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MORGAN,C.V. Niagara Mohawk Power Corp.
RECIP.NAME RECIPIENT AFFILIATION
VASSALLO,D.B. Operating Reactors Branch 2

SUBJECT: Forwards info re safety parameter display sys.Info suppls 840103 submittal in response to specific info requested by NRC.

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

September 18, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Vassallo:

This letter transmits information regarding the Nine Mile Point Unit 1 Safety Parameter Display System. This information supplements our January 3, 1984 submittal in response to specific information requests by your staff.

Sincerely,

NIAGARA MOHAWK POWER CORPORATION

C. V. Mangan
Vice President
Nuclear Engineering and Licensing

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Niagara Mohawk Power Corporation

Supplement 1

to

Submittal Regarding

the

Safety Parameter Display System

September 1984

1. Introduction and Purpose

Niagara Mohawk Power Corporation's letter dated January 3, 1984 transmitted a summary description of the Safety Parameter Display System for Nine Mile Point Unit 1. During a meeting at Nine Mile Point Unit 1 on February 27-29, 1984 the Nuclear Regulatory Commission staff reviewed Niagara Mohawk's proposed Safety Parameter Display System in detail. This review included the basis for the concept, the computer hardware and software, the current operating status, and the schedule of system developments. A trip report summarizing the results of this review was sent by the Nuclear Regulatory Commission staff on June 4, 1984. Further, a request for additional information based on Commission staff review of the January 3, 1984 submittal was sent to Niagara Mohawk on June 27, 1984.

This supplement provides both general and specific information regarding the questions raised, in order to expedite Commission staff review. This information is divided into two parts. The first part covers the June 4th trip report, where the subjects are paraphrased in order to appropriately focus on them. The second part provides specific information which answers the questions in the June 27th request.

2. Nuclear Regulatory Commission Trip Report

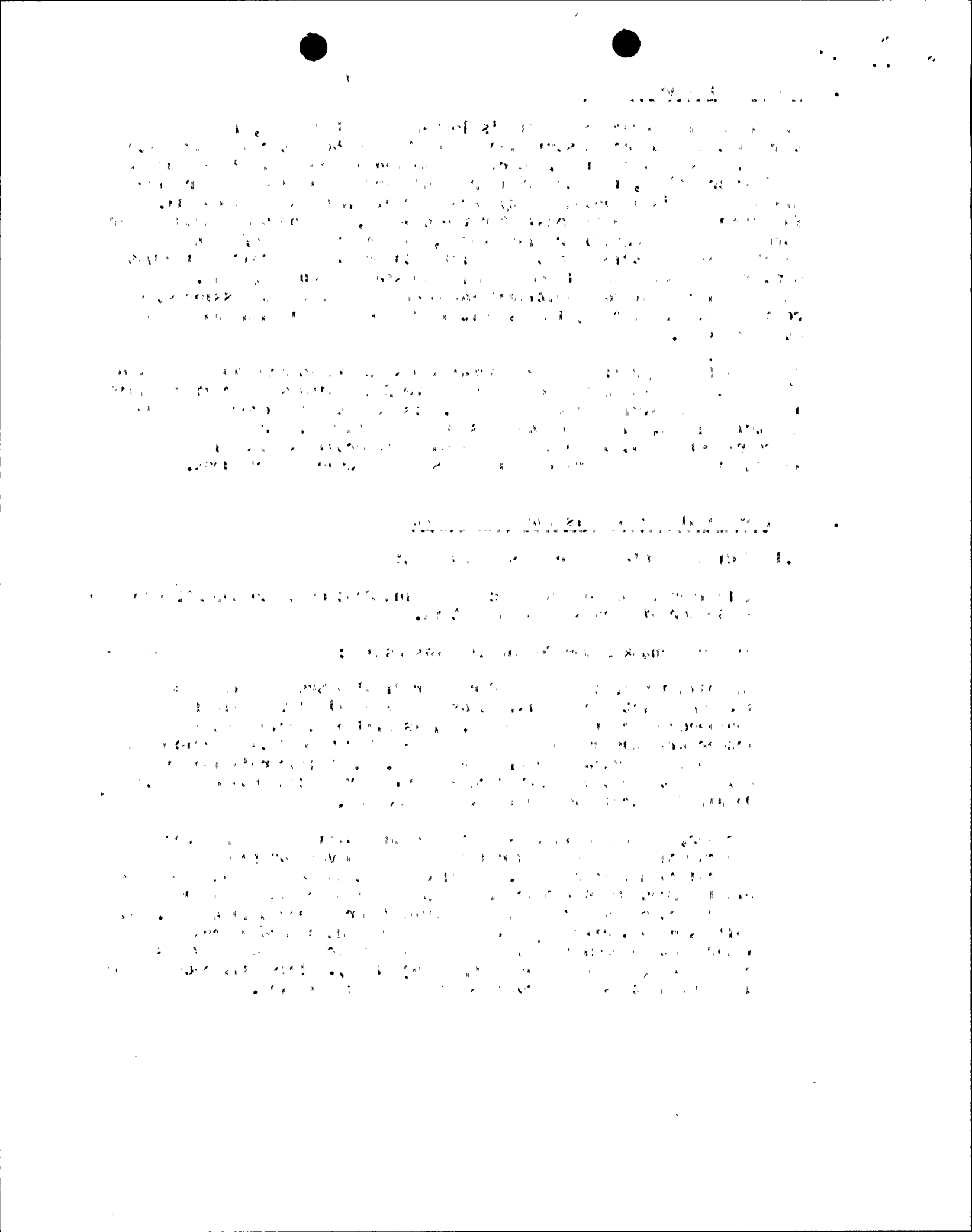
2.1 Nuclear Regulatory Commission Subject:

Relationship of the Emergency Operating Procedures to the Safety Parameter Display System Parameters.

Niagara Mohawk Power Corporation Discussion:

Installation of the Safety Parameter Display System will be well integrated into the revisions of the Nine Mile Point Unit 1 Emergency Operating Procedures. This will be carried out by integrating the people and the programs throughout the development of the Safety Parameter Display System. A similar relationship exists between the Safety Parameter Display System program and the Detailed Control Room Design Review program.

Further, Niagara Mohawk is active on the Boiling Water Reactor Owners Group committees working together on various facets of control room improvements. We also expect to take advantage of the Display/Procedures Integration Project being conducted by the Department of Energy and the Electric Power Research Institute. It follows necessarily that the Emergency Operating Procedures incorporate appropriate use of the Safety Parameter Display System parameters (as well as other operator aides). This will become more apparent as these two programs proceed to completion.



2.2 Nuclear Regulatory Commission Subject:

Specific Boundaries of the Nine Mile Point Unit 1 Safety Parameter Display System.

Niagara Mohawk Power Corporation Discussion:

2.2.1 Basis for Original Submittal:

Operation of a nuclear power plant is necessarily an iterative process of integrating the information, actions and concepts in the control and management of the man/machine systems and relationships involved. Therefore, the original Safety Parameter Display System submittal of January 3, 1984 contained an overall view to provide the Nuclear Regulatory Commission a comprehensive understanding of the enhancements available at Nine Mile Point Unit 1.

A complete set of operational aides is being developed, along with an acceptable Safety Parameter Display System, which have considerable flexibility, comprehensiveness and practicability to assist operators in a variety of situations. Our original submittal was intended to show how a Safety Parameter Display System, along with these aides, would function in the aforementioned integration processes. The following is a clearer delineation of this Safety Parameter Display System function in response to the questions raised by the Nuclear Regulatory Commission.

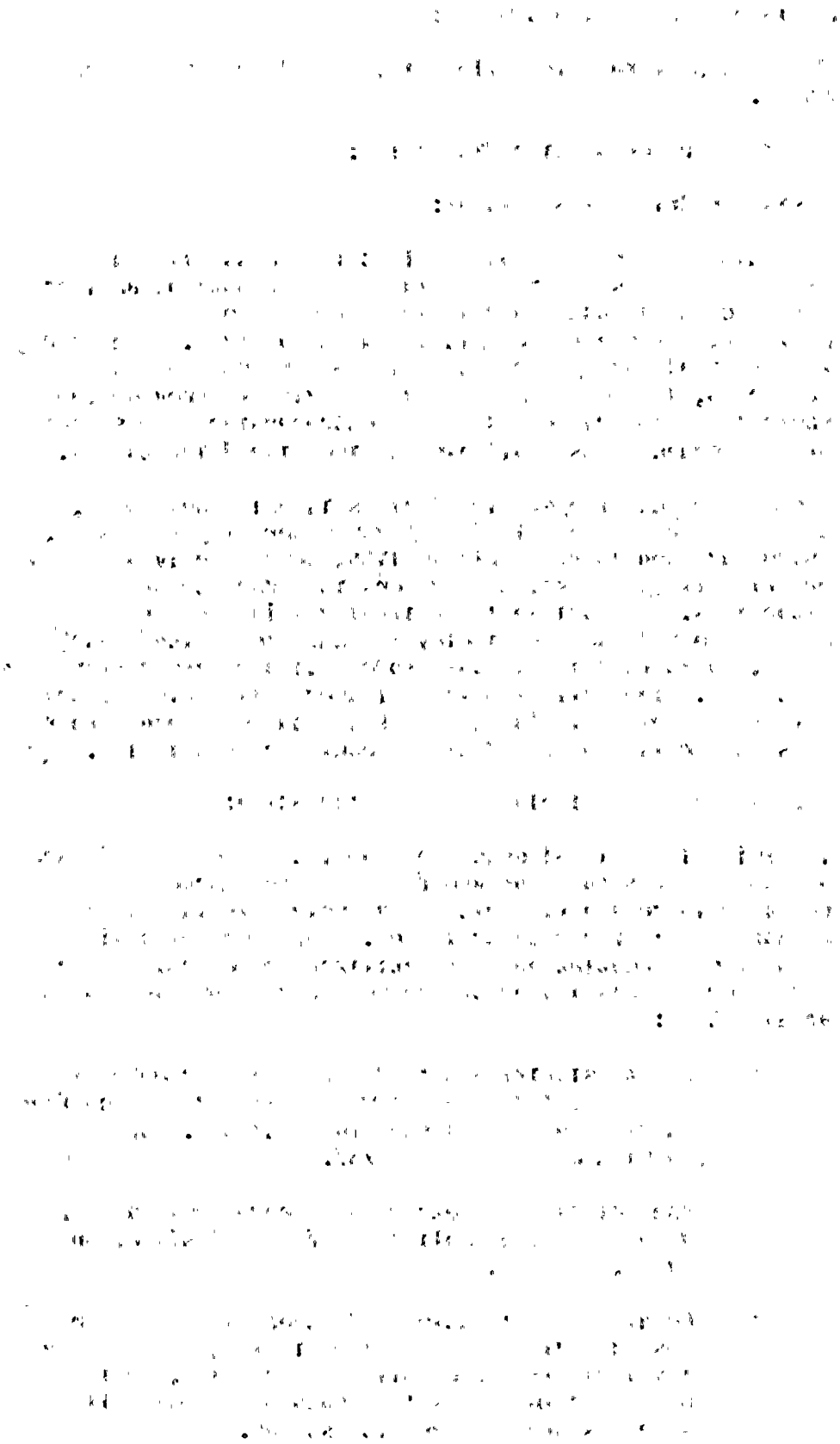
2.2.2 Safety Parameter Display System Delineation:

The initial submittal described the integrated use of three new cathode ray tubes driven from the plant process computer in conjunction with previously existing displays on panels E&F of our control room. Three superimposing sets of differentiations were utilized to determine which parameters to display on the cathode ray tubes and how to arrange them:

- Safety significance: Whether the parameter is a fundamental safety parameter relative to the five safety functions listed in Section 4.1 of Supplement 1 to NUREG-0737.

- Use priority: Whether the parameter is used for detection of anomolies, or for analysis of an event, or both.

- Cognitive application: Whether the parameter is most useful as an overview display, a secondary level display of detailed information, or in other pertinent displays such as the overall safety system operability status.



The process computer already has permanent input of most plant process variables and has built-in graphic display generation capability. This gives the plant operators the flexibility to generate a variety of differentiated operator aides quickly and reliably. This combination of cathode ray tube displays, and control room panel instrumentation and controls results in a powerful overall approach in fulfilling the basis described in 2.2.1 above.

However, the guidelines on the Safety Parameter Display System from Supplement 1 to NUREG 0737 focus specifically on the display of parameters which can be used to directly assess plant safety status, as described in the Nuclear Regulatory Commission's trip report. Thus, that portion of the overall approach described above which fits that delineation is the overview display. On this basis, the Nine Mile Point Unit 1 Safety Parameter Display System can be described and bounded as shown in Table 1 below.

Table 1

Specification of a Nine Mile Point 1 Safety Parameter Display System In Response to the Guidelines of Section 4.0 of Supplement 1 to NUREG 0737

A. Purpose: Separate and prominent overview display of preselected fundamental safety parameters for detection of significant anomolous plant behavior.

B. Application: Use of a cathode ray tube driven by the display generation subsystem of the plant process computer which previously had most of the plant process parameters permanently connected to it.

C. Parameters Preselected:

	Safety Function	Fundamental Safety Parameters
1.	Reactor Control	Average Power Range Monitor
2.	Reactor Core Cooling	Reactor Water Level Core Flow
3.	Reactor Coolant System Integrity	Reactor Pressure
4.	Containment Integrity	Drywell Pressure
5.	Radioactivity Control	Main Stack Release Rate

2.3 Nuclear Regulatory Commission Subject:

Validation of the Safety Parameter Display System.

Niagara Mohawk Power Corporation Discussion:

Data validation consists of comparing "multi" (at least two) independent sensor inputs, using redundancy checks for consistency and out of range checks for reasonableness. The Safety Parameter Display System utilizes both analog and digital parameters. Data processing consists of analog data validity checking, digital filtering of analog data, alert or failed analog sensor identification, alarm limits checking, input error checking, and "chattering" eliminations. These actions occur prior to the appropriate value being displayed on the graphic overview or secondary displays.

2.4 Nuclear Regulatory Commission Subject:

Continuous Display of the Safety Parameter Display System.

Niagara Mohawk Power Corporation Discussion:

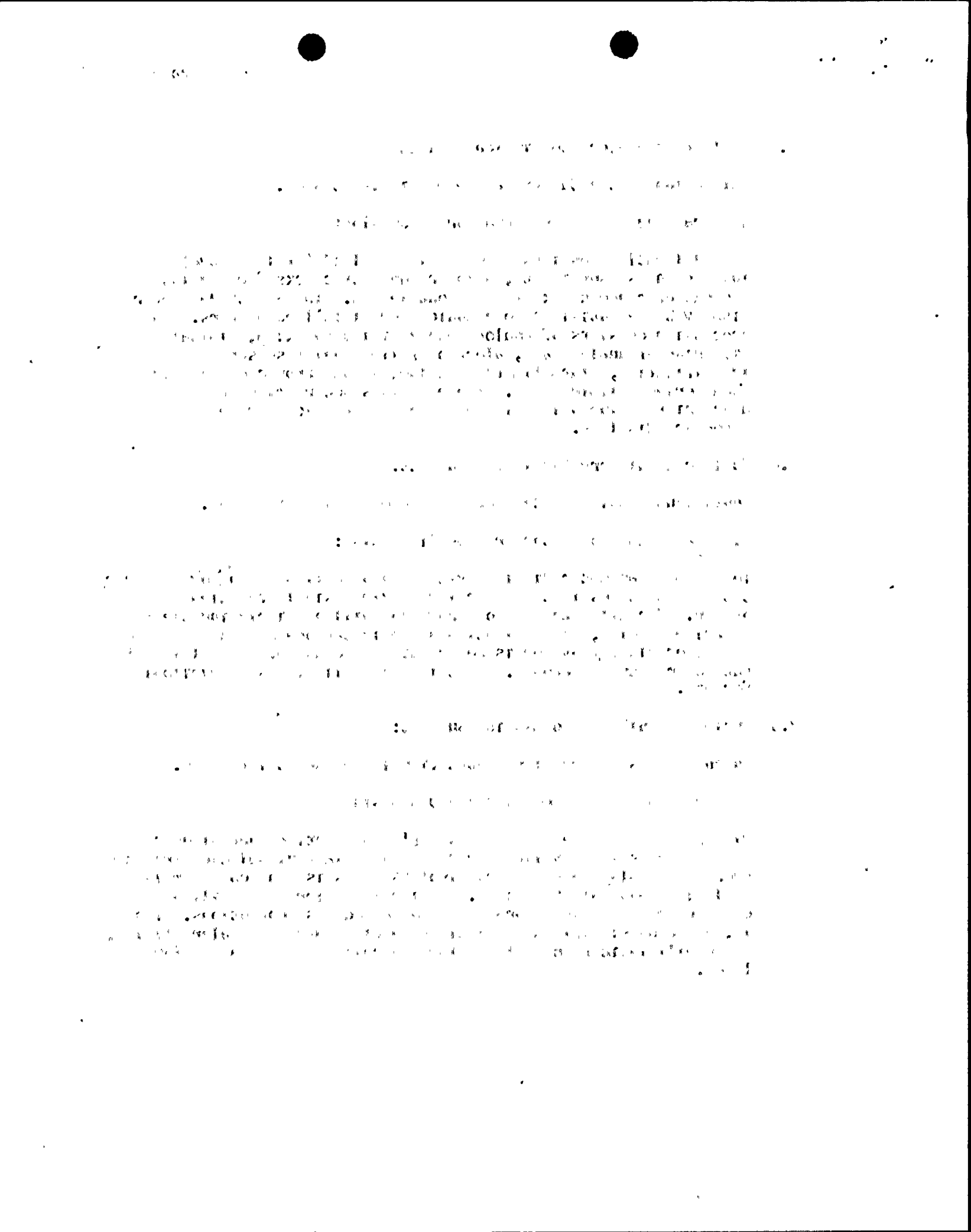
The Safety Parameter Display System can be called up on any of three cathode ray tubes in the control room via a single function key button. Normally, the cathode ray tube will be displaying the overview display, but dedicating a single cathode ray tube to Safety Parameter Display System is not required because of the multi cathode ray tube approach. That is, one will always be available for use.

2.5 Nuclear Regulatory Commission Subject:

Human Factors Observations About Visual Cues and Color Codes.

Niagara Mohawk Power Corporation Discussion:

Niagara Mohawk agrees with the staff's observations and plans to improve the system by incorporating appropriate visual cues from the overview display to secondary displays to assist the operator in analyzing abnormal situations. Similarly, color codes will be changed to agree with appropriate human factors conventions. That is, based on significant deviations to plant parameter alarm limits, green will indicate normal; yellow a warning; and red an action level.



3. Nuclear Regulatory Commission Request for Information

3.1 Introductory Statements:

3.1.1 Nuclear Regulatory Commission:

"In its submittal of January 3, 1984, adequate information was not provided by the licensee for the staff to confirm that the Safety Parameter Display System will be suitably isolated from electrical interference with equipment and sensors that are used in safety systems."

Niagara Mohawk Power Corporation Response:

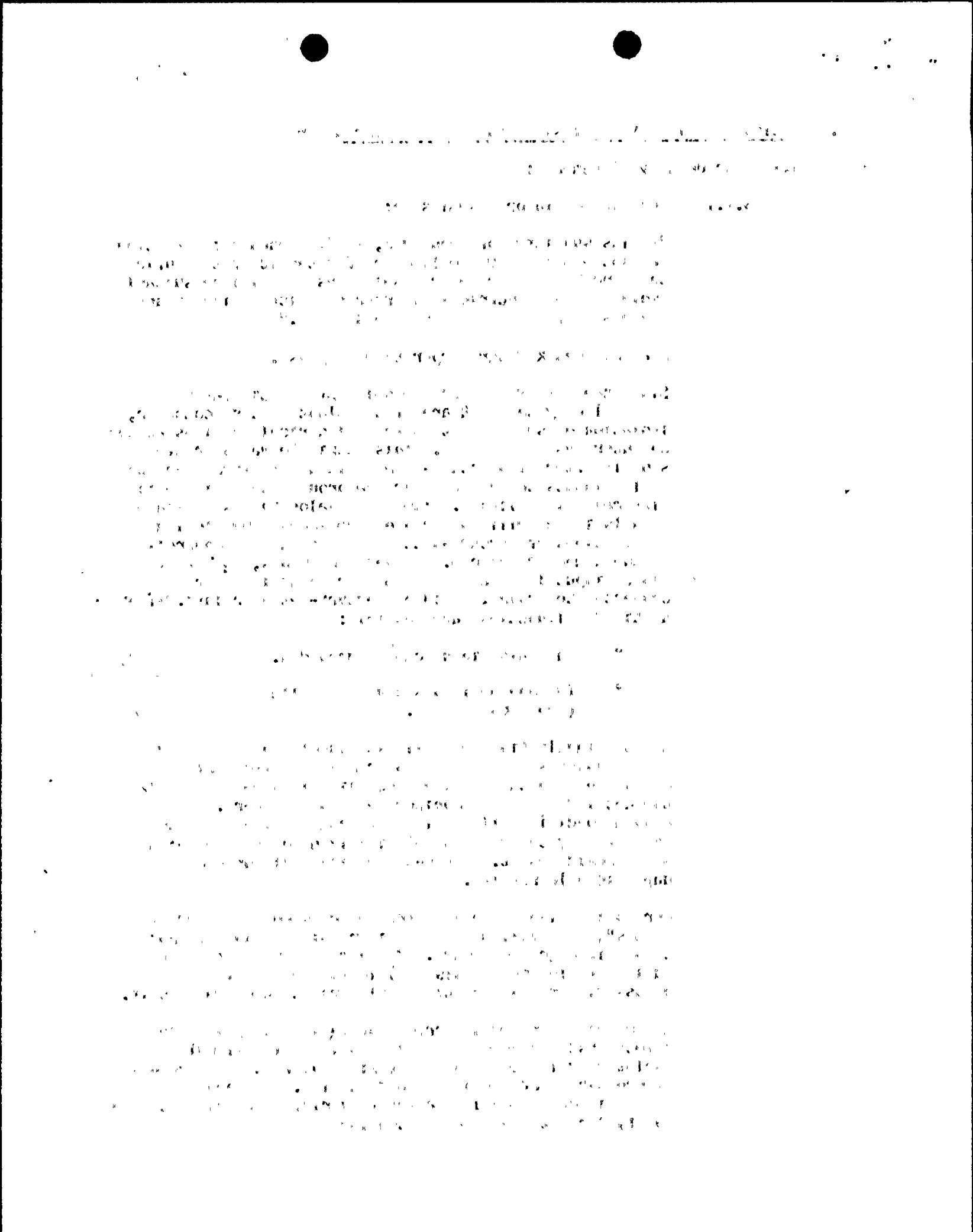
Since the Safety Parameter Display System display is controlled by the software of the plant process computer, isolation of safety systems from electrical problems at the computer must be assured. This attribute was addressed shortly after plant start-up when it was realized that the analog inputs to the computer are brought to a single input differential amplifier. The many analog inputs (voltage signals in the millivolt range) are scanned by closing combinations of mercury-wetted relay contacts, controlled by the computer program. In between inputs, both the analog input leads and the computer input leads are connected to ground, again by mercury-wetted relays. Two distinct malfunctions are possible:

- An analog input can be grounded.
- Two analog inputs can be paralleled (cross-connected).

Analog signals (in the millivolt range) from Local Power Range Monitors and Average Power Range Monitors ride on a common mode voltage of 100 VDC, which is used to polarize the Local Power Range Monitor neutron detectors. For a ground condition all Local Power Range Monitor detector tubes fed by the power supply involved would go dead; a scram could result. Cross-connection would produce unpredictable results.

For analog signals derived from process control current "loops", the milliamp current is regulated and will not change if a ground occurs. However, instrument/control equipment elements (resistors) in the loop could be bypassed. Cross-connection could produce the same result.

A general program was carried out in 1971 to equip the safety system connected computer points with signal isolators which keep the input side unaffected by grounds or cross-connections on the output side. Niagara Mohawk has reviewed the documentation to verify that this included Safety Parameter Display System inputs.



Three slightly different isolator versions were purchased and are indicated below. The internal circuitry is identical, except for resistor size in the output section which dictates range.

- Instrument/control loops, Rochester Instrument Systems Co. model SC-326 Isolated Millivolt Transmitter, 16-80 mv input and output, 13 total.
- Local Power Range Monitors, Rochester Instrument Systems Co. model XSC-326 Isolated Millivolt Transmitter, 0-160 mv input and output, 64 total.
- Average Power Range Monitors, Rochester Instrument Systems Co. model XSC-326 Isolated Millivolt Transmitter, 0-80 mv input and output, eight total.

The prefix X in XSC-326 refers only to a nonstandard method of external connection, jack-connected instead of hard-wired.

3.2 Responses to Specific Question:

3.2.1 Nuclear Regulatory Commission Request a:

"For each type of device used to accomplish electrical isolation at Nine Mile Point Unit 1 describe the specific testing performed to demonstrate that the device is acceptable for its application(s). This description should include elementary diagrams where necessary to indicate the test configuration and how the maximum credible faults were applied to the devices."

Niagara Mohawk Power Corporation Response:

The following standard production line test was applied to the isolators purchased by Niagara Mohawk:

Insulation Test - 500 VAC is applied sequentially between every terminal and ground (the chassis is connected to ground). No breakdown should occur.

This demonstrates it is safe to apply 100 VDC or any other low voltage at the input terminals (as is the case for Local Power Range Monitors and Average Power Range Monitors) without risk of breakdown to ground. Also, if a cross-connection applies 100 VDC to either output terminal, no breakdown occurs; Rochester Instrument System has also documented that there would be no effect on the input side of the in-operation isolator if this occurs. (Note that the output of the isolator is floating.)

3.2.2 Nuclear Regulatory Commission Request b:

"Data to verify that the maximum credible faults applied during the test were the maximum voltage/current to which the device could be exposed, and define how the maximum voltage/current was determined."

Niagara Mohawk Power Corporation Response:

The maximum voltages available in electrical panels in the control room, auxiliary control room and plant process computer are 120 VAC and 125 VDC. Further, the common mode voltage of 100 VDC (as previously described in the Niagara Mohawk introductory statement in 3.1.1 above) would only allow a maximum credible fault of 100 VDC due to a cross-connection. Thus, the 500 VAC insulation test described above is adequate.

3.2.3 Nuclear Regulatory Commission Request c :

"Data to verify that the maximum credible fault was applied to the output of the device in the transverse mode (between signal and return) and other faults were considered (i.e., open and short circuits)."

Niagara Mohawk Power Corporation Response:

Analyses performed by the Rochester Instrument Engineering Department indicates:

- If 120 VAC or 125 VDC were applied line-to-line across the output terminals, internal component damage would result in the output stage, but the input side would not be affected. This fault would require both leads of the voltage source to contact both terminals of the isolator, which is physically a highly unlikely event. This is demonstrated by our past good operating experience. However, in the unlikely event that such a fault did occur, only one isolator would be affected and its failure would be immediately apparent.

- A line-to-line short between the output terminals would not produce internal damage, nor would the input be affected.

- Likewise, an open circuited output would not do internal damage, or affect the input.

3.2.4 Nuclear Regulatory Commission Request d :

"Define the pass/fail acceptance criteria for each type of device."

Niagara Mohawk Power Corporation Response:

The Rochester Instrument production test for these types of isolators are described in the document, "Test Procedure for SC-326 and SC-326W, RIS A-1008-385." This includes the testing described above and the appropriate pass/fail acceptance criteria for conditions pertinent to the Nuclear Regulatory Commission's requests. A certificate of compliance was provided to Niagara Mohawk for a representative number of the installed isolators.

3.2.5 Nuclear Regulatory Commission Question e :

"Provide a commitment that the isolation devices comply with the environmental qualifications (10CFR50.49) and the seismic qualifications which were the basis for plant licensing."

Niagara Mohawk Power Corporation Response:

The Safety Parameter Display System isolation devices at Nine Mile Point Unit 1 are located in a mild environment (i.e., the auxiliary control room and the control room). These areas are not subject to harsh environmental conditions from the postulated events.

The rule for environmental qualification of electrical equipment (10CFR50.49) does not include equipment located in a mild environment. It has been concluded by the Nuclear Regulatory Commission in the development of the rule that the general quality and surveillance requirements applicable to electric equipment as a result of other Commission regulations, are sufficient to ensure adequate performance of electric equipment important to safety located in mild environments.

No seismic requirements were included in the purchase orders for these isolation devices (which was prior to the publication of IEEE 344 requirements for Class IE equipment) although they were generally constructed using good industrial practices and are not considered to be fragile. Maintenance experience with them has been excellent and they would generally be expected to withstand severe events without undue damage. We also note that no seismic guidelines were provided by the Nuclear Regulatory Commission for the Safety Parameter Display System, in general, per Supplement 1 to NUREG-0737.

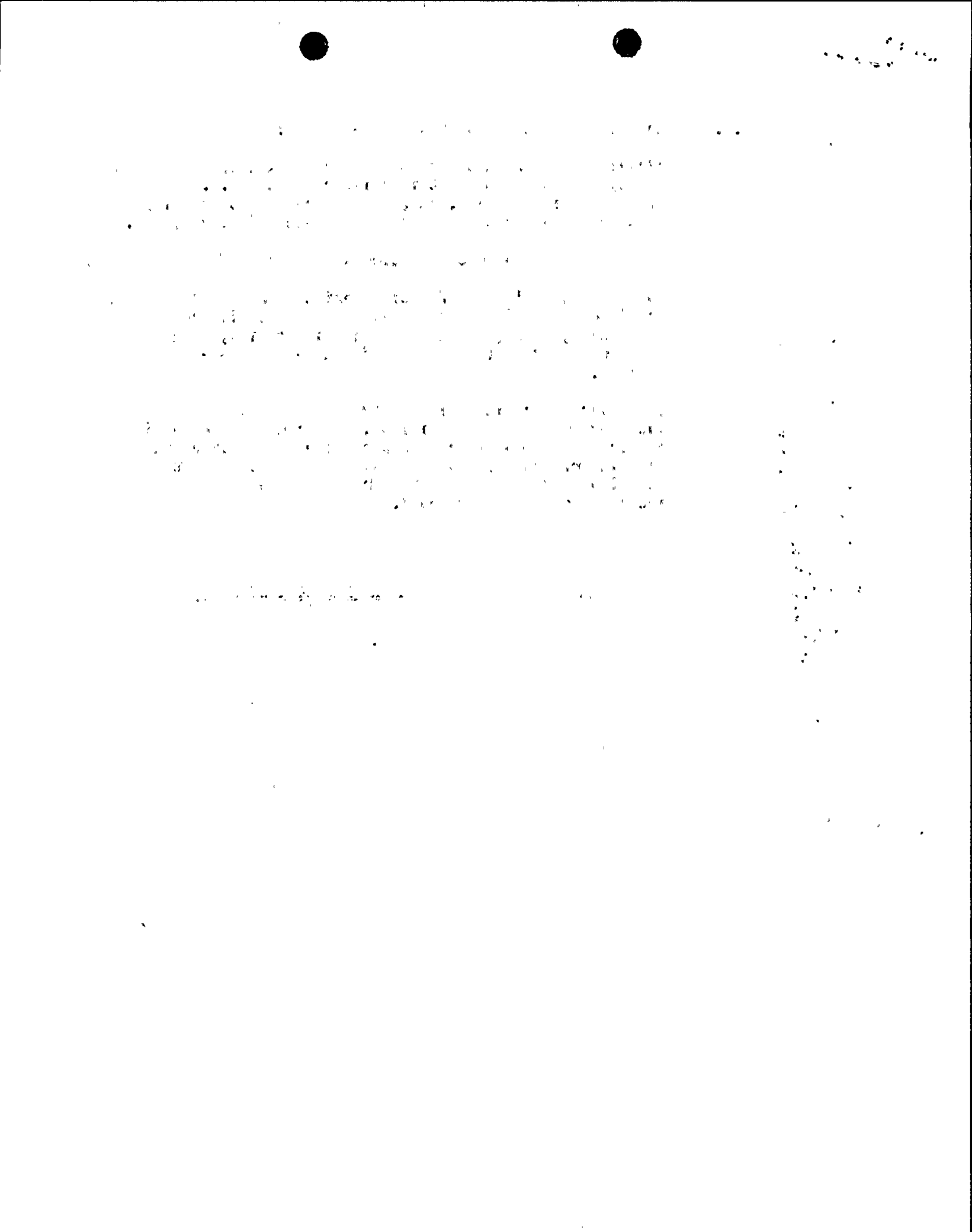
3.2.6 Nuclear Regulatory Commission Request f :

"Provide a description of the measures taken to protect the safety systems from electrical interference (i.e., Electrostatic Coupling, EMI, Common Mode and Crosstalk) that may be generated by Safety Parameter Display System."

Niagara Mohawk Power Corporation Response:

No manufacturer's specifications exist in regard to RFI/EMI (radiofrequency interference/electromagnetic interference) protection, CMRR (common mode rejection ratio), or any other category of interference for XSC-326 or SC-326 devices.

The devices were installed in 1971 and the subject interference was not specifically considered, nor was it required to be considered at that time. We believe that such interference is not a problem for our installation; experience over the last 13 years shows that no interferences have developed.



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NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

300 ERIE BOULEVARD, WEST
SYRACUSE, N.Y. 13202

NB
McKee

September 10, 1984

Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Document and Control Desk

Re: Docket No. 50-220
DPR-63

Dear Sir:

Submitted herewith is the Report of Operating Statistics and Shutdown for August 1984 for the Nine Mile Point Nuclear Station Unit #1.

Also included is a narrative report of Operating Experience for August 1984.

Very truly yours,

C V Mangan

C. V. Mangan
Vice President
Nuclear Engineering & Licensing

TEL/lo
attachments
cc: Director, Office of I&E (10 copies)

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