NIAGARA MOHAWK POWER CORP.
NINE MILE POINT UNIT 1

NMP1L 0534
Enclosure 1
Attachment B

EVALUATION OF THE LACK OF REDUNDANT WIDE RANGE RPV WATER LEVEL INDICATION

Report No. NMP1-RG197-WL2

Revision 0

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1.0 INTRODUCTION

RPV Water Level is designated as an "EOP Key Parameter" at Nine Mile Point Unit 1 (NMP-1), and the Wide Range RPV Water Level Instrument system is identified as one of the associated Regulatory Guide (RG) 1.97 Category 1 instruments[1].

'Redundancy' is one of the specific design features recommended by RG 1.97 for Category 1 instruments. However, at NMP-1, wide range RPV water level indication is supplied by a single-channel instrument system and there is currently no plan to modify the system to provide a second (i.e., redundant) channel.

This subject (lack of redundancy for wide range RPV water level indication) was specifically discussed with NRC Region I representatives during Inspection No. 50-220/89-25. The associated Inspection Report[2] states that:

> *"No significant safety issues were identified by the inspectors regarding the lack of a redundant channel for the RPV water level wide range instrumentation."*

In response to an associated Niagara Mohawk Power Corporation commitment documented in the NRC Report of Inspection No. 50-220/89-25, the following report has been developed to provide appropriate documentation of the basis for the acceptability of deviating from the RG 1.97 redundancy design criteria as regards the Wide Range RPV Water Level Instrument system at NMP-1.

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[1] Refer to NMPC letter NMP1L 0426 dated July 31, 1989.
[2] Refer to NRC letter to Niagara Mohawk dated November 14, 1989.

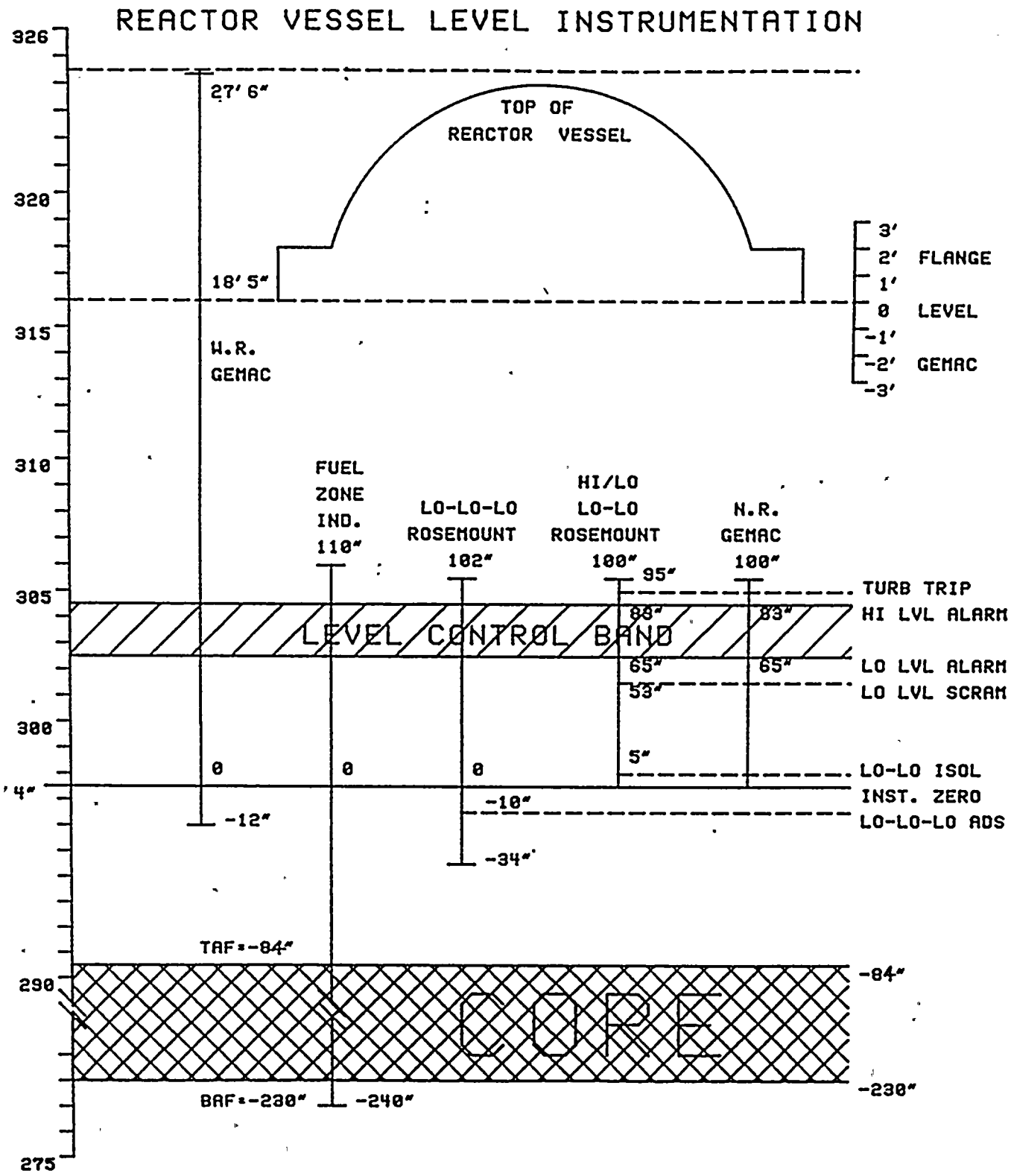
2.0 SYSTEM DESCRIPTION

2.1 Function

The principal function of the Wide Range RPV Water Level instrument system is to provide indication of the current status (value and trend) of this parameter to operators in the main control room. This function is accomplished through the use of hard wired meters and computer-driven display features presented on the screens of the Safety Parameter Display System (SPDS).

The Wide Range RPV Water Level Instrument system does not provide any initiating (or trip) signal for any automatic protective functions.

As shown in the figure on page 4, the range of RPV water level that is monitored by this system (Wide Range GEMAC) extends from approximately 6 feet above the top of the active fuel to the top of the reactor vessel. This instrument range overlaps the entire range of indication that is provided by the narrow range (0 inch to 100 inch) RPV water level instrument systems.


REACTOR VESSEL LEVEL INSTRUMENTATION
326
320
315
310
305
300
290
275
27' 6"
TOP OF
REACTOR VESSEL
18' 5"
W.R.
GEMAC
3'
2'
FLANGE
1'
0
LEVEL
-1'
-2'
GEMAC
-3'
FUEL
ZONE
IND.
110"
LO-LO-LO
ROSEMOUNT
102"
HI/LO
LO-LO
ROSEMOUNT
100"
N.R.
GEMAC
100"
95"
TURB TRIP
88"
83"
HI LVL ALARM
LEVEL CONTROL BAND
65"
65"
LO LVL ALARM
53"
LO LVL SCRAM
5"
LO-LO ISOL
0
0
0
4"
INST. ZERO
-10"
LO-LO-LO ADS
-12"
-34"
TAF=-84"
-84"
CORE
-230"
BAF=-230"
-240"

2.2 Design Features

A simplified sketch of the configuration of the Wide Range RPV Water Level Instrument system piping and associated components is illustrated in the figure on page 6. As shown in the sketch, two RPV water level transmitters (LT 36-33 and LT 36-35) are provided.

LT 36-33 supplies an "uncompensated" analog RPV water level signal to the SPDS, and a "pressure compensated" RPV water level signal (through various GEMAC signal processing and conditioning units) to two indicators located in the control room as follows:

- LI IA13 – Located on Panel F.

  Indicating scale ranges from -1 ft to +27.5 ft (instrument zero is the same reference as that for all other RPV water level instruments – except that of LI IA19 (below)).

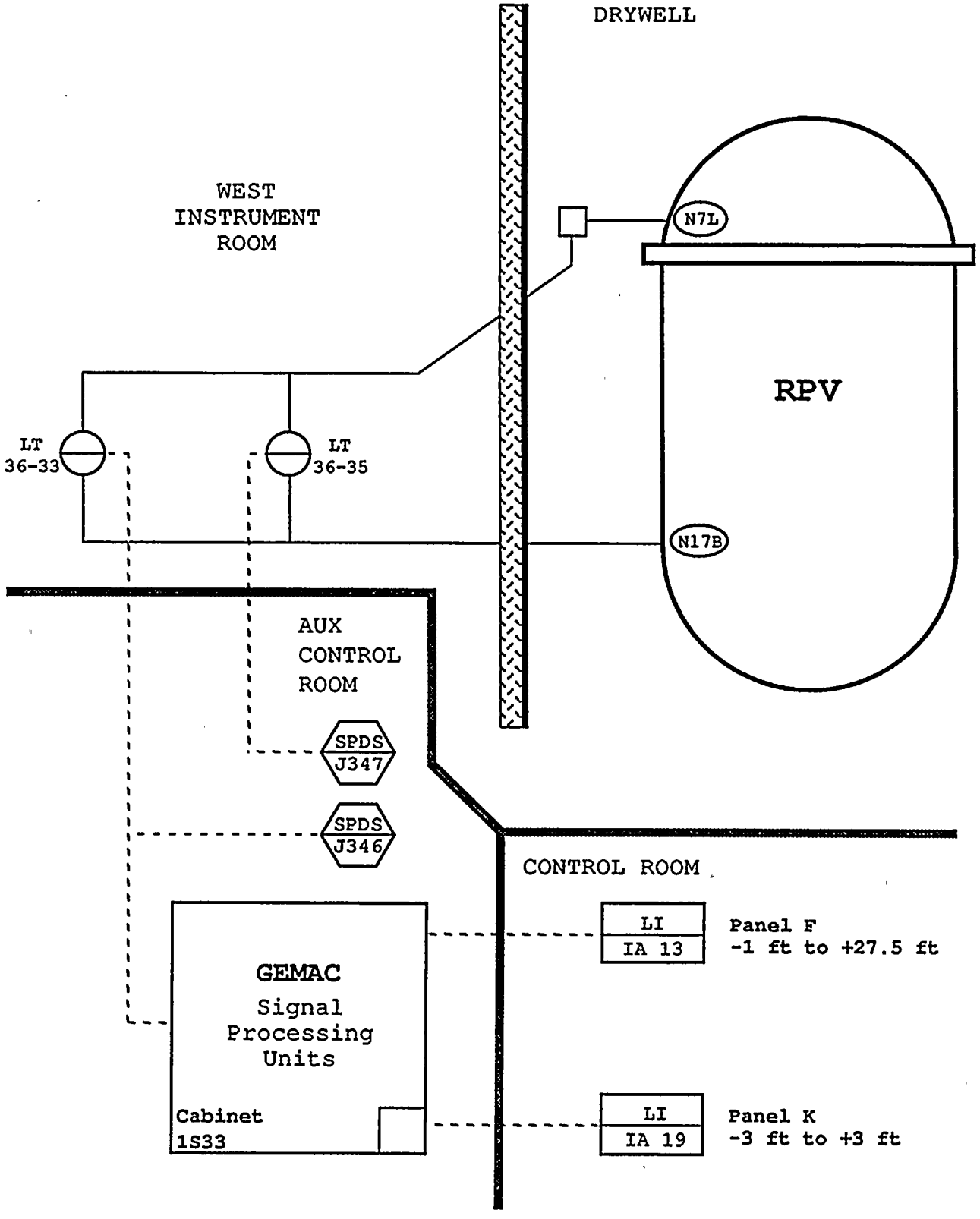
- LI IA19 – Located on Panel K.

  Indicating scale ranges from -3 ft to +3 ft (instrument zero corresponds to 18 ft 5 in. indicated on the scale of LI IA13, and is the level equivalent to the RPV flange).

LT 36-36 supplies an "uncompensated" analog RPV water level signal to (and only to) the SPDS.

A single variable leg (RPV penetration N17B) and a single reference leg (RPV penetration N7L) supply both LT 36-33 and LT 36-35; thus, the Wide Range RPV Water Level Instrument system is essentially a single-channel system.

LT 36-33 and LT 36-35 are both located in the West Instrument Room on elevation 281 feet, near column-row M-6,7.



WIDE RANGE (GEMAC) RPV WATER LEVEL INSTRUMENT SYSTEM

3.0 EVALUATION OF INSTRUMENT FAILURE

3.1 Normal Plant Operations

Throughout the full spectrum of normal plant operating conditions, from cold shutdown through and including operation at rated reactor power, the normal control band for RPV water level specified by applicable plant procedures is within, and is monitored and controlled using, the range of RPV water level indication supplied by fully redundant narrow range (0 inch to 100 inch) instrument systems. These include the following:

CHANNEL 11	CHANNEL 12
Hi/Lo Lo-Lo Rosemount: EPN: LI 36-09 (Panel F)	Hi/Lo Lo-Lo Rosemount: EPN: LI 36-10 (Panel F)
Narrow Range GEMAC EPN: LI ID59A (Panel F) EPN: LI ID59C (Panel K) EPN: LI ID 59D (Console E) EPN: LR/FR ID14 Black Pen (Panel F)	Narrow Range GEMAC EPN: LI ID59B (Panel F)

Use of the Wide Range RPV Water Level Instrument system is generally limited to certain plant shutdown conditions when, for a specific reason[3], it is desired to increase/maintain RPV water level at a value above that able to be indicated by the narrow range instrument systems. Even for these types of conditions, a complete loss of wide range RPV water level indication, whether due to an electrical failure or a mechanical failure, presents no significant plant safety concern because core coverage – and thus adequate core cooling – is easily able to be confirmed and maintained via "upscale high" indications supplied by the

[3] RPV flood-up in preparation for maintenance/refueling activities is one typical example.

various narrow range RPV water level instrument systems (all of which have dual-channel (electrically separate and independent) sensors and associated display devices).

3.2 Plant Design Basis Transient and Accident Analyses

The Wide Range RPV Water Level Instrument system does not provide any initiating (or trip) signal for any automatic protective functions. Therefore, a postulated failure of the Wide Range RPV Water Level Instrument system has no impact on the the analyzed response of Engineered Safety Features for plant design basis transients and accidents documented in the Final Safety Analysis Report. (i.e., the analysis of plant design basis transients and accidents that is documented in the Final Safety Analysis Report does not, in any way, rely upon the function or operation of the Wide Range RPV Water Level Instrument system).

3.3 Abnormal and Emergency Plant Operations

In general, the NMP-1 Emergency Operating Procedures (EOPs) direct that RPV water level be controlled either:

- Within the specified "preferred" range that extends between +53 inches (low end; defined by the low RPV water level scram (RPS trip) setpoint) to +95 inches (high end; defined by the high RPV water level turbine trip setpoint), or

- Within some alternate range below the "preferred" range, but still sufficient to assure adequate core cooling.

Both of these general instructions for control of RPV water level are able to be performed without any reliance on indication supplied by the Wide Range RPV Water Level Instrument system. (Refer to the figure shown on page 4, and the table presented on page 7.) Therefore, a failure of the Wide Range RPV Water Level Instrument system would have little (if any) effect on the control room crew's ability to carry out the actions specified in the EOPs for assuring adequate core cooling.

If a failure of the Wide Range RPV Water Level Instrument system were to occur in combination with multiple failures of other RPV water level instruments such that RPV water level "cannot be determined" (a combination of events that is clearly beyond the plant's design and licensing basis), the EOPs also provide explicit and detailed instructions for such a situation. In general, the directed action is to:

1. Transfer to EOP-7, "RPV Flooding," and

2. Inject into the RPV as required to establish/maintain Electromatic Relief Valves open and RPV pressure above a specified minimum value, and

3. Continue such injection until RPV water level indication is restored.

Through this means adequate core cooling continues to be assured even without any direct indication of RPV water level available.

4.0 SUMMARY AND CONCLUSION

A deviation from the redundancy design criteria recommended by RG 1.97 for Category 1 instruments is evaluated as being acceptable for the Wide Range RPV Water Level Instrument system at NMP-1 based on the following:

1. Other dual-channel Category 1 instrument systems are available for monitoring RPV water level above the top of active fuel (thereby providing redundant direct indication of adequate core cooling without reliance on the Wide Range RPV Water Level Instrument system).

2. No initiating (or trip) signal for any automatic protective function is supplied by the Wide Range RPV Water Level Instrument system.

3. The analysis of plant design basis transients and accidents that is documented in the Final Safety Analysis Report does not, in any way, rely upon the function or operation of the Wide Range RPV Water Level Instrument system.

4. The range of RPV water level that is monitored by the Wide Range RPV Water Level Instrument system is above both the 'preferred' and 'alternate' RPV water level control bands specified in the Emergency Operating Procedures (relates, also, to number 1 above).

5. The extreme condition *"RPV water level cannot be determined"* is explicitly addressed in the Emergency Operating Procedures, with appropriate and detailed instructions provided in EOP-7, "RPV Flooding" for assuring that adequate core cooling is maintained without reliance on any direct indication of RPV water level.

LONG TERM PROGRAM ACTIVITIES
for addressing
CABLE SEPARATION OF CIRCUITS
for
RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

LONG TERM PROGRAM ACTIVITIES FOR ADDRESSING CABLE SEPARATION OF CIRCUITS FOR RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

1.0 INTRODUCTION

In Niagara Mohawk Power Corporation (NMPC) letter NMP1L 0401 to the NRC dated May 19, 1989, a commitment was made to develop and implement, after restart from our last outage, a Long Term action plan addressing cable separation for Regulatory Guide (RG) 1.97 Category 1 instrument loops. This commitment was part of NMPC's response to NRC Issue No. 1 that was first identified in NRC letter to NMPC dated April 19, 1989.

NMPC's commitment further stated that the specifics of the Long Term action plan for cable separation would be based on the results of various Short Term actions associated with this same issue. The scope of the Short Term actions was detailed in letter NMP1L 0401. All Short Term actions were completed by NMPC and the results reviewed by the NRC (both NRR and Region I) during several on-site inspections[1] conducted prior to plant restart from our last outage.

In fulfillment of the Long Term action plan commitment identified above, and as the basis for closure of remaining NRC (Open) item 88-34-08, a description of the Long Term program activities for addressing cable separation for RG 1.97 Category 1 instrument loops is presented herein. As is the case with several other wide-ranging and long term program activities for Nine Mile Point Unit 1 (NMP#1), actions to evaluate cable separation are integrated into a broader comprehensive program being undertaken by NMPC called the Design Basis Reconstitution (DBR) Program. (The DBR Program was initially called the Engineering Program Integration Plan (EPIP), and information regarding its general scope and approach has previously been provided to the NRC.) Completed short term program activities associated with cable separation of RG 1.97 Category 1 instrument loops are also briefly described herein since the results of these activities relate to the Long Term action plan for cable separation that has been formulated and adopted for NMP#1.

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[1] Refer to the NRC reports of Inspections 50-220/89-12, 50-220/89-25, and 50-220/89-35.

2.0 BACKGROUND – SUMMARY OF COMPLETED SHORT TERM ACTIONS

In NRC audits conducted at NMP#1 during November 14-18, 1988, and March 27-31, 1989, three inspection items were identified with respect to the physical separation of electrical cables for RG 1.97 Category 1 instruments. Inspection item 88-34-01 involved the physical separation of wiring connections for the Channel 11 and the Channel 12 RPV pressure instrument loops. Inspection item 88-34-08 involved the electrical and physical separation of the control room post-accident monitoring display devices in the control complex. Inspection item 89-12-01 involved potential cable separation deviations in the cable routing for Category 1 instrumentation.

In response to the identified audit findings, a number of short term actions addressing cable separation were completed prior to plant restart and, based on the results of these short term actions, Inspection items 89-12-01 and 88-34-01 were closed.

The short term activities completed prior to restart included development of one-line cable routing sketches for each RG 1.97 Category 1 analog-signal instrument loop. The cable routing sketches were used to support an evaluation of the degree of physical separation that currently exists between cables of redundant instrument loops. Each sketch was color coded to indicate the channel designation (Channel 11, Channel 12, etc.) of the trays that are currently used for routing instrument loop cables from the sensor to the display device(s). From the completed cable routing sketches, a matrix of Category 1 instrument loops (listed by monitored plant parameter) vs. cable trays and penetrations was constructed to identify any cable routing that was (potentially) inconsistent with the loop's channelized power supply (i.e., RPS Bus 11, RPS Bus 12). From the constructed matrices, a composite list of potential cable routing discrepancies (divergences from the routing philosophy for instrument loop cables as presented in NMPC Engineering Design Guideline (EDG) No. 1300, "Cable Routing,") was developed. These potential discrepancies were documented, and the location of each was referenced to the applicable plant fire zone (fire zones as defined per the Appendix R Program).

A hazards evaluation team was assembled and the team performed a plant walkdown of the identified fire zones that contained identified potential cable separation discrepancies to determine if any single event caused by a potential hazard (e.g., missiles, pipe whip, or jet impingement from a high energy line break; flooding; external fires) could render both channels of functionally redundant Category 1

instrumentation for a parameter inoperable. The walkdown also investigated the features available in each area for detecting and mitigating the consequences of the postulated hazard event (e.g., smoke detectors, high temperature alarms, fire extinguishing systems, flooding alarms, and available personnel). The results of the hazards walkdown determined that no hazard sources existed that could through a single event render any two functionally redundant RG 1.97 Category 1 instrument loops inoperable, and, on this basis, no potential safety concerns were identified. Accordingly, it was concluded that no short term corrective actions in the form of revising the existing cable routing were required.

In combination, the completion of the cable routing evaluation and other related short term activities regarding RG 1.97 Category 1 instrument concerns satisfactorily demonstrated:

- conformance to the unit's design and licensing basis;
- compliance with prior commitments made to the NRC that pertain to RG 1.97 issues; and,
- safe plant operation as determined by conformance to the bases and assumption applicable to the plant-specific analysis of Design Basis Accidents (as documented in the FSAR) and the development and execution of Emergency Operating Procedures.

3.0 LONG TERM PROGRAM ACTIVITIES

As previously stated, the Long Term program for addressing cable separation concerns for RG 1.97 Category 1 instruments is only a portion of a much larger integrated effort associated with the evaluation of cable separation of Safety Related systems and subsystems that is being carried out within the scope and under the direction of the DBR Program. The objectives of the Long Term cable separation program are:

- to establish a clear and concise understanding of the design and licensing basis and criteria for cable separation at NMP#1;
- to further define specific cable separation criteria for Safety Related systems;
- to validate the as-built cable and raceway configurations, as required;
- to develop a systematic and comprehensive program for resolving any cable separation concerns, including RG 1.97 Category 1 instrument loop separation concerns, that may be identified during design verification and validation activities; and
- to establish and implement a program for long term cable separation compliance.

The long term program will result in (1) the development of a Design Criteria Document (DCD) that details cable separation design criteria for Safety Related electrical circuits, (2) the verification of the cable routing for RG 1.97 Category 1 analog-signal instrument loops, and (3) the development of a mechanism to assure continuing compliance with established design basis criteria, licensing requirements, and commitments made to the NRC. Specific task activities of the long term program include review of design basis requirements, development of design criteria, field verification of cable separation (as required), and establishment of cable separation configuration control practices and procedures.

3.1 Establishment of Design Basis Requirements

In order to define appropriate cable separation criteria for the present plant configuration, the original design basis used for the construction and licensing of NMP#1 must first be reconstructed A detailed review of the original FSAR and supplements thereto, the current UFSAR, Safety Evaluations Reports and associated

supplements, and other licensing documents will be conducted to identify previous commitments regarding electrical cable separation. A topical report which provides an overview of the evolution of electrical cable separation practices adopted by the nuclear industry and a comparison to the practices used in the design of NMP#1 will be prepared.

3.2 Development of Design Criteria Document

A Design Criteria Document (DCD) will be developed (within the scope of the DBR Program activities) which will provide explicit criteria for:

- Separation of cables for redundant Safety Related electrical circuits including instrument loops,
- Cable tray loading,
- Designating cable channelization,
- Cable markings, and
- Other cable routing design features, as appropriate.

The DCD will be written such that it will apply to:

- The design of all new Safety Related I&C and Power Distribution circuits.
- The design of all future modifications to existing Safety Related I&C and Power Distribution circuits.
- The evaluation of the adequacy of an existing circuit design, including newly designated Safety Related I&C and Power Distribution circuits, as directed by the Supervisor Nuclear Electrical Design.

The DCD will include an explicit instruction to comply with all existing plant licensing requirements, existing and (as they are formally established) upgraded plant design basis requirements, and commitments made to the NRC as related to the separation of Safety Related circuits.

The DCD will be developed from the topical report on the design basis requirements and the as-designed plant configuration. Current industry practices for older plants and available test results evidencing minimum acceptable separation configurations will be factored into the DCD. The functional/system redundancy requirements for cable separation will be reviewed to ensure consistency with the development of system level design basis documents that are also being developed under the DBR Program effort.

A review of the as-designed plant configuration will be performed to determine the cable routing design and the degree of cable separation for Safety Related systems. For each Safety Related system, the cables required for proper system function will be identified. The cable routing for these cables will be identified from the cable routing drawings and cable and conduit schedules. The separation of redundant cables will be identified from the physical tray and conduit drawings, in conjunction with the cable routing drawings and cable and conduit schedules. The existing cable routing configurations, along with the system-level design basis criteria, will be compiled. The compiled data will be utilized to determine the separation criteria for the existing plant configuration. Industry practices will be reviewed to determine how similar designs have been addressed by other utilities. Available test data will be utilized to justify existing as-designed configurations, as appropriate.

The schedule for completion of the DCD will be dictated primarily by the priority of this subject (separation of Safety Related electrical cables) relative to other DBR topics for which Design Criteria Documents are being developed (approximately 30 have been identified to date).

3.3 Verification and Validation of As-Built Configuration

The long term program for addressing cable separation will include a verification and validation of the as-built configuration for RG 1.97 Category 1 analog-signal instrument loops. These cables will be walked down to confirm the correctness of the routing sketches previously constructed as part of the short term activities. Field walkdowns of RG 1.97 Category 1 instrument loop cables and cable trays will be used to provide the as-built validation of current configuration.

Before any field walkdowns of cabling are performed, a means to address deviations from the design criteria will be developed. An Anomaly Evaluation Process will be established to ensure that, when (if) anomalies are identified, they are appropriately documented, evaluated, reported and resolved. Screening criteria will be developed which will establish minimal acceptance criteria for redundant raceway/cable configurations.

For validation of as-built raceway configurations and cable locations, detailed walkdown procedures will be developed. The DBR Program will establish a sampling methodology to validate the location of Safety Related cables installed in raceways. The cable configuration validation activity will be expandable as necessary to ensure that the assembled cable and raceway data bases accurately reflect the as-built plant condition. Anomalies encountered during the sampling process will be documented per the Anomaly Evaluation Process.

The verification, validation, and resolution activities will be performed for individual systems and subsystems (such as RG 1.97 instrument loops) per a relative priority schedule that is established within the DBR Program. Corrective actions deemed to be necessary (if any) will be undertaken within an integrated schedule formulated consistent with the DBR effort.

3.4 Establishment of Configuration Control Program

The long term program addressing cable separation will be completed by focusing on maintaining continued compliance with established design basis criteria, licensing requirements, and NRC commitments. The electrical separation design criteria will be updated to incorporate the final as-built conditions. The cable and raceway data will be updated (if necessary) to reflect the as-built plant configuration. Provisions will be made for ensuring that erroneous cable routing cannot be implemented once validation has been completed. Procedures which contain criteria and implementation practices involving cable separation (e.g., EDG-1300) will be reviewed and updated as necessary to incorporate the lessons learned from this program. In addition, the UFSAR will be updated to provide the details of the licensing basis for NMP#1 if necessary.

After issuance and prior to implementation of the Design Criteria Document, all affected Nuclear Electrical Design personnel will be trained to ensure that they fully understand the design basis requirements and their application to new design activities.

4.0 CONCLUSION

The Long Term program activities described above are consistent with the Short Term actions that were taken by NMPC and found acceptable to the Staff in resolving cable separation concerns during their prior reviews of RG 1.97 Category 1 instruments. The development of a Design Criteria Document that addresses cable separation for Safety Related circuits will provide a formal mechanism for assuring that similar methods and criteria will continue to be used in determining all future decisions regarding cable separation of circuits for RG 1.97 Category 1 (i.e., Safety Related) instrument loops at NMP#1.

LONG TERM PROGRAM ACTIVITIES
for addressing
ELECTRICAL ISOLATION
of
RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

LONG TERM PROGRAM ACTIVITIES FOR ADDRESSING ELECTRICAL ISOLATION OF RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

1.0 INTRODUCTION

In Niagara Mohawk Power Corporation (NMPC) letter NMP1L 0401 to the NRC dated May 19, 1989, a commitment was made to formulate, and to submit to the NRC a description of a Long Term action plan addressing electrical isolation concerns for Regulatory Guide (RG) 1.97 Category 1 instrument circuits at Nine Mile Point Unit 1 (NMP#1). This commitment was part of NMPC's response to NRC Issue No. 2 that was first identified in NRC letter to NMPC dated April 19, 1989.

NMPC's commitment further stated that the specifics of the Long Term action plan for isolation would be based on the results of various Short Term actions associated with this same issue. The scope of the Short Term actions was detailed in letter NMP1L 0401. All Short Term actions were completed by NMPC and the results reviewed by the NRC (both NRR and Region I) during several on-site inspections[1] conducted prior to plant restart from the 1987-1990 refueling outage.

In fulfillment of the Long Term action plan commitment identified above, a description of NMPC's Long Term program activities for addressing electrical isolation of RG 1.97 Category 1 instrument loops is presented herein. As is the case with several other wide-ranging and long term program activities for NMP#1, actions to address the issue of electrical isolation of safety related RG 1.97 instrument loops/circuits are integrated into a broader comprehensive program being undertaken by NMPC called the Design Basis Reconstitution (DBR) Program. (The DBR Program was initially called the Engineering Program Integration Plan (EPIP), and information regarding its general scope and approach has previously been provided to the NRC.) Completed short term program activities associated with the electrical isolation issue are also briefly described herein since the results of these activities relate directly to the Long Term action plan that has been formulated and adopted for NMP#1.

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[1] Refer to the NRC reports of Inspections 50-220/89-12, 50-220/89-25, and 50-220/89-35.

2.0 BACKGROUND – SUMMARY OF COMPLETED SHORT TERM ACTIONS

Reviews of NMP#1 RG 1.97 Category 1 instrumentation conducted by both NMPC Nuclear Engineering personnel and NRC Staff members identified a number of instances where an approved Class 1E isolation device did not exist at the interface between the Safety Related (SR) side and the non-safety related (NSR) side of a circuit. This lack of Class 1E isolation was determined to exist as follows:

1. Reactor Recirculation Flow analog signals to the process computer (the Safety Related instrument loops for APRM Flow Summers IA 72A and IA 72B).
2. Drywell Temperature analog signals to the process computer (the Safety Related instrument loops for TI 201-36B, TI 201-27B, and TI 201-33B).
3. Wide Range RPV Water Level analog signal to the process computer (the Safety Related instrument loop for LI IA-13).
4. Wide Range Drywell Pressure analog signals to the process computer (the Safety Related instrument loops for PI 201.2-484A and PI 201.2-483A).
5. Suppression Pool Water Level analog signals to the process computer (the Safety Related instrument loops for LI 58-05A and 58-06A).
6. Drywell Water Level analog signal to the process computer (the Safety Related instrument loop for LI 80-100).
7. Reactor Coolant System Pressure instrument loop connections to Feedwater Control System circuitry (the Safety Related instrument loops for PI 36-31A and PI 36-32A).

A detailed Failure Modes and Effects Analysis (FMEA) was performed to evaluate the possible adverse consequences of fault conditions occurring on the NSR side of the existing circuit configurations identified in 1 through 6 above. The FMEA considered the spectrum of credible potential failures of the Honeywell AFLM computer input cards, and the degradation effects that such failures could have on the associated Class 1E (SR) circuitry.

The FMEA study was supplemented by Maximum Credible Fault (MCF) testing of the computer input cards. The testing was physically performed at the NMP#1 site using actual cards configured and connected in the same manner as those used in the input circuitry to the plant computer.

The results of the FMEA and associated MCF testing successfully demonstrated that the existing configuration of the subject instrument loops, without any modification, provided adequate isolation of the SR circuitry (i.e., that the SR circuitry continued to function at an acceptable level) for the spectrum of credible faults that could possibly occur (both direct and induced) to the associated NSR circuitry/components.

The FMEA and MCF testing were conducted specifically for the configuration of the Reactor Recirculation Flow instrument loop interface with the process computer. However, the successful results of the analysis and testing were able to be extended to include the other identified non-isolated (non-Class 1E) instrument loop interfaces with the process computer because the connections and input cards used in these other instrument loops were reviewed and confirmed to be analytically equivalent.

An additional study was performed to specifically evaluate the unique configuration of the Reactor Coolant System Pressure instrument loop interfaces with the NSR Feedwater Control System circuitry (circuit configuration identified in item 7 on the previous page). The analysis considered the isolation evaluation criteria presented in IEEE Standard 384, "Criteria for Independence for Class 1E Equipment and Circuits," that were applicable to that specific circuit configuration, and concluded that the existing in-loop GEMAC modules provided adequate isolation for credible fault conditions.

Two plant hardware modifications were also completed prior to plant restart to correct specific isolation concerns that had been identified through reviews of instrument circuits conducted to support the previously described testing and analyses. The first involved re-wiring a selector switch to improve the physical separation and isolation between the redundant Channel 11 and Channel 12 instrument loops for Reactor Coolant System Pressure (NMP#1 Modification No. 89-147). The second involved rewiring several instrument loop connections to the process computer to improve the physical separation and electrical isolation between redundant RPS Channel 11 and RPS Channel 12 instrument loops (NMP#1 Modification No. 89-195).

Also prior to plant restart, a comprehensive engineering review of the isolation design of the existing Reactor Protection System scram (i.e., reactor trip) circuitry was performed. No potential safety concerns, deficiencies, or non-conformances with established NMP#1 acceptance criteria for isolation were identified.

NMPC has also recently completed an extensive Q-List review to identify potential isolation issues. As a result of this Q-List review and the associated isolation review performed for all RG 1.97 Category 1 analog instruments, NMPC believes that all open analog isolation issues related to RG 1.97 Category 1 instrumentation for NMP#1 have been identified, evaluated, and satisfactorily resolved.

3.0 LONG TERM PROGRAM ACTIVITIES

Based on the comprehensive scope of the actions taken to date (as described above), the absence of any potential safety concerns as regards electrical isolation of RG 1.97 Category 1 analog instrument loops at NMP#1 has been clearly demonstrated. Accordingly, NMPC's long term RG 1.97 activities regarding isolation will focus on maintaining continuing compliance with:

- Established plant licensing requirements,
- Existing and, if determined through the DBR Program to be appropriate, upgraded plant design basis criteria, and
- Current commitments made to the NRC regarding electrical isolation issues.

A Design Criteria Document (DCD) is currently being developed (within the scope of the DBR Program activities) which will detail the electrical isolation design criteria for Safety Related circuits at NMP#1. The DCD is currently scoped to address isolation of SR/NSR boundary interfaces for both Instrument and Control (I&C) circuits and Power Distribution circuits. The isolation design criteria for RG 1.97 Category 1 Safety Related circuits will be encompassed by the I&C requirements that are to be specified in that Design Criteria Document.

The DCD will be written such that it will apply to:

- The design of all new Safety Related I&C and Power Distribution circuits.
- The design of all future modifications to existing Safety Related I&C and Power Distribution circuits.
- The evaluation of the adequacy of an existing circuit design, including newly designated Safety Related I&C and Power Distribution circuits, as directed by the Supervisor Nuclear Electrical Design.

The DCD will include an explicit instruction to comply with all existing plant licensing requirements, existing and (as they are formally established) upgraded plant design basis requirements, and commitments made to the NRC as related to the isolation of Safety Related circuits. The document will also incorporate relevant guidance from IEEE Standard 384-1981, "Criteria for Independence of Class 1E Equipment and Circuits," as well as relevant guidance from other associated IEEE standards.

The DCD will identify specific methods available for achieving acceptable isolation at all SR/NSR interfaces, including:

- Installing an approved Class 1E isolation device at the interface of the currently designated SR/NSR boundary.
- Upgrading the qualification of an existing isolation device to Class 1E.
- Designating a new SR/NSR boundary at a point where an approved Class 1E isolation device exists.
- Demonstrating through appropriate comprehensive testing and/or analysis (i.e. a Failure Modes and Effects Analysis) that the existing circuit configuration provides acceptable isolation without any further modification.
- Classifying the existing NSR equipment at the SR/NSR interface as SR and placing this equipment on the NMP#1 Q-List such that Class 1E maintenance requirements and other appropriate 10CFR Part 50 Appendix B requirements are provided from the date of classification forward.
- Using separation distances and/or shielding and wiring techniques.
- Combinations of the above methods.

The document will also provide appropriate guidance for selection from among the available methods. Proper methods will be determined on a case by case basis taking into account the specific configuration of the circuit and other factors such as reliability considerations of the overall system arrangement. Design instructions will be included detailing what shall be done when it is identified that an existing designated SR/NSR circuit interface does not have a Class 1E isolation device and the existing configuration has not been previously analyzed and determined to be acceptable.

The schedule for completion of the DCD will be dictated primarily by the priority of this subject (electrical isolation) relative to other DBR topics for which Design Criteria Documents are being developed (approximately 30 DCDs have been identified to date). However, the specification of isolation design criteria for Safety Related (Class 1E) circuits has been given a relatively high priority by NMPC management as evidenced by work having already begun on this particular criteria document.

After issuance and prior to implementation of the Design Criteria Document, all affected Nuclear Electrical Design personnel will be trained to ensure that they fully understand the design basis requirements and their application to new design activities.

4.0 CONCLUSION

The Long Term program activities described above are consistent with the Short Term actions that were taken by NMPC and found acceptable to the Staff in resolving isolation concerns during their prior reviews of RG 1.97 Category 1 instruments. The development of a Design Criteria Document that addresses electrical isolation will provide a formal mechanism for assuring that similar methods and criteria will continue to be used in determining all future decisions regarding electrical isolation issues at NMP#1.

LONG TERM PROGRAM ACTIVITIES
for
IDENTIFICATION OF RG 1.97 CATEGORY 1 INSTRUMENT POWER SUPPLIES

LONG TERM PROGRAM ACTIVITIES FOR IDENTIFICATION OF RG 1.97 CATEGORY 1 INSTRUMENT POWER SUPPLIES

1. INTRODUCTION

In Niagara Mohawk Power Corporation (NMPC) letter NMP1L 0401 to the NRC dated May 19, 1989, a commitment was made to develop, issue, and make available to plant operators in the control room, one-line diagrams of the RPS circuits that supply power to RG 1.97 Category 1 analog instrument loops. A list of these circuits is provided below.

RPS Bus 11:	RPS Bus 12:
Circuit 4	Circuit 4
Circuit 6	Circuit 6
Circuit 7	Circuit 7
Circuit 9	Circuit 9
Circuit 11	Circuit 12
Circuit 12	Circuit 15
Circuit 23	Circuit 23
Circuit 25	Circuit 26
Circuit 26	Circuit 27
Circuit 27	Circuit 28

This commitment was part of NMPC's response to NRC Issue No. 6 that was first identified in NRC letter to NMPC dated April 19, 1989.

A brief description of currently in-progress and continuing work related to the completion of this committed long term action is provided below.

2. DESCRIPTION OF ACTIVITIES

The production of one-line diagrams for the RPS circuits that supply power to RG 1.97 analog instruments is encompassed by a broader task (currently in progress) to develop one-line diagrams for all RPS circuits and for I&C Bus 130. This larger task relates to a separate but related commitment made by NMPC (outside the scope of

RG 1.97 activities) to upgrade the availability of power source information for plant operators and technicians.

Initial drafts of one-line diagrams for all RPS circuits have already been completed and are currently undergoing independent engineering reviews. As applicable, source documents used to develop these diagrams included the RG 1.97 Load List (NMPC Nuclear Engineering Department document #N1-RG197-LL1), loop diagrams, elementary diagrams, and interconnection and connection drawings. In general, the type of information presented on the circuit one-line diagrams includes fuse sizes and panel locations for the fuses, and detailed load descriptions (including, as appropriate, system and/or component identification number) for each individual load on the circuit and all associated subcircuits.

When completed, draft diagrams are independently checked for completeness and accuracy by a senior Electrical Engineering Department Designer and identified discrepancies (if any) are corrected. Final diagrams are then approved by an Electrical Engineering Department Engineer and the responsible Lead (Instrument and Controls Group or Power Group) Engineer.

Approved final diagrams (including all subsequent revisions thereto) will be issued, distributed, and maintained as "Controlled" documents in accordance with current approved administrative procedures. One of the "Controlled Copy" locations for all completed and approved diagrams will be the Nine Mile Point Unit 1 control room.

One-line diagrams for all RPS circuits (and thus, necessarily, for all RPS circuits that supply power to RG 1.97 Category 1 analog instrument loops), will be completed and approved/issued by the end of 1991.

LONG TERM PROGRAM ACTIVITIES
for addressing
FUSING OF RPS CIRCUITS
THAT SUPPLY POWER TO
RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

LONG TERM PROGRAM ACTIVITIES FOR ADDRESSING FUSING OF RPS CIRCUITS THAT SUPPLY POWER TO RG 1.97 CATEGORY 1 INSTRUMENT LOOPS

1.0 INTRODUCTION

In Niagara Mohawk Power Corporation (NMPC) letter NMP1L 0401 to the NRC dated May 19, 1989, a commitment was made to implement, after restart from our last outage, a Long Term action plan for evaluating the fusing adequacy of RPS circuits that supply power to Regulatory Guide (RG) 1.97 Category 1 instrument loops. This commitment was part of NMPC's response to NRC Issue No. 3 that was first identified in NRC letter to NMPC dated April 19, 1989.

NMPC's commitment further stated that the specifics of the Long Term action plan for fusing would be based on the results of various Short Term actions associated with this same issue. The scope of the Short Term actions was detailed in letter NMP1L 0401. All Short Term actions were completed by NMPC and the results reviewed by the NRC (both NRR and Region I) during several on-site inspections[1] conducted prior to plant restart from the 1987-1990 refueling outage.

In fulfillment of the Long Term action plan commitment identified above, a description of the Long Term program activities for evaluating the fusing adequacy of RPS circuits that supply power to RG 1.97 Category 1 instrument loops is presented herein. As is the case with several other wide-ranging and long term program activities for NMP#1, actions to evaluate fusing adequacy are integrated into a broader comprehensive program being undertaken by NMPC called the Design Basis Reconstitution (DBR) Program. (The DBR Program was initially called the Engineering Program Integration Plan (EPIP), and information regarding its general scope and approach has previously been provided to the NRC.) Completed short term program activities associated with the evaluation of fusing adequacy for RPS circuits that supply power to RG 1.97 Category 1 instruments loops are also briefly described herein since the results of these activities relate to the Long Term action plan for fusing evaluation that has been formulated and adopted for NMP#1.

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[1] Refer to the NRC reports of Inspections 50-220/89-12, 50-220/89-25, and 50-220/89-35.

2.0 BACKGROUND – SUMMARY OF COMPLETED SHORT TERM ACTIONS

During previous inspections of RG 1.97 instrumentation at NMP#1, the NRC requested that NMPC complete, prior to restart, an evaluation of the fusing adequacy of two RPS circuits that supply power to RG 1.97 Category 1 instruments. These circuits were RPS Bus 12 Circuit 7 and RPS Bus 12 Circuit 12. The primary objectives of this evaluation were to determine whether or not:

- Existing fuses were adequately sized,
- Time/current characteristics of existing upstream fuses were properly coordinated with downstream fuses, and
- The location of existing fuses was sufficient to acceptably limit the number and types of loads that would be deenergized (potentially) given the occurrence of an "overcurrent" fault condition for any single load on the circuit.

The completed study of the two identified circuits concluded that existing upstream fuses and downstream fuses were properly sized and coordinated. However, it was also determined that not all loads on these two circuits were separately fused and thus the possibility existed that a loss of multiple loads on a circuit could occur as the result of an overcurrent fault of one individual load.

In conjunction with the detailed fusing study performed for RPS Bus 12 Circuits 7 and 12, a review of newly-developed one-line load sketches for the other RPS circuits that supply power to RG 1.97 Category 1 instruments (sketches developed in response to a separate but related "restart" issue) was performed and similar situations (i.e., a lack of individual fusing for each load) were identified.

To resolve the "lack of individual load fusing" condition that was identified, and to correct under-sized wiring concerns that were also identified through associated fusing reviews and evaluations, additional fusing (for individual loads) and appropriate new wiring were installed in various RPS circuits that supply power to RG 1.97 Category 1 instrumentation. These actions were completed prior to plant restart per Modification Nos. N1-89-210 and N1-89-253.

Additionally, NMPC committed to install before the end of the next refueling outage (currently scheduled for 1992) a redundant (separate and independent) instrument loop for each of the "EOP Key Parameters" that currently has only one channel of RG 1.97 Category 1 display instrumentation. These plant modifications are described in detail in Enclosure 7. [The one remaining exception to instrument redundancy will be indication for Wide Range RPV Water Level; the basis for this exception is documented in Attachment B of Enclosure 1.]

3.0 LONG TERM PROGRAM ACTIVITIES

NMPC's Long Term activities for fusing focus on maintaining continuing compliance with:

- Established plant licensing requirements,
- Existing and, if determined through the DBR Program to be appropriate, upgraded plant design basis criteria, and
- Current commitments made to the NRC regarding fusing of RPS circuits that supply power to RG 1.97 Category 1 instrument loops.

A Design Criteria Document (DCD) will be developed (within the scope of the DBR Program activities) which will detail the design criteria for fusing of Safety Related RPS circuits at NMP#1. This DCD will necessarily include criteria for the circuits that supply power to the RG 1.97 Category 1 instruments for "EOP Key Parameters" because such circuits are a sub-set of the RPS Safety Related circuits.

The DCD will be written such that it will apply to:

- The design of all new Safety Related RPS circuits.
- The design of all future modifications to existing Safety Related RPS circuits and loads powered by these circuits.
- The evaluation of the adequacy of an existing RPS circuit design as regards fusing, including newly designated Safety Related RPS circuits, as directed by the Supervisor Nuclear Electrical Design.

The DCD will include an explicit instruction to comply with all existing plant licensing requirements, existing and (as they are formally established) upgraded plant design basis requirements, and commitments made to the NRC as related to fusing of Safety Related RPS circuits at NMP#1. The document will also incorporate relevant guidance from applicable IEEE standards, the NEC Code, and other relevant fuse protection and wire sizing standards.

The DCD will include explicit criteria for:

- Proper sizing of fuses for individual loads.
- Proper sizing of upstream and downstream fuses based on circuit loading considerations.
- Acceptable wire AWG sizes for upstream and downstream fusing interconnections.
- Acceptable fuse coordination between upstream and downstream fuses based on the documented fuse time/current characteristics provided by the respective manufacturer.

NOTE: When fusing is used to achieve electrical isolation between Safety Related and Non-Safety Related equipment (subcircuits, loads, etc.), the criteria specified in the Design Criteria Document addressing electrical isolation of Safety Related circuits will also apply. (This subject is discussed in detail in Enclosure 3.)

The schedule for completion of the DCD addressing fusing of RPS Safety Related circuits will be dictated primarily by the priority of this subject relative to other DBR topics for which Design Criteria Documents are being developed (approximately 30 DCDs have been identified to date).

After issuance and prior to implementation of the Design Criteria Document that addresses fusing of RPS Safety Related circuits, all affected Nuclear Electrical Design personnel will be trained to ensure that they fully understand the design basis requirements and their application to new design activities.

Following issuance of the approved DCD addressing fusing of Safety Related RPS circuits, the "continuing evaluation" phase of fusing adequacy will begin. The following RPS circuits will be evaluated per the criteria of the approved DCD:

RPS Bus 11:	RPS Bus 12:
Circuit 4	Circuit 4
Circuit 6	Circuit 6
Circuit 7	Circuit 7
Circuit 9	Circuit 9
Circuit 11	Circuit 12
Circuit 12	Circuit 15
Circuit 23	Circuit 23
Circuit 25	Circuit 26
Circuit 26	Circuit 27
Circuit 27	Circuit 28

The RPS circuits listed above comprise all of those that supply power to RG 1.97 Category 1 analog instrument loops.

The schedule for completing these circuit evaluations will be established per the DBR Program, prioritized consistent with the relative priorities of other activities that are integrated within the Program. Likewise, the development and implementation of corrective actions (if any are deemed necessary) will be scheduled consistent with a relative priority schedule established per the DBR Program.

4.0 CONCLUSION

The Long Term program activities described above are consistent with the Short Term actions that were taken by NMPC and found acceptable to the Staff in resolving RPS circuit fusing concerns during their prior reviews of RG 1.97 Category 1 instruments. The development of a Design Criteria Document that addresses fusing of Safety Related RPS circuits will provide a formal mechanism for assuring that these same methods and criteria will continue to be used in determining all future decisions regarding fusing issues for RPS Safety Related circuits at NMP#1.

RG 1.97 PROGRAM ADMINISTRATION AND ASSOCIATED ACTIVITIES

RG 1.97 PROGRAM ADMINISTRATION AND ASSOCIATED ACTIVITIES

INTRODUCTION

Recognizing that continuing compliance with commitments made regarding implementation of Regulatory Guide (RG) 1.97 requires the on-going awareness and integrated efforts of a variety of Nuclear Engineering, Licensing, and Plant Operations personnel, NMPC has (and will continue to) institute a series of associated administrative actions as a means of effectively addressing this issue. These actions are identified and briefly described in this enclosure.

1.0 LISTINGS OF RG 1.97 INSTRUMENTATION

1.1 Verification of Information Presented in Tables Submitted as Enclosures to NMP1L 0426

Niagara Mohawk letter NMP1L 0426 dated July 31, 1989, submitted a series of enclosures that, in combination, documented the basis for classification of plant variables and associated RG 1.97 instrumentation as to specific Type and Category. These enclosures also provided detailed listings of specific design features for all designated RG 1.97 Category 1, 2, and 3 instruments for all variable types. In the letter transmitting the enclosures, a statement was made that a "final" independent verification of all the detailed instrument information (e.g., equipment part numbers, physical in-plant location of components) presented in the tables of the enclosures had not yet been fully completed. This verification activity was finished prior to plant restart, and the identified (potential) discrepancies were documented, investigated, and resolved.

An update of the instrument listings to reflect the results of this verification effort is now in progress, as described in Subsection 1.2 below.

1.2 Engineering Instrument List

In order to provide an effective mechanism for documenting current (i.e., present and future) RG 1.97 instrument information, including relevant information regarding new instruments and changes to existing instruments as may later occur through the completion of plant modifications, a RG 1.97 Engineering Instrument List (EIL) is being developed.

The scope of the EIL will include:

- Documentation of the basis and supporting plant-specific evaluation for the determination that there are no Type A Variables[1] for NMP#1.
- Documentation of the basis for, and the plant-specific determination of, the category and specific group of variables uniquely designated (for NM P#1) as "EOP Key Parameters."[2]
- For each EOP Key Parameter and Type B, C, D, and E variable, the associated NMP#1 Category 1, 2, and 3 (as applicable) RG 1.97 instrumentation, with the respective instrument loops defined by sensor and associated display device(s).
- Key design features of listed Category 1, 2, and 3 instrument loop sensors and associated display devices (e.g., equipment part number, component location, indicating range of display devices, component safety classification (per the approved Q-List database), component power supply (instrument bus and circuit designation), and applicability of Equipment Qualification Program requirements), as appropriate.
- Viable "Alternate" instruments and methods[3] available for determining and monitoring the current status of EOP Key Parameters; also, for the instruments that are listed in this group, key design features of instrument loop sensors and associated display devices (features as identified immediately above for the RG 1.97 Category 1, 2 and 3 instruments), as appropriate.

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[1] Refer to Enclosure 1 of letter NMP1L 0426 to the NRC dated July 31, 1989.

[2] Refer to Enclosure 2 of letter NMP1L 0426 to the NRC dated July 31, 1989.

[3] Refer to the "Hazards Analysis" documented in Enclosure 5 of letter NMP1L 0426 to the NRC dated July 31, 1989.

The EIL will incorporate the final verification "corrective actions" previously described under Subsection 1.1 above, and will also reflect the completed Q-List determinations (refer to Section 2.0, below) and the applicable completed plant modifications made to RG 1.97 instrumentation during the last refueling outage.

When completed (currently estimated to be no later than the end of March, 1991), the EIL will be issued, distributed, and maintained as a "controlled document" in accordance with current approved NMPC administrative procedures. "Controlled" maintenance and distribution of the EIL will assure that current RG 1.97 instrument information (and the associated bases for instrument designation, categorization, etc.) is readily available, through a single source, to those who require it.

1.3 Unique Identification of RG 1.97 Category 1 Instruments on P&IDs

As a further aid in identifying and disseminating RG 1.97 instrument information, key components (e.g., sensors and display devices) of RG 1.97 Category 1 instrument loops will be so identified on plant Piping and Instrument Diagrams (P&IDs) through the use of a unique symbol. Thus, the "special" classification of these instruments relative to other instruments shown on the P&IDs will be readily apparent.

"Controlled copy" distribution of P&IDs includes the main control room, therefore current RG 1.97 Category 1 instrument information will be made directly available to members of the on-shift crew through this mechanism.

1.4 Modification Package Checklist to Address Design Features of RG 1.97 Instruments

As one means for assuring that RG 1.97 instrument requirements will continue to be appropriately considered in the process of developing design modification packages, a revision to applicable Nuclear Engineering Department procedures will be made to add a check-off sheet, required to be reviewed and signed by a designated 'RG 1.97 Program Engineering Department Coordinator." This check-off sheet will be similar to the forms already in use for Appendix R Program, Equipment Qualification Program, etc., reviews and approvals required to be completed for the processing of plant design modifications.

1.5 Engineering Review of the List of "EOP Key Parameters" Following Revision of the EOPs

As a means for assuring that the defined list of EOP Key Parameters and associated Category 1 instruments specified in the RG 1.97 EIL (refer to Subsection 1.1 above) remains current, an appropriate "review" requirement will be added to the procedure governing revision of the NMP#1 Emergency Operating Procedures (N1-EOPs).

Through this mechanism, the Nuclear Engineering Department shall be informed of all "major" changes made to the N1-EOPs, and an appropriate review of the continued accuracy and sufficiency of the list of EOP Key Parameters and associated Category 1 instruments shall be made. The performance, completion, and results of such reviews will be documented. Necessary changes (if any are required) to the list of EOP Key Parameters and/or the list of associated Category 1 instruments can then proceed within the Nuclear Engineering Department per established relevant administrative processes and procedures.

2.0 ELECTRICAL Q-LIST UPDATE TO REFLECT CURRENT CLASSIFICATION OF RG 1.97 CATEGORY 1 INSTRUMENTS FOR "EOP KEY PARAMETERS"

An update of the Electrical Q-List as regards the safety classification of Category 1 instruments for EOP Key Parameters has been completed. As part of this activity, the following actions have been taken:

- The "Safety Related" designation has been added to component listings in the Q-List database for appropriate Category 1 instrument loop sensors, display devices, and all in-loop components, with an annotation as to "RG 1.97" also entered. For the few instances where Safety Related and Non-Safety Related boundaries remains in question (and, thus, subject to final determination), an action plan for final resolution has been implemented. See, also, the discussion in Section 3.0 regarding "Safety Related" as applies to the replacement of obsolete components.

- Color-coded Piping and Instrument Diagrams have been completed and are being maintained, reflecting current safety classifications of components, per the applicable instructions contained in procedure NEL-307, "NMP1 Q-List Coded Drawings."

3.0 LONG TERM PROGRAM PLAN FOR REPLACING OBSOLETE COMPONENTS OF RG 1.97 CATEGORY 1 INSTRUMENTATION AND COMPONENTS FOR "EOP KEY PARAMETERS "

3.1 Introduction

In Niagara Mohawk Power Corporation (NMPC) letter NMP1L 0507 to the NRC dated May 25, 1990, a commitment was made to evaluate options for dealing with obsolete RG 1.97 Category 1 instrumentation and to report the results in a long term program plan. This commitment resulted from a situation that arose from a previous commitment to forward-fit the RG 1.97 Category 1 instrumentation for EOP Key Parameters with Safety Related (Class 1E) replacement parts.

In preparation for satisfying the commitment to upgrade this RG 1.97 equipment to Safety Related, NMPC determined that two computer processing units within the Acurex RPV Water Level and Torus Temperature Monitoring system (Auto Data 10/5) are obsolete and have no one-for-one Safety Related replacements. Because the Acurex system processes inputs for display indication of two EOP Key Parameters (Fuel Zone RPV Water Level and Torus Water Temperature), NMPC changed its commitment by letter dated May 25, 1990 (NMP1L 0507) to allow procurement of non-safety related replacements for the obsolete Acurex processing units (if and when replacement is necessary).

3.2 Summary of On-Going Activities

Since the May 25, 1990 letter, NMPC has initiated actions to further evaluate and enhance its capability to deal appropriately with Safety Related equipment that is associated with the RG 1.97 Category 1 instrumentation for EOP Key Parameters, and which is now (or will in the foreseeable future become) obsolete.

The following actions have been taken specifically regarding the Acurex (Auto Data 10/5) situation:

a. Safety classification for the obsolete Acurex processing units has been revised from Safety Related to Q-Related.

b. Other components of RG 1.97 Category 1 instrument loops that were newly designated as Safety Related to support display indication of EOP Key Parameters were reviewed to determine whether there are other potential instances of obsolescence or nonavailability of Safety Related parts. It was determined that there are several components affecting the EOP Key Parameter Category 1 instrumentation that may be difficult to replace.

c. A review was undertaken to develop feasible options for satisfying the intent of our original commitment, that is, to provide reliable indications for operators to use when monitoring the real-time status of EOP Key Parameters. The review included a survey of other Mark 1 Boiling Water Reactor plants to identify whether they use currently available Safety Related instruments to provide the same function as the Acurex system currently in use at NMP-1, and if not, how those functions are provided. Discussions were also held with the original designer of the Acurex system and the manufacturer who now holds the rights to Acurex (Kaye Instruments) to determine whether the Acurex processing units can be modified or replaced with equivalent equipment that is available and has foreseeable vendor support, and to determine whether it can be upgraded by the vendor or by NMPC to Safety Related.

As stated above (action a.), the Acurex processing units are now designated as Q-Related. The Q-Related classification denotes treatment in conformance with 10CFR Part 50 Appendix B criteria except in the area of procurement. Therefore, when any activities affecting the functions of the Acurex system are planned, the following actions will be taken:

- Confirm that appropriate procedures have been developed for that activity (e.g., maintenance, testing).

- Confirm that a plan has been established for verifying that the activity has been correctly performed and documented.

- Confirm that processes and procedures are in place to control and document design changes, within the limitations of available design information and engineering judgement; verify changes as correct and within regulatory and design basis constraints.
- Procure replacement parts, materials, equipment, and services on a Safety Related basis except for Acurex processing units that are now obsolete and not obtainable from a supplier having an approved Nuclear QA program.
- Establish inspection and test requirements for activities such as maintenance and design modification as the need for these activities arises.
- Assure that only appropriately qualified personnel perform activities affecting the functions of the Acurex system.

Our review undertaken to address the obsolescence of Acurex system components (action c. on the previous page) has concluded, thusfar, that there are four feasible options for the long term:

1. Replace the Acurex Auto-Data 10/5 system with the manufacturer's follow-on product, the Auto-Data 10/60. Because this product cannot be procured Safety Related, it would have to be qualified by NMPC, as would any Non-Safety Related replacement parts. It does, however, have the advantage of matching the original Acurex in form, fit, and function.
2. Add Safety Related, hard-wired back-ups for the variables now processed by the Acurex system. This is the method used by most other BWR plants. This method may require operators to manually calculate water level density compensation when using the hard-wired back-up.
3. Replace the Acurex with a Safety Related equivalent from another vendor. Thusfar, two potential replacement systems have been identified, one from General Electric (the NUMAC system), and one from Foxboro. This option would be a major modification, the extent of which is as yet unknown. NMPC has, of this date, not received enough information to fully assess this option.
4. Retain the existing Acurex system and develop a source, either in-house or at a qualified vendor, for making Safety Related repairs to the obsolete Acurex processing units. More information is also needed regarding this option.

NMPC will make a final determination when there is sufficient basis for a clear choice among the various options, but no later than May 1, 1991. In the interim, NMPC will continue to treat the Acurex processors as "Q-Related" as described above. Other potential instances of obsolescence will be treated similarly as they are identified.

PLANNED PLANT MODIFICATIONS
for
RG 1.97 DISPLAY INSTRUMENTATION

PLANNED PLANT MODIFICATIONS
for
RG 1.97 CATEGORY 1 DISPLAY INSTRUMENTATION

1.0 INTRODUCTION

During NRC Inspection No. 50-220/89-25 (conducted September 18-29, 1989) Niagara Mohawk Power Corporation (NMPC) committed to install before the end of the next refueling outage (currently scheduled for 1992) additional display instrumentation for drywell temperature, drywell water level, and torus airspace pressure. The existing RG 1.97 instrument system for each of these parameters is currently classified as Category 1; however, no redundant (i.e., separate and independent) instrument channel exists for any of the parameters. The modifications described herein are being developed and implemented to specifically address this lack of redundancy.

The assigned modification number for each of the respective RG 1.97 instrument system upgrades is as follows:

- Mod. #N1-90-020 Add two new (separate and redundant) Safety Related RG 1.97 Category 1 instrument loops and a dedicated recorder for indication of torus airspace pressure.
- Mod. #N1-90-011 Add a new (separate and redundant) Safety Related RG 1.97 Category 1 instrument loop with a dedicated recorder for indication of drywell water level; also, extend the indicating range of the existing wide range torus water level instrument systems.
- Mod. #N1-90-012 Add a new (separate and redundant) Safety Related RG 1.97 Category 1 instrument loop with a dedicated recorder for indication of drywell temperature.

A draft Design Basis Document (DBD) and Conceptual Engineering Package (CEP) for each modification has been completed, and is currently undergoing final engineering reviews. The DBD provides design input criteria for electrical, mechanical, and structural design, and references appropriate design codes and standards. The CEP provides a description of the existing instrument system design and of the proposed

design modification, additional detailed electrical design criteria, and initial (proposed) revisions to plant drawings to show specific features of design installation (includes proposed changes to plant arrangement drawings, piping and instrument diagrams, connection and interconnection wiring diagrams, etc.).

The design descriptions presented below for each of the planned modifications have been developed from the current draft of the respective Design Basis Document and Conceptual Engineering Package. Even though these DBDs and CEPs are still "draft" documents, sufficient reviews of previous drafts have been performed such that no major changes to the basic design details described below are anticipated.

2.0 DESIGN DESCRIPTION OF MODIFICATION #N1-90-020

Existing RG 1.97 Category 1 instrumentation for monitoring torus airspace pressure consists of a single-channel Safety Related system, as follows:

- Indicating range: ..... 0 to 4 psig.
- Display devices: ..... meter PI 201.2-07B, located on control room Panel L.
  meter PI 201.2-07C, located on control room Panel K.
- Power supply: ..... RPS Bus 12 Circuit 7.

Modification #N1-90-020 will install two new (separate and redundant) RG 1.97 Category 1 Safety Related instrument loops and a dedicated strip-chart recorder for monitoring torus airspace pressure, as follows:

- Indicating range: ..... from 0 psig to, as a minimum, 60 psig (the upper end of the indicating range is based on encompassing the hydrostatic head that occurs for drywell flooding per EOP-7, and the torus vent valve operability limit as reflected in the Primary Containment Pressure Limit curve of the EOPs).
- Display devices: ..... two new meters and one new recorder to be located on control room Panel L.
- Power supply: ..... from RPS Bus 11 for the Channel 11 instrument loop, and RPS Bus 12 for the Channel 12 instrument loop (specific circuits are yet to be determined).

- Sensors: ..... two new pressure transmitters with associated new piping that is connected to the airspace at the top of the torus; each transmitter to be located in a different area of the Reactor Building such that the Channel 11 transmitter and piping is physically separate and completely independent from the Channel 12 transmitter and piping.

- Electrical cabling: ..... to be routed so as to maintain physical separation and independence between the Channel 11 and the Channel 12 instrument loops, from sensor through display device, consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the applicable Design Criteria Document addressing cable separation that is to be developed under the scope of associated DBR Program activities).

- SR/NSR isolation: ..... to be provided consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the new Design Criteria Document addressing electrical isolation of Safety Related circuits that is being developed under the scope of associated DBR Program activities).

- Component EQ: ..... to be established as required by the current NMPC Equipment Qualification Program for NMP#1.

- Additional remarks:

  a. Human factors guidelines regarding display instrument design, marking as RG 1.97 Category 1 instrumentation for EOP Key Parameters, etc, will be addressed consistent with the applicable criteria and requirements specified in the current NMP#1 Human Factors Manual.

  b. The existing (narrow range) torus airspace pressure instrument loop will remain unchanged.

3.0 DESIGN DESCRIPTION OF MODIFICATION #N1-90-011

Existing RG 1.97 Category 1 instrumentation for monitoring drywell water level consists of a single-channel Safety Related system, as follows:

- Indicating range: ..... from -364 inches to 0 inches (plant elevation 267 feet to plant elevation 297 feet 4 inches, respectively); encompasses elevations corresponding to the bottom and the top of the reactor core, and the elevation corresponding to the bottom of the opening of the drywell penetration for the post-accident vent line.
- Display device: ..... meter LI 80-100, located on control room Panel K.
- Power supply: ..... RPS Bus 12 Circuit 7.

Modification #N1-90-011 will install a new (separate and redundant) RG 1.97 Category 1 Safety Related Channel 11 instrument loop and a dedicated strip-chart recorder for monitoring drywell water level, as follows:

- Indicating range: ..... from plant elevation 201 feet (the bottom of the inside of the torus) to plant elevation 305.6 feet (above the top of the reactor core, and above the bottom of the opening of the drywell penetration for the post-accident vent line).
- Display devices: ..... one new meter and one new recorder to be located on control room Panel K.
- Power supply: ..... from RPS Bus 11 (the specific circuit is yet to be determined).

- Sensors: ..... two new pressure transmitters and associated new piping, with the upper piping penetration connected to the drywell at elevation 307 feet (penetration X-65) and the lower piping penetration connected to the bottom of the torus at elevation 201 feet 3.75 inches (penetration XS-357); pressure transmitter output signals to be processed by a "summer" module and the difference in sensed pressure converted to, and output as, a water level analog signal; the new pressure transmitters are to be located in an area of the Reactor Building that is separate from the existing Channel 12 drywell water level sensors.

- Electrical cabling: ..... to be routed so as to maintain physical separation and independence between the new Channel 11 instrument loop and the existing Channel 12 instrument loop, from sensor through display device, consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the applicable Design Criteria Document addressing cable separation that is to be developed under the scope of associated DBR Program activities).

- SR/NSR isolation: ..... to be provided consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the new Design Criteria Document addressing electrical isolation of Safety Related circuits that is being developed under the scope of associated DBR Program activities).

- Component EQ: ..... to be established as required by the current NMPC Equipment Qualification Program for NMP#1.

- Additional remarks:

  a. Human factors guidelines regarding display instrument design, marking as RG 1.97 Category 1 instrumentation for EOP Key Parameters, etc, will be addressed consistent with the applicable criteria and requirements specified in the current NMP#1 Human Factors Manual.

  b. The existing Channel 12 drywell water level sensors (PT 201.2-13 and PT 201.2-14) and associated display meter (LI 80-100) will remain in place. However, the monitoring range of this existing instrument loop will be expanded by changing the instrument piping for PT 201.2-13 to connect it to the drywell at elevation 306 feet 6 inches (penetration X-135), recalibrating the instrument loop electronics, and appropriately rescaling the display meter (LI 80-100) to reflect the revised range of indication.

  c. Also as part of this modification package, the upper sensing lines to the existing Channel 11 and Channel 12 wide range torus water level transmitters will be changed to locate the penetrations at the top of the torus, and the calibration of these level transmitters and the scales of the associated display meters and recorders revised to reflect the expanded range of indication; the new scale of the display meters and recorders (LI 58-05A , LI 58-06A, P/LR 201.2-307, and P/LR 201.2-308) will be from 1.0 feet to 30.0 feet, referenced to the bottom of the torus.

4.0 DESIGN DESCRIPTION OF MODIFICATION #N1-90-012

Existing RG 1.97 Category 1 instrumentation for monitoring drywell temperature consists of a single-channel Safety Related system, as follows:

- Indicating range: ..... from 50 to 300°F.
- Display devices: ..... Meters TI 201-36B (for drywell elevation 253 feet), TI 201-27B (for drywell elevation 320 feet), and TI 201-33B (for drywell elevation 230 feet), all meters are located on control room Panel L.
- Power supply: ..... RPS Bus 12 Circuit 7.

Modification #N1-90-012 will install a new (separate and redundant) RG 1.97 Category 1 Safety Related Channel 11 instrument loop and a dedicated strip-chart recorder for monitoring drywell temperature, as follows:

- Indicating range: ..... from 50 to 400°F (selectable so as to be able to display either the computed "average" value or the value from an individual temperature element).
- Display devices: ..... new indicator and one new recorder to be located on control room Panel L.
- Power supply: ..... from RPS Bus 11 (the specific circuit is yet to be determined).
- Sensors: ..... three new temperature elements located in the drywell so as to be separate and redundant to the existing Channel 12 drywell temperature elements.
- Electrical cabling: ..... to be routed so as to maintain physical separation and independence between the new Channel 11 instrument loop and the existing Channel 12 instrument loop, from sensor through display device, consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the applicable Design Criteria Document addressing cable separation that is to be developed under the scope of associated DBR Program activities).
- SR/NSR isolation: ..... to be provided consistent with plant design basis and licensing criteria that exist at the time the final modification package is being prepared (includes, as available, criteria detailed in the new Design Criteria Document addressing electrical isolation of Safety Related circuits that is being developed under the scope of associated DBR Program activities).
- Component EQ: ..... to be established as required by the current NMPC Equipment Qualification Program for NMP#1.

- Additional remarks:

  a. Human factors guidelines regarding display instrument design, marking as RG 1.97 Category 1 instrumentation for EOP Key Parameters, etc, will be addressed consistent with the applicable criteria and requirements specified in the current NMP#1 Human Factors Manual.

  b. The display of the existing Channel 12 drywell temperature instrument loop will also be revised to provide the same range and option of average/individual values that will be provided by the new Channel 11 instrumentation.

CONTROL ROOM PANEL MARKINGS
for
RG 1.97 INSTRUMENTS

CONTROL ROOM PANEL MARKINGS FOR RG 1.97 INSTRUMENTS

1. INTRODUCTION

The information presented herein is submitted as the basis for final closure of NRC (Open) Item 88-34-09 (reference: NRC report of Inspection No. 88-34, report issued January 23, 1989).

2. BACKGROUND

Regulatory Guide (RG) 1.97 states that display instruments for all Type A, B, and C Category 1 and 2 variables should be specifically identified on control panels. The implementation of a positive method for identifying RG 1.97 display instruments on the control room panels is consistent with the overall NMP-1 NUREG-0737 Supplement 1 program. This effort integrated the RG 1.97, Emergency Operating Procedures (EOPs), Detailed Control Room Design Review (DCRDR), and human factors programs.

In the NMP-1 control room the RG 1.97 variables are represented by approximately 140 display devices. Considering this large number of displays, our review team decided to mark only the Category 1 displays for EOP Key Parameters. The decision to identify only the Category 1 display instruments for the EOP Key Parameters, approximately 25 display devices, instead of display devices for all Type A, B, and C Category 1 and 2 variables was based on a desire to assist the operators in performance of the EOPs and to maintain the human factors practice, adopted during the DCRDR assessment, to minimize clutter on the control panels. Highlighting displays that should be used during EOP conditions may help operators to scan the control panels and quickly read the selected displays. If all 140 displays were identified, the significance of the coding would be lost.

The review team that made the decisions regarding marking of RG 1.97 instruments was composed of representatives from Operations, Engineering, Training, and Consulting Services Departments as well as an independent human factors specialist.

In addition, a walkdown of the NMP-1 control room panels was performed by a human factors specialist and a member of the Operations staff. Each RG 1.97 display instrument was observed for proper human factors characteristics such as location, range and divisions, and labeling.

3. INSTRUMENTS TO BE IDENTIFIED

A distinctive marking (described in Section 4 below) will be installed on each of the RG 1.97 Category 1 display instruments for the EOP Key Parameters, as listed below.

FOR NEUTRON FLUX (APRM REACTOR POWER):

Device ID No.	Device Description (Indicating Range)	Device Location
RI05A	APRM 11/12 chart recorder (0 to 125 %)	CR Console E
RI05B	APRM 13/14 chart recorder ((0 to 125 %)	CR Console E
RI05C	APRM 15/16 chart recorder (0 to 125 %)	CR Console E
RI05D	APRM 17/18 chart recorder (0 to 125 %)	CR Console E

FOR RPV WATER LEVEL:

Narrow Range Instruments -

Device ID No.	Device Description (Indicating Range)	Device Location
LI 36-09	RPV Water Level Hi/Lo Lo/Lo Rosemount Channel 11 meter (0 to 100 inches)	CR Panel F
LI 36-10	RPV Water Level Hi/Lo Lo/Lo Rosemount Channel 12 meter (0 to 100 inches)	CR Panel F

FOR RPV WATER LEVEL: (continued)

Wide Range Instruments -

Device ID No.	Device Description (Indicating Range)	Device Location
LI IA-13	RPV Water Level Wide Range GEMAC meter (-1 to +27.5 feet)	CR Panel F
LI IA-19	RPV Water Level Flange GEMAC meter (-3 to +3 feet)	CR Panel K

Fuel Zone Range Instruments -

Device ID No.	Device Description (Indicating Range)	Device Location
LI 36-43 [1F51]	RPV Water Level (ACUREX) Lo/Lo/Lo and Fuel Zone Channel 11 digital indicator (-240 to +110 inches)	CR Panel F
LI 36-44 [1F52]	RPV Water Level (ACUREX) Lo/Lo/Lo and Fuel Zone Channel 12 digital indicator (-240 to +110 inches)	CR Panel F
SYS 201.2-517	RPV Water Level (ACUREX) Data logger/recorder System 11 (-240 to +110 inches)	Panel 1S69 (Aux control room)
SYS 201.2-518	RPV Water Level (ACUREX) Data logger/recorder System 12 (-240 to +110 inches)	Panel 1S10 (Aux control room)

FOR REACTOR COOLANT SYSTEM PRESSURE:

Device ID No.	Device Description (Indicating Range)	Device Location
PI 36-31A	RPV Pressure Channel 11 meter (0 to 1600 psig)	CR Panel F
PI 36-32A	RPV Pressure Channel 12 meter (0 to 1600 psig)	CR Panel F
PR/FR ID75	RPV Pressure Channel 11/12 chart recorder (black pen) (0 to 1600 psig)	CR Panel F

FOR DRYWELL TEMPERATURE:

Device ID No.	Device Description (Indicating Range)	Device Location
TI 201-36B	Drywell Temperature Elevation 253 feet meter (50 to 300 °F)	CR Panel L
TI 201-27B	Drywell Temperature Elevation 320 feet meter (50 to 300 °F)	CR Panel L
TI 201-33B	Drywell Temperature Elevation 230 feet meter (50 to 300 °F)	CR Panel L

FOR DRYWELL PRESSURE:

Narrow Range Instruments -

Device ID No.	Device Description (Indicating Range)	Device Location
PI 201.2-105A	Drywell Pressure Channel 11 meter (0 to 75 psig)	CR Panel K
PI 201.2-106A	Drywell Pressure Channel 12 meter (0 to 75 psig)	CR Panel L

Wide Range Instruments -

Device ID No.	Device Description (Indicating Range)	Device Location
PI 201.2-484A	Drywell Pressure Channel 11 meter (-5 to +250 psig)	CR Panel L
PI 201.2-483A	Drywell Pressure Channel 12 meter (-5 to +250 psig)	CR Panel L
P/LR 201.2-307	Drywell Pressure Channel 11 chart recorder (blue pen) (0 to 250 psig)	CR Panel L
P/LR 201.2-308	Drywell Pressure Channel 12 chart recorder (blue pen) (0 to 250 psig)	CR Panel L

FOR SUPPRESSION POOL WATER LEVEL:

Device ID No.	Device Description (Indicating Range)	Device Location
LI 58-06A	Pool Water Level Channel 11 meter (0 to 13.75 feet)	CR Panel K
LI 58-05A	Pool Water Level Channel 12 meter (0 to 13.75 feet)	CR Panel K
P/LR 201.2-307	Pool Water Level Channel 11 chart recorder (red pen) (1 to 16 feet)	CR Panel L
P/LR 201.2-308	Pool Water Level Channel 12 chart recorder (red pen) (1 to 16 feet)	CR Panel L

FOR SUPPRESSION POOL WATER TEMPERATURE:

Device ID No.	Device Description (Indicating Range)	Device Location
TI 201.2-519	Pool Water Temperature Channel 11 meter (30 TO 230 °F)	CR Panel K
TI 201.2-520	Pool Water Temperature Channel 12 meter (30 TO 230 °F)	CR Panel K
SYS 201.2-517	Torus Temperature (ACUREX) Data logger/recorder System 11 (30 TO 230 °F)	Panel 1S69 (Aux control room)
SYS 201.2-518	Torus Temperature (ACUREX) Data logger/recorder System 12 (30 TO 230 °F)	Panel 1S10 (Aux control room)

FOR CONTAINMENT OXYGEN CONCENTRATION:

Device ID No.	Device Description (Indicating Range)	Device Location
H_2O_2/R 201.2-451	Containment Oxygen Conc. Channel 11 chart recorder (green pen) (0 to 5 % and 0 to 25 %, selectable)	CR Panel L
H_2O_2/R 201.2-450	Containment Oxygen Conc. Channel 12 chart recorder (green pen) (0 to 5 % and 0 to 25 %, selectable)	CR Panel L

FOR CONTAINMENT HYDROGEN CONCENTRATION:

Device ID No.	Device Description (Indicating Range)	Device Location
H_2O_2/R 201.2-451	Containment Hydrogen Conc. Channel 11 chart recorder (red pen) (0 to 5 % and 0 to 20 %, selectable)	CR Panel L
H_2O_2/R 201.2-450	Containment Hydrogen Conc. Channel 12 chart recorder (red pen) (0 to 5 % and 0 to 20 %, selectable)	CR Panel L

FOR DRYWELL WATER LEVEL:

Device ID No.	Device Description (Indicating Range)	Device Location
LI 80-100	Drywell Water Level meter (-360 to 0 inches)	CR Panel K

Marking these instruments should assist operators in locating indications to be used in determining EOP entry conditions and in monitoring important plant parameters specified by EOPs.

4. CONTROL PANEL MARKINGS

Installation of the markings for EOP Key Parameter Category 1 display instruments is currently in progress and will be completed by the end of the year. This process requires the issuance of a plant design modification package, with panel drawings revised to show the permanent changes being made, before the actual markings can be installed.

Instruments will be identified on the control room panels by a piece of 3/4-inch red tape installed on the bezel immediately above each specified display device. There are some exceptions to this; where the display device is other than an edge-wise meter, the tape will be placed in close proximity above the indicator; if, for some reason, the tape cannot be placed immediately above the device, it will be placed immediately below the device. The tape selected is opaque and can be firmly attached to the meter bezel so that it will not easily come off.

The decision to use red tape was based upon the results of a multi-disciplinary review. Methods used to identify RG 1.97 instruments at several other nuclear plants, including NMP-2, were evaluated by the review team. All other identification methods discussed were in some way related to the labels on the instruments. None of these methods could be duplicated because NMP-1 meters do not have separate labels but rather are labeled vertically within the meter. The use of small round orange stickers was proposed initially, but this scheme was rejected because the stickers could not be considered permanent. Clear yellow 1/2-inch drafting tape was then applied, but the clear yellow tape on the dark bezel did not show up prominently. It was also decided that yellow was used in the control room as a cautionary color, and that red would be more appropriate for EOP-related parameters.

5. TRAINING

Operator training regarding the identification of RG 1.97 Category 1 display instruments for EOP Key Parameters has been conducted in the simulator. At the time the markings were installed in the simulator, the simulator training instructors were informed as to their purpose and they then passed on this information to the operators as part of the normal training activities.

6. HUMAN FACTORS MANUAL

The NMP-1 Human Factors manual will be revised to include the convention for identification of the RG 1.97 Category 1 display instruments for EOP Key Parameters. The manual will specify the color and type of tape to be used, and the preferred location for the tape to be applied.