**Calculation RP-18-08, "MPS1 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6"**

The following pertinent information has been extracted from Millstone Calculation RP-18-08, "MPS1 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6". It is provided to assist technical reviewers that will be evaluating this license amendment request.

**Purpose:**
To determine new Emergency Action Level release threshold using updated guidance from NEI 99-01 Rev 6 for Millstone Unit 1 continuous monitored pathway from the Spent Fuel Pool Island Vent.

**References:**
1. Nuclear Energy Institute NEI 99-01, Rev. 6, "Methodology for Development of Emergency Action Levels," November 2012.
2. MP-22-REC-BAP01, Rev.29, "Millstone Radiological Effluent and Off-site Dose Calculation Manual (REMODCM)."
3. MP-22-REC-REF03, Rev. 6, "REMODCM Technical Information Document," Oct 18, 2016.
4. Calculation RA-0016, Revision 0 Addendum A, "Radiological Consequences of Release of all Gap Activity in the Spent Fuel Pool at MP1," Nov. 29, 2010.
5. Software-Meteorological Information and Dose Assessment System, MIDAS, Version 1.5.17.022218.
6. MIDAS Software QA Documentation, SQA-MIDAS-DOM-20180614.
7. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017.
8. MP-26-EPI-FAP10, Rev. 11, "Dose Assessment."
9. M2EAL-03053R2, Rev. 2, "MP2 EAL Offsite Dose Parameters."

**Computer Codes Used:**
MIDAS software (Ref 5) was utilized to determine the projected EDE, TEDE and Thyroid CDE for a one (1) hour release duration. Integrated TEDE for a 1 hour release duration is used for the purpose of calculating emergency action levels for the ALERT classification. MIDAS is classified per the Software Quality Assurance program as Class 3 software (Ref.6).

**Methodology:**
The meteorology and source terms used to develop the threshold values were chosen to best represent the conditions that would be expected at the time of the emergency.

The calculated threshold value considers a source of 100% Kr-85 release from damage of irradiated assemblies in the Unit 1 SFP and meteorology in accordance with NEI 99-01. The resulting values are adequately conservative and represent the best

estimate of the release rates that would result in exceeding the dose criteria of NEI 99-01.

To determine the ALERT radiological threshold for the MP1 SFPI vent, MIDAS was used to predict expected doses based on best estimate meteorological and plant conditions. Inputs to MIDAS use the most prevalent meteorological data and expected release point parameters and normalized source terms of 1 Ci/sec. No mitigating reduction mechanisms (decay, sprays, filters, etc.) were used as input into MIDAS for this particular calculation as iodine and particulate removal mechanisms have no effect to the release of Kr-85. The MIDAS outputs generated represent a radiological prediction normalized to the source entered (e.g., 1 Ci/sec of Kr-85).

The maximum projected EDE, TEDE at or beyond the site boundary distance were obtained from the MIDAS outputs. The TEDE dose was divided into the applicable EAL criteria to determine the radioactivity concentration (uCi/cc) seen by the radiation monitor which would yield the referenced dose criteria for the ALERT classification. This concentration is the rad monitor action level for the ALERT classification. Thyroid CDE limits were not included in this evaluation per new guidance in EPA-400 (Ref. 7) and agreement with the State of Connecticut to remove Thyroid PAGs in the EALs.

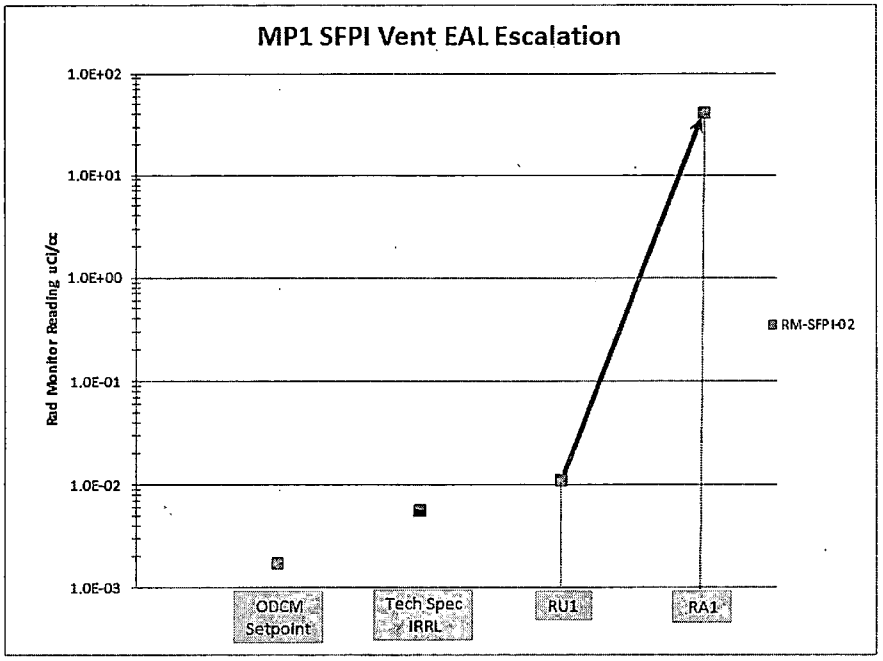
From the predicted release to obtain levels that achieve the ALERT EAL threshold limit of > 10 mrem TEDE, the corresponding number of irradiated fuel assemblies that would need to be damaged to achieve that source term will be determined.

**Conclusions:**

The condition where the NOUE threshold is exceeded for 60 minutes is indicative of the inability to terminate radioactive release within prescribed regulatory and license limits and therefore represents a loss of plant control and degraded safety. For the Unusual Event (NOUE) threshold value based on station release limits, the methodology and assumptions established with the Millstone REMODCM were followed.

For the ALERT threshold value determined, the release conditions required to produce 10 mrem TEDE from a pure Kr-85 release using predominant meteorological conditions was calculated using the MIDAS accident dose software code. The ALERT threshold value determined, while equivalent to release conditions that would produce 10 mrem TEDE, requires that 50% of the spent fuel pool irradiated assemblies will need to fail and release within 15 minutes to the environment to produce radiological conditions that produce such dose.

MP1 SFPI Vent RM-SFPI-02 EAL Thresholds



**Calculation RP-18-02, "MPS2 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6"**

The following pertinent information has been extracted from Millstone Calculation RP-18-02, "MPS2 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6". It is provided to assist technical reviewers that will be evaluating this license amendment request.

**Purpose:**
Calculation of new Emergency Action Levels were determined for radioactive releases from the MP2 Ventilation Vent, Millstone Stack, and Steam Safety/Atmospheric Dump Valve based on updated guidance from NEI 99-01, Rev 6 and revision to EPA-400 for removal of thyroid CDE PAG limits.

**References:**
1. Nuclear Energy Institute NEI 99-01, Rev. 6, "Methodology for Development of Emergency Action Levels," November 2012.
2. Software-Meteorological Information and Dose Assessment System, MIDAS, Version 1.5.17.022218.
3. MIDAS Software QA Documentation, SQA-MIDAS-DOM-20180614.
4. NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents," McKenna, T. J. and Gutter, U.S. Nuclear Regulatory Commission, Washington, D.C, 1988.
5. MP-22-REC-BAP01, Rev.27-01, "Millstone Radiological Effluent and Off-site Dose Calculation Manual (REMODCM)."
6. MG-EV-99-0004, Rev 0, "Units 1, 2, 3 Radiological Boundaries," July 20, 1999.
7. MP-26-EPI-FAP10, Rev. 11, "Dose Assessment."
8. Nuclear Energy Institute NEI 99-01, Rev. 4, "Methodology for Development of Emergency Action Levels," January 2003.
9. RERM-02906-R2, Rev. 1, "Millstone Unit 2 Vent Radiation Monitor (RM- 8132B) High Range Setpoint", Jan 16, 2003.
10. MP-22-REC-REF03, Rev. 6, "REMODCM Technical Information Document," Oct 18, 2016.
11. DWG 25203-20098, Rev. 05, "Main Steam Piping Plan - Containment & Aux. Bldg," dated 10/10/2003.
12. Millstone Unit 2 Radiation Monitor Manual.
13. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017.
14. M2EAL-03053R2, Rev. 2, "MP2 EAL Offsite Dose Parameters."

**MIDAS Dose Software:**
MIDAS software (Ref 3.2) was utilized to determine the projected EDE, TEDE and Thyroid CDE for a one (1) hour release duration. Integrated TEDE for a 1 hour release

duration are used for the purpose of calculating emergency action levels for ALERT, Site Area and General Emergency classifications. MIDAS is classified per the Software Quality Assurance program as Class 3 software (Ref. 3).

**Method of Calculation:**
The meteorology and source terms used to develop the threshold values were chosen to best represent the conditions that would be expected at the time of the emergency for each respective action level.

The calculated threshold values consider appropriate source term and meteorology in accordance with NEI 99-01. The resulting values are adequately conservative and represent the best estimate of the release rates that would result in exceeding the dose criteria of NEI 99-01. The values determined show consistent classification escalation from RU1 through RG1.

The RU1 thresholds based on the REMODCM Instantaneous Release Rate Limits that utilize annual average meteorology are shown to be essentially equal to 1 mrem TEDE using most prevalent meteorological conditions. This shows the same principles of dose and maintains consistency with the Technical Specifications. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the emergency condition. The Unusual Event (UE) EALs are calculated for release points controlled in the REMODCM, Ref. 3. The Main Steam Safety/Dump Valve and Auxiliary Feedwater Turbine Exhaust are not normal operation release points and are not contained in the Millstone Station REMODCM. Therefore, the UE EAL classification is not applicable for these accident release points.

To determine the EAL radiological thresholds for MP2 Ventilation Vent, Millstone Stack, and Main Steam Safety/Dump Valve release points, MIDAS was used to predict expected doses based on best estimate meteorological and plant conditions. Inputs to MIDAS use most prevalent met data and expected release point parameters together with event tree, core condition, mitigating reduction factors, and normalized source terms of 1 uCi/cc for vent and stack rad monitors and 1 Ci/sec for steam line rad monitors. An assumed one-hour decay time since shutdown and a one-hour duration of release are applied in each computer run. The mitigating reduction mechanisms (decay, sprays, filters, etc.) input into MIDAS for a given accident event determine the final radiological release source term mix. The MIDAS outputs generated for each release option represent a radiological prediction normalized to the source entered (e.g., 1 uCi/cc). For MP2 Vent and Millstone Stack releases, a LOCA accident type is selected for the event tree, whereas for Steam releases, a wet SGTR was selected. A fuel handling accident was not run in MIDAS since an additional mitigation reduction factor of 100 for the pool water would logically result in lower site boundary doses which would then lead to higher emergency action level thresholds for the MP2 Vent and Millstone Stack.

The maximum projected EDE, TEDE and Thyroid CDE dose at or beyond the site boundary distance were obtained from the MIDAS outputs. The TEDE dose was divided into the applicable EAL criteria to determine the radioactivity concentration (uCi/cc) seen by the radiation monitor, which would yield the referenced dose criteria for a given emergency classification. These concentrations are the rad monitor action levels for the various emergency classifications. Thyroid CDE limits were not included in this evaluation per new guidance in EPA-400 (Ref.13) and agreement with the State of Connecticut to remove Thyroid PAGs in the EALs.

**Conclusions:**
Following the guidance of NEI 99-01 Revision 6, recommended values for Millstone 2 release point EAL thresholds were calculated.

For the Unusual Event (NOUE) threshold values determined, there is a strong link established with the Millstone REMODCM. The NOUE values calculated at 2 times the plant specific instantaneous release rate limits for each effluent release point as set forth by the Millstone REMODCM showed similar predictions of dose (approximately 1 mrem TEDE). The condition where the NOUE threshold is exceeded for 60 minutes is indicative of the inability to terminate a radioactive release within prescribed regulatory and license limits and therefore represents a loss of plant control and degraded safety.

The ALERT, SAE and GE threshold values determined, represent a radioactive release that results in 1%, 10%, and 100% of the revised EPA Protective Action Guideline TEDE limits. These threshold limits were calculated using expected meteorological conditions based on 5 years of meteorological data collected from the plant MET tower. Dose analyses were performed using the most prevalent stability class and wind speed conditions at each respective level on the MET tower. The selection and use of predominant meteorological dispersion is appropriate and in accordance with the intent of NEI 99-01.

Figure 3 graphically displays the relationship between monitor effluent control setpoint values, the Technical Specification limit, and the four EAL threshold values for the two normal operational discharge release pathways from Millstone 2. This figure demonstrates that the four EALs are sufficiently separated and show escalation from the NOUE level up through the GE level. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the lowest EAL threshold.

Figure 4 is the graphical presentation of EAL threshold values for the main steam line radiation monitors at Millstone 2. Because secondary side safeties and ADVs are not normal operational discharge pathways and are not considered in the REMODCM, there are no REMODCM setpoints or limits for the steam safeties or exhausts. Additionally, the main steam radiation monitors are not sensitive enough to detect low

level activity in main steam. For these reasons, a NOUE threshold for the steam line exhaust pathways does not exist.

**Figure 3 – MP2 Vent RM8168 and Stack RM8169 EAL Escalation**

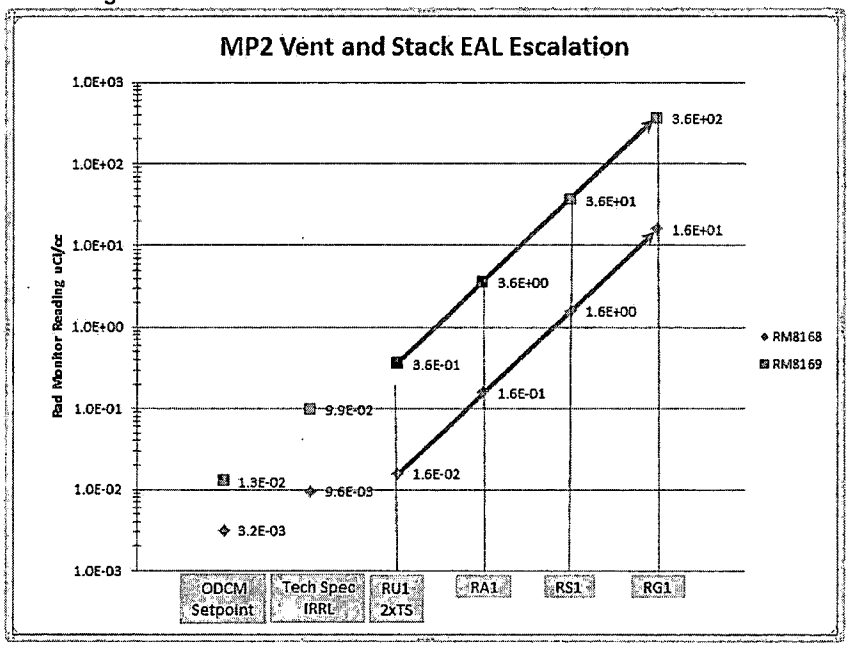
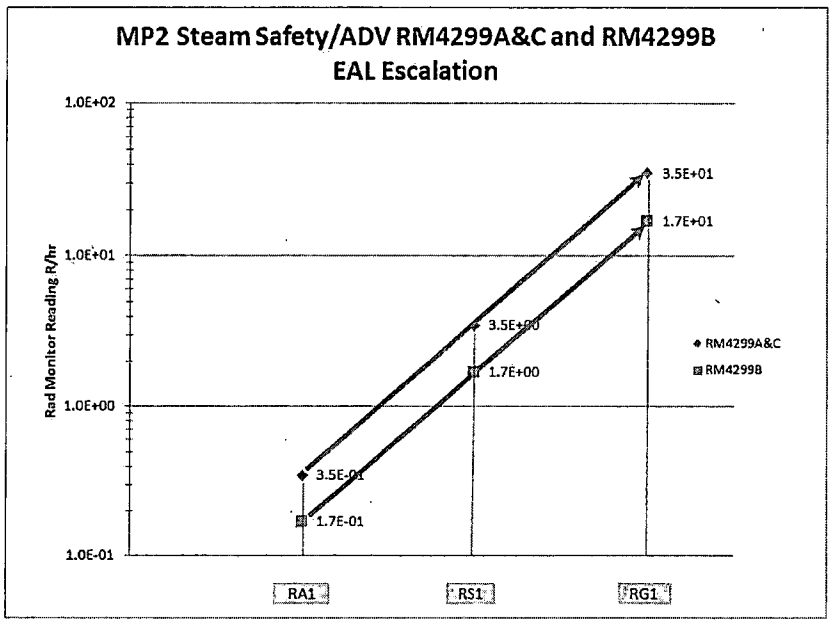



**Figure 4 – MP2 Steam Safety/ADV RM4299A&C and RM4299B EAL Escalation**



**Calculation RP-18-03, "MPS3 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6"**

The following pertinent information has been extracted from Millstone Calculation RP-18-03, "MPS3 Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6". It is provided to assist technical reviewers that will be evaluating this license amendment request.

**Purpose:**
Calculation of new Emergency Action Levels were determined for radioactive releases from the MP3 Ventilation Vent, Millstone Stack, Steam Safety/Atmospheric Dump Valve, and Auxiliary Feedwater Driven Turbine discharge based on updated guidance from NEI 99-01, Rev 6 and revision to EPA-400 for removal of thyroid CDE PAG limits.

**References:**
1. Nuclear Energy Institute NEI 99-01, Rev. 6, "Methodology for Development of Emergency Action Levels," November 2012.
2. Software-Meteorological Information and Dose Assessment System, MIDAS, Version 1.5.17.022218.
3. MIDAS Software QA Documentation, SQA-MIDAS-DOM-20180614.
4. NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents."
5. MP-22-REC-BAP01, Rev.27-01, "Millstone Radiological Effluent and Off-site Dose Calculation Manual (REMODCM)."
6. MG-EV-99-0004, Rev 0, "Units 1, 2, 3 Radiological Boundaries," July 20, 1999.
7. MP-26-EPI-FAP10, Rev. 11, "Dose Assessment."
8. Nuclear Energy Institute NEI 99-01, Rev. 4, "Methodology for Development of Emergency Action Levels," January 2003.
9. Blank.
10. MP-22-REC-REF03, Rev. 6, "REMODCM Technical Information Document."
11. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017.
12. Millstone Unit 3 Radiation Monitor Manual.
13. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017.
14. M2EAL-03053R2, Rev. 2, "MP2 EAL Offsite Dose Parameters."

**MIDAS Dose Software:**
MIDAS software (Ref 2) was utilized to determine the projected EDE, TEDE and Thyroid CDE for a one (1) hour release duration. Integrated TEDE for a 1 hour release duration is used for the purpose of calculating emergency action levels for ALERT, Site Area and General Emergency classifications. MIDAS is classified per the Software Quality Assurance program as class 3 software (Ref. 3).

**Method of Calculation:**
The meteorology and source terms used to develop the threshold values were chosen to best represent the conditions that would be expected at the time of the emergency for each respective action level.

The calculated threshold values consider appropriate source term and meteorology in accordance with NEI 99-01. The resulting values are adequately conservative and represent the best estimate of the release rates that would result in exceeding the dose criteria of NEI 99-01. The values determined show consistent classification escalation from RU1 through RG1.

The RU1 thresholds based on the REMODCM Instantaneous Release Rate Limits that utilize annual average meteorology are shown to be essentially equal to 1 mrem TEDE using most prevalent met conditions. This shows the same principles of dose and maintains consistency with the Technical Specifications. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the NOUE emergency condition. The Unusual Event (UE) EALs are calculated for release points controlled in the REMODCM, Ref. 5. The Main Steam Safety/Dump Valve and Auxiliary Feedwater Turbine Exhaust are not normal operation release points and are not contained in the Millstone Station REMODCM. Therefore, the UE EAL classification is not applicable for these accident release points.

To determine the EAL radiological thresholds for MP3 Ventilation Vent, Millstone Stack, Main Steam Safety/Dump Valve, and Aux Feedwater Turbine Exhaust release points, MIDAS was used to predict expected doses based on best estimate meteorological and plant conditions. Inputs to MIDAS use most prevalent met data and expected release point parameters together with event tree, core condition, mitigating reduction factors, and normalized source terms of 1 uCi/cc for vent and stack rad monitors and 1 Ci/sec for steam line rad monitors. An assumed one-hour decay time since shutdown and a one-hour duration of release are applied in each computer run. The mitigating reduction mechanisms (decay, sprays, filters, etc.) input into MIDAS for a given accident event determine the final radiological release source term mix. The MIDAS outputs generated for each release option represent a radiological prediction normalized to the source entered (e.g., 1 uCi/cc). For MP3 Ventilation Vent and Millstone Stack releases, a LOCA accident type is selected for the event tree, whereas for Steam releases, a wet SGTR was selected. A fuel handling accident was not run in MIDAS since an additional mitigation reduction factor of 100 for the pool water would logically result in lower site boundary doses which would then lead to higher emergency action levels thresholds for the MP3 Ventilation Vent and Millstone Stack.

The maximum projected EDE, TEDE and Thyroid CDE dose at or beyond the site boundary distance were obtained from the MIDAS outputs... The TEDE dose was divided into the applicable EAL criteria to determine the radioactivity concentration (uCi/cc) seen by the radiation monitor, which would yield the referenced TEDE dose criteria for a given emergency classification. These concentrations are the rad monitor action levels for the various emergency classifications. Thyroid CDE limits were not included in this evaluation per new guidance in EPA-400 (Ref. 13) and agreement with the State of Connecticut to remove Thyroid PAGs in the EALs.

**Conclusions:**
Following the guidance of NEI 99-01 Revision 6, recommended values for Millstone 3 release point EAL thresholds based on the results of this calculation are summarized in Table 1 of the EAL Matrices.

For the Unusual Event (NOUE) threshold values determined, there is a strong link established with the Millstone REMODCM. The NOUE values calculated at 2 times the plant specific instantaneous release rate limits for each effluent release point as set forth by the Millstone REMODCM showed similar predictions of dose (approximately 1 mrem TEDE).The condition where the NOUE threshold is exceeded for 60 minutes is indicative of the inability to terminate a radioactive release within prescribed regulatory and license limits and therefore represents a loss of plant control and degraded safety. The ALERT, SAE and GE threshold values determined, represent a radioactive release that results in 1%, 10%, and 100% of the revised EPA Protective Action Guideline TEDE limits. These threshold limits were calculated using expected meteorological conditions based on 5 years of meteorological data collected from the plant MET tower. Dose analyses were performed using the most prevalent stability class and wind speed conditions at each respective level on the MET tower. The selection and use of predominant meteorological dispersion is appropriate and in accordance with the intent of NEI 99-01.

Figure 3 graphically displays the relationship between monitor effluent control setpoint values, the Technical Specification limit, and the four EAL threshold values for the two normal operational discharge release pathways from Millstone 3. This figure demonstrates that the four EALs are sufficiently separated and show escalation from the NOUE level up through the GE level. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the lowest EAL threshold.

Figure 4 shows the graphical presentation of EAL threshold values for the main steam line radiation monitors and auxiliary feedwater turbine exhaust (AFW TT) at Millstone 3, respectively. Because secondary side safeties, ADVs, and AFW TT are not normal operational discharge pathways and are not considered in the REMODCM, there are no REMODCM setpoints or limits for these steam exhausts. Additionally, these steam

monitors are not sensitive enough to detect low level activity in main steam. For these reasons, NOUE thresholds for the steam line exhaust pathways do not exist.

**Figure 3 – MP3 Vent (RE10) and Stack (RE19) EAL Escalation**

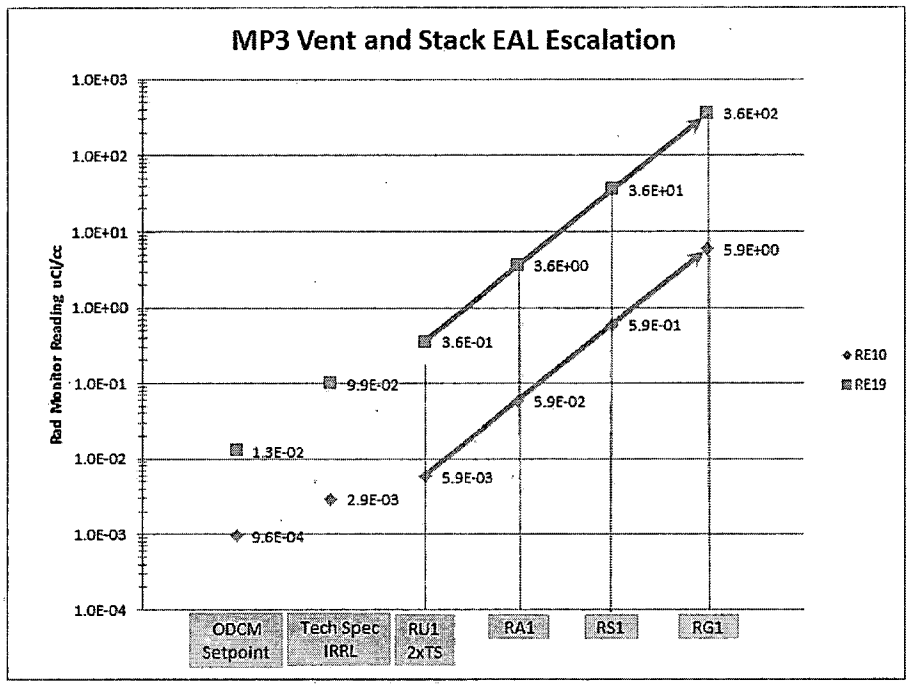
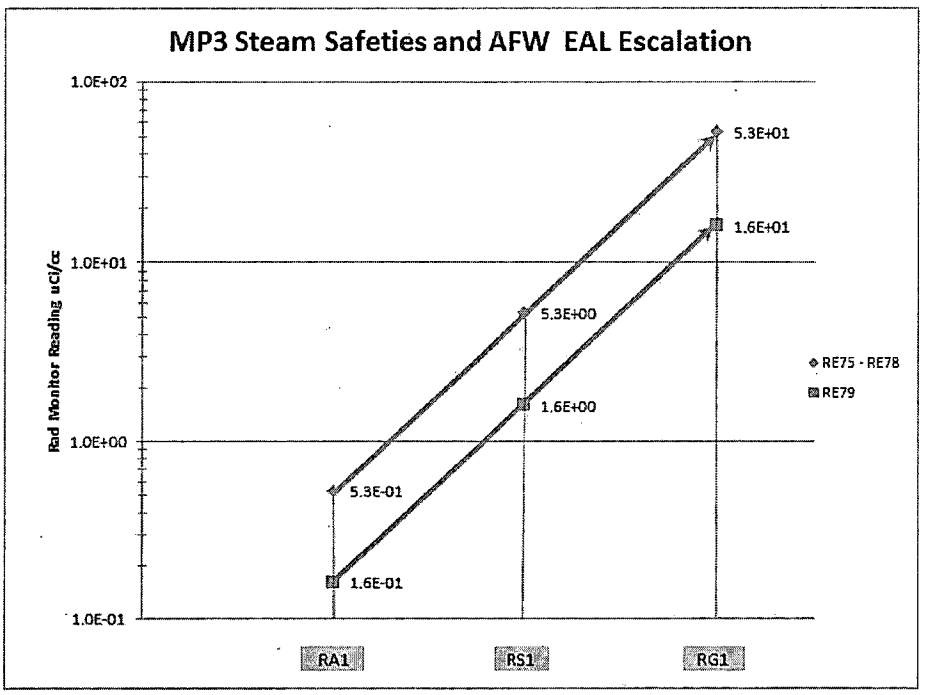



**Figure 4 – MP3 Steam Safety (RE75 – RE78) and AFW TT (RE79) EAL Escalation**



## Calculation RP-08-22, "North Anna Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6"

The following pertinent information has been extracted from North Anna Calculation RP-08-22, "North Anna Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6". It is provided to assist technical reviewers that will be evaluating this license amendment request.

**Purpose:**
Calculation of new Emergency Action Levels were determined for radioactive releases from the NAPS Ventilation Vent, Process Vent, Steam Safety/PORV, and Auxiliary Feed water Steam Exhaust discharge based on updated guidance from NEI 99-01, Rev 6 and revision to EPA-400.

**References:**

1. Nuclear Energy Institute NEI 99-01, Rev. 6, "Methodology for Development of Emergency Action Levels," November 2012.
2. Software-Meteorological Information and Dose Assessment System, MIDAS, Version 1.5.17.022218.
3. MIDAS Software QA Documentation, SQA-MIDAS-DOM-20180614 and all previous files.
4. NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents", McKenna, T. J. and Gutter, U.S. Nuclear Regulatory Commission, Washington, D.C, 1988.
5. VPAP-2103N, Revision 28, "Off-site Dose Calculation Manual (North Anna)."
6. NA-ENGT-000-CME 97-0010, Rev. 0, "Evaluation of the Required Tech Spec Flow Rate Value for Process Vent Blowers..." Feb. 10, 1997.
7. EPIP-4.03, Revision 22, "North Anna Power Station Dose Assessment Team Controlling Procedure".
8. Nuclear Energy Institute NEI 99-01, Rev. 4, "Methodology for Development of Emergency Action Levels," January 2003.
9. Calculation PA-0225, Revision 0, Addendum (00, 00A, 00B, 00C), "North Anna Radiation Monitor Conversion Factors and EAL Readings".
10. HP-3010.040, Revision 27, "North Anna Power Station - Radiation Monitoring System Setpoint Determination".
11. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents", January 2017.
12. RP-AA-151, Revision 0, "Radiation Protection Technical Bases Analyses or Calculations".
13. NAPS UFSAR, Revision 53.03.
14. NE-GL-0035N, "PC-MIDAS Guideline", Revision 11.
15. 1-E-0, Rev. 50, North Anna Emergency Procedure – "Reactor Trip or Safety Injection".
16. DC NA-11-01082, Rev. 01, "Main Steam Radiation Monitor Replacement".

**Computer Codes Used:**

MIDAS Dose Software

MIDAS software (Ref. 2) was utilized to determine the projected EDE, TEDE and Thyroid CDE for a one (1) hour release duration. Integrated TEDE for a 1 hour release duration is used for the purpose of calculating emergency action levels for ALERT, Site Area and General Emergency classifications. MIDAS is classified per the Software Quality Assurance program as class 3 software (Ref.3).

**Methodology:**

The meteorology and source terms used to develop the threshold values were chosen to best represent the conditions that would be expected at the time of the emergency for each respective action level.

The calculated threshold values consider appropriate source term and meteorology in accordance to NEI 99-01. The resulting values are adequately conservative and represent the best estimate of the release rates that would result in exceeding the dose criteria of NEI 99-01. The values determined show consistent classification escalation from RU1 through RG1.

RU1 thresholds, based on the ODCM Instantaneous Release Rate Limits that utilize annual average meteorology, are compared against dose criteria to maintain a logical and consistent escalation between the UE and ALERT thresholds. Both are based on the same principles of dose and maintain consistency with the Technical Specifications. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the NOUE emergency condition. The Unusual Event (UE) EALs are calculated for release points controlled in the ODCM, Ref. 5. The Main Steam Safety/PORV and Auxiliary Feedwater Turbine Exhaust are not normal operation release points and are not contained in the North Anna ODCM. Therefore, the UE EAL classification is not applicable for these accident release points.

To determine the EAL radiological thresholds for Ventilation Vent, Process Vent, Main Steam Safety/PORV, and Aux Feedwater Turbine Exhaust release points, MIDAS was used to predict expected doses based on best estimate meteorological and plant conditions. Inputs to MIDAS use most prevalent met data and expected release point parameters together with event tree, core condition, mitigating reduction factors, and normalized source terms of 1 uCi/cc for vent and process vent rad monitors and 1 Ci/sec for steam line rad monitors. An assumed one-hour decay time since shutdown and a one-hour duration of release are applied in each computer run. The mitigating reduction mechanisms (decay, sprays, filters, etc.) input into MIDAS for a given accident event determine the final radiological release source term mix. The MIDAS outputs generated for each release option represent a radiological prediction normalized to the source entered (e.g., 1 uCi/cc).

For Ventilation Vent and Process Vent releases, a LOCA accident type is selected for the event tree, whereas for Steam releases, a wet SGTR was selected. A fuel handling accident was not run in MIDAS since an additional mitigation reduction factor of 100 for the pool water would logically result in lower site boundary doses which would then lead to higher emergency action levels thresholds for the Ventilation Vent and Process Vent.

The maximum projected EDE, TEDE and Thyroid CDE dose at or beyond the site boundary distance were obtained from the MIDAS outputs. These doses were divided into the applicable EAL criteria to determine the radioactivity concentration (uCi/cc) seen by the radiation monitor, which would yield the referenced dose criteria for a given emergency classification. These concentrations are the rad monitor action levels for the various emergency classifications. The lowest predicted concentration between each dose analyzed is selected as the applicable EAL limit.

**Conclusions:**
Following the guidance of NEI 99-01 Revision 6, recommended values for North Anna release point EAL thresholds based on the results of this calculation are summarized in Table R-1 of the EAL Matrices.

For the Unusual Event (NOUE) threshold values determined, the NOUE values are set at 10 times less than the calculated ALERT threshold values (i.e., 1 mrem TEDE). This deviation from the prescribed guidance in NEI 99-01 Revision 6 is necessitated because some plant specific instantaneous release rate limits following the ODCM guidance would result in NOUE threshold values greater than corresponding ALERT threshold values. The condition where the NOUE threshold is exceeded for 60 minutes is indicative of the inability to terminate a radioactive release within prescribed regulatory and license limits and therefore represents a loss of plant control and degraded safety.

The ALERT, SAE and GE threshold values determined, represent a radioactive release that results in 1%, 10%, and 100% of the revised EPA Protective Action Guideline TEDE limits. These threshold limits were calculated using expected meteorological conditions based on 5 years of meteorological data collected from the plant MET tower. Dose analyses were performed using the most prevalent stability class and wind speed conditions at each respective level on the MET tower. The selection and use of predominant meteorological dispersion is appropriate and in accordance with the intent of NEI 99-01.

Figure 6 graphically displays the relationship between monitor effluent control setpoint values, the Technical Specification limit, and the four EAL threshold values for the two normal operational discharge release pathways from North Anna. This figure demonstrates that the four EALs are sufficiently separated and show escalation from the NOUE level up through the GE level. Sufficient margin exists between plant

setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the lowest EAL threshold.

Figure 7 shows the graphical presentation of EAL threshold values for the main steam line radiation monitors and auxiliary feedwater turbine exhaust (AFW TT) at North Anna, respectively. Because secondary side safeties, PORVs, and AFW TT are not normal operational discharge pathways and are not considered in the ODCM, there are no ODCM setpoints or limits for these steam exhausts. Additionally, these steam monitors are not sensitive enough to detect low level activity in main steam. For these reasons, NOUE thresholds for the steam line exhaust pathways do not exist.

**Figure 6 – NAPS Vent and Process Vent EAL Escalation**

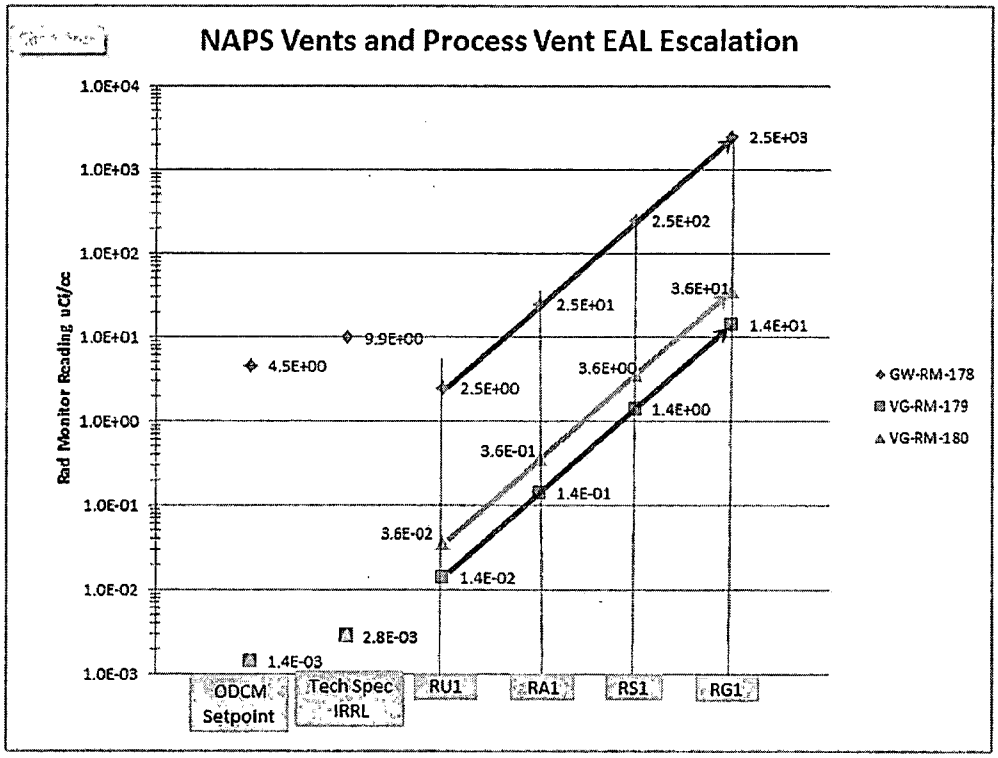
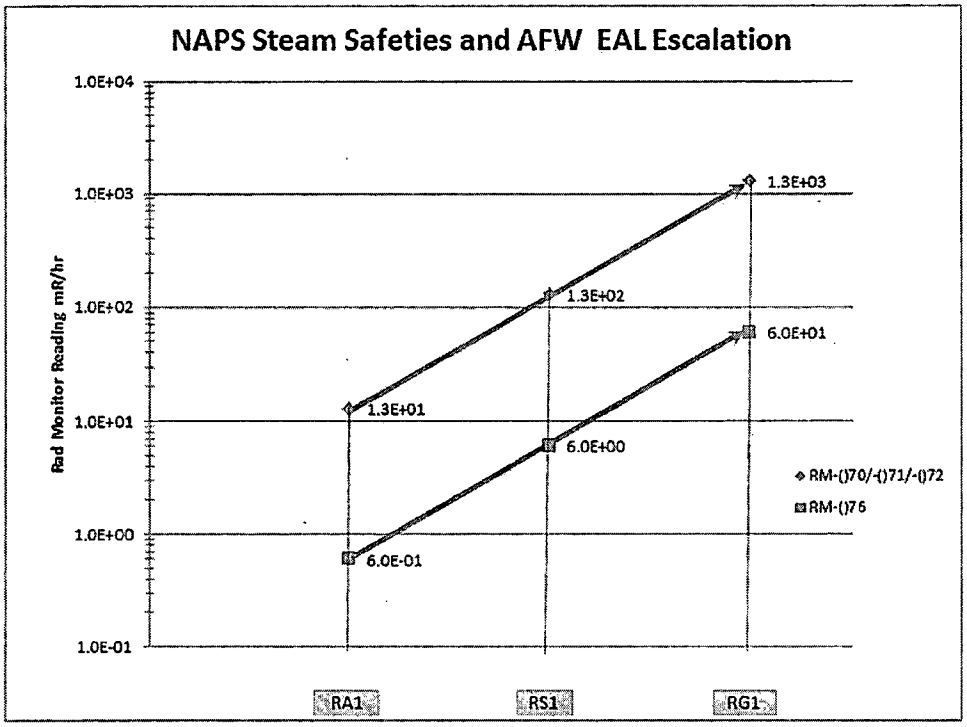


**Figure 7 – NAPS Steam Safety and AFW TT EAL Escalation**



**Calculation RP-18-01, "Surry Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6"**

The following pertinent information has been extracted from Surry Calculation RP-18-01, "Surry Abnormal Rad Release Gaseous EAL Thresholds Based on NEI 99-01, Revision 6". It is provided to assist technical reviewers that will be evaluating this license amendment request.

**Purpose:**
Calculation of new Emergency Action Levels were determined for radioactive releases from the SPS Ventilation Vent, Process Vent, Steam Safety/PORV, and Auxiliary Feedwater Steam Exhaust discharge based on updated guidance from NEI 99-01, Rev 6 and revision to EPA-400.

**References:**
1. Nuclear Energy Institute NEI 99-01, Rev. 6, "Methodology for Development of Emergency Action Levels," November 2012.
2. Software-Meteorological Information and Dose Assessment System, MIDAS, Version 1.5.17.022218.
3. MIDAS Software QA Documentation, SQA-MIDAS-DOM-20161219 and all previous files.
4. NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents," McKenna, T. J. and Gutter, U.S. Nuclear Regulatory Commission, Washington, D.C, 1988.
5. VPAP-2103S, Revision 20, "Off-site Dose Calculation Manual (Surry)."
6. EPIP-4.03, Revision 20, "Surry Power Station - Dose Assessment Team Controlling Procedure."
7. Nuclear Energy Institute NEI 99-01, Rev. 4, "Methodology for Development of Emergency Action Levels," January 2003.
8. Calculation PA-0224, Revision 0, Addendum (00, 00A, 00B, 00C, D, and E), Surry Power Station Radiation Monitor Emergency Action Levels (EALs) for the Process Vent and Ventilation Vent #2, Steam Line, and Auxiliary Feedwater Exhaust."
9. HP-3010.040, Revision 36, "Surry Power Station - Radiation Monitoring System Setpoint Determination."
10. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents", January 2017.
11. RP-AA-151, Revision 0, "Radiation Protection Technical Bases Analyses or Calculations."
12. DC SU-10-01083, Rev. 01, "NRC Radiation Monitors Replacement Project."
13. NE-GL-0035S, "PC-MIDAS Guideline," Revision 11.

**Method of Calculation:**

The meteorology and source terms used to develop the threshold values were chosen to best represent the conditions that would be expected at the time of the emergency for each respective action level.

The calculated threshold values consider appropriate source term and meteorology in accordance to NEI 99-01. The resulting values are adequately conservative and represent the best estimate of the release rates that would result in exceeding the dose criteria of NEI 99-01. The values determined show consistent classification escalation from RU1 through RG1. The RU1 thresholds are based on the REMODCM Instantaneous Release Rate Limits that utilize annual average meteorology. They are based on the same principles of dose and maintain consistency with the Technical Specifications. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the NOUE emergency condition.

The Unusual Event (UE) EALs are calculated for release points controlled in the ODCM, Ref. 5. The Main Steam Safety/PORV and Auxiliary Feedwater Turbine Exhaust are not normal operation release points and are not contained in the Surry ODCM. Therefore, the UE EAL classification is not applicable for these accident release points.

To determine the ALERT, SAE and GE EAL radiological thresholds for Ventilation Vent, Process Vent, Main Steam Safety/PORV, and Aux Feedwater Turbine Exhaust release points, MIDAS was used to predict expected doses based on best estimate meteorological and plant conditions. Inputs to MIDAS use most prevalent met data and expected release point parameters together with event tree, core condition, mitigating reduction factors, and normalized source terms of 1 uCi/cc for vent and process vent rad monitors and 1 Ci/sec for steam line rad monitors. An assumed one-hour decay time since shutdown and a one-hour duration of release are applied in each computer run. The mitigating reduction mechanisms (decay, sprays, filters, etc.) input into MIDAS for a given accident event determine the final radiological release source term mix. The MIDAS outputs generated for each release option represent a radiological prediction normalized to the source entered (e.g., 1 uCi/cc).

For Ventilation Vent and Process Vent releases, a LOCA accident type is selected for the event tree, whereas for Steam releases, a wet SGTR was selected. A fuel handling accident was not run in MIDAS since an additional mitigation reduction factor of 100 for the pool water would logically result in lower site boundary doses which would then lead to higher emergency action levels thresholds for the Ventilation Vent and Process Vent.

The maximum projected EDE, TEDE and Thyroid CDE dose at or beyond the site boundary distance were obtained from the MIDAS outputs. These doses were divided into the applicable EAL criteria to determine the radioactivity concentration (uCi/cc)

seen by the radiation monitor, which would yield the referenced dose criteria for a given emergency classification. These concentrations are the rad monitor action levels for the ALERT, SAE and GE emergency classifications. The lowest predicted concentration between each dose analyzed is selected as the applicable EAL limit.

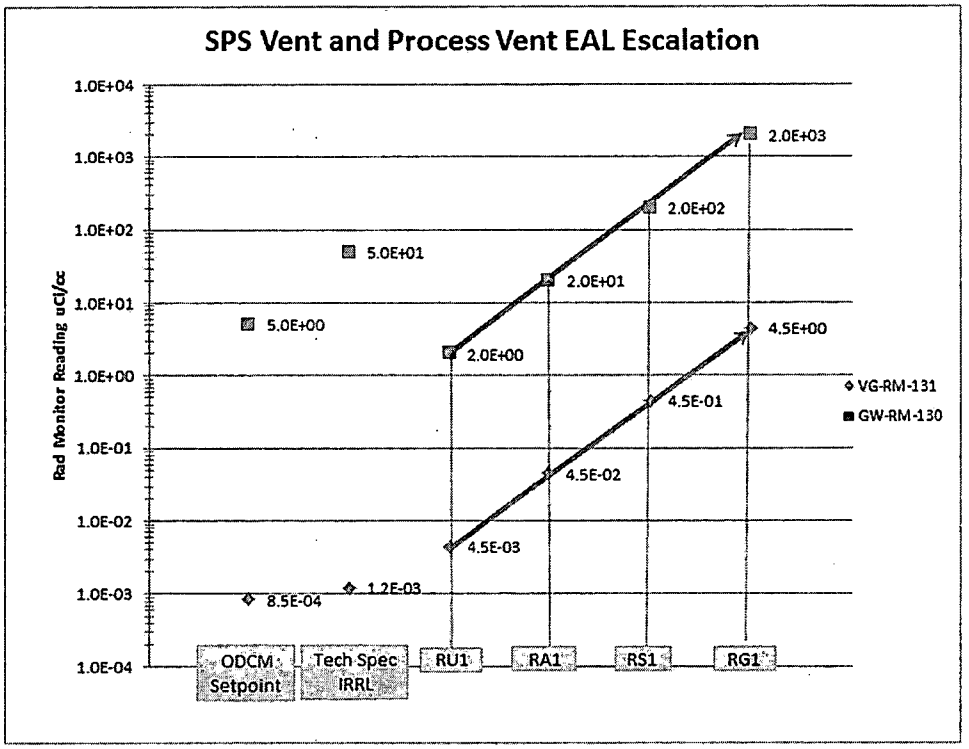
**Conclusion:**
Following the guidance of NEI 99-01 Revision 6, recommended values for Surry release point EAL thresholds based on the results of this calculation are summarized in Table 1 of the EAL Matrices.

For the Unusual Event (NOUE) threshold values determined, the NOUE values are set at 10 times less than the calculated ALERT threshold values (i.e., 1 mrem TEDE). This deviation from the prescribed guidance in NEI 99-01 Revision 6 is necessitated because some plant specific instantaneous release rate limits following the ODCM guidance would result in NOUE threshold values greater than corresponding ALERT threshold values. These NOUE thresholds when exceeded for 60 minutes are indicative of the inability to terminate a radioactive release within prescribed regulatory and license limits and therefore represents a loss of plant control and degraded safety.

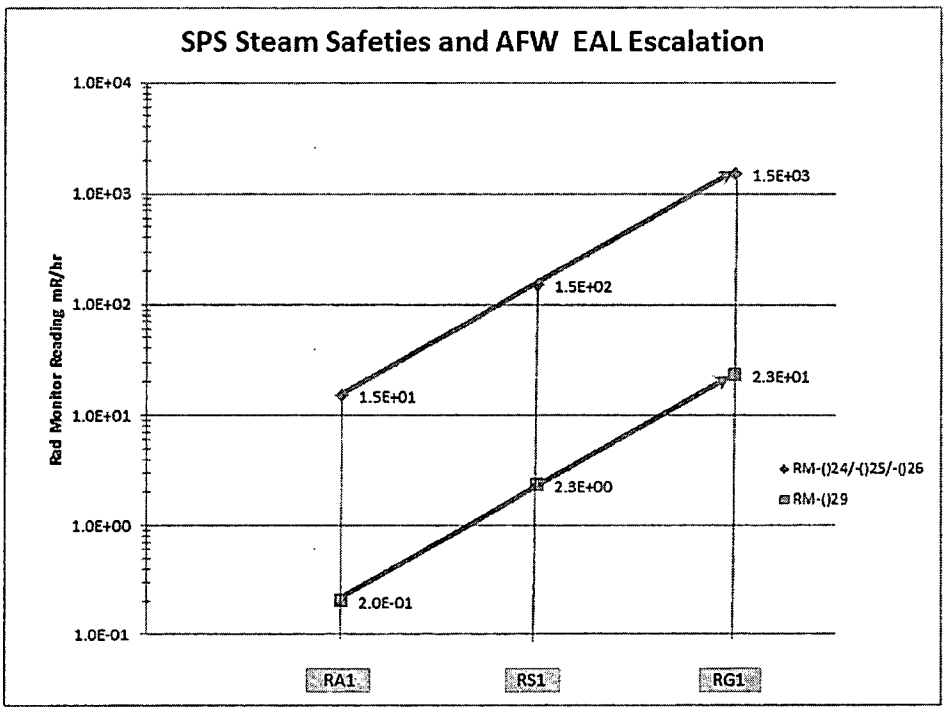
The ALERT, SAE and GE threshold values determined, represent a radioactive release that results in 1%, 10%, and 100% of the revised EPA Protective Action Guideline TEDE limits. These threshold limits were calculated using expected meteorological conditions based on 5 years of meteorological data collected from the plant MET tower. Dose analyses were performed using the most prevalent stability class and wind speed conditions at each respective level on the MET tower. The selection and use of predominant meteorological dispersion is appropriate and in accordance with the intent of NEI 99-01.

Figure 3 graphically displays the relationship between monitor effluent control setpoint values, the Technical Specification limit, and the four EAL threshold values for the two normal operational discharge release pathways from Surry. This figure demonstrates that the four EALs are sufficiently separated and show escalation from the NOUE level up through the GE level. Sufficient margin exists between plant setpoint alarms and the EAL thresholds to provide sufficient awareness to the Operators prior to reaching the lowest EAL threshold.

Figure 4 shows the graphical presentation of EAL threshold values for the main steam line radiation monitors and auxiliary feedwater turbine exhaust (AFW TT) at Surry, respectively. Because secondary side safeties, PORVs, and AFW TT are not normal operational discharge pathways and are not considered in the REMODCM, there are no REMODCM setpoints or limits for these steam exhausts. Additionally, these steam monitors are not sensitive enough to detect low level activity in main steam. For these reasons, NOUE thresholds for the steam line exhaust pathways do not exist.




(VG-RM-131 is the Vent RM and GW-RM-130 is the Process Vent RM.)




(RM-()24, 25 and 26 are the Main Steam Safety RMs and RM-()29 is the AFW Terry Turbine RM.)