Westinghouse RCPs because of the various thermal-hydraulic conditions set up by plant specific SLO piping designs. WCAP-10541 and this NSAL addresses the Westinghouse RCP shaft seal package (8 inch nominal pump shaft size) where the No. 1 seal is a controlled-leakage film riding design and the No. 2 and No. 3 seals are rubbing face designs. Similarly designed RCP seals (e.g., 7 inch nominal pump shaft size seals or Licensees of Westinghouse seals) may or may not be affected depending on how the Licensee uses WCAP-10541 in their current licensing basis. The plants listed in Table 3 were supplied with Westinghouse seals with the original RCP; however, some plants may have replaced them with another manufacturer's seals. This NSAL presents an evaluation for an estimated No. 1 seal leak rate, consistent with the analysis accuracy performed in WCAP-10541, based on various conservatively modeled categories of SLO piping designs. This issue does not represent a substantial safety hazard pursuant to 10 CFR 21 reportability.

Additional information, if required, may be obtained from George Konopka, (412) 374-5629.

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WCAP-10541 established the RCP seal performance for events where the No. 1 RCP seal and the SLO lines are subjected to a loss of all seal cooling (i.e., no seal injection, no thermal barrier cooling). These events result in two-phase flow in the No. 1 SLO line. The thermal-hydraulic conditions in the No. 1 seal and the SLO piping are key factors which determine the nominal steady state leakage of the No. 1 seal. Table 5-4 of WCAP-10541 provides L/D (length/diameter or equivalent length for piping flow resistance) information for a representative Westinghouse 4-loop plant SLO piping system for nominal, upper and lower bound L/D values with the corresponding seal leak rates.

The WCAP leakoff L/D analysis was performed using a representative leakoff line configuration for a typical Westinghouse 4-loop plant. These values were not intended to bound all plant No. 1 SLO line designs. Additional guidance was provided in Technical Bulletin NSD-TB-91-07, Revision 1 (Reference 2) regarding over-pressurization of the RCP SLO line. Technical Bulletin TB-04-22, Revision 1 (Reference 3), which may be superseded in the future, addresses a loss of all seal cooling and assumes 21 gpm nominal leak rate resulting from the presence of an orifice or rotameter in the SLO line.

Licensees may have applied the information from the WCAP and Technical Bulletins as an ‘acceptance criterion’ to show applicability of the nominal case of 21 gpm in regulatory applications including risk-informed applications using probabilistic risk analysis (PRA) methodology.

ISSUE DESCRIPTION

Various plant licensees have inquired about the information provided in WCAP-10541, particularly Table 5-4, “Effect of Leakoff Line L/D on Seal Flowrate.” In general, the L/D information in Table 5-4 was used for sensitivity of the No. 1 SLO line performance, given an assumed L/D variation in the No. 1 seal SLO piping design. Licensees may have applied the information from Table 5-4, as well as TB-04-22 information, as an ‘acceptance criterion’ to show applicability of the nominal 21 gpm performance case in WCAP-10541 (i.e., assuming all seals functioned as expected).

A review of the WCAP-10541 supporting analysis was performed to determine if the basis of the L/D information reported in Table 5-4 could be applied as an acceptance criterion. The RCP loss of all seal cooling event analyzed in the WCAP results in two-phase flow in the No. 1 SLO line. It was determined that an L/D criteria, contained in Table 5-4, could not be used to reliably predict the No. 1 SLO line flow with two-phase flow. It was noted that the WCAP analysis was conservatively performed on a high flow basis; for example, the flow measurement orifice was conservatively ignored and pipe lengths were varied, but the effect of various pipe diameters was not evaluated. The analyzed plant was chosen as a representative plant for the WCAP-10541 program at that time.

TECHNICAL EVALUATION

Westinghouse first reviewed the different types of SLO piping designs with respect to their flow resistance characteristics with two-phase flow. Analyses were then run to determine the nominal leak rate for various flow restrictors or the equivalent pipe lengths necessary to obtain an estimated No. 1 seal leak rate. The leakage rates obtained by these analyses are based on conservative high-flow piping models assumed by Westinghouse and should only serve as an overall estimated flow consistent with the analysis results provided in WCAP-10541. Licensees that have incorporated the 21 gpm (WCAP-10541) leak rate into their plant specific documentation can compare their specific SLO piping configuration(s) to the configurations addressed in the following Tables 1 and 2 to determine if the 21 gpm No. 1 seal leak rate remains valid.

SLO Configurations

Westinghouse engineering reviewed a large number of SLO piping configurations of Westinghouse-designed 2, 3 and 4 loop plants. This review identified the various No. 1 SLO piping designs

implemented over time. Based on this review, the SLO designs can be grouped into the following general arrangement categories:

1. Early plant designs which used a rotameter for the No. 1 SLO flow measurement. Two models of rotameters were assessed:
   a. Brooks rotameter, which has connections bored to ½" diameter Schedule 160.
   b. Schutte & Koerting rotameter, which has 1" 1500 lb class flanges. The plants with these rotameters were contacted and they have either been replaced or changed to an orifice plate flow meter. The review found one plant replaced this meter with another rotameter with a ¼" minimum clearance.

   These SLO designs used larger bore piping (i.e., greater than ¾" diameter Schedule 160), relative to the latest plant designs. Therefore, the rotameter cases analyzed were ½" diameter Schedule 160 bore and ¼" bore.

Case 1.a: Early plant design ½" Schedule 160 (Brooks rotameter), and
Case 1.b: Early plant design ¼" I.D. bore (replacement rotameter).

2. The next generation of plant designs replaced the rotameter with an orifice plate flow meter. The bore size of these orifices is nominally ⅜". These plant designs continued to use larger diameter SLO piping relative to the later designs, consistent with the rotameter designs. Therefore, a ⅜" orifice bore case was analyzed.

Case 2: Orifice plate flow meter with ⅜" bore and > ¾" diameter SLO piping.

3. The latest plant designs used smaller bore piping (i.e., ≤ ¾" diameter Schedule 160) and an orifice plate flow meter with an orifice bore of about ¼". Therefore, a ¼" orifice bore case was analyzed.

Case 3: Orifice plate flow meter with ¼" bore and < ¾" diameter SLO piping

4. For plants that may not fall into the categories listed above, it is recognized that most plants have some amount of ¾" diameter Schedule 160 piping. Therefore, two cases were analyzed in which the minimum length of ¾" diameter Schedule 160 piping is needed to provide a flow of about 21 gpm or 30 gpm.

Case 4.a: Plants not in Cases 1, 2 or 3; length of ¾" diameter Schedule 160 piping that provides a flow of 21 gpm, and
Case 4.b: Plants not in Cases 1, 2 or 3; length of ¾" diameter Schedule 160 piping that provides a flow of 30 gpm.

Unless a plant made a significant SLO line configuration change, Westinghouse anticipates that most configuration changes would fall within the bounds determined by the results of this engineering review (e.g., rotameters that were replaced with orifices would be expected to match the orifice sizes considered above).

No. 1 Seal Faceplate Material

The No. 1 SLO flow performance is related to the No. 1 seal face plate material – either Aluminum Oxide (Al_2O_3) or Silicon Nitride (Si_3N_4). Although most plants would be expected to have upgraded to the lower leakage standard design Si_3N_4 seals, Westinghouse has not confirmed this. Therefore, most of the analyzed cases assumed Al_2O_3 seals because these seals result in higher leakage at nominal RCS operating temperature and pressure following a loss of all seal cooling. Some plants may have installed

the 'engineered' Si_3N_4 seal, whose leakage following a loss of all seal cooling is bounded by the standard Si_3N_4 seal performance.

Analysis of SLO Designs

The engineering review identified the categories of SLO piping configurations to consider. Based on the two-phase flow analyses, as indicated in Table 1, the piping designs with flow measuring devices (rotameter or flow orifice) result in choked flow, which occurs at those locations in the system. In the cases analyzed for ¾" diameter Schedule 160 piping, choked flow occurs at the end of the pipe where the pipe length is sufficient to limit the No. 1 seal flow. These are the conservative maximum flows that the system can pass for each configuration, and are independent of the downstream piping effects, such as operator action closing the No.1 seal return containment isolation valve.

Based on the engineering review, the various cases analyzed are summarized in Table 1.

Table 1 – Summary of Cases Analyzed

Case Number	Description	Comments (*Al_2O_3 seals are conservatively assumed, unless noted.*)
1.a.	Early plant design - rotameter case with ½" Schedule 160 bore rotameter connections.	Choked flow occurs across rotameter connections. A Si_3N_4 case is run for this limiting design.
1.b	Early plant design - rotameter case with ¼" bore rotameter connections.	Choked flow occurs across rotameter connections.
2	Orifice plate flow meter with approximately ⅜" orifice plate bore.	Choked flow occurs across the flow element orifice.
3	Orifice plate flow meter with approximately ¼" orifice plate bore.	Choked flow occurs across the flow element orifice.
4.a	Plants not in Cases 1, 2 or 3; determined minimum length of ¾" diameter Schedule 160 piping to limit flow to 21 gpm.	Choked flow occurs at end of pipe. No flow measurement components assumed.
4.b	Plants not in Cases 1, 2 or 3; determined minimum length of ¾" diameter Schedule 160 piping to limit flow to 30 gpm.	Choked flow occurs at end of pipe. No flow measurement components assumed.

Table 2 provides a summary of results for the "21 gpm case" in WCAP-10541, based on the SLO line and seal material assumptions in Table 1. With these results, plants should review their specific SLO piping configuration and use the results as guidance for modeling the plant specific impacts. The results in Table 2 are bounding for the generic SLO piping configurations used in the model. As indicated in Table 2, the ½" diameter Schedule 160 rotameter arrangement provided the highest flows (32 gpm with Al_2O_3 seals). An additional case was run for this design using Si_3N_4 seals, with a resulting flow of 25 gpm. Therefore, for plants with Si_3N_4 seals, the worst case change in performance is from 21 gpm to 25 gpm. Although not specifically analyzed, the same approximate 7 gpm drop in flow could be applied to the ⅜" orifice case for Si_3N_4 seals. That is, 31 gpm predicted for Al_2O_3 seals would equate to about 24 gpm for the Si_3N_4 seals.

Table 2 – Summary of Analysis Results

Case Number	Description	Results
1.a.	Early plant design - rotameter case with ½" Schedule 160 bore rotameter connections.	32 gpm (Al_2O_3); 25 gpm (Si_3N_4)
1.b	Early plant design - rotameter case with ¼" bore rotameter connections.	12 gpm (Al_2O_3)
2	Orifice plate flow meter with approximately ⅜" orifice plate bore.	31 gpm (Al_2O_3)
3	Orifice plate flow meter with approximately ¼" orifice plate bore.	16 gpm (Al_2O_3)
4.a	Plants not in Cases 1, 2 or 3; minimum length of ¾" diameter Schedule 160 piping for 21 gpm.	60 ft. of pipe required (Al_2O_3) to limit flow to 21 gpm
4.b	Plants not in Cases 1, 2 or 3; minimum length of ¾" diameter Schedule 160 piping for 30 gpm.	20 ft. of pipe required (Al_2O_3) to limit flow to 30 gpm

The results shown in Table 2 are based on no-load plant conditions (i.e., 2250 psia and 550 Btu/lb enthalpy). Subsequent to a loss of all seal cooling event, the plant operators will take actions to cool down and depressurize the plant to conserve reactor coolant inventory. Decay heat removal will be provided by the steam generators with possibly very low reactor coolant sub-cooling levels. For this assessment, the end point of these actions is assumed to be above the residual heat removal system cut-in conditions: about 304 psia, 390 Btu/lb enthalpy, 413.7°F and 4.87°F sub-cooling. The limiting ½" diameter Schedule 160 rotameter case was analyzed for these 'end of cooldown' conditions with a flow of 14 gpm, which applies to both Al_2O_3 and Si_3N_4 seals. This may be different than the leakage assumed for the RCP seals at reduced pressure in WCAP-10541, Figure 5-5 and conditions that are predicted by accident analysis computer codes which use an orifice break flow model.

Orifice Plate Evaluation

Since these analyses credit the high velocity choked flow conditions (note, the Reference 1 analysis ignored the orifice), the limiting component flow measurement orifices were evaluated for integrity in order to supplement the piping integrity recommendations in Reference 3. Based on evaluating the ¼" and ⅜" bore, ⅛" thick flat plate orifices, the results were:

- Negligible erosion after 16 hours of the worst case conditions in Table 2; and
- Minimal deflection of the orifice plate.

Therefore, the flow performance assumptions remain valid. However, if a loss of all seal cooling event occurs, replacement of the orifice plate is recommended prior to returning the orifice plate to normal flow measurement service.

SAFETY SIGNIFICANCE

The Westinghouse 10 CFR 21 evaluation concluded that no substantial safety hazard exists, however licensees will need to determine the impact on other licensing basis issues.

Westinghouse determined that when modeling the SLO line for plants with certain types of SLO piping configurations, and those that use the Aluminum Oxide (Al_2O_3) No. 1 seal faceplate material, the SLO flow could be as high as 32 gpm. Most plants are not expected to be in this category. The Al_2O_3 faceplate material is expected to produce higher SLO flowrates during a loss of all seal cooling event, as compared to the standard faceplates made from Silicon Nitride (Si_3N_4). Although the estimate of 32 gpm (and 14 gpm at end of cooldown) is applicable to only some of the current Westinghouse plants it was

conservatively assumed for the Part 21 evaluation. It was concluded with respect to the events and evaluations associated with a loss of all seal cooling, that an increase in the as-calculated RCP seal leakage rate from 21 gpm to 32 gpm during a loss of all seal cooling event will not create a substantial safety hazard. The calculated increase in seal leak rate during such conditions was evaluated as discussed below.

RCS Loop Operability in Modes 1, 2, 3, and 4

RCS loop operability in Modes 1, 2, 3, and 4, which is required to provide forced reactor coolant circulation, is not impacted. This issue does not affect RCS integrity nor loop flow through the RCP. The issue only affects the small flow through the RCP seal package following a loss of all RCP seal cooling; the RCP seal package performance during normal operation of the RCPs is not impacted. Any loss of all RCP seal cooling event would result in a trip or shutdown of the RCPs, when they are no longer required to provide forced reactor coolant circulation.

10 CFR 50.63 Station Blackout (SBO)

In previous SBO analyses, the time to core uncovery following a loss of seal cooling was originally evaluated using the WFLASH, TREAT and the LOFTRAN codes. The Westinghouse nuclear steam supply system (NSSS) designs are licensed with an SBO coping time based on NUMARC 87-00, Revision 1 (Reference 4) and typically fall into the 4-8 hour range for a.c. power recovery. Previous analyses have shown that with the operators performing a plant cooldown and assuming an initial 21 gpm leakage rate per RCP, the time to core uncovery far exceeds an 8 hour coping time. If initial seal leakage increases to 32 gpm and seal leakage after plant cooldown is assumed to be 14 gpm, the time to core uncovery, based on a reference plant analysis, is estimated to be approximately 17 hours, which does not impact the coping time. Therefore, it is concluded that the time to core uncovery following an SBO event will occur beyond the plant licensing basis coping time, even with an increased seal leakage rate as a result of bounding seal and seal leakoff line design parameters.

Extended Loss of AC Power (ELAP)

Plant specific FLEX (Diverse and Flexible Coping Strategies) analyses evaluate timelines necessary to implement operator actions, including RCS makeup capabilities to maintain core cooling. In these ELAP analyses, the time to initiation of reflux cooling and to core uncovery will be shortened by an increase in RCP seal leakage and may result in additional requirements for makeup capability or resources to complete the required manual actions to maintain core cooling. RCP seal leakage as high as 32 gpm and 14 gpm after plant cooldown to RHR cut-in conditions may challenge those timelines and capabilities using accepted compliance methodologies. This would include the potential impacts on the evaluations performed in WCAP-17601-P, Revision 1, Reference 5.

10 CFR 50.48, Fire Protection and 10 CFR 50, Appendix R, Fire Protection Program

10 CFR 50.48(a) and (b) / 10 CFR 50, Appendix R, specifies the requirements for an acceptable fire protection program. 10 CFR 50 Appendix R(III)(L)(2)(b) states, “The reactor coolant makeup function shall be capable of maintaining the reactor coolant level above the top of the core for BWRs and be within the level indication in the pressurizer for PWRs.” Some fire scenarios result in a loss of RCP seal cooling and a loss of all high pressure RCS make-up capability. The Appendix R fire protection coping analyses evaluate timelines necessary to restore some means of high pressure make-up to maintain the pressurizer water level on-span. RCP seal leakage as high as 32 gpm will challenge those timelines and may not allow compliance with the “pressurizer water level on-span criterion.” However, there will be sufficient mass remaining in the RCS to prevent core uncovery up to the make-up restoration timeline, should a fire result in a loss of seal cooling.

Risk-Informed Applications and Methods, and Use of the PRA Model

The accepted PRA model for RCP seal behavior following a loss of all seal cooling is provided in the NRC approved WOG2000 model inWCAP-15603, Revision 1-A (Reference 6). This model considers different RCP seal failure modes and assigns a probability and the associated flowrate of RCS inventory loss through the seals. The 21 gpm seal leakage case applies to cases where all three of the RCP seal stages are functioning and limiting the seal leakoff flow. The potential for the failure of one or more seal stages is also evaluated in PRA assessments. The case where the No. 1 seal functions while the No. 2 and No. 3 seals are assumed to fail, results in a leak rate of 182 gpm, while the failure of all three seals would result in a leak rate of 480 gpm. These higher leakage rates are not affected by the seal leakoff line configuration.

The dominant RCP seal leak contributor to the PRA results is the 182 gpm leak rate resulting from failure of the No. 2 and No. 3 seals following a loss of all seal cooling. In many cases, this failure mode dictates risk-informed applications, and therefore, it is not expected that variations in the 21 gpm leak rate (including variations in leak rate at lower pressure) as a result of No. 1 seal leakoff line configurations will impact risk-informed applications, including NFPA-805 (Reference 7) (10 CFR 50.48(c)). It is also noted that the PRA results are only one of five factors that are considered in a risk-informed approach as specified in Regulatory Guide 1.174 through 1.177.

Risk-informed applications used by licensees may include, but are not limited to, risk-informed Technical Specifications, identification of risk significant components for determining maintenance activities as required by 10 CFR 50.65(a)(4) and determination of availability and reliability targets for safety system components in the Mitigating System Performance Index calculations for the Reactor Oversight Process (ROP). The impact of an increase in the 21 gpm leak rate used in the PRA model and applied to risk-informed applications needs to be evaluated by each licensee based on their PRA models and results.

Reportability

While this issue could potentially result in an unanalyzed condition, it would not significantly degrade plant safety as discussed in NUREG-1022, Revision 3, “Event Report Guidelines 10 CFR 50.72 and 50.73” (Reference 8).

AFFECTED PLANTS

Any plant that has used or applied the WCAP-10541 RCP SLO line leak rate of 21 gpm for licensing basis purposes is potentially affected by the NSAL. This NSAL, and the cases specifically evaluated above, address the Westinghouse-supplied RCP shaft seal package design, where the No. 1 seal is a controlled-leakage film riding seal and the No. 2 and No. 3 seals are both rubbing face designs. Some plants may employ RCP seals of a similar design but may have been supplied by a manufacturer other than Westinghouse. If this is the case, there is a possibility that the SLO line backpressure issue could apply to these plants and this possibility should be evaluated on an as-needed basis.

The plants listed in Table 3 are units where Westinghouse originally supplied the RCP shaft seal package as part of the Westinghouse NSSS or in a few cases, to non-Westinghouse plants. Plants that are no longer operating are not listed. In some cases the current RCP seals may have come from a manufacturer other than Westinghouse.

Table 3 - RCP Seals originally supplied by Westinghouse Electric Company

A.W. Vogtle 1 & 2	Diablo Canyon 1 & 2	Millstone 3	Shikoku Ikata 1
Almaraz 1 & 2	Doel 1, 2 & 4	North Anna 1 & 2	Sizewell B
Angra Dos Reis 1	Genkai 1	Oconee 1	South Texas 1 & 2
Asco 1 & 2	H.B. Robinson 2	Ohi 1 & 2	Surry 1 & 2
Beaver Valley 1 & 2	Indian Point 2 & 3	Point Beach 1 & 2	Takahama 1 & 2
Beznau 1 & 2	J.M. Farley 1 & 2	Prairie Island 1 & 2	Three Mile Island 1
Braidwood 1 & 2	Kori 1, 2, 5 & 6	R.E. Ginna	Turkey Point 3 & 4
Byron 1 & 2	Krsko	Ringhals 2, 3 & 4	V.C. Summer
Callaway	Lemoniz 1 & 2	Salem 1 & 2	Vandellos 2
Catawba 1 & 2	Maanshan 1 & 2	Seabrook 1	Watts Bar 1 & 2
Comanche Peak 1 & 2	McGuire 1 & 2	Sequoyah 1 & 2	Wolf Creek
D.C. Cook 1 & 2	Mihama 1, 2 & 3	Shearon Harris	Yonggwang 1 & 2

NRC AWARENESS

This issue is not reportable in accordance with 10 CFR 21. Therefore, the NRC has not been notified by Westinghouse.

RECOMMENDED ACTIONS

1. Affected plants should review their SLO piping design to determine which of the four cases listed in Table 1, may apply to their plant.
2. If an affected plant determines that the conditions and results in Tables 1 and 2 do not apply to nor bound the specific conditions for their plant, a plant specific evaluation may need to be performed to determine the No. 1 seal leak rate during a loss of all seal cooling event.
3. If the plant specific No. 1 seal leak rate is calculated to be greater than 21 gpm, nominal, and the difference is significant enough to impact compliance with the current licensing basis (CLB) including consideration of the leakage at lower RCS pressure conditions, the licensee may need to reassess the impact on the CLB.
   a. With respect to 10 CFR 50.63, SBO, confirm that the coping time remains greater than the plant specific coping time.
   b. For FLEX mitigating strategies, confirm that the timelines and capabilities remain within the plant specific analyses.
   c. For 10 CFR 50.48(a) and (b) / Appendix R Fire Protection Program, review the impact of the issue against the Fire Protection Program licensing basis.
   d. For risk-informed applications, including NFPA-805, and other applications of the PRA model, assess the impact of increased leakage on the PRA model and risk-informed applications that utilized the PRA model and the 21 gpm leak rate assumption.

REFERENCES

1. WCAP-10541, Revision 2 "Westinghouse Owners Group Report, Reactor Coolant Pump Seal Performance Following a Loss of All AC Power," November 1986.
2. Westinghouse Technical Bulletin NSD-TB-91-07, Revision 1, "Overpressurization of RCP #1 Seal Leakoff Line," June 18, 1992.
3. Westinghouse Technical Bulletin TB-04-22, Revision 1, "Reactor Coolant Pump Seal Performance – Appendix R Compliance and Loss of All Seal Cooling," August 9, 2005.
4. NUMARC 87-00, Revision 1, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," August 1991.
5. WCAP-17601-P, Revision 1, "Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs," January 2013.
6. WCAP-15603, Revision 1-A "WOG 2000 Reactor Coolant Pump Seal Leakage Model for Westinghouse PWRs," June 2003.
7. NFPA-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2010 Edition.
8. NUREG-1022, Revision 3, "Event Report Guidelines 10 CFR 50.72 and 50.73," January 2013.