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PERRY NUCLEAR POWER PLANT

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U.S. Nuclear Regulatory Commission
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Perry Nuclear Power Plant
Docket No. 50-440
Emergency Technical Specification
Change Request - Deletion of
RCIC Differential Temperature
Isolation Actuation Instrumentation

Gentlemen:

The Cleveland Electric Illuminating Company (CEI) hereby requests amendment of Facility Operating License NPF-58 for the Perry Nuclear Power Plant, Unit 1. In accordance with the requirements of 10CFR50.91(b)(1), a copy of this request for amendment has been sent to the State of Ohio as indicated below.

This letter requests revision of Technical Specification 3.3.2. The change to Specification 3.3.2 will remove the requirement to have RCIC Equipment Room Differential Temperature Isolation Actuation Instrumentation, and will affect Technical Specification Tables 3.3.2-1, 3.3.2-2, 3.3.2-3, and 4.3.2.1-1.

It is requested that this proposed amendment be processed under the emergency situation clause provided in 10CFR50.91(a)(iii)(5). Under the present plant situation, until such time as the differential temperature instruments are deleted from the Technical Specifications, the RCIC system is considered inoperable in accordance with Technical Specification 3.7.3. As such the Perry Nuclear Power Plant would be required to commence a plant shutdown by February 1, 1990. Attachment 1 includes the Summary/Safety Analysis, the Statement of Emergency Situation, the No Significant Hazards Consideration and the Environmental Consideration. Attachment 2 includes the proposed markup of the changed Technical Specification pages.

If you have any questions, please call and we will respond promptly in order to support issuance of this change on an emergency basis.

Very truly yours,

Al Kaplan

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Vice President
Nuclear Group

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Summary/Safety Analysis

The purpose of this License Amendment Request is to propose a change to the Perry Nuclear Power Plant (PNPP) Technical Specification (TS) 3.3.2, Tables 3.3.2-1, 3.3.2-2, 3.3.2-3, and 4.3.2.1-1. These Tables list various Containment Isolation Actuation Instrumentation. The proposed change would eliminate the Reactor Core Isolation Cooling (RCIC) Equipment Room Differential Temperature (delta-T) Containment Isolation Actuation Instrumentation from the specification.

It has been determined that these instrument trips are not required in order to meet any of the 10CFR50 Appendix A General Design Criteria (GDC) due to the redundancy and diversity of other existing leak detection instrumentation. GDC 30 states that "means shall be provided for detecting and to the extent practical, identifying the location of the source of reactor coolant leakage." GDC 54 states that "piping systems penetrating primary reactor containment shall be provided with leak detection, isolation, and containment capabilities having redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating these piping systems." These design criteria are intended to ensure early detection of leak conditions, to identify the leak location as much as possible and to allow for manual or automatic system isolation depending on the size of the leak and the function of the system involved. The leak detection functions and isolation functions which remain effective after approval of this change will fully meet the letter and intent of these design criteria.

The Perry design includes features that monitor for leak conditions as well as for larger line break conditions. The features span a wide range of redundant and diverse functions with the differential temperature-based instruments accounting for only a portion of the features. Enclosure 1 lists the other automatic isolations which are available for monitoring leaks/breaks in the RCIC turbine or its steam supply line within the RCIC Equipment Room, and Enclosure 2 lists the additional alarms that are available to detect and locate breaks in this line so that they may be manually isolated.

As can be seen in Enclosure 1, there exists redundant high ambient temperature isolation instrumentation in the RCIC Equipment Room. At PNPP the high ambient temperature isolation and differential temperature isolation setpoints were both based on detecting the same range of leak sizes. These ambient temperature instrument isolations are redundant and divisionalized, thus satisfying the redundancy requirements of GDC 54 without reliance on the delta-T instrumentation. In addition to temperature-based leak detection, Enclosure 1 shows that there are three other methods of automatic RCIC isolation: RCIC Steam Line Flow-High detectors, RCIC Steam Supply Pressure-Low detectors, and RHR/RCIC Steam Line Flow-High detectors. Each of these diverse leak detection methods is also redundant and divisionalized, and their logic is designed so that any one detector can perform the isolation function.

In addition to these automatic isolations, the operator has numerous other alarms or other indications of a leak in the RCIC Equipment Room. Enclosure 2 lists four other process indicators which are available to the operator. These include the RCIC Equipment Room Floor Sump-High Level Alarms, Auxiliary Building Exhaust Ventilation Radiation Monitor, and Unit 1 Plant Ventilation Radiation Monitor. It should be noted that Enclosure 2 also includes the delta-T instrumentation as an alarm available to the operators, since it is CEI's intent to maintain the alarm capability of these instruments even after the isolation function is disabled. The Perry Updated Safety Analysis Report (USAR) Tables 5.2-8 and 5.2-9 give a summary of the various isolations and alarms used for leak detection for RCIC as well as for other plant systems.

With these various automatic isolations, alarms, and system indications available, CEI has concluded that the General Design Criteria are met without any reliance on the differential temperature isolations in this area.

CEI also reviewed NUREG 0800 "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition", for any additional guidance in interpreting the GDC. Various subsections of Section 6.2.4 of the Standard Review Plan (SRP) entitled "Containment Isolation System," do provide additional guidance. Section 6.2.4.II.6.c states that containment isolation provisions for lines in systems such as RCIC may include remote-manual valves, as long as provisions are made to detect possible leakage from these lines outside containment. Section 6.2.4.II.6.h goes on to state that systems classified as "essential" may include remote manual containment isolation valves, as long as there are provisions made to detect possible leakage from lines outside containment. Finally, Section 6.2.4.II.6.1, requires diversity in the parameters sensed for initiation of containment isolation to satisfy the requirement of GDC 54 for reliable isolation capabilities.

This SRP guidance is met or exceeded without reliance on the differential temperature isolation. The first two sections referenced indicate it would be acceptable to have the RCIC containment isolation valves be remote-manual valves as long as they meet the criteria of those paragraphs. RCIC is specifically called out in 6.2.4.II.6.c as a system meeting this criterion. This GDC philosophy is consistent with the proposed PNPP configuration which would provide for delta-T alarms and subsequent operator actions upon a small steam leak. Also, although RCIC is not an Engineered Safety Feature (ESF) system at PNPP, RCIC has been classified as "essential" per the direction of NUREG-0737 (i.e. a system which should not be automatically isolated upon a LOCA signal). This classification is documented in USAR Table 6.3-32 and this classification has been reviewed and accepted by the NRC in Section 6.2.7(3) of Supplement 2 to the PNPP Safety Evaluation Report (SSER), dated January 1983. The philosophy of classifying systems as either essential or non-essential is that it is undesirable to needlessly isolate certain systems which can be used to respond to transients or accidents. This philosophy is a reflection of the GDC 54 words relating to "the importance to safety of isolating these piping systems." As noted above, it is CEI's intent to disable the isolation trip from the RCIC Equipment Room Differential

Temperature Instrumentation, but maintain the alarm capability. Although the other isolation functions described in Enclosure 1 also have alarm setpoints associated with them, and there is justification for complete elimination of the delta-T instruments based on the ability to meet GDC 54 without reliance on them, retention of these instruments as another alarm will give the operators an additional indication of possible leakage in the RCIC area when the RCIC system is operating, so that the containment isolation valves could be remote-manually shut if the operator confirmed by alternate means that a leak has occurred.

Operating experience at Perry has shown that retention of the RCIC area differential temperature isolation has a negative effect on plant safety due to RCIC isolations when no steam line leaks are actually present. On one occasion a trip of RCIC has already occurred during a plant transient in which the RCIC system had automatically initiated to restore reactor vessel water level, and on a previous occasion delta-T alarms were received due to the range of "normal" differential temperatures seen by the leak detection system. The differential temperature in the room is measured by two independent pairs of thermocouples. The cold leg of the thermocouple pair is located inside of the RCIC Room Cooler Unit in the air flow directly downstream of the cooling coils, and the hot leg of the thermocouple pair is located on the RCIC area wall. In this arrangement the leak detection system is monitoring the differential temperature across the RCIC room cooler. If a steam leak develops while the cooler is in operation, the differential temperature will increase between the inlet and outlet of the cooler as heat from the steam leak is exchanged across the cooling coils. This differential temperature will provide an alarm as it reaches the alarm setpoint and currently will also generate an isolation signal at a slightly higher setpoint.

The cooling coils are fed by the Emergency Closed Cooling (ECC) Water System. The ECC system is in turn cooled by the Emergency Service Water (ESW) system, which takes its water from Lake Erie. The temperature of Lake Erie varies greatly over the year from around 32-33^{o} F during the winter months up to 80^{o}F during the summer. This in turn varies the temperature of the ECC water, which in turn varies the outlet temperature of the RCIC room cooler. Therefore, even without the RCIC room ambient temperature changing, the differential temperature sensed by the leak detection system does change throughout the year, based on Lake Erie temperatures. In an attempt to compensate for this CEI has initiated a "winter" position on numerous cooling water throttle valves, including the ECC outlet valve to the RCIC Room Cooler. The ECC outlet valve is put in the winter position whenever Lake Erie temperatures reach 55^{o}F or lower. However, this does not completely compensate to maintain the cold leg thermocouple at a consistent temperature, and the leak detection system still experiences a range of differential temperatures based solely on external temperatures. This has created a substantial problem in assuring a proper degree of margin is maintained between the maximum room operating differential temperature and the isolation setpoint differential temperature.

In addition to the seasonal variations in temperatures, the difficulty in determining a valid setpoint is aggravated because RCIC is called upon to respond to anticipated operational transients when there are few other heat loads on the ECC system upstream of the RCIC room coolers and no "Post-small break-LOCA" heat loads in the room. The design setpoint necessarily has to account for Post-LOCA factors to ensure RCIC operation in worst case conditions, but it complicates the choice of an acceptable setpoint for "normal" conditions. For these reasons, it has been concluded that the ranges in actual room differential temperature values over the year and between RCIC operation during anticipated transients versus "post-small break-LOCA" conditions results in choices of setpoints which would have either excessive or inadequate margins to the desired isolation actuation point. It was further concluded that since this isolation function was not required to meet any regulatory requirement, continuing to use a differential temperature isolation trip with the complexities involved in determining a proper trip setpoint could lead to further spurious trips, and actually be a detriment to plant operations and safety because of unnecessary system challenges and reduced availability of a desirable water injection system during plant transients.

CEI has also performed a review of industry experience to determine if other facilities have experienced problems with differential temperature leak detection isolation. Institute of Nuclear Power Operations (INPO) Significant Operating Experience Report (SOER) 81-13 discussed an event at Hatch 1 in June of 1980 where both RCIC and HPCI failed. One of INPO's recommendations from their review of this event was that licensees should consider modifying the RCIC system differential temperature isolation logic to reduce the frequency of unwarranted isolations. A followup report on the Hatch problem was issued by the Nuclear Safety Analysis Center (NSAC) of INPO in April of 1981 entitled "High Pressure Core Cooling System Malfunctions at Hatch 1." Appendix F of this report is titled HPCI and RCIC Reliability, which stated that their review had determined twelve instances of inadvertent HPCI or RCIC isolation due to malfunction of the differential temperature leak detection. This report went on to state that INPO believed (in the 1981 timeframe) that this leak detection system had been removed at all plants.

A later report from NSAC (NSAC/53), entitled "Reliability of BWR High Pressure Core Cooling," dated August 1982, recommended in Section 2 and Table B-2 that the RCIC Equipment Room Differential Temperature trip be bypassed during auto-initiation events of RCIC, but the alarm function be maintained.

A limited review was performed of Technical Specifications from other BWR plants. This review identified that several other plants had apparently already removed this isolation circuitry from their detection systems, and/or had Technical Specifications approved without the delta-T isolation trip.

General Electric (GE), the Nuclear Steam System Supplier for the Perry Nuclear Power Plant was also requested to evaluate Perry's RCIC leak detection system and determine the necessity for having the RCIC area differential temperature isolation capability. In a letter dated January 11, 1990 GE concluded that the RCIC area differential temperature leak detection could be eliminated without causing a degradation in the safe operation of the plant, based on the redundancy and diversity of the remaining leak detection instrumentation. GE also reviewed similar differential temperature detection in the Residual Heat Removal (RHR), and Reactor Water Cleanup (RWCU) areas of the plant and concluded that these differential temperature isolation functions could also be eliminated. A request to change the Technical Specifications for these instruments is being evaluated for future submittal.

At the same time that GE issued the above letter, they approved a change to the Perry Nuclear Power Plant Leak Detection Design Specification Data Sheet, to indicate that differential temperature isolations were not required in the RCIC, RHR and RWCU Areas.

Based on the above reviews, it would appear that other plants have experienced problems with differential temperature isolations of the RCIC system, and at least several have already eliminated it from their leak detection circuitry. In addition, GE has also determined (and CEI concurs) that the Perry leak detection design is sufficiently redundant and diverse to meet the requirements of GDC 54 without any reliance on the differential temperature isolation.

CEI has reviewed the Accident Analysis as discussed in the Updated Safety Analysis Report (USAR). There is no specific accident analysis dealing with small steam leaks from the reactor coolant system or connected systems. However, leakage from a break in the RCIC steam line is bounded by the steam system pipe break outside of containment (USAR Section 15.6.4), which is not affected by elimination of the RCIC Area Differential Temperature Isolation Instrumentation.

For these reasons, CEI concludes that the RCIC Area Differential Temperature Isolation Actuation Instruments could be eliminated from the Technical Specifications, and the isolation function eliminated from the plant design without negatively affecting the safe operation of the plant.

Background Information on the January 7, 1990 RCIC Isolation and Subsequent Actions

On January 7, 1990, the RCIC system was operating, supplying water to the Reactor, following an RPS actuation (Scram) on reactor vessel low water level, which resulted from a loss of normal feedwater. After approximately 37 minutes of operation the RCIC system isolated because of an indicated high differential temperature (delta-T) in the RCIC area. Reactor vessel level continued to be maintained using other plant systems. A review of the RCIC trip resulted in the following conclusions:

1. The differential temperature trip was not caused by a steam leak in the RCIC Equipment Room. The area ambient temperature changed very little during the entire event.

2. The thermocouple which provides the low temperature indication for the delta-T logic indicated decreasing temperatures following the RCIC initiation, which eventually resulted in the RCIC delta-T trip. This thermocouple is located inside the RCIC Equipment Room Cooler Unit, measuring the temperature of the airflow downstream of the cooling water coils. This room cooler is in a standby condition without any cooling water flow during normal plant operations. When RCIC is automatically initiated the source of cooling water to the RCIC room cooler [Emergency Closed Cooling (ECC) Water System] is also initiated, supplying water to the cooling coils. At the same time, the RCIC room cooler fan starts, sending air over the cooling coils and past the thermocouple. Since the ECC system is cooled by Lake Erie water via the Emergency Service Water (ESW) system, this water temperature is variable based on ESW (Lake Erie) temperature. As stated above, this transient occurred on January 7, 1990 with the lake temperature at 32-33°F and ECC temperatures which dropped down to approximately 53-55°F. This resulted in the air passing the thermocouple at the time of the trip being cooled to around 68-70°F with the room ambient temperature steady between 105-107°F. This was sufficient to create a differential temperature large enough to cause the RCIC isolation.

3. Following the trip, valve lineups to the room cooler were verified to be correct per the guidance provided in the system operating instruction. During the subsequent investigation of the trip, actual flow through the RCIC room cooler was determined by the use of Heise gauges across a flow orifice. The observed flow was calculated to be greater than the desired flow rate (approximately 6.5 gpm versus 4.3 gpm). The 4.3 gpm flow rate had previously been determined to be the correct value after investigation into similar conditions was conducted in late January/early February 1987. At that time, RCIC room delta-T alarm signals were being received due to the cold ECC temperature (alarm setpoint is approximately 8°F below the isolation setpoint). Calculations were performed to determine the correct position for the ECC system throttle valve to the RCIC room cooler for cold weather operations. These calculations determined that with Lake Erie temperature at or below 55°F the throttle valve should be positioned to provide a flow of 4.3 gpm, or 1/4 turn open. The RCIC system was tested following this determination in 1987. After this successful testing, CEI changed procedures to require the throttle valve to be positioned 1/4 turn open during winter operations (Lake temperature <55°F). This was the position the valve was verified to be in following the RCIC isolation, however since there was a concern that giving the operators the direction to open a one inch valve 1/4 turn may lead to slightly different settings by using different operators, the system flow was checked using Heise gauges as stated above. The

RCIC system had been run a number of times during previous winters for various time periods with no delta-T alarms received, much less any isolations. With the rethrottling of this valve, CEI felt it was reasonable to believe that the differential temperature instrumentation would work properly and not provide spurious RCIC isolations.

4. Portions of the thermal insulation were not installed on the RCIC steam turbine at the time of the isolation. However, observed ambient temperatures and review of existing calculations determined that this probably did not play a significant role in the high differential temperature. This was therefore ruled out as a major contributor, although the insulation was reinstalled prior to plant restart, following the January 7, 1990 scram.

5. On January 12, 1990 CEI held discussions with various NRC staff members to communicate to the staff what the cause of the isolation had been, and what corrective actions were being taken. CEI indicated at that time that upon plant restart the RCIC system would be tested after the reactor plant reached normal pressures and temperatures, and tested again after the RCIC equipment room temperatures stabilized to near the same temperatures as seen on January 7 in an attempt to as closely match those experienced on January 7 as possible.

   In order to give some assurance that the RCIC system would operate as required without delta-T trips, the test procedure stipulated that the RCIC system would be run at rated flow for a minimum of two hours without tripping. Also, to account for all the possible varying plant conditions, ambient temperatures, and variances in ECC system flow rates, all of which could affect the RCIC room delta-T input parameters, a test acceptance criterion was established which required that no delta-T channel reading should come within 5 degrees of the trip setpoint during the test.

   The RCIC system was first tested on the morning of January 18, 1990 following the plant restart and return to power. Approximately 2 minutes into the test the RCIC room delta-T readings were within 2 degrees of the trip setpoint. The Operators decided to secure from the test, and placed the RCIC system in its normal standby condition. After discussions with the Operators and personnel involved in the test, it was determined that the test should be attempted again to determine the validity of the first test results. The retest was performed starting at about 2:00 p.m. on January 18, 1990. The RCIC system was run for a two hour period during which time the RCIC delta-T readings for one channel initially approached to within approximately 2 degrees of the isolation setpoint, then stabilized at approximately 4.5 degrees away from the isolation setpoint.

In CEI's judgement this margin to the isolation trip setpoint was not sufficient to ensure the reliability of the RCIC system during future responses to plant transients or accidents. Therefore, the plant declared RCIC inoperable and entered the Actions of Technical Specification 3.7.3 which requires the plant to restore RCIC to an OPERABLE status within 14 days or be in HOT SHUTDOWN within 12 hours. This action will require a plant shutdown by February 1, 1990 if this proposed change is not approved.

Statement of Emergency Situation

10CFR50.91(a)(5) states that where the Commission finds that an emergency situation exists, in that failure to act in a timely manner would result in derating or shutdown of a nuclear power plant, it may issue a license amendment involving a no significant hazards consideration, without prior notice and opportunity for a hearing or for public comment. As stated above the plant is presently in a Technical Specification Action Statement which will require a plant shutdown if the Technical Specifications are not revised prior to February 1, 1990. 10CFR50.91(a)(5) also requires the licensee to state why the emergency situation occurred and why it could not be avoided. Until the RCIC system differential temperature isolation actuation instrumentation failed to meet CEI's acceptance criteria during the testing performed on January 18, 1990, CEI felt that the investigation/corrective action taken in response to the January 7, 1990 RCIC isolation was comprehensive and appropriate. After reviewing the results of the investigations performed following both the recent RCIC delta-T isolation and the previous RCIC delta-T alarms, CEI felt it was reasonable to believe that restoration of the system configuration to its 1987 status would allow for RCIC operation (when no steam line leaks are present) without receipt of RCIC delta-T isolation. CEI could not foresee that the RCIC differential temperature isolation instrumentation would again create the potential for RCIC isolations during future demands in response to transients. Therefore, prior to completion of the January 18, 1990 testing, there was no need for any Technical Specification change to be submitted, and the emergency situation was not avoidable.

No Significant Hazards Consideration

The Nuclear Regulatory Commission (NRC) has promulgated standards in 10CFR50.92(c) for determining whether a proposed amendment to a facility operating license involves no significant hazards consideration. A proposed amendment to an operating license involves no significant hazards considerations if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
(2) Create the possibility of a new or different kind of accident than previously evaluated; or
(3) Involve a significant reduction in a margin of safety.

CEI has reviewed the proposed amendment with respect to these standards and has determined that the proposed changes do not involve a significant hazard because:

(1) The proposed change does not involve a significant increase in the probability or consequences of a previously evaluated accident.

The differential temperature isolation instrumentation provides monitoring for leaks. Therefore, the probability for leak initiation is not affected by the elimination of the isolation instrumentation trip.

The consequences of a previously evaluated accident also has not changed. As previously described, the remaining isolation actuation instrumentation and alarms cover a wide range of steam piping leaks and breaks including the ranges presently covered by the differential temperature instrumentation. As such any leak over the range monitored by the differential temperature instrumentation will be sensed by other redundant and diverse instrumentation with alarm and/or isolation capability. The range of possible RCIC steamline breaks (up to and including a circumferential steamline break) is not affected by this proposed change. As such the consequences of a RCIC steamline break will not change, and are still bounded by the steamline break outside of containment scenario analyzed in USAR Section 15.6.4. Thus, the consequences of a previously evaluated accident have not changed.

(2) The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. As stated above the differential temperature isolation actuation instrumentation is a monitoring system. Elimination of the isolation function of this monitoring system cannot create a new type of accident, since breaks of the RCIC steamline, up to and including a circumferential break, are bounded by other accidents presently analyzed in USAR Section 15.6.4.

(3) The proposed change does not involve a significant reduction in the margin of safety. There will still exist sufficient redundant and diverse leak detection instrumentation to detect steam leaks/breaks in the RCIC area. This change does not therefore affect any accident analysis nor does it have any effect on performance characteristics of safety systems. As such it will not result in a reduction in the margin of safety. Also, since this change will increase the reliability of the RCIC system by eliminating trips, overall plant safety will be slightly increased.

Environmental Consideration

Cleveland Electric Illuminating has reviewed the proposed Technical Specification change against the criteria of 10 CFR 51.22 for environmental considerations. As shown above, the proposed change does not involve a significant hazards consideration, nor increase the types and amounts of effluents that may be released offsite, nor significantly increase individual or cumulative occupational radiation exposures. Based on the foregoing, CEI concludes that the proposed Technical Specification change meets the criteria given in 10 CFR 51.22(c)(9) for a categorical exclusion from the requirement for an Environmental Impact Statement.

NJC/CODED/V3051

RCIC LEAK DETECTION ISOLATION SIGNALS

The following RCIC valves are isolated by the leak detection instrumentation described below:

RCIC Trip System A:	1E51F064	RCIC Trip System B:	1E51F063
	1E51F031		1E51F076

1. RCIC Equipment Room Ambient Temperature-High

1E31N602A	Closes RCIC Trip System A valves
1E31N602B	Closes RCIC Trip System B valves

2. RCIC Steam Line Flow-High

1E31N683A	Closes RCIC Trip System A valves
1E31N683B	Closes RCIC Trip System B valves

3. RCIC Steam Supply Pressure-Low

1E31N685A	Closes RCIC Trip System A valves
1E31N685B	Closes RCIC Trip System B valves

4. RHR/RCIC Steam Flow-High

1E31N684A	Closes RCIC Trip System A valves
1E31N684B	Closes RCIC Trip System B valves

5. RCIC Turbine Exhaust Diaphragm Pressure-High (Although these instruments isolate the RCIC system, they are not detecting steam line breaks).

1E51N655A 1E51N655E	Both switches must actuate to close RCIC Trip System A valves
1E51N655B 1E51N655F	Both switches must actuate to close RCIC Trip System B valves

Enclosure 2 - Alternate Methods of Determining RCIC Room Leaks

1. RCIC Room Sump Level Switches

   1G61N430
   1G61N730

2. RCIC Room Differential Temperature Alarm *

   1E31N603A
   1E31N603B

3. Auxiliary Building Ventilation Exhaust Radiation Monitor

   1D17K700

4. Unit 1 Vent Radiation Monitor

   1D17K780

* These are instruments being deleted from the Tech Spec's as an isolation actuation instrument by this proposed change. Will remain installed and be available for alarm function to indicate possible steam leakage when the RCIC Room is being cooled by its room cooler.