A Subsidiary of RGS Energy Group, Inc.

ROCHESTER GAS AND ELECTRIC CORPORATION • 89 EAST AVENUE, ROCHESTER, N.Y. 14649-0001 • 716 546-2700 www.rge.com

ROBERT C. MECREDY
Vice President
Nuclear Operations

May 3, 2001

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Guy S. Vissing
Project Directorate I-1
Washington, D.C. 20555

Subject: Application for Amendment to Facility Operating License
Control Room Emergency Air Treatment System (CREATS) Actuation
Instrumentation Change (LCO 3.3.6)
Rochester Gas and Electric Corporation
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Vissing:

The enclosed License Amendment Request (LAR) proposes to revise the Ginna Station Improved Technical Specifications (ITS) associated with the Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation (LCO 3.3.6).

The LAR is being proposed since Rochester Gas and Electric (RG&E) has determined that the reliability of the existing CREATS Actuation Instrumentation has been inadequate and resulted in numerous occasions of requiring the CREATS to be placed in the recirculation mode. A new system is necessary to replace the existing Control Room Radiation Intake Monitor requiring a change to the ITS.

RG&E requests that this amendment be approved by October 1, 2001, with an implementation date to correspond with the completion of the proposed modification, or 30 days, which ever is greater.

Very truly yours,

Robert C. Mecredy

A001

1000296

Attachments:

I. License Amendment Request
II. No Significant Hazards Consideration Determination
III. Environmental Impact Consideration Determination
IV. Marked up copy of R.E. Ginna Nuclear Power Plant Improved Technical Specifications
V. Proposed Revised R.E. Ginna Nuclear Power Plant Improved Technical Specifications
VI. Simplified Diagrams of the Existing and Proposed System Design

Enclosures:

1. DA EE-2000-009, Instrument Loop Performance Evaluation and Setpoint Verification, Instrument Loop Number RMS R45/R46

2. DA EE-2001-013, Control Room Radiation Monitors Analytical Limit Calculation

xc: Mr. Guy S. Vissing (Mail Stop 8C2)
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

U.S. NRC Ginna Senior Resident Inspector

Mr. F. William Valentino, President
New York State Energy, Research, and Development Authority
Corporate Plaza West
286 Washington Avenue Extension
Albany, NY 12203-6399

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
Rochester Gas and Electric Corporation	)	Docket No. 50-244
(R.E. Ginna Nuclear Power Plant)	)	

APPLICATION FOR AMENDMENT
TO OPERATING LICENSE

Pursuant to Section 50.90 of the regulations of the U.S. Nuclear Regulatory Commission (the "Commission"), Rochester Gas and Electric Corporation ("RG&E"), holder of Facility Operating License No. DPR-18, hereby requests that the Improved Technical Specifications set forth in Appendix A to that license be amended. This request for change in Improved Technical Specifications is to revise the Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation (LCO 3.3.6) requirements to reflect a planned plant modification.

A description of the amendment request, necessary background information, and justification of the requested change are provided in Attachment I and VI. The no significant hazards consideration determination is provided as Attachment II. The environmental impact consideration determination is provided as Attachment III. A marked up copy of the current Ginna Station Improved Technical Specifications which shows the requested change is set forth in Attachment IV. The proposed revised Improved Technical Specifications are provided in Attachment V.

The evaluation set forth in Attachment I and III demonstrates that the proposed change does not involve a significant change in the types or a significant increase in the amounts of effluents or any change in the authorized power level of the facility. The proposed change also does not involve a significant hazards consideration, as documented in Attachment II.

WHEREFORE, Applicant respectfully requests that Appendix A to Facility Operating License No. DPR-18 be amended in the form attached hereto as Attachment V.

Rochester Gas and Electric Corporation

By _____
Robert C. Mecredy
Vice President
Nuclear Operations Group

Subscribed and sworn to before me
on this 3rd day of May, 2001.

_____
Notary Public

MICHALENE A BUNTS
Notary Public, State of New York
Registration No. 01BU6018576
Monroe County
Commission Expires Jan 11, 2003

Attachment I
R.E. Ginna Nuclear Power Plant

LICENSE AMENDMENT REQUEST
CONTROL ROOM EMERGENCY AIR TREATMENT SYSTEM (CREATS)
ACTUATION INSTRUMENTATION CHANGE

This attachment provides a description of the amendment request and necessary justification for the proposed changes. The attachment is divided into four sections as follows. Section A identifies all changes to the current Ginna Station Improved Technical Specifications (ITS) while Section B provides the background and history associated with the changes being requested. Section C provides detailed justification for the proposed changes. Section D lists all references used in Attachments I, II, and III.

A. DESCRIPTION OF AMENDMENT REQUEST

This License Amendment Request (LAR) proposes to revise Ginna Station ITS to reflect the changes associated with the proposed installation of new Control Room Radiation Intake Monitors. The changes are summarized below and shown in Attachments IV and V.

1. LCO 3.3.6

   a. The Completion Time of the Required Action for a loss of one channel/train will be extended from 1 hour to 7 days as the result of installing redundant channels/trains.

   b. A new Condition will be added for the loss of two channels/trains with an immediate Completion Time for the Required Action.

   c. A new surveillance will be added to require a CHANNEL CHECK of the Control Room Radiation Intake Monitors.

   d. Table 3.3.6-1 will be revised to replace the column heading "Trip Setpoint" with "Allowable Value."

   e. Table 3.3.6-1 will be revised to increase the number of trains of Manual Initiation, and Automatic Actuation Logic and Actuation Relays, from one train to two trains.

f. Table 3.3.6-1 will be revised to remove reference to the Iodine, Noble Gas, and Particulate Control Room Radiation Intake Monitors. These monitors will be replaced by two new Geiger-Mueller (GM) tube intake radiation monitors. This change will also include the allowable value for the trip setpoint of the new radiation monitors.

B. BACKGROUND

B.1 History

An evaluation of the Ginna Control Room habitability system was performed in the early 1980's, as the result of NUREG-0737, Item III.D.3.4, "Control Room Habitability" (Reference 1). This evaluation concluded that the Area Radiation Monitor in the control room (R-1) was poorly located and of insufficient sensitivity to fulfill the NUREG requirements. Based on this assessment RG&E committed to install additional instrumentation and controls to detect airborne radioactive materials at the control room ventilation system air intake and isolate the emergency zone upon detection of such materials (Reference 2). The NRC completed their review and approval of the RG&E response to NUREG-0737, Item III.D.3.4, and transmitted the associated Safety Evaluation Report on April 11, 1983 (Reference 3). These modifications resulted in the installation of an offline radiation monitoring system which takes a suction from the control room ventilation system air intake and includes Particulate, Iodine, and Noble Gas radiation monitors.

The current instrumentation consists of a single train of Noble Gas (R-36), Particulate (R-37), and Iodine (R-38) radiation monitors. These detectors are located on the operating level of the Turbine Building outside of the control room access door and utilize a common air supply pump. The monitor skid is currently powered from a non-safety related electrical source and on a loss of power it fails to the safe condition. A high radiation signal from any of these detectors (Particulate $>1 \times 10^{-8}$ $\mu Ci/cm^3$; Iodine $>9 \times 10^{-9}$ $\mu Ci/cm^3$; and Noble Gas $>1 \times 10^{-5}$ $\mu Ci/cm^3$) will initiate the CREATS filtration train and isolate each air supply path with two dampers (see ITS Bases Figure B 3.7.9-1). The control room operator can also initiate the CREATS filtration train and isolate the air supply paths by using a manual pushbutton in the control room.

This CREATS Actuation Instrumentation system has had a number of failures and issues associated with it which have resulted in the control room ventilation system being required to be isolated and the CREATS filtration train placed in service for long periods of time per the requirements of LCO 3.3.6. These issues include numerous component failures, system actuation due to electronic noise, and quality concerns and obsolescence of replacement parts. A large amount of time has been expended by both engineering and maintenance personnel to attempt to resolve these issues and maintain the system operable (Reference 5).

B.2 Hardware Modification

The concerns discussed in Section B.1 have ultimately led to a determination that a system replacement is required to ensure adequate reliability. It is proposed that the existing monitoring system be replaced with a pair of GM tube plenum probes which will measure the radiation within the 42-inch control room ventilation system air intake. The new GM tube plenum probes will be powered from separate safety related sources and be configured into two redundant actuation logic trains, including manual initiation. These detectors will provide a fast and dependable monitoring system. This style of monitor does not depend on a sample pump or any moving parts to accomplish its monitoring function, providing increased system reliability. Attachment VI contains simplified diagrams of the existing and proposed system design.

B.3 Setpoint Analyses Summary

In addition to the control room radiation monitor reliability, RG&E previously identified a potential issue with respect to clearly defined operability limits for instrumentation specified within the Ginna Station ITS. A meeting was subsequently held with representatives of RG&E and the NRC (Reference 6) to discuss this issue and a proposed resolution. RG&E proposed to submit an application for amendment to revise the form of the instrumentation tables contained within ITS Chapter 3.3, Instrumentation, to provide a single "Allowable Value" column that uses a common basis for channel operability. This resolution would have the nominal field trip setpoint specified in plant procedures with the operability limit identified in ITS. The control room ventilation isolation (LCO 3.3.6) specification only contains a "Trip Setpoint" column which is meant to provide the operability limit. Therefore, Table 3.3.6-1, is changed to replace the "Trip Setpoint" column title with "Allowable Value." This title change is consistent with NUREG-1431 (Reference 4) and the Ginna Station Setpoint Verification Program (SVP), which is discussed below. It also provides consistent terminology for instrumentation requirements within the ITS with the "Allowable Value" providing a clearly defined basis for operability and differentiating it from the nominal field trip setpoint. The remaining tables contained within ITS Chapter 3.3 will be addressed under a separate amendment request.

The Ginna Station SVP is designed to document the acceptability of safety-related instrumentation setpoints as used in the accident analysis and emergency operating procedures (EOPs). The following are several terms which are defined for consistent use and application in the setpoint verification process.

Nominal Trip Setpoint - The value at which a given instrument channel is expected to trip or actuate. This value is surrounded by a tolerance band, typically 1%, since it is recognized that a bistable or relay cannot continuously be set for a single exact value.

Calculated Trip Setpoint - The maximum value at which the Nominal Trip Setpoint would normally be allowed to be set. This value is calculated by taking the Analytical Limit minus the TLU

Analytical Limit - The value at which the accident analysis assumes the instrument channel will trip.

Allowable Value - The value documented in the SVP that is used in the ITS as the operability setpoint. This is generated by taking the Calculated Trip Setpoint and adding to it the applicable TIUs (see below) for component(s) located between the testing point and the bistable or relay that is verified during periodic Channel Operability Tests (COTs).

Total Instrument Uncertainty (TIU) - The total uncertainty assigned to each component within the instrument channel. This value is generated by calculating the square root of the summed squares (SRSSs) of the component's individual uncertainties. For example, uncertainties are calculated separately for process measurement (PMU), measurement and test equipment (M&TEU), accident environment (AEU), accident current leakage (CLU), instrument rack (REU), sensor (SU), drift (DU), and tolerance (TU) effects. A TIU is generated by combining the relevant uncertainties as follows:

$$TIU = [(PMU)^2 + (M\&TEU)^2 + (AEU)^2 + (CLU)^2 + (REU)^2 + (SU)^2 + (DU)^2 + (TU)^2]^{1/2}$$

Note that a TIU may not include all of the above effects, only those which are relevant to the component.

Total Loop Uncertainty (TLU) - The total uncertainty assigned to the entire instrument loop for a specific channel. This is generated by calculating the SRSSs of each of the applicable instrument component TIUs.

The SVP is basically comprised of setpoint calculations for each required instrument channel. Each calculation documents the instrument channel being evaluated, performance requirements (e.g., EOP setpoints and analytical limits), calculates uncertainties, and generates TIUs, TLUs, and Allowable Values. Enclosure 1 provides the setpoint calculation for the new Ginna Station control room radiation monitors. Specifically, it documents the calculation of the Allowable Value proposed to be added to the ITS.

C. JUSTIFICATION OF CHANGES

This section provides the justification for all changes described in Section A above and shown on Attachments IV and V. The justifications are organized based on whether the change is: more restrictive (M), less restrictive (L), administrative (A), or the requirement is relocated (R). The justifications listed below are also referenced in the technical specification(s) which are affected (see Attachment IV).

C.1 More Restrictive

M.1 A new Required Action associated with the loss of two channels/trains of CREATS actuation instrumentation will be added which will require that the CREATS be placed in Mode F (emergency radiation protection mode) immediately. In this condition, the CREATS actuation instrumentation is not capable of performing its intended automatic function and therefore the Required Action is to manually place the system in a conservative mode of operation. The proposed Required Actions and Completion Time are consistent with NUREG-1431.

M.2 The surveillance requirements associated with LCO 3.3.6 will be revised to add a requirement to perform a CHANNEL CHECK of the Control Room Radiation Intake Monitor once every 12 hours. Performance of this surveillance will ensure that a gross failure of the instrumentation has not occurred. The proposed new surveillance provides a higher assurance of the operability of the instrumentation and is consistent with the guidance of NUREG-1431.

M.3 The number of Required Channels associated with Manual Initiation, and Automatic Actuation Logic and Actuation Relays, of the CREATS Actuation Instrumentation as listed in Table 3.3.6-1 will be increased from one train to two trains. This increase in number of actuation trains provides for redundancy in the actuation circuitry and is consistent with the guidance of NUREG-1431.

C.2 Less Restrictive

L.1 The Completion Time of the Required Action for Condition A. of LCO 3.3.6, for a loss of one channel/train, will be extended from 1 hour to 7 days. This change is the result of the proposed installation of redundant channels/trains for the radiation monitors, manual initiation, and automatic actuation logic trains, where there are currently three separate monitoring channels and one manual initiation within one train. In this condition, the remaining redundant OPERABLE channel/train is adequate to perform the control room protection function.

The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining channel/train to provide the required capability. If the channel/train cannot be restored to OPERABLE status, the CREATS must be placed in Mode F. This accomplishes the actuation instrumentation function and places the unit in a conservative mode of operation. The proposed Required Actions and Completion Time are consistent with NUREG-1431.

L.2 Table 3.3.6-1 is revised to remove reference to the Iodine, Noble Gas, and Particulate Control Room Radiation Intake Monitors and to add reference to the two new GM tube intake monitors. This change is considered to be less restrictive in that the current system utilizes three channels from diverse instrumentation that are treated as three, one-out-of-one functions to initiate actuation of the CREATS filtration train. The new system will utilize a one-out-of-two logic from redundant instrumentation.

The existing Control Room Intake Monitor is comprised of three separate and distinct types of monitors: a Particulate, an Iodine, and a Gas monitor. This style of monitoring system requires a sampling system that draws an isokinetic quantity of the air from the Control Room intake plenum. The sampling system for this equipment requires a sampling nozzle plumbed into the Control Room plenum with a "tubing run" of about 55 feet in length. The sample flow motive force is a 25-CFM carbon vane positive displacement pump. The flow is measured by a rotameter that provides a low flow alarm, and associated circuitry. This sample is routed through a moving filter, with particulate removal efficiency of 99.9% for all particulates of three microns and larger in the sample stream, and measured using a beta detector. This beta detector is located approximately 1/8 inch from the filter paper. The sample stream is then routed, by way of the plumbing contained internal to the monitor skid, to the activated charcoal cartridge, equipped with a gamma scintillator which is located approximately 0.25 inches from the "Iodine" cartridge. The sample is then routed to the Noble Gas sample chamber where another beta scintillation detector responds to the beta decay energies for the fission gas products.

This system is presently designed with a three, one-out-of-one, alarm logic to actuate the CREATS filtration train. The Particulate monitor and the Noble Gas monitor have each spuriously alarmed numerous times as the result of a combination of elevated naturally occurring Radon (during temperature inversions), electrical noise in the circuitry, and a conservative alarm setpoint. The elevated naturally occurring Radon level artificially "raises" the background to values approaching the alarm setting of the Particulate monitor. As a result of this increased background count rate, any small perturbation in the AC voltage (spikes) causes this monitor to actuate the CREATS system.

The new proposed GM tube intake monitors will not be affected to the same degree as the current system, as there will be no filter medium to collect and concentrate the naturally occurring Radon. This renders the new monitors much less susceptible to alarming as the result of the naturally occurring Radon. The detectors will, however, respond to a wide range of gamma energies.

The new in-duct GM tube probes are essentially area monitors. They will respond to the gamma energy spectrum contained in the postulated incoming accident cloud being drawn into the control room ventilation plenum. The individual detector assemblies of the current control room monitor skid have to collect and detect sufficient radioactivity (particulate, iodine, and gas), specific to the detectors to cause an alarm. An area monitor style detector sums all the forms of the radioactivity into a dose rate response. The use of two probes will provide for redundancy and the safety related power supplies will provide for increased reliability. These safety related power supplies are addressed under ITS LCO 3.8.7 and 3.8.8.

The Nominal Trip Setpoints for the current individual detectors of the Control Room Intake Monitor, as contained in ITS Table 3.3.6-1, are conservatively based on the 10 CFR 20, App. B, limits that were in effect prior to 1993. The 10 CFR 20 limits were revised in 1993 to be in accordance with international regulation found in ICRP Publication 26/30 (References 7 and 8) and the allowable concentrations of a number of isotopes increased, which in effect resulted in the Ginna Nominal Trip Setpoints becoming more conservative. The proposed Allowable Value of the setpoint for the new monitors is based on a correlation to the limit specified in 10 CFR 50, Appendix A, GDC 19 and the guidance provided by the NRC in NUREG-0737 (Reference 1) section II.B.2, Dose Rate Criteria, and NUREG-0800 (Reference 9) section 6.4, Control Room Habitability Program. This is a maximum of 5 rem body dose, with a 30 day weighted average dose rate of less than 15 mr/hr. The Allowable Value is calculated in accordance with the Ginna Station Setpoint Verification Program (Enclosures 1 and 2) and will provide for isolation of the control room ventilation system which will prevent exceeding these limits. The Nominal Trip Setpoint will be contained within plant procedures and be conservatively adjusted to provide margin to the Allowable Value.

The current control room accident dose calculations (as described in the Ginna UFSAR), for which the limits as discussed above are met following a postulated loss-of-coolant-accident, conservatively assume that the cloud released during the accident enters the control room envelope for 30 seconds prior to ventilation system isolation. The proposed change in Control Room Intake Monitor design and setpoints will not invalidate this assumption as the response time of the new monitors to a release is bounded by the time used in the analyses (Enclosure 2).

C.3 Administrative

A.1 Table 3.3.6-1, is changed to replace the "Trip Setpoint" column title with "Allowable Value." This title change is consistent with NUREG-1431, the Ginna Station Setpoint Verification Program, and previous discussions with NRC staff (Reference 6). It also provides consistent terminology for instrumentation requirements within the ITS with the "Allowable Value" providing a clearly defined basis for operability.

There are no relocated (R) changes associated with this LAR.

D. REFERENCES

1. NUREG-0737 Clarification of TMI Action Plan Requirements

2. Letter from John E. Maier (RG&E) to Dennis M. Crutchfield (NRC), "NUREG-0737 Requirements", Docket No. 50-244, September 4, 1981.

3. Letter from Dennis M. Crutchfield (NRC) to John E. Maier (RG&E), "NUREG-0737, ITEM III.D.3.4, CONTROL ROOM HABITABILITY R. E. Ginna Nuclear Power Plant", April 11, 1983.

4. NUREG-1431 Rev.1, Standard Technical Specifications for Westinghouse Plants

5. License Event Report (LER) 1998-003, Revision 2, Actuations of Control Room Emergency Air Treatment System Due to Invalid Causes.

6. Letter to file from Guy S. Vissing (NRC), Summary of Meeting with Representatives of Rochester Gas and Electric Corporation (RG&E) July 9, 1998, Concerning a Proposed Change in the Engineered Safeguards Features Actuation System Instrumentation Technical Specifications Chapter 3.3 (Tac No. MA23), dated August 7, 1999.

7. International Commission on Radiological Protection. Recommendations of the International Commission on Radiation Protection, ICRP Publication 26; 1977.

8. International Commission on Radiological Protection. Limits on Intakes of Radionuclides by Workers, ICRP Publication 30; 1989.

9. NUREG-0800, Standard Review Plan

Attachment II
R.E. Ginna Nuclear Power Plant

No Significant Hazards Consideration Evaluation

The proposed changes to the Ginna Station Improved Technical Specifications as identified in Attachment I Section A and justified by Section C have been evaluated with respect to 10 CFR 50.92(c) and shown not to involve a significant hazards consideration as described below. This attachment is organized based on Attachment I Section C.

Evaluation of More Restrictive Changes

The more restrictive change associated with amending LCO 3.3.6 to add a requirement to immediately place the Control Room Emergency Air Treatment System (CREATS) in the emergency mode of operation upon the loss of two channels/trains of Radiation Monitors, Manual Initiation, or Automatic Actuation Logic and Actuation Relays, does not involve a significant hazards consideration as discussed below:

1) Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The change adds a conservative requirement for actions to be taken when there is a loss of function of the CREATS actuation instrumentation. This does not increase the probability of an accident previously evaluated since the CREATS actuation itself is not an accident initiator. The proposed change is consistent with the guidance of NUREG-1431 and provides assurance that the CREATS is in the conservative mode of operation for a response to an accident. Therefore, the probability or consequences of an accident previously evaluated is not significantly increased.

2) Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change for a new Required Action does not of itself involve a physical alteration of the plant or change in the methods governing normal plant operation, only in the required completion time. The change only involves implementing a conservative action upon loss of operability the CREATS actuation instrumentation. Therefore, the possibility for a new or different kind of accident from any accident previously evaluated is not created.

3) Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change requires placing the CREATS in the conservative mode of operation for a response to an accident. The change adds conservatism as determined by the guidance of NUREG-1431. Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the preceding information, it has been determined that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed change meets the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

The more restrictive change associated with amending the surveillance requirements for LCO 3.3.6 to add a requirement to perform a CHANNEL CHECK of the Control Room Radiation Intake Monitor once every 12 hours does not involve a significant hazards consideration as discussed below:

1) Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The change adds a requirement to perform a CHANNEL CHECK of the Control Room Radiation Intake Monitors once every 12 hours. This does not increase the probability of an accident previously evaluated since the surveillance is only a visual verification of the state of the radiation monitors and the monitors themselves are not an accident initiator. The proposed surveillance is based on the NUREG-1431 guidance and gives a higher assurance that the radiation monitors are operable. Therefore, the probability or consequences of an accident previously evaluated is not significantly increased.

2) Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change for a new surveillance does not of itself involve a physical alteration of the plant (i.e. no new or different type of equipment will be added to perform the actual surveillance) or changes in the methods governing normal plant operation. The change only involves implementing a conservative visual determination of the operability of the Control Room Radiation Intake Monitor. Therefore, the possibility for a new or different kind of accident from any accident previously evaluated is not created.

3) Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change only adds a visual surveillance of the Control Room Radiation Intake Monitor. The surveillance adds conservatism as determined by the guidance of NUREG-1431. Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the preceding information, it has been determined that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed change meets the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

The more restrictive changes associated with amending Table 3.3.6-1 to increase the number of trains of Manual Initiation, and Automatic Actuation Logic and Actuation Relays, from one train to two trains does not involve a significant hazards consideration as discussed below:

1) Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The change adds a requirement for redundancy in the actuation circuitry for the Control Room Emergency Air Treatment System (CREATS). This does not increase the probability of an accident previously evaluated since the CREATS actuation instrumentation themselves are not an accident initiator. The proposed change is based on the NUREG-1431 guidance and gives a higher assurance that the CREATS actuation instrumentation is operable. Therefore, the probability or consequences of an accident previously evaluated is not significantly increased.

2) Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change affects the number actuation trains required to initiate a Control Room Emergency Air Treatment System isolation following an event. All design and performance criteria will continue to be met and no new single failure mechanisms have been created. The change only involves providing increased redundancy. Therefore, the possibility for a new or different kind of accident from any accident previously evaluated is not created.

3) Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change adds a requirement for increased redundancy. The change adds conservatism as determined by the guidance of NUREG-1431. Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the preceding information, it has been determined that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed change meets the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

Evaluation of Less Restrictive Changes

The less restrictive change associated with amending the Completion Time of the Required Action of LCO 3.3.6, for a loss of one channel/train of Radiation Monitors, Manual Initiation, or Automatic Actuation Logic and Actuation Relays, from 1 hour to 7 days does not involve a significant hazards consideration as discussed below:

1) Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The change is the result of the proposed installation of redundant channels/trains for the radiation monitors, manual initiation trains, and automatic actuation logic trains. This does not increase the probability of an accident previously evaluated since the CREATS actuation itself is not an accident initiator. The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining channel/train to provide the required capability. The proposed change is consistent with the guidance of NUREG-1431. Therefore, the probability or consequences of an accident previously evaluated is not significantly increased.

2) Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change to extend the allowed time that a single channel/train may be inoperable is not of itself an accident initiator. Therefore, the possibility for a new or different kind of accident from any accident previously evaluated is not created.

3) Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change is the result of a proposed modification to the facility which will improve redundancy and therefore allow for an extended completion time. The change is consistent with the guidance of NUREG-1431. Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the preceding information, it has been determined that the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed change meets the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

The less restrictive change associated with amending Table 3.3.6-1 to remove reference to the Iodine, Noble Gas, and Particulate Control Room Radiation Intake Monitors and to add reference to the two new Geiger-Mueller (GM) tube intake monitors, with revised setpoints, does not involve a significant hazards consideration as discussed below:

1) Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The proposed change to replace the current Control Room Radiation Intake Monitor requirement for three diverse radiation monitors with a requirement for two redundant monitors does not affect the probability of an accident as the Control Room Radiation Intake Monitors in and of themselves, have no failure modes or effects which are precursors to accidents. The proposed change does not introduce any new failure modes or effects to any other system or component which is a precursor to an accident. The new monitors with revised setpoints will provide a fast and dependable monitoring system as this style of monitor is not limited by any moving parts or sampling delay time to accomplish its monitoring function. The use of two probes will provide for redundancy, in lieu of the diversity within the current system, and the safety related power supplies will provide for increased reliability. The new monitors still provide rapid post accident detection capability prior to the buildup of significant radioactivity levels inside the Ginna Station control room. Therefore, the probability or consequences of an accident previously evaluated is not significantly increased.

2) Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change affects the number and type of monitors and actuation setpoint utilized to initiate a Control Room Emergency Air Treatment System isolation following an accident. All design and performance criteria will continue to be met and no new single failure mechanisms have been created, as proper separation will be provided. The monitors will be powered from separate safety related sources. The proposed change creates no new functional inter-actions with existing plant equipment nor does it introduce any new failure modes or mechanisms which could lead to reactor core damage or fission product release. Therefore, because the change does not affect any system that can act as an accident precursor, the possibility for a new or different kind of accident from any accident previously evaluated is not created.

3) Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change provides a commensurate level of protection for the control room and provides a more reliable and redundant system. The radiation monitor response time and isolation damper closure time, utilizing the revised setpoints, will continue to be met and the new monitors will respond to the gamma energy spectrum contained in the postulated incoming accident cloud being drawn into the control room ventilation plenum. Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the preceding information, it has been determined that the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed changes meet the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

Evaluation of Administrative Change

The less restrictive change associated with amending Table 3.3.6-1 to replace the column heading "Trip Setpoint" with "Allowable Value" does not involve a significant hazards consideration as discussed below:

1. Operation of Ginna Station in accordance with the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated. The proposed change only revises the title of the column used for the operability limit. As such, this change is administrative in nature and does not impact initiators or analyzed events or assumed mitigation of accident or transient events. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously analyzed.

2. Operation of Ginna Station in accordance with the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change does not involve a physical alteration of the plant (i.e., no new or different type of equipment will be installed) or change in the methods governing normal plant operation. The proposed changes will not impose any new or different requirements. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Operation of Ginna Station in accordance with the proposed change does not involve a significant reduction in a margin of safety. The proposed change will not reduce a margin of plant safety because the change involves only a title change and the operability limit is still maintained. This change is administrative in nature. As such, no question of safety is involved, and the change does not involve a significant reduction in a margin of safety.

Based upon the above information, it has been determined that the proposed administrative changes to the Ginna Station Technical Specifications do not involve a significant increase in the probability or consequences of an accident previously evaluated, does not create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed changes meet the requirements of 10 CFR 50.92(c) and do not involve a significant hazards consideration.

Attachment III
R.E. Ginna Nuclear Power Plant

Environmental Impact Consideration Determination

RG&E has evaluated the proposed changes and determined that:

1. The changes do not involve a significant hazards consideration as documented in Attachment II; and

2. The changes do not involve a significant change in the types or significant increase in the amounts of any effluent that may be released offsite since no specifications related to offsite releases are affected; and

3. The changes do not involve a significant increase in individual or cumulative occupational radiation exposure since the different type of equipment being installed provides a commensurate level of protection.

Accordingly, the proposed changes meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed changes is not required.

Attachment IV
R.E. Ginna Nuclear Power Plant

Proposed Revised R.E. Ginna Nuclear Power Plant
Improved Technical Specifications

Included pages:

3.3-41
3.3-42
3.3-43
3.3-44
B 3.3.6-1 *
B 3.3.6-2 *
B 3.3.6-3 *
B 3.3.6-4 *
B 3.3.6-5 *

* These bases pages are being provided for information only to show the changes that RG&E intends to make following approval of the LAR. The bases are under RG&E control for all changes in accordance with Specification 5.5.13. RG&E requests that the NRC document acceptance of these bases changes in the SER.

3.3 INSTRUMENTATION

3.3.6 Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation

LCO 3.3.6 The CREATS actuation instrumentation for each Function in Table 3.3.6-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4,
During movement of irradiated fuel assemblies,
During CORE ALTERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel inoperable. (or train)	A.1 --------NOTE-------- The control room may be unisolated for ≤ 1 hour every 24 hours while in this condition. ---------- Place CREATS in Mode F.	7 days (1 hour)
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, 3, or 4. (or B) (C.)	B.1 Be in MODE 3. (C) AND B.2 Be in MODE 5. (C)	6 hours 36 hours

(continued)

B. see next page

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies or during CORE ALTERATIONS. or B	C.1 Suspend CORE ALTERATIONS. D AND C.2 Suspend movement of irradiated fuel assemblies. D	Immediately Immediately

M.1

B. One or more Functions with two channels or two trains inoperable.	B.1 ---- NOTE ---- The control room may be unisolated for ≤ 1 hour every 24 hours while in this condition ---------- Place CREATS in Mode F.	 Immediately

SURVEILLANCE REQUIREMENTS

----------NOTE----------
Refer to Table 3.3.6-1 to determine which SRs apply for each CREATS Actuation Function.

SURVEILLANCE	FREQUENCY
SR 3.3.6.1 Perform COT.	92 days
SR 3.3.6.2 ----------NOTE---------- Verification of setpoint is not required. ---------- Perform TADOT.	24 months
SR 3.3.6.3 Perform CHANNEL CALIBRATION.	24 months
SR 3.3.6.4 Perform ACTUATION LOGIC TEST.	24 months

M.2

SR 3.3.6.1 Perform CHANNEL CHECK. 12 hours

Table 3.3.6-1 (page 1 of 1)
CREATS Actuation Instrumentation

A.1

FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT / ALLOWABLE VALUE
1. Manual Initiation	(2) (1) train (5)	SR 3.3.6 (2) (3)	NA
2. Automatic Actuation Logic and Actuation Relays	(2) (1) train (5)	SR 3.3.6 (4) (5)	NA
3. Control Room Radiation Intake Monitor (5)	(2)	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.4	≤ .5 mR/hr
a. Iodine	1	SR 3.3.6.1 SR 3.3.6.3	≤ 9 x 10^{-9} µCi/cc
b. Noble Gas	1	SR 3.3.6.1 SR 3.3.6.3	≤ 1 x 10^{-5} µCi/cc
c. Particulate	1	SR 3.3.6.1 SR 3.3.6.3	≤ 1 x 10^{-8} µCi/cc

M.3

L.2

B 3.3 INSTRUMENTATION

B 3.3.6 Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation

BASES

BACKGROUND

The CREATS provides a protected environment from which operators can control the plant following an uncontrolled release of radioactivity. This system is described in the Bases for LCO 3.7.9, "Control Room Emergency Air Treatment System (CREATS)." This LCO only addresses the actuation instrumentation for the high radiation state CREATS Mode F.

two GM probe radiation monitors installed in the outside air intake for the Control Room Ventilation system.

The high radiation state CREATS Mode F actuation instrumentation consists of noble gas (R-36), particulate (R-37), and iodine (R-38) radiation monitors. These detectors are located on the operating level on the Turbine Building and utilize a common air supply pump. A high radiation signal from any of these detectors will initiate the CREATS filtration train and isolate each air supply path with two dampers. The control room operator can also initiate the CREATS filtration train and isolate the air supply paths by using a manual pushbutton in the control room.

either

either of two handswitches

APPLICABLE SAFETY ANALYSES

The location of components and CREATS related ducting within the control room emergency zone envelope ensures an adequate supply of filtered air to all areas requiring access. The CREATS provides airborne radiological protection for the control room operators in MODES 1, 2, 3, and 4, as demonstrated by the control room accident dose analyses for the most limiting design basis loss of coolant accident and steam generator tube rupture (Ref. 1). This analysis shows that with credit for the CREATS, or with credit for instantaneous isolation of the control room coincident with the accident initiator and no CREATS filtration train available, the dose rates to control room personnel remain within GDC 19 limits.

Insert 1

During movement of irradiated fuel assemblies or during CORE ALTERATIONS, the CREATS ensures control room habitability in the event of a fuel handling accident. It has been demonstrated that the CREATS is not required in the event of a waste gas decay tank rupture (Ref. 2).

The CREATS Actuation Instrumentation satisfies Criterion 3 of the NRC Policy Statement.

LCO

The LCO requirements ensure that instrumentation necessary to initiate the CREATS is OPERABLE.

1. Manual Initiation

The LCO requires one train to be OPERABLE. The train consists of one pushbutton and the interconnecting wiring to the actuation logic. The operator can initiate the CREATS Filtration train at any time by using a pushbutton in the control room. This action will cause actuation of all components in the same manner as any of the automatic actuation signals required by this LCO.

2. Automatic Actuation Logic and Actuation Relays

The LCO requires one train of Actuation Logic and Actuation Relays to be OPERABLE. Actuation logic consists of all circuitry associated with manual initiation and Control Room Intake Monitors within the actuation system, including the initiation relay contacts responsible for actuating the CREATS.

3. Control Room Radiation Intake Monitor

The LCO specifies single channels of iodine (R-38), noble gas (R-36), and particulate (R-37) of the Control Room Intake Monitors to ensure that the radiation monitoring instrumentation necessary to initiate the CREATS filtration train and isolation dampers remains OPERABLE.

Insert 2 →

APPLICABILITY

In MODES 1, 2, 3, and 4, the CREATS actuation instrumentation must be OPERABLE to control operator exposure during and following a Design Basis Accident.

During movement of irradiated fuel assemblies or during CORE ALTERATIONS, the CREATS actuation instrumentation must be OPERABLE to cope with the release from a fuel handling accident.

ACTIONS

The most common cause of channel inoperability is failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific calibration procedures. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a COT, when the process instrumentation is set up for adjustment to Nominal bring it within specification. The "as left" Trip Setpoint must be within the tolerance specified by the calibration procedure. If the "as found" Trip Allowable Value Setpoint exceeds the limits specified in Table 3.3.6-1, the channel must be declared inoperable immediately and the appropriate Condition entered.

A Note has been added to the ACTIONS indicating that separate Condition entry is allowed for each Function. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.6-1 in the accompanying LCO. The Completion Time(s) of the inoperable channel/train of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A applies to one or more Functions with one channel of the CREATS actuation instrumentation inoperable.

Insert 3

If one or more radiation monitor channels, the manual initiation train, or the automatic actuation logic train is inoperable, action must be taken to restore OPERABLE status within 1 hour or isolate the control room from outside air. In this Condition for the manual initiation train inoperable or a radiation monitor channel inoperable, the remaining CREATS actuation instrumentation is adequate to perform the control room protection function but the actuation time or responsiveness of the CREATS may be affected. In this Condition for the automatic actuation logic train inoperable or all radiation monitor channels inoperable, the CREATS is not capable of performing its intended automatic function. This is considered a loss of safety function. The CREATS, however, may still be capable of being placed in CREATS Mode F by manual operator actions. The 1 hour Completion Time is based on the low probability of a DBA occurring during this time frame, and the ability of the CREATS dampers to automatically isolate the control room or be manually isolated by the operator.

The Required Action for Condition A is modified by a Note which allows the control room to be unisolated for ≤ 1 hour every 24 hours. This allows fresh air makeup to improve the working environment within the control room and is acceptable based on the low probability of a DBA occurring during this makeup period.

Insert 4 →

B.1 and B.2

Condition B applies when the Required Action and associated Completion Time of Condition A has not been met and the plant is in MODE 1, 2, 3, or 4.The plant must be brought to a MODE that minimizes accident risk. To achieve this status, the plant must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

Condition C applies when the Required Action and associated Completion Time of Condition A has not been met during movement of irradiated fuel assemblies or during CORE ALTERATIONS. Movement of irradiated fuel assemblies and CORE ALTERATIONS must be suspended immediately to reduce the risk of accidents that would require CREATS actuation. This places the plant in a condition that minimizes risk. This does not preclude movement of fuel or other components to a safe position.

SURVEILLANCE REQUIREMENTS

A Note has been added to the SR Table to clarify that Table 3.3.6-1 determines which SRs apply to which CREATS Actuation Functions.

Insert 5

SR 3.3.6.1

This SR is the performance of a COT once every 92 days on each required channel to ensure the entire channel will perform the intended function. This test verifies the capability of the instrumentation to provide the automatic CREATS actuation. The setpoints shall be left consistent with the plant specific calibration procedure tolerance. The Frequency of 92 days is based on the known reliability of the monitoring equipment and has been shown to be acceptable through operating experience.

SR 3.3.6.2

This SR is the performance of a TADOT of the Manual Initiation Function every 24 months. The Manual Initiation Function is tested up to, and including, the master relay coils.

The Frequency of 24 months is based on the known reliability of the Function and the redundancy available, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that excludes verification of setpoints because the Manual Initiation Function has no setpoints.

SR 3.3.6.3 (4)

This SR is the performance of a CHANNEL CALIBRATION every 24 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

The Frequency of 24 months is based on operating experience and is consistent with the typical industry refueling cycle.

SR 3.3.6.4 (5)

This SR is the performance of an ACTUATION LOGIC TEST. All possible logic combinations are tested for the CREATS actuation instrumentation. In addition, the master relay is tested for continuity. This verifies that the logic modules are OPERABLE and there is an intact voltage signal path to the master relay coils. This test is acceptable based on instrument reliability and operating experience.

REFERENCES

1. UFSAR, Section 6.4.

2. Letter from Robert C. Mecredy, RG&E, to Guy S. Vissing, NRC, Subject: Application for Amendment to Facility Operating License Control Room Emergency Air Treatment System CREATS Applicability Change (LCO 3.3.6 and LCO 3.7.9), dated July 21, 2000.

IMPROVED TECHNICAL SPECIFICATION BASES INSERTS

Insert 1

The Allowable Value for the Control Room Radiation Intake Monitors is based on a correlation to the limit specified in 10 CFR 50, Appendix A, GDC 19 and the guidance provided by the NRC in NUREG-0737 section ll.B.2, Dose Rate Criteria, and NUREG-0800 section 6.4, Control Room Habitability Program. This is a maximum of 5 rem body dose, with a 30 day weighted average dose rate of less than 15 mr/hr. This allowable value is calculated in accordance with the Ginna Station Setpoint Verification Program and will provide for isolation of the control room ventilation system which will prevent exceeding these limits. The current control room accident dose calculations conservatively assume that the cloud released during the accident enters the control room envelope for 30 seconds prior to ventilation system isolation. The response time of the Control Room Intake Monitors to an actual release is bounded by the time used in the analyses.

Insert 2

The Nominal Trip Setpoint used in the Control Room Radiation Intake Monitors is based on the Allowable Value specified in Table 3.3.6-1. The selection of this trip setpoint is such that adequate protection is provided when all sensor and processing time delays, calibration tolerances, instrumentation uncertainties, and instrument drift are taken into account. The Nominal Trip Setpoint specified in plant procedures is therefore conservatively adjusted with respect to the Analytical Limit. If the measured setpoint exceeds the procedural tolerances of the Nominal Trip Setpoint value, the setpoint is considered OPERABLE unless the Allowable Value as specified in Table 3.3.6-1 is exceeded. The Nominal Trip Setpoint specified in the plant procedures bounds the Allowable Value.

Insert 3

If one radiation monitor channel, one manual initiation train, or one automatic actuation logic train is inoperable, 7 days are permitted to restore it to OPERABLE status. In this condition the remaining redundant OPERABLE channel/train is adequate to perform the control room protection function. However, the overall reliability is reduced because a single failure in the OPERABLE channel/train could result in a loss of function. The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining channel/train to provide the required capability. If the channel/train cannot be restored to OPERABLE status, the CREATS must be placed in Mode F. This accomplishes the actuation instrumentation function and places the system in a conservative mode of operation.

Insert 4

B.1

Condition B applies to the failure of two radiation monitor channels, two manual initiation trains, or two automatic actuation logic trains. In this Condition the CREATS actuation instrumentation is not capable of performing its intended automatic function. This is considered a loss of safety function. The Required Action is to place the CREATS in Mode F immediately. This accomplishes the actuation instrumentation function that may have been lost and places the system in a conservative mode of operation.

The Required Action for Condition B is modified by a Note which allows the control room to be unisolated for $\leq$ 1 hour every 24 hours. This allows fresh air makeup to improve the working environment within the control room and is acceptable based on the low probability of a DBA occurring during this makeup period.

Insert 5

SR 3.3.6.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or of more serious instrument conditions. A CHANNEL CHECK will detect gross channel failure; thus, it is a verification that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Channel check acceptance criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency of 12 hours is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

Attachment V
R.E. Ginna Nuclear Power Plant

Proposed Revised R.E. Ginna Nuclear Power Plant
Improved Technical Specifications

Included pages:

3.3-41
3.3-42
3.3-43
3.3-44

3.3 INSTRUMENTATION

3.3.6 Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation

LCO 3.3.6 The CREATS actuation instrumentation for each Function in Table 3.3.6-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4,
During movement of irradiated fuel assemblies,
During CORE ALTERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel or train inoperable.	A.1 --------NOTE-------- The control room may be unisolated for ≤ 1 hour every 24 hours while in this condition. ---------- Place CREATS in Mode F.	7 days
B. One or more Functions with two channels or two trains inoperable.	B.1 --------NOTE-------- The control room may be unisolated for ≤ 1 hour every 24 hours while in this condition. ---------- Place CREATS in Mode F.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 5.	36 hours
D. Required Action and associated Completion Time of Condition A or B not met during movement of irradiated fuel assemblies or during CORE ALTERATIONS.	D.1	Suspend CORE ALTERATIONS.	Immediately
	AND		
	D.2	Suspend movement of irradiated fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

----------NOTE----------
Refer to Table 3.3.6-1 to determine which SRs apply for each CREATS Actuation Function.

	SURVEILLANCE	FREQUENCY
SR 3.3.6.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.6.2	Perform COT.	92 days
SR 3.3.6.3	----------NOTE---------- Verification of setpoint is not required. ---------- Perform TADOT.	24 months
SR 3.3.6.4	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.6.5	Perform ACTUATION LOGIC TEST.	24 months

Table 3.3.6-1 (page 1 of 1)
CREATS Actuation Instrumentation

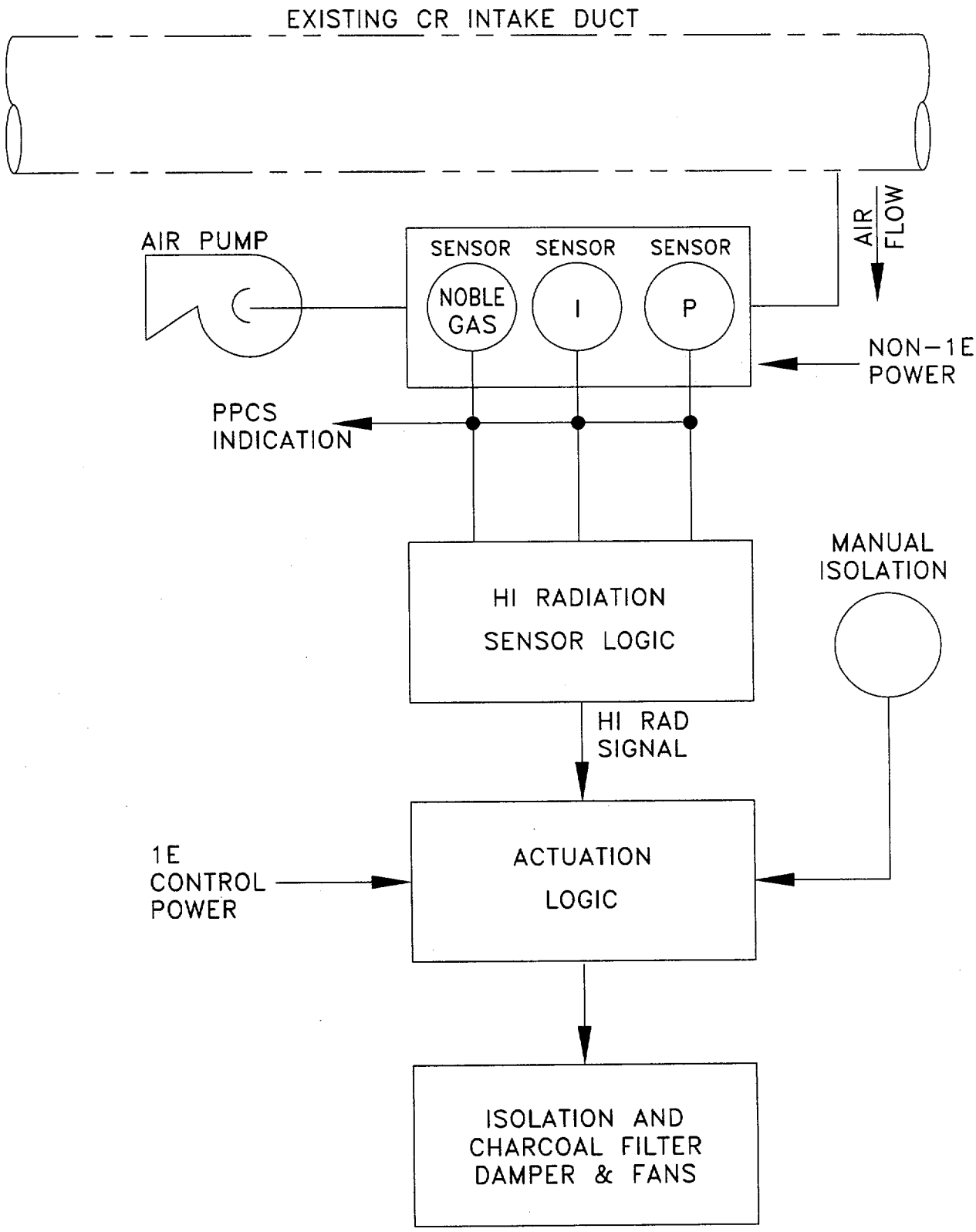
	FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1.	Manual Initiation	2 trains	SR 3.3.6.3	NA
2.	Automatic Actuation Logic and Actuation Relays	2 trains	SR 3.3.6.5	NA
3.	Control Room Radiation Intake Monitors	2	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.4	≤ .5 mR/hr

Attachment VI
R.E. Ginna Nuclear Power Plant

Simplified Diagrams of the Existing and Proposed System Design

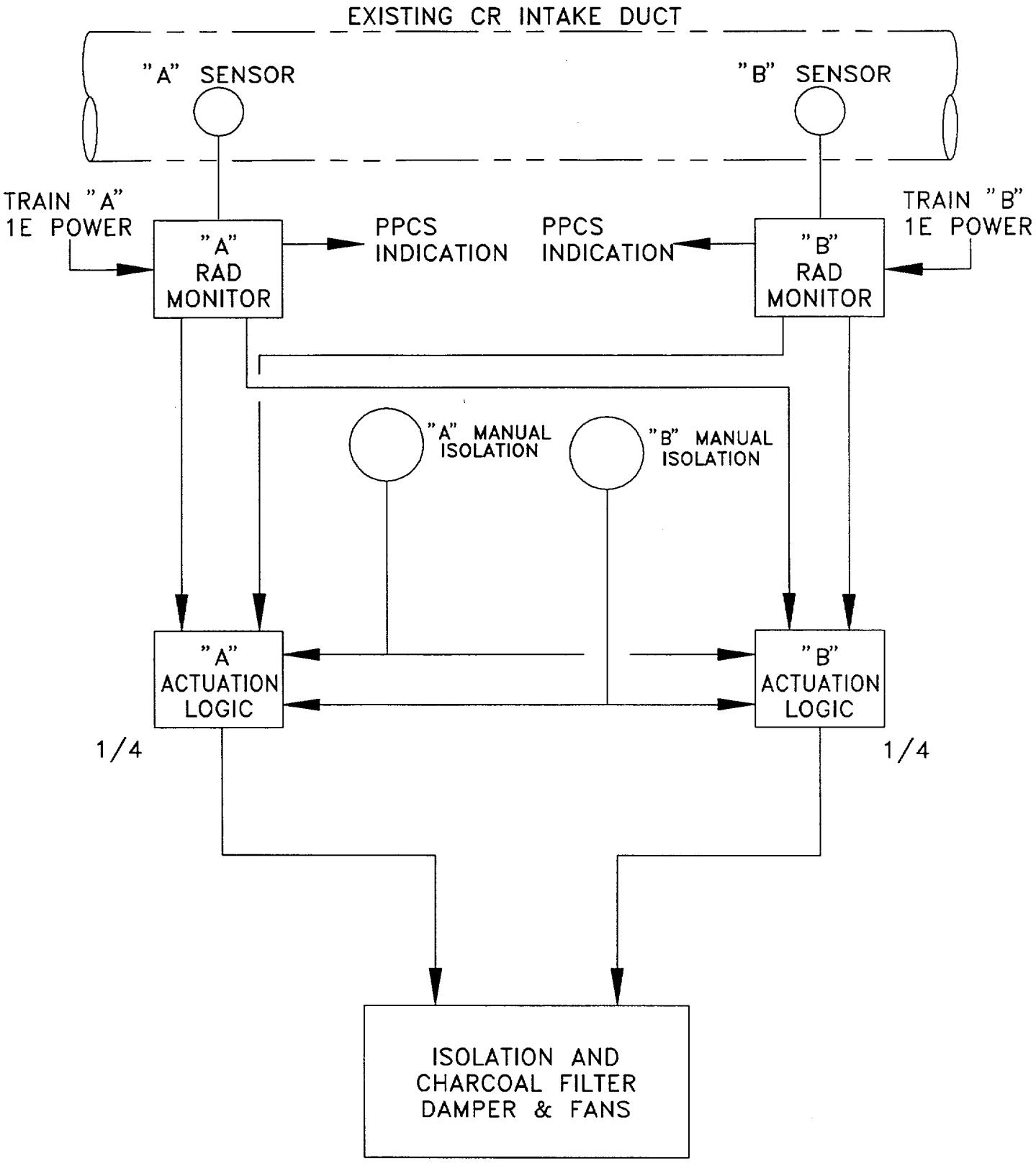
CR RADIATION INTAKE MONITORING INSTRUMENTATION

(EXISTING)



CR RADIATION INTAKE MONITORING INSTRUMENTATION

(PROPOSED)



Enclosure 1
R.E. Ginna Nuclear Power Plant

Design Analysis
Ginna Station

Instrument Loop Performance Evaluation
and Setpoint Verification

Instrument Loop Number RMS R45/R46

Rochester Gas and Electric Corporation
89 East Avenue
Rochester, New York 14649

DA-EE-2000-009
Revision 0
April 3, 2001

Prepared by: John R. Guinder	Design Engineer	4/3/2001 Date
Reviewed by: RW Elias	Reactor Engineering & Analysis	4/9/2001 Date
Reviewed by: Thomas Staley	Nuclear Safety & Licensing	4/30/01 Date
Approved by: James C. Jackson (APPROVED FOR CONSTRUCTION)	Independent Review Engineer	4/30/2001 Date

REVISION STATUS SHEET

REVISION	AFFECTED SECTIONS	DESCRIPTION OF REVISIONS
0	All	Initial issuance to support PCR 99-004

INSTRUMENT PERFORMANCE EVALUATION AND
SETPOINT VERIFICATION

TABLE OF CONTENTS

INSTRUMENT PERFORMANCE EVALUATION AND SETPOINT VERIFICATION

1.0 Purpose:

The purpose of this calculation is to document the overall loop uncertainty associated with the proposed control room ventilation system air intake radiation monitors R-45 and R-46, and to ensure that sufficient margin exists at the alarm setpoint. Since R-45 and R-46 are identical in design, R-45 will be discussed; however, this calculation applies to both loops. These monitors are being proposed by PCR 99-004 to replace the current R-36, R-37, and R-38.

2.0 Conclusions:

The calculated uncertainties of ±36.8% for the indication and 37.7% for the alarm is acceptable to ensure proper indication and alarm functions and to ensure that control room ventilation isolation occurs prior to exceeding the proposed Improved Technical Specification limit.

3.0 Design Inputs:

3.1 Victoreen (Inovision), Installation Operation, and Maintenance Instruction Manual, Model 955A, Part No. 955A-1, published 5/96 by Victoreen (Inovision) Inc.

3.2 RG&E Drawing 33013-1867, Control Room HVAC.

3.3 PCR 99-004, Control Room Radiation Monitor Skid Replacement.

3.4 EE-171, Control Room Radiation Monitor Specification, 12/6/99.

3.5 RG&E drawing 33013-0721, Control Building Ventilation Duct New Outside supply.

3.6 Procedure P-9, Radiation Monitoring System.

3.7 RG&E sketch 33013-2656-1, RMS1, RMS2 and RMS3 Rack Layout.

3.8 RG&E sketch 33013-2787-1, Control Room Ventilation Instrument Locations, Instrument Panels and Conduit Layout.

3.9 Design Analysis, DA-EE-2001-013, Control Room Radiation Monitors Analytical Limit Calculation.

3.10 Victoreen (Inovision) procedure CAL848AD, Calibration Procedure for Model 848-8A 10 mCi Field Calibrator -- Digital, dated 3/2/01.

4.0 Referenced Documents:

4.1 Regulatory Guide 1.97, "Instrumentation for Light Water-Cooled Nuclear Plants to Assess Plant and Environs Conditions During and Following an Accident", (Rev. 3, Dated 5/83).

4.2 RG&E Drawing 10905-384, Elementary Wiring Diagram Annunciator Panel E.

4.3 RG&E UFSAR, Sections 6.4.2, 6.4.5, 11.5.2, and Table 3.11-1 Environmental Service Conditions for Equipment Designed to Mitigate Design Basis Events.

4.4 Improved Technical Specifications, R.E. Ginna Nuclear Power Plant, Section 3.3.6 and Table 3.3.6-1.

4.5 Procedure CH-RETS-RMS, RMS Monitor Setpoint Determination.

4.6 AR-E-11, Alarm Response Procedure, Control Room HVAC.

4.7 ANSI NB.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.

4.8 ODCM, Offsite Dose Calculation Manual.

4.9 Procedure CH-RETS-CAL-SPEC, Calibration of Victoreen (Inovision) RMS Detectors to Establish Alarm Setpoints.

4.10 Procedure EP-3-S-0505, Instrument Setpoint/Loop Accuracy Calculation Methodology.

4.11 ANSI N13.10-1974, Specification and Performance Of On-Site Instrumentation For Continuously Monitoring Radioactivity In Effluents.

4.12 ANSI N42.22-1995, American National Standard Traceability of Radioactive Sources.

5.0 Assumptions:

5.1 Victoreen (Inovision) reference accuracy specification for the detector is ±20% of actual dose (reading), ±1 digit (±1% of reading) for the digital display and ±3% of reading for the alarm setting.

Basis:

Reference Victoreen (Inovision) Model 897A series detector and Model 956A-201 Universal Digital Ratemeter specification sheets in Design Input 3.1.

5.2 The following inaccuracies were assumed:

Detector power supply effect is negligible.

Detector and monitor drift effects are assumed to ±10% of reading.

Basis:

The equipment operates within stated limits of performance specifications for the variations in external power supply voltage. The high voltage setting for optimal detector response is set at the mid point of the voltage plateau. This allows for variations in the detector dc supply voltage of at least ± 50 vdc with no significant change in the detector response. Normal variations in the regulated 120 VAC ±2% supply (MQ400E) will result in insignificant changes to the detector and UDR dc voltage levels. Therefore, the external power supply effect is considered negligible.

The detector is a GM tube which has negligible drift over a 30 month period and the monitor digital signal processing is inherently stable. Therefore, although the drift may be considered negligible, a 30 month drift value of ±10% of reading will conservatively be used.

5.3 The monitor (indication) M&TE error is conservatively estimated to be ±5.0%.

Basis:

M&TE equipment should be more accurate than the device being calibrated by a ratio of 4 to 1. The calibration of the system will be performed during normal conditions and the calibration tolerance for the displayed indication is ± 20% of the Cs 137 source strength. Plant calibration procedures normally require that the accuracy of the test equipment is four times greater than the accuracy of the equipment being calibrated (reference IP-MTE-1). It is assumed that the M&TE equipment used to calibrate the monitor has an accuracy equal to 1/4th of the calibration accuracy. Therefore, it is considered that the M&TE error of +5% of the reading for the meter is conservative.

5.4 The detector and monitor (ratemeter) temperature and radiation effects are negligible.

Basis:

The detector will be located in the control room ventilation duct, which per design input 3.2 has temperature limits of 2°F to 91°F. The vendor specification of -10°F to 122°F envelopes these limits. The monitor (ratemeter) will be located in the main control room where the normal temperature limits are 50°F to 104°F (normally 70-78°F). The vendor specification of 32°F to 122°F envelopes these limits also.

For a steam line break accident, the turbine building temperature may reach as high as 220°F (for 30 minutes), then is reduced to100°F within 3 hours (see section 7.3.3.2). Because of the high flow rate (2000 cfm) in the 42 inch ventilation duct and the relatively short duration that the turbine building temperature is greater than 100°F, there will be no significant increase in the internal duct temperature. Therefore, the detector will continue to operate below the vendor specified upper limit of 122°F.

It is assumed that control ventilation isolation will occur prior to any significant increase in radiation levels in the control room and therefore there will be no radiation effect on the monitor.

5.5 Insulation resistance error (cable leakage effect) is not applicable..

Basis

During harsh temperature and humidity conditions associated with a LOCA or HELB design basis accident, insulation resistance (current leakage) effects may induce signal current leakage. The cable that connects the detector to the monitor will not be exposed to a harsh environment during accident conditions. Therefore, abnormal environmental conditions due to an accident are not applicable to this function.

5.6 Indicator resolution is assumed to be negligible.

Basis

Indicator resolution is assumed to be $\pm$ 1 digit (least significant digit) per draft ISA-dTR67.04.03, "Indication Uncertainties and Their Relationship With Indicated Values". The least significant digit of the Victoreen (Inovision) model 956A-201 UDR is 1/100 mr/hr, and therefore will have a negligible effect on the overall uncertainty value of the indicated reading.

5.7 Indicator calibration tolerance is assumed to be $\pm$ 20% of reading, the alarm/control room HVAC isolation actuation tolerance is assumed to be $\pm$6% of setting.

Basis

A new calibration procedure will be developed for calibration of the monitor display and also for the alarm/control room HVAC isolation setting. The calibration procedure requirements for the indicator tolerance band will be +/-20% of the corrected Cs 137 source value, and for the alarm/control room HVAC isolation actuation the tolerance will be $\pm$6% of the alarm setting.

5.8 M&TE accuracy and drift uncertainty for the alarm are assumed to be $\pm$ 3% of setting.

Basis

The vendor does not specify a drift setting for the alarm setpoint. The alarm setpoint circuitry is part of the UDR (Universal Digital Ratemeter) and as such is expected to be inherently stable. The drift term will therefore be conservatively set equal to the vendor alarm reference accuracy of 3% of setting. The M&TE error effect is conservatively assumed to be equal to the reference accuracy for the alarm setting. This is considered reasonable because it is necessary for the M&TE equipment to be more accurate than the device being calibrated in order for the calibration to be effective. In addition, M&TE equipment is required to be more accurate than the device being calibrated by a factor of 4:1 unless otherwise justified.

5.9 The statistical accuracy of the indication is ±10% of reading.

Basis

During normal operation the "statistics" switch may be maintained in the 10% position. This causes the monitor to base the displayed radiation level on the (last) minimum number of counts that will ensure a "precision" of ±10% at 95% confidence. Therefore, the displayed radiation level will move after each update within an approximately 10% band around the "true" radiation level.

The total response time of the system to a step change in the radiation value is 60 seconds, due to the operation of the pulse counting algorithms. The detector radiation value displayed is the result of a rolling average of the latest 60, 1 second values, and is updated once per second. An alarm will be initiated within one second after the current rolling one minute average exceeds the alarm setpoint.

For a large radiation source term, as during a postulated Design Basis Accident, the effect of the statistical error and time averaging circuitry become negligible. The Control Room intake air gamma activity rises well above the level of the control room ventilation isolation setpoint in a very short period of time (Design Input 3.9).

5.10 Cs-137 reference source field calibrator has an uncertainty of ±10%.

Basis

Victoreen (Inovision) calibration procedure CAL848-8AD "Calibration Procedure for Model 848-8A 10 mCi Field Calibrator -- Digital" specifies an uncertainty of ±10% relative to actual dose rate for the Model 848-8A field calibrator.

5.11 The process measurement effects due to location of the detector will not negatively impact the calculation.

Basis

The detector location in the air duct will be such that there is adequate mixing of the sample. The measurement of the activity inside the duct is a representative sample of the actual activity such that isolation will occur before significant exposure can occur. The more centralized in the duct the detector is, the more accurate the reading. The input to this calculation assumes the most offset mounting location, at 28" to the end of the duct. Any location more centralized will result in a more conservative result. There is also a conservative assumption that only the activity within the air duct is being measured and no credit is taken for any activity outside the duct (at the detector location in the turbine building).

5.12 The energy dependence is ± 15% of the reading.

Basis

The response of a radiation detector is sensitive to the specific radionuclide present. Changes in the level of radiation flux incident upon the detector and the environment will cause changes in the detector response. Each type of detector has a different response to radiation of varying energies. The vendor specification sheet for this detector shows an energy dependence value of ± 15% of the reading.

5.13 The Analytical Limit for Control Room Ventilation isolation is 0 .96 mr/hr as read at the in-duct monitoring locations..

Basis

The Analytical Limit of the setpoint for the monitors is based on the limit in the Control Room specified in 10 CFR 50, Appendix A, GDC 19 and the guidance provided by the NRC in NUREG-0737 Clarification of TMI Action Plan Requirements section ll.B.2, Dose Rate Criteria, and NUREG-0800 Standard Review Plan section 6.4, Control Room Habitability Program. Areas that require continuous occupancy are to be designed for a maximum of 5 rem whole body dose, or its equivalent to any part of the body for the duration of the accident. This is further defined as a 30 day weighted average dose rate of less than 15 mrem/hr. Due to the reduced effective volume within the air duct as compared to the Control Room the Analytical Limit at the detector location must be lowered. Per reference 3.9 Design Analysis, this results in an Analytical Limit of 0.96 mr/hr.

5.14 The high alarm/control room ventilation isolation actuation setpoint shall be set high enough (greater than 10 times background) to prevent spurious alarms and undesired actuations of control room isolation.

Background radiation levels were measured at the control room air intake duct (at the detector location) and also at the roof air intake to the control room. All readings were less than 0.01 mr/hr, which is less than 1/10th of the high alarm/control room ventilation isolation actuation setpoint of 0.25 mr/hr.

R-45 Block Diagram

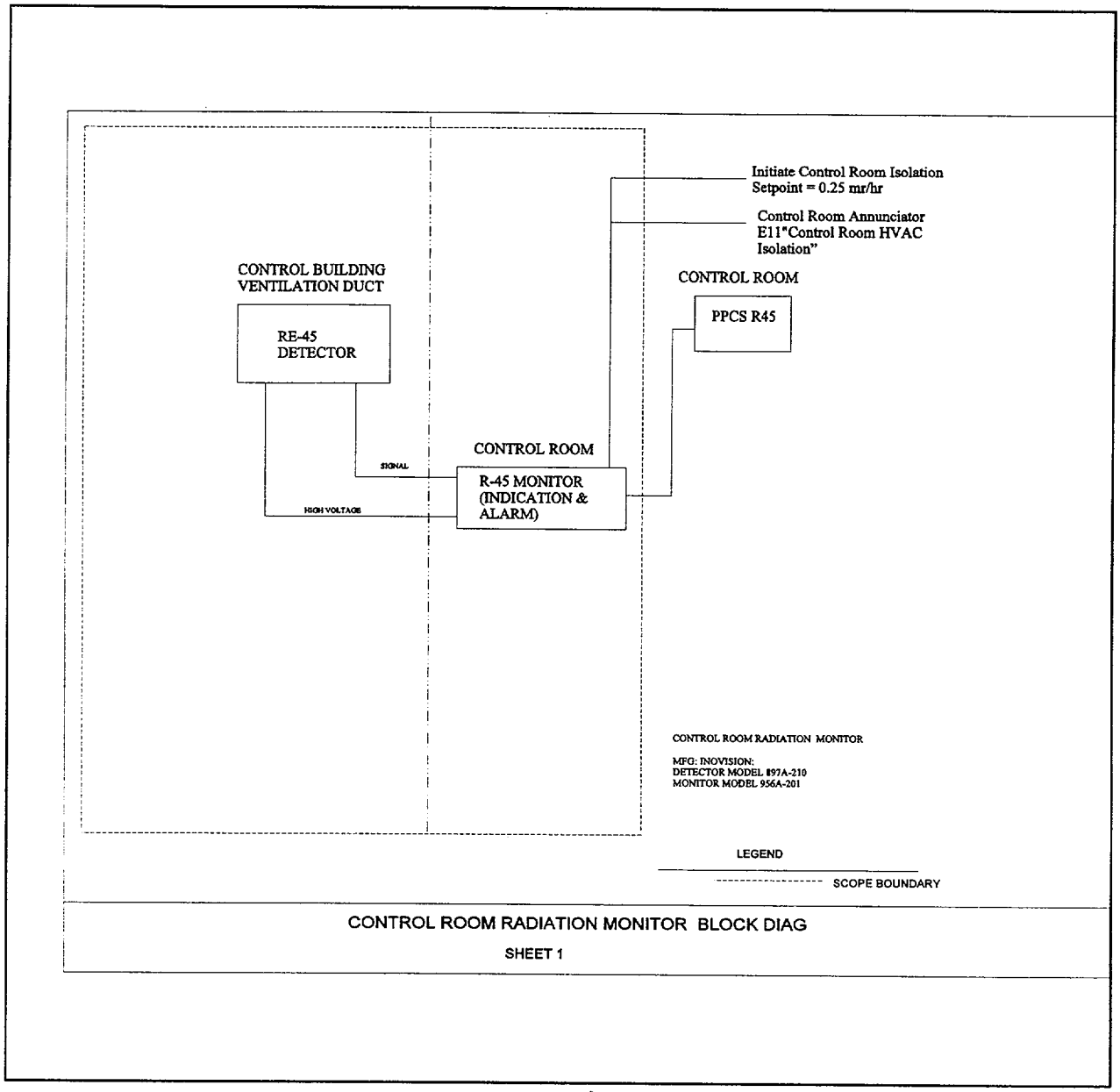


Figure 1

6.0 Computer Codes:

N/A

7.0 Analysis:

7.1 Instrument Channel and Scope of Analysis - Refer to Figure 1

7.1.1 Description of Functions

The Control Room Ventilation Radiation Monitoring System will consist of two redundant monitoring channels R-45 and R-46, which will provide information concerning the gamma radiation intensity within the ventilation stream of the control room supply air. Each channel will consist of a model 897A-210 Geiger-Muller (GM) tube detector with an integral preamplifier, and a model 956A-201 Universal Digital Ratemeter (UDR). The G-M tube is a halogen quenched aluminum encased device, sensitive to beta-gamma activity in the gas sample. The Victoreen (Inovision) monitor (ratemeter) converts the detector input (counts) into a mr/hr display. The ratemeter will output 1-5 vdc representative of the radiation level in mr/hr to the PPCS. It will also have a contact output that feeds the control room HVAC isolation and MCB Annunciator E11 circuitry. Alarm and control room ventilation isolation functions will occur when the high alarm/isolation setpoint is reached. The two channels are identical, therefore, further discussion will be on R-45, but will also be applicable to R-46.

7.1.2 Protection

This channel does not perform any (reactor) protective functions.

7.1.3 Control

This channel will generate an automatic control room ventilation isolation signal (isolating the Control Room HVAC) when the sensed radiation signal reaches the high alarm setpoint. Also, the charcoal filter fan will be started and the control room ventilation system dampers aligned to recirculate the control room air through the HEPA and charcoal filters.

7.1.4 Indication

RMS Channel R-45 will provide control room personnel with digital indication of the radiation level of the incoming air to the control room and a high radiation/control room HVAC isolation alarm (control room annunciator E11).

Summary of Instrument Channel Functions

Function	Description of Function	Safety Classification	Within this scope?
Reactor Protection	None	N/A	N/A
Eng. Safety Features	None	N/A	N/A
Control	Control Room Ventilation Isolation	Safety Related	YES
Alarm	Control Room Radiation	Safety-Related	YES
Indication	Control Room Radiation	Safety-Related	YES

7.2 Documenting the Components of Sensor Accident Uncertainty (AEUp and AEUs)

7.2.1 Pipe Breaks

N/A

7.2.2 Seismic Event

N/A

7.2.3 Documenting the Components of the Accident Current Leakage Effect (CLU)

During harsh temperature and humidity conditions associated with LOCA or HELB design basis accidents, insulation resistance effects induce signal current leakage. Abnormal environmental conditions due to an accident are not applicable to this function.

CLU = N/A

7.2.4 Determining the Components of Process Measurement Uncertainty (PMU)

The random nature of the radioactive decay process causes a statistical uncertainty in the detection process. These inherent fluctuations are random and approximately normally distributed. They represent an unavoidable source of uncertainty in all nuclear measurements, often resulting in the predominant source of imprecision of error. The statistical accuracy is $\pm$ 10% (Assumption 5.9).

$Pma_1 = \pm 10.0\%$

The energy dependence of the reading is ± 15% (Assumption 5.12).

$Pma_2 = \pm 15.0\%$

Victoreen (Inovision) calibration procedure CAL848-8AD "Calibration Procedure for Model 848-8A 10 mCi Field Calibrator -- Digital" specifies an uncertainty of ±10% relative to actual dose rate for the Model 848-8A field calibrator. (Assumption 5.10).

$Pma_3 = \pm 10.0\%$

7.3 Instrument Loop Performance Requirements

7.3.1 Documenting the Design Requirements for Monitoring the Process Parameter

7.3.1.1 Identify Performance Related Design Bases Associated With the Instrument Loop:

SR **Safety Classification (SR/SS/NS).**

NO **NUREG 0737/RG 1.97 as documented in Table 7.5-1, of the Ginna UFSAR**

Per a review of UFSAR Table 7.5-1, this instrument channel is not identified in RG 1.97 as being required as a post-accident monitoring instrument.

NO **EQ (per the 10 CFR 50.49 list)**

This instrument loop is not identified as requiring Environmental Qualification.

S1 **Seismic Category (Seismic Class I/ Structural Integrity Only / NS)**

YES **Technical Specifications**

The limits applicable to this instrument loop will be addressed in Section 3.3.6 of the Ginna Improved Technical Specifications.

YES **UFSAR**

This instrument will be described in Sections 6.4.2.2, 6.4.2.2.3, 6.4.5, and 11.5.2.2.16 of the Ginna UFSAR.

NO **EOP**

Per a review of the EOP Setpoint database, there are no EOP related setpoints covered by this analysis.

7.3.2 **Description of Limits**

Function	Analytical Limit	Reference
Control Room Isolation	.96 mr/hr	Design Input 3.9

7.3.3 **Documenting the Environmental Conditions Associated With the Process Parameter**

7.3.3.1 **Identification of the Sensor Location:**

Control room 42 inch diameter air intake duct, turbine building operating floor

7.3.3.2 **Description of Environmental Service Conditions for the Sensor:**

Normal Operation, Turbine Building

Reference 4.3, UFSAR Table 3.11-1.

Temperature: 50°F to 104°F
Pressure: Atmospheric
Humidity: 60% Nominal
Radiation: Negligible

The detector will be located in the Control room air intake duct, which per PCR 99-004, section 3.2.2 has the following ambient environmental limits: temperature limit of 2°F to 91°F, pressure at 0 psig, and 100% humidity.

During Calibration

Same as Normal Operation above.

Accident, Turbine Building

Reference 4.3, UFSAR Table 3.11-1.

Temperature: 220°F for 30 minutes, reduce to 100°F within 3 hours.
Pressure: 1.14 psig on mezzanine and basement levels, 0.7 psig on operating floor for 30 minutes, reduce to ambient 3 hours.
Humidity: 100%
Radiation: Negligible
Flooding: 18 inches in basement

7.3.3.3 **Identification of Other Components Locations:**

Instrument	Location
R-45 Monitor (Indicator) and alarm.	Control Room, Rack RMS2

7.3.3.4 **Description of Environmental Service Conditions for Other Components:**

Normal Operation, Main Control Room

Reference 4.3, UFSAR Table 3.11-1.

Temperature: 50°F to 104°F (usually 70 - 78°F)
Pressure: Atmospheric
Humidity: 60% Nominal
Radiation: Negligible

During Calibration

Same as Normal Operation Above.

Accident, Main Control Room

Reference 4.3, UFSAR Table 3.11-1.

Temperature: Less than 104°F
Pressure: Atmospheric
Humidity: 60% Nominal
Radiation: Negligible
Flooding N/A

7.4 Instrument Channel Component Specifications:

Identify and summarize the specifications associated with each instrument within the scope of this analysis. Complete one Instrument Specification Table for each instrument.

EIN: Readout Module R-45

Specification	Data	Source
Manufacturer/Model No	Victoreen (Inovision)/956A-201	Design Input 3.1
Input Range	digital pulse corresponding to 10E-2 to 10E+3 mr/hr	Design Input 3.1
Output Range	10E-2 to 10E+3 mr/hr indication	Design Input 3.1
Safety Classification	Safety-Related	Proposed
Setpoints	0.25 mr/hr	Proposed
Location	Control Room	Proposed
Accuracy	monitor $\pm$1 % of reading detector $\pm$20 % of reading	Assumption 5.1
Drift	$\pm$ 10.0% of reading	Assumption 5.2
Calibration Uncertainty (M&TE)	$\pm$ 5.0% of reading	Assumption 5.3
Calibration Tolerance	$\pm$ 20.0% of source value	Assumption 5.7
Temperature Effect	Negligible	Assumption 5.4

7.5 Determining the Indication Uncertainties

No logarithmic conversions take place between the detector signal and the ratemeter digital display or alarm circuit. Therefore, no calculations for converting from % of reading to equivalent linear full scale (ELFS) are required.

7.5.1 Process Measurement Uncertainty (PMU)

(reference section 7.2.4)

$$PMU = (Pma_1^2 + Pma_2^2 + Pma_3^2)^{1/2}$$

$$PMU = (10.0^2 + 15.0^2 + 10.0^2)^{1/2} = 20.6\%$$

7.5.2 Accident Environmental Uncertainties (AEU)

AEU = 0%

7.5.3 Accident Current Leakage Effect (CLU)

CLU = 0%

7.5.4 Calibration Uncertainties (M&TEU):

Per assumption 5.3, Measurement and Test Equipment Effect (M&TEU) is 5%.

$Ice_1 = \pm 5\%$

$M\&TEU = \pm[(Ice_1)^2]^{1/2}$

$M\&TEU = \pm[(5.0)^2]^{1/2}$

$M\&TEU = \pm 5.0\%$

7.5.5 Tolerance Uncertainty (TU):

The as left tolerance of the indicator is

$Ice_2 = \pm 20\%$

$TU = \pm[(Ice_2)^2]^{1/2}$

$TU = \pm[(20.0)^2]^{1/2}$

$TU = \pm 20.0\%$

7.5.6 Sensor Uncertainty (SU):

The sensor uncertainty is $\pm 20\%$ (Assumption 5.1)

$Sa = \pm 20\%$

$SU = \pm[(Sa)^2]^{1/2}$

$SU = \pm [(20.0)^2]^{1/2}$

$SU = \pm 20.0\%$

7.5.7 Drift Uncertainty (DU):

The drift uncertainty is assumed to be 10% (Assumption 5.2).

$Red_1 = \pm 10.0\%$

$DU = \pm[(Red_1)^2]^{1/2}$

$DU = \pm[(10.0)^2]^{1/2}$

$DU = 10.0\%$

7.5.8 Rack Equipment Uncertainty (REU):

Rack equipment uncertainty Rea_1 is 1.0% (Assumption 5.1)

$Rea_1 = \pm 1.0\%$

$REU = [(Rea_1)^2]^{1/2}$

$REU = \pm [(1.0)^2]^{1/2}$

$REU = \pm 1.0\%$

7.6 Calculating the Total Loop Uncertainties (Indication)

Provide the total loop uncertainty (TLU) for each end device for normal, seismic and accident conditions as applicable.

7.6.1 TLU Indicator

$TLU_I = \pm (PMU^2 + M\&TEU^2 + SU^2 + DU^2 + REU^2 + TU^2)^{1/2}$

$TLU_I = \pm (20.6^2 + 5.0^2 + 20.0^2 + 10.0^2 + 1.0^2 + 20.0^2)^{1/2}$

$TLU_I(+) = +36.8\%$ of reading

$TLU_I(-) = -36.8\%$ of reading

7.7 Determining Alarm Uncertainties

The alarm circuits are integral to the monitor. The additional parameters that must be taken into consideration for the determination of the alarm setting uncertainty are listed in the following table.

EIN: Readout Module R-45 Alarm Function

Specification	Data	Source
Accuracy	$\pm$ 3% of Setting	Design Input 3.1
Calibration Tolerance	$\pm$ 6% of Setting	Assumption 5.7
M&TE Accuracy	$\pm$ 3% of Setting	Assumption 5.8
Drift Uncertainty	$\pm$ 3% of Setting	Assumption 5.8

7.7.1 Calibration Uncertainties (M&TEU):

Alarm Measurement and Test Equipment Uncertainty

The M&TE error effect for calibrating the alarm is considered equal to the reference accuracy.

Amte = ± 3.0%

M&TEU = $\pm[(\text{Amte})^2]^{1/2}$

M&TEU = $\pm(3.0^2)^{1/2}$

M&TEU = ±3.0%

7.7.2 Tolerance Uncertainty (TU):

Alarm Calibration accuracy

The as left tolerance for the high alarm setpoint is ± 6.0% of setting.

Ace = ±6.0%

TU = $\pm$ $[(\text{Ace})^2]^{1/2}$

TU = $\pm$ $[(6.0\%)^2]^{1/2}$

TU = ±6.0%

7.7.3 Rack Equipment Uncertainty (REU):

Alarm reference accuracy = ±3% of setting

Are = ±3.0%

REU = $[(\text{Are})^2]^{1/2}$

REU = $\pm$ $[(3.0)^2]^{1/2}$

REU = $\pm$ 3.0%

7.7.4 Determining Drift Uncertainty (DU)

Red_2= $\pm$ 3.0%

DU = $\pm$ $[(\text{Red}_2)^2]^{1/2}$

DU = $\pm$ $[(3.0)^2]^{1/2}$

DU = $\pm$ 3.0%

7.8 Calculating the Total Loop Uncertainties (Alarm)

7.8.1 TLU Alarm

$TLU_A = \pm (TLU_I + M\&TEU^2 + + DU^2 + REU^2 + TU^2)^{1/2}$

$TLU_A = \pm (36.8^2 + 3.0^2 + 3.0^2 + 3.0^2 + 6.0^2)^{1/2}$

$TLU_A(+) = +37.7\%$ of setting

$TLU_A(-) = -37.7\%$ of setting

Where:

TLU_I = The Total Loop Uncertainty Indication
TLU_A = The Total Loop Uncertainty Alarm
CLU = Current Leakage Uncertainty
AEUs = Accident Environmental Uncertainty (Seismic)
PMU = Process Measurement Uncertainty
REU = Rack Equipment Uncertainty
SU = Sensor Uncertainty
DU = Drift Uncertainty
TU = Tolerance Uncertainty
IU = Indication Uncertainty
M&TEU= Measurement and Test Equipment Uncertainty

No distinction is made between Normal and Accident conditions for the Total Loop Uncertainty.

End Device	TLU
R-45 (Ind)	+/-36.8% of reading
R-45 (Alm)	+/-37.7% of setting

7.9 Comparing the Reference Accuracy vs. the Calibration Tolerance

Identify the calibration tolerance associated with each component. Next, obtain the reference accuracy associated with each component. Translate both effects into the equivalent units.

Tag No.	Reference Accuracy	Calibration Tolerance
R-45 (mon)	± 20% (Reading)	± 20 % of (Reading)
R-45 (Alm)	± 3% (Setting)	± 6.0% (Setting)

Reference accuracy is based on Assumption 5.1. The tolerance is appropriate.

8.0 Results:

8.1 Maximum Calculated Setpoint and Allowable Value

Maximum Calculated Setpoint = Analytical Limit - TLU

= 0.96 mr/hr - (0.377 x 0.96 mr/hr) = **0.60 mr/hr**

The alarm setpoints should be set such that they actuate control room isolation before the control room ventilation air duct radiation level exceeds 0.96 mr/hr. Therefore, the maximum calculated setpoint will be 0.60 mr/hr.

The channel operability test (COT) is actually a functional check, therefore no credit will be taken for the COT uncertainty.

COT=0

Allowable Value = Maximum Calculated Setpoint + COT

= 0.60 mr/hr + 0 = 0.60 mr/hr

The **Allowable Value** specified within the Improved Technical Specifications should be conservatively listed as ≤ **0.5 mr/hr**.

8.2 Conclusion

A review of the instrument loop performance requirements against the proposed loop configuration for RMS R-45 was conducted by this evaluation. The results of this review determined that the proposed safety related control room radiation monitor will initiate control room ventilation isolation prior to exceeding the 0.96 mr/hr limit. For conservatism it is recomended that the alarm (control room isolation) nominal setpoint will be set at **0.25 mr/hr**, which is in excess of the minimum value of 0.1mr/hr discussed in assumption 5.14.

Enclosure 2
R.E. Ginna Nuclear Power Plant

Design Analysis

Ginna Station

Control Room Radiation Monitors Analytical Limit Calculation

Rochester Gas & Electric Corporation

89 East Avenue

Rochester, New York 14649

DA-EE-2001-013

Revision 0

4/24/01
Effective Date

Prepared By:	Paul M Swift **Assigned Engineer**	4/6/01 **Date**
Prepared By:	 **Health Physics**	4/6/01 **Date**
Reviewed By:	 **Reviewer**	4/24/01 **Date**

Revision Status Sheet

Revision Number	Affected Sections	Description of Revision
0	All	Original.

1.0 Purpose

1.1 The purpose of this analysis is to determine the analytical limit for the Control Room Radiation Monitors R-45 and R-46 such that they will initiate Control Room isolation to ensure that Control Room dose stays below required limits. This will include calculations that support the installation of the radiation detectors in the air intake duct and show the relationship between "in duct" exposure rates, as measured by R-45 and R-46, and the dose rate for Control Room personnel .

1.2 This analysis will also demonstrate that, for the worst case accident cloud, the Control Room isolates before any dose rate limit is exceeded in the Control Room

2.0 Conclusions

2.1 The analysis demonstrates that the analytical limit for R-45 and R-46 will be 0.96 mr/hour.

3.0 Design Inputs

3.1 PCR 99-004, Control Room Radiation Monitor Replacement.

3.2 EE-171, Control Room Radiation Monitor Specification, Ginna Station, PCR 99-004

4.0 Referenced Documents

4.1 Drawings

RG&E Drawings:

Drawing #
SK33013-2787-1

4.2 Codes And Standards

4.2.1 GDC 19

4.2.2 NUREG-0737, Clarification of TMI Action Plan Requirements section 11.B.2, Dose Rate Criteria

4.2.3 NUREG-0800 Standard Review Plan section 6.4, Control Room Habitability Program

4.2.4 ICRP #23 Report of the Task Group on Reference Man, 1975. (Pg. 15-Length of total body for reference adult male: 170 cm)

4.3 Equipment Information

4.3.1 Inovision Installation, Operation, and Maintenance Instruction Manual, Area Monitoring System, Model 955A

5.0 Assumptions

5.1 Assumptions made are detailed within the calculation, and have all been evaluated to be in the conservative direction, as discussed.

6.0 Computer Codes

6.1 MegaShield 1.2, WMG, used to calculate dose rates for given isotope cloud and geometries. This analysis has printouts from this program attached for various models.

6.2 Computer Output

This is the tabulation of computer runs performed using MegaShield, identified by Case and Case ID. The outputs of each case run is attached to this analysis, and can be identified by the Case ID. A summary of the results are tabulated in section 7.2.3.

Case	Case ID	Attachment #	Description
CRD26	megashld\GPG.MS1	Attachment 1	Control room ductwork, short end piece when detector is located 26" into ductwork
CRD Isotope Base	megashld\GPG.MS1	Attachment 2	Control room ductwork, long end piece when detector is located 26" into ductwork
Side donut	megashld\donut2.MS1	Attachment 3	Area at side of detector, used for both 26" and 38" location. Two (2) required to cover both sides of detector.
38 short	megashld\crdiso.MS1	Attachment 4	Control room ductwork, short end piece when detector is located 38" into ductwork.
CRD Isotope Base	megashld\CRD12126.MS1	Attachment 5	Control room ductwork, long end piece when detector is located 38" into ductwork.
Control Room	megashld\gpg2.MS1	Attachment 6	Control room shielding run based on cutting the control room into four (4) mirror rectangles. Four calculations required to provide total coverage.

7.0 Analysis

7.1 Control Room Dose Rate Limit Determination

7.1.1 Per references 4.2.1, 4.2.2, and 4.2.3, areas that require continuous occupancy are to be designed for a maximum of 5 rem whole body dose, or its equivalent to any part of the body for the duration of the accident. This is further defined as a 30 day weighted average dose rate of less than 15 mr/hr . The 15 mr/hr will be considered the analytical dose limit for inside the Control Room.

7.2 In Duct Conversion Factor

7.2.1 Radiation Monitors R-45 and R-46 are GM Tube type detectors. Reference 4.3.1 EE-171 design specification describes the requirements for operation of the detection equipment.

One of the variables in measuring radioactive dose rates is the size of the cloud of radioactive gas that envelopes the detector. For a constant concentration of noble gas and radiodine in air, up to certain size based on photon energy, the larger the cloud that the detector is immersed in, the greater the exposure and resulting dose rate. The detectors will be mounted in the Control Room HVAC air intake duct. This mounting limits the size of the cloud that the detector will see to the physical dimensions of the duct work. Conservatively assuming that the walls of the duct provide 100% shielding from any source outside of the duct, the detector will only be exposed to, and thus measure, the activity imposed on it by a volume of noble gas contained within a cylinder measuring 42" diameter by 151" in length. For the *same concentration* of noble gas in a much larger volume, approaching semi-infinite cloud, the detector would read significantly higher.

The control room more closely approaches a semi-infinite configuration than the control room ductwork; however, a calculation was also required to determine the dose rate difference due to geometry considerations. The conclusion is that, due to the difference in cloud sizes from the semi-infinite cloud standard, the detector mounted in the duct will not provide a mr/hr dose reading that reflects the dose rate that an operator in the Control Room would receive, without computational correction.

7.2.2 Calculations were performed to determine the relationship between an in-duct exposure rate indication and a Control Room dose rate. The initial condition is for a uniform cloud representative of our Design Basis Accident (DBA) release for the different isotopes and concentrations of each isotope. The calculation considers the detector exposed to that uniform cloud in the in-duct position, and then exposed to the same cloud in the center of the Control Room, assuming: there is no isolation; no dilution; and the cloud has uniformly filled the Control Room to the DBA cloud concentrations, for all noble gas and radiodine isotopes.

7.2.3 R-45 and R-46 exposure rates were determined utilizing the MegaShield shielding code. Three runs were required per detector location to accurately model the right cylinder geometry of the air intake duct to a DBA cloud. The first set of calculations determined the exposure rate response of a detector located approximately 26 inches from the bottom of the vertical run of ductwork exposed to a DBA cloud, as shown in reference drawing 4.1 . The second set of calculations assumed the detector was located 38" from the bottom of the vertical run. Each location (26" and 38" above the bottom of the vertical run) had a computer run to mimic the duct area below the detector, one to mimic the duct area above the detector, and a third to mimic the area between the detector and the duct wall to the side. The results of each run were in mR/hr assuming total attenuated exposure as seen by the detector considering geometric build up.

Computer Run Results Summary:

Detector at 26" height

Case	Case ID	Dose Equivalent Rate	Exposure Rate	Description
CRD26	megashld\GPG.MS1	1.60 mrem/hr	1.74 mr/hr	Control room ductwork, short end piece when detector is located 26" into ductwork
CRD Isotope Base	megashld\GPG.MS1	1.75 mrem/hr	1.91 mr/hr	Control room ductwork, long end piece when detector is located 26" into ductwork
Side donut	megashld\donut2.MS1	0.69 mrem/hr times 2	0.76 mr/hr times 2	Area at side of detector, used for both 26" and 38" location. Two (2) required to cover both sides of detector.
Total		**4.73 mrem/hr**	**5.16 mr/hr**	

Detector at 38" height

Case	Case ID	Dose Equivalent Rate	Exposure Rate	Description
38 short	megashld\crdiso.MS1	1.84 mrem/hr	2.00 mr/hr	Control room ductwork, short end piece when detector is located 38" into ductwork
CRD Isotope Base	megashld\CRD12126.MS1	2.26 mrem/hr	2.47 mr/hr	Control room ductwork, long end piece when detector is located 38" into ductwork
Side donut	megashld\donut2.MS1	0.69 mrem/hr times 2	0.76 mr/hr times 2	Area at side of detector, used for both 26" and 38" location. Two (2) required to cover both sides of detector.
Total		**5.48 mrem/hr**	**5.98 mr/hr**	

The control room dose rate was also determined using MegaShield. To accurately monitor the area the detector was located in the center of the control room. The calculation for the control room assumed the detector was located in the center of the room at an elevation equal to the height of reference man (ICRP #23). The results of the computer runs are in mrem/hr or dose equivalent for AP exposure as seen by the detector considering geometric build up.

Detector in Control Room Model

Case	Case ID	Dose Equivalent Rate	Exposure Rate	Description
Control Room	megashld\gpg2.MS1	20.17mrem/hr times 4	22.02 mr/hr times 4	Control room shielding run based on cutting the control room into four (4) mirror rectangles. Four calculations required to provide total coverage.
Total		**80.68 mrem/hr**	**88.08 mr/hr**	

7.2.4 For the assumed DBA cloud concentrations, an in-duct detector is estimated to read 5.16 and 5.98 mr/hr at 26" and 38" respectively. For the same concentration in the Control Room, it would read 80.68 mr/hr, due only to the larger cloud size that would be seen in the CR. The ratio of CR exposure to in-duct detectors reading is:

26" Location - $80.68 / 5.16 = 15.64$

38" Location - $80.68 / 5.98 = 13.49$

The 26" ratio of 15.64 is the more conservative value of the two calculated and will be used. The closer to the end of the cylinder the detector is located, the ratio becomes larger, which is in the conservative direction. Therefore, the 15.64 ratio will be used as the limiting value for any detector installed in the duct as long as it is a minimum of 26" from the end of the duct cylinder. With this assumption, actual duct installation can vary from the 26" and 38" distances and still be enveloped by this calculation, as long as no closer than 26".

7.2.5 This ratio of 15.64 will be linear throughout the measurement range of the radiation monitoring system. Therefore, it will be considered a constant, such that for any value of mrem/hr read in the duct, the control room dose will be determined by multiplying the in-duct value by 15.64. The following sections illustrate this conversion method.

7.2.6 The 30 day weighted average dose rate limit is 15 mr/hr in the Control Room. Applying the in-duct conversion factor of 15.64, the in-duct reading equivalent to the 15 mr/hr analytical limit is $15 \div 15.64 = 0.96$ mr/hr. Therefore, the analytical limit for the alarm setpoint as detected in the duct is 0.96 mr/hr.

7.3 Design Basis Accident Cloud Response

7.3.1 The total response time of the system to a step change in the radiation value is 60 seconds, which is the total averaging time of the detector due to the pulse counting algorithm. The DBA cloud would have a concentration of noble gas that would result in an in-duct reading of 5.63 mr/hr, as described above. With a 60 second rolling average that is at 0 mr/hr at time zero, and is hit with a 5.63 mr/hr cloud, it would take 11 seconds to reach a reading of 0.96 mr/hr. Two factors make that delay in reaching the analytical limit insignificant. First, the transit time for the air to get from the in-duct detector location to the Control Room isolation dampers is greater than 30 seconds, so the cloud will not have reached the Control Room in that time period. Secondly, if the transit time is not considered and it is assumed that the cloud is dumping into the Control Room for the complete 11 seconds, that air is diluted into the total Control Room volume, dramatically reducing the cloud concentration and hence effective dose. Mathematically, 11 seconds of air at 2,000 cfm is 367 cu. ft., diluted into the CR volume of 36,000 cu. ft. The resulting concentration of noble gas in the CR is approximately 1% of the DBA concentration, or less than 0.9 mr/hr actual Control Room dose which is insignificant when compared to the 30 day dose rate of 15 mr/hr.

8.0 Conclusions

8.1 This calculation demonstrates that the analytical limit is 0.96 mr/hr for the Control Room Radiation Monitors mounted in the duct. This setpoint will envelope any event that releases airborne radiation that could enter the Control Room via the CR air intake system.

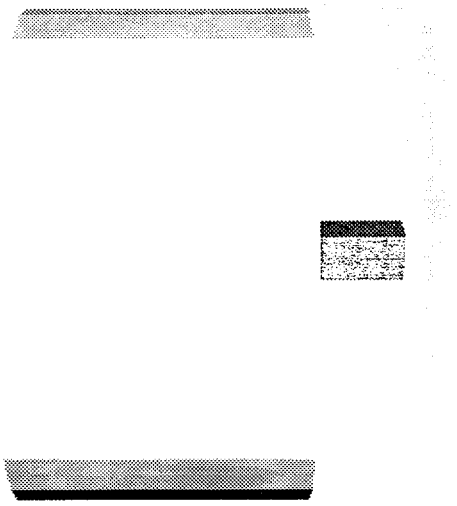
8.2 This analysis also demonstrates that the radiation monitoring system will isolate the Control Room for the worst case LOCA cloud entering the air intake duct before the cloud can enter the Control Room to a level to cause Control Room dose levels to reach 15 mr/hr.

MegaShield 1.2 - Source Input Data

Case Title: CRD26
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 4/23/2001 10:05:32 AM Total Run Time: 847 seconds

Run By:
Reviewed By:

Case Model



Source Data

Geometry:	Cylinder-Hrz	
Radius:	21.00	in
Height:	22.72	in
Mass:	6.293E+02	gm
Volume:	3.148E+04	in^3
Material/Density:	Air	0.00

Integration Parameters

Radial:	100
Circumferential:	100
Axial:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	2.356E-05	2.356E-02	4.568E-05	3.744E-02	8.718E+05	1.690E+00	1.385E+03
I-132	3.402E-05	3.402E-02	6.596E-05	5.407E-02	1.259E+06	2.441E+00	2.000E+03
I-133	4.826E-05	4.826E-02	9.356E-05	7.669E-02	1.786E+06	3.462E+00	2.837E+03
I-134	5.308E-05	5.308E-02	1.029E-04	8.434E-02	1.964E+06	3.807E+00	3.121E+03
I-135	4.519E-05	4.519E-02	8.760E-05	7.180E-02	1.672E+06	3.241E+00	2.657E+03
Kr-83m	1.192E-05	1.192E-02	2.310E-05	1.893E-02	4.409E+05	8.547E-01	7.006E+02
Kr-85	9.037E-07	9.037E-04	1.752E-06	1.436E-03	3.344E+04	6.482E-02	5.313E+01
Kr-85m	2.518E-05	2.518E-02	4.881E-05	4.001E-02	9.316E+05	1.806E+00	1.480E+03
Kr-87	4.852E-05	4.852E-02	9.407E-05	7.711E-02	1.795E+06	3.481E+00	2.853E+03
Kr-88	6.855E-05	6.855E-02	1.329E-04	1.089E-01	2.536E+06	4.917E+00	4.031E+03
Kr-89	8.367E-05	8.367E-02	1.622E-04	1.330E-01	3.096E+06	6.001E+00	4.919E+03
Xe-131m	1.027E-06	1.027E-03	1.991E-06	1.632E-03	3.800E+04	7.367E-02	6.038E+01
Xe-133	1.882E-04	1.882E-01	3.648E-04	2.990E-01	6.962E+06	1.350E+01	1.106E+04
Xe-133m	5.839E-06	5.839E-03	1.132E-05	9.279E-03	2.160E+05	4.188E-01	3.433E+02
Xe-135	4.817E-05	4.817E-02	9.339E-05	7.655E-02	1.782E+06	3.455E+00	2.832E+03
Xe-135m	3.762E-05	3.762E-02	7.294E-05	5.979E-02	1.392E+06	2.699E+00	2.212E+03
Xe-138	1.600E-04	1.600E-01	3.101E-04	2.542E-01	5.918E+06	1.147E+01	9.405E+03
Totals:	**8.836E-04**	**8.836E-01**	**1.713E-03**	**1.404E+00**	**3.269E+07**	**6.338E+01**	**5.195E+04**

DA-EE-2001-013 Rev.0 Attachment 1

MegaShield 1.2 - Shield Input Data

Case Title: CRD26
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 4/23/2001 10:05:32 AM Total Run Time: 847 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: CRD26
File Name: D:\MEGASHLD\CRDISO.MS1 Buildup Region: Source Outer
Run Date: 4/23/2001 10:05:32 AM Total Run Time: 847 seconds Buildup Method: Average

Region Composition Density Table

All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

MegaShield 1.2 - Dose Results

Case Title: CRD26
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 4/23/2001 10:05:32 AM Total Run Time: 847 seconds Standard Grouping

Detector #1: X = 11.36 in Y = 21.00 in Z = 0.00 in

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 1.591E+00 with Buildup: 1.596E+00

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	5.002E+03	1.618E-01	1.642E-01	1.618E-02	1.642E-02	2.465E-05	2.500E-05
1.500E-01	1.238E+06	4.011E+01	4.055E+01	6.016E+00	6.082E+00	9.854E-03	9.962E-03
2.000E-01	3.283E+06	1.064E+02	1.073E+02	2.127E+01	2.146E+01	3.734E-02	3.768E-02
3.000E-01	2.271E+06	7.366E+01	7.414E+01	2.210E+01	2.224E+01	4.167E-02	4.194E-02
4.000E-01	4.108E+06	1.333E+02	1.340E+02	5.332E+01	5.359E+01	1.032E-01	1.038E-01
5.000E-01	3.736E+06	1.213E+02	1.218E+02	6.064E+01	6.091E+01	1.181E-01	1.186E-01
6.000E-01	3.300E+06	1.072E+02	1.076E+02	6.430E+01	6.455E+01	1.247E-01	1.252E-01
8.000E-01	6.021E+06	1.956E+02	1.962E+02	1.565E+02	1.570E+02	2.962E-01	2.972E-01
1.000E+00	3.096E+06	1.006E+02	1.009E+02	1.006E+02	1.009E+02	1.841E-01	1.846E-01
1.500E+00	2.875E+06	9.348E+01	9.366E+01	1.402E+02	1.405E+02	2.344E-01	2.348E-01
2.000E+00	4.933E+06	1.605E+02	1.607E+02	3.210E+02	3.215E+02	4.936E-01	4.944E-01
3.000E+00	5.372E+05	1.748E+01	1.750E+01	5.245E+01	5.251E+01	7.075E-02	7.083E-02
4.000E+00	1.386E+05	4.513E+00	4.517E+00	1.805E+01	1.807E+01	2.212E-02	2.214E-02
Totals:	**3.554E+07**	**1.154E+03**	**1.159E+03**	**1.016E+03**	**1.019E+03**	**1.736E+00**	**1.741E+00**

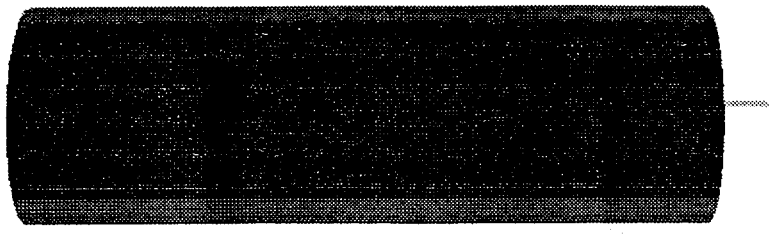
DA-EE-2001-013 Rev. 0 Attachment 1

MegaShield 1.2 - Source Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\GPG3.MS!
Run Date: 2/26/2001 8:07:44 AM Total Run Time: 850 seconds

Run By:
Reviewed By:

Case Model



Source Data

Geometry:	Cylinder-Hrz	
Radius:	21.00	in
Height:	121.72	in
Mass:	3.371E+03	gm
Volume:	1.686E+05	in^3
Material/Density:	Air	0.00

Integration Parameters

Radial:	100
Circumferential:	100
Axial:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	1.262E-04	1.262E-01	4.568E-05	3.744E-02	4.671E+06	1.690E+00	1.385E+03
I-132	1.823E-04	1.823E-01	6.596E-05	5.407E-02	6.744E+06	2.441E+00	2.000E+03
I-133	2.585E-04	2.585E-01	9.356E-05	7.669E-02	9.566E+06	3.462E+00	2.837E+03
I-134	2.844E-04	2.844E-01	1.029E-04	8.434E-02	1.052E+07	3.807E+00	3.121E+03
I-135	2.421E-04	2.421E-01	8.760E-05	7.180E-02	8.957E+06	3.241E+00	2.657E+03
Kr-83m	6.384E-05	6.384E-02	2.310E-05	1.893E-02	2.362E+06	8.547E-01	7.006E+02
Kr-85	4.842E-06	4.842E-03	1.752E-06	1.436E-03	1.791E+05	6.482E-02	5.313E+01
Kr-85m	1.349E-04	1.349E-01	4.881E-05	4.001E-02	4.991E+06	1.806E+00	1.480E+03
Kr-87	2.600E-04	2.600E-01	9.407E-05	7.711E-02	9.618E+06	3.481E+00	2.853E+03
Kr-88	3.673E-04	3.673E-01	1.329E-04	1.089E-01	1.359E+07	4.917E+00	4.031E+03
Kr-89	4.482E-04	4.482E-01	1.622E-04	1.330E-01	1.658E+07	6.001E+00	4.919E+03
Xe-131m	5.502E-06	5.502E-03	1.991E-06	1.632E-03	2.036E+05	7.367E-02	6.038E+01
Xe-133	1.008E-03	1.008E+00	3.648E-04	2.990E-01	3.730E+07	1.350E+01	1.106E+04
Xe-133m	3.128E-05	3.128E-02	1.132E-05	9.279E-03	1.157E+06	4.188E-01	3.433E+02
Xe-135	2.581E-04	2.581E-01	9.339E-05	7.655E-02	9.549E+06	3.455E+00	2.832E+03
Xe-135m	2.016E-04	2.016E-01	7.294E-05	5.979E-02	7.458E+06	2.699E+00	2.212E+03
Xe-138	8.569E-04	8.569E-01	3.101E-04	2.542E-01	3.171E+07	1.147E+01	9.405E+03
Totals:	**4.734E-03**	**4.734E+00**	**1.713E-03**	**1.404E+00**	**1.752E+08**	**6.338E+01**	**5.195E+04**

MegaShield 1.2 - Shield Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\GPG3.MS!
Run Date: 2/26/2001 8:07:44 AM Total Run Time: 850 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\GPG3.MS!
Run Date: 2/26/2001 8:07:44 AM
Total Run Time: 850 seconds
Buildup Region: Source Outer
Buildup Method: Average

Region Composition Density Table

All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

MegaShield 1.2 - Dose Results

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\GPG3.MS!
Run Date: 2/26/2001 8:07:44 AM Total Run Time: 850 seconds Standard Grouping

Detector #1: X = 64.14 in Y = 21.00 in Z = 0.00 in

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 1.736E+00 with Buildup: 1.747E+00

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	2.680E+04	1.757E-01	1.812E-01	1.757E-02	1.812E-02	2.675E-05	2.759E-05
1.500E-01	6.635E+06	4.358E+01	4.461E+01	6.537E+00	6.692E+00	1.071E-02	1.096E-02
2.000E-01	1.759E+07	1.157E+02	1.179E+02	2.313E+01	2.358E+01	4.061E-02	4.139E-02
3.000E-01	1.217E+07	8.017E+01	8.130E+01	2.405E+01	2.439E+01	4.535E-02	4.599E-02
4.000E-01	2.201E+07	1.452E+02	1.468E+02	5.807E+01	5.872E+01	1.124E-01	1.137E-01
5.000E-01	2.001E+07	1.321E+02	1.334E+02	6.607E+01	6.670E+01	1.287E-01	1.299E-01
6.000E-01	1.768E+07	1.168E+02	1.178E+02	7.009E+01	7.067E+01	1.360E-01	1.371E-01
8.000E-01	3.226E+07	2.134E+02	2.148E+02	1.707E+02	1.718E+02	3.231E-01	3.252E-01
1.000E+00	1.658E+07	1.098E+02	1.104E+02	1.098E+02	1.104E+02	2.009E-01	2.021E-01
1.500E+00	1.540E+07	1.021E+02	1.025E+02	1.531E+02	1.537E+02	2.559E-01	2.570E-01
2.000E+00	2.643E+07	1.753E+02	1.759E+02	3.506E+02	3.518E+02	5.392E-01	5.410E-01
3.000E+00	2.878E+06	1.911E+01	1.915E+01	5.732E+01	5.746E+01	7.732E-02	7.751E-02
4.000E+00	7.427E+05	4.933E+00	4.943E+00	1.973E+01	1.977E+01	2.418E-02	2.423E-02
Totals:	**1.904E+08**	**1.258E+03**	**1.270E+03**	**1.109E+03**	**1.116E+03**	**1.894E+00**	**1.906E+00**

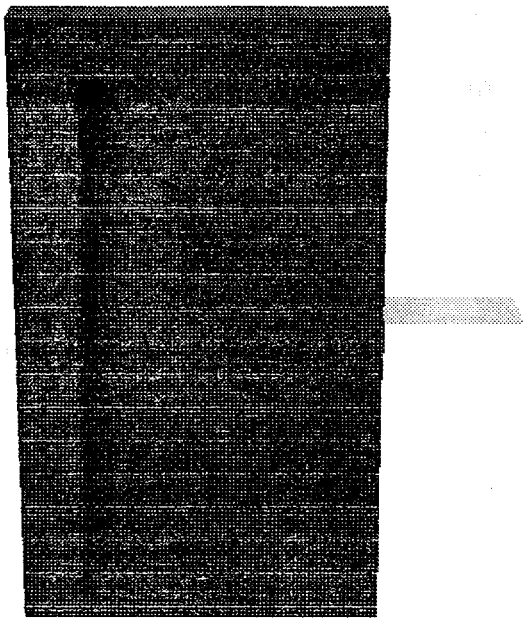
MegaShield 1.2 - Source Input Data

Case Title: Side Donut
File Name: D:\MEGASHLD\DONUT2.MS1
Run Date: 2/23/2001 2:57:19 PM Total Run Time: 743 seconds

Run By:

Reviewed By:

Case Model



Source Data

Geometry:	Rectangle	
Length:	21.00	in
Width:	3.20	in
Height:	42.00	in
Mass:	5.643E+01	gm
Volume:	2.822E+03	in^3
Material/Density:	Air	0.00

Integration Parameters

Length:	100
Width:	100
Height:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	2.113E-06	2.113E-03	4.568E-05	3.744E-02	7.817E+04	1.690E+00	1.385E+03
I-132	3.051E-06	3.051E-03	6.596E-05	5.407E-02	1.129E+05	2.441E+00	2.000E+03
I-133	4.327E-06	4.327E-03	9.356E-05	7.669E-02	1.601E+05	3.462E+00	2.837E+03
I-134	4.759E-06	4.759E-03	1.029E-04	8.434E-02	1.761E+05	3.807E+00	3.121E+03
I-135	4.052E-06	4.052E-03	8.760E-05	7.180E-02	1.499E+05	3.241E+00	2.657E+03
Kr-83m	1.068E-06	1.068E-03	2.310E-05	1.893E-02	3.953E+04	8.547E-01	7.006E+02
Kr-85	8.103E-08	8.103E-05	1.752E-06	1.436E-03	2.998E+03	6.482E-02	5.313E+01
Kr-85m	2.258E-06	2.258E-03	4.881E-05	4.001E-02	8.353E+04	1.806E+00	1.480E+03
Kr-87	4.351E-06	4.351E-03	9.407E-05	7.711E-02	1.610E+05	3.481E+00	2.853E+03
Kr-88	6.147E-06	6.147E-03	1.329E-04	1.089E-01	2.274E+05	4.917E+00	4.031E+03
Kr-89	7.502E-06	7.502E-03	1.622E-04	1.330E-01	2.776E+05	6.001E+00	4.919E+03
Xe-131m	9.209E-08	9.209E-05	1.991E-06	1.632E-03	3.407E+03	7.367E-02	6.038E+01
Xe-133	1.687E-05	1.687E-02	3.648E-04	2.990E-01	6.243E+05	1.350E+01	1.106E+04
Xe-133m	5.236E-07	5.236E-04	1.132E-05	9.279E-03	1.937E+04	4.188E-01	3.433E+02
Xe-135	4.319E-06	4.319E-03	9.339E-05	7.655E-02	1.598E+05	3.455E+00	2.832E+03
Xe-135m	3.374E-06	3.374E-03	7.294E-05	5.979E-02	1.248E+05	2.699E+00	2.212E+03
Xe-138	1.434E-05	1.434E-02	3.101E-04	2.542E-01	5.307E+05	1.147E+01	9.405E+03
Totals:	**7.923E-05**	**7.923E-02**	**1.713E-03**	**1.404E+00**	**2.932E+06**	**6.338E+01**	**5.195E+04**

MegaShield 1.2 - Shield Input Data

Case Title: Side Donut
File Name: D:\MEGASHLD\DONUT2.MS1
Run Date: 2/23/2001 2:57:19 PM Total Run Time: 743 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: Side Donut
File Name: D:\MEGASHLD\DONUT2.MS1 Buildup Region: Source Outer
Run Date: 2/23/2001 2:57:19 PM Total Run Time: 743 seconds Buildup Method: Average

Region Composition Density Table

All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

DA-EE-2001-013 Rev. 0 Attachment 3

MegaShield 1.2 - Dose Results

Case Title: Side Donut
File Name: D:\MEGASHLD\DONUT2.MS1
Run Date: 2/23/2001 2:57:19 PM Total Run Time: 743 seconds Standard Grouping

Detector #1: X = 10.50 in Y = 21.00 in Z = 0.00 in

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 6.923E-01 with Buildup: 6.931E-01

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	4.485E+02	7.061E-02	7.100E-02	7.061E-03	7.100E-03	1.075E-05	1.081E-05
1.500E-01	1.110E+05	1.749E+01	1.756E+01	2.623E+00	2.634E+00	4.297E-03	4.315E-03
2.000E-01	2.943E+05	4.636E+01	4.652E+01	9.273E+00	9.305E+00	1.628E-02	1.633E-02
3.000E-01	2.037E+05	3.209E+01	3.217E+01	9.627E+00	9.651E+00	1.815E-02	1.820E-02
4.000E-01	3.683E+05	5.805E+01	5.816E+01	2.322E+01	2.327E+01	4.496E-02	4.505E-02
5.000E-01	3.350E+05	5.280E+01	5.289E+01	2.640E+01	2.645E+01	5.143E-02	5.151E-02
6.000E-01	2.959E+05	4.665E+01	4.672E+01	2.799E+01	2.803E+01	5.429E-02	5.437E-02
8.000E-01	5.399E+05	8.513E+01	8.523E+01	6.810E+01	6.818E+01	1.289E-01	1.291E-01
1.000E+00	2.776E+05	4.377E+01	4.382E+01	4.377E+01	4.382E+01	8.011E-02	8.020E-02
1.500E+00	2.577E+05	4.066E+01	4.069E+01	6.098E+01	6.103E+01	1.019E-01	1.020E-01
2.000E+00	4.423E+05	6.978E+01	6.982E+01	1.396E+02	1.396E+02	2.146E-01	2.148E-01
3.000E+00	4.816E+04	7.600E+00	7.603E+00	2.280E+01	2.281E+01	3.075E-02	3.077E-02
4.000E+00	1.243E+04	1.961E+00	1.962E+00	7.846E+00	7.848E+00	9.614E-03	9.618E-03
Totals:	**3.187E+06**	**5.024E+02**	**5.032E+02**	**4.422E+02**	**4.427E+02**	**7.554E-01**	**7.562E-01**

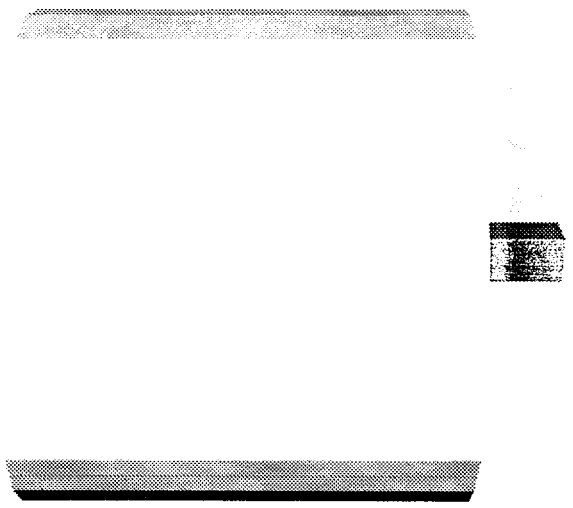
DA-EE-2001-013 Rev. 0 Attachment 3

MegaShield 1.2 - Source Input Data

Case Title: 38 short
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 3/20/2001 8:38:11 AM Total Run Time: 839 seconds

Run By:
Reviewed By:

Case Model



Source Data

Geometry:	Cylinder-Hrz	
Radius:	21.00	in
Height:	34.72	in
Mass:	9.617E+02	gm
Volume:	4.810E+04	in^3
Material/Density:	Air	0.00

Integration Parameters

Radial:	100
Circumferential:	100
Axial:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	3.601E-05	3.601E-02	4.568E-05	3.744E-02	1.332E+06	1.690E+00	1.385E+03
I-132	5.199E-05	5.199E-02	6.596E-05	5.407E-02	1.924E+06	2.441E+00	2.000E+03
I-133	7.375E-05	7.375E-02	9.356E-05	7.669E-02	2.729E+06	3.462E+00	2.837E+03
I-134	8.111E-05	8.111E-02	1.029E-04	8.434E-02	3.001E+06	3.807E+00	3.121E+03
I-135	6.905E-05	6.905E-02	8.760E-05	7.180E-02	2.555E+06	3.241E+00	2.657E+03
Kr-83m	1.821E-05	1.821E-02	2.310E-05	1.893E-02	6.737E+05	8.547E-01	7.006E+02
Kr-85	1.381E-06	1.381E-03	1.752E-06	1.436E-03	5.110E+04	6.482E-02	5.313E+01
Kr-85m	3.847E-05	3.847E-02	4.881E-05	4.001E-02	1.424E+06	1.806E+00	1.480E+03
Kr-87	7.415E-05	7.415E-02	9.407E-05	7.711E-02	2.744E+06	3.481E+00	2.853E+03
Kr-88	1.048E-04	1.048E-01	1.329E-04	1.089E-01	3.876E+06	4.917E+00	4.031E+03
Kr-89	1.279E-04	1.279E-01	1.622E-04	1.330E-01	4.731E+06	6.001E+00	4.919E+03
Xe-131m	1.569E-06	1.569E-03	1.991E-06	1.632E-03	5.807E+04	7.367E-02	6.038E+01
Xe-133	2.876E-04	2.876E-01	3.648E-04	2.990E-01	1.064E+07	1.350E+01	1.106E+04
Xe-133m	8.923E-06	8.923E-03	1.132E-05	9.279E-03	3.302E+05	4.188E-01	3.433E+02
Xe-135	7.362E-05	7.362E-02	9.339E-05	7.655E-02	2.724E+06	3.455E+00	2.832E+03
Xe-135m	5.750E-05	5.750E-02	7.294E-05	5.979E-02	2.127E+06	2.699E+00	2.212E+03
Xe-138	2.444E-04	2.444E-01	3.101E-04	2.542E-01	9.044E+06	1.147E+01	9.405E+03
Totals:	**1.350E-03**	**1.350E+00**	**1.713E-03**	**1.404E+00**	**4.996E+07**	**6.338E+01**	**5.195E+04**

MegaShield 1.2 - Shield Input Data

Case Title: 38 short
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 3/20/2001 8:38:11 AM Total Run Time: 839 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: 38 short
File Name: D:\MEGASHLD\CRDISO.MS1 Buildup Region: Source Outer
Run Date: 3/20/2001 8:38:11 AM Total Run Time: 839 seconds Buildup Method: Average

Region Composition Density Table

All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

MegaShield 1.2 - Dose Results

Case Title: 38 short
File Name: D:\MEGASHLD\CRDISO.MS1
Run Date: 3/20/2001 8:38:11 AM Total Run Time: 839 seconds Standard Grouping

Detector #1: X = 17.36 in Y = 21.00 in Z = 0.00 in

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 1.830E+00 with Buildup: 1.836E+00

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	7.644E+03	1.860E-01	1.891E-01	1.860E-02	1.891E-02	2.832E-05	2.880E-05
1.500E-01	1.893E+06	4.610E+01	4.668E+01	6.914E+00	7.002E+00	1.133E-02	1.147E-02
2.000E-01	5.017E+06	1.223E+02	1.235E+02	2.445E+01	2.471E+01	4.293E-02	4.337E-02
3.000E-01	3.471E+06	8.468E+01	8.532E+01	2.540E+01	2.560E+01	4.790E-02	4.827E-02
4.000E-01	6.277E+06	1.532E+02	1.542E+02	6.130E+01	6.167E+01	1.187E-01	1.194E-01
5.000E-01	5.709E+06	1.394E+02	1.402E+02	6.972E+01	7.008E+01	1.358E-01	1.365E-01
6.000E-01	5.043E+06	1.232E+02	1.238E+02	7.394E+01	7.427E+01	1.434E-01	1.441E-01
8.000E-01	9.201E+06	2.249E+02	2.258E+02	1.800E+02	1.806E+02	3.406E-01	3.419E-01
1.000E+00	4.731E+06	1.157E+02	1.161E+02	1.157E+02	1.161E+02	2.118E-01	2.124E-01
1.500E+00	4.393E+06	1.075E+02	1.078E+02	1.613E+02	1.616E+02	2.696E-01	2.702E-01
2.000E+00	7.539E+06	1.846E+02	1.849E+02	3.692E+02	3.698E+02	5.678E-01	5.688E-01
3.000E+00	8.209E+05	2.011E+01	2.014E+01	6.033E+01	6.041E+01	8.138E-02	8.149E-02
4.000E+00	2.118E+05	5.191E+00	5.197E+00	2.076E+01	2.079E+01	2.545E-02	2.547E-02
Totals:	**5.431E+07**	**1.327E+03**	**1.334E+03**	**1.169E+03**	**1.173E+03**	**1.997E+00**	**2.003E+00**

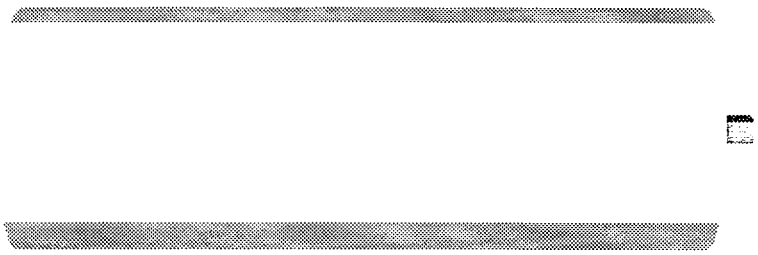
MegaShield 1.2 - Source Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\CRD12126.MS1
Run Date: 3/20/2001 8:12:56 AM Total Run Time: 831 seconds

Run By:

Reviewed By:

Case Model



Source Data

Geometry:	Cylinder-Hrz	
Radius:	21.00	in
Height:	109.72	in
Mass:	3.039E+03	gm
Volume:	1.520E+05	in^3
Material/Density:	Air	0.00

Integration Parameters

Radial:	100
Circumferential:	100
Axial:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	1.138E-04	1.138E-01	4.568E-05	3.744E-02	4.210E+06	1.690E+00	1.385E+03
I-132	1.643E-04	1.643E-01	6.596E-05	5.407E-02	6.079E+06	2.441E+00	2.000E+03
I-133	2.331E-04	2.331E-01	9.356E-05	7.669E-02	8.623E+06	3.462E+00	2.837E+03
I-134	2.563E-04	2.563E-01	1.029E-04	8.434E-02	9.484E+06	3.807E+00	3.121E+03
I-135	2.182E-04	2.182E-01	8.760E-05	7.180E-02	8.074E+06	3.241E+00	2.657E+03
Kr-83m	5.754E-05	5.754E-02	2.310E-05	1.893E-02	2.129E+06	8.547E-01	7.006E+02
Kr-85	4.364E-06	4.364E-03	1.752E-06	1.436E-03	1.615E+05	6.482E-02	5.313E+01
Kr-85m	1.216E-04	1.216E-01	4.881E-05	4.001E-02	4.499E+06	1.806E+00	1.480E+03
Kr-87	2.343E-04	2.343E-01	9.407E-05	7.711E-02	8.670E+06	3.481E+00	2.853E+03
Kr-88	3.311E-04	3.311E-01	1.329E-04	1.089E-01	1.225E+07	4.917E+00	4.031E+03
Kr-89	4.040E-04	4.040E-01	1.622E-04	1.330E-01	1.495E+07	6.001E+00	4.919E+03
Xe-131m	4.960E-06	4.960E-03	1.991E-06	1.632E-03	1.835E+05	7.367E-02	6.038E+01
Xe-133	9.087E-04	9.087E-01	3.648E-04	2.990E-01	3.362E+07	1.350E+01	1.106E+04
Xe-133m	2.820E-05	2.820E-02	1.132E-05	9.279E-03	1.043E+06	4.188E-01	3.433E+02
Xe-135	2.326E-04	2.326E-01	9.339E-05	7.655E-02	8.608E+06	3.455E+00	2.832E+03
Xe-135m	1.817E-04	1.817E-01	7.294E-05	5.979E-02	6.723E+06	2.699E+00	2.212E+03
Xe-138	7.725E-04	7.725E-01	3.101E-04	2.542E-01	2.858E+07	1.147E+01	9.405E+03
Totals:	**4.267E-03**	**4.267E+00**	**1.713E-03**	**1.404E+00**	**1.579E+08**	**6.338E+01**	**5.195E+04**

DA-EE-2001-013 Rev.0 Attachment 5

MegaShield 1.2 - Shield Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\CRD12126.MS1
Run Date: 3/20/2001 8:12:56 AM Total Run Time: 831 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\CRD12126.MS1 Buildup Region: Source Outer
Run Date: 3/20/2001 8:12:56 AM Total Run Time: 831 seconds Buildup Method: Average

---

Region Composition Density Table
All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

MegaShield 1.2 - Dose Results

Case Title: CRD ISOTOPE BASE
File Name: D:\MEGASHLD\CRD12126.MS1
Run Date: 3/20/2001 8:12:56 AM Total Run Time: 831 seconds Standard Grouping

Detector #1: X = 54.86 in Y = 21.00 in Z = 0.00 in

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 2.251E+00 with Buildup: 2.262E+00

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	2.416E+04	2.283E-01	2.339E-01	2.283E-02	2.339E-02	3.476E-05	3.562E-05
1.500E-01	5.981E+06	5.661E+01	5.767E+01	8.491E+00	8.650E+00	1.391E-02	1.417E-02
2.000E-01	1.585E+07	1.502E+02	1.525E+02	3.004E+01	3.050E+01	5.273E-02	5.353E-02
3.000E-01	1.097E+07	1.041E+02	1.052E+02	3.122E+01	3.157E+01	5.887E-02	5.953E-02
4.000E-01	1.984E+07	1.884E+02	1.901E+02	7.536E+01	7.603E+01	1.459E-01	1.472E-01
5.000E-01	1.804E+07	1.715E+02	1.727E+02	8.573E+01	8.637E+01	1.670E-01	1.682E-01
6.000E-01	1.594E+07	1.516E+02	1.525E+02	9.093E+01	9.153E+01	1.764E-01	1.775E-01
8.000E-01	2.908E+07	2.767E+02	2.782E+02	2.214E+02	2.226E+02	4.190E-01	4.213E-01
1.000E+00	1.495E+07	1.424E+02	1.430E+02	1.424E+02	1.430E+02	2.606E-01	2.617E-01
1.500E+00	1.388E+07	1.323E+02	1.328E+02	1.985E+02	1.992E+02	3.318E-01	3.329E-01
2.000E+00	2.382E+07	2.272E+02	2.278E+02	4.545E+02	4.557E+02	6.989E-01	7.008E-01
3.000E+00	2.594E+06	2.476E+01	2.481E+01	7.429E+01	7.443E+01	1.002E-01	1.004E-01
4.000E+00	6.694E+05	6.393E+00	6.403E+00	2.557E+01	2.561E+01	3.134E-02	3.138E-02
Totals:	**1.716E+08**	**1.632E+03**	**1.644E+03**	**1.438E+03**	**1.445E+03**	**2.457E+00**	**2.469E+00**

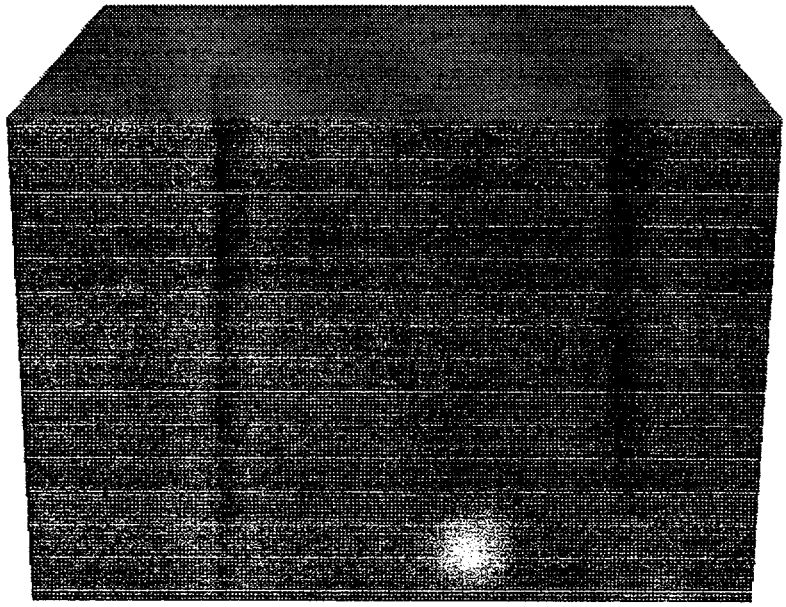
DA-EE-2001-013 Rev. 0 Attachment 5

MegaShield 1.2 - Source Input Data

Case Title: CntrlRoom No Gap
File Name: D:\MEGASHLD\GPG2.MS1
Run Date: 2/23/2001 12:35:23 PM Total Run Time: 746 seconds

Run By:
Reviewed By:

Case Model



Source Data

Geometry:	Rectangle	
Length:	24.40	ft
Width:	19.50	ft
Height:	19.00	ft
Mass:	3.123E+05	gm
Volume:	9.040E+03	ft^3
Material/Density:	Air	0.00

Integration Parameters

Length:	100
Width:	100
Height:	100

Case Data

Buildup Region:	Source	
Energy Grouping:	Std.	
Minimum Energy:	1.000E-01	MeV
Minimum %:	0.00	

Source Nuclides

Nuclide	Curies	milliCuries	uCi/cc	uCi/gm	Bequerels	Bq/cc	Bq/gm
I-131	1.169E-02	1.169E+01	4.568E-05	3.744E-02	4.327E+08	1.690E+00	1.385E+03
I-132	1.689E-02	1.689E+01	6.596E-05	5.407E-02	6.247E+08	2.441E+00	2.000E+03
I-133	2.395E-02	2.395E+01	9.356E-05	7.669E-02	8.862E+08	3.462E+00	2.837E+03
I-134	2.634E-02	2.634E+01	1.029E-04	8.434E-02	9.746E+08	3.807E+00	3.121E+03
I-135	2.242E-02	2.242E+01	8.760E-05	7.180E-02	8.297E+08	3.241E+00	2.657E+03
Kr-83m	5.913E-03	5.913E+00	2.310E-05	1.893E-02	2.188E+08	8.547E-01	7.006E+02
Kr-85	4.485E-04	4.485E-01	1.752E-06	1.436E-03	1.659E+07	6.482E-02	5.313E+01
Kr-85m	1.249E-02	1.249E+01	4.881E-05	4.001E-02	4.623E+08	1.806E+00	1.480E+03
Kr-87	2.408E-02	2.408E+01	9.407E-05	7.711E-02	8.910E+08	3.481E+00	2.853E+03
Kr-88	3.402E-02	3.402E+01	1.329E-04	1.089E-01	1.259E+09	4.917E+00	4.031E+03
Kr-89	4.152E-02	4.152E+01	1.622E-04	1.330E-01	1.536E+09	6.001E+00	4.919E+03
Xe-131m	5.097E-04	5.097E-01	1.991E-06	1.632E-03	1.886E+07	7.367E-02	6.038E+01
Xe-133	9.339E-02	9.339E+01	3.648E-04	2.990E-01	3.455E+09	1.350E+01	1.106E+04
Xe-133m	2.898E-03	2.898E+00	1.132E-05	9.279E-03	1.072E+08	4.188E-01	3.433E+02
Xe-135	2.391E-02	2.391E+01	9.339E-05	7.655E-02	8.846E+08	3.455E+00	2.832E+03
Xe-135m	1.867E-02	1.867E+01	7.294E-05	5.979E-02	6.909E+08	2.699E+00	2.212E+03
Xe-138	7.938E-02	7.938E+01	3.101E-04	2.542E-01	2.937E+09	1.147E+01	9.405E+03
Totals:	**4.385E-01**	**4.385E+02**	**1.713E-03**	**1.404E+00**	**1.623E+10**	**6.338E+01**	**5.195E+04**

DA-EE-2001-013 Rev. 0 Attachment 6

MegaShield 1.2 - Shield Input Data

Case Title: CntrlRoom No Gap
File Name: D:\MEGASHLD\GPG2.MS1
Run Date: 2/23/2001 12:35:23 PM Total Run Time: 746 seconds

This case has no shields.

MegaShield 1.2 - Material Input Data

Case Title: CntrlRoom No Gap
File Name: D:\MEGASHLD\GPG2.MS1 Buildup Region: Source Outer
Run Date: 2/23/2001 12:35:23 PM Total Run Time: 746 seconds Buildup Method: Average

Region Composition Density Table
All densities in gm/cc

Material	Source Outer	Gap
Air	1.220E-03	1.220E-03
Totals:	**1.220E-03**	**1.220E-03**

DA-EE-2001-013 Rev. 0 Attachment 6

MegaShield 1.2 - Dose Results

Case Title: CntrlRoom No Gap
File Name: D:\MEGASHLD\GPG2.MS1
Run Date: 2/23/2001 12:35:23 PM Total Run Time: 746 seconds Standard Grouping

Detector #1: X = 12.20 ft Y = 5.70 ft Z = 0.00 ft

Total Dose Equivalent Rate for AP Exposure in mRem/hr, w/o Buildup: 1.983E+01 with Buildup: 2.017E+01

Energy	Disintegrations	Flux (photons/sq cm/sec)		Fluence (MeV/sq cm/sec)		Exposure (mR/hr)	
(MeV)	(photons/sec)	w/o Buildup	with Buildup	w/o Buildup	with Buildup	w/o Buildup	with Buildup
1.000E-01	2.483E+06	1.971E+00	2.152E+00	1.971E-01	2.152E-01	3.002E-04	3.277E-04
1.500E-01	6.146E+08	4.908E+02	5.244E+02	7.362E+01	7.866E+01	1.206E-01	1.288E-01
2.000E-01	1.629E+09	1.306E+03	1.378E+03	2.611E+02	2.756E+02	4.584E-01	4.837E-01
3.000E-01	1.127E+09	9.079E+02	9.445E+02	2.724E+02	2.834E+02	5.136E-01	5.343E-01
4.000E-01	2.039E+09	1.648E+03	1.700E+03	6.591E+02	6.802E+02	1.276E+00	1.317E+00
5.000E-01	1.854E+09	1.502E+03	1.543E+03	7.512E+02	7.714E+02	1.463E+00	1.503E+00
6.000E-01	1.638E+09	1.330E+03	1.361E+03	7.979E+02	8.166E+02	1.548E+00	1.584E+00
8.000E-01	2.988E+09	2.433E+03	2.480E+03	1.947E+03	1.984E+03	3.685E+00	3.755E+00
1.000E+00	1.536E+09	1.254E+03	1.274E+03	1.254E+03	1.274E+03	2.295E+00	2.332E+00
1.500E+00	1.427E+09	1.168E+03	1.182E+03	1.753E+03	1.774E+03	2.930E+00	2.964E+00
2.000E+00	2.448E+09	2.010E+03	2.029E+03	4.019E+03	4.058E+03	6.181E+00	6.240E+00
3.000E+00	2.666E+08	2.194E+02	2.209E+02	6.582E+02	6.628E+02	8.879E-01	8.941E-01
4.000E+00	6.880E+07	5.671E+01	5.702E+01	2.268E+02	2.281E+02	2.780E-01	2.795E-01
Totals:	**1.764E+10**	**1.433E+04**	**1.470E+04**	**1.267E+04**	**1.289E+04**	**2.164E+01**	**2.202E+01**

DA-EE-2001-013 Rev. 0 Attachment 6