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RS-20-038

10 CFR 50.90

May 6, 2020

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

Subject: Response to Request for Additional Information for the License Amendment Request to Change Technical Specifications to Increase Allowable MSIV Leakage Rates and Revise Secondary Containment Surveillance

References:

1. Letter from P.R. Simpson (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, " Application to Increase Technical Specifications Allowable MSIV Leakage Rates, Revise Secondary Containment Surveillance Requirement, and Request Exemption to 10 CFR 50, Appendix J, Option B," dated October 21, 2019 (ML19294A304)

2. E-mail from R. Haskell (U.S. Nuclear Regulatory Commission) to R.L. Steinman (Exelon Generation Company, LLC), "FINAL: Dresden Units 2 & 3 Re: LAR Request for Additional Information to Modify Technical Specifications to Main Steam Isolation Valve Leakage Requirements (L-2019-LLA-0232)," dated March 27, 2020 (ML20094H029)

In the Reference 1 letter, Exelon Generation Company, LLC, (EGC) requested an amendment to Renewed Facility Operating License Nos. DPR-19 for Dresden Nuclear Power Station (DNPS), Unit 2 and DPR-25 for DNPS, Unit 3. The proposed change would increase the main steam isolation valve (MSIV) leakage rate limit for all four steam lines from 86 to 156 standard cubic feet per hour (scfh) for Unit 2 and from 86 to 218 scfh for Unit 3; credit the drywell spray system and add a new technical specification (TS) 3.6.2.6, "Drywell Spray"; and adopt Technical Specification Task Force Traveler (TSTF) 551, "Revise Secondary Containment Surveillance Requirements."

Attachment 1 contains the responses to the NRC request for additional information (RAI) questions in Reference 2. Attachment 2 provides the revised dose consequence calculation which supersedes the version provided in Reference 1.

EGC has reviewed the information supporting a finding of no significant hazards consideration, and the environmental consideration, that were previously provided to the NRC in Reference 1.

The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

EGC is notifying the State of Illinois of this response related to a previous application for a change to the operating license by sending a copy of this letter and its attachments to the designated State Official in accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b).

There are no regulatory commitments contained within this letter.

Should you have any questions concerning this letter, please contact Ms. Rebecca L. Steinman at (630) 657-2831.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 6th day of May 2020.

Respectfully,

Patrick R Simpson

Patrick Simpson
Sr. Manager Licensing
Exelon Generation Company, LLC

Attachments:
1. Response to NRC Request for Additional Information
2. DRE05-0048, Revision 6, Dresden Unit 2 & 3 Post-LOCA EAB, LPZ, and CR Dose - AST Analysis

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Dresden Nuclear Power Station
Illinois Emergency Management Agency – Division of Nuclear Safety

Regulatory Basis/Issue re: Spray Credit in the LOCA Model (ARCB-RAI-1a, -1b, -1c)

RG 1.183, Appendix A, Section 3.3 states, in part, that, "Reduction in airborne radioactivity in the containment by containment spray systems that have been designed and are maintained in accordance with Chapter 6.5.2 of the SRP (Ref. A-1) may be credited." Section 3.3 also states, in part, that, "The evaluation of the containment sprays should address areas within the primary containment that are not covered by the spray drops… The containment building atmosphere may be considered a single, well-mixed volume if the spray covers at least 90% of the volume and if adequate mixing of unsprayed compartments can be shown."

Enclosure B, "DRE05-0048, Revision 5, Dresden Units 2 & 3 Post-LOCA EAB, LPZ, and CR Dose – AST Analysis," Section 2.1.3, "Reduction In Airborne Activity Inside Containment," page 10 of the LAR, acknowledges that the drop size spectrum emitted by the spray nozzles is a key parameter in determining the fission product removal effectiveness and states that detailed drop size information for the spray nozzles could not be located. Section 5.3.2.12, "Drywell Spray Parameters," of the LAR provides a spray pump volumetric flow rate of 2,352 gallons per minute (gpm). Sprays would be initiated by manual action 10 minutes post-accident with an assumed termination at 4 hours and a fall height of 27' 5" (27.4 ft or 8.36 meters (m)).

The NRC staff examined the DNPS Updated Final Safety Analysis Report (UFSAR), Section 6.2.2, "Containment Heat Removal Systems," for evidence that the containment spray systems have been designed to provide a reduction in airborne activity consistent with SRP Section 6.5.2. Section 6.2.2.1 "Design Basis" of the DNPS UFSAR does not include information in the systems design basis related to removal or scrubbing of airborne radioisotopes. Although, Section 6.2.2.2 "System Design" does state that "Drywell sprays also remove post-LOCA airborne halogen and particulate fission products from the drywell atmosphere." The NRC staff notes that containment spray design requirements regarding the ability to reduce airborne radioactivity are discussed in Enclosure B, Section 2.1.3, "Reduction in Airborne Activity Inside Containment," in a comparison between SRP Section 6.5.2 review items.

The NRC staff examined the calculation of the particulate removal coefficient as documented in Enclosure B, Section 7.11, "Spray Calculations," p. 44 of Enclosure B (Calculation No. DRE05-0048). Based on this examination, it appears that the spray drop fall height of 27' 5" (27.4 ft or 8.36 meters (m)) was determined by the difference in elevations between the lower drywell spray header and the bottom of the drywell floor. This method does not appear to consider the obstructions that are present in the drywell, which could reduce the effective spray drop fall height. In addition, the analysis assumes a spray flow rate of 2,352 gpm. As with spray drop fall height, obstructions in the drywell could reduce the effective spray flow rate available for reducing airborne radioactivity. The NRC staff notes that both the unobstructed free fall height and spray flow rate are important factors in determining the ability of the containment sprays to effectively reduce airborne radioactivity. This issue related to reductions in spray fall height and spray flow rate resulting from impingement has been addressed in previous AST applications.

NUREG/CR-5966, "A Simplified Model of Aerosol Removal by Containment Sprays," Section H, (ADAMS Accession No. ML063480542) discusses the issue of obstructions interfering with the effectiveness of sprays as follows:

H. Droplet-Structure Interactions

Reactor containment buildings are not simple, open volumes. Immediately below spray headers there is often a substantial open space. But, eventually, falling drops begin to encounter equipment, structures and operating floor of the reactor. The drywells of Mark I containments are well-known for the congestion that can interfere in the free fall of water droplets.

The flooring in many reactor containments is grating or so-called "expanded sheet metal." Below the flooring are large volumes which, in a severe reactor accident, would hold aerosol-contaminated gas. It is of interest to know, then, if spray droplets, after hitting structures and the open flooring, would continue to sweep aerosols from the containment atmosphere. Certainly, in the case of the design basis analysis of iodine removal from containment atmospheres, it has been traditional to assume droplets are ineffective once they have hit a structure or the flooring.

ARCB-RAI-1a

Please describe how the design characteristics of the drywell spray system that effect its ability to provide a reduction in airborne activity, as discussed in Enclosure B, Section 2.1.3 of the LAR, will be incorporated into the DNPS UFSAR.

Response to ARCB-RAI-1a

The Dresden Nuclear Power Station (DNPS) Updated Final Safety Analysis Report (UFSAR) will be updated in accordance with 10 CFR 50.71(e) as part of implementation of the approved amendment. A summary of the proposed changes is provided below.

- Sections 6.2.2.1, 6.2.2.2, 6.3.2.2.2, and 6.3.3.4.1 along with Table 15.6-13 will be updated to include how drywell spray aids in removal of airborne fission products.
- Section 6.3.2.2.2 will be revised to remove statements about drywell spray not being necessary.
- Section 6.2.2.2 will be revised to summarize the design characteristics of the drywell spray system that impact its ability to provide a reduction in airborne activity. The level of detail will be similar to that included in the table in Section 2.1.3 of DRE05-0048 and includes meeting the requirements of ANS/ANSI 56.5 as it relates to calculation of airborne fission product removal following a LOCA such as geometry, physical features, flow characteristics, and mixing considerations as described in Standard Review Plan Section 6.5.2.

ARCB-RAI-1b

Please provide additional information to justify the use of the fall height of 27’ 5” (27.4 ft or 8.36 meters (m)) in the determination of the particulate removal coefficient, including an explanation of how obstructions present in the drywell were considered.

Response to ARCB RAI-1b

The spray removal coefficient used in Revision 5 of DRE05-0048 for a decontamination factor (DF) ≤ 50 is 15.0 hr^{-1}. This value was based in part on a spray fall height calculated as the difference between the lower spray header elevation (529'-9") and the bottom of drywell elevation (502'-4"). The calculated value of 15.0 hr^{-1} was input into the RADTRAD model.

DRE05-0048 Revision 6 Section 7.11 clarifies that the calculated spray removal coefficient is conservative as compared to the methodology used for Nine Mile Point Unit 1 (ADAMS Accession No. ML073230597) and Oyster Creek (ADAMS Accession No. ML050940234), which made specific reductions in the calculation based on obstructions in the drywell or blocked nozzles that may impede flow. In addition to the equipment installed in the drywell, these obstructions include two floors of grating between the spray headers and the bottom of the drywell: one between the two spray headers at elevation 537'-1.25" and one below the lower spray header at elevation 515'-5.75". In conjunction with the conservatisms in the flow rate discussed in the response to ARCB RAI-1c, the overall spray removal coefficient is conservative as compared to the methodology used for Nine Mile Point Unit 1 and Oyster Creek, which reduced the average spray header fall height to account for obstructions including grating and equipment. Since both elevations of spray nozzles (upper at 551'-2" and lower at 529'-9") will be available following a LOCA, the average fall height between these two elevations could have been used to calculate the fall height but using the lower header elevation provides some additional conservatism. DRE05-0048 Revision 6 is provided in Attachment 2 and confirms that the Revision 5 RADTRAD spray removal coefficient input of 15.0 hr^{-1} remains valid considering the margin available in the fall height and the flow rate as discussed in the response to ARCB RAI-1c.

ARCB-RAI-1c

Please provide additional information to justify use of the full spray flow rate of 2,352 gpm in the determination of the particulate removal coefficient, including an explanation of how obstructions present in the drywell were considered.

Response to ARCB RAI-1c

As described in the proposed amendment, the conservative drywell spray flow rate of 2,352 gallons per minute (gpm) is based on 160 drywell spray nozzles providing 14.7 gpm each. Each ring header contains 160 nozzles uniformly spaced around the drywell. The flow rate assumed in the analysis is based on only a single header providing flow even though both headers can be supplied simultaneously by a single Low Pressure Coolant Injection (LPCI) pump. UFSAR Section 6.2.1.3.3 states that the design basis drywell spray flow is 4,750 gpm and the wetwell spray flow rate is 250 gpm. TS Surveillance Requirement (SR) 3.6.2.3.2 specifies that each required LPCI pump develops a flow rate greater than or equal to 5000 gpm while operating in the suppression pool cooling mode, which is substantially greater than the 2,352 gpm assumed for the calculation of the spray removal coefficient.

Overall, the spray removal coefficient used in DRE05-0048 is more conservative than the methodology used for Oyster Creek and Nine Mile Point Unit 1 due to using a reduced flow rate as compared to the design flow. The Oyster Creek methodology (ADAMS Accession No.

ML050940234) uses the average spray header fall height with a 1/3 reduction for obstructions along with a 1/3 reduction in the spray flow rate. Section 7.11 of DRE05-0048 Revision 6 demonstrates the spray removal coefficient based on the lower spray header fall height and a flow rate of 2,352 gpm is conservative when compared to the Oyster Creek methodology with a 1/3 reduction of the average fall height and a 1/3 reduction of the design flow rate of 4,750 gpm (i.e., reduced to 3,167 gpm).

Therefore, the drywell spray flow rate of 2,352 gallons per minute (gpm) used in the determination of the particulate removal coefficient is conservative and sufficient to account for the effect of drywell obstructions and/or potential spray nozzle blockage.

Regulatory Basis/Issue re: Aerosol Removal in Steam Lines with Sprays Credited (ARCB-RAI-2)

RG 1.183, Appendix A, Section 6.3 states, in part, that the "Reduction in the amount of radioactivity upstream of the outboard MSIVs may be credited, but the amount of reduction is evaluated on an individual case basis." Section 6.5 states, in part, that the "Reduction in the MSIV releases due to deposition in the main steam piping downstream of the MSIVs may be credited if the components and piping systems used are capable of performing their safety function during and following a safe shutdown earthquake and that the amount allowed will be evaluated on an individual case basis."

SRP Section 15.0.1 states, in part, that "Independent calculations should be performed as necessary to conclude, with reasonable assurance, that the applicant’s analyses are acceptable."

Attachment 1, "Evaluation of Proposed Changes," page 16 of the LAR states, in part:

> The currently approved main steam line aerosol removal model (AEB 98-03) does not include deposition by thermophoresis, diffusiophoresis, or flow irregularities.
>
> It is reasonable to consider the use of aerosol removal by sprays and aerosol removal in the main steam lines as independent removal mechanisms because they rely on different physical mechanisms except for diffusiophoresis. However, neither the spray model nor the MSL [main steam line] aerosol removal model consider removal by diffusiophoresis making the model conservative with respect to the experimental data.

Enclosure B, Section 5.8, "Changes Between Revision 4 and Revision 5," page 31 of the LAR, states, in part, that the "Drywell spray meets the requirements in NUREG-0800 Section 6.5.2 as demonstrated in Section 2.1.3 and has been previously accepted for Nine Mile Point Units 1 and 2, Oyster Creek, and Hatch."

The NRC staff notes that the AST applications cited above with credited drywell sprays were previously accepted on an individual case basis that included considerations on the particular design and under different conditions, such as credit applied for the condenser, lower MSIV leakage rates and decontamination factors, and a "penalty" applied for sedimentation (aerosol settling) to account for the recognition that the sprays preferentially remove large particles in primary containment. For example, in the Nine Mile Point 2 (NMP2) AST application, an aerosol settling velocity of 0.000066 m/s (compared to an aerosol settling velocity of 0.00081 m/s proposed in the DNPS LAR) was applied to reflect the spray removal credited in the NMP2 containment, and to address the NRC staff's concerns regarding the use of AEB-98-03. In its approval of the NMP2 application, the NRC staff found this value to be sufficiently conservative (along with other conservatisms) to reflect the effectiveness of the sprays.

NUREG/CR-5966 provides details on how sprays impact aerosols. This guidance document indicates that the sprays shift the sizes of aerosols in the containment towards those that are removed most slowly (the mean aerosol size decreases as the sprays operate). Estimates of aerosol deposition in the steam lines is determined using, in part, Equation 5 of AEB-98-03. Equation 5 provides the aerosol settling (and thus the aerosol deposition) in the steam line and indicates that the aerosol settling is proportional to the square of the diameter of the aerosols. Because the sprays shift the size of the aerosols to smaller sizes, the aerosols settling in the steam lines would decrease due to these smaller diameter aerosols.

The LAR proposes to credit sprays to remove fission products following a design basis LOCA, but it does not appear to adjust the MSL aerosol deposition from the impact of the sprays in the revised LOCA radiological analysis. Enclosure B, Section 7.4, "Rate Constant (λ_s) for Aerosol Settling in Main Steam Piping," Table 2 page 56 of the LAR shows the same 40th percentile aerosol settling velocity 9.56 ft/hr (0.000804 m/s) in all control volumes as used in the CLB with no credit for sprays. This is non-conservative when applying credit for sprays and considering the additional conservatism in the CLB, which would be removed through this LAR. The sprays change the aerosols on a time-dependent basis through each control volume that impacts its removal in the MSLs.

From the NRC staff's examination of the submitted information, it appears that the revised LOCA radiological analysis considers the aerosol removal by sprays and aerosol removal in the MSLs as independent removal mechanisms. The NRC staff notes that regardless of the specific removal mechanisms involved, larger aerosol particles in the containment atmosphere will be the preferentially removed, thereby making subsequent removal by deposition in downstream piping more challenging.

ARCB-RAI-2

Please provide justification as to why the proposed aerosol settling velocity and model to credit sprays in the DNPS design is consistent with Reg 1.183, Revision 0. Please include sufficient technical detail to enable the NRC staff to perform an independent assessment on this aerosol settling velocity and model, and the subsequent calculated control room and offsite doses.

Response to ARCB RAI-2

The DNPS current licensing basis (CLB) includes a number of specific conservatisms included in the LOCA dose consequence assessment that were credited as part of the approval of the Alternate Source Term (AST) amendment, whose design basis was provided by DRE05-0048. Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Plants" defines AST as a fission product release from the reactor core into the containment (more specifically in the drywell for BWRs). As indicated in Appendix A to RG 1.183, Regulatory Position 6.1, the NRC accepts the practice of treating fission product concentration in the drywell as representative of that available for release via the MSIV leakage pathway.

Both the CLB and the revised LOCA AST dose analysis assume the drywell is the source of MSIV leakage in accordance with the NRC guidance summarized above, so it is appropriate to consider radionuclide removal mechanisms in the drywell before release via the MSIV leakage pathway. A sensitivity analysis was performed to evaluate the impact of sprays on the aerosol settling velocity and to identify other inputs with well-defined uncertainty or conservatism that could be used to offset the uncertainty associated with the current aerosol deposition model. This sensitivity analysis concludes that there is sufficient conservatism to offset the uncertainty introduced by the drywell spray effects on the aerosol deposition model without credit for holdup and aerosol deposition in the condenser.

In order to address the reduced aerosol removal rates due to drywell spray, sensitivity cases on various conservatisms were evaluated. Some of the inherent conservatisms in the AST LOCA model are listed below. This list is not a complete list of every conservatism that may be present. However, these conservatisms are ones that are reasonable to define and model deterministically.

- Credit full drywell spray lambdas (not included in this study)
- Credit for plateout and deposition in drywell (not included in this study)
- Inclusion of all four main steam lines for holdup and deposition
- Outboard main steam line piping holdup and deposition
- Increased spray duration
- More realistic control room operator breathing rate
- Aerosol impaction on first closed MSIV
- Condenser holdup and deposition

There are other significant conservatisms associated with the AST LOCA model. For example, control room atmospheric dispersion factors have readily defined uncertainty distributions and if incorporated would demonstrate there is a substantial amount of margin in the input parameters. However, for simplicity, the distribution of potential values for such input parameters were not evaluated in the sensitivity study. The modeling changes associated with the sensitivity analysis are described as follows.

<u>Nodalization Changes</u>

The sensitivity analysis modified the nodalization of the main steam line to overcome limitations of the RADTRAD code. The Unit 2 DRE05-0048 nodalization was modified to separately model each of the four main steam lines as shown in Figure RAI-2b. As a result, each sensitivity case includes four RADTRAD models, one for each line with three well-mixed nodes per line.

<u>Outboard Main Steam Line Piping</u>

The outboard steam lines up to the turbine stop valves at DNPS are seismically qualified, so including holdup and deposition in this piping as part of the outboard compartment (third well-mixed node in Figure RAI-2b) conforms with the requirements of RG 1.183. Each sensitivity case includes the nodes representing the outboard main steam line piping.

Impact of Spray on Aerosol Settling Velocity

A simplified model was developed using first principles as identified in NUREG/CR-5966, "A Simplified Model of Aerosol Removal by Containment Sprays." Specifically, the ordinary differential equation shown on page 1 of NUREG/CR-5966 was solved to provide an analytical solution of the suspended aerosol mass in the drywell. The spray removal rate in this simplified model is the same as that identified in DRE05-0048 Section 2.1.3 and RG 1.183, Appendix A, Section 3.3. Since sprays will remove aerosols at different rates depending on their particle size, the spray removal rate is adjusted by collection efficiency variation as provided in Figure 19 of NUREG/CR-5966. The suspended aerosol mass was solved from the beginning of the accident through the termination of the sprays for 20 distinct particle size groups. The mass of particles in each group is defined by the probability distribution associated with the source distribution.

The size distribution of the particles released from the fuel was assumed to be a log-normal with 2 micron Aerodynamic Mass Median Diameter (AMMD) (0.473 micron geometric mean diameter) with a Geometric Standard Deviation (GSD) of 2. The aerosol mass was calculated for each group independently with no consideration of particles interacting with one another. Therefore, agglomeration is not accounted for, and this conservatism will artificially and permanently lower the average particle size as large particles are removed and not replaced. The result is a much smaller gravitational settling and spray removal rate. Table RAI-2a summarizes the results of the 20-group particle size distribution in the drywell. Figure RAI-2a visually illustrates the time-dependent nature of the aerosol particle size distribution. As shown in Figure RAI-2a, the effect of the drywell spray in reducing the size of the particles is accounted for in the model.

These particle size and settling velocity distributions were then used to recalculate the aerosol removal rate using the equation provided in Section 7.4.1 of DRE05-0048. The resulting aerosol removal factors are summarized in Table RAI-2d.

Base Sensitivity Case

The starting point for the sensitivity analysis is the bounding DRE05-0048 Revision 6 Unit 2 RADTRAD model including the parameter changes described above plus two other changes for consistency with the response to ARCB-RAI-4: 1) evaluation of an 8 hour spray duration and 2) removal of deposition credit in a steam line between the RPV nozzle and an inboard MSIV.

Note that although this sensitivity analysis uses the Unit 2 RADTRAD model inputs, the relative change in the calculated doses are expected to be similar for the Unit 3 RADTRAD model inputs.

The doses associated with the described model changes are represented by the "Base Sensitivity Case" (S0) row in Table RAI-2e. Seven additional sensitivity cases (S1 through S7) were run considering the one or more of the additional sensitivity parameter changes described in the following three subsections to determine their relative impact on the calculated control room and offsite doses.

In summary, the S0 case includes the following changes from the DRE05-0048 Revision 6 Unit 2 model, which are maintained without alteration in sensitivity cases S1 through S7.

- Inclusion of all four main steam lines for holdup and deposition and associated nodalization changes shown in Figure RAI-2a
- Inclusion of outboard main steam line piping holdup and deposition
- Revised aerosol removal factors that consider the impact of sprays
- Removal of deposition upstream of an inboard MSIV (see ARCB-RAI-4 response)
- Increased spray duration from 4 hours to 8 hours (see ARCB-RAI-4 response)

<u>Breathing Rate Sensitivity</u>

DRE05-0048 uses a constant control room operator breathing rate consistent with the value given in RG 1.183. However, a review of breathing rate data in Table 6-17 of EPA/600/R-09/052F, "Exposure Factors Handbook: 2011 Edition" indicates that the RG 1.183 value is conservative. To evaluate the sensitivity of the dose result to the assumed breathing rate, the rate is adjusted. For the first 2 hours, the CLB breathing rate assumption from RG 1.183 was retained for conservatism. However, after 2 hours the breathing rate was reduced using the 95^{th} percentile data for light intensity work typical of control room operator activity from the EPA handbook (3.28E-4 m^3/sec from 2 to 12 hours and 3.06E-4 m^3/sec from 12 hours to 30 days).

<u>Aerosol MSIV Impaction Sensitivity</u>

The Nine Mile Point Unit 1 AST LOCA licensing basis described in H21C092 (ADAMS Accession No. ML070110240) credits the phenomenon of impaction at the first closed MSIV. In this scenario, some of the travelling aerosol particles will be deposited on the MSIV valve sealing surface as the aerosols entrained with the carrier gas pass through the closed MSIV. Nine Mile Point Unit 1 conservatively determined this impaction results in a Decontamination Factor (DF) of 2, which is modeled as a 50% filter in the transfer pathway through the first closed MSIV. This reduction is only accounted for once in each main steam line. This approach was previously approved for Nine Mile Point Unit 1 (ADAMS Accession No. ML073230597) and is reasonable given that the aerosol settling rates calculated in this sensitivity analysis are conservatively low and are even lower than those used in the Nine Mile Point Unit 1 analysis.

<u>Condenser Holdup and Aerosol Deposition Sensitivity</u>

A further conservatism that is not currently modeled in DRE05-0048 is the holdup and aerosol deposition provided by the condenser. Depending on the event scenario, multiple pathways could exist to route activity to the condenser including the drain lines and the turbine itself. In this sensitivity, the leakage is assumed to travel to the condenser through the drain lines from the main steam line piping between the MSIVs. This conservatively neglects any holdup and deposition in the outboard main steam line piping. Modelling the release to the condenser from the piping between the MSIV is consistent with other plants in the Exelon fleet (e.g., LaSalle and

Limerick). Operating experience associated with the North Anna earthquake and post-Fukushima evaluations have shown that components and piping systems typically used in this release path are sufficiently rugged to ensure they are capable of performing some level of radioactivity removal during and following a safe shutdown earthquake (SSE). Thus, it is reasonable to assume that the condenser pathway could be made available for mitigating the consequences of MSIV leakage.

The data used to calculate the steam line and condenser aerosol removal rates are provided in Tables RAI-2b and 2c and are essentially duplicated from DRE05-0048 Sections 7.2 and 7.3.

Individual Sensitivity Cases and Results

A total of seven sensitivity cases (S1 through S7) were performed by varying the Base Sensitivity Case (S0). As Table RAI-2e indicates, these sensitivity cases are various combinations of the three parameter sensitivities described above (breathing rate, MSIV impaction, and condenser holdup). The results are summarized in Table RAI-2e. The table also contains the overall Unit 2 dose results from Table 8-3 of DRE05-0048 Revision 6 and the corresponding Attachment 12.10 Unit 2 results (substitute the Attachment 12.10 MSIV leakage pathway results into Table 8-3 to get the overall dose values displayed in Table RAI-2e) for comparison.

As expected, the conservative modelling of the drywell spray impact on the aerosol removal in the main steam lines without adjusting any other sensitivity parameter in the RADTRAD inputs results in an increased Control Room dose.

The increase in dose is due to the conservative modeling approach taken to incorporate the effects of the drywell sprays. In order to analyze the effect of drywell spray, simplifications of the aerosol physics were made. As a result, the calculated lambdas are very low compared to values typically seen with high fidelity computer codes. For example, as discussed briefly before, the Nine Mile Point Unit 1 AST licensing basis calculation (ADAMS Accession No. ML070110240) employed a higher fidelity approach and, in general, calculated higher steam line lambdas. As a result, the overall decontamination factor for aerosols in this sensitivity analysis is conservatively lower than what could typically be afforded by a higher fidelity approach. Given this larger conservatism it is not unusual or unexpected that the calculated doses increased substantially, even over the 10 CFR 50.67 limits. This under estimation of the aerosol settling also justifies the usage of the aerosol impaction, which is consistent with the Nine Mile Point Unit 1 approval.

Only considering the sensitivity of the calculated dose consequence to a limited number of RADTRAD inputs allows demonstration of margin between the site-specific dose and the acceptance criteria limits. For example, considering the combined effect of the S0 changes and impaction (S2), the calculated doses remain below the 10 CFR 50.67 regulatory limits. In fact, Table RAI-2e demonstrates that every combination of sensitive parameters that includes either impaction or condenser credit results in calculated doses below the Unit 2 doses in DRE05-0048 Revision 6.

As described above, there are other inherent conservatisms included in the dose consequence assessment, such as those associated with the atmospheric dispersion factors and source term, that are not included in the evaluated sensitivity cases. Taking these additional inherent conservatisms into account would further offset the impact of the revised aerosol removal factors. The availability of these margins provides reasonable assurance that the applicable dose limits would not be exceeded.

The sensitivity results also demonstrate that the condenser is very effective at substantially reducing the dose consequences. Even if this capability is limited to a small fraction of the reduction shown in the sensitivity analyses in Table RAI-2e, the condenser credit has the capability to ensure post-LOCA releases remain well within the 10 CFR 50.67 limits.

In conclusion, Regulatory Guide 1.183 Revision 0 does not provide detailed guidance directing the use of a specific aerosol deposition model. The sensitivity analysis results described in this RAI response confirm adequate margin is present in the DRE05-0048 Revision 6 calculated doses when using existing AEB 98-03 aerosol deposition with a 40th percentile settling velocity including drywell spray. Therefore, the proposed aerosol settling velocity and spray model is consistent with Regulatory Guide 1.183 Revision 0.

Table RAI-2a: Drywell Particle Size Distributions

Group	D_a (micron)	Settling Velocity (m/s)	Cumulative Probability		
			No Spray	With Spray	
			Release	During Release	After Release
1	0.091	2.33E-07	0.0001	0.00022	0.00027
2	0.106	3.14E-07	0.003	0.00672	0.00805
3	0.326	3.00E-06	0.01	0.02229	0.02646
4	0.409	4.71E-06	0.03	0.06648	0.07823
5	0.552	8.61E-06	0.05	0.11034	0.12900
6	0.642	1.16E-05	0.08	0.17574	0.20404
7	0.750	1.59E-05	0.1	0.21902	0.25309
8	0.850	2.04E-05	0.15	0.32675	0.37441
9	0.984	2.73E-05	0.2	0.43368	0.49339
10	1.140	3.67E-05	0.25	0.53994	0.61048
11	1.268	4.53E-05	0.3	0.64516	0.72460
12	1.410	5.61E-05	0.35	0.74960	0.83655
13	1.552	6.79E-05	0.4	0.85226	0.94361
14	1.683	7.99E-05	0.45	0.93218	0.99815
15	1.840	9.55E-05	0.5	0.96127	1.00000
16	1.997	1.13E-04	0.6	0.97445	1.00000
17	2.371	1.59E-04	0.7	0.98084	1.00000
18	2.897	2.37E-04	0.8	0.98723	1.00000
19	3.600	3.66E-04	0.9	0.99361	1.00000
20	4.859	6.66E-04	1	1.00000	1.00000

Figure RAI-2a: Time-Dependent Aerosol Particle Size Distribution

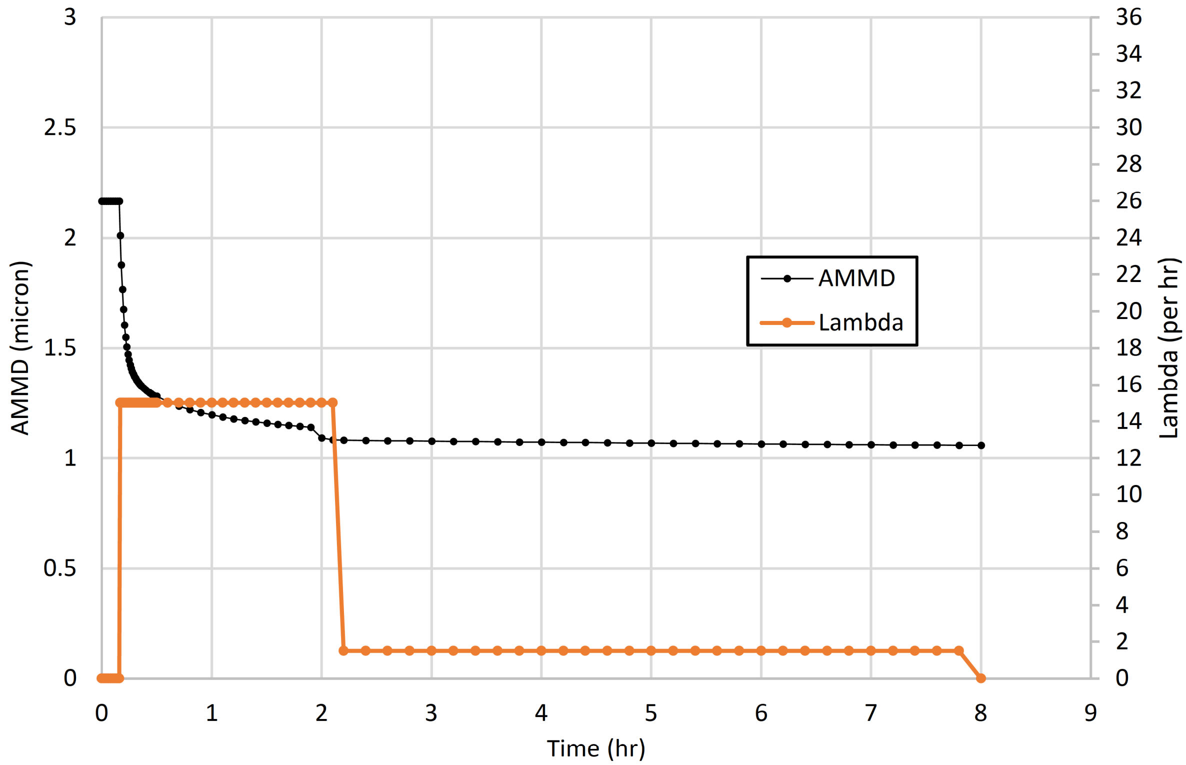

Figure RAI-2b: Modified Nodalization for a Single Steam Line

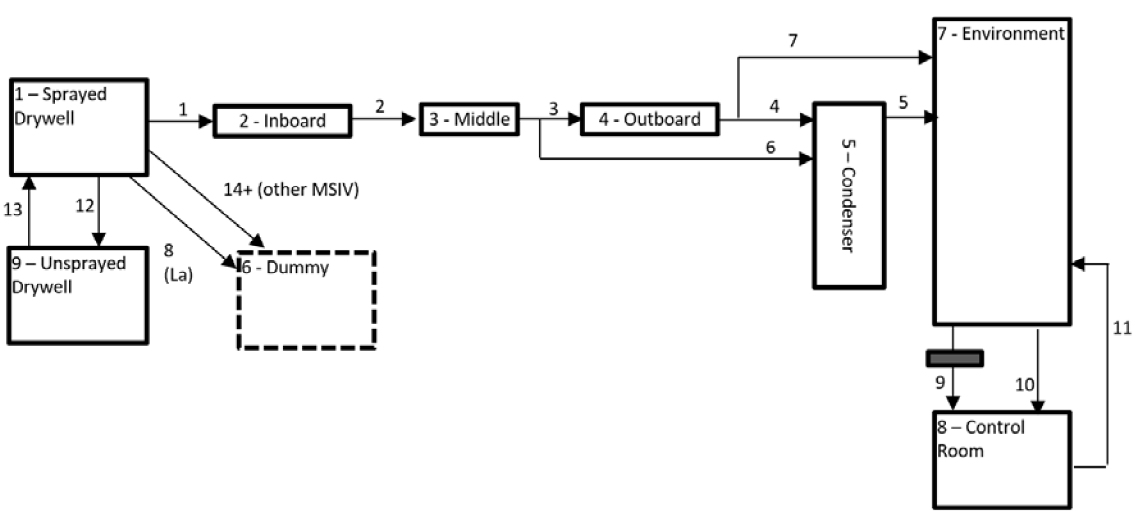

Table RAI-2b: Steam Line and Condenser Geometry Data

Steam Line "A"			
Parameter*	Inboard	Between	Outboard
A (ft^2)	34.54	40.83	63.58
V (ft^3)	152.96	47.28	175.39
Steam Line "B"			
Parameter*	Inboard	Between	Outboard
A (ft^2)	34.54	40.83	63.58
V (ft^3)	152.96	47.28	175.39
Steam Line "C"			
Parameter*	Inboard	Between	Outboard
A (ft^2)	42.33	42.41	63.58
V (ft^3)	163.75	49.11	175.39
Steam Line "D"			
Parameter*	Inboard	Between	Outboard
A (ft^2)	34.52	42.41	63.58
V (ft^3)	152.93	49.11	175.39

Parameter*	Condenser
A (ft^2)	2695
V (ft^3)	136695

* A is the horizontal settling area of the inside of the pipe and V is the volume.

Table RAI-2c: Steam Line Leak Rate Data

Inboard Flow Rate Q (cfh)				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	3.57E+01	1.78E+01	1.78E+01	1.78E+01
spray initiation* to 2 hr	3.57E+01	1.78E+01	1.78E+01	1.78E+01
2 hr to 24 hr	2.10E+01	1.05E+01	1.05E+01	1.05E+01
24 hr+	1.05E+01	5.22E+00	5.22E+00	5.22E+00

Between Flow Rate Q (cfh)				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	3.57E+01	5.00E+01	5.00E+01	5.00E+01
spray initiation* to 2 hr	3.57E+01	5.00E+01	5.00E+01	5.00E+01
2 hr to 24 hr	2.10E+01	2.94E+01	2.94E+01	2.94E+01
24 hr+	1.05E+01	1.47E+01	1.47E+01	1.47E+01

Outboard Flow Rate Q (cfh)				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	1.00E+02	5.00E+01	5.00E+01	5.00E+01
spray initiation* to 2 hr	1.00E+02	5.00E+01	5.00E+01	5.00E+01
2 hr to 24 hr	5.87E+01	2.94E+01	2.94E+01	2.94E+01
24 hr+	2.94E+01	1.47E+01	1.47E+01	1.47E+01

* Drywell sprays are initiated 10 minutes after the event.

Table RAI-2d: Steam Line and Condenser Aerosol Removal Factors

Inboard Aerosol Deposition λ_s (hr^{-1})				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	n/a	0.211	0.230	0.211
spray initiation* to 2 hr	n/a	0.091	0.102	0.091
2 hr to 24 hr	n/a	0.074	0.082	0.074
24 hr+	n/a	0.067	0.074	0.067

Between Aerosol Deposition λ_s (hr^{-1})				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	0.917	0.511	0.484	0.507
spray initiation* to 2 hr	0.375	0.300	0.291	0.299
2 hr to 24 hr	0.302	0.239	0.231	0.238
24 hr+	0.276	0.196	0.188	0.195

Outboard Aerosol Deposition λ_s (hr^{-1})				
	Steam Lines			
Time Period	"A"	"B"	"C"	"D"
0 to spray initiation*	0.254	0.143	0.136	0.142
spray initiation* to 2 hr	0.138	0.105	0.102	0.105
2 hr to 24 hr	0.111	0.081	0.078	0.080
24 hr+	0.093	0.059	0.057	0.059

Time Period	Condenser λ_s (hr^{-1})
0 to spray initiation*	0.00819
spray initiation* to 2 hr	0.00517
2 hr to 24 hr	0.00410
24 hr+	0.00333

* Drywell sprays are initiated 10 minutes after the event.

Table RAI-2e: Sensitivity Study Results

Case		Condenser Credit	Breathing Rate	MSIV Impaction	Dose (rem TEDE)		
Id	Description				Control Room	EAB	LPZ
N/A	DRE05-0048 Table 8-3				4.86	2.07	0.91
N/A	DRE05-0048 Attachment 12.10				4.69	2.24	0.91
S0	Base Sensitivity Case				5.80	1.88	0.80
S1	Sensitivity 1		X		5.49	1.88	0.80
S2	Sensitivity 2			X	4.02	1.29	0.70
S7	Sensitivity 7		X	X	3.83	1.29	0.70
S3	Sensitivity 3	X			1.00	0.09	0.37
S4	Sensitivity 4	X	X		0.99	0.09	0.37
S5	Sensitivity 5	X		X	0.99	0.09	0.37
S6	Sensitivity 6	X	X	X	0.98	0.09	0.37

Regulatory Basis/Issue re: Transport of Radioactivity in the Drywell (ARCB-RAI-3)

RG 1.183, Appendix A, Section 3.1 states, in part:

> The radioactivity released from the fuel should be assumed to mix instantaneously and homogeneously throughout the free air volume of the primary containment in PWRs or the drywell in BWRs as it is released. This distribution should be adjusted if there are internal compartments that have limited ventilation exchange. The suppression pool free air volume may be included provided there is a mechanism to ensure mixing between the drywell to the wetwell.

Section 3.3 states, in part, that the "Evaluation of the containment sprays should address areas within the primary containment that are not covered by the spray drops." Section 6.1 states, in part, that the "activity available for release via MSIV leakage should be assumed to be that activity determined to be in the drywell for evaluating containment leakage."

Enclosure B, Section 2.1.2, "Transport in Primary Containment," page 9 of the LAR states, in part, that "For calculating the MSIV leakage flow rates between the drywell and the environment, the flow rate analysis is based on the total drywell volume during the first 2 hours of the LOCA, and then the combined drywell plus suppression chamber air volume after 2 hours, at which time the containment volume is expected to become well mixed following the restoration of core cooling."

Section 7.2.3, "MSIV Leakage During 2-24 hrs," page 36 of the LAR states, in part:

> Two hours after a LOCA, the drywell and suppression chamber volumes are expected to reach an equilibrium condition and the post-LOCA activity is expected to be homogeneously distributed between these volumes. The homogeneous mixing in the primary containment will decrease the activity concentration and therefore decrease the activity release rate through the MSIVs. To model the effect of this mixing, the MSIV flow rate used in the RADTRAD model is decreased by calculating a new leak rate based on the combined volumes of the drywell and suppression chamber.

Enclosure B, Section 2.1.2, "Transport in Primary Containment," page 8 of the LAR references Table 2 of AEB-98-03, which shows the dependence of radiological consequences on containment mixing conditions for the Perry Nuclear Power Plant. However, the Perry Nuclear Power Plant has a Mark III containment, which is significantly different than the Mark I containment at DNPS. These differences are not addressed in the proposed LAR.

The LAR proposes a significant change to the CLB transport modeling in primary containment by adding a compartment in the drywell to credit sprays and by crediting transport between the sprayed and unsprayed portions of the drywell. As a result, it is not clear that the assumption of equilibrium conditions at 2 hours exists between drywell and wetwell volumes. The proposed credit for sprays and the addition of the sprayed compartment decreases the activity in the drywell from the activity in the CLB and, therefore, will create a difference in the modeled activity in the sprayed drywell compartment as compared to the activity in the wetwell.

From the NRC staff's examination of Enclosure B, RADTRAD Output Files related to all three fuel types, it appears that the I-131 activity concentrations for the sprayed and unsprayed portions of the drywell do not reach equilibrium conditions until after 5 hours. This is beyond the time when drywell sprays are assumed to terminate at 4 hours post-accident for aerosol removal.

ARCB-RAI-3

Please provide additional information to explain why the high flow rates necessary to create equilibrium conditions between the drywell and wetwell would exist for the time period from 2 hours in the DNPS design.

Response to ARCB RAI-3

The assumption of equilibrium conditions between the drywell and wetwell is based on the steaming / condensing phenomenon associated with the restoration of core cooling at 2 hours. Although the wetwell is not modeled separately in the containment leakage and MSIV leakage RADTRAD cases, the wetwell volume is used in the main steam line flow rate calculations starting at 2 hours. Crediting drywell sprays for airborne fission product removal does not change this well mixed assumption.

The RADTRAD modeling is based on separating the unsprayed and sprayed drywell volumes because the drywell sprays are assumed to cover less than 90% of the drywell volume (see Regulatory Guide 1.183 Section 3.3). The RADTRAD modeling is intended to conservatively concentrate the airborne activity in the sprayed volume directly connected to the MSIV leakage pathways. This modeling technique is intended to maximize dose, not to accurately reflect the thermal-hydraulic conditions that would be present in the drywell. The discrepancy noted in the I-131 inventory between the sprayed and unsprayed volumes is unrelated to the well mixed assumption between the drywell and wetwell at 2 hours and is instead a byproduct of this conservative modeling technique inside the drywell.

To demonstrate that the modeling technique is conservative, a RADTRAD sensitivity case that greatly increases the flow rate between the sprayed and unsprayed drywell volumes at 2 hours is added as Attachment 12.9 to DRE05-0048 Revision 6 (See Attachment 2). This sensitivity case is based on the main steam line leakage case with the elemental iodine removal corrected as discussed in the response to ARCB-RAI-5. As expected, the large flow rate between the sprayed and unsprayed drywell volumes leads to decreased control room and offsite doses because more activity is being "diluted" by the unsprayed volume rather than being released through the MSIV leakage pathway.

Regulatory Basis/Issue re: Recirculation Line Rupture Vs Main Steam Line Rupture (ARCB-RAI-4)

SRP 15.0.1 Section III, 6.a., Section III Review Procedures states, in part, that "The sequence of accident events described by the licensee should be reviewed to ensure that the analyzed case that maximizes the radioactivity release has been considered."

In the LAR, Section 3.1, Aerosol Deposition in Horizontal Main Steam Lines Upstream of Inboard MSIV, the licensee states:

> The CLB analysis assumes that the horizontal MSL volume upstream of the failed inboard MSIV does not remove aerosols and only credits removal in portions of the MSL piping upstream of two intact inboard MSIVs. This assumption is based on a postulated main steam line pipe break just upstream of a MSIV. The initiating event is a large pipe break of a recirculation suction line with a failure of the inboard MSIV of a steam line to close. Multiple simultaneous pipe breaks are not considered as part of the design basis containment analysis; as a result, the LOCA dose analysis does not consider multiple simultaneous pipe breaks.

The licensee addressed this issue in Section 2.3.4, Recirculation Line Rupture Vs Main Steam Line Rupture, which states that because the recirculation presents a greater challenge to selective aspects of facility design, a recirculation line rupture is the limiting event with respect to radiological consequences. The NRC notes that while it is true that mechanistically a recirculation line break would be expected to present a more significant challenge to the reactor core than a ruptured MSL, the source term used to satisfy § 50.67 is a deterministic source term imposed on the facility to test the ability of systems to mitigate the releases sufficiently to meet predetermined acceptance criteria. Assuming a ruptured MSL in the evaluation of the acceptability of MSIV leakage is consistent with the guidance from RG 1.183 that assumptions should be selected with the objective of maximizing the postulated radiological consequences.

The NRC staff notes that Calculation No. DRE05-0048 Rev. 5, Section 2.3.4 includes a discussion of the basis for assuming a recirculation line rupture instead of ruptured MSL in the assessment of MSIV leakage stating that:

> Although postulating a main steam line break in one steam line inside the drywell would maximize the dose contribution from the MSIV leakage, the steam line break is not a credible event during a LOCA, since the ASME Category 1 main steam piping is designed to withstand the SSE.

The NRC staff notes that the integrity of the entire reactor coolant pressure boundary must comply with SSE requirements to satisfy Appendix A to Part 100. The assumption of a ruptured MSL for evaluating MSIV leakage in conjunction with a deterministic source does not imply a ruptured MSL in addition to a recirculation line rupture. Rather the evaluation assumes a ruptured MSL (with a deterministic source term) to maximize the dose contribution from MSIV leakage.

ARCB-RAI-4

Please provide additional information to justify that assuming a recirculation line rupture instead of a main steam line rupture is consistent with the guidance from RG 1.183 that assumptions should be selected with the objective of maximizing the postulated radiological consequences.

Response to ARCB-RAI-4

The original accepted DNPS AST design basis included modeling of MSIV leakage through three main steam lines, with the shortest of those steam lines assuming a failure of the inboard main steam isolation valve to close. The RADTRAD modeling of this steam line therefore included a single volume consisting of the entire volume between the RPV nozzle and the outboard MSIV. In the original AST design basis, holdup of leakage was credited in this entire volume while only the volume between the MSIVs was credited for elemental and particulate deposition. The proposed amendment changed the RADTRAD modeling to credit deposition in the volume between the RPV nozzle and the outboard MSIV.

To address this RAI, the RADTRAD model is reverted to reflect the original AST assumptions, which is holdup in the entire volume between the RPV nozzle and the outboard MSIVs and deposition only in the volume between the MSIVs. To counteract this modeling change, the duration that the drywell spray is removing particulates in containment is increased from 4 hours to 8 hours. Per Assumption 4.6.8 of DRE05-0048, drywell sprays can continue post LOCA until the drywell pressure is reduced to below 6 psig, which is to ensure adequate drywell pressure to operate the LPCI pumps (i.e., net positive suction head available, NPSHa). Per the containment analysis that assumes drywell sprays operational, drywell and wetwell pressure remains above 6 psig until at least 38,597 seconds (10.7 hours) following the LOCA. The main body assumes the sprays shut off at 4 hours for conservatism, but for the purposes of this sensitivity, a spray shut off time of 8 hours is modeled. An 8 hour shutoff time remains conservative with respect to the containment analysis. No other model changes are made in this sensitivity such as credit for deposition and holdup in the 4th available main steam line.

As shown in Attachment 12.10 of Revision 6 of DRE05-0048, the limiting control room dose RADTRAD model and limiting EAB and LPZ RADTRAD dose model are modified as described above and the results show that the MSIV leakage contribution to control room dose is reduced to 3.75 rem as compared to 3.91 rem listed in Table 8-4 of DRE05-0048. MSIV leakage pathway contributions to the offsite doses for the Unit 3 case show a slight increase from 3.57 rem to 3.84 rem for the Exclusion Area Boundary (EAB) and from 0.879 rem to 0.883 rem for the Low Population Zone (LPZ). However, the overall doses remain below 10 CFR 50.67 limits. Therefore, it is concluded that the conservatism associated with limiting the drywell spray to a 4-hour duration when up to 10 hours of spray could be justified assures adequate margin to compensates for any non-conservatism associated with the recirculation break assumption used in DRE05-0048 Revision 6.

Regulatory Basis/Issue re: Crediting Iodine Removal in Previously Not Credited Steam Line Piping (ARCB-RAI-5)

RG 1.183, Appendix A, Section 6.3 states, in part, that the "Reduction of the amount of released radioactivity by deposition and plateout on steam system piping upstream of the outboard MSIVs may be credited, but the amount of reduction in concentration allowed will be evaluated on an individual case basis."

Table 3-1, "Summary of LOCA Analysis Revisions," of the LAR presents changes to the current licensing basis (CLB) for the revised LOCA radiological analysis. One of the proposed changes involves a change to the elemental iodine removal credited in the main steam lines (MSLs).

The CLB credits elemental iodine removal in the two intact steam lines but not in the line with the failed MSIV. The LAR proposes to substantially increase the elemental iodine removal in the MSLs between the reactor pressure vessel (RPV) and the outboard MSIV by crediting elemental removal in the line with the assumed failed MSIV and by increasing the removal in the previously credited volumes from 50 percent to up to about 98 percent.

From the NRC staff's examination of Enclosure B Section 7.3, "Main Steam Line Volumes & Surface Area for Plateout of Activity," page 38 of the LAR, some discrepancies in the tabulated data and parameter values applied as parameters in the revised LOCA radiological analysis were observed:

Table 40, "MSIV Failed & Intact Steam Line Volumes for Elemental Iodine Removal Efficiency Calculation," page 97. The calculated volume for "D" (Volume V4) given as "4.33 m^3" should be "4.64 m^3." The calculated volume of "E" (Volume V5) of "4.33 m^3" should be "1.39 m^3."

Table 46, "Elemental Iodine Deposition Rate - Intact Steam Line Volume V4," page 100. The Main Steam Line Total Surface Area given as "10.07 m^2" should be "12.35 m^2." As a result, the Elemental Iodine Removal Rates (hr^{-1}) and Elemental Iodine Deposition Efficiencies for all listed post-LOCA times in Table 46 are impacted.

Table 51, "Net Elemental Iodine Removal Efficiency - Intact Steam Line Volume V4," page 103. As a result of Table 46 observed discrepancies, the Elemental Iodine Deposition Efficiencies, Elemental Iodine Resuspension Efficiencies, and Elemental Net Deposition Efficiencies (%) for all listed post-LOCA times in Table 51 are impacted.

As a result of the Table 51 observed discrepancies, the RADTRAD model input parameter values for elemental iodine are impacted.

ARCB-RAI-5

Please address the observed discrepancies described above and evaluate their impact on the calculated control room and offsite doses in the revised LOCA radiological analysis.

Response to ARCB RAI-5

- Table 40, "MSIV Failed & Intact Steam Line Volumes for Elemental Iodine Removal Efficiency Calculation," page 97. The calculated volume for "D" (Volume V4) given as "4.33 m^3" should be "4.64 m^3." The calculated volume of "E" (Volume V5) of "4.33 m^3" should be "1.39 m^3."

    Corrected the calculated volumes for "D" and "E" in the note of Table 40 on page 101 of DRE05-0048 Revision 6. This was a typographic error in the note; the correct volumes are provided in the body of Table 40 and are used to calculate the values used in the RADTRAD models. Therefore, this correction has no impact on the calculation result.

- Table 46, "Elemental Iodine Deposition Rate - Intact Steam Line Volume V4," page 100. The Main Steam Line Total Surface Area given as "10.07 m^2" should be "12.35 m^2." As a result, the Elemental Iodine Removal Rates (hr^{-1}) and Elemental Iodine Deposition Efficiencies for all listed post-LOCA times in Table 46 are impacted.

Corrected the surface area ("B") used in Table 46 on page 104 of DRE05-0048 Revision 6 from 10.07 m^2 to 12.35 m^2 for all timesteps. The corresponding Elemental Iodine Removal Rate ("D") and Elemental Iodine Deposition Efficiency ("E") are also updated for each timestep.

- Table 51, "Net Elemental Iodine Removal Efficiency - Intact Steam Line Volume V4," page 103. As a result of Table 46 observed discrepancies, the Elemental Iodine Deposition Efficiencies, Elemental Iodine Resuspension Efficiencies, and Elemental Net Deposition Efficiencies (%) for all listed post-LOCA times in Table 51 are impacted.

  Updated the Elemental Iodine Deposition Efficiency ("A") in Table 51 on page 107 of DRE05-0048 Revision 6 for all timesteps to the corrected values from Table 46. The resulting Elemental Iodine Net Deposition Efficiency ("C") is also updated for each timestep. The net deposition efficiency from Table 51 is used as input into the MSIV leakage RADTRAD cases. The 15 MSIV leakage cases, five for each fuel type, were updated and rerun using these revised values.

The changes discussed above did not result in any changes to the design basis dose consequences.

Electrical Engineering New Reactors and Licensing (EENB)

Regulatory Basis/Issue re: Equipment Environmental Quality (EQ) (EENB-RAI-1, RAI-2, RAI-3)

10 CFR 50.49 (e)(1) requires that the time-dependent temperature and pressure at the location of the electric equipment important to safety must be established for the most severe design basis accident during and following which this equipment is required to remain functional.

10 CFR 50.49 (e)(2) requires that humidity during design basis accidents must be considered.

10 CFR 50.49 (e)(4) requires that the radiation environment must be based on the type of radiation, the total dose expected during normal operation over the installed life of the equipment, and the radiation environment associated with the most severe design basis accident during or following which the equipment is required to remain functional.

10 CFR 50.49(b)(2) requires qualification of nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in subparagraphs (b)(1) (i) (A) through (C) of paragraph (b)(1) of 10 CFR 50.49 by the safety-related equipment.

EENB-RAI-1

Provide an evaluation that shows that the temperatures, pressures, and humidity remain bounded by the existing environmental qualification for equipment and components impacted by the MSIV increased leakage rate and the drywell spray.

Response to EENB-RAI-1

The Dresden Nuclear Power Station Environmental Qualification (EQ) Program already includes evaluation of spray and assumes an accident humidity inside the drywell of 100%. Therefore, the existing EQ assessment already covers the inclusion of drywell spray in the loss of coolant accident dose assessment. The MSIVs are designed to close and be leak-tight during the worst conditions of pressure, temperature, and steam flow following a break in the main steam line outside containment. The equipment and components potentially impacted by the increased main steam isolation valve (MSIV) leak rate are located in the main steam tunnel and turbine building, downstream of the MSIVs. The normal service environmental conditions in main steam tunnel or turbine building are due to the fluid flowing through the main steam lines when the MSIVs are open and thus not impacted by allowing increased leakage past the closed valve. The bounding accident temperature and pressure profiles in the main steam tunnel and turbine building are associated with a high energy line break (HELB) in the steam tunnel. When the increased MSIV leakage is considered, the HELB temperature and pressure profile in these zones continues to bound the LOCA profile. Additionally, the accident humidity in these zones is already assumed to be 100%. Therefore, the proposed increase in allowable MSIV leakage would contribute no additional environmental impact to equipment qualified for use in the main steam tunnel or the turbine building.

EENB-RAI-2

Explain how you have assessed the impact of the proposed change on non-safety related equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishments of safety functions by the safety-related equipment.

Response to EENB-RAI-2

Because there is no change to EQ design basis temperatures, pressure, humidity, or radiation values, the proposed increase in MSIV leakage has no impact on non-safety related equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions by the safety-related equipment.

EENB-RAI-3

Confirm whether any components are being added to the EQ equipment list to comply with 10 CFR 50.49 due to the proposed changes. If components are being added, describe the equipment qualification for the environmental conditions the components are expected to be exposed to.

<u>Response to EENB-RAI-3</u>

No components are being added to the EQ equipment list due to the proposed increase in allowable MSIV leakage.

Technical Specifications (STSB)

Regulatory Basis/Issue re: Flow Path Configuration Control (STSB-RAI-1)

10 CFR 50.36(c)(3), requires technical specifications (TS) to include surveillance requirements (SR) to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met.

<u>STSB-RAI-1</u>

How does the licensee verify the required valves are positioned correctly to ensure the drywell spray sub-system will perform its safety-related function, if required?

<u>Response to STSB-RAI-1</u>

The valves that provide the isolation points between the Low Pressure Coolant Injection (LPCI) system and the containment spray system are normally closed motor-operated valves that can be manually operated from the control room. These valves do not automatically open following a loss-of-coolant-accident (LOCA) but can be manually opened by the control room operators. DNPS tests these valves during refueling outages in accordance with the inservice testing program to ensure they can perform their safety function of opening following a LOCA.