Enclosure 1: Quantitative Risk Assessment Based on Reference Plants

I. General Discussion

The purpose of this NRC staff evaluation in the LIC 504 HEAF assessment is to determine the change in risk between the new version of the PRA HEAF methodology, "High Energy Arcing Fault Frequency and Consequence Modeling (draft for public comment)," (ADAMS ML22158A071) and the existing PRA HEAF methodology documented in NUREG/CR-6850 (2005) and Supplement 1 to NUREG/CR-6850 (2010). Thus, this analysis assesses the importance of the new PRA HEAF methodology relative to the existing HEAF methodology.

The new methodology provides an approach for evaluating HEAFs associated with switchgear cabinets and bus ducts. In particular, medium voltage switchgear (1,000 VAC – 35,000 VAC) and low voltage switchgear (440 VAC – 1000 VAC), i.e., load centers, and bus ducts are sources of HEAFs. Although isophase bus ducts (i.e., a bus duct housing the conductor for a single phase) are sources of HEAFs, the staff determined that the methodology described in NUREG-6850, Supplement 1, appropriately addresses HEAF events for isophase bus ducts. Therefore, the new methodology does not provide a change in the approach to perform the corresponding risk analysis, and thus isophase bus ducts do not present a change in risk between the new and old HEAF PRA methodology. The new methodology provides new fire ignition frequencies; new likelihoods of HEAF events based on fault location, power source, and fault clearing time; and new HEAF zones of influence (ZOIs) for switchgear cabinets and bus ducts. Operating experience shows that motor control centers (MCCs) do not produce HEAFs consistent with those described in the new methodology. Also, MCCs have several design features that increase the reliability of electrical fault isolation. Therefore, HEAFs from MCCs were not evaluated for their effects on the change in risk, as they are not identified as a HEAF source in the new PRA HEAF methodology.

To assess the importance of the new HEAF methodology, the staff conducted site walkdowns at two volunteer reference plants: a boiling water reactor and a pressurized water reactor. The reference plants were selected based on the availability of an independent NRC-developed Standardized Plant Analysis Risk (SPAR) model that includes fire risk, the licensees' ability to support the staff's activities, and the variations in plant configuration to provide better insights on the method. The use of two reference sites reflected the plant-specific nature of the HEAF PRA analysis. For example, the important rooms in one reference plant contained many more sources and much more cabling than in the other reference plant. The staff relied upon the base PRA and updated analyses performed by both reference plants. The analyses at these two plants range from highly detailed to more simplified. The staff, when performing its own analyses, maintained the level of detail of the HEAF PRA from the reference plant. The staff walked down important switchgear and bus ducts and performed independent checks of the targets for each of these sources. In addition, sensitivity analyses were performed on the reference plants to represent plants that would have different characteristics and physical configurations. These sensitivity studies assumed more challenging locations of conduits and cable trays and longer fault clearing times, which led to larger ZOIs or multiple simultaneous cabinet fires.

Despite the existence of SPAR models for the voluntary plants, the staff relied upon the calculations of conditional core damage probability (CCDP) and conditional large early release probability (CLERP) performed by the reference plants. To gain confidence in these calculations, the NRC staff performed both direct and indirect confirmatory checks on these values. As discussed in Section V below, the staff performed explicit checks of these values for bus ducts and found that PRA component failures were not modeled downstream of the bus ducts in one reference plant model. To address this deficiency, the staff developed and applied a multiplicative factor for the scenario risks to account for the omission. Additionally, assessments were made by the staff to confirm the CCDPs and CLERPs for the switchgear. Furthermore, the staff has planned some narrowly scoped, additional HEAF-related confirmatory testing in the near future, which may provide additional quantitative information.

II. Switchgear Cabinets

The electrical distribution system for switchgear is divided into switchgear zones for the purposes of frequency and ZOI. The new methodology uses factors such as fault clearing time, cable insulation, and switchgear zone in which the fire occurs to determine a more realistic ZOI. For some HEAF scenarios, the new ZOI associated with switchgear is larger than the original ZOI, but in most cases the new ZOIs are smaller than the original ZOI. Damage from the fire due to the HEAF in the new methodology also occurs instantaneously in the switchgear cabinet of origin, and for longer fault clearing times produces a larger, delayed fire involving multiple cabinets. As such, structures, systems, and components (SSCs) in a limited region in front of and above the cabinet are assumed to be damaged in the new methodology, whereas the original methodology did not necessarily produce damage in this location. However, cables protected by an Electrical Raceway Fire Barrier System[1] (ERFBS) in the ZOI are not assumed to be damaged in the new methodology, whereas they could be damaged in the original methodology.

For the Reference Plant No. 1, the 4 kV switchgear had the larger contribution to risk in the base reference plant PRA model and were evaluated quantitatively to assess the impact of the new PRA HEAF methodology. Other HEAF sources were evaluated either in preparation for this analysis or during on-site walkdowns and were ruled out, on a case specific basis, as significant contributors to changing the estimated HEAF risk based on use of the new method. The staff did not identify additional targets using the new methodology due to the location of cable trays and conduits relative to the revised ZOIs during the walkdown. The PRA approach, applied originally by the Reference Plant No. 1 and maintained for the new methodology, was based on first assuming a hot gas layer (HGL) in the small switchgear rooms found at the reference plant, and then removing successively important targets from being damaged as allowed by detailed fire modeling. The plant had a relatively quick fault clearing time, which reduces the associated ZOI for the HEAF event. The new methodology also allows credit for ERFBSs located in the ZOI to protect cables from damage, and this feature of the new methodology drove the risk decrease in the updated reference plant calculation. Post Fukushima Dai-ichi diverse and flexible coping strategies (FLEX) were credited in both the reference plant analysis and in the sensitivity study.

For Reference Plant No. 2, 6.9kV switchgear and certain 480 V safety related switchgear had the larger contribution to risk in the base reference plant PRA model and were evaluated quantitatively for the impact of the new PRA HEAF methodology. Other HEAF sources were evaluated either in preparation for this analysis or from on-site walkdowns and were ruled out, on a case specific basis, as significant contributors to changing the estimated HEAF risk based on use of the new method. The level of detail of the staff's analysis for Reference Plant No. 2 is consistent with the simpler level of detail used in the reference plant analysis of record. For

[1] Electrical raceway fire barrier systems are installed around electrical components and cables. These systems have withstood a fire exposure in accordance with an approved test procedure and are rated in hours of fire resistance. They are used to maintain the protected components and cables free of fire damage as part of a layered approach to fire protection.

example, Reference Plant No. 2, in some cases, used conservative modeling assumptions to simplify the analysis. The staff did not identify new targets for the new methodology from the region in front of and above the cabinet, as this reference plant had conservatively captured all targets in the vicinity of the cabinets from its walkdowns. Reference Plant No. 2 had a relatively long fault clearing time, allowing a fire to grow and spread to adjacent cabinets, but there are no multiple cabinet fires assumed in the reference plant analysis. However, the simplified analysis approach also led to conservative assumptions of target damage, which would mitigate the estimated risk impact of multiple cabinet fires for this plant. ERFBSs in the switchgear room were credited in the fire scenarios for this plant. FLEX was not credited in either the Reference Plant No. 2 analysis or its sensitivity studies.

III. Switchgear Cabinets Sensitivity Studies

For Reference Plant No. 1, the ZOI and configuration of the switchgear (SWGR) rooms were adjusted in the sensitivity studies. The ZOI was extended for the first switchgear bank to damage a conduit containing a critical target located outside the ZOI for the reference plant. For the second switchgear bank, a conduit containing a critical target, which terminated in the end cabinet in the reference plant was assumed to run along the full length of the cabinets as a sensitivity such that the conduit would experience fire damage for each cabinet; thus, leading to a fire induced Loss -of -Offsite Power (LOOP). Finally, a cable tray containing critical targets running in front of the third switchgear bank and just outside the damage zone for each single cabinet was assumed damaged by the fire developed by the HEAF in each cabinet.

Additionally, fire modeling sensitivities were conducted for Reference Plant No. 1 on two load cabinets on each side of the first switchgear bank to represent multiple cabinet fires from assumed long fault clearing times during a HEAF event. The fault clearing time for the plant was adjusted to be long in the sensitivity study such that HEAF fires would grow and extend into the cabinets on each side of the load cabinet. The sensitivity studies for plant No. 1 in some cases led to a larger CCDP than the reference plant PRA model of record, and in some cases led to different timing for damage.

For Reference Plant No. 2, the sensitivity study removed credit for all HEAF protective structures installed to prevent HEAF induced damage. In the reference plant, these HEAF protective structures were placed over four switchgear cabinets and were installed either to prevent a HGL or to prevent localized damage to more important targets, which became apparent from the fire PRA. The sensitivity only includes the HEAF scenario results for those four switchgear cabinets, not all the switchgears. This switchgear room is a large room, containing a significant amount of equipment and cabling, and a HGL has the potential to cause damage to both trains of safety equipment. FLEX was not credited in the reference plant analysis or the sensitivity study. Additional analysis was performed for the site visit and the HGL evaluated for the sensitivity study was found to be unrealistic in the absence of the structure either due to the limited amount of combustibles, which would contribute to the fire scenario or due to the configuration of the low voltage switchgear cabinet, which had no ZOI extending above it.

The results of the sensitivity studies are reported in Section IV.

IV. Switchgear Cabinets Analysis Results

The results of the analysis for switchgear cabinets for both reference plants are discussed in this section. Table 1 provides the results of the Reference Plant No. 1 and sensitivity studies from that plant. All units in Table 1, as well as the following Tables 2 through 4, are per reactor-year.

For Reference Plant No. 1, the risk change between the plant with the new PRA HEAF model and NUREG/CR-6850 is negative, and thus a reduction. The risk decrease for the reference plant is largely attributed to the new methodology allowing credit for ERFBS protecting equipment within the HEAF ZOI. Additionally, for the same reason, the change in risk is negative for the sensitivity studies, which included fire modeling sensitivities and changes to the plant configuration as well as a larger ZOI. It is worth noting that only the changes to the analysis, which increased the CCDP led to the sensitivity study risk being larger than the plant risk from the new methodology.

Table 1: Switchgear risk and change in risk for Reference Plant No. 1 (including sensitivities)

Description	CDF (new method)	CDF (NUREG/CR-6850)	ΔCDF	LERF (new method)	LERF (NUREG/CR-6850)	ΔLERF
Reference Plant No. 1	1.7E-06	1.3E-05	-1.1E-05	3.9E-08	3.5E-07	-3.2E-07
Sensitivity Study - (1) changes to plant configuration & ZOI	2.5E-06	1.3E-05	-1.0E-05	4.9E-08	3.5E-07	-3.1E-07
Sensitivity Study - (2) Fire Modeling	1.7E-06	1.3E-05	-1.1E-05	3.9E-08	3.5E-07	-3.2E-07
Combined Sensitivity Study – (1) & (2)	2.5E-06	1.3E-05	-1.0E-05	4.9E-08	3.5E-07	-3.1E-07

Table 2 shows the results of the Reference Plant No. 2 and sensitivity studies from that plant. For this plant, only the contributions from the switchgear rooms are evaluated. These rooms are the largest risk contributors in the PRA using the existing methodology, and the staff believes these rooms would remain the largest contributors with the new PRA HEAF methodology due to the congested nature of the room and the functions these rooms provide.

First of all, for the Reference Plant No. 2, the core damage frequency (CDF) increases between the plant with the updated PRA HEAF model and NUREG/CR-6850 is 5.0E-07/reactor-year. This change in CDF in part reflects the more simplified analysis performed by the plant, which failed some targets together, which were spatially separated (e.g., those physically located at different ends of a switchgear bank).

The increase in CDF is 1.1E-05/reactor-year for the sensitivity study, which removed the HEAF protective structure from above the relevant sets of switchgear. The risk contribution is derived from damage to localized targets, rather than from an HGL. The risk values for this sensitivity study in Table 2 represent the risk only from the switchgear cabinets, which had HEAF protective structures above them. Because the Reference Plant No. 2 results are developed from a larger number of HEAF fire scenarios than the sensitivity study results (which rely only on those switchgear cabinets with HEAF protective structures), the CDF and large early release frequency (LERF) for the reference plant cannot be directly compared with the sensitivity study. Yet, the ΔCDF and ΔLERF between the two cases can be compared. However as for the reference plant analysis, the staff believes this value from the sensitivity study to be conservative due to the simplified analysis performed.

Table 2: Switchgear risk and change in risk for Reference Plant No. 2 (including sensitivities)

Description	CDF (new method)	CDF (NUREG/CR-6850)	ΔCDF	LERF (new method)	LERF (NUREG/CR-6850)	ΔLERF
Reference Plant No. 2	8.7E-07	3.7E-07	5.0E-07	2.2E-08	1.2E-08	9.2E-09
Sensitivity Study - all HEAF protective structures removed (CDF/LERF based only on the subset of switchgear associated with protective structures)	1.1E-05	3.5E-09	1.1E-05	3.0E-07	2.3E-10	3.0E-07

V. Bus Ducts

Bus ducts deliver power from the unit and auxiliary transformers into the plant and provide power to the switchgears. The electrical distribution system is divided into bus duct zones for the purposes of frequency and ZOI for bus ducts. From the HEAF impulse at t=0, both the NUREG/CR-6850 and the new methodology assume damage to targets that are within the ZOI. However, the ZOI in the new methodology is dependent on the fault clearing time, bus duct enclosure material, cable fragility, and electrical distribution zone in which the fire occurs, whereas the existing methodology uses a single ZOI for all bus ducts. For the bus duct HEAF scenarios, the new methodology leads to a larger ZOIs in most cases, with the ZOI increasing for larger fault clearing times. The ZOI allows for a HEAF from one bus duct to damage another bus duct. Also, the updated methodology treats the origin of the ZOI at the edge of the duct, which is different from the previous methodology, which treated the origin of the ZOI at the center of the bus duct. The new methodology also produces a ZOI extending 1.5 feet horizontally from both sides of the edge of the bus duct enclosure that projects downwards to the floor. This damage zone will damage all open targets below the bus duct enclosure and potentially ignite the first target depending on target characteristics. Cables protected by ERFBS in the ZOI are not assumed damaged in the new methodology, whereas they could be damaged in the original methodology. In both the new and old methodology there are two options for the implementation of how scenarios are developed for bus ducts:

- Transition Point Method: Scenarios are assumed at bolted connections, at turns both vertical and horizontal, and at transition points. Targets within the ZOI and underneath the bus duct around these points are assumed to fail.
- Linear Foot Method: Targets along the entire linear foot run within the ZOIs and underneath the bus ducts are assumed to fail. A minimum of 12 feet must be assumed for each scenario if this method is selected for both SSCs target selection and frequency apportioning. More targets may be collected for fire scenarios in the Linear Foot Method than for the Transition Point Method, and therefore the Linear Foot Method is conservative.

For Reference Plant No. 1, the Transition Point Method was used to develop scenarios for bus ducts. The NRC staff conducted walkdowns in each of the 4 kV and 13 kV switchgear rooms, as the bus duct runs were most risk significant in the 4 kV and 13 kV switchgear rooms in the base reference plant PRA model. Each of the switchgear rooms were evaluated by the staff during the on-site walkdowns to identify the appropriate scenarios and targets within the reference plant ZOI, based on the reference plant power distribution configuration and fault clearing times. A refined analysis was performed for the reference plant on each switchgear room with the updated methodology. In comparison to the application of the previous methodology in the reference plant PRA, this new analysis method generally yielded additional targets within the ZOI for each of the scenarios that were evaluated. Additional scenarios were also identified based on the plant walkdown. For one of the scenarios in the 4 kV switchgear rooms, the original methodology yielded 6 targets within the ZOI. Application of the new methodology for the reference plant yielded 9 targets within the ZOI for the same scenario. However, those new targets collected by the enlarged ZOI for the updated PRA model for the reference plant were not important to risk. The plant had a relatively short fault clearing time, which yielded a relatively small ZOI for bus duct scenarios, given the range of ZOIs possible from the new methodology.

For the Reference Plant No. 2 in question, the Linear Foot Method was used to develop scenarios for bus ducts. Scenarios of 12 to 168 feet were postulated and targets were selected based on those bus duct runs. All SSCs along the bus duct run were assumed to fail in the Linear Foot Method if a HEAF occurred in the bus ducts. The analysis process for Reference Plant No. 2 aligned with the more simplified process used by the reference plant analysis. The fault clearing time for Reference Plant No. 2 was on the upper end of the set of potential times, leading to ZOIs between 3 and 5 ft. Reference Plant No. 2 implemented the new methodology by updating their base case analysis by conducting a drawing review to identify new potential targets for their scenarios, but they did not conduct walkdowns to confirm the drawing review. In the site visit, the NRC team chose to walk down nine of the fifty multi-phase bus duct scenarios in the reference plant's HEAF analysis based on several factors. Specifically, the NRC team walked down scenarios that 1) were the highest risk contributors in the base plant results, 2) had the potential for a LOOP due to the routing of the bus ducts, and 3) had visible targets given the plant configuration and known obstructions. The staff also prioritized the walkdowns based on risk contribution to the plant in the base case analysis and specifically looked at configurations, which could lead to a LOOP scenario caused by bus duct to bus duct interactions (unit auxiliary transformer (UAT) failure impacting the SAT or vice versa). Additionally, at least one walkdown was performed in each fire area of importance to the bus duct results (Turbine Building, A & B Switchgear Rooms, and Radiation Controlled Area). The results for the nine walked down scenarios were calculated and the plant's base case analysis and updated results were compared with the new methodology implemented by the staff. The results of the staff walkdown resulted in a larger change in CDFs for the chosen nine scenarios than calculated by the Reference Plant No. 2. The staff noted that important targets were added to the ZOIs from its walkdowns and identified non-conservatisms from its analytical review regarding propagating failures in the PRA model due to bus duct failures. Based on the results, the team decided to use the walkdown evaluation as the basis for the change in risk.

To implement this approach, additional analysis was performed using a multiplicative factor developed by the staff to adjust the scenario risk for the remaining forty-one scenarios that relied solely on the licensee's drawing review analysis and were not walked down by the staff. As discussed earlier, the staff concluded that the risk for remaining 41 scenarios could have been underestimated based only on the drawing review. To develop the multiplication factor, the licensee's drawing review CCDP results for the nine scenarios the staff walked down were compared to the staff walkdown CCDP results, and an average difference between the two different types of CCDPs was established. On average, the comparison revealed the CCDP for the staff walkdown results was 4 times greater than the licensee's CCDP from the drawing review methodology. This factor of 4 is case specific and is only applicable to the staff's reference plant analysis discussed here, and thus should not be used for other plants or other analyses. This CCDP increase was driven by the additional targets included from the staff's walkdown observations. The staff multiplicative factor of 4 was then applied to the remaining licensee CCDP results.

Applying the multiplicative factor for the remaining scenarios should bound the non-conservatisms in the licensee's drawing review results (based on the staff's selection of risk significant walkdown scenarios). The change in LERF calculations used the same approach for the remaining scenarios with a multiplicative factor of 13 based on the same nine scenario comparisons for LERF.

VI. Bus Ducts Sensitivity Studies

For Reference Plant No. 1, a sensitivity was performed in which the ZOI was adjusted to the maximum value in the new methodology, based on the limiting plant power distribution configuration and fault clearing times. During the walkdowns, each of the identified scenarios were evaluated for the reference plant ZOI, as well as this maximum ZOI sensitivity of 5 ft. This expanded ZOI resulted in additional targets within the ZOI for the sensitivity analysis for each of the evaluated scenarios in the 4 kV and 13 kV switchgear rooms. For the 4 kV switchgear room case described earlier where the new methodology yielded 9 targets for a scenario within the ZOI, the sensitivity case for the same scenario yielded 29 targets, which illustrates the potential impact of the methodology for non-reference plants. The sensitivity study for Reference Plant No. 1 generally led to a larger CCDP than the reference plant due to the additional targets included within the ZOI. The results of the sensitivity studies will be reported in the next section according to CCDP sensitivities from configuration and ZOI changes, and according to fire modeling sensitivities. Finally, the sensitivity study results due to the ZOI, and the fire modeling changes, will also be reported in next section.

Unlike Reference Plant No. 1, no sensitivity study was performed for Reference Plant No. 2 because the long fault clearing times for Reference Plant No. 2 led to ZOIs on the upper end of those ZOIs allowed in the PRA HEAF methodology for any plant; and thus, a sensitivity study using the described method would have limited value.

VII. Bus Ducts Analysis Results

The results of the analysis for bus ducts are found below. Table 3 shows the results of the Reference Plant No. 1 and sensitivity study from that plant.

For Reference Plant No. 1, the risk change between the plant with the updated PRA HEAF model and NUREG/CR-6850 is a very small increase. Even though additional targets are captured in the new ZOI, the risk increase for this reference plant is small since those targets are not important to risk. Contrary to the results for the reference plant, the sensitivity study for Reference Plant No. 1 expanded the ZOI to 5 feet and captured important risk sequences resulting in a greater change in risk.

Table 3: Bus duct risk and change in risk for Reference Plant No. 1 (including sensitivities)

Description	CDF (new method)	CDF (NUREG/CR-6850 Supplement 1)	ΔCDF	LERF (new method)	LERF (NUREG/CR-6850 Supplement 1)	ΔLERF
Reference Plant No. 1	5.0E-07	4.6E-07	4.5E-08	3.6E-08	1.5E-08	2.0E-08
Sensitivity Study - changes to ZOI	9.4E-06	4.6E-07	8.9E-06	1.7E-07	1.5E-08	1.5E-07

Table 4 shows the results of the analyses for Reference Plant No. 2.

For Reference Plant No. 2, the risk change between the plant with the updated PRA HEAF model and NUREG/CR-6850 is a significant increase. The risk increase for the reference plant is largely attributed to the new large ZOIs, the use of the Linear Foot Method instead of the Transition Point Method for establishing scenarios, the change in methodology to place the origin of ZOI at the edge of the bus duct (instead of the center), and the importance of the additional cables captured in the ZOI. For the analysis using the multiplication factor, the change in risk for all PRA HEAF scenarios is approximately 50% larger than the risk increases for the nine walked down fire scenarios. No sensitivity studies were performed for Reference Plant No. 2 since the fault clearing times (FCTs) of the plant yielded the larger bus duct ZOIs; however, a multiplicative factor was applied to account for the difference in the staff's walkdown information and the information from the licensee's drawing review, including the non-conservatisms with regard to propagating failures in the PRA model.

Table 4: Bus Duct Risk and Change in Risk for Reference Plant No. 2

Description	CDF (new method)	CDF (NUREG/CR-6850 Supplement 1)	ΔCDF	LERF (new method)	LERF (NUREG/CR-6850 Supplement 1)	ΔLERF
Reference Plant No. 2 (9 scenarios that were walked down)	2.0E-05	4.5E-09	2.0E-05	1.0E-06	2.8E-10	1.0E-06
Reference Plant No. 2 (All scenarios, including multiplicative factors of 4 for CDF and 13 for LERF)	3.3E-05	1.4E-07	3.3E-05	3.7E-06	7.4E-09	3.7E-06

VIII. Conclusions

Several insights can be extracted from the assessments of the reference plants, including the sensitivity studies performed in this assessment.
First, the larger ZOIs for bus ducts addressed in the sensitivity study for Reference Plant No. 1 demonstrates that this larger ZOI can result in important risk increases. Reference Plant No. 1 used the Transition Point Method for its analysis, credited ERFBS as allowed in the new PRA HEAF methodology, and performed a highly resolved analysis, which leads the staff to believe that these results are realistic.

The results of Reference Plant No. 2 also highlight the importance of bus ducts in the new methodology. The risk increase associated with use of the new methodology for this analysis is significant. Reference Plant No. 2 had a long fault clearing time, which yielded larger ZOIs for that reference plant. Although Reference Plant No. 2 performed a more simplified analysis than Reference Plant No. 1, including using the Linear Foot Method for scenarios, the staff believes that the conclusion that bus ducts can be important with the new methodology is strengthened with the Reference Plant No. 2 results.

The sensitivity studies for switchgear cabinets for Reference Plant No. 1 demonstrate that the risk increase for larger ZOIs can be mitigated by several factors, including the plant-specific equipment configuration and use of ERFBS. It should be noted that at least one electrical raceway was generally in close proximity to the switchgear cabinets for Reference Plant No. 1, and therefore, the increase in ZOI in the sensitivity analysis is not important for this specific configuration. Also, fire modeling and configuration changes were not important to Reference Plant No. 1. However, it is expected that the new PRA HEAF methodology will have a more significant effect on bus ducts than switchgear.

The staff concludes that the new HEAF methodology could be important for switchgears, depending on configuration and other attributes. For different configurations, the new methodology may be important for switchgear fires. For example, a multi-cabinet switchgear fire will result from a longer fault clearing time, and such a fire will produce damage in a location in front of and above the switchgear cabinet, which is out of the switchgear ZOI of the previous methodology. Should important cables exist in this region, these new scenarios could produce a risk increase in the plant.

The final insight is not limited to HEAF but applies generally to fire PRA. The sensitivity study for switchgear for Reference Plant No. 2, which relies upon HEAF protective structures, proves that protecting important cabling from fire damage is important in mitigating HEAF risk, which is an overall conclusion, in general, for fire risk.