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June 25, 1984

1CAN068402

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-368
License No. NPF-6
NUREG 0737 Supplement 1 -
Regulatory Guide 1.97

Gentlemen:

Section 6 of Supplement 1 to NUREG 0737, pertaining to Regulatory Guide 1.97, requires each licensee to submit a report describing how it meets the specific recommendations of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Environs Conditions During and Following an Accident." In our response to Supplement 1 dated April 15, 1983, AP&L committed to submit the ANO-1 Regulatory Guide 1.97 position document by June 29, 1984. The attached document contains this comprehensive report and includes the schedules for proposed instrument upgrades. In the development of this position document AP&L has expended in excess of $300,000. We expect the cost associated with implementing the proposed modifications identified in this position document to be in excess of $4 million. Assuming no extraordinary delays, all modifications should be implemented during the next two refueling outages.

It was the NRC's intent, as stated in the cover letter transmitting Supplement 1 to NUREG 0737, that Regulatory Guide 1.97 be used as a source of guidance as opposed to being interpreted as a strict regulation, for both the NRC and the licensee. AP&L supports this position, for it allows the needed flexibility for each licensee to comply with this plant specific issue.



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We believe the attached document fully addresses Section 6 to NUREG 0737 Supplement 1 for ANO-1. We will keep you informed of our progress in the implementations of our upgrades committed herein through the biannual updates on NUREG 0737 Supplement 1.

Very truly yours,

John R. Marshall

John R. Marshall
Manager, Licensing

JRM:DEJ:dr

Attachment

ARKANSAS NUCLEAR ONE
UNIT 1
REGULATORY GUIDE 1.97 POSITION DOCUMENT

## INTRODUCTION

Supplement 1 to NUREG-0737 was transmitted with Mr. D. G. Eisenhut's Generic Letter 82-33 dated December 17, 1982 (ØCNA128226). This document required AP&L to develop a position regarding compliance with Regulatory Guide 1.97 and to submit this position to the NRC on a schedule consistent with that of an overall integrated program to meet all NUREG-0737 Supplement 1 requirements. Section 6.2 of Supplement 1 to NUREG-0737 recommended that the submittal include documentation, which could be in the form of a table, which addresses the following for each Type A, B, C, D and E variable shown in Regulatory Guide 1.97:

(a) instrument range
(b) environmental qualification
(c) seismic qualification
(d) quality assurance
(e) redundance and sensor(s) location(s)
(f) power supply
(g) location of display
(h) schedule for any new installation or upgrade

This document provides the requested information and is consistent in organization with Table 3 (PWR Variables) of Regulatory Guide 1.97, Revision 3, dated May 1983. Revision 3 was used as opposed to Revision 2 because it more accurately reflects the current NRC guidance on post-accident monitoring.

## TABLE FORMAT

Table 1 (attached) lists the variables recommended by Regulatory Guide 1.97, Revision 3, and with the exception of Type A variables, identifies the recommended range and category (i.e., Neutron Flux, $10^{-6}$ to 100% F.P., Cat. 1). The subsequent columns provide the AP&L response to the Regulatory Guide 1.97 recommendations including the AP&L assigned category, range, redundancy, power supply, type of control room display availability on SPDS, schedule for upgrading if applicable, and comments. The comments provided include current instrumentation capabilities as well as planned upgraded capability.

The power supply column specifies the type of available power as follows:

1E - instrument is powered from a qualified 1E power source.
UPS - instrument is powered from a battery backed uninterruptable power source.
DG - instrument is powered from a source that is backed by the emergency diesel generators.
OP - instrument is powered from the normal offsite power source.

The SPDS column specifies whether the variable is available on the SPDS display. If it is identified as a planned addition to SPDS, it will be installed during the 1R6 outage. The SPDS display is located in both the Unit 1 and Unit 2 Control Rooms, the Technical Support Center and the Emergency Offsite Facility.

Another type of Control Room Display is the Gaseous Effluent Radiation Monitoring System (GERMS). The GERMS is a computerized dose projection system which combines effluent release data with real time meteorological data. GERMS terminals are located in the same facilities as the SPDS.

The schedule column specifies the expected latest date for completion of any planned upgrades. All equipment modifications necessary will be performed during refueling outages to allow safe installation. The schedules given identify the refueling outage when the work is planned to be completed. A schedule of 1R6 implies the upgrade will be completed by the end of the ANO-1 sixth refueling outage. The current schedule for the ANO-1 sixth refueling outage is September, 1984, and for the seventh refueling outage is March, 1986. These dates are approximations since the actual refueling outages are dependent on plant availability. The specified schedules are based on an integrated consideration of currently planned major plant modifications.

The comment column specifies the status of compliance (i.e., complies, will comply, complies with justification) and gives the reference for further information including justification of deviations and explanation of planned modifications.

DEFINITION OF VARIABLES

The variables identified in Table 1 are divided into five types in accordance with the Regulatory Guide 1.97. The definition for each type of variable is as follows:

Type A - Those variables which provide the primary information required to permit the control room operators to take specific manual actions for which no automatic control is provided, and that are required for a safety system to accomplish its safety function for design basis accident scenarios. Type A variables are not specified in Regulatory Guide 1.97. They are plant specific and must be selected based on a review of Emergency Operating Procedures to identify information essential for the direct accomplishment of specified safety functions. As a result of a review of the ANO-1 Emergency Operating Procedures, the following variables were identified as Type A:

RCS Hot Leg Water Temperature
RCS Pressure
Containment Hydrogen Concentration
Steam Generator Level
Steam Generator Pressure
Condensate Storage Tank Level
Borated Water Storage Tank Level

Type B - These variables provide information to indicate whether plant safety functions are being accomplished. Plant safety functions are defined as: reactivity control, core cooling, maintaining reactor coolant system integrity, and maintaining containment integrity.

Type C - These variables provide information to indicate the potential for breach or the actual breach of barriers to fission product release. The barriers are defined as: fuel cladding, primary coolant pressure boundary, and containment.

Type D - These variables provide information to indicate the operation of individual safety systems and other systems important to safety. These variables help the operator make appropriate decisions in using the individual systems important to safety in mitigating the consequences of an accident.

Type E - These variables provide information for use in determining the magnitude of the release of radioactive materials and for use in assessing the consequences of such releases.

EVALUATION CRITERIA

As recommended by Regulatory Guide 1.97, each variable type was evaluated based on the importance to safety of the measurement of the specific variable. The criteria are therefore separated into three categories for a graded approach as follows:

Category 1: provides the most stringent requirements and is intended for key variables. Type A, B and C key variables fall into this category.

Category 2: provides less stringent requirements and applies to instrumentation designated for indicating system operating status. Type D and E key variables fall into this category.

Category 3: provides requirements that will ensure that high quality off-the-shelf instrumentation is obtained and applies to backup and diagnostic instrumentation. This category is also used when the state-of-the-art will not support requirements for higher qualified instrumentation. All backup variables fall into this category.

The specific design and qualification criteria used to evaluate each variable, based on the category classification, are presented below:

CATEGORY 1:

Environmental Qualification - Currently installed instrumentation was evaluated to determine if, as a minimum, the equipment meets the requirements of IE Bulletin 79-01B and 10CFR50.49. This determination was based on either having actual environmental qualification documentation available or documentation on similar equipment available. For those instruments for which proper documentation does not currently exist, either documentation will be generated or the equipment will be replaced. If proper qualification cannot be documented or if new equipment is purchased to meet other Category 1 or 2 requirements, this equipment will be qualified in accordance with 10CFR50.49. Instrumentation whose qualification can not be documented will be replaced by 1R7. Documentation pertaining to environmental qualification will be maintained on file.

Seismic Qualification - Currently installed instrumentation was evaluated against the seismic qualification criteria used as a basis for the plant operating license. These criteria are described in the ANO-1 FSAR, Section 7.1.1.8. The ANO-1 seismic criteria are synonymous with the requirements for Class 1 equipment as defined in IEEE Standard 344-1971. New instrumentation will be installed in accordance with the criteria specified in the FSAR.

Redundancy and Sensor Location - A response of "Yes" in the redundancy column indicates that redundant channels are available up to and including any isolation device and that the channels are both electrically independent and physically separate from each other and from non-safety equipment in accordance with IEEE Standard 279-1971. This standard was used as the basis for the ANO-1 operating license and meets the intent but not all the strict requirements for physical separation of redundant channels are defined in Regulatory Guide 1.75. Where applicable, the general sensor location is listed.

Power Supply - All Category 1 instruments are supplied with power from a Class 1E power supply. The ANO-1 Class 1E power system is designed to meet the requirements of IEEE 279-1971, IEEE 308-1971, 10CFR50 including Appendices A and B, and Safety Guides 6 and 9.

Quality Assurance - All instrumentation was, and will continue to be purchased and installed in accordance with the provisions of the NRC approved AP&L Quality Assurance Program described in the ANO-1 FSAR, Section 1.6.

Control Room Display and Recording - Continuous real-time display of at least one channel is provided in the Control Room. Recording of the instrument readout information is provided for at least one of the redundant channels, although this recording may be "Non-Q". Variables which input to the SPDS may be displayed and/or trended on demand. Where it has been determined that direct and immediate trend or transient information is essential for operator information or action, a continuous dedicated recorder is provided with redundant backup recording and trending available on SPDS and redundant dedicated indicators in the control room that can be utilized for trend information if necessary.

CATEGORY 2:

Environmental Qualification - Same as Category 1

Seismic Qualification - No specific provision

Redundancy - Not required

Power Supply - Powered by DG or UPS, both considered to be highly reliable

Quality Assurance - Same as Category 1

Control Room Display - "On-demand" or continuous display is provided in the control room. No direct or immediate trend or transient information was determined to be essential for operator information or action.

CATEGORY 3:

Environmental Qualification - Not required

Seismic Qualification - Not required

Redundancy - Not required

Power Supply - Powered by any available source of power

Quality Assurance - Same as Category 1

Control Room Display - Same as Category 2

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| TYPE "A" VARIABLES | | | | | | | | |
| RCS Hot Leg Water Temp | 1 | 50°-700°F | Yes (2 Channels) | 1E | 1 Indicator 1 Recorder | Yes | 1R7 | Will comply; see Table 2, Note 1. |
| RCS Pressure | 1 | 0-3000 psig | Yes (2 Channels) | 1E | 1 Indicator 1 Recorder | Yes | 1R6 | Will comply; see Table 2, Note 2. |
| Containment Hydrogen Concentration | 1 | 0-10% Vol | Yes (2 Channels) | 1E | 2 Indicators 1 Recorder | Yes (Planned) | --- | Complies |
| Steam Generator Level | 1 | 6"-156" $H_2O$ 102"-500" $H_2O$ | Yes (2 Channels/SG/ range) | 1E | 4 Dual Indicators (1SG Channel with both ranges/Indicator) 2 Dual Pen Recorders (1SG Range/Pen) | Yes | 1R6 | Will comply; see Table 2, Note 3. |
| Steam Generator Pressure | 1 | 0-1200 psig | Yes (2 Channels/SG) | 1E | 2 Indicators (1/SG) 2 Dual Pen Recorders (1/SG) | Yes | --- | Complies; see Table 2, Note 4. |
| Condensate Storage Tank Level | 1 | 0-100% | Yes (2 channels) | 1E | 1 Indicator 1 Recorder | Yes | --- | Will comply; see Table 2, Note 5. |
| Borated Water Storage Tank Level | 1 | Bottom to Top | Yes (2 Channels) | 1E | 2 Indicators 1 Recorder | Yes | 1R7 | Will comply; see Table 2, Note 6. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| TYPE "B" VARIABLES | | | | | | | | |
| Neutron Flux<br>$10^{-6}$% to 100% F.P.<br>(Cat. 1) | 1 | $10^{-8}$% to 100% F.P. | Yes (2 Channels) | 1E | 1 Recorder | Yes | 1R6 | Will comply; see Table 2, Note 7. |
| Control Rod Position<br>Full In or Not Full In<br>(Cat. 3) | 3 | Full In or Not Full In | N/A | UPS | CRT (SPDS) | Yes | --- | Complies |
| RCS Soluble Boron Conc.<br>0-6000 PPM<br>(Cat. 3) | 3 | --- | N/A | N/A | N/A | No | --- | Complies; see Table 2, Note 8. |
| RCS Cold Leg Water Temp<br>50° to 700°F<br>(Cat. 1)<br>50° to 400°F<br>(Cat. 3) | 3 | 50°-650°F | N/A | DG/UPS | 1 Dual Indicator (Selectable to any cold leg) | Yes (Selectable) | --- | Complies; see Table 2, Note 9. |
| RCS Hot Leg Water Temp<br>50° to 700°F<br>(Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |
| RCS Pressure<br>0-3000 psig<br>(Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Core Exit Temp. 200°F to 2300°F (Cat. 3) | 1 | --- | --- | --- | --- | --- | --- | Will comply; see Table 2, Note 10. |
| Coolant Inventory; Bottom of Hot Leg to Top of Vessel (Cat. 1) | 1 | --- | --- | --- | --- | --- | --- | Will comply; see Table 2, Note 11. |
| Degrees of Subcooling; 200°F subcooling to 35°F superheat (Cat. 2) | 2 | 0-200°F | Yes (2 Channels) | 1E | 2 Indicators 1 Recorder | Yes | --- | Complies; see Table 2, Note 12. |
| RCS Pressure 0-3000 psig (Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |
| Containment Sump Water Level Narrow Range (Sump) (Cat. 2) | 2 | 0-56" | N/A | 1E | 1 Indicator | Yes (Planned) | --- | Complies |
| Wide Range (Plant Specific) (Cat. 1) | 1 | 0-144" | Yes (2 Channels) | 1E | 2 Indicators 1 Recorder | Yes (Planned) | --- | Complies |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Containment Pressure<br>0 to Design Pressure<br>(Cat. 1)<br>-5 psig to Design Pressure<br>(Cat. 1) | 1 | 0-210 psia<br>(-15-195 psig)<br>Design=74 psia<br>(59 psig) | Yes<br>(2 Channels) | 1E | 2 Indicators<br>1 Recorder | Yes<br>(Planned) | --- | Complies |
| Containment Isolation Valve Position<br>Closed/Not Closed<br>(Cat. 1) | 1 | Closed/Not Closed | Yes | 1E | Lights<br>(2/Valve) | No | 1R7 | Will comply; see Table 2, Note 13. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| TYPE "C" VARIABLES | | | | | | | | |
| Core Exit Temp $200^{o}$ to $2300^{o}F$ (Cat. 1) | — | — | — | — | — | — | — | See previous listing on page 3. |
| Radioactivity Concentration or Radiation Level in Circulating Primary Coolant 1/2 Tech Spec Limit to 100 Times Tech Spec Limit (Cat. 1) | 3 | $10^{-4}$uCi/gm to 10 Ci/gm | N/A | OP | — | No | — | Complies; see Table 2, Note 14. |
| Analysis of Primary Coolant (Gamma Spectrum) 10uCi/ml to 10 Ci/ml or TID-14844 Source Term in Coolant Volume (Cat. 3) | 3 | $10^{-4}$uCi/ml to 10Ci/ml | N/A | OP | — | No | — | Complies |
| RCS Pressure 0-3000 psig (Cat. 1) | — | — | — | — | — | — | — | See previous listing on Page 1. |
| Containment Pressure -5 psig to Design Pressure (Cat. 1) | — | — | — | — | — | — | — | See previous listing on Page 4. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Containment Sump Water Level<br>Narrow Range (Sump)<br>(Cat. 2)<br>Wide Range (Plant Specific)<br>(Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 3. |
| Containment Area Radiation Monitors<br>1R/hr to $10^{4}$R/hr<br>(Cat. 3) | 1 | 1R/hr to $10^{7}$R/hr Gamma | Yes | 1E | 2 Indicators<br>1 Recorder | Yes | 1R6 | Will comply; see Table 2, Note 15. |
| Effluent Radioactivity-Noble Gas Effluent from Condenser Air Removal System Exhaust<br>$10^{-6}$uCi/cc to $10^{-2}$uCi/cc<br>(Cat. 3) | 3 | $10^{-6}$uCi/cc to $10^{-2}$uCi/cc based on Xe-133 | N/A | DG | 1 Indicator<br>1 Recorder | Yes | --- | Complies; see Table 2, Note 16. |
| RCS Pressure<br>0-3000 psig<br>(Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |
| Containment Hydrogen Concentration<br>0-10% Volume Capable of Operating from -5 psig up to Maximum Design Pressure<br>(Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Containment Pressure -5 psig to 3 Times Design Pressure (Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 4. |
| Containment Effluent Radioactivity-Noble Gases from Identified Release Points $10^{-6}$uCi/cc to $10^{-2}$uCi/cc (Cat. 2) | 3 | $1.1E^{-7}$uCi/cc to $1.3E^{5}$uCi/cc 0-110% Vent Design Flow | N/A | OP | CRT (GERMS Computer) | No | --- | Complies; see Table 2, Note 17. |
| Effluent Radioactivity-Noble Gases from Bldgs $10^{-6}$uCi/cc to $10^{-2}$uCi/cc (Cat. 2) | 3 | $1.1E^{-7}$uCi/cc to $1.3E^{5}$uCi/cc 0-110% Vent Design Flow | N/A | OP | CRT (GERMS Computer) | No | --- | Complies; see Table 2, Note 17. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| TYPE "D" VARIABLES | | | | | | | | |
| RHR System Flow 0-110% Design Flow (Cat. 2) | 2 | 0-4500 GPM (Design= 4000 GPM) | N/A | 1E | 2 Indicators | Yes | 1R6 | Will comply; see Table 2, Note 18. |
| RHR Heat Exchanger Outlet Temp $32^{o}$-$350^{o}$F (Cat. 2) | 2 | 0-400$^{o}$F | N/A | UPS/DG | 2 Indicators (1/Containment Spray Line) | Yes | --- | Complies |
| Core Flood Tank (Accumulator) Level Bottom to Top (Cat. 2) | 2 | 8.75%-91.25% (Bottom to Top) | N/A | UPS/DG | 4 Indicators (2/Tank) | Yes | 1R7 | Will comply; see Table 2, Note 19. |
| Core Flood Tank Pressure; 0-750 psig (Cat. 2) | 3 | 0-800 psig | N/A | UPS/DG | 4 Indicators (2/Tank) | No | --- | Complies; see Table 2, Note 20. |
| Core Flood Tank (Accumulator) Isol. Valve Position Closed/Not Closed (Cat. 2) | 2 | Closed/ Not Closed | N/A | DG | 8 Lights (2/Valve) | No | --- | Complies |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Boric Acid Charging Flow 0-110% Design Flow (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See Table 2, Note 21. |
| Flow in HPI System 0-110% 0-110% Design Flow (Cat. 2) | 2 | 0-400 GPM (Design= 262 GPM) | N/A | 1E | 2 Indicators (1/HPI Loop) | Yes | 1R6 | Will comply, see Table 2, Note 22. |
| Flow in LPI System 0-110% 0-110% Design Flow (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See previous listing, Page 8, "RHR System Flow" |
| Refueling Water Storage Tank Level Top to Bottom (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See previous listing, Page 1. |
| RCP Status Motor Current (Cat. 3) | 3 | 0-600 amps | N/A | UPS | CRT (SPDS) | Yes | 1R7 | Will comply; see Table 2, Note 23. |
| Primary System Safety Relief Valve Positions (Including PORVs and Code Valves) or Flow Through or Pressure in Relief Valve Lines Closed/Not Closed (Cat. 2) | 2 | Closed/ Not Closed | N/A | DG | 2 Indicators (1/Safety Valve) | Yes | --- | Complies |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Pressurizer Level Top to Bottom (Cat. 1) | 1 | 87" - 407" (Top to Bottom) | Yes (2 Channels) | 1E | 1 Recorder | Yes | 1R7 | Will comply; see Table 2, Note 24. |
| Pressurizer Heater Status Electric Current (Cat. 2) | 2 | Current | N/A | DG | CRT (SPDS Computer) | Yes | 1R7 | Will comply; see Table 2, Note 25. |
| Quench Tank Level Top to Bottom (Cat. 3) | 3 | 10-90% (Top to Bottom) | N/A | DG | 1 Indicator | No | --- | Complies |
| Quench Tank Temp 50-750°F (Cat. 3) | -- | --- | --- | --- | --- | --- | --- | See Table 2, Note 26. |
| Quench Tank Pressure 0 to Design Pressure (Cat. 3) | 3 | 0-100 psig Design=100 psig | N/A | DG | 1 Indicator | No | --- | Complies |
| Steam Generator Level from Tube Sheet to Separators (Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |
| Steam Generator Pressure from Atmospheric Pressure to 20% Above the Lowest Safety Valve Setting (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 1. |

TABLE 1

AP&L RESPONSE TO RG1.97

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| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Safety/Relief Valve Positions or Main Steam Flow Closed/Not Closed (Cat. 2) | 2 | Closed/ Not Closed | N/A | DG | 2 Lights/ Valve | Yes | 1R7 | Will comply; see Table 2, Note 27. |
| Main Feedwater Flow 0-110% Design Flow (Cat. 3) | 3 | 0-6.0 X $10^6$ lb/hr (Design= 5.5 X $10^6$ lb/hr) | N/A | UPS/DG | 2 Indicators (1/MF Pump) 2 Recorders (1/MF Pump) | Yes | --- | Complies |
| Auxiliary Feedwater Flow 0-110% Design Flow (Cat. 1-for B&W Plants) | 1 | 0-900 GPM (Design= 700 GPM) | Yes (4 Channels) (1/Leg) | 1E | 4 Indicators (1/Channel) | Yes (Planned) | --- | Complies |
| Condensate Storage Tank Level Plant Specific (Cat. 1) | --- | --- | --- | --- | --- | --- | --- | See previous listing, Page 1. |
| Containment Spray Flow 0-110% Design Flow (Cat. 2) | 2 | 0-2000 GPM (Design= 1800 GPM) | N/A | 1E | 2 Indicators (1/Containment Spray Line) | Yes | 1R6 | Will comply; see Table 2, Note 28. |
| Heat Removal by the Containment Fan Heat Removal System | 3 | On-Off | N/A | 1E | Lights (1/Fan Breaker) | No | --- | Will comply; see Table 2, Note 29. |
| Plant Specific (Cat. 2) | | 0-5000 GPM | N/A | DG | CRT (SPDS) | Yes | 1R6 | --- |

TABLE 1

AP&L RESPONSE TO RG1.97

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| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Containment Atmosphere Temp 40-400°F (Cat. 2) | 3 | 0°-300°F | N/A | OP/UPS | CRT (SPDS) | Yes | --- | Complies; see Table 2, Note 30. |
| Containment Sump Water Temp 50-250°F (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See Table 2, Note 31. |
| Makeup Flow-In 0-110% Design Flow (Cat. 2) | 3 | 0-200 GPM Design= 149 GPM | N/A | UPS/DG | 1 Indicator | No | --- | Complies; see Table 2, Note 32. |
| Letdown Flow-Out 0-110% Design Flow (Cat. 2) | 3 | 0-160 GPM (Design= 45 GPM) | N/A | UPS/DG | 1 Indicator | No | --- | Complies; see Table 2, Note 32. |
| Makeup Tank Level Top to Bottom (Cat. 2) | 3 | 0-100" (Top to Bottom) | N/A | UPS/DG | 1 Indicator | No | | Complies; see Table 2, Note 32. |
| Component Cooling Water Temp to ESF System 40-200°F (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See Table 2, Note 33. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Component Cooling Water Flow to ESF System 0-110% Design Flow (Cat. 2) | 2 | 0-150 psig Closed/ Not Closed | N/A | 1E | 2 Indicators 2 Lights/Valve | No | --- | Complies; see Table 2, Note 34. |
| High Level Radioactive Liquid Tank Level Top to Bottom (Cat. 3) | 3 | 5-96% (Top to Bottom) | N/A | DG | 4 Indicators (1/Tank) | No | --- | Complies |
| Radioactive Gas Holdup Tank Pressure 0-150% Design Pressure (Cat. 3) | --- | --- | --- | --- | --- | --- | --- | See Table 2, Note 35. |
| Emergency Ventilation Damper Position Closed/Not Closed (Cat. 2) | 2 | Closed/ Not Closed | N/A | DG | 2 Lights (1/Both CR Isol. Redundant Damper) | No | --- | Complies |
| Status of Standby Power and Other Energy Sources Important to Safety (Electric, Hydraulic, Pneumatic) voltages, currents, pressures; Plant Specific (Cat. 2) | 2 | Voltages; Breaker Positions; etc. | N/A | Various | CRT (SPDS) | Yes | 1R7 | Will comply; see Table 2, Note 36. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| TYPE "E" VARIABLES | | | | | | | | |
| Containment Area Radiation -High Range, 1R/hr to $10^7$R/hr (Cat. 1) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 6. |
| Radiation Exposure Rate (inside bldgs or areas where access is required to service equipment important to safety) $10^{-1}$R/hr to $10^4$R/hr (Cat. 3) | 3 | $10^{-2}$R/hr to $10^3$R/hr; $10^{-4}$R/hr to $10^1$R/hr; $10^{-3}$R/hr to $10^3$R/hr | N/A | DG | 20 Indicators 1 Recorder | Yes | --- | Complies; see Table 2, Note 37. |
| Noble Gases & Vent Flow Rate | | | | | | | | |
| --Containment or purge effluent $10^{-6}$uCi/cc to $10^5$uCi/cc 0-110% Vent Design Flow (Cat. 2) | -- | --- | --- | --- | --- | -- | --- | See previous listing on Page 7. |
| --Reactor Shield Bldg Annulus (if in design) | -- | --- | --- | --- | --- | --- | --- | Not in design. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| --Auxiliary Bldg (including any bldg containing primary system gases, e.g., waste gas decay tank) $10^{-6}$uCi/cc to $10^{3}$uCi/cc 0-110% Vent Design Flow (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | See previous listing on Page 7. |
| --Condenser Air Removal System Exhaust $10^{-6}$uCi/cc to $10^{5}$uCi/cc 0-110% Vent Design Flow (Cat. 2) | 3 | $1.1E^{-7}$uCi/cc to $1.3E^{5}$uCi/cc 0-110% Vent Design Flow | N/A | OP | CRT (GERMS Computer) | No | --- | Complies; see Table 2, Note 17. |
| --Common Plant Vent Discharging Any of the Above Releases (if containment purge is included) $10^{-6}$uCi/cc to $10^{3}$uCi/cc 0-110% Vent Design Flow (Cat. 2) | 3 | $1.1E^{-7}$uCi/cc to $1.3E^{5}$uCi/cc 0-110% Vent Design Flow | N/A | OP | CRT (GERMS Computer) | No | --- | Complies; see Table 2, Note 17. |
| --Vent from Steam Generator Safety Relief Valves or Atmospheric Dump Valves $10^{-1}$uCi/cc to $10^{3}$uCi/cc (Cat. 2) | 2 | .066uCi/cc to $6.55E^{3}$uCi/cc (Xe-133 D.E.) | N/A | 1E | 2 Indicators | Yes (Planned) | --- | Complies; see Table 2, Note 38. |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| --All other identified release points $10^{-6}$uCi/cc to $10^{2}$uCi/cc (Cat. 2) | -- | --- | --- | --- | --- | --- | --- | No other identified release points. |
| Particulates and Halogens | | | | | | | | |
| --All identified plant release points (except steam generator safety relief valves or atmospheric steam dump valves and condenser air removal system exhaust). Sampling with on-site analysis capability; for particulates and halogens $10^{-3}$uCi/cc to $10^{2}$uCi/cc 0-110% Vent Design Flow (Cat. 3) | 3 | $10^{-3}$uCi/cc to $10^{2}$uCi/cc 0-110% Vent Design Flow | N/A | OP | CRT (GEPMS Computer) | No | --- | Complies; see Table 2, Note 39. |
| Airborne Radiohalogens and Particulates (Portable Sampling with On-Site Analysis Capability) $10^{-9}$uCi/cc to $10^{-3}$uCi/cc (Cat. 3) | 3 | $10^{-9}$uCi/cc to $10^{-3}$uCi/cc | N/A | N/A | N/A | N/A | --- | Complies |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Plant and Environs Radiation; $10^{-3}$R/hr to $10^{4}$R/hr, Photons; $10^{-3}$ RADS/HR to $10^{4}$ RADS/HR, Beta Radiations and Low-Energy Photons (Portable Instrumentation) | 3 | $10E^{-3}$R/hr to $10E^{3}$R/hr Photons; $10^{-3}$RADS/hr to 50 RADS/hr | N/A | N/A | N/A | N/A | --- | Complies; see Table 2, Note 40. |
| Plant and Environs Radioactivity (Portable instrumentation) (Isotopic Analysis) (Cat. 3) | 3 | Isotopic Analysis | N/A | N/A | N/A | N/A | --- | Complies; see Table 2, Note 41. |
| Wind Direction 0-360° (± 5° accuracy with a deflection of 10°). Starting speed < 1 mph; damping ratio >0.4; distance constant less than or equal to 2 meters. (Cat. 3) | 3 | 0-360° ±1/2% full scale; starting speed-.75 mph; damping ratio - .6; distance constant - 1m. | N/A | OP | 1 Recorder CRT (GERMS Computer) | No | --- | Complies |
| Wind Speed 0-50 mph (± .5 mph accuracy for wind speeds < 5 mph, 10% for speeds > 5 mph, with a starting threshold < 1 mph and a distance constant not to exceed 2 meters (Cat. 3) | 3 | 0-100 mph accuracy greater of ± 1% or ± 0.15 mph; starting threshold - 0.6 mph; distance constant - 5 ft. | N/A | OP | 1 Recorder CRT (GERMS Computer) | No | --- | Complies |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Estimation of Atmospheric Stability Based on Vertical Temp Difference from Primary System -9°F to 18°F and +0.3°F accuracy per 164' intervals or analogous range for alternative stability estimates. (Cat. 3) | 3 | -3° to 5°C Temp Difference 0-40°- Wind Direction Sigma | N/A | OP | 1 Dual Pen Recorder CRT (GERMS Computer) | No | --- | Complies; see Table 2, Note 42. |
| Primary Coolant and Sump (Grab Sample) (Cat. 3) | 3 | --- | N/A | N/A | N/A | N/A | --- | Complies; see Table 2, Note 43. |
| --Gross Activity 1 uCi/ml to 10 Ci/ml | | | | | | | | |
| --Gamma Spectrum (isotopic analysis) | | | | | | | | |
| --Boron concentration 0-6000 PPM | | | | | | | | |
| --Chloride Content 0-20 PPM | | | | | | | | |
| --Dissolved hydrogen or Total Gas 0-2000 cc/kg | | | | | | | | |
| --Dissolved Oxygen 0-20 PPM | | | | | | | | |
| --pH 1-13 | | | | | | | | |

TABLE 1

AP&L RESPONSE TO RG1.97

ANO-1



| VARIABLE RECOMMENDED PER RG1.97 (REV. 3) | CATEGORY | RANGE | REDUNDANCY | POWER SUPPLY | CR DISPLAY | SPDS | SCHEDULE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Containment Air Grab Sample (Cat. 3) | 3 | --- | N/A | N/A | N/A | N/A | --- | Complies; see Table 2, Note 43. |
| --Hydrogen Content 0-10% Vol. | | | | | | | | |
| --Oxygen Content 0-30% Vol. | | | | | | | | |
| --Gamma Spectrum (Isotopic Analysis) | | | | | | | | |

TABLE 2

AP&L RESPONSE TO REGULATORY GUIDE 1.97
ANO-1

NOTE 1: Currently on ANO-1 there are eight RTD's measuring Hot Leg Water Temperature: Four fully qualified loops with a range of 520°-620°F provide a temperature input to the RPS (these same four loops also provide input signals to the computer with a range of 120°-920°F) and four non-safety grade loops that provide signals for control and indication with a range of 520-620°F. In order to meet RG1.97 requirements, two new RTD's will be purchased and installed in a spare thermowell in each hot leg. This signal will be input to the SPDS computer and feed Category 1 indication in the control room. The RTD's and input to the SPDS will be installed during 1R6. The control room indication equipment will be installed during 1R7.

NOTE 2: ANO-1 currently has three wide range (0-2500 psig) RCS pressure transmitters. These three transmitters provide inputs to the ESAS. The ESAS provides one wide range pressure output which is recorded in the control room. The proposed design change for RCS pressure will provide two new class 1E pressure transmitters. One of these transmitters will provide continuous control room indication, the other will feed a class 1E recorder. Both transmitters will have a 0-3000 psig range.

NOTE 3: ANO-1 has installed the Emergency Feedwater Initiation & Control System which will become operational by mid-1985. This system provides Class 1E, redundant, level indication in the control room. The lower range measured is 6"-156" above lower tube sheet. The high range measured is 102"-500" above lower tube sheet. Monitoring levels lower than 6" would not be meaningful since operator action would not be affected. The upper range is still being studied by B&W. With this system, AP&L meets the intent of RG1.97.

** NOTE 4: ANO-1 has indication of main steam pressure at the turbine as well as at the steam generators. These pressure indications are provided in the control room. The steam generator outlet pressures are measured over the range from 0-1200 psig. The NRC recommendation is for the range to be 20% above the lowest safety valve setting. Since the lowest safety valve is 1050 psig, the range would have to be in the order of 1275 psig to meet the NRC's recommendation. The following discussion is provided to justify that the existing range of 0-1200 psig is sufficient.

The main steam lines are provided with safety relief valves, atmospheric dump valves, and condenser dump valves to prevent overpressurization of the lines as well as for pressure control capability. ANO-1 has ~40% excess steam relief capacity with all

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safety valves and condenser dump valves operable. ANO-1 technical specifications require 14 of the 16 main steam safety valves to be operable during power operation. Fourteen safety valves will relieve ~110% of rated steam flow. Combined with the condenser dump valves, these 14 safety valves will provide a total of ~25% excess steam relief capacity. Based on the facts that the highest safety valve setting is 1100 psig, and an excess relief steam capacity of ~25% is normally maintained when as many as two safety valves are inoperable, the existing range of 0-1200 psig is sufficient to meet the intent of R.G. 1.97.

NOTE 5: A new seismic condensate storage tank is planned for use by ANO-1 and ANO-2. Redundant Class 1E tank level indication will be provided in the control room and as inputs to SPDS upon completion of this design change. This modification and schedule is still being discussed with the NRC staff.

NOTE 6: ANO-1 currently has indication of BWST level in the control room; however, it meets only Category 2 requirements. The existing instrument loops will be replaced with two fully qualified instrument loops with redundant indication in the control room, both channels input to the SPDS computer and 1 channel recorded.

NOTE 7: There are currently two channels of source range neutron flux at ANO-1. These channels consist of $BF^3$ proportional counters, in-reactor building amplifiers, and control room signal processors. These channels cannot be qualified.

In order to comply with R.G. 1.97, two complete new channels will be installed. These channels will consist of fully qualified fission chamber based instrumentation. One channel will have Class 1E control room recording and both channels will be input to SPDS. Range will be $10^{-8}$ to 100% power.

** NOTE 8: During normal operation boron concentration is measured by a boronometer in the letdown line or through radiochemistry analysis. Following a serious accident, however, the letdown line will be isolated (either procedurally to conserve reactor coolant and limit exposure to personnel in the auxiliary building or via a reactor building isolation signal) and the radiochemistry lab may become inaccessible due to radiation levels such that on-site grab sample analysis for boron is not possible. Therefore, in accordance with NUREG-0737, Item II.B.3, the Post Accident Sampling System (PASS) for ANO-1 was designed to provide boron concentration measurement capability. The range and design criteria for the PASS is consistent with guidance provided for Item II.B.3 which has been addressed by AP&L in previous submittals and discussions with the NRC.

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** NOTE 9: Reg. Guide 1.97 lists cold leg water temperature as a Category 1 (key) variable and core exit temperature as a Category 3 (backup) variable for the core cooling function. Hot leg and cold leg temperature indications may not in all cases provide valid information on the status of core cooling. Since they are located in the RCS loops and not the reactor vessel, there must be either forced or natural circulation flow through the steam generators for their indications to be representative of actual core conditions. Also, due to the proximity of the cold leg RTD's to the HPI nozzles, HPI flow may significantly affect the cold leg temperature indication particularly in the absence of forced RCS flow. Incore temperature monitors provide a more direct indication of core cooling independent of whether or not there exists coolant flow through the loops.

For these reasons, core exit temperature is the key variable for monitoring core cooling and is qualified to Category 1 requirements while RCS cold leg temperature serves as a backup variable and is qualified to Category 3 requirements accordingly.

NOTE 10: ANO-1 will meet the requirements for measurement of Core Exit Temperature and Coolant Inventory as detailed in our response (1CAN048308) to the Inadequate Core Cooling Order for Modification of Licenses. In summary, ANO-1 presently has 32 radially distributed core exit thermocouples with a range of 0-2300°F, 16 of which input to the plant computer and 16 to SPDS.

Four gamma thermometer probes will be installed in place of four existing in-core instrument assemblies to provide information from the reactor core. Each probe will contain multiple differential and absolute thermocouple sensors distributed axially along its length. The absolute thermocouples will be located at the core inlet and outlet regions as well as at central elevations of the core. Direct temperature readout will be available from these sensors at these four locations.

NOTE 11: Coolant Inventory will be monitored using RADCAL Gamma thermometers. Gamma thermometer probes will be installed to monitor level in the upper head and plenum regions of the reactor vessel. A gamma thermometer probe will also be installed for detection of water level in each RCS Hot Leg. All channels will be Class-1E up to and including the isolation devices. All channels are input to a common display, the SPDS computer. Recording will be performed using the trending capabilities of the SPDS computer.

NOTE 12: During situations that may result in superheated conditions in the RCS, incore temperature and hot leg RTD's will be monitored against RCS pressure to determine the degree of superheat or subcooling. The SPDS computers will plot on the CRT core exit temperature versus

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pressure on a grid with the saturation curve so that the operator can tell at a glance the thermodynamic status of the reactor coolant. Therefore, a range of 0°F-200°F subcooled on the subcooled margin monitor is adequate to meet the intent of Reg. Guide 1.97.

NOTE 13: Reactor building isolation valves listed in Table 5-1 of ANO-1's FSAR were evaluated. This evaluation excluded check valves and locked closed manual valves which are part of a passive boundary. Redundancy is satisfied by GDC 55, 56, or 57. With the exception of seven (7), all position switches are Class 1E with "open-closed" indicating lights in the control room. These seven (7) switches will be upgraded to comply with Reg. Guide 1.97.

** NOTE 14: During normal plant operations RCS radiation levels are measured by a radiation monitor in the letdown line and through radiochemistry analysis. These two techniques are used to quantify the activity in the primary coolant and to determine Technical Specification compliance. Following a serious accident, however, the letdown line will be isolated (either procedurally to conserve reactor coolant, and limit exposure to personnel in the auxiliary building or via a reactor building isolation signal) and the radiochemistry lab may become inaccessible due to radiation levels. Therefore, these normal methods are not suitable for post accident analysis. Section II.B.3 of NUREG-0737 requires that the capability exist at each nuclear plant to sample the RCS to assess the magnitude of fuel failures during post-accident conditions. As such, this method should be the primary means of determining clad breach.

The Post Accident Sampling System for ANO-1 was designed to comply with the requirements of NUREG-0737 Item II.B.3. These requirements did not require that the system be safety grade. Therefore, PASS does not comply with the strict requirements specified for Category 1 equipment. Since PASS is designed in accordance with the requirements of NUREG-0737, Item II.B.3, and those requirements are consistent with the criteria of Reg. Guide 1.97 Category 3, the PASS variables have been specified as Category 3 by AP&L. The range covered by PASS is consistent with guidance provided for Item II.B.3 of NUREG-0737. Pass data is verbally relayed to the control room.

NOTE 15: The existing High Range Radiation Monitoring System meets all requirements of a Category 1 instrument loop, with the exception of having at least 1 channel recorded. Difficulties were encountered with the acquisition of a qualified isolator/amplifier for the signal range. Testing has recently been completed successfully. The isolator/amplifier, recorder, and input to SPDS will be installed by 1R6.

NOTE 16: ANO-1 currently has a radiation monitor that will meet the specified concentration range if the detector response is attributed to Xe-133, as allowed for in Footnote 9 of Reg. Guide 1.97.

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Footnote 9 also specifies that the monitor response (output in uci/cc) should not vary more than a factor of two as the isotopic mixture of the measured gas varies from typical fresh to 10-day-old fission gas mixtures. The stated purpose of detecting steam generator tube rupture is adequately fulfilled by periodically observing the indicated gross activity in the condenser exhaust and watching for a step change. The baseline reading and the magnitude of the step change are not critical so long as the monitor has sufficient dynamic range. For this reason the isotopic mixture accuracy specification is not necessary. Since the average gamma energy of fission gases decreases by nearly a factor of two in ten days, it is unlikely that the monitor response would vary by less than a factor of two. However, the ANO-1 monitor meets the intent of Reg. Guide 1.97.

** NOTE 17: The Gaseous Effluent Radiation Monitoring System (GERMS) for ANO-1 was designed to comply with the requirements of NUREG-0737, Item II.F.1. These requirements did not include providing a "highly reliable" power supply. Therefore, GERMS does not comply with the strict requirements specified for Category 2 variables of Reg. Guide 1.97. Since GERMS is designed in accordance with the requirements of NUREG-0737, Item II.F.1, and those requirements are consistent with the criteria of Reg. Guide 1.97 Category 3, the GERMS variables have been specified as Category 3 by AP&L. The range covered by GERMS is consistent with Reg. Guide 1.97 recommendations.

NOTE 18: ANO-1 currently has one monitoring instrument loop per reactor coolant loop which measure LPI flow over the range 0-3000 gpm per branch line. These two loops will be upgraded to Category 2 requirements measuring a range equal to at least 0-110% of design flow. These will be continuous indication of both loops in the control room and both will be input to the SPDS computer.

NOTE 19: ANO-1 presently has two level indication loops on each of the two Core Flood Tanks. These instrument loops will be upgraded to meet Category 2 requirements.

** NOTE 20: Core Flood Tank Pressure is a key variable for pre-accident status to assure that this passive safety system is prepared to serve its function as dictated by the ANO-1 Technical Specifications. This pressure indication provides no essential information for operator action during or following an accident. The key variable necessary to determine whether the Core Flood Tanks have fulfilled their safety function is Core Flood Tank Level. Therefore, Core Flood Tank Pressure is a backup variable and has accordingly been classified as a Category 3 variable.

** NOTE 21: The B&W designed NSSS does not include a charging system as part of the Emergency Core Cooling System (ECCS). Flow paths from the ECCS to the RCS include High Pressure Injection (HPI), Low Pressure

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Injection (LPI) with the BWST or the RB Sump as the suction source and the Core Flood Tank injection. HPI and LPI flow rates, BWST Level, RB Sump Level, and Core Flood Tank Level are monitored by Category 2 Type D RG 1.97 variables. Therefore, Boric Acid Charging Flow does not need to be monitored as a Type D variable to monitor the operation of the ECCS.

NOTE 22: ANO-1 currently has two monitoring instrument loops per reactor coolant loop which measure HPI flow over the range 0-262.5 gpm per branch line. These four loops will be upgraded to Category 2 requirements measuring a range equal to at least 0-110% of design flow. These will be continuous indication of all 4 loops in the control room and all four will be input to the SPDS computer.

NOTE 23: Current transducers will be added to existing ANO-1 RCP motor current circuit in order to provide indication in the SPDS computer of RCP motor current.

NOTE 24: Pressurizer level is presently monitored by three transmitters with a single dual element RTD providing temperature compensation input. The operator selects one of the level transmitters and one of the RTD elements for control. The compensated level is recorded and is monitored by a panel mounted level indicator. The instrumentation loops do not currently meet Category 1 requirements.

During 1R6, two qualified level transmitters will be installed for the pressurizer. A new thermowell will be installed through an existing nozzle in the pressurizer and qualified RTD's will be installed in the new and existing thermowells. Two channels of level and temperature will be routed to the electrical penetration rooms where the signals will be isolated in a qualified instrument cabinet. The level and temperature signals will be sent to ICS cabinets for control and to the SPDS computer for monitoring.

Qualified level compensation networks will be installed in the isolation instrument cabinets during 1R7. Indication in the control room will also be installed to bring the instrument loops in compliance with Category 1 requirements during 1R7.

NOTE 25: The pressurizer heater banks do not presently have electric current indication in the control room. Transducers will be added to the proportional heater circuits and input to SPDS. This will allow "on-demand" indication of pressurizer heater current.

NOTE 26: Quench tank level and pressure are available for monitoring quench tank performance. The liquid temperature will always be less than or equal to the saturation temperature for the Quench Tank Pressure. It is therefore felt that this temperature measurement should be deleted from the Accident Monitoring instrumentation for ANO-1.

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NOTE 27: Presently ANO-1 does not have a Safety Relief Valve position indication (SRVPI) system. A new SRVPI system will be provided in compliance with R.G. 1.97 to monitor valve open and closed positions.

NOTE 28: ANO-1 currently has one monitoring instrument loop per reactor building spray line which measures reactor building spray flow over the range at least 0-1800 gpm per line. These two loops will be modified to provide environmentally qualified transmitters measuring a range equal to at least 0-110% of design flow. There will be continuous indication of both loops in the control room and both will be input to the SPDS computer.

NOTE 29: The key variable for monitoring reactor building cooler performance is reactor building pressure which is a Category 1 variable. Backup instrumentation (Category 3) includes a Class 1E indication of the reactor building cooling fan motor breaker status and an SPDS indication of service water flow through the cooler which is being added during 1R6. Therefore, the breaker status and flow instrumentation have been classified as Category 3 since they are backup variables to the Category 1 reactor building pressure instrumentation. This instrumentation meets the intent of Reg. Guide 1.97.

** NOTE 30: Reactor building atmospheric temperature is not a key variable for accident monitoring. The key variable for reactor building monitoring is reactor building pressure which is measured by Category 1 instrumentation. Reactor building atmospheric temperature is a backup variable for reactor building accident monitoring and as such is measured by Category 3 instrumentation with a range of 0° to 300°F. This range is justified based on ANO-1 safety analysis which demonstrates that the worst case peak reactor building temperature would be 286.5°F (FSAR Table 6-9). Therefore, the existing range of 0° to 300°F is in excess of that required for accident monitoring. Since the key variable for reactor building accident monitoring (i.e., reactor building pressure) is currently Category 1, the backup variable of reactor building temperature for ANO-1 is appropriately listed as Category 3 and meets the intent of Reg. Guide 1.97.

** NOTE 31: ANO-1 FSAR accident analysis assumes saturated conditions for sump water during sump recirculation. With this conservative assumption, adequate NPSH exists for reactor building spray and safety injection pumps at all feasible sump water temperatures. Therefore, there is no need to monitor sump temperature to verify adequate NPSH for ECCS pumps or for any other accident monitoring requirements.

** NOTE 32: The installed instrumentation is adequate for the intended monitoring function. For accidents in which harsh environments are a result, the system containing this instrumentation (letdown and

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makeup portion of the Makeup and Purification System) is not required in the mitigation of these accidents. Letdown is automatically isolated upon an ESF Actuation. Thus, it is appropriate that this instrumentation meet the recommendations of Category 3.

NOTE 33: The ANO-1 system for cooling the ESF components is the Service Water System. The inlet temperature of the service water by design is based on a maximum temperature of 129.5°F from the emergency cooling pond. The average temperature of the pond (June through September) is 85°F; furthermore, there is no control over the temperature of the service water. Therefore, there is no need to indicate the service water temperature in the control room since, by design, no useful information would be provided to the operator by such instrumentation.

NOTE 34: Cooling water to ESF system components at ANO-1 is supplied by the service water system. Design flow to various ESF components varies from 6 gpm for the reactor building spray pump bearing coolers to 3000 gpm for the decay heat removal coolers. Due to this wide range of design flows to ESF components, total loop flows would not be indicative of overall system performance. A better indication of proper system operation is that the correct service water header pressure exists and that remote actuated valves supplying service water to ESF components are in their proper positions. Service water header pressure and remote actuated valve position indications are available in the control room and meet Category 2 qualification requirements.

NOTE 35: Indication of radioactive gas holdup tank pressure is not a necessary control room variable for post accident monitoring. In the event of an accident which results in significant failed fuel or significant radioactive gas release, the manual transfer of radioactive gases to the radioactive gas holdup tanks would not be attempted since the reactor building would be utilized as the holdup tank. There are no automatic transfer operations involving the radioactive gas holdup tanks. Therefore, the monitoring in the control room of the radioactive gas holdup tanks during post accident conditions is not necessary since these tanks are not utilized for accident mitigation.

NOTE 36: AP&L is in the process of defining the necessary parameters needed to assess the status of standby power. These required bus voltages, breaker status information, etc. will be added as inputs to the SPDS computers. A specific graphic display for the SPDS is being developed to give the operator the status of standby power at a glance.

** NOTE 37: ANO-1 currently has an Area Radiation Monitoring System consisting of 20 Area Monitors, four with a range of $10^{-2}$ R/hr to $10^{3}$ R/hr and 16 with a range of $10^{-4}$ R/hr to $10^{1}$ R/hr. These ranges are based on

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background reading in the areas in which they are located. Should personnel entry be required in areas where these monitors have gone off scale or indicate a high radiation area a health physics escort would accompany personnel into these areas using portable instrumentation to assess radiation levels. The high range for portable instrumentation at ANO is $10^3$ R/hr. We do not anticipate, even under emergency conditions, sending personnel into radiation fields of this magnitude. We believe that this meets the intent of Regulatory Guide 1.97.

NOTE 38: As detailed in Note 25, a system is being considered for safety relief valve position indication. The range of the existing radiation monitor is insufficient to cover the specified range as KR-85; however, when a calculated method is applied as suggested in Footnote 13 of RG 1.97 (Rev. 3), the Xe-133 dose equivalent concentration of fission gases from 1% failed fuel which can be measured by the monitor does meet the RG 1.97 recommendation for minimum sensitivity. The emergency response of the current monitor (Eberline RMS-II/DA1-6) has not been tested above 1.25 MEV. It is, however, specified to be flat within ±15% from 40 KEV to 1.25 MEV.

NOTE 39: Each Super Particulate Iodine Noble Gas (SPING) monitor which inputs to the Gaseous Effluent Radiation Monitoring System has the capability to measure halogen and particulate activity as it is accumulated on a sample media. The SPING microcomputer then calculates the gross radiohalogen and particulate sample concentration based on the rate of increase of activity on the filter media. If necessary, to further define the analysis or to extend the range, an isotopic analysis of the filter media can be performed by plant radiochemistry personnel. This technique provides a range at least equivalent to that which is recommended by Regulatory Guide 1.97.

NOTE 40: Existing portable instrumentation can detect gamma dose rates from $10^{-3}$ R/hr to $10^3$ R/hr and beta dose rates from $10^{-3}$ Rad/hr to 50 Rad/hr. In the plant we do not anticipate encountering radiation fields greater than those which can be measured by our current equipment except under severe accident conditions. Even under accident conditions we do not anticipate sending individuals into greater than $10^3$ R/hr fields. Therefore, we meet the intent of Regulatory Guide 1.97 with our current equipment.

NOTE 41: Gamma spectroscopy can be performed using equipment in the HP department and the radiochemistry department at ANO, and in the Technical Analysis Laboratory in Little Rock. In addition, we have an ND-60 spectrometer in the ANO Emergency Offsite Facility which can be used for less defined analysis. It is not appropriate that this instrumentation be portable due to rough handling it would encounter in the field and the limited amount of time field teams have to assess the release. Therefore, we comply with the intent of RG 1.97.

** Reflects Justification developed by the B&W Owners Group RG1.97 Task Force

NOTE 42: Atmospheric stability at ANO is derived from the temperature differential indicated between 34 and 180 feet. The -3° to 5°C temperature range covers the seven Pasquill stability classes vs. Delta-T as derived from Regulatory Guide 1.23 as specified in the ANO-2 FSAR. Expansion of the range would provide no additional useful information. In addition to temperature differential, atmospheric stability can also be calculated for all seven classes using wind direction sigma. Therefore, we meet the intent of Regulatory Guide 1.97.

NOTE 43: Post accident sampling of the RCS and the reactor building air will be accomplished utilizing the Post Accident Sampling System (PASS). The PASS was installed to meet the requirements of NUREG 0737 Item II.B.3. The range and accuracy capability of the PASS is being resolved at this time through further acceptance testing of the Orion equipment. AP&L is in contact with the NRC Division of Licensing to assure compliance with item II.B.3. Based on the fact that we are in compliance with item II.B.3 of NUREG 0737, we meet the intent of Regulatory Guide 1.97.

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