NIAGARA MOHAWK POWER CORPORATION

RESPONSE TO

NRC-GENERIC LETTER #88-14

(AIR SYSTEMS ANOMALIES)

RELATIVE TO

NINE MILE POINT - NUCLEAR POWER STATION - UNIT 1

SUMMARY REPORT

EVALUATION: RESULTS, FINDINGS AND CONCLUSIONS

- PHASE I PROGRAM TASKS -

ASSESSMENT OF PLANT AIR AND GAS SYSTEMS

RELATIVE TO

LICENSED DESIGN AND OPERATIONAL BASES

March 1989

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ABSTRACT

Nuclear Regulatory Commission's (NRC's) Generic Letter #88-14, dated August 8, 1988, titled: "Instrument Air Supply System Problems Affecting Safety-Related Equipment," requested information regarding the design, operation and maintenance of the Nine Mile Point Unit 1 Plant Air and Gas Systems. The purpose of this report is to provide the NRC with a summary of the evaluation results, findings and conclusions of Niagara Mohawk's technical assessment of the Air and Gas Systems. As a result of this evaluation Niagara Mohawk has concluded that the Unit 1 Plant Air and Gas Systems continue to conform to their original design and operational bases, operate within their safety analysis conditions, and comply with previous FSAR commitments. These systems have provided reliable and safe service.

1.0 INTRODUCTION

1.1 Purpose of the Report

Nuclear Regulatory Commission's (NRC's) Generic Letter #88-14, dated August 8, 1988, titled: "Instrument Air Supply System Problems Affecting Safety-Related Equipment," requested information regarding the design, operation and maintenance of the Nine Mile Point Unit 1 Plant Air and Gas Systems. The purpose of this report is to provide the NRC with a summary of the evaluation results, findings and conclusions of Niagara Mohawk's technical assessment of the Air and Gas Systems. A separate report containing similar evaluation results, findings and conclusions have been submitted for Unit 2.

1.2 NMPC Response Program Plan

In order to perform a design and operations verification the Plant Air and Gas Systems, Niagara Mohawk established a special technical task force and program plan. Also, in order to respond in a timely and meaningful manner, Niagara Mohawk divided the program into three phases. The elements of the plan and each phase are described below.

1.3 Approach of the Program

The purpose of Niagara Mohawk's program is to:

a) verify the Air Systems' original/current design and operational bases by re-evaluating their requirements, their documentation, and their resultant operational configurations;

b) verify that the Air Systems assumed and actual performances are within the bases cited above by conducting a series of confirmatory tests, inspections and samplings and/or by evaluating their past operating experiences; and

c) evaluate operator actions and training, equipment maintenance, test procedures and system failure modes to show that they are adequate to ensure that the subject safety-related equipment will function as intended.

The Phase I evaluation tasks were designed to demonstrate (a) that the current systems are being operated within their design bases, within their safety evaluation, and in conformance with their regulatory requirements; (b) that the system predicted and actual failure modes are indeed correct and representative of the analysis assumptions; (c) that their failure modes do not result in unacceptable safety system interactions; (d) that operators can take appropriate action during system failures; and (e) that equipment can receive appropriate attention and maintenance. This phase demonstrated compliance with the current system commitments and expectations.

Phase II of the program is to conduct additional system/component degradation evaluations, tests, or analyses. These evaluations are appropriate in light of the vast amount of operating experience information now available. Further air quality and quantity measurements will be performed. This phase will include additional system/component degradations evaluations, analyses and tests (if appropriate) to ultimately demonstrate or conclude that the subject Air and Gas Systems will continue to perform their intended safety functions even when subjected to new failure modes, system interactions or performance degradations. The Phase II program results will be submitted to the NRC after the evaluations and/or tests are conducted during the next normally scheduled refueling outages (Spring-1991).

Phase III will include corrective actions identified in Phase I or II and the incorporation of improvements to further enhance the reliability and availability of Plant Air and Gas Systems.

[illegible], [illegible], [illegible]

2.0 SUMMARY OF REPORT - EVALUATION RESULTS, FINDINGS AND CONCLUSIONS

2.1 General - Results, Findings and Conclusions

Niagara Mohawk concludes that the subject Plant Air and Gas Systems continue to conform to their original design bases and safety evaluations and comply with applicable FSAR commitments. The subject systems have provided reliable and safe service.

2.2 Specific - Results, Findings and Conclusions

The results of the Phase I evaluation confirm that:

a) the current systems are being operated within their design bases and within their safety evaluations and in conformance with FSAR commitments;

b) there is agreement among the FSAR system design and operational bases and the current engineering and operating documentation representing these bases;

c) the systems' performances are within their design and operational bases;

d) the systems' assumed and actual failure modes are in agreement with their surveillance tests and their operating experiences and are representative of safety analysis assumptions;

e) their failure modes have not resulted in unacceptable safety system actuations or frequent plant disturbances;

f) reactor operators are aware of and can take appropriate action during air/gas system failures;

g) air/gas systems equipment can and do receive appropriate attention, maintenance, surveillance and testing; and that

h) the subject systems have in the past and are expected in the future to provide safe and reliable plant air services.

The results of the Phase I evaluation further indicate that:

i) the subject systems continue to comply with and conform to applicable FSAR commitments;

- Review of the operating aspects of the Air/Gas Systems design and operational bases indicate agreement with the FSAR system descriptions, expected conduct of operation, safety analysis assumptions and FSAR commitments.

ii) the system design and operational bases are being maintained in agreement with both engineering and operating documentation;

- Review of the systems air/gas quality, quantity, air/gas source and user reliability relative to their actual and expected performance confirms their compliance with their design and operational bases.

iii) the current system failure modes are conservative, consistent and appropriate;

- Detailed review of the various failure modes (e.g. fail/safe, instantaneous, complete, etc.) with general operating experience, operating procedure insights, reactor operator awareness and FSAR analysis assumptions, did not uncover any new or significant safety problems or plant operating mode changes.

iv) reactor operator training, operating procedures and instrumentation and control system capabilities relative to Air/Gas System failures are adequate;

- Significant amount of information and instructions are available to the reactor operator relative to Air System anomalies and their implications. The operator is capable of responding to (e.g. preventing, mitigating or accommodating) a wide variety of events involving air system losses. Credit for short term operator action is not taken in the FSAR analysis. The reactor operator's participation and impact, therefore, would be expected to be greater than the safety analysis predictions.

v) Air/Gas System maintenance, testing and surveillance procedures and practices are extensive and have been highly effective;

- A review of the plant Maintenance Program reveals that over 200 specific procedures exist dealing with maintenance related aspects (e.g. preventative corrective maintenance, surveillance and operability tests, etc.). These procedures not only cover the Air/Gas System components but involve the air/gas user load components as well. Approximately 30 of these are directly associated with Air/Gas Systems performance.

vi) the actual air/gas quality supplied is adequate; and

- A wide spectrum of air quality recommendations exist. Many of these may be unjustifiably restrictive and unnecessary for most air/gas users; however, for some devices they may be appropriate.

vii) Operating experience at the Plant has been good. The incorporation of industry experience feedback recommendations into the plant design and operation is an important part of any plant improvement program.

The evaluation concludes that the plant already complies with or conforms to many of the recent air system performance improvement recommendations (e.g. SOER-88-01, NSAC-128, NUREG-1275, etc.). Phase II of the program will examine these recommendations in detail.

2.3 Specific Responses to the Information Requested by the Generic Letter

In response to the specific information requested in the generic letter, the following summary is provided:

General

Review NUREG-1275 and perform design and operations verification of air systems.

- NUREG-1275 was reviewed in detail. The operating experiences described in the document were examined for their applicability to the subject systems of this evaluation. The recommendations were also reviewed and are under further evaluation for implementation.

- A design and operational verification evaluation was conducted relative to the Plant Air and Gas Systems. The evaluation examined FSAR commitments, engineering design operations documentation and operating performance. The evaluation concluded: a) the subject systems comply with and conform to their design and operational bases; b) FSAR commitments and the engineering documentation are in agreement; c) plant systems are operating within their safety analyses; and d) current design and operational bases provide adequate assurance that the systems intended safety functions can be met.

Specific

Verify by test that actual air quality is consistent with the manufacturer's recommendations for individual components served.

- The actual air/gas quality of the subject systems was sampled and measured and found to be acceptable.

Verify that maintenance practices, emergency procedures and training are adequate to ensure that safety-related equipment will function as intended on loss of instrument air.

- The Plant maintenance practices and procedures, the operating procedures including emergency procedures and operator training aspects were reviewed and found to be adequate to ensure that the subject safety related equipment will function as intended on loss of instrument air or during design basis accidents. The evaluation concluded: i) a comprehensive maintenance and surveillance program existed and that a substantial number of maintenance practices and procedures are directed specifically at air systems reliability; ii) the reactor operators are aware of the status of the subject systems, have specific procedures dealing with air system disturbance and their mitigation and are therefore capable of conducting a safe and orderly plant shutdown during loss of air/gas or DBA situations; and iii) the reactor operators do receive training in air systems anomalies including slow air loss sequences.

Verify that the design of the entire instrument air system including air or other pneumatic accumulators is in accordance with its intended function. Verify by test that air-operated safety-related components will perform as expected in accordance with all design-basis events, including a loss of the normal instrument air system. This design verification should include an analysis of current air operated component failure positions. Also verify that they are correct for assuring required safety functions.

- The design and operational bases were reviewed to confirm that the subject systems (including their air/gas pneumatic accumulators) will perform in a manner as to assure their intended safety functions. This evaluation reviewed air/gas system performances not only during normal and transient operation, but also under loss of air and design basis accident conditions. A review to confirm their failure modes was also conducted. Special emphasis was given to the review of air/gas systems safety functions relative to their verification during surveillance and testing.

- The evaluation concluded that:

  1) The current plant/system operability and surveillance testing adequately ensures or demonstrates that the intended safety functions of the components can be reliably expected when called upon;

  2) Most air/gas system component related safety functions fail-safe either on loss of air, loss of power, or upon the receipt of a safety action signal;

3) The reactor operators are capable of conducting safe and orderly plant shutdowns under air loss conditions including slow bleed rate failure;

4) Air system degradations or failures can be identified and accommodated. The failure modes of components supplied by air/gas service have been reviewed and found to be as cited in FSAR safety analyses for loss of air or DBA events.

Provide discussion of the NMPC program to maintain air quality.

- The evaluation concluded that the current plant design, operation, maintenance and surveillance procedures and practices are adequate to assure safe and reliable air service. Conformance to them will assure continued safe operation. This conclusion was based upon the following:

  1) The evaluation specifically reviewed the adequacy of the current air/gas quality and found it acceptable. A number of improvements in sampling and monitoring of an air quality were identified for further evaluation and implementation. These will further strengthen the current air quality assurance.

  2) The evaluation of the current maintenance and surveillance practices concluded that these programs are sufficiently adequate to assure continued reliable air/gas service. They were found to be both comprehensive and effective. No changes were suggested.

  3) The review of system or component-level failure modes and effects found them to be adequate. Further review is, however, recommended in order to investigate the suspectibility of the components/systems to air quality degradation type effects.

<u>Additional</u>

Confirm within 180 days that the verification as described above has been performed.

- The evaluation as described above was conducted within 180 days. However, the internal NMPC review and verification of the evaluation results, findings and conclusions required an extension of the submittal date. The NRC was notified of the delay. This subject submittal provides the delayed but verified evaluation.

Some testing may need to be performed at a refueling or shutdown. Deferred testing until next refueling should be indicated.

- This evaluation concluded that the current plant operability and surveillance testing procedures adequately monitor the reliability of the subject systems and demonstrate their safety function availability. No further testing is currently scheduled or required at this time in order to comply with or conform to FSAR commitments, design and operational bases or safety analysis.

- Additional air/gas quality/quantity sampling will be conducted during the next shutdown.

Documentation should be maintained for a minimum of two years.

- The evaluation documentation will be maintained, stored and available for two years as requested by the generic letter.

3.0 PLANT COMPRESSED/STORED AIR/GAS SYSTEMS - DESIGN AND OPERATIONAL BASES

3.1 Introduction

In this section, a brief discussion is presented relative to the identification and definition of:

a) the specific plant Air/Gas System examined;
b) the Air Sources;
c) the Air/Gas Users or loads and their corresponding safety categories;
d) the fundamental characteristics of the air media quality and quantity being supplied, and;
e) the failure modes assumed for each system/load.

In the review and evaluation of Air/Gas Systems and their design and operational bases an important consideration should be recognized.

- The fundamental function of a air/pneumatic system is to provide a medium by which a rapid change of state in a device can occur and/or a medium which contains its own energy source to affect that change of state. In the application to nuclear safety systems, the predominant use of pneumatic devices is to affect a rapid change of state. This "change of state" will occur upon any one or all of the following:

  a) a loss of air servicing the device, or
  b) a loss of electrical control power, or
  c) a receipt of a signal to affect either a) or b) above.

In a majority of the air application cases, the Fail/Safe - dump or release of air will affect a change of state. A small percentage of the remaining air applications involve the supply of air or the application of air pressure. Some cases involved a combination of dump and supply of air.

- The important observation here is that whether its Fail/Safe (intentionally cutting off air) or Loss-of-Air (unintentional air loss), the dumping of air is a fundamentally sound and regularly used concept with air-operated valves. Most of the air loads examined in the report fall into the dump air operation cited above. That is, most perform their safety function upon loss-of-air or the dumping of air. They are, therefore, biased to "fail/safe" upon the loss of air.

- Air systems are also designed to serve two masters at the same time. That is, to provide a reliable air source to operate and control components for normal operation and to reliably remove air during accident situations.

In summary, regardless of the supply of air, most devices dump air to assume a safe state. Therefore, the most important element to evaluate is the ability of the device to reliably lose or dump air.

3.2 Air/Gas Systems Evaluated

The Plant utilizes several compressed gas/air systems. These are the plant's main air systems:

a) Instrument Air System (IAS),
b) Service Air System (SAS), and
c) Breathing Air System (BAS)

There are also system-specific air/gas systems such as:

i) the Emergency Diesel Generator Starting Air System,
ii) the Combustible Gas Control System which uses large external storage tanks,
iii) the Secondary Nitrogen System which uses bottled nitrogen,
iv) the Hydrogen System (for Generator cooling), and
v) the Fire Suppression Systems:

- CO2 system which utilizes a large storage tank, and
- Halon and the CO2 systems, which use storage bottles.

A small breathing air compressor exists which is used for filling self-contained breathing apparatus equipment only.

The compressed/stored air/gas systems evaluated in this report will be confined to:

a) the Instrument Air System,
b) the Service Air System,
c) the Diesel Generator Starting Air Systems, and
d) the Combustible Gas Control System

These systems are evaluated since they either directly perform safety functions or they supply air/gas to components which participate in safety function actions.

3.3 Air/Gas Sources

A brief description of the subject systems is given below. More detailed information on the design, operation, maintenance and testing of the system is available in the document sources noted in the descriptions below and in the documents listed in Appendix B of this report.

Instrument Air System (IAS)

The Instrument Air System (IAS) is the most redundant and reliable main air system in the plant. This system provides a clean, dry, filtered source of air used for plant control and valve operation. The system is composed of two identical Air Compressors (#11 & #12) and a third larger Air Compressor (#13), air filters and dryers and the necessary piping and instrumentation.

Instrument Air Compressor #13 is the lead compressor and runs continuously, loading and unloading with system demand to maintain 101-106 psig at #12 Instrument Air Receiver (IAR). This compressor can handle the majority of normal system demands. A second Instrument Air Compressor (#11 or #12) normally runs unloaded and loads when #11 Instrument Air Receiver pressure decays to 98 psig. Should the receiver pressure drop further to 93 psig, the third idle compressor starts and loads. If receiver pressure drops yet further to 90 psig, the Service Air-Instrument Air backup valve automatically opens allowing Service Air to supply the Instrument Air System Header, upstream of the Air Dryer.

Instrument Air Compressor start/stop controls and indicating lights, Instrument Air Receiver pressure indications, and compressor amperage indications are provided in the Main Control Room. Local indications are provided to permit a more detailed assessment of system/component operation. Main Control Room annunciation and computer point print-out are also provided to alert Main Control Room personnel of off-normal events.

Plant Operating Procedure N1-OP-20 lists the off-normal alarms along with the operator responses to these alarms for the IAS. These alarms include:

1) IAC trips;
2) high IAC discharge air temperature;
3) high cooling water temperature;
4) low IAR pressures; and
5) high filter delta-p;

Service Air System (SAS)

The Service Air System (SAS) provides a filtered air supply for uses not generally concerned with plant control, such as for air driven tools, and acts as a backup air supply for the IA system. A single Service Air Compressor runs continuously and will load and unload with system demand to maintain 95-105 psig at the Service Air Receiver (SAR).

Service Air Compressor (SAC) start/stop controls and indicating lights, Service Air Receiver pressure indication and compressor amperage indication are provided in the Main Control Room. Local indications are provided to permit a more detailed assessment of the Service Air System (air pressures and temperatures, and compressor operation parameters). Main Control Room annunciation and computer point print-out are also provided to alert Main Control Room personnel of off-normal events.

Plant Operating Procedure N1-OP-20 list the off-normal alarms along with the operator responses to these alarms for the SAS. These alarms include:

1) SAC trip;
2) SAC high discharge air temperature;
3) SAR low air pressure;
4) SAC high cooling water temperature.

Diesel Generator Starting Air System

The Emergency Diesel Generator Starting Air System is a separate dedicated air system used to provide a source of filtered air for starting the unit's emergency diesels. Each of the two emergency diesels is supplied with its own starting air system. Because the air systems are mechanically, physically, and electrically separated, a failure on one Diesel Generator System will not impact the other Diesel Generator System.

Each starting air system consists of two compressors (connected in parallel) and five air storage tanks (connected in parallel) and the necessary piping and instrumentation. From full normal storage tank pressure (about 220 psig), each air system is designed to provide sufficient air for five diesel starts (assuming no air leaks and with no compressor operation).

Each compressor is automatically started from its own low pressure switch which senses system air pressure. The lead compressor (selectable) will start and load when sensed pressure decays to 185 psig. Should air pressure drop to 175 psig, the alternate compressor is signaled to start and load. If any compressor fails to start on the initial command, each is designed to attempt a second start. Each compressor is ultimately powered from its respective power distribution board. Even with a loss of air event coincident with a total 115KV power failure, power is continuously maintained to the compressors.

The Diesel Generator Air Start System is not directly monitored from the Main Control Room. Alarm annunciation and computer print-out of low system air pressure at the setpoint of 175 psig are provided to the Main Control Room. There is also alarm annunciation for low voltage of the B electrical control panels sections (PB16 and PB17) which supply the compressor power boards from the diesels. However, proper operation of the system is verified locally each shift. If inspection shows that the air pressure is low and no automatic compressor startup has occurred, local switches are provided to start one or both compressors. Also, to minimize water accumulation and to prevent its side effects the receivers are blown down each shift.

[illegible]

If the starting air system should experience a gradual loss of air pressure, the system will respond as previously mentioned. Should the low starting air alarm activate in the Main Control Room, Operation Procedure, N1-OP-45, Emergency Diesel Generators, provides guidance on the expected operator actions to alleviate or mitigate the off-normal conditions. Part of this response calls for starting the redundant diesel if conditions require.

The IST Program is currently being expanded to monitor the performance of safety-related air user loads of the Air System.

Combustible Gas Control System

The combustible gas control system is designed to prevent a combustible hydrogen-oxygen concentration from accumulating in the primary containment atmosphere before or during a loss-of-coolant accident. The combustible gas control system performs the following functions:

a. inerting of the primary containment within twenty-four hours after startup and subsequent deinerting for shutdown.

b. supplying nitrogen makeup during normal operation.

c. providing a controlled supply of nitrogen into the primary containment following a loss-of-coolant accident.

d. providing a containment venting capability at any time through the emergency ventilation system.

e. providing continuous hydrogen-oxygen concentration monitoring of the primary containment atmosphere.

The combustible gas control system consists of two functionally independent system: containment inerting system and the containment atmosphere dilution system.

- The containment inerting system is designed to purge the primary containment atmosphere with pure nitrogen within twenty-four hours after startup and provide makeup during normal operation. The system also reintroduces air into the primary containment prior to shutdown to allow for personnel access.

- The containment atmospheric dilution system is designed to limit the oxygen concentration of the primary containment atmosphere to less than 4.0 percent during a loss-of-coolant accident. Following a loss-of-coolant accident, hydrogen and oxygen may be released within the primary containment from postulated metal-water reactions and from radiolysis. The initially inerted primary containment prevents the combustion of hydrogen evolved from a metal-water reaction. However, radiolytic decomposition results in the release of both

hydrogen and oxygen. The containment atmospheric dilution system functions by adding nitrogen to the primary containment atmosphere as the radiolytic formation of oxygen occurs. Oxygen concentration is, therefore, diluted to remain below 4 percent by volume. Nitrogen required for containment atmospheric dilution system operation is supplied from two nitrogen supply systems. Each nitrogen supply system consists of a storage tank, vaporizer, electric heater and all of the required piping, valves and instrumentation to assure its delivery to the containment atmosphere. The Inerting Nitrogen System also has a steam boiler vaporizer.

Discharge from either system is through the normal containment inerting system piping system downstream of the isolation valves.

- The system is also designed to provide containment venting capability. This capability provides for venting the primary containment through the emergency ventilation system or to the main condenser after normal operation. The system also provides other vent paths with pressure control valves to ensure that the downstream pressure does not exceed 0.5 psig under post LOCA conditions. Isolation valves exist on all of system piping systems (e.g., from the containment to these pathways or from the nitrogen sources to the containment).

- Two redundant hydrogen and oxygen sampling systems also serve as an integral part of the containment atmospheric dilution system. They continuously monitor the hydrogen and oxygen concentrations within the drywell and suppression chamber. A continuous indication of hydrogen concentration and oxygen concentration in the primary containment atmosphere is provided in the main control room. Isolation valves are situated on the sampling lines.

Some of the valving (cited above) serves a number of important system isolation, nitrogen injection or process control functions. Some of these valves are controlled by the use of nitrogen from the subject system, itself. Several important isolation and injection valves therefore depend on the nitrogen gas supply for their operability. It is for this reason that the system, itself, is being reviewed here. The control of hydrogen concentration by the subject system is a very important plant safety function. The delivery of the nitrogen through the injection valves is very critical. These same valves must also provide safety related containment/system isolation functions when needed. They, therefore, must serve two masters (e.g. Fail/Safe-Closure for isolation and Stay/Safe-Opening for injection).

3.4 Air/Gas Users

The following system/components air/gas users have been identified for evaluation:

FSAR Designated Primary Safety Air/Gas Users

There are air-operated systems/components which must directly change state in order to perform or assure a safety function during a Design Basis Accident. Many of these devices dump their air supplies (e.g. fail/safe) and assume a non-energized state. This non-energized state is usually to assume a "CLOSED" position. However, some valves fail to "OPEN" position. Some valves are required to assume a different position depending on the accident being evaluated.

- Main Steam Line Isolation Valves (MSIVs)
- Primary Coolant and Coolant Isolation Valves (PCIS)
- Reactor Building (Secondary Containment) Emergency Ventilation/Isolation System Dampers
- Diesel Generator System (EDGs)
  - ° Air Starters
- Control Rod Drive System
  - ° HCU Valving
  - ° Scram Valving
  - ° Scram Discharge Instrumentation Volume Valving
- Main Control Room Ventilation System Dampers
- Post Accident Sampling System Valving
- Emergency Service Water System Valving
- Reactor Building Closed Loop Cooling Water System Valving
- Combustible Gas Control System - Containment Atmospheric Dilution System

Other Safety-Related Air/Gas Users

These are air-operated systems/components which may directly or indirectly change state in order to perform or assure a safety function after a Design Basis Accident. Some of the air operated valves require air supplies for post-event operation. Early in the DBA some valves in the following systems usually assume a "CLOSED" position. Some, however, assume an "OPEN" position and thus continue providing some service.

- Containment Spray System (CSS) Valving
- Core Spray Cooling System (CSCS) Valving
- Feedwater High Pressure Core Spray System (HPCS) Valving
- Emergency Cooling System (ECS) Valving
- Reactor Water Cleanup System (RWCUS) Valving
- Fuel Pool Cooling and Cleanup System (FPCCS) Valving

Power Generation Air/Gas Users

These are systems/components which utilize air but which are not involved in any Design Basis Accident scenario or sequence event. They generally require air to perform a function. They generally lose air on a DBA and, therefore, assume a "CLOSED" position. However, again a small number are assumed to fail "OPEN" in order to allow them to continue to provide their service.

- Fire Protection System
- Radwaste Systems
- Off-Gas System
- Combustible Gas Control System - Inerting System

3.5 Air Quality and Quantity Considerations

The following air/gas quality/quantity requirements have been identified.

Air/Gas Quality	FSAR Requirements	Design[1] Specifications
Instrument Air System (IAS):		
Supply Pressure -	105 psig	105 psig
Dew Point -	(-10°F)	(-10°F)
Hydrocarbon Content -	Oil Free	Oil Free
Particulate -	Not > 3 Micron[3]	Not > 5 Micron [3]
Service Air System (SAS)		
Supply Pressure -	105 psig	105 psig
Dew Point -	(-10°F)	(-12°F)
Hydrocarbon Content -	Oil Free	Oil Free
Particulate -	Not > 3 Micron[3]	Not > 5 Micron[3]
Diesel Generator Starter Air System (DESAS)		
Supply Pressure -	(2)	200 psig
Dew Point -	(2)	Clean, Dry &
Hydrocarbon Content -	(2)	High Pressure
Particulate -	(2)	Air
Containment Atmospheric Dilution System	(2)	(2)

(1) Design specifications envelope vendor recommendations or reflect acceptable alternatives.
(2) Air/Gas quality/quantity aspects are not described in FSAR.
(3) These are considered equivalent since their difference is miniscule. The 3-5 micron ANSI Standard requirements are for desicant dryer systems and not for the subject refrigerant system here.

Air/Gas Quantity	FSAR Requirements	Design(1) Specifications
Instrument Air System (IAS)		
Compressors -	Two Comp.@485scfm ea. One Comp.@729scfm	Two @ 485 scfm ea. One @ 729 scfm
Driers -	(2)	485 scfm
After filters -	(2)	Two @ 500 scfm ea., 98% efficiency
Service Air System (SAS)		
Compressors -	500 scfm	500 scfm
Driers -	(2)	750 scfm
After filters -	(2)	Two @ 250 scfm ea., 98% efficiency

Air Quantity	FSAR Requirements	Design(1) Specifications
Diesel Generator Starter Air System (DESAS)		
Compressors - Driers - After filters -	Air System has sufficient capacity for 5 air starts	Air System has sufficient capacity for 5 air starts
Containment Atmospheric Dilution System	11,300 gal + 4,000 gal	11,300 gal + 4,000 gal

(1) Design Specification Envelope Vendor Recommendations or Reflect Acceptable Alternatives.

3.6 Failure Mode Considerations

Service Air System

The Service Air System air user loads are designed to fail/safe on:

a) loss of air,
b) loss of control power, and
c) receipt of a trip signal.

The air loads on this system, therefore, are designed to assume a new change of state:

a) where their function is no longer needed, or
b) where they are required to assume a new position (e.g. opposite of their previous position in order to perform their function), or
c) where they are required to assume both a new position and a new function.

This system is periodically tested and continuously monitored to assure its reliability and availability. Although it services no direct safety function, it can be an alternate to the Instrument Air System when needed.

Instrument Air System Failure Modes

The Instrument Air System air user loads are designed to either:

1) Fail/safe due to:

   a) loss-of-air,
   b) loss of control power, and a
   c) receipt of a trip signal;

or

2) Stay/safe due to:

   (i) air being maintained by the system receiver tanks and in the air piping system header network for a short period of time upon the loss of the compressors.

The Instrument Air System is a safety system in that it was designed to continue to provide instrument air even under Design Basis Accident conditions. Several of the system's safety related loads may require air for period of time immediately after a DBA event to provide a safety-related service. An example of this situation involves the Emergency Cooling (Isolation Condenser) System where during the course of an accident one may desire to close the system valving. The loss of air by design will not result in the loss of the Emergency Cooling System operation or closure of its valving. A loss of air could, however, preclude its isolation. It's for that reason continued air service is provided. This is one of a few very isolated actuations where use of air after a DBA might be directly valuable.

The Instrument Air System and its safety-related loads are periodically tested and subject to surveillance and continuous monitoring. This assures that the systems' stay/safe status is maintained. However, the system and its safety-related loads are not given appreciable operational credit under accident conditions. The system's fail/safe change of state actions are also periodically verified. They are, however, verified at selective important safety loads, (e.g. Containment Isolation valving is periodically exercised).

Diesel Generator - Air Start Systems Failure Modes

The Diesel Generator Air Start Systems are designed to provide:

Stay/Safe Safety Function Services

The diesel generators require compressed air to assist in their initial operation. Each diesel generator has a separate and independent air starter system. Each air starter system has a number

of redundant active (e.g., compressors) and passive components (e.g., air receiver tanks). These components are assembled into two subsystems. However, they do share common air flow pathways. No single active component failure will render both of the individual Diesel Generator Systems inoperable. However, a Single Active Component Failure could negate one or both air start subsystems on the individual Diesel Generator. Operational and surveillance tests are periodically conducted to assure that the Air Starter Systems are satisfying their safety-related service and that they will be available to perform as required.

Containment Atmospheric Dilution System Failure Modes

The Containment Atmospheric Dilution System is designed to provide:

Safe/Safe Safety Function Services

The Containment Atmospheric Dilution System is design to provide nitrogen make up to the primary containment even when subjected to Single Active Component Failure. No single active component failure will render both make-up subsystems inoperable. No single component failure will prevent the delivery of the gas to the containment atmosphere. The subject system injection and isolation valves are either supplied with system gas or with air from the Instrument Air System.

4.0 PLANT COMPRESSED/STORED AIR/GAS SYSTEMS - EVALUATION RESULTS, FINDINGS AND CONCLUSIONS

4.1 Introduction

In response to the generic letter, a design and operations verification of the Unit 1 Instrument Air, Service Air, the Diesel Generator Air Starter and the Combustible Gas Control Systems was conducted. The re-evaluation examined the following areas:

a) FSAR Commitment Conformance - Verification
b) System Design and Operational Bases - Verification
c) Reactor Operator Training and Involvement in Normal Operation and Loss of Air Events
d) Maintenance, Testing and Surveillance Aspects
e) Air/Gas Quality Measurements
f) Operating Experience Performance and Feedback
g) System/Component Failure Mode & Effect Analysis
h) Recent NRC Maintenance Inspection Results
i) Review Observations

Each of the above subject review areas will be treated individually in the sub-sections which follow. The discussions will reflect a summary of verification results, findings and conclusions.

4.2 FSAR Commitment Conformance - Verification

A review of the FSAR regulatory and licensing documentation relative to Air/Gas Systems was conducted for compliance with previous commitments. The review examined:

a) the original and the updated FSAR,
b) significant licensing issues over the past ten years,
c) NRC-IE Information Notices and NRC-NRR Generic Letters and Bulletins,
d) NRC and Industry Operating Experience Reports,
e) internal Licensee Event Reports (LERs), and
f) NRC Inspection Reports, all involving the subject Air/Gas Systems.

The re-evaluation (verification) review concluded that:

- the design and operational bases are in compliance with the documented bases cited in the original and the updated FSARs;
- the actual design and operational documentation is consistent with the current regulatory documentation;
- the actual subject systems operations and performances are consistent with and in conformance with the plant safety analysis assumptions and conditions;

- changes or modifications to the subject systems or their components over the years are also within the safety analysis envelopes and are consistent with system design and operational bases;

- the important subject system operating parameters - air quality and air quantity - are consistent with their design and operating requirements; and

- the current and previous failure mode and effects are consistent with the plant safety analysis.

- the current failure modes (e.g., using instantaneous, complete, and plant-wide loss scenarios and assumptions) remain sufficiently conservative to bound the plant implications and to assure continued reliable plant operation.

In summary, the subject Air Systems comply with and conform to the FSAR commitments associated with their design and operational bases, their failure modes and effects, and their safety analysis.

4.3 System Design and Operational Bases - A Design Engineering Verification

A review (verification) of the subject Air/Gas Systems design and operational bases was undertaken.

The review specifically addressed:

a) Air/Gas Quality
b) Air/Gas Quantity
c) Air/Gas Sources & Identification of Air/Gas Users
d) System Documentation Status
e) The Identification of Plant Modifications
f) The Identification of System Failure Modes

The detailed review of the Air/Gas Systems' engineering documentation associated with the FSAR-related safety systems and safety functions revealed that:

- there are over 1,200 air/gas users; approximately 200 of them have been classified as safety related or Q-listed and, appropriately, 50 are directly involved in Design Basis Accident mitigation. A new list of all instrument air users was assembled. This list contains a comprehensive tabulation of the important individual user requirements. The valves identified or discussed for a safety function in the FSAR safety analysis section are included on this list.

- the FSAR design and operational commitments and the design and operation documentation are compatible. No discrepancies or conflicts were identified. Comparison between FSAR system description and design documentation confirmed this agreement between FSAR commitments and the design.

[illegible]

The verification of the plant air/gas quality was undertaken. The results of the sampling are summarized below:

- The sample points analyzed indicate that hydrocarbon content is less than 1 ppm.
- The dew points appear to be better than required.
- The particulate size appears to be low. In most cases, it appears as low as the filter background level.
- Overall, the quality of air/gas as determined by grab sampling is within the acceptable level of hydrocarbon content, particulate size and dew point prescribed by the FSAR.

A preliminary review was made of the adequacy of the Air/Gas System air/gas quantity. A detailed review will be conducted during the Phase II portion of the program. Quantity aspects -- allowable leakage, leakage detection, system integrity criteria, etc. -- will be evaluated then. The preliminary review concluded that the air sources are more than adequate to supply the air users under their various modes of operation.

A qualitative failure mode analysis of important safety-related valves was conducted. The plant P&IDs were compared with the Operating Procedure valve line-ups, the FSAR safety analysis assumptions, and the system descriptions. Review of pre-operational and system operability test data concluded that system components fail in the specified mode. (Refer to Appendix B for a list of the P&IDs and the Operating Procedures.)

In summary, the review concludes that:

- the air/gas quality and quantity produced by the instrument air source is sufficient to satisfactorily operate the air/gas users connected to the sources; and
- the design of the subject Air/Gas Systems is consistent with the design described in the FSAR.

4.4 Reactor Operator Involvement Considerations

A review of the reactor operator aspects related to normal and degraded Air/Gas System performance was conducted. A brief evaluation of the approximately 25 operating procedures associated with the subject Air System Sources and User Systems was conducted. The review identified that over 50 to 100 Main Control Room Air System anomaly indicators, annunciator or computer alarm printouts associated with Air Systems are available to the operators. A review of the classroom and Plant Simulator training was also conducted.

The evaluation supports the conclusion that the reactor operator can be a very valuable participant in prevention, mitigation and accommodation of plant air loss events. Currently in the FSAR, Chapter 14 event evaluations only took credit for the operator's involvement late in the event scenarios (after the 10 minute mark to be precise). The operator's earlier participation appears to be justifiable. Therefore, operators are expected to prevent or mitigate many of the air anomalies before they impact the plant.

The 25 Operating Procedures cover a full spectrum of the Air System anomalies. The central operating procedure N1-OP-20 is the lead operator response document.

The evaluation results indicate that:

- there is an extensive network of system and component equipment status indicators, alarms, annunciations and computer printout recordings available to the reactor operators in the Main Control Room;

- there is a comprehensive set of operating procedures to assist the operator in taking the necessary actions to prevent the air/gas loss, mitigate its loss effects and/or even to accommodate its loss with a variety of alternative recovery actions;

- the reactor operator is trained in the execution of the procedures both by classroom and simulator training experience;

- the response of the plant and its systems to the loss of air is also understood; and

- plant conditions resulting from the loss of air have been demonstrated or simulated.

In summary, it is concluded that the Loss of Instrument Air event is a well understood potential plant disturbance. Additionally, even though most plant protective actions are automatic, the reactor operator can be a very valuable participant in the prevention, mitigation and accommodation of air loss events.

4.5 Maintenance, Testing and Surveillance Aspects

A review of the subject Air/Gas System - Air/Gas Sources and Air/Gas Users was conducted. The evaluation examined and reviewed in detail:

a) The Air Systems and the safety-related load systems P&IDs. This review essentially created an independent safety-related component list.

b) The existing Air/Gas System Source/User Mechanical/Electrical/ Instrument and Control Maintenance Procedures. This review involved over 200 procedures.

c) The Maintenance Annual Review Summaries since 1981.

d) The Work Tracking System (WTS) or Work Request (WR) histories covering Air System components since 1984.

e) Nuclear Plant Reliability Data System (NPRDS) failure data base for components involving Air Systems.

f) Licensee Event Reports (LERs) directly related to Air Systems.

g) Major Modifications that were made to the Air System.

h) Problem Reports written against Air System components.

i) Backlog of Work Requests relative to the subject system and their air users.

The evaluation found that:

- there exists an extensive network of maintenance-related procedures relative to the subject Air Systems and their safety-related loads;

- these procedures address a wide spectrum of coverage including corrective maintenance, preventative maintenance, surveillance and operability testing, installation and calibration aspects, etc.;

- there are over 1,000 written and formally controlled procedures to cover plant operation. Over 500 of these are related to corrective maintenance, preventative maintenance, surveillance testing and instrument calibrations. Over 200 maintenance procedures have been identified with Plant Air Systems - Sources and their Users Systems; and approximately 30 of these are directly related to Air System maintenance.

- an examination of the Maintenance Annual Review Summaries since 1981 identifies a number of Air System problems which are of obvious concern. The Main Steam Line Isolation Valve Operators have been subject to failure due to dirt in the pilot valve. The Feedwater System Flow Control Valve Operators/Regulators have experienced similar failures. Several Control Rod Drive System Scram Inlet/Outlet Valve Diaphragms failed in 1987. Later evaluation attributed their failure to problems not associated with air quality considerations. The frequency and extent of the above problems are regarded to be small and under control.

- the review of the NPRDS data identified:

  a) dirt as the primary cause of air operated (AOV)/air process (SOV) valve problems (5 events) involving MSLIVs;

  b) component failures (Air Compressors) associated with the DG Air Start Systems caused 2 failures of the DG to start on demand.

  Each of these problems was addressed and are continuing to be addressed on a periodic basis.

- the Licensee Event Reports were reviewed. Over 11 LERs were identified involving air systems aspects;

- an examination of the Plant Problem Report System did not identify any significant Air System problems;

- a review of Work Request Program history indicates that Air System components do not require an inordinate amount of maintenance service (corrective action). Approximately 1% of all WRs are associated with Air System and approximately 1% of current backlog involve Air Systems; and

- an examination of the Plant Modifications or Potential Modifications to Air Systems reveals that nineteen changes have been suggested or made to the various systems over the last ten years. Eight have been incorporated. The other eleven are either under active Engineering evaluation or have been tabled for later consideration.

In summary, the performance of the Air Systems and their safety-related air users (Generic Letter 88-14 Scope) systems/components has been satisfactory. System reliability and integrity has been maintained at a high level through an extensive preventative and corrective maintenance program. A majority of the problems identified with these systems have been reported in a timely manner. A longer period of time is often required to address those that involve hardware changes and/or plant modifications. Those involving procedures are more quickly resolved and implemented. System modifications have improved overall system performance and reliability.

4.6 Air/Gas Quality Measurements

A series of air/gas quality measurements were made throughout the plant. A representative set of samples were drawn and reviewed.

Appendix C of this report describes the results of the air/gas quality samplings. The air/gas quality test results are presented in Table C-1 of Appendix C. The conclusions based on these results, ANSI/ISA Specification 7.3, FSAR commitments and manufacturers' recommended air quality, are as follows:

- Unit 1 meets the ANSI/ISA Standard of 1 ppm for oil concentration.

- Unit 1 meets the ANSI/ISA dew point standard of 35°F at line pressure (-10°F at atmospheric pressure).

- Particulate sizing analyses do not guarantee that no particles greater than 3 micron are present. However, results do show that particle loading is low enough that no discernible particle concentrations above filter media background were detectable. Also, the particle size determinations on initial tests indicated that no particles were found that approached particle sizes limits recommended by manufacturers.

In summary, a series of expedited plant air/gas quality sampling measurements were successfully completed at the Plant during the recent shutdown. The air/gas quality measurements (pressure, micron level, dew point, hydro carbon content) for the subject system complied with the air/gas quality standards or the vendor's recommendations or the FSAR commitments (whichever criteria is appropriate).

4.7 Operation Experience Performance and Feedback

Operating experiences (reports and studies) were reviewed. The reports and studies included:

a) NRC-IE Information Notices,
b) NRC-AEOD Case Studies,
c) INPO-SOERs, SERs, OM&Rs, etc.,
d) EPRI/NSAC Reports,
e) GE-SILs,
f) LERs and events at other facilities.

The results of the review of operating experience feedback aspects are summarized below:

- A review of NRC-IE Information Notices IE-IN-87-28 and its Supplement #1 & IE-IN-86-50) was conducted in March, 1988. Recommendations involving a) increased periodic monitoring of the Air System air quality and b) additional air-loss testing (including gradual air-loss testing) are being evaluated.

- A special project was initiated to address INPO-SOER #88-01. The initial assessment of the document recommendations found that the current design and operation complies most of the proposed improvements. The remaining recommendations are under more evaluation.

- A preliminary review of recently issued EPRI/NSAC #128 report indicates similar agreement to its recommendation. However, again a few suggestions are under further review.

- A review of NUREG-1275 was also conducted. Again, most of the findings and conclusions are unquestionably acceptable and an integral part of the current Air System design and operation. The remaining items fall into the same evaluation categories cited above.

- Unit 1 has experienced a number of unusual events involving Air System failures or anomalies. The most significant event at Unit 1 involved:

  Unit 1 LER 87-24 ... An unusual event involving a reactor water level oscillation attributed to a feedwater flow instability caused by a flow control valve failure. Dirt in the Feedwater Flow Control Valve positioner was identified as the root cause. Remedial actions have been taken to avoid a repeat of this event.

- Comparison of the subject Air Systems performance to the Industry "averages" (see NSAC #128, Plant/Systems Failure Profiles) indicates that the subject systems are operating reasonably well. A review of the LERs indicates that dirt or contamination in two devices (MSLIV's and FWCVs) was responsible for over 75% of the anomalies experienced.

In summary, the operating experience review concludes that:

- Unit 1 is performing better than industry average relative to Air System anomalies, LERs, etc.;

- the Air/Gas Systems do not appear to be affecting plant availability or plant protection systems functions, nor are they demanding special maintenance or unusual operational attention; and

- Air/Gas systems are an integral part of most safety systems and since they are providing an important support service, elimination of any degraded performance is obviously deserving of attention and resolution. Air/Gas System problems, especially those identified by operating experience feedback, are receiving proper attention and disposition.

4.8 Reactor Operator Training

A review of Air/Gas System related issues, concerns and considerations related to operator training and their capabilities to prevent, mitigate or accommodate loss-of-air events was conducted.

The review of operator training relative to operator actions on loss of air event concluded that:

- Training on Air Systems is provided in both the Non-licensed Operator Training and in the Licensed Operator Training Programs. Changes in the Air Systems Operating Procedure and significant air system events would be discussed in the Requalification Licensed Operator Training Program. Training on a loss of air event and the implementation of Special Operating Procedure SOP-6 is performed on the Plant Simulator in the Initial License Program, and is performed annually in the Requalification Program.

- The Simulator is presently designed to allow training on various rates of air system pressure degradation - from small leaks to much larger sized breaks. It can simulate system interactions and duplicate systems level performances.

- The Training Program does provide training instruction relative to air loss scenarios.

- The Training Program does not address Plant Air System recovery aspects per se. The Plant Operating Procedures do address the startup, normal operation and shutdown aspects of air systems.

In summary, the objective of the operator training program for Air Systems does not emphasize event recovery but rather the proper actions to be taken to mitigate the consequences of the event and to place the plant in a safe condition. Event recovery actions are taken following initial operator actions. The operator training is confined to existing, formal documented instructions or procedures.

4.9 System/Component Failure Mode and Effects Analysis (FMEAs)

An evaluation of the Air/Gas Systems relative to their original failure modes and effects was conducted. Considerations of other failure modes and effects were also reviewed.

The review concluded that the original FMEA bases are appropriate; that the plant performance is in agreement with these FMEAs; and that the FMEAs are still appropriate even in light of new operating experience insights. These conclusions are based on the following:

- The review of the plant engineering (e.g. drawings, logic diagrams, etc.) and operating procedures (e.g. Operating Procedures for the Air Systems) concluded that the failure modes assumed to occur in the FSAR safety analysis are in agreement with the documentation and engineering analysis of it.

- A review of pre-operational tests or operational surveillance test or maintenance operability testing data indicates that the assumed failure modes will have occurred as described.

- A re-evaluation of the design basis loss-of-air event described in the FSAR Safety Analysis section concludes that the equipment failure modes cited are appropriate for the safety action needed and design basis conditions required. The resultant plant effects describing the event outcome are bounded by the analyses.

- A review of the operating experience has resulted in the identification of several new failure modes and effects. Many of these are isolated, component unique cases. A plant-by-plant evaluation of similar failures is suggested. Phase II will evaluate these new concerns.

In summary, the original failure modes and effects described in the FSAR and reflected in the plant design and operational bases and the documentation still are to be sufficiently conservative to continue to serve as applicable bases for evaluating the plant safety relative to Air System anomalies.

4.10 Recent NRC Special Maintenance Program Inspection

The NRC conducted a Special Maintenance Inspection of the Nine Mile Point Nuclear Station in November 1988. The NRC inspection team reviewed not only the NMPC programmatic aspects of the Maintenance Program but also the application of the program to certain selected systems. The Plant Air Systems were singled out for specific evaluation. The inspection of the Air Systems involved maintenance, operating performance, safety evaluation, testing and surveillance aspects.

After an intense and thorough review, the NRC identified only two areas for further review. The most notable concerned the question involving the extent and type of failure mode testing done to verify the effects and of a loss of air to the Main Steam Line Isolation Valves. This matter will be addressed in the near future when the NRC Inspection Report findings are released.

4.11 Review Observations

In addition to performing an comprehensive re-evaluation of the Unit 1 Air Systems' design and operational bases, the maintenance practices, the operator training and capabilities, and the system failure modes and effects, Niagara Mohawk thoroughly re-reviewed the operating experience reports. This review examined the NRC and industry findings, conclusions and their recommendations and the plant operating data upon which they were based. The intent of the following is to provide an Air System Issue perspective from the reactor operator point-of-view and to identify potential plant Air/Gas Systems improvements.

Industry Recommendations

Niagara Mohawk believes that Unit 1 already complies with many of the recommendations presented by the AEOD, NRC, INPO and EPRI/NSAC reports. Those recommendations yet to be addressed and complied with are under administrative and engineering review.

Cautions To Be Exercised In Reviewing Air System Changes

The following areas require further review and insight prior to plant design or operational bases changes.

° Committing to the ASNI Air Quality Standard on all Air Systems & Loads

- Review of vendor recommendations, operating experience insights, and even the capability to monitor at this low level all suggest that the specified criteria may be unnecessary, restrictive, impracticable and possibly not cost-beneficial.

° Requiring Total System/Plant Slow Bleed Testing

  - The need for this testing is not apparent. Current FMEAs do not identify a significant impact relative to it. Quantitative evaluation of its potential modes/effects, probability/consequence, etc. are needed prior to its consideration for a plant-wide application.

° Emphasizing Immediate Operator Action To Affect Immediate Air System Recoveries

  - Most plant safety actions automatically fail/safe on loss of air. Most failed services are not needed to assure safe and orderly shutdown. The operators' attention should not be diverted from the current shutdown system operation. Recovery of unnecessary systems and services should be 3rd or 4th order priority. Restoration of air later should be addressed after the plant is stable. Many air losses will not be preventable upon the indication of the degradation.

° Using Normal Operation Failure Modes As Accident Scenario Initiators or Conditions

  - Most of the Air Systems' operating experience failures (both their failure modes and effects) occurred during normal operating plant maneuvers. To superimpose them in accident scenario sequences in a qualitative sense may appear to be attractive or reasonable; however, in a quantitative sense, it may certainly fall far outside reasonable probability limits (10^{-6}). The presumption that MSIVs do not close at the on-set of a DBA-LOCA should not be qualitatively imposed without quantitative evaluation. So it is with other normal operation failure modes. Super-position should be only considered after quantitative evaluation.

<u>Improvements Identified For Consideration, Evaluation and Implementation</u>

The following areas have been tentatively identified for further review and evaluation. Several of them are to be addressed in greater detail in Phase II of the NMPC program.

° Increased and Expanded Air Quality Measurements & Monitoring

  - Additional Plant Periodic Sampling
  - Permanent On-Line Monitoring and Sampling Capability

- In-House Evaluation
- New Monitoring Equipment For On-Line Monitoring or Sampling
- Development of More Representative Sampling Techniques
- Sampling Capability at Critical Loads During Operation
- Installation of Permanent On-Line Monitors

° Increased and Expanded Air Quantity Measurements & Monitoring

- Installation of Air Quantity Monitoring Instrumentation
- Monitoring of Compressor Duty Cycles
- Monitoring Critical Component Air Headers
- Development of System Integrity Criteria, Allowable Leak Rate
- Consideration of Air System Break/Leak Detection Capabilities

° Development and Maintenance of Air User Information Base Documentation

- Creation of a Comprehensive List of Air Users and their Intervening Devices
- Updating Q-Lists/SR Lists
- Reconfirmation of Vendor/Instrument User Air Quality/Quantity Requirements
- Development of a More Practical Air Quality Requirement Criterion
- Development of a Specific Gas Purchase Specification

° Increased and Expanded Engineering and Operational Evaluation of Air User Loads and their Failure Modes & Effects

- Address all Air/Gas Users; not just ESF Devices
- Provide Continued Air Service to Multi-operational Valves
- Investigate Fast Recovery Air Opportunities
- Investigate Use of Emergency Bottled Air Sources
- Evaluate Possible Segmented Air Load Arrangements
- Evaluate Failure Modes in Nitrogen Systems
- Evaluate System Inter-and Intra-actions
- Evaluate Nitrogen and Air System Complementary and Supplementary Services

° Increased Attention to Air/Gas System Problem Reports/Resolution Recommendations/Active Implementation

- Improve Root Cause Analysis
- Reduce Backlog of Problems
- Evaluate More Far-Reaching Implications
- Reduce Chronic Occurrences
- Improve Anticipatory Problem Efforts
- Implement Industry Improvements More Quickly

5.0 FUTURE PROGRAM TASKS, SUBMITTALS AND EFFORTS

5.1 Completion of Phase I Tasks

A significant effort was mounted by Niagara Mohawk to respond to the subject letter in a comprehensive and timely manner. The final confirmatory review of the results of the evaluation documentation is now underway. Substantial changes in the results, findings and conclusions different from those cited in this report are not expected.

5.2 Execution of Phase II Plans and Tasks

General Considerations

Phase II is designed to examine and evaluate considerations involving new insights and potential new requirements relative to air systems and their loads as the result of or indicated by the review of operating experience feedback, new safety aspect, or perceptions or new air service considerations related to plant reliability or availability.

Most of these considerations are beyond the current design and operational bases. They may include:

a) failure modes beyond the class failures (e.g. single failures criterion, fail/safe, fail complete, fail instantaneous, fail common mode, etc.);
b) failure modes involving events other than the design basis accident scenarios; operational implications involving less subtle, possibility more pronounced and more complex system interactions than are currently required to be evaluated;
c) system and human factors aspects;
d) extended time domain system and failure modes beyond the current instantaneous automatic action evaluations now considered;
e) evaluations involving equipment and air users beyond the current primary safety system domains; and
f) failure modes involving intermediate air/gas controllers (solenoid valves), processors (regulators) and air filters.

Specific Tasks of Phase II

As indicated above, the specific tasks are still being developed at this time. However, in order to respond to the request to define and schedule future air system evaluation tasks, the following preliminary list of Phase II tasks are offered:

A. Conduct additional evaluations into intervening Air/Gas System devices (e.g., components between the air/gas sources and the final air users); further evaluate of air quality/quantity system/component specifications; evaluate intervening devices failure modes and their specific maintenance.

B. Conduct further in-depth evaluations into air/gas quantity considerations including compressor duty cycles, allowable leakage, air/gas system usage loads, etc.

C. Conduct further plant air/gas source - user air/gas quality sampling evaluations.

D. Evaluate operator capabilities to prevent Air System loss when early indicated air degradations are present.

E. Evaluate the capability of current Air/Gas Systems to accommodate failure modes and effects beyond the current design and operational base.

F. Evaluate Air/Gas System header response to selective system/component perturbations, failure modes, leak rates, etc.

G. Evaluate Air System improvements which can significantly enhance the availability of system safety loads under system perturbations.

Phase II tasks will be developed over the next few months. They will be defined, scheduled and pursued soon afterward. July 1, 1989, is a tentative date for completing the definition of Phase II tasks.

5.3 Reporting of Phase II - Evaluation Results

Phase II tasks will be conducted up to and through the next scheduled refueling outage (1991). The results of the Phase II evaluation will be reported in a similar Summary Report. It will report a summary of the evaluation - results, findings and conclusions.

5.4 Completion of Phase III Implementation Tasks

Implementation of any long-term plant Air System improvements will be pursued as a Phase III program activity. Corrective actions or improvements that are identified during the program will be evaluated and implemented as necessary prior to, during or shortly after the next refueling shutdown period. System improvements cited in Section 4.11 will be addressed during Phase II for incorporation during Phase III.

APPENDIX A

PHASE I - EVALUATION TASKS

A.1 Introduction

A.2 FSAR Commitment Conformance - Verification

A.3 System Design and Operational Bases - Verification

A.4 Reactor Operator Involvement

A.5 Maintenance, Surveillance and Testing Aspects

A.6 Air/Gas Quality Measurements

A.7 Operating Experience Performance and Feedback

A.8 Reactor Operator Training

A.9 System/Component Failure Modes and Effects Analysis

A.10 Summary Statement

A.1 Introduction

In response to the generic letter, a re-evaluation of the subject Plant Air and Gas Systems was conducted. Listed below are the individual areas which were examined. The specific tasks that were undertaken in each of them in Phase I are identified by "°" symbol. Those tasks which were partially evaluated in Phase I but which will be further evaluated in Phase II are identified by "+" symbol. The lead NMPC organization responsible for the evaluation in the Specific Area is also identified in the ( ) symbol.

A.2 FSAR Commitment Conformance - Verification (Licensing)

° Review current licensing documentation to identify deviations between actual plant design and operation and the previous committed considerations.
° Review the current and the previous FSAR design and operational bases, performance commitments and requirement compliances relating to the Air System configurations.
° Review current operating experience insights, reports, etc. for potential safety, regulatory or reliability implications.
° Review old plant design and operational bases in light of new regulatory initiatives -- important to safety, safety-related, safety interaction related, etc. and identify potential shortfalls and weaknesses.
\+ Compare differences between Unit 1 and Unit 2 design and operational bases relative to safety, regulatory or reliability aspects.
\+ Evaluate air system relative to new FMEAs being suggested by the NRC.
\+ Evaluate the system design bases under proposed new safety classification aspects.

A.3 System Design and Operational Bases - Verification (Design Engineering)

° Perform a design and operational review (verification) evaluation of the Air Systems.
° Review of the Air Systems to assure that they are in conformance with their design basis and regulatory requirement commitments.
° Identify and evaluate major system changes since the system original installation and operation.
° Identify all important Air System air users and their failure modes. Identify safety air users.
° Evaluate current Air System operational configurations and their missions relative to their (original) design and operational bases. Identify any major changes.
° Evaluate the Air System engineering documentation to assure that it is consistent with the actual system design and operation.
° Evaluate the Air System existing air quality/quantity vs. the expected (original) design basis characteristics. Identify deviations.
\+ Identify system or component shortfalls, chronic problem areas, operational weaknesses or questionable performance or system responses.
\+ Compare old and new air quality standards & vendor recommendations.
\+ Identify system and/or component improvements which might be appropriate or necessary to assure continued reliable performance.

+ Identify system or component failure modes and effects which were not previously anticipated (e.g., self-contamination in air operated valves which are lubricated).

A.4 Reactor Operator Involvement (Operations)

° Review operating and emergency procedures relative to Air System normal, transient (degraded) and accident (failure) operation.
° Assess the operator training received relative to actual plant events and expected operator actions.
° Assess the need for more timely or more proactive operator actions.
° Review and assess current MCR instrumentation or plant system performance indicators that would indicate a complete or degrading loss-of-air event.
+ Assess what operator actions could be taken to avoid the consequences of an air system loss or degradation.
+ Assess operator actions for a partially degraded or a segmented loss of air in the Air System network.
+ Assess time required to respond to air loss situations.

A.5 Maintenance, Surveillance and Testing Aspects (Maintenance)

° Review and evaluate the maintenance practices and procedures relative to Air Systems and their safety-related loads.
° Review preventative and corrective maintenance (PM/CM) procedures and practices relative to their adequacy to assure that safety-related equipment will function as intended on loss of air supplies.
° Review Work Requests (WR) related to Air Systems and their safety loads. Identify troublesome components, system deficiencies, unreliable operations, etc. Identify priority of WRs, denoting backlog, response time, etc.
° Review operating history of the Air Systems and their safety-related loads.
° Identify minor modifications, system changes, etc. since original installation.
° Evaluate Air Systems' overall performances. Identify shortfalls. Cite recommended changes.
+ Identify air quality/quantity considerations relative to maintenance aspects.
+ Assess the systems' overall integrity (leakages, inadvertent openings, etc.).
+ Identify filter changeout practices.

A.6 Air/Gas Quality Measurements (Chemistry and Rad Protection)

° Determine the system air quality by measuring dew point, micron level, oil-hydrocarbon content and sample pressure.
° Acquire five representative air samples to verify by test that actual air quality is consistent with Plant Air Systems design standards and/or manufacturers recommendations and/or an acceptable alternate level.

- ° Investigate and secure an outside certified air sample analysis organization (e.g. Texas Research Institute).
- ° Process the acquired samples taken and evaluate them in a timely manner on a priority basis. Samples should be evaluated relative to criteria determined by regulatory or emergency basis.
- ° Investigate the development of an in-house sampling capability. Consider and pursue the acquisition of off- and in-line monitoring equipment.
- ° Investigate a second backup, local sample analysis source.
- \+ Evaluate the sampling of other locations (different from the selected initial five sample points).

A.7 <u>Operating Experience Performance and Feedback (Licensing)</u>

- ° Evaluate the current Plant Air Systems relative to IE-87-28, IE-86-50, and INPO-SOER 88-1 and other recent operating experience reports (e.g., EPRI/NSAC #128, AEOD Reports, NUREG-1275).
- ° Review Plant NRC Inspection Reports and identify any remedial actions to air system shortfalls, deviations, potential problem areas.
- ° Identify any significant operating events in the Air Systems played an important role.
- ° Review plant LERs. Identify those associated with Air Systems. Discuss the overall assessment of the Air Systems operation relative to the Industry average.
- \+ Identify weaknesses or shortcomings that are conductive to short-term, relatively easy or convenient resolution (e.g., better maintenance, frequent inspections, use of more filters, etc.).
- \+ Identify any system operating modes which are different from the designed or anticipated operational bases (e.g., two 100% systems which are both running at capacity, etc.).

A.8 <u>Reactor Operator Training (Training)</u>

- ° Review plant training practices, procedures, lesson plans, relative to air systems and their safety related loads, etc.
- ° Evaluate Air Systems training relative to non-operating personnel (e.g., maintenance, chemistry and rad protection, etc.).
- ° Review Air Systems training relative to the recovery of air upon its loss.
- ° Evaluate simulator training in light of fast or slow degraded air system failure modes and effects.
- \+ Evaluate current training in light of recent operating experiences, NRC concerns, industry recommendations, new failure modes.
- \+ Review training programs relative to prevention aspects of Air Systems loss rather than mitigation and accommodation aspects.
- \+ Evaluate Air System quality/quantity monitoring training.

A.9 System/Component Failure Mode and Effects Analysis (Licensing and Design Engineering)

Evaluation Tasks

- ° Re-verify that the Air Systems failure modes and effects assumed in the FSAR as reflected in the Plant design, operational, maintenance and test documentation.
- ° Re-verify that the Air Systems failure modes and effects assumed in the FSAR Safety Analysis are still valid and appropriate.
- ° Investigate the basis of assuming that fast, instantaneous, complete, plant inside Air Systems air loss is the appropriate worst-case failure mode.
- \+ Identify and evaluate system or component failure modes and effects which may not have been previously anticipated (e.g. self-contamination in air operators which are lubricated) but which have occurred.
- \+ Evaluate a slow bleed air loss failure mode and its effects.

A.10 Summary Statement

Most of the above identified evaluation tasks have been completed. These tasks represent a fairly comprehensive and a rather ambitious re-examination of the subject Air/Gas Systems. The major objective of the above cited Phase I program tasks was to review the current operating Air/Gas Systems in sufficient breadth and depth detail as to reconfirm:

a) that their original design and operational bases are being met;
b) that their compliance with their FSAR commitments are being maintained;
c) that their maintenance, testing and surveillance are adequate;
d) that their performance is acceptable;
e) that the reactor operations are trained to and are able to mitigate or accommodate a wide spectrum of air loss events; and confirm
f) that their failure modes and effects as described in their safety analysis evaluation are correct and appropriate.

APPENDIX B

EVALUATION REFERENCES

B.1 Introduction

The following documents were examined and utilized in the evaluation of the subject Plant Air/Gas Systems.

B.2 Regulatory Documentation

- FSAR, Section VI.D...Containment Isolation System
- FSAR, Section VII.G...Combustible Gas Control System
- FSAR, Section X.I.3...Breathing, Instrument and Service Air System
- FSAR, Section XV.B.3.22...Instrument Air Failures
- FSAR, Section XV.B.3.5...MSLIV Closure Transient
- Technical Specifications

B.3 System Design Documentation (Dwg. #s)

Air/Gas Sources

- Instrument Air System.................C-18011-C, Sheet 2, Rev. 10
- Breathing and Service Air Systems.....C-18011-C, Sheet 1, Rev. 16
- Emergency Diesel Generator
  - Starting Air System.............C-18026-C, Sheet 1, Rev. 4
    C-18026-C, Sheet 2, Rev. 5
- Combustible Gas Control System
  - N2 Gas Purge....................C-18014-C, Sheet 1, Rev. 38
  - TIP System......................C-18014-C, Sheet 2, Rev. 31
  - Leak Rate System................C-18014-C, Sheet 3, Rev. 12
  - N2 Supply.......................C-18014-C, Sheet 4, Rev. 22

FSAR Primary Safety Air/Gas Users

- Main Steam System
  - MSLIV Isolation Valves...........C-18002-C, Sheet 1, Rev. 21
- Emergency Cooling System.............C-18017-C, -------, Rev. 32
- Control Rod Drive System.............C-18016-C, Sheet 1, Rev. 14
  C-18016-C, Sheet 2, Rev. 15
- Containment Spray System.............C-18012-C, Sheet 2, Rev. 26
- Reactor Building Closed Loop.........C-18022-C, Sheet 3, Rev. 10
  -Cooling Water System Sheet 4, Rev. 7
- Main Control Room Ventilation System..C-18047-C, -------, Rev. 15
- Reactor Building/Emergency
  Ventilation System..................C-18013-C, Sheet 1, Rev. 16
- Primary Containment Isolation Valves..C-18006-C, Sheet 3, Rev. 7
  - Floor Drain Valves
  - Vent Valves
  - Equipment Drain Valves
- Primary Containment Isolation Valves
  - Vacuum Breakers.............C-18006-C, Sheet 1, Rev. 18
    C-18006-C, Sheet 3, Rev. 7
- Post Accident Sampling System Valving.C-18041-C, Sheet 7, Rev. 5

Secondary Safety Related Air/Gas Users

- Feedwater/High Pressure Coolant.......C-18005-C, Sheet 1, Rev. 16
  Injection System.....................C-18005-C, Sheet 2, Rev. 15
- Reactor Water Cleanup System..........C-18009-C, Sheet 1, Rev. 25
- Spent Fuel Pool Cooling and Cleanup
  System...............................C-18008-C, -------, Rev. 11
- Reactor Core Spray System.............C-18007-C, -------, Rev. 32
- Service Water System..................C-18027-C, Sheet 1, Rev. 16
- Reactor Shutdown Cooling System.......C-18018-C, Sheet 1, Rev. 12
  Sheet 2, Rev. 4
- Makeup Water System...................C-18034-C, Sheet 2, Rev. 11

Power Generation Air/Gas Users

- Fire Protection System................C-18039-C, Sheet 1, Rev. 6
- Radwaste System.......................C-18041-C, Sheet 6, Rev. 9
- Off-Gas System........................C-18010-C, Sheet 1, Rev. 25
  Sheet 2, Rev. 15
  Sheet 3, Rev. 13
  Sheet 4, Rev. 10

B.4 Operating Procedures (Operating Procedure #s)

- Main Steam System............................N1-OP-1
- Core Spray System............................N1-OP-2
- Reactor Cleanup System.......................N1-OP-3
- Shutdown Cooling System......................N1-OP-4
- Control Rod Drive System.....................N1-OP-5
- Fuel Pool Filtering/Cooling System...........N1-OP-6
- Primary Containment Area Cooling System.......N1-OP-8
- Nitrogen Inerting System.....................N1-OP-9
- Reactor Building HVAC System.................N1-OP-10
- Reactor Building Closed Loop Cooling System...N1-OP-11
- Emergency Cooling System.....................N1-OP-13
- Containment Spray System.....................N1-OP-14
- Feedwater/HPCIS System.......................N1-OP-16
- Service Water System.........................N1-OP-18
- Service, Instrument and Breathing Air System..N1-OP-20
- Off-Gas System...............................N1-OP-25
- Emergency Diesel Generator System............N1-OP-45
- High Pressure Coolant Injection..............N1-OP-46
- Main Control Room Ventilation System.........N1-OP-49
- Fire Protection System.......................N1-OP-21
- Startup and Shutdown Operations..............N1-OP-43
- Instrument Air Failure.......................N1-SOP-6
- Power Failure (115 KV Loss)..................N1-SOP-5
- Emergency Operating Procedures
  - RPV Control..........................N1-EOP-2
  - Failure to Scram.....................N1-EOP-3
  - Primary Containment Control..........N1-EOP-4
  - Secondary Containment Control........N1-EOP-5
  - Radioactivity Release Control........N1-EOP-6
  - Drywell Flooding.....................N1-EOP-10

B.5 Maintenance, Surveillance and Testing Procedures (Operating Procedure #2)

Mechanical Maintenance Procedures

- Maintenance of HCU Inlet/Outlet Scram Valves..............N1-MMP-44-654.7
- Maintenance of Diesel Generator Air Compressor..............N1-MMP-09-600
- Maintenance of Emergency Cooling System Isolation Valves....N1-MMP-05-220
  N1-MMP-39-221
  N1-MMP-39-219
- Maintenance of Control Rod Drive System Valves..............N1-MMP-44-653
  N1-MMP-44-654
- Maintenance of Containment Spray System Valves..............N1-MMP-80-230
- Maintenance of Instrument Components.......................N1-MMP-94-005
  N1-MMP-94-601
- Maintenance of Containment Vacuum Relief Valves.............N1-MMP-GEN-200
- Maintenance of Off System Valves............................N1-MMP-GEN-235
- Maintenance of Instrument Air Compressors..................N1-MMP-94-601
- Maintenance of Instrument Air Dryers.......................N1-MMP-94-005
- Replacement of Instrument Air Filters......................N1-MMP-GEN-506
- Maintenance of Diesel Generator Auxiliaries.................N1-MMP-GEN-850
- Maintenance of Joy Air Compressor/Aftercooler...............N1-MMP-GEN-407
- Replacement of Service Air Oil Removal Filter...............N1-MMP-34.7

Mechanical Preventative Maintenance Procedures

- PM of outside MSLIVs - Air Operators.....................N1-MPM-01-R243
- PM of CRD-HCUs..N1-MPM-44-R658
- PM of Instrument Air System - Semi-Annual Inspection.....N1-MPM-94-SA604
- PM of Containment Vent & Purge Valves....................N1-MPM-201-104218
- PM of Instrument Air Compressors.........................N1-MPM-A15
- PM of Instrument Air Intake Filter.......................N1-MPM-94-SA509
- PM of Emergency Diesel Generators........................N1-MPM-DG-R852

Instrument Maintenance Procedures

- Repair/Replacement of CRD Scram Pilot Solenoid Valves....N1-IMP-R-048-005
- Repair/Replacement of Primary Containment Isolation/SOV..N1-IMP-X-999-003
- Repair/Replacement of Miscellaneous SOV..................N1-IMP-SOV-3
- Repair/Replacement of Fisher Transducers.................N1-TNP-X-999-001

Instrument Surveillance Procedures

- PM of Emergency Cooling Level Control Channels A & B.....N1-IPN-A-060-002
  N1-IPN-A-060-001
- Reactor Building Emergency Ventilation System............N1-ICP-A-202
- Air Pressure Regulator Testing...........................N1-IDP-X-999-002
- Instrument Air System - Pressure Switches................N1-IDP-X-999-009
- CRD Scram Valve Timing...................................N1-IPM-X-044-008
- Vibration Requirements for Rotating Equipment............N1-IDP-X-209-001

Operational Surveillance Procedures - Operability Tests

- Reactor Building Emergency Ventilation System............N1-ST-C5
- Main Control Emergency Ventilation System................N1-ST-C9,-M9
- ARI Back-Up Scram System.................................N1-ST-C14
- Emergency Cooling System.................................N1-ST-IC2,-M2
- LOCA - Diesel Generator Auto Simulation Test.............N1-ST-R2
- Reactor Coolant Isolation Valves.........................N1-ST-Q4
- Main Steam Isolation Valve-Full Closure Test.............N1-ST-V8
- Containment Venting/Purge Via Reactor Building...........N1-ST-V1
- Primary Containment Isolation Valve Exercising...........N1-ST-Q5
- Emergency Vent System Operability Test...................N1-ST-M8
- Primary Containment O2 Concentration Check...............N1-ST-D0

System and Component Cleaning Procedures

- PM of Instrument Air System - Dryer......................N1-MPM-94-SA020

B.6 Training Documents

- NMP1 Operations Technology Manual, Chapter 30, Plant Air Systems

B.7 Air Quality Requirements/Standards

- ANSI/ANS-59.3-1984...Safety Criteria For Control Air Systems
- ANSI/ISA-57.3 (R 1981)...Quality Standard For Instrument Air

Purchase Specification Requirements

- IAS-Refrigerated Dryer, Purchase Req. #NM-117-SPE (9/19/66)
- IAS Refrigerated Dryer, Purchase Req. #824067 (2/18/78)
- IAS Post Filter, Purchase Req. #S+W-N1-285 (9/29/66)

B.8 Generic Operating Experience Documentation

- NRC, Information Notice #87-28, Air System Problem at US LWRs
- NRC, Information Notice #86-50, Inadequate Testing of Pneumatic Components
- NRC, Generic Letter #88-14, Instrument Supply System Problems Affecting Safety-Related Equipment
- NRC, NUREG #1275, Operating Experience Feedback Report - Air System Problems
- INPO, SOER #88-01, Instrument Air System Failures
- NRC, Information Notice #85-84, Inadequate Inservice Testing of MSLIVs
- INPO, NPRDS, Failure Data - Air-Related Components
- EPRI/NSAC, NSAC #128, Pneumatic Systems and Nuclear Plant Safety
- B&WOG, Report, Safety & Performance Improvement Program - Instrument Air System Review
- EdS Nuclear, CP&L Report, H. B. Robinson Plant - Instrument Air System Reliability Study
- INPO, NPRDS, Air System Components & Safety Load Performance Data

- Stoller, Inc., Nuclear Power Experience Reports, Air System Performance
- NUS/LIS, NRC Staff & ACRS Meeting Notes, GL #88-14, Air System Problems Discussion, Date 1/18/89

B.9 Plant Specific Operating Experience Documentation

- Unit 1, Licensee Event Reports - Related to Air Systems
  75-05 - Reactor Building-Emergency Ventilation Failed-Metallic Oxide Formation
  78-005 - MSLIV failed to operate-pilot valve internal problem
  80-007 - MSLIV failed to operate-rust in pilot shuttle
  80-009 - Containment Spray Valve failed to operate-dirt buildup
  80-013 - CRD failed to manual scram-moisture in scram solenoid
  84-008 - Containment Spray Air Test caused loss of air-operator error
  85-021 - Feedwater Flow Control Valve Failure-air loss
  87-24 - Feedwater Flow Control Valve Failure-dirty air
  82-003 - Reactor Cleanup System Release-air in level instruct
  81-034 - MSLIV failed to operate-air SOV failed to move piston
  81-039 - MSLIV failed to operate-dirt in valve operator
- NMPC, Problem Report Program, Air System Problem
- NMPC, Annual Maintenance Review Program, Air System Problems
- NMPC, Plant Improvement Program, Air System Recommended Modification
- Inter-Plant/Unit Information/Experience Exchange

B.10 Plant Startup and Pre-Operational Test Procedures (Procedures #s)

° Reactor Building Emergency Ventilation System	N1-POT-12
° Fuel Pool Filter/Cooling System	N1-POT-16
° Reactor Cleanup System	N1-POT-18
° Reactor Shutdown Cooling System	N1-POT-19
° Core Spray System	N1-POT-21
° Containment Spray System	N1-POT-22 & 22A
° Instrument & Breathing Air System	N1-POT-24
° Service Air System	N1-POT-25
° Containment Isolation Valves	N1-POT-27 & 27A
° Control Rod Drive System	N1-POT-28 & 29A,B,C
° Diesel Generator System	N1-POT-33
° Main Control Room Ventilation System	N1-POT-68A
° Primary Containment Isolation/Purge/Vacuum System	N1-POT-77A & B
° HPCI System	N1-POT-88
° Instrument Air System	N1-POT-115

B.11 Summary Statement

Over 1,000 written procedures alone exist at Unit 1. Approximately 100 (10%) were identified and subject to review during the course of this evaluation. A review of the above listing indicates that there is an extensive amount of information available relative to the subject Air and Gas Systems. It can equally be considered that this amount of information also required constant attention to maintain its validity and applicability. Since these documents are subject to rigorous

review for accountability, control, and accuracy, it is fair to say that the Plant Air and Gas Systems receives a considerable amount of review and attention.

The review of the Air/Gas Systems reference listings listed above indicates:

a) that there is a wealth of operating/experience feedback on their performance;
b) that an extensive amount of maintenance, testing and surveillance attention is given to the subject systems/components;
c) that there is a significant number of operator instructions on how to successfully handle a wide variety of system/component malfunctions, anomalies, major disruptions or complete loss of the system functions, and
d) that a comprehensive system/component performance program exists to assure constant attention to system problems or shortfalls.

APPENDIX C

- IN PLANT AIR/GAS QUALITY - SAMPLING RESULTS -

C.1 Introduction

This appendix addresses the concerns described in GL 88-14 that suggest the quality of air/gas being produced at the sources, delivered through the piping systems and received and processed by the loads may have been the dominant contributor to the several significant operating experience events.

In order to verify that the quality of air/gas being generated and received is in conformance with the plant regulatory commitments and requirements, the equipment vendor requirements, the recommendations of industry standards or the insights offered by operating experience reviews, a comprehensive air quality sampling and analysis plan was established.

Since Unit 1 was shut down during the 180-day period allotted to respond to the generic letter, a concerted effort was made to sample a representative number of plant air pathways within this time period. The results of this expedited sampling is given here.

C.2 Selection of Sampling Locations

A sampling task force was established for each Unit. It was composed of Licensing, Design Engineering, Operations, Chemistry & Rad Protection, Maintenance & Operations Support personnel. A review of the important air/gas system sources and safety-related air/gas user loads lead to a sampling candidate list. The initial list identified 15 sample candidates. The list was ultimately reduced to 7 specific sample points. These representative sample points were chosen on the basis of a combination of final selection criteria. These included:

a) critical and sensitive safety component loads,
b) important safety system function loads,
c) long and tortuous piping runs,
d) piping runs subjected to a wide variation of temperature changes,
e) piping runs providing most diverse loads, and
f) worst case sample extraction points.

Also considered was the ease of obtaining the samples without disrupting plant configurations, plant operation, piping system integrity aspects, repeated accessibility, etc.

C.3 Sampling and Testing

Background

Sampling was performed by NMPC personnel under the direction of a Syracuse, New York, engineering and analysis company, O'Brien & Gere Engineers, Inc. Analyses for oil concentration and particle size were performed by O'Brien & Gere. Texas Research Institute (TRI) of Dallas, Texas, performed dew point analyses and also duplicated the oil concentration analyses. This initial sampling was intended to provide immediate input for NMPC's response to generic letter air quality concern. Further periodic sampling will be instituted. More extensive

and sophisticated analysis techniques will be applied to future sampling. Consideration of continuous isokinetic, on-line, statistical sampling, etc. are now under consideration. Procurement of on-site dew point measuring device is in progress. Full on-site measurement capability is now under development.

Sampling Results - Findings & Conclusions

The air quality test results are presented in Table C-1. The conclusions based on these results, ANSI/ISA Specification 7.3, FSAR commitments and manufacturers' recommended air quality, are as follows:

1) Unit 1 met the ANSI/ISA Standard of 1 ppm for oil concentration.

2) Unit 1 met the ANSI/ISA Standard dew point standard of 35°F at line pressure (-10°F at atmospheric pressure).

3) Particulate sizing analyses do not guarantee that no particles greater than 3 to 5 micron are present. However, results do show that particle loading is low enough that no discernible particle concentrations above filter media background were detectable. Secondly, particle size determinations on initial tests indicated that no particles were found that approached particle size limits recommended by manufacturers.

Discussion

In response to the air quality portion of Generic Letter 88-14, two phases of instrument air/gas sampling have been conducted at Unit 1. The first phase consisted of blowdown of approximately 10 sample points throughout Unit 1, and visual observation for the presence of oil, moisture, particles or crud. No deviations in air quality were observed.

Phase 2 sampling was initiated to provide quantification of oil concentration, dew point and particle size and loading. Sample collection and control was accomplished using procedures, filter media and calibrated flow meter prepared or supplied by O'Brien & Gere. Sample flow rates and sampling time durations were developed based on filter cassette capacity and analytical capabilities. Final sampling parameters were 2-3 liters/minute flow rate and 6-8 hour sample time. It should be noted that isokinetic sampling was not feasible, but samples were taken from the bottom of manifolds and receivers when possible in order to yield conservative results.

Acceptance criteria are a combination of ANSI/ISA Specification 7.3, FSAR commitments, manufacturers' recommended air quality for various safety-related instruments, and design specifications for each of the instrument air/gas systems at Unit 1. Based on these sources, criteria are:

1) Dew Point: +35°F at line pressure (-10°F at atmospheric pressure)

2) Oil Content: 1 ppm maximum

3) Particle Size: 3 to 5 micron w/relief to 40 micron based on manufacturers' recommended instrument requirements and FSAR description of 'clean, dry air.'

Analytical methods used were developed by O'Brien & Gere, with the exception of dew point, which was done by TRI. NMPC is in the process of purchasing a dew point analyzer; however, it will not be available prior to the response submitted. Analytical methods are:

1) Particle Sizing: particle sizing by microscopy based on ASTM Standard F25-68, "Sizing and Counting Airborne Particulate Contamination in Clean Rooms and Other Dust Controlled Areas Designed for Electronic and Similar Applications."

2) Oil Concentration: gravimetric analysis using microgram balance.

3) Dew Point: desiccant moisture absorption to determine water loading; results converted to dew point at atmospheric pressure.

C.4 Future Plant Air/Gas Quality Sampling

The NMPC response program is currently developing a comprehensive air quality verification program plan to be executed during the next scheduled refueling outage.

This plan will consider both temporary and permanent sampling provisions, more extensive sampling (e.g., additional sample points), more sophisticated sampling techniques (e.g., isokinetic extraction, in-line dew point measurements, etc.), and more frequent periodic sampling (e.g., selective during plant operation sampling). This increased sampling evaluation does not imply that the current systems and their performance are anything less than adequate and in full compliance with requirements.

C.5 Summary Statement

Based on the results of our sampling and the conservative instrument air/gas requirements specified by the manufacturers (e.g., GE for MSIVs and SRV/ADS valves) and those recommendations made by Industry Air Quality Standards, the Nine Mile Point Unit 1 Compressed/Stored Air/Gas Systems appear to be operating and performing as designed and approved. Plant air quality does not appear to represent an immediate or long-term threat to the continued reliable operation of the Unit. This is based on the current air quality and the present Plant Air/Gas Systems performances.

[illegible]

However, in order to avoid any isolated component failures and to assure continued satisfactory air quality (e.g., past experience at Unit 1 with MSIVs and FWCVs), additional attention and consideration is being given to increased air quality measurements in the future.

TABLE C-1

PLANT AIR/GAS QUALITY SAMPLING RESULTS

SAMPLE POINT	OIL, PPM TRI	OIL, PPM OBG	DEW POINT, °F	PARTICLE SIZE
TB 291 Receiver	< 0.2	0.03/< 0.01	-33	[1]
CB 250 Off Gas Drain	0.3	< .01	-108 *	[1]
TB 261 MSIV	< 0.2	< .01	-47	BKGRD
R_XB 237 near CRD	< 0.2	< .01	-33	BKGRD
Screenhouse	< 0.2	< .01	-44	BKGRD
DGB Diesel Generator	--	--	+12	--
Nitrogen Systems	--	--	[2]	--

NOTES:

-- No Sample Taken

* Suspect sample

[1] Particles > 5 above background found, but their level was within range of blank cassettes background levels.

[2] Sample Unavailable at this time - Nitrogen System is not operational during shutdown. Procured nitrogen (similar to Unit 2 nitrogen procured and tested gas) is believed to be within requirements).