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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Annual Radioactive Effluent Release Report

Gentlemen:

Attached is the Annual Radioactive Effluent Release Report for the period January 1 through December 31, 1994. This report is submitted in accordance with Waterford 3 Technical Specification 6.9.1.8.

If you have any questions, please contact R.W. Prados at (504) 739-6632.

Very truly yours,

Gregory Davis for

R.F. Burski
Director
Nuclear Safety

RFB/RWP/ssf
Attachment

cc: (w/Attachment)
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(w/o Attachment)
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Annual Radioactive Effluent Release

Report

January 1, 1994 - December 31, 1994

Waterford 3 SES

Entergy Operations, Inc.

W21419HP

TABLE OF CONTENTS

9.0 T. BLES

10.0 ATTACHMENTS

1.0 SCOPE

This Annual Radioactive Effluent Release Report is submitted as required by Waterford 3's Technical Specification 6.9.1.8. It covers the period from January 1, 1994 through December 31, 1994. Information in this report is presented in the format outlined in Appendix B of Regulatory Guide 1.21.

The information contained in this report includes:

(1) A summary of the quantities of radioactive liquid and gaseous effluents and solid wastes released from the plant during the reporting period;

(2) A summary of the meteorological data collected during 1994;

(3) Assessment of radiation doses due to liquid and gaseous radioactive effluents released during 1994;

(4) A submittal of changes to the Offsite Dose Calculation Manual and Process Control Program during this reporting period.

(5) A discussion of why required monitoring instrumentation was not returned to service within the time specified.

(6) A discussion of unplanned/abnormal releases.

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

The Limits applicable to the release of radioactive material in liquid and gaseous effluents are described in the following sections. These limits are addressed in UNT-005-014, Offsite Dose Calculation Manual.

2.1.1 Fission and Activation Gases (Noble Gases)

The dose rate due to radioactive noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

The air dose due to noble gases released in gaseous effluents from the site to areas at or beyond the site boundary shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

2.1.2 Iodines; Particulates, Half Lives > 8 Days; and Tritium

The dose rate due to Iodine-131 and 133, tritium, and all radionuclides in particulate form with half lives greater than eight (8) days, released in gaseous effluents from the site to areas at and beyond the site boundary, shall be limited to less than or equal to 1500 mrem/yr to any organ.

The dose to a member of the public from Iodine 131 and 133, tritium, and all radionuclides in particulate form with half lives greater than eight (8) days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

2.1.3 Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-4 μCi/ml total activity.

The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ, and

b. During any calendar year to less than or equal to 3 mrem to the whole body and to less than or equal to 10 mrem to any organ.

2.1.4 Uranium Fuel Cycle Sources

The dose or dose commitment to any member of the public due to releases of radioactivity and radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which shall be limited to less than or equal to 75 mrem) over 12 consecutive months.

2.2 Maximum Permissible Concentrations

2.2.1 Fission and Activation Gases; Iodines; and Particulates, Half Lives > 8 Days

For gaseous effluents, maximum permissible concentrations are not directly used in release rate calculations since the applicable limits are expressed in terms of dose rate at the site boundary.

2.2.2 Liquid Effluents

The maximum permissible concentration (MPC) values specified in 10 CFR Part 20, Appendix B, Table II, Column 2 are used as the permissible concentrations of liquid radioactive effluents at the unrestricted area boundary. A value of 2.0E-4 μCi/ml is used as the MPC for dissolved and entrained noble gases in liquid effluents.

2.3 Average Energy

This is not applicable to Waterford 3's Effluent Specifications. E-Bars are not required to be calculated from effluent release data.

2.4 Measurements and Approximations of Total Radioactivity

The quantification of radioactivity in liquid and gaseous effluents was accomplished by performing the sampling and radiological analysis of effluents in accordance with the requirements of Tables 5.3-1 and 5.4-1 of UNT-005-014, Offsite Dose Calculation Manual.

2.4.1 Fission and Activation Gases (Noble Gases)

For continuous releases, a gas grab sample was analyzed monthly for noble gases. Each week a Gas Ratio (GR) was calculated according to the following equation:

$$GR = \frac{\text{Average Weekly Noble Gas Monitor Reading}}{\text{Monitor Reading During Noble Gas Sampling}}$$

The monthly sample analysis and weekly Gas Ratio were then used to determine noble gases discharged continuously for the previous week. For gas decay tank and containment purge batch releases, a gas grab sample was analyzed prior to release to determine noble gas concentrations in the batch. In all cases the total radioactivity in gaseous effluents was determined from measured concentrations of each radionuclide present and the total volume discharged.

2.4.2 Iodines and Particulates

Iodines and particulates discharged were sampled using a continuous sampler which contained a charcoal cartridge and a particulate filter. Each week the charcoal cartridge and particulate filter were analyzed for gamma emitters using gamma spectroscopy. The determined radionuclide concentrations and effluent volume discharged were used to calculate the previous week's activity released.

The particulate samples were composited and analyzed quarterly for Sr-89 and Sr-90 by a contract laboratory (Teledyne Isotopes). Particulate gross alpha activity was measured weekly using alpha scintillation counting techniques. The determined activities were used to estimate effluent concentrations in subsequent releases until the next scheduled analysis was performed.

Grab samples of continuous and batch releases were analyzed monthly for tritium. The determined concentrations were used to estimate tritium activity in subsequent releases until the next scheduled analysis was performed.

2.4.3 Liquid Effluents

For continuous releases, samples were collected weekly and analyzed using gamma spectroscopy. The measured concentrations were used to determine radionuclide concentrations in the following week's releases. For batch releases, gamma analysis was performed on the sample prior to release.

For both continuous and batch releases, composite samples were analyzed quarterly by a contract laboratory (Teledyne Isotopes) for Sr-89, Sr-90, and Fe-55. Samples were composited and analyzed monthly for tritium and gross alpha using liquid scintillation and gas flow proportional counting techniques, respectively. For radionuclides measured in the composite samples, the measured concentrations in the composite samples from the previous month or quarter were used to estimate released quantities of these isotopes in liquid effluents during the current month or quarter.

The total radioactivity in liquid effluent releases was determined from the measured and estimated concentrations of each radionuclide present and the total volume of the effluent discharged.

2.5 Batch Releases

A summary of information for gaseous and liquid batch releases is included in Table 1.

2.6 Unplanned/Abnormal Releases

During this reporting period, there were two abnormal releases. These are:

2.6.1 First Event:

Liquid radioactive waste was released from Waste Condensate Tank "A" with an incorrect and non-conservative permit release setpoint on the liquid waste Radiation Monitor. Licensee Event Report (LER) Number 94-018 documents this event. A discussion is provided below.

From November 17 through November 28, 1994, there were seven other liquid radioactive releases made under permits generated with incorrect but conservative setpoints. On November 28, 1994, the actual release based on the average monitor readings during the release period, was 1.05E-04 uci/ml which is significantly below the setpoint limit of 7.67-02 uCi/ml calculated pursuant to 10CFR20, Appendix B, Table II. The analysis, documentation, and control of the release of liquid radioactive waste was not in accordance with the requirements and methodology of the Offsite Dose Calculation Manual (ODCM) procedure UNT-005-014. At no time the concentrations of radioactive materials in unrestricted areas exceeded the limits within the ODCM. The Health and safety of the public were not compromised during this event.

Description of Event:

On October 10, 1994, the quarterly liquid waste composite samples for the third quarter were completed and a date of September 31, 1994, which does not exist, was entered on the sample receipt form by Waterford 3 personnel. The sample analysis which were for the nuclides Fe-55, Sr-89, and Sr-90, from the contract laboratory report, were entered into the computer system for the liquid composites with the non-existent date on November 16, 1994. The ND-6600 computer system did not flag the non-existent date and did accept it as an input.

From November 17, 1994 through November 23, 1994, five release permits were generated using composite data with the non-existent date, which was not transferred by the computer, causing the computer to generate the permits without the nuclides Fe-55, Sr-89, and Sr-90. There were no warning or error messages indicating the data was not transferred. Therefore, these nuclides were not transferred to the release permit files.

On November 23, 1994, the HP foreman designee discovered the three nuclides were missing from the release permits. The HP foreman gave instructions by phone for all the technicians to manually enter the non-gamma nuclides in the computer. From November 24 through November 29, 1994, three more permits were generated by manually entering the non-gamma nuclides. The HP technicians were unaware than an extra symbol, an asterisk, was required when manually entering data in the computer in order to classify the nuclide as non-gamma emitters. The non-gamma nuclides were entered in the computer without the asterisk symbol and the error was discovered on November 28, 1994 by the HP foreman.

Cause of Event:

The root cause of this event was the lack of self-check by the HP Technician when he entered the date on the sample form and again when he used the completed Teledyne Analysis Report with the non-existent date of September 31, 1994,

There were various contributing causes for this event which fell into the two general categories of inappropriate action (Human Performance) and inadequate equipment design. Relative to human performance, a contributing cause was the lack of specific system knowledge in that the HP technician thought once he has entered the data into the composite file that it would be used in the release permit dose and setpoint computations. There was also a lack of specific system knowledge in that the technicians entered the non-gamma emitting nuclides into the computer without the proper character identifying them as non-gamma nuclides. Relative to equipment, a contributing cause was inadequate software design since the computer accepted the non-existent date, then later discarded the data due to the non-existent date. Also, the message, "Composite Merge to Waste Files Successful" appearing on the pre-release permit report misleading. There were no warnings or error messages indicating the data was discarded.

Corrective Action:

The setpoints for the permits were reevaluated and corrected in November 30, 1994. The limits of 10CFR20, Appendix B, Table II were not exceeded based on the average monitor readings during the release periods for all permits. Seven of the permits were generated with incorrect but conservative setpoints. The actual release was 1.05E-04 uCi/ml which is significantly below the setpoint limit 7.67-02 uCi/ml calculated pursuant to 10CFR20, Appendix B, Table II.

Actions Taken to Prevent Recurrence

The following corrective measures have been completed:

1. Toolbox training was given to all HP count room technicians on how to review the composite data and evaluate setpoints for release permits.

2. The computer input process for the ND-6600 software was changed to have one technician input the composite data and another qualified technician review the data was entered correctly. This corrective measure is a temporary measure until the new computer software is implemented.

3. The individual involved with the erroneous data inputs has been counseled in accordance with improving Human Performance procedure.

4. The QA department performed an independent audit of the composite files and logs.

5. A new computer software has been implemented.

6. HP management evaluated the miscommunications which occurred between November 23 and November 30, 1994 and approved actions have been taken and reviewed with HP staff.

2.6.2 Second Event:

Circulating Water (CW) monitor (PRM-IRE-1900) alarmed as a result of contaminated Condensate Makeup (CMU) water leakage past the circulating water radiation monitor purge isolation valve. This event is described in CR-94-498.

Description of Event:

On May 3, 1994, Circulating Water (CW) monitor PRM-IRE-1900 alarmed and the circulating water system was sampled by HP personnel. Initially, it was thought that the CW radiation monitor had malfunctioned because samples of the circulating water system did not indicate the presence of radioactivity. On May 4, 1994, work on the CW radiation monitor PRM-IRE-1900 was commenced as per CI #291371.

At 23:00 on May 12, 1994, Circ. Water (CW) discharge was sampled for Action Notice 94-31. The sample was taken via the flush connection on the CW discharge radiation monitor (PRM-IRE-1900) in the -35 wing area. The sample analysis showed trace amounts of Cobalt-58. CW was re-sampled taking extra precautions against cross-contamination and the analysis results confirmed the detected activity. Investigation showed that Circ. Water inlet, the counting equipment, sample containers, steam generator blowdown and ACCW were not contaminated. The source of the radioactivity was not found. The only remaining system connected to the CW radiation monitor is the Condensate Makeup (CMU) which provides flushing water for the purge function of the monitor.

On May 13, 1994, CMU was sampled in the -4 wing area off the same header that supplies the CW radiation monitor and was found to be contaminated at a level nearly 100 times the activity in the CW samples. The CMU purge isolation valve PRMMVAAA014-102 on the circulating water radiation monitor was isolated.

Cause of Event:

The root cause of this event is an indeterminate radioactive liquid leak from the containment sump water into the Condensate Makeup (CMU) system via the Containment Radiation Monitor (PRM-IRE-6777). Two contributing causes were identified and resulted in the unplanned radioactive effluent release from May 3 to May 13, 1994. These two contributing causes are:

a) leakage into the circulating water radiation monitor (PRM-IRE-1900) from the CMU header via the radiation monitor purge valve (PRMVAAA014-102)

b) maintaining the CMU Supply Valve (CMU-901) to the containment sump and circulating water monitors in the shut position instead of open. If the CMU-901 valve is left open, leakage on the radiation monitors would cause CMU to leak into the radiation monitor instead of out the monitor into the CMU header shared by both containment sump and circulating water monitors (CMU pressure is greater than containment sump pump or circulating water pressures). Leaving CMU-901 shut allowed the daily purges of the circulating water monitor to minimize mud build-up, and to sufficiently de-pressurize the isolated CMU header as to allow containment sump water to be introduced into the shared CMU header piping during sump pumping.

Corrective Action:

1. Circulating water monitor inlet purge valve PRMMVAAA014-102 was determined to be leaking by and CI #291535 was initiated for repair. It was replaced on June 16, 1994.

2. Dose assessment was performed for the apparent CMU leakage through PRMMVAAA014-102 valve on May 27, 1994. The highest calculated organ dose was 0.0944 mRem which is 0.94% of its annual limit. The total body estimate was 0.0716 mRem (i.e. 2.4% of its annual limit).

3. Flushing of the contaminated CMU headers was commenced on May 19, 1994 and was completed on June 14, 1994.

4. The circulating water radiation monitor (PRM-IRE 1900) was returned to service on June 17, 1994.

Action to Prevent Recurrence:

1. System Engineer for the condensate makeup system reviewed the standby valve line up. Operating procedure OP-003-004, "System Operating Procedure, Condensate Makeup" was revised to change the required valve position for valve CMU-901 from closed to open.

2. WA 01124497 identified that valve PRMMVAAA012-102 which is located in the RB -4 area, introduced radioactive water into the CMU system. A new WA 01126636 was initiated to replace this valve during the Refuel Outage #7.

3. The manual isolation valves for CMU flushing water to all liquid effluent radiation monitors are now maintained in a locked shut position according to the operations procedure. Purging of these radiation monitors now requires temporarily repositioning these valves.

3.0 GASEOUS EFFLUENTS

The quantities of radioactive material released in gaseous effluents are summarized in Tables 1A, 1B, and 1C. Note that there were no elevated releases, since all Waterford 3 releases are considered to be at ground level. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

4.0 LIQUID EFFLUENTS

The quantities of radioactive material released in liquid effluents are summarized in Tables 2A and 2B. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

5.0 SOLID WASTES

The summary of radioactive solid wastes shipped offsite for disposal is listed in Table 3. For certain waste forms Waterford 3 is now using volume reduction services provided by Scientific Ecology Group, Inc. and Alaron Corp. These waste forms are identified in Table 3 and volumes reported reflect the volume of waste shipped offsite, not final disposal volumes. Final disposal volumes are reported as they become available. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

6.0 METEOROLOGICAL DATA

In Table 4 the hourly meteorological data from January 1, 1994 through December 31, 1994, is presented in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. The Waterford-3 data recovery results by parameter are as follows:

Parameter	Annual Data Recovery Rate
Delta T	100.0%
Wind Speed	99.68%
Wind Direction	99.68%
Overall*	99.68%

* Simultaneous occurrence of valid data for all three parameters.

7.0 ASSESSMENT OF DOSES

7.1 Dose Due to Gaseous Effluents

7.1.1 Air Doses at the Site Boundary

Air doses from gaseous effluents were evaluated at the closest offsite location that could be occupied continuously during the term of plant operation and that would result in the highest dose. This location was determined by examining the atmospheric dispersion parameters (χ/Q's) at the closest offsite locations that could be continuously occupied during plant operation in each of the meteorological sectors surrounding the plant. The location that would have the highest dose would be that location having the most restrictive (largest) χ/Q value. Based on actual meteorological data collected during 1994, this location was determined to be in the NNE sector at a distance of 966 meters from the plant. Doses were assessed at this location in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering only beta and gamma exposures in air due to noble gas. The results of these assessments for the year 1994 are summarized as follows:

Beta air dose: 1.608 mrad
Gamma air dose: 0.606 mrad

The beta and gamma air doses are 8.04% and 6.06% of the Annual Dose Limits, respectively. The results of the dose calculations by quarter are summarized in Table 5.

7.1.2 Maximum Organ Dose to the Critical Receptor

The maximum organ dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary was determined for 1994.

An assessment of the maximum organ dose was performed for the critical receptor. The critical receptor was assumed to be located at the nearest residence to the plant having the most restrictive atmospheric dispersion (χ/Q) and deposition (D/Q) parameters. Furthermore, it was assumed that the receptor living at this residence consumed food products that were either raised or produced at this residence. Using land use census and meteorological data for 1994, the residence with the highest χ/Q and D/Q values was determined to be in the NE sector at a distance of 1448 meters. The dose calculation was performed in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering the inhalation, ground plane exposure, and ingestion pathways.

The maximum organ dose to the critical receptor was determined to be 0.187 mrem to the infant thyroid. This represents 1.25% of the Annual Dose Limit. Dose calculation results are summarized by quarters in Table 5.

7.2 Doses Due to Liquid Effluents

The annual doses to the maximum exposed individual resulting from exposure to liquid effluents released during 1994 from Waterford 3 were 0.796 mrem total body and 1.048 mrem to the maximum exposed organ (liver). These values are 26.53% and 10.48% respectively, of the Annual Dose Limits. Dose calculation results are summarized by quarters in Table 5. The doses were calculated in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual.

7.3 40 CFR Part 190 Dose Evaluation

In accordance with Waterford 3 Offsite Dose Calculation Manual, Section 5.5.2, dose evaluations to demonstrate compliance with Surveillance Requirements 5.5.1.a and 5.5.1.b of the ODCM, dealing with dose from the uranium fuel cycle, need to be performed only if quarterly doses exceed 3 mrem to the total body (liquid releases), 10 mrem to any organ (liquid releases), 10 mrad gamma air dose, 20 mrad beta air dose, or 15 mrem to any organ from radioiodines and particulates.

At no time during 1994 were any of these limits exceeded; therefore, no evaluations were required.

7.4 Doses to Public Inside the Site Boundary

The Member of the Public inside the site boundary expected to have the maximum exposure due to gaseous effluents would be an employee at Waterford 1 and 2 fossil fuel plants, located in the NW sector, approximately 670 meters from the plant. Based on an assumed occupancy of 25% (40 hour work week) and the fact that all employees are adults, the maximum organ dose would be less than 8.28E-04 mrem to the thyroid. Total body and skin doses were calculated to be 8.55E-03 and 1.70E-02 mrem, respectively. These doses were calculated according to the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering only the inhalation and ground plane exposure pathways.

8.0 RELATED INFORMATION

8.1 Changes to the Process Control Program

There was no change to the Process Control Program during the reporting period.

8.2 Changes to the Offsite Dose Calculation Manual

There was a minor change to the Offsite Dose Calculation Manual (ODCM) [Change 1 to procedure UNT-005-014, Revision 3].

The dose calculation formula for liquid effluents was changed due to a typographical error. Also, new subsection 5.3.5.3 was added to provide a correct setpoint determination for monitors which sample a portion of the waste stream that has been diluted. Waterford 3 has one such radiation monitor: Steam Generator Blowdown Heat Exchanger Circulating Water Discharge (PRM-IRE-1900) when the steam generator blowdown releases are to be discharged via the circulating water system to the Mississippi River. A Copy of the Offsite Dose Calculation Manual is included in Attachment 10.1.

8.3 Unavailability of REMP Milk Samples

Due to the unavailability of three milk sampling locations within five kilometers of the plant, Broad Leaf sampling is performed in accordance with ODCM Table 5.8-1. Milk is collected, when available, from the control location and two identified sampling locations as indicated in Waterford 3 Offsite Dose Calculation Manual, Attachment 6.14.

8.4 Report of Required Effluent Instrument Inoperability

ODCM Specification 5.6.1.b and 5.6.2.b require reporting in the Annual Radioactive Effluent Release Report of why designated inoperable effluent monitoring instrumentation was not restored to operability within the time specified in the Action Statement. During the reporting period, there were three cases when the instrument was not restored to operability within the time specified. These cases are described in the following section.

8.4.1 Monitor: Circulating Water Discharge Radiation Monitor (PRM-IRE-1900)

Time Required by Specifications to Restore Operability:

30 Days

Period of Inoperability: 05/04/1994 to 00:10 to 06/17/1994 at 17:49 (44 Days, 17 Hours and 39 Minutes)

Cause of Inoperability:

At 23:50 on May 3, 1994, Circulating Water Radiation Monitor (PRM-IRE-1900) alarmed as a result of contaminated Condensate Makeup (CMU) water leakage past the circulating water radiation monitor purge isolation valve PRMMVAAA014-102 as in CR-94-498. Circulating Water Radiation Monitor was out of service at 00:10 on May 4, 1994 and returned to service at 20:45 on June 17, 1994.

Reason Operability Not Restored Within Allotted Time:

Work was delayed to replace the leaking valve until flushing the CMU/CW piping and decon the monitor sample chamber were completed on June 14, 1994. On June 16, 1994, Valve PRMMVAAA014-102 was replaced. It was tested by Health Physics personnel to confirm that leakage no longer existed prior to returning the Circulating Water Radiation Monitor (PRM-IRE-1900) to service on June 17, 1994.

8.4.2 Monitor: Dry Cool Tower Sump #1 Radiation Monitor (PRM-IRE-6775)

Time Required by Specifications to Restore Operability:

30 Days

Period of Inoperability: 05/16/1994 at 02:57 to 06/18/1994 at 20:58 (34 Days, 18 Hours and 01 Minute)

Cause of Inoperability:

At 02:57 on May 16, 1994, Dry Cooling Tower (DCT) Sump #1 Radiation Monitor (PRM-IRE-6775) was removed from service as a result of sample chamber contamination. On May 25, 1994 an extended purge was performed on the DCT Sump #1. This event was related to the Condensate Makeup header cleaning as in CR-94-498. After the decontamination of the sump was completed, sample chamber was deconned and reinstalled back into the DCT Sump #1 radiation monitor several times. On June 15, 1994 the detector signal and high voltage cables were damaged by the sample chamber lead door. New HV and signal cables were installed on June 17, 1994. Operations personnel then performed a discharge after the DCT radiation monitor was valved in, but the radiation monitor did not indicate the flow through the skid. Troubleshooting of the flow indicator found trash in the sample line. Backflushing the sample line cleared the obstruction and the count rate was acceptable with HP Department. The Operation personnel declared that the DCT Sump #1 radiation monitor operation satisfactory and returned to service at 20:58 on June 18, 1994.

Reason Operability Not Restored Within Allotted Time:

Work was delayed due to extended purge to decontaminate the DCT sump prior to decon and installing the sample chamber. The work delay was related to the Condensate Makeup header cleaning as in CR-94-498. On June 15, 1994, the detector signal and high voltage were damaged by the sample chamber lead door and new HV and signal cables were installed on June 17, 1994. A flow indication problem was resolved after backflushing the trash found in the sample line. It was then tested by Health Physics and Operations personnel and was returned to service at 20:58 on June 18, 1994.

8.4.3 Monitor: Plant Stack Radiation Monitor "A"
(PRM-IRE-0100.1)

Time Required by Specifications to Restore Operability:

30 Days

Period of Inoperability: 06/18/1994 at 09:15 to
08/13/1994 at 17:24
(66 Days, 07 Hours and 39 Minute)

Cause of Inoperability: (see WA-01124383):

On May 18, 1994, the flow pump tripped intermittently on the plant stack radiation monitor "A". Trouble shooting of this problem indicated that the iodine and gas flow probe had failed high. Maintenance Department suggested replacing the failed Kurz linear flow probe with a like item from stores. The identified flow probe (a new type installed by DC-3033) was not available in the stores.

On August 13, 1994, the iodine/gas KURZ flow probe was replaced and a new iodine/gas pump was also installed. The new probe was calibrated as per procedure MI-003-380. After the maintenance personnel confirmed that the flow pump no longer tripped off intermittently, the plant stack radiation monitor "A" was returned to service at 17:24 on August 13, 1994.

Reason Operability Not Restored Within Allotted Time:

Work was delayed due to unavailability of the new type of iodine/gas KURZ flow probe which was installed as per DC-3033. When the new probe was received in the plant stores and was installed by maintenance personnel, a faulty iodine/gas pump PRMMPMP0016 was found. The faulted pump was removed and a new pump was obtained from the stores and installed in the same day. Then, the new flow probe was calibrated and the plant stack "A" radiation monitor was returned to service on August 13, 1994.

8.5 Activity Released Via Secondary Pathways

The following secondary release paths were continuously monitored for radioactivity: 1) the Hot Machine Shop Exhaust (AH-35), 2) Decontamination Shop Exhaust (AH-34), 3) the RAB H&V Equipment Room Ventilation system Exhaust (E-41A and E-41B); and 4) the Switchgear/Cable Vault Area Ventilation System (AH-25). Continuous sampling for these areas is maintained in order to demonstrate the operability of installed treatment systems and to verify integrity of barriers separating primary and secondary ventilation systems. Sampling for these areas was limited to continuous particulate and iodine sampling and monthly noble gas grab sampling. The activity released via these secondary pathways resulted from routine operations and remained below significant levels.

8.6 Missed Effluent Samples:

8.6.1 No gaseous effluent samples were missed during this reporting period.

8.6.2 There was one missed liquid effluent sample for the Dry Cooling Tower Sump (DCTS) #1 as documented in the Condition Report number CR-94-581 as follows:

Description of Event:

Action statement 94-0037 was issued for the Dry Cooling Tower Sump #1 radiation monitor inoperability, to implement the proper requirement from Offsite Dose Calculation Manual (ODCM), Table 5.6-1 Action 29. This action requires that grab samples are collected and analyzed within 24 hours of collection time for radioactivity at a lower limit if detection of at least 1E-07 uCi/ml. Thus samples must be collected once per 24 hours. At 13:30 on June 15, 1994, sample was collected two hours and forty five minutes after its scheduled time.

Cause of Event:

The cause of this event was a personnel error. The formal methods to ensure that samples required as the results of action declaration in Technical Specifications and ODCM Specifications were in place. The HP Technician failed to use the timer/clock provided. This event was not a result of any willful action by the involved individual and if he used the tools provided, it probably would have prevented the incident from occurring.

Corrective Action:

Dry Cooling Tower Sump #1 was sampled immediately upon the technician's realization that the sample has past due. The control room logs were checked to determine if any liquids were released during the time that elapsed between the scheduled sample time (10:45) and actual sample collection time (13:30). It was found that no liquids were released during the two hours and 45 minutes time period.

Action to Prevent Recurrence:

1. The individual responsible for the late action statement sample was counseled on July 14, 1994 in accordance with the Plant Management Directive No. 42 "Improving Human Performance". He was counseled about the importance of collection of these samples within the prescribed time. Also stressed the use of the timer/clocks provided as tools to help eliminate these incidents.

2. LER-92-011 was reviewed for the applicability of its corrective actions as related to this incident. The corrective actions in the referenced LER were adequate and only remotely related to this event.

8.7 Major Changes to Radioactive Waste Systems

During the reporting period, no Major Changes were made to any Radioactive Waste Systems.

8.8 Additional Information

The most recent Reactor Coolant System E-Bar calculation was 0.286 MeV/Disintegration from a sample obtained on June 1, 1994. Reactor Coolant System E-Bar is supplied for information only and is not used for effluent dose calculations.

9.0 TABLES

1 Batch Release Summary
1A Semiannual Summation of all Releases by Quarter - All Airborne Effluents
1B Semiannual Airborne Continuous Elevated and Ground Level Releases
1C Semiannual Airborne Batch Elevated and Ground Level Releases
2A Semiannual Summation of All Releases by Quarter - All Liquid Effluents
2B Semiannual Liquid Continuous and Batch Releases
3 Solid Waste Shipped Offsite for Disposal
4 Joint Frequency Distribution of Meteorological Data
5 Dose Calculation Results for 1994

10.0 ATTACHMENTS

10.1 Changes to Offsite Dose Calculation Manual; January 1, 1994 to December 31, 1994 (131 pages)

TABLE 1

(1 of 2)

REPORT CATEGORY	: BATCH RELEASE SUMMARY
RELEASE POINT	: ALL
TYPE OF RELEASE	: BATCH LIQUID AND GASEOUS
PERIOD START TIME	: 0:00 HRS = 12:00AM JANUARY 1, 1994
PERIOD END TIME	: 4343:59 HRS = 11:59PM JUNE 30, 1994

LIQUID RELEASES

NUMBER OF RELEASES	:	122	
TOTAL TIME FOR ALL RELEASES	:	32464.0	MINUTES
MAXIMUM TIME FOR A RELEASE	:	780.0	MINUTES
AVERAGE TIME FOR A RELEASE	:	266.1	MINUTES
MINIMUM TIME FOR A RELEASE	:	31.0	MINUTES
AVERAGE STREAM FLOW	:	694826.2	GPM

GASEOUS RELEASES

NUMBER OF RELEASES	:	8	
TOTAL TIME FOR ALL RELEASES	:	5499.0	MINUTES
MAXIMUM TIME FOR A RELEASE	:	1441.0	MINUTES
AVERAGE TIME FOR A RELEASE	:	687.4	MINUTES
MINIMUM TIME FOR A RELEASE	:	34.0	MINUTES

TABLE 1

(2 of 2)

REPORT CATEGORY	: BATCH RELEASE SUMMARY
RELEASE POINT	: ALL
TYPE OF RELEASE	: BATCH LIQUID AND GASEOUS
PERIOD START TIME	: 4344:00 HRS = 12:00AM JULY 1, 1994
PERIOD END TIME	: 8759:59 HRS = 11:59PM DECEMBER 31, 1994

LIQUID RELEASES

NUMBER OF RELEASES	:	131	
TOTAL TIME FOR ALL RELEASES	:	35143.0	MINUTES
MAXIMUM TIME FOR A RELEASE	:	344.0	MINUTES
AVERAGE TIME FOR A RELEASE	:	268.3	MINUTES
MINIMUM TIME FOR A RELEASE	:	126.0	MINUTES
AVERAGE STREAM FLOW	:	898211.1	GPM

GASEOUS RELEASES

NUMBER OF RELEASES	:	6	
TOTAL TIME FOR ALL RELEASES	:	1050.0	MINUTES
MAXIMUM TIME FOR A RELEASE	:	360.0	MINUTES
AVERAGE TIME FOR A RELEASE	:	175.0	MINUTES
MINIMUM TIME FOR A RELEASE	:	15.0	MINUTES

TABLE 1A

(1 of 2)

REPORT CATEGORY : SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
TYPE OF ACTIVITY : ALL AIRBORNE EFFLUENTS
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

TYPE OF EFFLUENT	UNIT	QUARTER 1 HOURS 1-2160	QUARTER 2 HOURS 2161-4344	EST.TOTAL ERROR %
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.40E 03	7.41E 00	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	1.80E 02	9.42E-01	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	5.98E-05	4.01E-05	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	7.70E-06	5.11E-06	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	3.56E-06	2.05E-05	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	4.58E-07	2.60E-06	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	2.99E-06	4.62E-06	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	7.31E 01	1.04E 01	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	9.40E 00	1.32E 00	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

TABLE 1A

(2 of 2)

REPORT CATEGORY : SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
TYPE OF ACTIVITY : ALL AIRBORNE EFFLUENTS
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

TYPE OF EFFLUENT	UNIT	QUARTER 3 HOURS 4345-6552	QUARTER 4 HOURS 6553-8760	EST.TOTAL ERROR %
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	4.68E 02	1.99E 02	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	5.89E 01	2.51E 01	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	7.72E-06	5.80E-08	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	9.72E-07	7.30E-09	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	2.16E-05	3.08E-05	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	2.72E-06	3.87E-06	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	5.18E-06	2.50E-06	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	2.27E 01	4.50E 01	1.50E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	2.85E 00	5.67E 00	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

TABLE 1B

(1 of 2)

REPORT CATEGORY : SEMIANNUAL AIRBORNE CONTINUOUS ELEVATED AND GROUND LEVEL RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.

TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES

REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

NUCLIDE	UNIT	ELEVATED RELEASES QUARTER 1 HOURS 1-2160	ELEVATED RELEASES QUARTER 2 HOURS 2161-4344	GROUND RELEASES QUARTER 1 HOURS 1-2160	GROUND RELEASES QUARTER 2 HOURS 2161-4344
FISSION GASES					
KR-85M	CURIES	0.00E-01	0.00E-01	6.68E-01	0.00E-01
XE-131M	CURIES	0.00E-01	0.00E-01	7.75E 00	0.00E-01
XE-133M	CURIES	0.00E-01	0.00E-01	9.90E 00	0.00E-01
XE-133	CURIES	0.00E-01	0.00E-01	1.03E 03	5.78E 00
XE-135	CURIES	0.00E-01	0.00E-01	4.45E 01	1.39E 00
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	1.09E 03	7.17E 00
IODINES					
I-131	CURIES	0.00E-01	0.00E-01	5.98E-05	4.01E-05
PARTICULATES					
H-3	CURIES	0.00E-01	0.00E-01	7.29E 01	1.03E 01
CR-51	CURIES	0.00E-01	0.00E-01	0.00E-01	2.26E-06
MN-54	CURIES	0.00E-01	0.00E-01	0.00E-01	7.76E-07
CO-58	CURIES	0.00E-01	0.00E-01	9.41E-07	1.21E-05
CO-60	CURIES	0.00E-01	0.00E-01	0.00E-01	1.39E-06
ZR-95	CURIES	0.00E-01	0.00E-01	0.00E-01	1.15E-06
NB-95	CURIES	0.00E-01	0.00E-01	0.00E-01	1.36E-06
RU-103	CURIES	0.00E-01	0.00E-01	2.74E-07	0.00E-01
RU-106	CURIES	0.00E-01	0.00E-01	7.14E-07	0.00E-01
CS-137	CURIES	0.00E-01	0.00E-01	1.63E-06	1.42E-06
G ALPHA	CURIES	0.00E-01	0.00E-01	2.99E-06	4.62E-06
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	7.29E 01	1.03E 01

TABLE 1B

(2 of 2)

REPORT CATEGORY : SEMIANNUAL AIRBORNE CONTINUOUS ELEVATED AND GROUND
: LEVEL RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

NUCLIDE	UNIT	ELEVATED RELEASES QUARTER 3 HOURS 4345-6552	ELEVATED RELEASES QUARTER 4 HOURS 6553-8760	GROUND RELEASES QUARTER 3 HOURS 4345-6552	GROUND RELEASES QUARTER 4 HOURS 6553-8760
FISSION GASES					
KR-85M	CURIES	0.00E-01	0.00E-01	7.06E-01	3.79E-01
XE-133	CURIES	0.00E-01	0.00E-01	4.20E 02	1.81E 02
XE-135	CURIES	0.00E-01	0.00E-01	2.14E 01	4.31E 00
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	4.43E 02	1.86E 02
IODINES					
I-131	CURIES	0.00E-01	0.00E-01	7.72E-06	5.80E-08
I-133	CURIES	0.00E-01	0.00E-01	3.67E-06	0.00E-01
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	1.14E-05	5.80E-08
PARTICULATES					
H-3	CURIES	0.00E-01	0.00E-01	2.25E 01	4.50E 01
MN-54	CURIES	0.00E-01	0.00E-01	0.00E-01	1.38E-07
CO-58	CURIES	0.00E-01	0.00E-01	1.39E-07	0.00E-01
CO-60	CURIES	0.00E-01	0.00E-01	0.00E-01	2.65E-07
CS-137	CURIES	0.00E-01	0.00E-01	1.72E-07	5.31E-07
CS-138	CURIES	0.00E-01	0.00E-01	0.00E-01	8.23E-04
G ALPHA	CURIES	0.00E-01	0.00E-01	5.18E-06	2.50E-06
BR-82	CURIES	0.00E-01	0.00E-01	2.13E-05	2.98E-05
SB-125	CURIES	0.00E-01	0.00E-01	0.00E-00	1.63E-07
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	2.25E 01	4.50E 01

TABLE 1C

(1 of 2)

REPORT CATEGORY : SEMIANNUAL AIRBORNE BATCH ELEVATED AND GROUND
: LEVEL RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

NUCLIDE	UNIT	ELEVATED RELEASES QUARTER 1 HOURS 1-2160	ELEVATED RELEASES QUARTER 2 HOURS 2161-4344	GROUND RELEASES QUARTER 1 HOURS 1-2160	GROUND RELEASES QUARTER 2 HOURS 2161-4344
FISSION GASES					
KR-85M	CURIES	0.00E-01	0.00E-01	6.83E-01	0.00E-01
KR-85	CURIES	0.00E-01	0.00E-01	4.96E 00	0.00E-01
KR-88	CURIES	0.00E-01	0.00E-01	4.89E-01	0.00E-01
XE-131M	CURIES	0.00E-01	0.00E-01	3.50E 00	0.00E-01
XE-133M	CURIES	0.00E-01	0.00E-01	3.40E 00	0.00E-01
XE-133	CURIES	0.00E-01	0.00E-01	2.84E 02	1.91E-01
XE-135	CURIES	0.00E-01	0.00E-01	8.84E 00	3.54E-03
AR-41	CURIES	0.00E-01	0.00E-01	4.11E-01	3.94E-02
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	3.06E 02	2.34E-01
IODINES					
NONE					
PARTICULATES					
H-3	CURIES	0.00E-01	0.00E-01	1.47E-01	1.30E-01

TABLE 1C

(2 of 2)

REPORT CATEGORY : SEMIANNUAL AIRBORNE BATCH ELEVATED AND GROUND
: LEVEL RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

NUCLIDE	UNIT	ELEVATED RELEASES :QUARTER 3 :HOURS :4345-6552	ELEVATED RELEASES :QUARTER 4 :HOURS :6553-8760	GROUND RELEASES :QUARTER 3 :HOURS :4345-6552	GROUND RELEASES :QUARTER 4 :HOURS :6553-8760
FISSION GASES					
KR-85M	CURIES	0.00E-01	0.00E-01	8.56E-05	0.00E-01
XE-131M	CURIES	0.00E-01	0.00E-01	5.36E-01	2.80E-01
XE-133M	CURIES	0.00E-01	0.00E-01	1.54E-01	5.73E-02
XE-133	CURIES	0.00E-01	0.00E-01	2.45E 01	1.25E 01
XE-135	CURIES	0.00E-01	0.00E-01	5.66E-02	1.64E-02
AR-41	CURIES	0.00E-01	0.00E-01	1.92E-01	7.61E-02
TOTAL FOR PERIOD	CURIES	0.00E-01	0.00E-01	2.55E 01	1.29E 01
IODINES					
NONE					
PARTICULATES					
H-3	CURIES	0.00E-01	0.00E-01	1.83E-01	3.15E-02

TABLE 2A

(1 of 2)

REPORT CATEGORY : SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
TYPE OF ACTIVITY : ALL LIQUID EFFLUENTS
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

TYPE OF EFFLUENT	UNIT	QUARTER 1 HOURS 1-2160	QUARTER 2 HOURS 2161-4344	EST.TOTAL ERROR %
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE(NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	2.61E 00	6.19E-01	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	7.81E-09	1.76E-09	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	3.23E 02	3.15E 01	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	9.67E-07	8.94E-08	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	5.54E 00	1.75E-01	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	1.66E-08	5.07E-10	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E-01	0.00E-01	1.50E 01
E. WASTE VOL RELEASED(PRE-DILUTION)	GAL	2.40E 06	2.26E 06	1.50E 01
F. VOLUME OF DILUTION WATER USED	GAL	8.83E 10	9.31E 10	1.50E 01

TABLE 2A

(2 of 2)

REPORT CATEGORY : SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
TYPE OF ACTIVITY : ALL LIQUID EFFLUENTS
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

TYPE OF EFFLUENT	UNIT	QUARTER 3 HOURS 4345-6552	QUARTER 4 HOURS 6553-8760	EST.TOTAL ERROR %
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE(NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.43E-01	2.82E-01	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	2.71E-10	7.54E-10	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.61E 02	2.43E 02	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	3.06E-07	6.48E-07	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	5.10E-01	6.32E-01	1.50E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	9.69E-10	1.69E-09	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E-01	0.00E-01	1.50E 01
E. WASTE VOL RELEASED(PRE-DILUTION)	GAL	2.36E 06	1.47E 06	1.50E 01
F. VOLUME OF DILUTION WATER USED	GAL	1.39E 11	9.88E 10	1.50E 01

TABLE 2B

(1 of 4)

REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 1 HOURS 1-2160	CONTINUOUS RELEASES QUARTER 2 HOURS 2161-4344	BATCH RELEASES QUARTER 1 HOURS 1-2160	BATCH RELEASES QUARTER 2 HOURS 2161-4344
ALL NUCLIDES					
H-3	CURIES	1.73E-01	1.50E-01	3.23E 02	3.14E 01
NA-24	CURIES	0.00E-01	0.00E-01	1.58E-04	1.21E-04
CR-51	CURIES	0.00E-01	0.00E-01	1.72E-02	3.27E-02
MN-54	CURIES	0.00E-01	0.00E-01	1.45E-02	5.81E-03
MN-56	CURIES	0.00E-01	0.00E-01	5.74E-05	0.00E-01
FE-55	CURIES	0.00E-01	0.00E-01	1.01E-03	1.30E-02
FE-59	CURIES	0.00E-01	0.00E-01	4.14E-03	3.74E-03
CO-58	CURIES	0.00E-01	0.00E-01	2.10E 00	3.51E-01
CO-60	CURIES	0.00E-01	1.68E-06	5.18E-02	2.18E-02
RB-88	CURIES	0.00E-01	0.00E-01	1.97E-03	5.80E-02
SR-92	CURIES	0.00E-01	0.00E-01	0.00E-01	3.38E-05
ZR-95	CURIES	0.00E-01	0.00E-01	9.90E-03	1.24E-02
ZR-97	CURIES	0.00E-01	0.00E-01	1.17E-03	0.00E-01
NB-95	CURIES	0.00E-01	0.00E-01	1.51E-02	1.83E-02
MO-99	CURIES	0.00E-01	0.00E-01	2.14E-03	0.00E-01
TC-99M	CURIES	0.00E-01	0.00E-01	4.30E-03	9.42E-05
AG-110M	CURIES	0.00E-01	0.00E-01	0.00E-01	2.58E-04
TE-132	CURIES	0.00E-01	0.00E-01	1.15E-04	0.00E-01
I-131	CURIES	0.00E-01	0.00E-01	1.81E-01	8.30E-03
I-132	CURIES	0.00E-01	0.00E-01	2.81E-04	1.20E-05
I-133	CURIES	0.00E-01	0.00E-01	1.01E-02	2.50E-04
I-135	CURIES	0.00E-01	0.00E-01	1.06E-03	0.00E-01
CS-134	CURIES	0.00E-01	3.78E-06	6.10E-02	1.03E-02
CS-136	CURIES	0.00E-01	0.00E-01	2.41E-03	2.93E-05
CS-137	CURIES	0.00E-01	4.02E-06	3.98E-02	6.90E-03
BA-140	CURIES	0.00E-01	0.00E-01	3.02E-04	0.00E-01
LA-140	CURIES	0.00E-01	0.00E-01	5.50E-03	1.58E-04
CE-141	CURIES	0.00E-01	0.00E-01	0.00E-01	3.20E-06

TABLE 2B

(2 of 4)

REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED.

TYPE OF ACTIVITY : ALL RADIONUCLIDES

REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 1 HOURS 1-2160	CONTINUOUS RELEASES QUARTER 2 HOURS 2161-4344	BATCH RELEASES QUARTER 1 HOURS 1-2160	BATCH RELEASES QUARTER 2 HOURS 2161-4344
ALL NUCLIDES CONTINUED					
CE-144	CURIES	0.00E-01	0.00E-01	0.00E-01	1.10E-03
W-187	CURIES	0.00E-01	0.00E-01	0.00E-01	1.25E-03
KR-85M	CURIES	0.00E-01	0.00E-01	3.25E-04	8.55E-04
KR-85	CURIES	0.00E-01	0.00E-01	4.35E-02	0.00E-01
KR-87	CURIES	0.00E-01	0.00E-01	0.00E-01	5.20E-05
KR-88	CURIES	0.00E-01	0.00E-01	3.87E-04	7.00E-04
XE-131M	CURIES	0.00E-01	0.00E-01	8.38E-02	9.87E-05
XE-133M	CURIES	0.00E-01	0.00E-01	3.13E-02	3.05E-03
XE-133	CURIES	0.00E-01	0.00E-01	5.33E 00	1.52E-01
XE-135	CURIES	0.00E-01	0.00E-01	5.44E-02	2.13E-02
AR-41	CURIES	0.00E-01	0.00E-01	0.00E-01	1.48E-04
CO-57	CURIES	0.00E-01	0.00E-01	2.36E-03	5.81E-04
SB-124	CURIES	0.00E-01	0.00E-01	1.28E-02	5.10E-03
SN-113	CURIES	0.00E-01	0.00E-01	9.05E-04	5.70E-04
NB-97	CURIES	0.00E-01	0.00E-01	5.00E-03	1.48E-04
SB-122	CURIES	0.00E-01	0.00E-01	1.18E-02	0.00E-01
SB-125	CURIES	0.00E-01	0.00E-01	4.67E-02	6.69E-02
SB-127	CURIES	0.00E-01	0.00E-01	0.00E-01	7.43E-05
SB-126	CURIES	0.00E-01	0.00E-01	1.68E-03	0.00E-01
TOTAL FOR PERIOD	CURIES	1.73E-01	1.50E-01	3.31E 02	3.22E 01

TABLE 2B

(3 of 4)

REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 3 HOURS 4345-6552	CONTINUOUS RELEASES QUARTER 4 HOURS 6553-8760	BATCH RELEASES QUARTER 3 HOURS 4345-6552	BATCH RELEASES QUARTER 4 HOURS 6553-8760
ALL NUCLIDES					
H-3	CURIES	1.46E-01	5.24E-02	1.61E 02	2.42E 02
NA-24	CURIES	0.00E-01	0.00E-01	1.55E-05	7.62E-06
CR-51	CURIES	0.00E-01	0.00E-01	0.00E-01	1.75E-04
MN-54	CURIES	2.41E-06	6.09E-08	6.86E-04	8.78E-04
FE-55	CURIES	0.00E-01	0.00E-01	3.96E-02	2.48E-01
FE-59	CURIES	0.00E-01	0.00E-01	4.55E-06	2.17E-05
CO-58	CURIES	8.04E-07	0.00E-01	2.79E-02	6.71E-03
CO-60	CURIES	0.00E-01	0.00E-01	6.87E-03	6.00E-03
ZN-65	CURIES	0.00E-01	0.00E-01	3.40E-06	0.00E-01
RB-88	CURIES	0.00E-01	0.00E-01	3.57E-04	0.00E-01
SR-89	CURIES	0.00E-01	0.00E-01	0.00E-01	2.06E-04
SR-92	CURIES	0.00E-01	0.00E-01	0.00E-01	1.91E-06
ZR-95	CURIES	0.00E-01	0.00E-01	3.62E-04	9.65E-04
NB-95	CURIES	0.00E-01	0.00E-01	9.35E-04	1.86E-03
TC-99M	CURIES	0.00E-01	0.00E-01	1.31E-04	0.00E-01
RU-105	CURIES	0.00E-01	0.00E-01	0.00E-01	1.65E-05
I-131	CURIES	0.00E-01	0.00E-01	4.02E-02	7.39E-04
I-133	CURIES	1.32E-06	0.00E-01	1.08E-03	6.24E-05
I-134	CURIES	0.00E-01	0.00E-01	0.00E-01	2.49E-05
I-135	CURIES	0.00E-01	0.00E-01	4.54E-05	5.00E-06
CS-134	CURIES	6.17E-06	3.23E-06	6.47E-03	3.68E-03
CS-137	CURIES	2.58E-05	3.69E-06	4.86E-03	3.21E-03
CS-138	CURIES	0.00E-01	0.00E-01	7.60E-04	0.00E-01
LA-140	CURIES	0.00E-01	0.00E-01	1.46E-05	8.37E-05
LA-142	CURIES	0.00E-01	0.00E-01	3.37E-06	0.00E-01
CE-144	CURIES	0.00E-01	0.00E-01	1.05E-03	0.00E-01
W-187	CURIES	2.64E-06	0.00E-01	1.87E-03	2.24E-04
KR-85M	CURIES	0.00E-01	0.00E-01	4.81E-05	1.52E-05

W21419HP

TABLE 2B

(4 of 4)

REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 3 HOURS 4345-6552	CONTINUOUS RELEASES QUARTER 4 HOURS 6553-8760	BATCH RELEASES QUARTER 3 HOURS 4345-6552	BATCH RELEASES QUARTER 4 HOURS 6553-8760
ALL NUCLIDES CONTINUED					
KR-85	CURIES	0.00E-01	0.00E-01	3.49E-03	1.39E-02
XE-131M	CURIES	0.00E-01	0.00E-01	9.51E-03	1.43E-02
XE-133M	CURIES	0.00E-01	0.00E-01	3.24E-03	1.77E-03
XE-133	CURIES	0.00E-01	0.00E-01	4.86E-01	5.97E-01
XE-135	CURIES	0.00E-01	0.00E-01	7.64E-03	5.16E-03
CO-57	CURIES	0.00E-01	0.00E-01	8.07E-06	5.95E-06
SB-124	CURIES	0.00E-01	0.00E-01	9.49E-05	3.64E-06
SN-113	CURIES	0.00E-01	0.00E-01	1.65E-05	5.36E-05
NB-97	CURIES	0.00E-01	0.00E-01	4.61E-05	6.18E-06
SB-125	CURIES	0.00E-01	8.20E-06	9.43E-03	8.80E-03
SB-127	CURIES	0.00E-01	0.00E-01	1.79E-05	0.00E-01
TOTAL FOR PERIOD	CURIES	1.46E-01	5.24E-02	1.61E 02	2.43E 02

W21419HP

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 8.72 Burial Volume	2.55E-02 *1 2.55E-02 Burial Activity	—+25% —+25%
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 7.2 Burial Volume	8.06E-02 *1 3.66E-02 Burial Activity	—+25% —+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 9.74 Burial Volume	1.24E-01 *1 1.24E-01 Burial Activity	–+25% –+25%
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 7.37 Burial Volume	8.43E-02 *1 8.45E-02 Burial Activity	–+25% –+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 9.70 Burial Volume	5.87E-02 *1 5.87E-02 Buried Activity	-+25% -+25%
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 7.90 Burial Volume	3.51E-01 *1 3.51E-01 Buried Activity	-+25% -+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	58.91 8.43 Burial Volume	1.77E-01 *1 1.77E-01 Buried Activity	−+25% −+25%
(B) Non Compacted Dry Activity Waste Shipped to Alaron Corp for Volume Reduction *	2080	8.83 0.00 Burial Volume	7.69E-05 *1 0.00E-00 Buried Activity	−+25% −+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(B) Compacted Dry Active Waste in a Carbon Steel B-25 Box	570	16.14	5.95E-02 *2	-+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(A) Resin Waste Management Resin Dewatered in a High Integrity Container (Bead Resin)	641.2	18.16	1.35E+03 *2	-+25%
(A) Resin Waste Management Resin Dewatered in a High Integrity Container (Bead Resin)	174.3	4.94	4.70E+00 *2	-+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

WASTE TYPE	CONTAINER VOLUME (Ft3)	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(A) Resin Dewatered in a Carbon Steel Liner (Bead Resin Powdex Resin)	398.8	11.29	2.32E-03 *2	-+25%
(A) Powdex Resin in a Carbon Steel B-25 Box	950	26.9	2.52E-05 *2	-+25%
(A) Filters in a High Integrity Container	120.3	3.41	1.88E+01 *2	-+25%

* Waste volume shipped for volume reduction do not reflect final burial waste volume unless otherwise stated.

*1 Activity determined by estimations.

*2 Activity determined by measurements.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL
DURING PERIOD OF 1/1/94 TROUGH 12/31/94

NUMBER OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
6	Sole Use Cask	Barnwell, SC
2	Sole Use Flatbed	Barnwell, SC
8	Sole Use Flatbed	Wampum, PA

WASTE CLASS	# OF SHIPMENTS	TYPE	TYPE OF CONTAINER	MODE	DISTINATION
B	4	>A LSA	Poly -HIC	Truck	Barnwell,SC
AU	8	LSA	Strong-Tight	Truck	Wampum, PA
AU	3	LSA	Strong-Tight	Truck	Barnwell,SC
CS	1	>A LSA	Strong-Tight	Truck	Barnwell,SC

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

SUMMARY BY MAJOR WASTE TYPES

(A) Spend Resins, Filter sludges, Evaporator Bottoms, etc.

(B) Dry Compressible Waste, Contaminated Equipment, etc.

(C) Irradiated Components, Control Rods, etc.

(D) Other (N/A)

WASTE TYPE	WASTE VOLUME (M3)	TOTAL ACTIVITY (Ci)	ERROR
(A)	64.70	1.376E+03	-+ 25%
(B)	437.27*	9.60E-01	-+ 25%
(C)	NONE	N/A	N/A
(D)	NONE	N/A	N/A

* Includes all Type Waste Volume.

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

SUMMARY BY MAJOR WASTE TYPE (Cont'd)

WASTE TYPE	NUCLIDE NAME	% ABUNDANCE	CURIES
(A)	Co-58	56.48	7.77E+02
	Cs-134	20.76	2.86E+02
	Cs-137	14.46	1.99E+02
	Fe-55	2.88	3.96E+01
	Ni-63	2.62	3.61E+01
	Co-60	1.205	1.66E+01
	Ce-144	0.740	1.02E+01
	Mn-54	0.154	2.12E+00
	I-131	0.524	7.21E+00
	H-3	0.054	7.37E-01
	C-14	0.033	4.57E-01
	Ni-59	0.028	3.81E-01
	Zr-95	0.026	3.54E-01
	Pu-241	0.023	3.22E-01
	Nb-95	0.015	2.11E-01
	Sr-90	0.003	3.65E-02
	Pu-238	0.0003	4.51E-03
	Cm-242	0.0003	4.52E-03
	Cm-243/244	0.0003	3.56E-03
	PU-239/240	0.0001	1.94E-03
	Am-241	0.0001	[illegible].42E-03
	TOTAL	100.00	1.376E+03

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

SUMMARY BY MAJOR WASTE TYPE (Cont'd)

WASTE TYPE	NUCLIDE NAME	% ABUNDANCE	CURIES
(B)	Co-58	41.95	4.03E-01
	Co-60	27.15	2.61E-01
	Cs-137	11.54	1.11E-01
	Cs-134	5.65	5.43E-02
	Mn-54	5.30	5.09E-02
	Ni-63	4.21	4.04E-02
	Fe-55	2.97	2.85E-02
	Co-57	0.962	9.24E-03
	H-3	0.0889	8.53E-04
	Nb-95	0.0908	8.72E-04
	Ni-59	0.0428	4.11E-04
	C-14	0.0386	3.71E-04
	Pu-241	0.0070	6.70E-05
	Sr-90	0.0029	2.77E-05
	Cm-242	0.0003	2.97E-06
	TOTAL	100.00	**9.60E-01**

SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL DURING PERIOD OF 1/1/94 TROUGH 12/31/94

SUMMARY BY MAJOR WASTE TYPE (Cont'd)

Notes

NOTE 1: Scientific Ecology Group (SEG) sent a combined total of 6.25 m3 of Type B waste with a total of 1.68E-01 Curies of activity for burial. Also Quadrex sent a combined total of 16.19 m3 of Type B waste with a total of 3.96E-01 Curies of activity for burial.

Estimates of the major nuclide composition are included the previous Effluent Release Reports. This waste was generated in 1993.

TABLE 4

(1 of 4)

JOINT FREQUENCY DISTRIBUTION OF METEOROLOGICAL DATA

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class A

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	3	8	28	9	0	0	0	0	48
NNE	0	0	0	0	4	9	36	12	0	0	0	0	61
NE	0	0	0	0	2	15	110	10	0	0	0	0	137
ENE	0	0	0	0	1	12	7	3	0	0	0	0	23
E	0	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	0	1	3	4	11	6	0	0	0	0	25
SE	0	0	0	0	2	9	31	20	0	0	0	0	62
SSE	0	0	0	2	2	7	17	17	3	0	0	0	48
S	0	0	2	0	4	10	14	12	0	0	0	0	42
SSW	0	0	0	2	5	10	12	0	0	0	0	0	29
SW	0	0	0	2	6	22	26	3	0	0	0	0	59
WSW	0	0	1	2	10	19	15	0	0	0	0	0	47
W	0	0	0	2	6	16	4	0	0	0	0	0	28
WNW	0	0	0	1	0	12	0	0	0	0	0	0	13
NW	0	0	0	1	2	2	9	0	0	0	0	0	14
NNW	0	0	0	2	5	12	21	7	0	0	0	0	47
Total	0	0	3	15	55	168	341	99	3	0	0	0	684

Number of calms for A Stability: 0

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class B

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	1	6	13	12	3	1	0	0	0	36
NNE	0	0	0	0	1	7	15	7	0	1	0	0	31
NE	0	0	0	2	5	16	52	6	0	0	0	0	81
ENE	0	0	0	0	1	6	6	0	0	0	0	0	13
E	0	0	0	0	0	3	2	0	0	0	0	0	5
ESE	0	0	0	0	0	2	5	2	0	0	0	0	9
SE	0	0	0	0	2	4	15	7	0	0	0	0	28
SSE	0	0	0	2	1	3	14	7	0	0	0	0	27
S	0	0	0	1	3	7	10	9	0	0	0	0	30
SSW	0	0	0	2	0	2	6	5	0	0	0	0	15
SW	0	0	0	1	1	5	7	5	0	0	0	0	19
WSW	0	0	0	2	4	6	3	0	0	0	0	0	15
W	0	0	1	0	1	3	0	0	0	0	0	0	5
WNW	0	0	0	3	3	4	2	1	0	0	0	0	13
NW	0	0	0	3	3	1	2	0	0	0	0	0	9
NNW	0	0	0	1	4	3	5	2	1	0	0	0	16
Total	0	0	1	18	35	85	156	54	2	1	0	0	352

Number of calms for B Stability: 0

TABLE 4

(2 of 4)

JOINT FREQUENCY DISTRIBUTION OF METEOROLOGICAL DATA

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class C

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	2	11	20	6	3	0	0	0	0	42
NNE	0	0	0	3	7	12	21	1	0	0	0	0	44
NE	0	0	0	1	6	26	38	5	0	0	0	0	76
ENE	0	0	0	1	0	11	13	1	0	0	0	0	26
E	0	0	1	0	0	3	5	0	0	0	0	0	9
ESE	0	0	0	0	1	3	5	2	0	0	0	0	11
SE	0	0	0	1	2	8	11	5	0	0	0	0	27
SSE	0	0	0	0	0	4	13	4	0	0	0	0	21
S	0	0	1	1	3	9	12	2	2	0	0	0	30
SSW	0	0	0	3	1	2	7	2	0	0	0	0	15
SW	0	0	0	3	3	8	10	0	0	0	0	0	24
WSW	0	1	1	1	4	6	4	0	0	0	0	0	17
W	0	0	0	0	5	5	0	0	0	0	0	0	10
WNW	0	0	0	2	3	6	4	3	0	0	0	0	18
NW	0	0	0	1	2	4	6	1	0	0	0	0	14
NNW	0	0	1	0	6	9	18	5	3	0	0	0	42
Total	0	1	4	19	54	136	173	34	5	0	0	0	426

Number of calms for C Stability: 0

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class D

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	0	1	3	16	29	53	133	57	5	1	0	0	298
NNE	0	1	4	26	30	48	78	23	0	0	0	0	210
NE	0	1	4	21	26	110	184	30	1	0	0	0	377
ENE	0	1	3	6	10	32	83	21	3	0	0	0	159
E	0	2	1	2	3	9	40	1	0	0	0	0	58
ESE	0	1	0	1	4	15	56	9	4	0	0	0	90
SE	0	1	1	4	6	35	85	12	3	0	0	0	147
SSE	0	1	0	12	16	53	90	22	2	0	0	0	196
S	0	0	5	7	17	45	47	27	16	1	0	0	165
SSW	0	1	5	5	12	24	24	24	9	0	1	0	105
SW	0	1	6	15	11	38	37	3	0	0	0	0	111
WSW	1	1	2	16	19	42	16	1	0	0	0	0	98
W	0	2	5	16	13	27	15	1	0	0	0	0	79
WNW	0	0	2	12	18	11	16	1	0	0	0	0	60
NW	0	1	3	16	14	22	51	17	1	0	0	0	125
NNW	0	0	2	4	8	36	91	36	24	0	0	0	201
Total	1	15	46	179	236	600	1046	285	68	2	1	0	2479

Number of calms for D Stability: 0

TABLE 4

(3 of 4)

JOINT FREQUENCY DISTRIBUTION OF METEOROLOGICAL DATA

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class E

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	2	6	9	25	45	69	110	8	1	0	0	0	275
NNE	2	2	4	21	34	66	78	4	0	0	0	0	211
NE	0	1	7	21	39	132	121	7	0	0	0	0	328
ENE	0	0	5	13	27	67	63	2	0	0	0	0	177
E	1	3	1	11	18	35	38	0	0	0	0	0	107
ESE	1	5	4	12	21	60	71	3	0	0	0	0	177
SE	0	4	2	21	40	136	89	10	1	0	0	0	303
SSE	2	8	13	33	73	93	36	7	1	0	0	0	266
S	2	14	16	38	47	63	50	16	6	1	0	0	253
SSW	5	5	18	40	34	51	40	10	1	0	0	0	204
SW	4	10	11	39	36	48	13	2	0	0	0	0	163
WSW	4	7	16	21	16	18	3	0	0	0	0	0	85
W	3	5	13	31	13	5	2	0	0	0	0	0	72
WNW	1	4	11	38	18	9	3	0	0	0	0	0	84
NW	1	6	12	16	14	22	21	0	0	0	0	0	92
NNW	2	1	3	18	22	69	52	5	2	0	0	0	174
Total	30	81	145	398	497	943	790	74	12	1	0	0	2971

Number of calms for E Stability: 5

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class F

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	1	5	6	14	16	26	5	0	0	0	0	0	73
NNE	2	2	9	13	13	11	2	0	0	0	0	0	52
NE	3	7	7	24	15	31	6	0	0	0	0	0	93
ENE	0	2	5	5	5	3	4	0	0	0	0	0	24
E	3	3	4	3	3	6	1	0	0	0	0	0	23
ESE	1	7	3	0	4	7	2	0	0	0	0	0	24
SE	3	4	9	14	20	8	0	0	0	0	0	0	58
SSE	3	5	26	40	23	27	4	2	0	0	0	0	130
S	4	19	36	48	16	14	3	3	0	0	0	0	143
SSW	10	27	40	57	10	2	1	0	1	0	0	0	148
SW	9	17	31	37	11	6	2	0	0	0	0	0	113
WSW	4	22	21	20	9	5	0	0	0	0	0	0	81
W	4	13	[illegible]6	16	6	2	0	0	0	0	0	0	67
WNW	5	7	12	16	5	4	0	0	0	0	0	0	49
NW	2	7	14	10	4	4	2	0	0	0	0	0	43
NNW	4	8	9	17	12	13	1	0	0	0	0	0	64
Total	58	155	258	334	172	169	33	5	1	0	0	^	1185

Number of calms for F Stability: 33

TABLE 4

(4 of 4)

JOINT FREQUENCY DISTRIBUTION OF METEOROLOGICAL DATA

Joint frequency distribution of wind speed and direction in hours 01-01-94 00:00to 12-31-94 23:59 Pasquill Class G

Wind Speed (M/S) at 10-m Level

Wind Direction	.35-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10	10.1-13	13.1-18.0	>18.0	Total
N	3	10	10	7	3	0	0	0	0	0	0	0	33
NNE	1	1	3	1	2	3	0	0	0	0	0	0	11
NE	3	2	1	1	3	8	0	0	0	0	0	0	18
ENE	0	0	0	4	0	0	0	0	0	0	0	0	4
E	0	0	0	1	0	0	0	0	0	0	0	0	1
ESE	2	1	0	0	0	0	0	0	0	0	0	0	3
SE	0	3	3	2	2	1	0	0	0	0	0	0	11
SSE	1	2	4	9	3	0	0	0	0	0	0	0	19
S	4	8	18	22	3	1	0	0	0	0	0	0	56
SSW	9	12	30	32	4	0	0	0	0	0	0	0	87
SW	4	29	23	10	1	1	0	0	0	0	0	0	68
WSW	8	22	17	10	1	0	0	0	0	0	0	0	58
W	13	13	13	10	0	0	0	0	0	0	0	0	49
WNW	8	23	11	6	0	0	0	0	0	0	0	0	48
NW	4	10	3	3	0	0	0	0	0	0	0	0	20
NNW	7	13	12	6	2	0	0	0	0	0	0	0	40
Total	67	149	148	124	24	14	0	0	0	0	0	0	526

Number of calms for G Stability: 71

Total vaild hours for all stabilities = 8732
Total invaild hours for all stabilities = 28

TABLE 5

(1 of 2)

DOSE CALCULATION RESULTS FOR 1994

(DOSES DUE TO GASEOUS RADIOACTIVE EFFLUENTS)

** UNIT 1 ** QUARTER 1 OF 1994 **
DOSE FROM RADIOIODINES, PARTICULATES, AND TRITIUM
AT CONTROLLING LOCATION:

TOTAL DOSE (MREM) FOR BONE	: 1.5660E-04
TOTAL DOSE (MREM) FOR LIVER	: 5.8835E-02
TOTAL DOSE (MREM) FOR TOTAL BODY	: 5.8721E-02
TOTAL DOSE (MREM) FOR THYROID	: 9.4832E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 5.8813E-02
TOTAL DOSE (MREM) FOR LUNG	: 5.8678E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 5.8673E-02
NOBLE GAS DOSE AT SITE BOUNDARY:	
TOTAL BODY DOSE TOTAL (MREM)	: 3.4823E-01
SKIN DOSE TOTAL (MREM)	: 8.2264E-01
NOBLE GAS AIRDOSE AT SITE BOUNDARY:	
TOTAL GAMMA AIRDOSE (MRAD)	: 4.0790E-01
TOTAL BETA AIRDOSE (MRAD)	: 1.0856E 00

** UNIT 1 ** QUARTER 2 OF 1994 **
DOSE FROM RADIOIODINES, PARTICULATES, AND TRITIUM
AT CONTROLLING LOCATION:

TOTAL DOSE (MREM) FOR BONE	: 1.4618E-04
TOTAL DOSE (MREM) FOR LIVER	: 8.5181E-03
TOTAL DOSE (MREM) FOR TOTAL BODY	: 8.4317E-03
TOTAL DOSE (MREM) FOR THYROID	: 3.2646E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 8.4945E-03
TOTAL DOSE (MREM) FOR LUNG	: 8.4055E-03
TOTAL DOSE (MREM) FOR GI-LLI	: 8.3988E-03
NOBLE GAS DOSE AT SITE BOUNDARY:	
TOTAL BODY DOSE TOTAL (MREM)	: 3.2283E-03
SKIN DOSE TOTAL (MREM)	: 7.1471E-03
NOBLE GAS AIRDOSE AT SITE BOUNDARY:	
TOTAL GAMMA AIRDOSE (MRAD)	: 3.5937E-03
TOTAL BETA AIRDOSE (MRAD)	: 6.8561E-03

** UNIT 1 ** QUARTER 3 OF 1994 **
DOSE FROM RADIOIODINES, PARTICULATES, AND TRITIUM
AT CONTROLLING LOCATION:

TOTAL DOSE (MREM) FOR BONE	: 1.8809E-05
TOTAL DOSE (MREM) FOR LIVER	: 1.8207E-02
TOTAL DOSE (MREM) FOR TOTAL BODY	: 1.8193E-02
TOTAL DOSE (MREM) FOR THYROID	: 2.2875E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 1.8205E-02
TOTAL DOSE (MREM) FOR LUNG	: 1.8187E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 1.8187E-02
NOBLE GAS DOSE AT SITE BOUNDARY:	
TOTAL BODY DOSE TOTAL (MREM)	: 1.2014E-01
SKIN DOSE TOTAL (MREM)	: 2.7980E-01
NOBLE GAS AIRDOSE AT SITE BOUNDARY:	
TOTAL GAMMA AIRDOSE (MRAD)	: 1.4022E-01
TOTAL BETA AIRDOSE (MRAD)	: 3.6464E-01

** UNIT 1 ** QUARTER 4 OF 1994 **
DOSE FROM RADIOIODINES, PARTICULATES, AND TRITIUM
AT CONTROLLING LOCATION:

TOTAL DOSE (MREM) FOR BONE	: 2.5350E-05
TOTAL DOSE (MREM) FOR LIVER	: 3.6166E-02
TOTAL DOSE (MREM) FOR TOTAL BODY	: 3.6149E-02
TOTAL DOSE (MREM) FOR THYROID	: 3.6183E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 3.6153E-02
TOTAL DOSE (MREM) FOR LUNG	: 3.6150E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 3.6148E-02
NOBLE GAS DOSE AT SITE BOUNDARY:	
TOTAL BODY DOSE TOTAL (MREM)	: 4.6030E-02
SKIN DOSE TOTAL (MREM)	: 1.0804E-01
NOBLE GAS AIRDOSE AT SITE BOUNDARY:	
TOTAL GAMMA AIRDOSE (MRAD)	: 5.4397E-02
TOTAL BETA AIRDOSE (MRAD)	: 1.5040E-01

** UNIT 1 ** TOTALS FOR 1994 **
DOSE FROM RADIOIODINES, PARTICULATES, AND TRITIUM
AT CONTROLLING LOCATION:

TOTAL DOSE (MREM) FOR BONE	: 3.4693E-04
TOTAL DOSE (MREM) FOR LIVER	: 1.2173E-01
TOTAL DOSE (MREM) FOR TOTAL BODY	: 1.2150E-01
TOTAL DOSE (MREM) FOR THYROID	: 1.8654E-01
TOTAL DOSE (MREM) FOR KIDNEY	: 1.2166E-01
TOTAL DOSE (MREM) FOR LUNG	: 1.2142E-01
TOTAL DOSE (MREM) FOR GI-LLI	: 1.2141E-01
NOBLE GAS DOSE AT SITE BOUNDARY:	
TOTAL BODY DOSE TOTAL (MREM)	: 5.1763E-01
SKIN DOSE TOTAL (MREM)	: 1.2176E 00
NOBLE GAS AIRDOSE AT SITE BOUNDARY:	
TOTAL GAMMA AIRDOSE (MRAD)	: 6.0611E-01
TOTAL BETA AIRDOSE (MRAD)	: 1.6075E 00

TABLE 5

(2 of 2)

DOSE CALCULATION RESULTS FOR 1994

(DOSES DUE TO LIQUID RADIOACTIVE EFFLUENTS)

** UNIT 1 ** QUARTER 1 OF 1994 **	
TOTAL DOSE (MREM) FOR BONE	: 2.8456E-01
TOTAL DOSE (MREM) FOR LIVER	: 5.6576E-01
TOTAL DOSE (MREM) FOR TOTAL BODY	: 4.3865E-01
TOTAL DOSE (MREM) FOR THYROID	: 1.2811E-01
TOTAL DOSE (MREM) FOR KIDNEY	: 1.9706E-01
TOTAL DOSE (MREM) FOR LUNG	: 7.5504E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 6.4784E-02

** UNIT 1 ** QUARTER 2 OF 1994 **	
TOTAL DOSE (MREM) FOR BONE	: 7.1214E-02
TOTAL DOSE (MREM) FOR LIVER	: 1.4458E-01
TOTAL DOSE (MREM) FOR TOTAL BODY	: 1.1235E-01
TOTAL DOSE (MREM) FOR THYROID	: 1.6487E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 5.5558E-02
TOTAL DOSE (MREM) FOR LUNG	: 2.6484E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 2.3459E-02

** UNIT 1 ** QUARTER 3 OF 1994 **	
TOTAL DOSE (MREM) FOR BONE	: 1.5554E-01
TOTAL DOSE (MREM) FOR LIVER	: 2.5489E-01
TOTAL DOSE (MREM) FOR TOTAL BODY	: 1.8254E-01
TOTAL DOSE (MREM) FOR THYROID	: 2.6236E-02
TOTAL DOSE (MREM) FOR KIDNEY	: 9.4223E-02
TOTAL DOSE (MREM) FOR LUNG	: 4.0086E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 2.2117E-02

** UNIT 1 ** QUARTER 4 OF 1994 **	
TOTAL DOSE (MREM) FOR BONE	: 4.4275E-02
TOTAL DOSE (MREM) FOR LIVER	: 8.3036E-02
TOTAL DOSE (MREM) FOR TOTAL BODY	: 6.2868E-02
TOTAL DOSE (MREM) FOR THYROID	: 4.8720E-03
TOTAL DOSE (MREM) FOR KIDNEY	: 3.0302E-02
TOTAL DOSE (MREM) FOR LUNG	: 1.3470E-02
TOTAL DOSE (MREM) FOR GI-LLI	: 6.9512E-03

** UNIT 1 ** TOTALS FOR 1994 **	
TOTAL DOSE (MREM) FOR BONE	: 5.5559E-01
TOTAL DOSE (MREM) FOR LIVER	: 1.0483E 00
TOTAL DOSE (MREM) FOR TOTAL BODY	: 7.9641E-01
TOTAL DOSE (MREM) FOR THYROID	: 1.7571E-01
TOTAL DOSE (MREM) FOR KIDNEY	: 3.7715E-01
TOTAL DOSE (MREM) FOR LUNG	: 1.5554E-01
TOTAL DOSE (MREM) FOR GI-LLI	: 1.1731E-01

ATTACHMENT 10.1

(131 PAGES)

CHANGES TO UNT-005-014

OFFSITE DOSE CALCULATION MANUAL (ODCM)

January 1, 1994 To December 31, 1994

UNT-005-014

REVISION 3

EFFECTIVE DATE ________

SAFETY-RELATED

ADMINISTRATIVE PROCEDURE

OFFSITE DOSE CALCULATION MANUAL

PORC AND PORC - S/C REVIEW AND APPROVAL SHEET	
REVIEW OF: UNT-005-014 - (Change 1) Offsite Dose Calculation Manual (Rev. 3)	PORC ☒ PORC - S/C ☐
The PORC or PORC S/C has reviewed this item and determined that a Safety/Commitment Review was performed (if applicable), that a Safety Evaluation was performed (if applicable), that an unreviewed safety question does not exist, and that nuclear safety is/was not adversely affected.	

PORC MEMBER	MEMBER SIGNATURE	RECOMMENDED FOR APPROVAL	
		YES	NO
Maintenance Superintendent	[signature]	✓	
Operations Superintendent	D Warr	✓	
Radiation Protection Superintendent	DAVE RAMZY	✓	
Quality Assurance Member	A. F. Koehler	✓	
Mgmt Knowledgeable in Engineering	Paul A. Gropp	✓	
Manager Operations & Maintenance			
PORC-S/C Member			
PORC-S/C Member			
PORC-S/C Member			

Meeting No. 94-014 Item No. VI-K Date: 2/24/94

This item is recommended for approval? ☒ YES ☐ NO

This item requires SRC/NRC review prior to implementation? ☐ YES ☒ NO

If yes, ensure documentation supporting review is attached.

	SIGNATURE	RECOMMENDED FOR APPROVAL		DATE
		YES	NO	
PORC-S/C Chairman				
PORC Chairman	[signature]	✓		2-24-94

Comments:

Approved by [signature] Date 2/28/94

General Manager Plant Operations

Check Block:
- [x] PORC
- [ ] PORC-S/C

WATERFORD 3 SES
PLANT OPERATING MANUAL
CHANGE/REVISION/DELETION REQUEST

Procedure No.: UNT-005-014 **Title:** Offsite Dose Calculation Manual

Effective Date : ____ (if different from approval date)

COMPLETE A, B and C:

A. Change No.: 1 [x] **Permanent** [ ] **Deviation** **Expiration Date:** ____

B. Revision: 3

C. Deletion: [ ] **Yes** [ ] **No**

DESCRIPTION OF CHANGE, REVISION, OR DELETION: Changed formula (1) of the dose calculation formula for liquid effluents due to a typographical error. the formula should have used Δt_ℓ vice Dt_ℓ. Added new subsection 5.3.5.3 to add a correct liquid radiation monitor setpoint calculation for monitors that sample a portion of the waste stream that has been diluted. The methodology follows the same as for monitors that sample an undiluted waste stream, but also includes a term that considers any additional dilution the waste stream undergoes prior to the actual withdrawal and monitoring of the fluid.

REASON FOR CHANGE, REVISION, OR DELETION: Clarify dose calculation formula, and to provide a correct setpoint determination for situations in which the effluent radiation monitor is sampling a diluted waste stream. Waterford-3 has one such radiation monitor: Steam Generator Blowdown Heat exchanger Circulating Water discharge (PRM-IRE-1900) when SGBD releases are to be discharged via the Circ Water system to the Mississippi River.

Originator: Gregory A. Hood **Date:** 2-14-94

Technical Review: D Landeche **Date:** 2/16/94

Group Head Review: [signature] **Date:** 2/16/94

***TEMPORARY APPROVAL (SRO):** ____ **Date:** ____

***TEMPORARY APPROVAL:** ____ **Date:** ____

*Refer to paragraphs 3.2.18 and 5.3.2.10c for temporary approval requirements

PORC AND PORC - S/C
REVIEW AND APPROVAL SHEET

REVIEW OF: UNT- 005-014 - Offsite Dose Calculation Manual (Rev. 3)	PORC ☒ PORC - S/C ☐

The PORC or PORC S/C has reviewed this item and determined that a Safety/ Commitment Review was performed (if applicable), that a Safety Evaluation was performed (if applicable), that an unreviewed safety question does not exist, and that nuclear safety is/was not adversely affected.

PORC MEMBER	MEMBER SIGNATURE	RECOMMENDED FOR APPROVAL	
		YES	NO
Maintenance Superintendent		✓	
Operations Superintendent		✓	
Radiation Protection Superintendent	SAMR RAMZY		
Quality Assurance Member		✓	
Mgmt Knowledgeable in Engineering		✓	
Manager Operations & Maintenance			
PORC-S/C Member			
PORC-S/C Member			
PORC-S/C Member			

Meeting No. 93-100 Item No. VI-D Date: 1[illegible] 1/93

This item is recommended for approval? ☒ YES ☐ NO

This item requires SRC/NRC review prior to implementation? ☐ YES ☒ NO

If yes, ensure documentation supporting review is attached.

	SIGNATURE	RECOMMENDED FOR APPROVAL		DATE
		YES	NO	
PORC-S/C Chairman				
PORC Chairman		✓		12/21/93

Comments:

Approved by ______________ Date 12/23/93
General Manager Plant Operations

Check Block:

☒ PORC

☐ PORC-S/C

WATERFORD 3 SES
PLANT OPERATING MANUAL
CHANGE/REVISION/DELETION REQUEST

Procedure No.: UNT-005-014 **Title:** OFFSITE DOSE CALCULATION MANUAL

Effective Date : 1/1/94 (if different from approval date)

COMPLETE A, B and C:

A. Change No.: N/A ☐ **Permanent** ☐ **Deviation** **Expiration Date:** N/A

B. Revision: 3

C. Deletion: ☐ **Yes** ☒ **No**

DESCRIPTION OF CHANGE, REVISION, OR DELETION: Corrected location descriptions for various REMP sample locations, changed person responsible for REMP to reflect current organization at Waterford-3. Added definition of "MAJOR CHANGE" to a radioactive waste system, clarified note in table 5.6-3 pertaining to MCES releases, added section specifying content of the Annual Radioactive Release Report (1.21 Report), added section to specify content of special Reports, added section addressing Secondary Release Paths, corrected some minor typographical errors, respecified what the plant will use as "Restricted Area" under new 10CFR20 for Non-Effluents, deleted MKE-4 from sample location in the REMP (Goats milk), deleted milk goats from dispersion/deposition factor table in Att. 6.2.

REASON FOR CHANGE, REVISION, OR DELETION: This procedure revision incorporates some recommendations resulting from inspection and audit activities. It also updates REMP sample locations and is consistent with other plant procedure revised for the "New" 10CFR20, implementation of occupation exposure controls. Radioactive Effluents are still governed by the "Old" 10CFR20 at this time, until a Technical specification change is approved.

Originator: Gregg L. Hood **Date:** 12-15-93

Technical Review: SAM R RAMZY **Date:** 12-16-93

Group Head Review: [signature] **Date:** 12/16/93

***TEMPORARY APPROVAL (SRO):** ______ **Date:** ______

***TEMPORARY APPROVAL:** ______ **Date:** ______

*Refer to paragraphs 3.2.18 and 5.3.2.10c for temporary approval requirements

TABLE OF CONTENTS

LIST OF EFFECTIVE PAGES

Title	Revision 3
1-250	Revision 3
2, 31, 38A, 35, 36	Change 1

Change 1

1.0 PURPOSE

1.1 The offsite Dose Calculation Manual (ODCM) is a supporting document of the Waterford 3 Technical Specifications. This document provides (1) The Radiological Effluent Specifications and Radiological Environmental Monitoring Program required by Technical Specification 6.8.3; (2) the general characteristics of the Waterford 3 site; (3) the detailed Radiological Environmental Monitoring Program (REMP); (4) the description of the Radiological Environmental Monitoring Interlaboratory Comparison Program; (5) the liquid and gaseous radwaste block flow diagram; (6) the Radioactive Liquid and Gaseous Waste Sampling and Analysis Programs; (7) the general methodology to be used to calculate dose to individuals due to releases of radioactive gaseous and liquid effluents from the Waterford 3 site; (8) the general methodology to be used to calculate effluent monitor setpoints and allowable release rates to ensure compliance with the Radiological Effluent Controls, 10CFR20, and 10CFR50 criteria; (9) the methodology to be used to ensure representative sampling of liquids; and (10) the methodology to be used to comply with 40CFR190 criteria.

1.2 The Offsite Dose Calculation Manual (ODCM) follows the general models suggested by NUREG 0133 and Regulatory Guide 1.109. However, alternate calculation methods from those presented may be used provided the overall methodology is acceptable and consistent with regulation or provided the alternate methodology is conservative. In addition, the most up-to-date dose conversion factors and bioaccumulation factors may be substituted in lieu of Regulatory Guide 1.109 values.

1.3 Actual step-by-step dose calculations will be performed by in-plant procedures which are consistent with the methodology presented in this document.

2.0 REFERENCES

2.1 Waterford 3 SES Technical Specifications, Chapter 16 of Waterford 3 FSAR.

2.1.1 Technical Specification 6.14.1

2.1.2 Technical Specification 6.14.2

2.2 USNRC Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Gaseous-Effluents from Light-Water-Cooled Reactors, July 1977.

2.3 USNRC Regulatory Guide 1.113, Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, April 1977.

2.4 USNRC Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, Revision 1, October, 1977.

2.5 USNRC NUREG 0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, October 1978.

2.6 Code of Federal Regulations: Title 10, Parts 20, 40, 50 and 100; Title 40, Part 190.

2.7 USNRC Generic Letter 89-01, Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program.

2.8 UNT-006-010, Event Notification and Reporting

2.9 International Atomic Energy Agency (IAEA) Safety Series No.57, Generic Models and Parameters for Assessing the Environmental Transfer of Radionuclides from Routine Releases, Exposures of Critical Groups.

2.10 USNRC Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Revision 1, June, 1974.

2.11 UNT-006-011, Condition Report

3.0 DEFINITIONS

3.1 ACTION shall be that part of a Specification which prescribes remedial measures required under designated conditions.

3.2 CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter which the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel including the sensor and alarm and/or trip functions, and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, and total channel steps such that the entire channel is calibrated.

3.3 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

3.4 A CHANNEL FUNCTIONAL TEST shall be:

a. Analog channels - the injection of a simulated signal into channel as close to the sensor as practicable to verify OPERABILITY including alarm and/or trip functions.

b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.

c. Digital computer channels - the exercising of the digital computer hardware using diagnostic programs and the injection of simulated process data into the channel to verify OPERABILITY including alarm and/or trip function.

3.5 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the following intervals.

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
P	Completed prior to each release.
Q	At least once per 92 days
SA	At least once per 184 days.
R	At least once per 18 months.
S/U	Prior to each reactor startup.
N.A.	Not applicable.

3.6 MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

3.7 A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

3.0 DEFINITIONS (cont'd)

3.8 An OPERATIONAL MODE (i.e. MODE) shall correspond to any one inclusive combination of core reactivity condition, power level and average reactor coolant temperature as specified.

OPERATIONAL MODE	REACTIVITY CONDITION, K_{eff}	% OF RATED THERMAL POWER*	AVERAGE COOLANT TEMPERATURE
1. POWER OPERATION	$\geq$ 0.99	> 5%	$\geq$ 350°F
2. STARTUP	$\geq$ 0.99	$\leq$ 5%	$\geq$ 350°F
3. HOT STANDBY	< 0.99	0	$\geq$ 350°F
4. HOT SHUTDOWN	< 0.99	0	350°F> T_{avg}>200°F
5. COLD SHUTDOWN	< 0.99	0	$\leq$ 200°F
6. REFUELING**	$\leq$ 0.95	0	$\leq$ 140°F

*Excluding decay heat.

**Fuel in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

3.9 PURGE or PURGING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

3.10 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

3.11 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

3.0 DEFINITIONS (cont'd)

3.12 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY, access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreation purposes. This definition is applicable to areas established for effluent release limits. See Attachment 6.1.

3.13 A VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on noble gas effluents. Engineered Safety Feature (ESF) (atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

3.14 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

3.0 DEFINITIONS (cont'd)

3.15 A WASTE GAS HOLDUP SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

3.16 A MAJOR CHANGE to a radioactive waste system shall be any alteration or modification to the system that causes waste characteristics (e.g. chem form, pH, etc.), waste form or waste activity in liquid gaseous or solid effluents to significantly deviate.

4.0 RESPONSIBILITIES

4.1 General Manager, Plant Operations has lead responsibility for ensuring implementation of the Radiological Effluent Specifications and Radiological Environmetal Monitoring Program as required by Technical Specification 6.8.3 and as set forth in this procedure.

4.2 The Radiation Protection Superintendent is responsible for ensuring Radiological Effluent Specifications and the Radiological Effluent Monitoring Program are performed as required according to procedures and methodologies established by this document. He is also responsible for ensuring the Annual Effluent Release Report is performed and issued as required.

4.3 Manager, Security and General Support is responsible for ensuring the Radiological Environmental Monitoring Program is performed as required according to procedures and methodologies established by this document. He is also responsible for issuance and submittal of the Annual Environmental Report as required by this document. He is also responsible for the negotiation and maintenance of vendor contracts to supply Sample Analyses and Reports as required by the Radiological Environmental Monitoring Program. He is also responsible for ensuring the Land Use Census is performed as required.

5.0 PROCEDURE

5.1 SITE CHARACTERISTICS

Waterford 3 SES is located on the west (right descending) bank of the Mississippi River at River Mile 129.6 between Baton Rouge, Louisiana, and New Orleans, Louisiana. The site is in the northwestern section of St. Charles Parish, Louisiana, near the towns of Killona and Taft.

The geographic coordinates for the Waterford 3 reactor are Latitude 29° 59' 42" North, and Longitude 90° 28' 16" West. Based on the UTM (Universal Transverse Mercator) Zone 15, the UTM coordinates are Northing 3,320,743 meters and Easting 743,962 meters.

The Mississippi River is the closest prominent natural feature to Waterford 3, while other important nature features include Lac des Allemands, about 5.5 miles southwest of the site, and Lake Pontchartrain, about 7 miles northeast of the site. The land slopes gently from its high points near the Mississippi (10-15 ft. above mean sea level) to extensive wetlands located 1.5 to 2.5 miles inland from the river.

Most of the man-made features are located on the narrow strip of dry land between the Mississippi River and the wetlands. Near the Waterford 3 site are several large industrial facilities, including Waterford 1 and 2 (0.4 miles northwest of the site), Little Gypsy Steam Electric Station (0.8 miles northeast of the site, across the river from Waterford 3), Agrico, a fertilizer manufacturer (0.6 miles east-southeast), Occidental Chemical Company (0.8 miles east-southeast), and Union Carbide, a chemical manufacturer (1.2 miles east-southeast). Louisiana Power & Light Company (LP&L) owns and Entergy Operations, Inc. operates the above-mentioned steam electric stations.

5.1 SITE CHARACTERISTICS (cont'd)

Attachment 6.1 provides a map of the UNRESTRICTED AREA and SITE BOUNDARY for radioactive effluents. LP&L will have full control of all activities conducted within the exclusion area boundary of the Waterford 3 site. All of the property within the designated exclusion area is owned by LP&L with the exception of the bottom lands below mean low water of the Mississippi River.

LP&L owns, in title, all surface rights within the exclusion area boundary of the plant. There is presently no intention to allow exploration for subsurface minerals from points on the surface of the exclusion area.

The Mississippi River, Louisiana Highway 18, the Missouri Pacific Railroad right-of-way, and the west (right descending) bank levee of the Mississippi River constitute traversals of the site exclusion area as allowed by 10CFR100.3 (a). Refer to the Waterford 3 Emergency Plan Implementing Document for the arrangements which have been made to give LP&L authority and control over these traversals. (Note that Louisiana Highway 3127 does traverse the SITE BOUNDARY but not the exclusion area. However, LP&L does have the authority to control this traversal in accordance with the Waterford 3 Emergency Plan Implementing Document.)

In addition to Waterford 3, there are two fossil-fueled units, Waterford SES Units 1 and 2, which are owned by LP&L and which are within the site exclusion area. The plant staff for these two units consists of about 60 people. Since this includes workers assigned to shifts, it is a conservative estimate of the maximum number of fossil plant personnel that would be within the exclusion area at any given time. Evacuation procedures for Waterford SES Units 1 and 2 are described in the Waterford 3 Emergency Plant Implementing Document.

5.1 SITE CHARACTERISTICS (cont'd)

A portion of the land within the SITE BOUNDARY is utilized for agricultural activities. Farmers presently work the land but can be expected to actually be in the field less than 10 percent of the time.

Fishing in the Mississippi River from the batture is a rare practice in the Waterford area. An estimated maximum of 2 people may be expected to be engaged in this activity for a period less than 10 percent of the time within the exclusion area.

Texaco maintains a gas valve station east-southeast of the Waterford 3 SES island structure just within the radius of the exclusion area. This valve station is automated and requires only periodic monthly maintenance involving, typically, two persons. Evacuation procedures for these maintenance workers are described in the Waterford 3 Emergency Plan Implementing Document.

The Waterford property is shown in Figure 5.1-3 of the Waterford 3 Site Technical Specifications (STS) and includes 3,561.3 acres. The plant area is about 48 acres and is defined as including the fenced area immediately adjacent to Waterford 3. The site area is shown in Figure 5.1-3 of the STS along with principal station structures and nearby features. The site includes only station structures and does not include any residential, recreational, or other industrial structures. There is a visitor center and adjacent recreational area approximately 1.0 mile SSW of the plant.

The SITE BOUNDARIES for establishing effluent release limits along with radioactive effluent release points are given in Attachment 6.1. The nearest distances to the boundary line are shown in Attachment 6.2 of this procedure. The release point elevations for gaseous effluents are provided in Attachment 6.1.

5.1 SITE CHARACTERISTICS (cont'd)

The restricted area, defined for the purpose of controlling access for the purpose of protecting individuals against undue risks from radiation and radioactive materials, coincides with the current or future Security Protected Area fence.

For the purpose of establishing effluent release limits in accordance with 10CFR20 and Appendix I to 10CFR50, the concept of the restricted area, as defined above, is not applicable. The effluent release limits are established in order to ensure that: (1) the concentrations of the radionuclides in gaseous effluents discharged from the plant stack and exhaust systems do not result in exceeding the limits at the site boundary, with limits set forth in Table II, Column 1 of Appendix B to 10CFR20; (2) the concentration of radionuclides in liquid effluent at the unrestricted area boundary does not exceed the limits set forth in Table II, Column 2 of Appendix B to 10CFR20; and (3) the cumulative liquid and gaseous radionuclide releases do not result in exposures to individuals within the UNRESTRICTED AREA or at the SITE BOUNDARY in excess of the limits set forth in Appendix I to 10CFR50.

1980 population by annular sectors within 5 miles or Waterford 3 can be found in the Environmental Report. Population was estimated for 1977 and projected for 1980. The methodology for estimating and projecting population is described in detail in section 6.1.4.2 of the Environmental Report. The closest town to Waterford 3 is Killona, 0.9 miles west-northwest. Other towns near the plant include Norco 2.5 miles east; Hahnville, 3.7 miles east-southeast; and LaPlace, 4.7 miles north. There are also smaller settlements and homes along both banks of the river, the nearest such place to Waterford 3 being Montz, 1.0 mile northeast.

5.2 SPECIFICATIONS AND SURVEILLANCE REQUIREMENTS

5.2.1 Compliance with the SPECIFICATIONS contained in the succeeding sections is required during the OPERATIONAL MODES or other conditions specified therein; except that failure to meet the SPECIFICATIONS requires that the associated ACTION requirements shall be met.

5.2.2 Noncompliance with this procedure shall exist when the requirements of the SPECIFICATION and/or associated ACTION requirements are not met within the specified time intervals. If the SPECIFICATION is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

5.2.3 Surveillance Requirements shall be applicable during all OPERATIONAL MODES or other conditions specified for individual systems unless otherwise stated in an individual Surveillance Requirement.

5.2.4 Each Surveillance Requirement shall be performed within the specified time interval with:

5.1.4.1 A maximum allowable extension not to exceed 25% of the surveillance interval.

5.2 SPECIFICATIONS AND SURVEILLANCE REQUIREMENTS Cont'd

5.2.5 Failure to perform a Surveillance Requirement within the specified time interval shall constitute a failure to meet the OPERABILITY requirements for a Specific System for Operation. Exceptions to these requirements are stated in the individual specifications. Surveillance Requirements do not have to be performed on inoperable equipment.

5.2.6 Failure to comply with the compensatory ACTION requirements or failure to complete the surveillance requirements within the specified time shall be documented and evaluated in accordance with UNT-006-011 and UNT-006-010 procedures.

5.3 LIQUID EFFLUENTS

5.3.1 Concentration Specification

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Attachment 6.1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microcurie/ml total activity.

APPLICABILITY: At all times

ACTION:

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits, and describe the events leading to this condition in the next Annual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

a. Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 5.3-1.

5.3 LIQUID EFFLUENTS (cont'd)

b. The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in section 5.3.5 to assure that the concentrations at the point of release are maintained within the limits of Specification 5.3.1.

TABLE 5.3-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/mL)
A. Batch Waste Release Tanks [b,f,g,h,i]	P Each Batch	P Each Batch	Principal Gamma Emitters[c]	5×10^{-7}
			I-131	1×10^{-6}
1. Boric Acid Condensate 2. Waste Condensate	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P Each Batch	M Composite[d]	H-3	1×10^{-5}
3. Laundry Waste			Gross Alpha	1×10^{-7}
4. Turbine Building Industrial Waste Sumps*	P Each Batch	Q Composite[d]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
5. Dry Cooling Tower Sumps #1 and #2*				
6. Regenerative Waste				
7. Filter Flush				
8. Waste				

*When release from this source is batch in nature.

TABLE 5.3-1 (Continued)

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)a ($\mu Ci/mL$)
B. Continuous Release[e,f]	W Grab Sample	W	Principal Gamma Emitters[c]	$5x10^{-7}$
1. Turbine Building Industrial Waste Sumps**[h]			I-131	$1x10^{-6}$
2. Dry Cooling Tower Sump #1**[i]	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
3. Dry Cooling Tower Sump #2**[i]	W Grab Sample	M Composite[d]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
4. Circulating Water Discharge-Steam Generator Blow-down HX[i]	W Grab Sample	Q Composite[d]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$
5. Auxiliary Component Cooling Water Pumps[i]				

**When release from this source is continuous in nature.

TABLE 5.3-1 (Continued)

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)a (μCi/mL)
B. Continuous Release[e,f]	W Continuous[k]	W Composite[d]	Principal Gama Emitters[c]	$5x10^{-7}$
6. Steam Generator Blowdown Discharge[j,l]			I-131	$1x10^{-6}$
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
	W Continuous[k]	M Composite[d]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	W Continuous[k]	Q Composite[d]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

TABLE 5.3-1 (Continued)
TABLE NOTATION

[a]The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot e^{-\lambda \Delta t}}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fraction radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for plant effluents is the elapsed time between the midpoint of sample collection and the time of counting.

Typical values of E, V, Y, and Δt should be used in the calculation.

TABLE 5.3-1 (Continued)

TABLE NOTATIONS

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

[b]A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in Section 5.3.6 to assure representative sampling.

[c]The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report pursuant to Specification 6.9.1.8.

[d]A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

[e]A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

[f]Prior to analyses, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

TABLE 5.3-1 (Continued)

TABLE NOTATIONS

[g]If the contents of the filter flush tank or the regenerative waste tank contain detectable radioactivity, no discharges from these tanks shall be made to the UNRESTRICTED AREA and the contents of these tanks shall be directed to the liquid radwaste treatment system.

[h]Turbine Building Industrial Waste Sump (TBIWS)

The TBIWS shall be required to be sampled and analyzed in accordance with this table if any of the following conditions exist:

(1) Primary to secondary leakage is occurring; or,

(2) Activity is present in the secondary system as indicated by either the SGB monitors or secondary sampling and analysis; or,

(3) Activity was present in the TBIWS during the previous 4 weeks.

If none of the above situations exists, then the sampling and analysis of this stream need not be performed.

[i]Sampling and analysis of the dry cooling tower sumps and the auxiliary component cooling water pump discharge will be required only when detectable activity exists in the CCW.

Sampling and analysis of the circulating water discharge-steam generator blowdown heat exchanger discharge (CWD-SGB) will be required only when detectable activity exists in the secondary system.

[j]Sampling and analysis of the steam generator blowdown will be required only when the blowdown is directed to the circulating water system or Waterford 3 waste pond.

TABLE 5.3-1 (Continued)

TABLE NOTATIONS

Steam generator blowdown to the Waterford 3 waste pond will be limited to situations requiring secondary chemistry control where the Circulating Water System is not available or the secondary chemistry is outside the requirements for Circulating Water System discharge. Blowdown to the waste pond will be terminated upon detection of sample activity greater than the LLD levels of Table 5.3-1.

[k]To be representative of the quantities and concentration of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream.

[l]Steam generator blowdown discharge to the waste pond is not available unless radiation monitoring and automatic isolation capabilities are added to the waste pond discharge path.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.2 Dose Specification

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to UNRESTRICTED AREAS (see Attachment 6.1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the total body and to less than or equal to 10 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identified the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include (1) the results of radiological analyses of the drinking water source and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141.

5.3 LIQUID EFFLUENTS (cont'd)

SURVEILLANCE REQUIREMENTS:

a. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with methodology and parameters in Section 5.3.7 at least once per 31 days.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.3 Liquid Radwaste Treatment System Specification

The liquid radwaste treatment system shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent to UNRESTRICTED AREAS (see Attachment 6.1) would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31 day period.

APPLICABILITY: At all times.

ACTION:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the liquid radwaste treatment system not in operation, prepare and submit to the Commission within 30 days pursuant to Technical Specification 6.9.2 a Special Report that includes the following information.

   1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action (s) taken to prevent a recurrence.

5.3 LIQUID EFFLUENTS (cont'd)

SURVEILLANCE REQUIREMENTS

a. Doses due to liquid releases to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in Section 5.3.7.

b. The installed Liquid Radwaste Treatment System shall be demonstrated OPERABLE by meeting Specifications 5.3.1 and 5.3.2.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.4 Liquid Effluent Dose Calculation

5.3.4.1 The dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas are calculated for the purpose of implementing Section 5.3.2 using the following expression:

$$D_{t\ell} = \Delta t_\ell \, F_\ell \sum_{i=1}^{n} A_{it} \, C_{i\ell} \qquad (1)$$

$$D_t = \sum_{\ell=1}^{m} D_{t\ell} \qquad (2)$$

$D_{t\ell}$ = the cumulative dose commitment to the total body or any organ (t) from the liquid effluents for each liquid release in mrem during time period (ℓ);

D_t = the cumulative dose commitment to the total body or any organ (t) from the liquid effluents for all (ℓ) time periods;

Δt_ℓ = the length of the ℓ^{th} time period over which the release is made, in hours;

$C_{i\ell}$ = the concentration of radionuclide (i) in undiluted liquid effluent during time period Δt_ℓ from any liquid release, in $\mu Ci/ml$;

5.3 LIQUID EFFLUENTS (cont'd)

A_{it} = the site-related liquid ingestion dose commitment factor to the total body or any organ (t) for each identified nuclide (i) in mrem-ml/hr- μCi (Attachment 6.3), and;

F_ℓ = the near field average dilution factor for $C_{i\ell}$ during any liquid effluent release. Defined as the ratio of the undiluted liquid waste flow during release to the average flow from the site discharge structure to site boundary receiving waters.

$$F_\ell = \frac{liquid\ radioactive\ waste\ flow}{discharge\ structure\ exit\ flow}$$

The liquid radioactive waste flow is the maximum flow from the effluent release. The discharge structure exit flow is the flow during disposal from the discharge structure release point into the receiving water body. For radionuclides not determined in each batch or weekly composite, the dose contribution to the current calendar quarter cumulative summation may be approximated by using a ratio of concentrations based on the previous monthly or quarterly composite analyses.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.4.2 Equation (1) above for calculating the dose contributions required the use of a dose factor, A_{it}, for each nuclide (i) which embodies the dose factors and dilution factors for the points of pathway origin. The adult total body dose factor and the adult organ dose factor for each radionuclide will be used from Table E-11 of Regulatory Guide 1.109; thus the list contains critical organ dose factors for various organs. The dose factor is written:

$$A_{it} = K_o\left(\frac{U_w}{D_w} + U_f BF_i\right) DCF_{it} \qquad (3)$$

where:

U_w = 730 l/yr adult water consumption;

D_w = Dilution factor from near field area to potable water intake;

= 220 for discharges from the circulating water discharge into the Mississippi River (based on the ratio of the average Mississippi River flow to the maximum discharge flow);

= 1 for discharges into the 40 Arpent Canal (based on the assumption that dilution from the near field area to a potable water intake is negligible);

5.3 LIQUID EFFLUENTS (cont'd)

A_{it} = Composite dose parameter for the total body or critical organ (t) of an adult for nuclide (i) for all appropriate pathways (mrem-ml/hr-µCi);

K_o = Unit conversion factor;

$= 1.14e+5 = 10^6 \frac{pCi}{\mu Ci} \cdot 10^3 \frac{ml}{Kg} \div 8760 \frac{hr}{yr}$

U_f = 21 kg/yr, adult fish consumption;

BF_i = Bioaccumulation factor for nuclide (i) in fish (pCi/kg per pCi/l) from Attachment 6.21 and;

DCF_{it} = Dose conversion factor for nuclide (i) and organ (t) for adults (mrem/pCi). Values are from Table E-11 of Regulatory Guide 1.109.

NOTE

For other liquid pathways the appropriate dose factors will be utilized.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.5 <u>Liquid Effluent Monitor Setpoint Calculation Methodology</u>

Specifications 5.3.1 and 5.6.1 require that the liquid effluent monitoring instrumentation alarm/trip setpoints be set so that the concentration of radioactive material released from the site is limited to 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. (For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 μCi/ml total activity). This section presents the method to be used for determining setpoints in accordance with Surveillance Requirements 5.3.1 and 5.6.1.

5.3.5.1 The calculated setpoints for the liquid effluent monitors, that have no additional dilution prior to withdrawal of the monitored fluid, satisfy the following equation:

$$c = \frac{(SF)(RF)(F+f)\sum_{i=1}^{n} C_i}{TMPC(f)} \qquad (4)$$

where;

$\sum_{i=1}^{n} C_i$ = the undiluted effluent gamma concentration μCi/ml for all radionuclides i). The value will be derived from radioanalysis of liquid effluent to be released. This value will be supplied for each liquid release;

5.3 LIQUID EFFLUENTS (cont'd)

c = the setpoint, in μCi/ml, of the liquid effluent monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release. This setpoint represents a value which, if exceeded would result in concentrations exceeding the limits of 10CFR20, Appendix B, Table II, Column 2, to an UNRESTRICTED AREA;

JH 2-14-94 Change 1

f = the undiluted liquid effluents flow as measured at the liquid effluent monitor location in gpm;

F = the dilution water flow as determined via pump curves or other appropriate measures that determine correct plant operating configuration in gpm;

NOTE
If F is large compared to f then $F + f \simeq F$.

SF = Safety factor to ensure that the effluent limit is not exceeded. Actual value is set by procedure (in the range 0.5 - 0.9);

5.3 LIQUID EFFLUENTS (cont'd)

RF = Release fraction allocated to this release (to be used only in situations of simultaneous or concurrent release);

$$TMPC = \sum_{i=1}^{n} \frac{C_i}{MPC_i} + \sum_{j=1}^{m} \frac{C_j}{MPC_j}$$

$\frac{C_j}{MPC_j}$ = the undiluted nongamma MPC_j fraction for all nongamma emitting radionuclides (j);

$\frac{C_i}{MPC_i}$ = undiluted gamma MPC_i fraction for all gamma emitting radionuclides (i);

MPC_j = Maximum Permissible Concentration for the applicable nongamma-emitting isotope (j) from 10CFR20, Appendix B, Table II, Column 2; and

MPC_i = Maximum Permissible Concentration for the applicable gamma-emitting isotope (i) from 10CFR20, Appendix B, Table II, Column 2.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.5.2 The values of C_i and C_j will be measured for each release as appropriate and the parameters for f and F will be supplied based on current plant operating configurations. The setpoint will be calculated in terms of μCi/ml and the liquid effluent monitor will be adjusted as necessary to ensure that liquid releases are secured prior to exceeding limits specified in 10CFR20, Appendix B, Table II, Column 2 to an UNRESTRICTED AREA.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.5.3 Radiation Monitor setpoints for liquid effluent radiation monitors that have additional dilution prior to actual withdrawal of the monitored fluid, shall be determined according to the formula below:

$$c = \frac{(SF)(RF)(F+f)\sum_{i=1}^{n} C_i}{(TMPC)(f+F')} \qquad (4a)$$

where;

F' = Additional dilution flow at the radiation monitor in gpm;

c = the setpoint in μCi/ml, of the liquid effluent monitor measuring the radioactivity concentration in the effluent line after partial or total dilution and subsequent release. This setpoint represents a value which, if exceeded, would result in concentrations exceeding the limits of 10CFR20, Appendix B, Table II, Column 2, to an UNRESTRICTED AREA;

and;

all other terms have been previously defined.

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5.3 LIQUID EFFLUENTS (cont'd)

5.3.6 Representative Liquid Sampling

Prior to grab sampling liquid waste tanks, methods should be used to guarantee representative sampling. Large volumes of liquid waste should be mixed in as short a time as possible and uniformly distributed prior to sampling. To determine the minimum mixing time for tanks from which releases are made, the following tests were performed prior to initial use for release purposes.

a. The tank was filled to a known volume.

b. A specific quantity of a selected chemical and/or sediments was added to the tank.

c. Recirculation was initiated through the normal path.

d. Periodic samples were taken until equilibrium was reached.

e. The time observed to completely mix the tank is used as a minimum recirculation time prior to effluent sampling. Records of the test will be maintained.

5.3 LIQUID EFFLUENTS (cont'd)

5.3.7 Dose Projection for Liquid Effluents

Specification 5.3.3 requires that appropriate subsystems of the liquid radwaste treatment system be used to reduce releases of radioactivity when the projected doses due to the liquid effluent from each reactor unit to UNRESTRICTED AREAS would exceed 0.06 mrem total body or 0.2 mrem to any organ in a 31-day period. The following calculational method is provided for performing this dose projection.

At least once every 31 days, the total dose from all liquid releases for the quarter-to-date will be divided by the number of days into the quarter and multiplied by 31. If this projected dose exceeds 0.06 mrem total body or 0.2 mrem any organ, and the Liquid Waste Management System has not been operating, it shall be operated, if operation would reduce the monthly projected doses below 0.06 mrem total body or 0.2 mrem any organ. (This is performed in accordance with the Surveillance Requirements of 5.3.3.)

5.3 LIQUID EFFLUENTS (cont'd)

5.3.8 Liquid Effluent Bases

a. CONCENTRATION (Section 5.3.1)

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

5.3 LIQUID EFFLUENTS (cont'd)

The sampling and analysis of the contents of the regenerative waste tank and the filter flush tank is performed if primary to secondary leakage occurs in a steam generator. The contents of these tanks cannot be discharged to the UNRESTRICTED AREA if any radioactivity is detected in these tanks since the discharge from these tanks is unmonitored. When radioactivity is detected in these tanks, the contents from these tanks must be discharged to the liquid radwaste system where the contents may then be monitored upon discharge.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Handford Company Report ARH-SA-215 (June 1975).

5.3 LIQUID EFFLUENTS (cont'd)

b. DOSE (Section 5.3.2)

This specification is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141.16.

5.3 LIQUID EFFLUENTS (cont'd)

b. DOSE (Section 5.3.2) (cont'd)
The dose calculation methodology and parameters implement the requirement in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

5.3 LIQUID EFFLUENTS (cont'd)

c. LIQUID RADWASTE TREATMENT SYSTEM (Section 5.3.3) The OPERABILITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10CFR Part 50.36a, General Design Criterion 60 of Appendix A 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

5.4 GASEOUS EFFLUENTS

5.4.1 Dose Rate Specification

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Attachment 6.1) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the total body and less than or equal to 3000 mrems/yr to the skin, and

b. For iodine-131, iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

<u>APPLICABILITY</u>: At all times

<u>ACTION</u>:

With the dose rate(s) exceeding the above limits, immediately restore the release rate to within the above limit(s), and describe the events leading to this condition in the next Annual Radioactive Effluent Release Report.

5.4 GASEOUS EFFLUENTS (cont'd)

SURVEILLANCE REQUIREMENTS:

a. The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in Section 5.4.5.

b. Representative samples and analysis of gaseous effluents shall be obtained in accordance with the sampling and analyses program specified in Table 5.4-1.

c. Based upon the sampling and analysis performed in Table 5.4-1 the dose rate due to I-131, I-133, H-3, and all other radionuclides in particulate form with half-lives greater than 8 days shall be determined to be within the above limits in accordance with the methodology and parameters in Section 5.4.5.

TABLE 5.4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUEMNCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/mL)
A. Waste Gas Holdup Tanks	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[b]	$1x10^{-4}$
B. Containment PURGE (Plant Stack)	P Each PURGE[c] Grab Sample	P Each PURGE[c]	Principal Gamma Emitters[b]	$1x10^{-4}$
		M	H-3	$1x10^{-6}$
C.1 Plant Stack	M[c,d,i] Grab Sample	M	Principal Noble Gas Gamma Emitters[b]	$1x10^{-4}$
			H-3	$1x10^{-6}$
C.2 Fuel Handling Building Ventilation (Normal) Exhaust	M[e,j] Grab Sample	M	Principal Noble Gas Gamma Emitters[b]	$1x10^{-4}$
			H-3	$1x10^{-6}$

TABLE 5.4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUEMNCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/mL)
D.1 All Release Types as listed in B., C.1, and C.2 above	Continuous[f,h,j]	W[g] Charcoal Sample	I-131	1×10^{-12}
			I-133	1×10^{-10}
D.2 Main Condenser Evacuation and Turbine Gland Sealing System	Continuous[f,h,j]	W[g] Particulate Sample	Principal Noble Gas Gamma Emitters[b]	1×10^{-11}
	Continuous[f,h,j]	M Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous[f,h,j]	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[f,h,j]	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6}

5.4-1 (Continued)

TABLE NOTATION

[a]The LLD is defined, for purpose of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot e^{-\lambda \Delta t}}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

5.4-1 (Continued)

TABLE NOTATION

Δt for plant effluents is the elapsed time between the midpoint of sample collection and the time of counting.

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

[b]The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, I-133, Cs-134, Cs-137, Ce-141, and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Semiannual Radioactive Effluent Release Report pursuant to Technical Specification 6.9.1.8.

[c]Sampling shall also be performed within 24 hours following shutdown, startup, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period. Analysis for principle gamma emitters as defined in (b) above shall be completed within 48 hours of sampling.

[d]Tritium grab samples shall be taken at least once per 24 hours when the refueling canal is flooded.

[e]Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

5.4-1 (Continued)

TABLE NOTATIONS

[f]The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Section 5.4.1, 5.4.2, and 5.4.3.

[g]Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup or THERMAL POWER change exceeding 15% of RATED THERMAL POWER in 1 hour and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

[h]If no primary to secondary leakage exists, then only the gross beta or gamma noble gases analysis need be performed for the main condenser evacuation and turbine gland sealing system. If a primary to secondary leak exists and the release from the main condenser evacuation and turbine gland sealing system has not been released via the plant stack, then the sampling and analysis must be performed.

[i]Note (c) above is not applicable for the plant stack unless the noble gas monitor shows that effluent activity has increased by a factor of 3.

[j]Fuel Handling Building sampling is required whenever irradiated fuel is in the storage pool.

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.2 Dose-Noble Gas Specification

The air dose due to noble gases released in gaseous effluents to areas at and beyond the SITE BOUNDARY (see Attachment 6.1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times.

ACTION:

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

5.4 GASEOUS EFFLUENTS (cont'd)

SURVEILLANCE REQUIREMENTS:

Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in Section 5.4.6 at least once per 31 days.

5.4.3 Dose - Iodine-131, Iodine-133, Tritium, and Radionuclides in Particulate Form Specification

The dose to MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the SITE BOUNDARY (see Attachment 6.1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ and,

b. During any calendar year: Less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times

5.4 GASEOUS EFFLUENTS (cont'd)

ACTION:

With the calculated dose from the release of iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS:

Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in Section 5.4.7 at least once per 31 days.

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.4 Gaseous Radwaste Treatment Specification

The VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be OPERABLE and appropriate portions of these systems shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases to areas at and beyond the SITE BOUNDARY (see Attachment 6.1) would exceed either:

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times.

ACTION:

With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that includes the following information:

a. Identification of any inoperable equipment or subsystems, and the reason for the inoperability,

b. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

5.4 GASEOUS EFFLUENTS (cont'd)

c. Summary description of action(s) taken to prevent a recurrence.

<u>SURVEILLANCE REQUIREMENTS</u>:

a. Doses due to gaseous releases to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in Section 5.4.9.

b. The installed Gaseous Radwaste Treatment System shall be demonstrated operable by meeting Specifications 5.4.1, 5.4.2 and 5.4.3.

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.5 Calculational Methodology for Gaseous Effluent Dose Rate

This section presents the calculational methods used for calculating gaseous effluent doses in fulfillment of Specification 5.4.1.

5.4.5.1 The dose rate due the radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following values and expressions:

Release rate limit for noble gases:

$$K' \overline{(X/Q)}_v \sum_{i=1}^{n} K_i \, Q_{iv} \leq 500 \ \frac{mrem}{yr} \ \textit{total body} \quad (5)$$

$$K' \overline{(X/Q)}_v \sum_{i=1}^{n} (L_i + 1.1 M_i) Q_{iv} \leq 3000 \ \frac{mrem}{yr} \ \textit{skin} \quad (6)$$

Release rate limit for Iodine-131, Iodine-133, tritium and for all radionuclides in particulate form with half-lives greater than 8 days:

$$\overline{(X/Q)}_v \sum_{i=1}^{n} P_{it} Q_{iv} \leq 1500 \ \frac{mrem}{yr} \ \textit{any organ} \quad (7)$$

5.4 GASEOUS EFFLUENTS (cont'd)

Where:

K' = a constant of unit conversion, 1E6 pCi/ μCi;

K_i = the total body dose factor due to gamma emissions for each identified radionuclide (i) in units of mrem/yr per pCi/m³ (Attachment 6.4);

L_i = the skin dose factor due to beta emissions for each identified radionuclide (i) in units of mrad/yr per pCi/m³ (Attachment 6.4);

M_i = the air dose factor due to gamma emissions for each identified radionuclide (i) in units of mrad/yr per pCi/m³ (Attachment 6.4). The constant 1.1 converts air dose to skin dose;

5.4 GASEOUS EFFLUENTS (cont'd)

P_{it} = the thyroid dose parameter for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days (i) for the inhalation pathway only, in mrem/yr per $\mu Ci/m^3$ (Same as R_i values for the child receptor listed in Attachment 6.5). The dose factor is based on the most restrictive age group (child) and most restrictive organ (thyroid) at the SITE BOUNDARY;

P_{it} = (child breathing rate of 3700 m^3/yr)(DFA_i) (K') where DFA_i is the inhalation dose factor for each radionuclide from Table E-9, Reference 2.4;

$\sum_{i=1}^{n}$ = summation for all identified radionuclides;

5.4 GASEOUS EFFLUENTS (cont'd)

Q_{iv} = the average release rate of radionuclides (i) (either noble gas or Iodine-131, Iodine-133, tritium, and radionuclides in the particulate form with half-lives greater than 8 days, as appropriate) during the time of release from all vent releases (v). Value is averaged over one hour and is in units of μCi/sec; and

$\overline{(X/Q)}_v$ = 1.1E-5 sec/m³ in the ESE sector at 0.6 mile for all vent releases (v) (the highest calculated annual average dispersion factor at the SITE BOUNDARY based on historical data). The actual X/Q for the time of release may be determined and used under certain circumstances.

NOTE
All radioiodines are assumed to be released in elemental form.

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.6 Calculational Methodology for Noble Gas Doses

This section presents the calculational methods used for calculating noble gas effluent dose in air in accordance with Surveillance Requirement 5.4.2.

5.4.6.1 The air dose due to noble gases released in gaseous effluents to areas at or beyond the SITE BOUNDARY will be determined by the following expressions:

a. During any calendar quarter, for gamma radiation:

$$D_\gamma = (1.14e+2)\overline{(\chi/Q)}_v \sum_{i=1}^{n} M_i \sum_{j=1}^{m} \Delta t_j \; Q_{ijv} \qquad (8)$$

and for beta radiation:

$$D_\beta = (1.14e+2)\overline{(\chi/Q)}_v \sum_{i=1}^{n} N_i \sum_{j=1}^{m} \Delta t_j \; Q_{ijv} \qquad (9)$$

b. During any calendar year, for gamma radiation:

$$D_\gamma = (1.14e+2)\overline{(\chi/Q)}_v \sum_{i=1}^{n} M_i \sum_{j=1}^{m} \Delta t_j \; Q_{ijv} \qquad (10)$$

and for beta radiation:

$$D_\beta = (1.14e+2)\overline{(\chi/Q)}_v \sum_{i=1}^{n} N_i \sum_{j=1}^{m} \Delta t_j \; Q_{ijv} \qquad (11)$$

5.4 GASEOUS EFFLUENTS (cont'd)

Where:

D_γ = the total gamma (γ) air dose from gaseous effluents for the total time period and not to exceed 5 mrad quarterly and 10 mrad yearly;

D_β = the total beta (β) air dose from gaseous effluents for the total time period and not to exceed 10 mrad quarterly and 20 mrad yearly;

Q_{ijv} = the average release rate of radionuclides (i) in gaseous effluent from all vent releases (v) in μCi/sec during the time period Δt_j;

$\overline{(X/Q)}_v$ = 1.1E-5 sec/m³ in the ESE sector at 0.6 mile for all vent releases (v). The actual X/Q for the time of release may be determined and used under certain circumstances;

5.4 GASEOUS EFFLUENTS (cont'd)

Δt_j = the length of the j^{th} time period over which Q_{ijv} are accumulated for all gaseous releases in hours; and

M_i and N_i = the gamma and beta air dose factors (respectively) for a uniform semi-infinite cloud of radionuclide (i) in mrad/yr per pCi/m^3 (Attachment 6.4).

1.14E2 = a constant of units conversion

= $(1\ yr/8760\ hr)\ (10^6\ pCi/\mu Ci)$

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.7 Calculational Methodology for Doses Due to Radioiodines, Tritium, and Radioactive Materials in Particulate Form

This section presents the calculational methods used for calculating doses due to iodine-131, iodine-133, tritium, and radionuclides in particulate form in accordance with Surveillance Requirement.

5.4.7.1 The dose to an individual from iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the SITE BOUNDARY will be determined by the following expressions:

During any calendar quarter:

$$D_{ita} = 1.14e - 4 \ \Delta t \sum_{i=1}^{n} R_{ita} \ W_v \ Q_{iv} \qquad (12)$$

During any calendar year:

$$D_{ita} = 1.14e - 4 \ \Delta t \sum_{i=1}^{n} R_{ita} \ W_v \ Q_{iv} \qquad (13)$$

5.4 GASEOUS EFFLUENTS (cont'd)

Where:

1.14E-4 = a constant of units conversion

= 1yr/8760 hr;

D_{ita} = the cumulative dose to an organ (t), age group (a), due to radionuclides (i) in gaseous effluents; not to exceed 7.5 mrem quarterly or 15 mrem yearly;

W_v = the dispersion parameter for estimating the dose to an individual at the controlling location for long term vent releases (v);

$W_v = \overline{(\chi/Q)}_v$ for the inhalation pathway from vent releases (v) in sec/m³, from historical data, at the location of the critical receptor (Attachment 6.2);

$W_v = \overline{(D/Q)}_v$ for the food and ground plane pathways from vent releases (v) in m², from historical data at the location of the critical receptor (Attachment 6.2), with the exception of tritium, which shall use $W_v = \overline{(\chi/Q)}_v$;

5.4 GASEOUS EFFLUENTS (cont'd)

R_{ita} = the dose factor from each identified radionuclide (i), for each applicable organ (t), and age group (a), in mrem/yr per uCi/m^3 for the inhalation pathway (Attachment 6.5) and in mrem/yr per uCi/m^2-sec for the food and ground plane pathways (Attachments 6.6, 6.7, 6.8, 6.9, and 6.10). For sectors with real pathways within 5 miles of the plant, the values of R_i are used based on these real pathways; for sectors with no real pathways within 5 miles from the plant, R_i is used assuming that the cow-grass-milk pathway exists at the 5-mile distance. (R_i's were calculated using the methodology found in Reference 2.5, pages 31-36.);

Q_{iv} = the average release rate of radionuclides (i) in gaseous effluent from all vent releases (v) in μCi/sec; and

Δt = the time required for the release in hours for all releases per quarter or per year.

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.8 Gaseous Effluent Monitor Setpoint Calculational Methodology

5.4.8.1 Specification 5.6.2 requires that the radioactive gaseous effluent monitoring instrumentation alarm/trip setpoints be set to ensure the limits of Specification 5.4.1 are not exceeded.

5.4.8.2 The calculated high alarm/flow termination setpoint is the maximum value for that particular release. For conservatism, an administrative safety factor (SF) of usually 10% will be utilized in the setpoint calculation. To allow for simultaneous releases from common or different release points a Release Fraction (RF) may be used to allocate percentages of the total allowable release.

5.4.8.3 Since the noble gas dose rates are more limiting than the radioiodine dose rate, gaseous setpoints will be based on noble gas dose rates (less than or equal to 500 mrem/yr total body, and less than or equal to 3000 mrem/yr skin). Specifically, gaseous setpoints will be based on the most limiting of the following equations:

5.4 GASEOUS EFFLUENTS (cont'd)

a. Total body (Q_{tb}):

Where:

$$Q_{tb} = \frac{(500\,\frac{mrem}{yr})(RF)(SF)}{\overline{(\chi/Q)}_v\,(1.0e+6\,\frac{pCi}{\mu Ci})\,\frac{\sum_{i=1}^{n} K_i Q_{iv}}{\sum_{i=1}^{n} Q_{iv}}} \qquad (14)$$

$\sum_{i=1}^{n}$ =summation of all nuclides considered;

Q_{tb} = maximum release rate allowed to give a limiting total body dose rate of 500 mrem/yr in μCi/sec;

K_i = the total body dose factor due to gamma emissions for each identified radionuclide (i) in units of mrem/yr per pCi/m³ (Attachment 6.4);

5.4 GASEOUS EFFLUENTS (cont'd)

Q_{iv} = average release rate of isotope (i) from the release point (v) in μCi/sec;

RF = release fraction allotted to release point in consideration;

$\overline{(\chi/Q)}_v$ = 1.1E-5 sec/m^3 (in the ESE sector at 0.6 mile). The sector with highest value of annual average atmospheric dispersion factor at the site boundary for the release point (v) in question; and

SF = administrative safety factor to account for uncontrollable variables (sampling, monitoring errors, etc.). Usually, the SF takes on a value of 0.9.

5.4 GASEOUS EFFLUENTS (cont'd)

b. For Skin (Q skin):

$$Q_{skin} = \frac{(3000\,\frac{mrem}{yr})(RF)(SF)}{\overline{(\chi/Q)}_v (1.0e+6\,\frac{pCi}{\mu Ci}) \frac{\sum_{i=1}^{n}(L_i + 1.1M_i)Q_{iv}}{\sum_{i=1}^{n} Q_{iv}}} \qquad (15)$$

where all terms are as defined as above except:

Q_{skin} = maximum release rate allowed to give a limiting skin dose of 3000 mrem/yr in μCi/sec;

L_i = skin dose factor due to beta emissions for each identified radionuclide (i) in units of mrem/yr per pCi/m³ (Attachment 6.4);

1.1 = conversion factor to convert from air to skin dose; and

M_i = air dose factor due to gamma emissions for identified noble gas isotope (i) in units of mrad/yr per pCi/m³ (Attachment 6.4).

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.8.4 The monitor setpoint is calculated is the following manner:

$$SN = \frac{Q}{F_{max}} \qquad (16)$$

Where:

SN = maximum monitor setpoint in µCi/cm;

F_{max} = maximum effluent flow rate (cm^3/sec); and

Q = Minimum value of Q_{tb} or Q_{skin}.

5.4.8.5 Since Kr-88 is the noble gas with the highest dose rate conversion factors, for conservatism, the preceeding calculations may be computed using Kr-88 only. Total body dose becomes more limiting than skin and the release limit is:

$$Q_{Kr-88} = \frac{(500 \frac{mrem}{yr})(RF)(SF)}{(\chi/Q)_v (1.0e+6 \frac{pCi}{\mu Ci})(K_{Kr-88})} \qquad (17)$$

5.4 GASEOUS EFFLUENTS (cont'd)

where:

Q_{Kr-88} = the maximum release rate, based on Kr-88, allowed to give a limiting total body dose rate of 500 mrem/yr in µci/sec; and

K_{Kr-88} = the total body dose factor due to Kr-88 in units of mrem/yr per pCi/m³ (Attachment 6.4).

All other terms are as previously defined.

The monitor setpoint can be calculated as:

$$SN = \frac{Q_{Kr-88}}{F_{max}} \qquad (18)$$

and all terms are previously defined

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.9 <u>Dose Projection due to Gaseous Effluents</u>

5.4.9.1 Specification 5.4.4 requires that appropriate subsystems of the Gaseous Radwaste Treatment System be used to reduce releases of radioactivity when the projected doses due to the gaseous effluent to areas at and beyond the SITE BOUNDARY would exceed, in a 31-day period, any of the following:

0.2 mrad to air from gamma radiation; or
0.4 mrad to air from beta radiation; or
0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

5.4.9.2 The following calculational method is provided for performing this dose projection.

At least once every 31 days the gamma air dose, beta air dose and the maximum organ dose for the month-to-quarter will be divided by the number of days into the quarter and multiplied by 31. If these projected doses exceed any of the values listed above and the Gaseous Waste Management System has not been operating, it shall be operated to reduce radioactivity levels prior to release. (This is performed in accordance with the Surveillance Requirements of Specification 5.4.4.)

5.4 GASEOUS EFFLUENTS (cont'd)

5.4.10 Gaseous Effluent Bases

a. DOSE RATE (Section 5.4.1)

This specification is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in a UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the total body and 3000 mrem/yr to the skin.

5.4 GASEOUS EFFLUENTS (cont'd)

These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

b. DOSE - NOBLE GASES (Section 5.4.2)

The Specification is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. It implements the guides set forth in Section II.B of Appendix I.

5.4 GASEOUS EFFLUENTS (cont'd)

The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977.

5.4 GASEOUS EFFLUENTS (cont'd)

Sections 5.4.2 and 5.4.3 equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

Grab sampling of effluents from the main condenser evacuation and turbine gland sealing system is not required when this source has been continuously discharging to the plant stack over the past 30 days. If no primary to secondary leakage in the steam generator exists, then there should be no radioactive release from the main condenser evacuation and turbine gland sealing system and the gross beta or gamma monitoring for noble gases will be sufficient to determine if any radioactivity is present in the release. If a primary to secondary leak exists, then the release from the main condenser evacuation and turbine gland sealing systems will be sampled and analyzed in accordance with Table 5.4-1.

5.4 GASEOUS EFFLUENTS (cont'd)

c. IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM (Section 5.4.3)

This specification is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Specifications are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The calculational methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated.

5.4 GASEOUS EFFLUENTS (cont'd)

The calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions.

The release rate specifications for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

5.4 GASEOUS EFFLUENTS (cont'd)

d. GASEOUS RADWASTE TREATMENT (Section 5.4.4)

The OPERABILITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The discharge from the main condenser evacuation and turbine gland sealing system shall be required to be directed to the plant stack when the release rate of I-131 from this source is $\geq 2 \times 10^{-4}$ μCi/s. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

5.5 TOTAL DOSE

5.5.1 TOTAL DOSE SPECIFICATION

The annual (calander year) dose or dose commitment to any MEMBER OF THE PUBLIC due to release of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

APPLICABILITY: At all times.

ACTION:

With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Specification 5.3.2.a, 5.3.2.b, 5.4.2.a, 5.4.2.b, 5.4.3.a, or 5.4.3.b calculations shall be made including direct radiation contributions from the reactor units and from outside storage tanks to determine whether the above limits of Specification 5.5.1 have been exceeded. This evaluation should be done in accordance with guidance in Section 5.5.2. If such is the case, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits.

5.5 TOTAL DOSE (cont'd)

This Special Report, as defined in 10 CFR 20.405c, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

<u>SURVEILLANCE REQUIREMENTS</u>:

a. Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Specification 5.3.2, 5.4.2, and 5.4.3 and in accordance with the methodology and parameters in the ODCM.

5.5 TOTAL DOSE (cont'd)

b. Cumulative dose contributions from direct radiation from the reactor units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in the ODCM. This requirements is applicable only under condition set forth in Specification 5.5.1.

5.5 TOTAL DOSE (cont'd)

5.5.2 40 CFR 90 DOSE EVALUATION

This section demonstrates compliance with Specification 5.5.1 Surveillance Requirements. Specifically, the dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which shall be limited to less than or equal to 75 mrem) over 12 consecutive months.

Dose evaluations to demonstrate compliance with the above dose limits need to be performed only if quarterly doses exceed:

(1) 3 mrem to the total body (liquid releases).
(2) 10 mrem to any organ (liquid releases).
(3) 15 mrem to the thyroid or any organ from radioiodines and particulates (gaseous releases).

otherwise no evaluations are required.

For the evaluation of doses to real individuals from liquid releases, the same calculational methods as employed in Section 5.3.4 will be used. However, more encompassing and realistic assumptions will be made concerning the dilution and ingestion of radionuclides by individuals who live and fish in the Waterford 3 area.

5.5 TOTAL DOSE (cont'd)

The results of the Radiological Environmental Monitoring Program will be used in determining the realistic dose based on actual measured radionuclide concentrations. For the evaluation of doses to real individuals from gaseous releases, the same calculational methods as employed in sections 5.4.6 and 5.4.7 will be used. The total body dose factor should be substituted for the gamma air dose factor (M_i) to determine the total body dose. Otherwise, the same calculational sequence applies. More realistic assumptions will be made concerning the actual location of real individuals, the meteorological conditions, and the consumption of food. Data obtained from the latest land use census should be used to determine locations for evaluating doses. The results of the Radiological Environmental Monitoring Program will be included in determining more realistic doses based on actual measured radionuclide concentrations.

Cumulative dose contributions from direct radiation, from the reactor unit, and from Radwaste Storage Tanks shall be determined utilizing the results of routine plant perimeter surveys, TLD data, or a combination of both when necessary.

5.5 TOTAL DOSE (cont'd)

5.5.3 <u>Total Dose Bases</u>

The specification is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives if Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered.

5.5 TOTAL DOSE (cont'd)

5.5.3 Total Dose Bases

If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed.

The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Specifications 5.3.1 and 5.4.1. An individual is not considered a MEMBER OF THE PUBLIC during in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

5.6 INSTRUMENTATION

5.6.1 Radioactive Liquid Effluent Monitoring Instrumentation Specification

The radioactive liquid effluent monitoring instrumentation channels shown in Table 5.6-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 5.3.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in Section 5.3.5.

APPLICABILITY: At all times.

ACTION:

a. With radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Specification, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel inoperable.

5.6 INSTRUMENTATION (Cont'd)

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 5.6-1. Restore the inoperable instrumentation to OPERABLE status within 30 days or, if unsuccessful, explain in the next Annual Radioactive Effluent Release Report, pursuant to Technical Specification 6.9.1.8, why this inoperability was not corrected within the time specified. Releases need not be terminated after 30 days provided the specified ACTIONS are continued.

SURVEILLANCE REQUIREMENT

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 5.6-2.

TABLE 5.6-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1. RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE		
a. Boric Acid Condensate Discharge	1	28
b. Waste, Waste Condensate and Laundry Discharge	1	28
c. Dry Cooling Tower Sumps	1/sump	29
d. Turbine Building Industrial Waste Sump	1	29
e. Circulating Water Discharge (Blowdown Heat Exchanger and Auxiliary Component Cooling Water Pumps) #	1	29
2. CONTINUOUS COMPOSITE SAMPLERS		
a. Steam Generator Blowdown Effluent Line	1	29
3. FLOW RATE MEASUREMENT DEVICES		
a. Boric Acid Condensate Discharge	1	30
b. Waste, Waste Condensate and Laundry Discharge	1	30
c. Turbine Building Industrial Waste Sump*	N.A.	N.A.
d. Dry Cooling Tower Sumps*	N.A.	N.A.
e. Circulating Water Discharge* (Blowdown and Blowdown Heat Exchanger and Auxiliary Component Cooling Water Pumps)	N.A.	N.A.

#Automatic termination of blowdown discharge only

TABLE 5.6-1 (Continued)

TABLE NOTATIONS

*Pump performance curves generated in place shall be used to estimate flow.

ACTION STATEMENTS

ACTION 28 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that prior to initiating a release:

a. At least two independent samples are analysed in accordance with Specification 5.3.1, and

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge line valving;

ACTION 29 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that grab samples are collected and are analyzed within 24 hours of collection time for radioactivity at a lower limit of detection of at least 10-7 microcurie/ml. The sample collection frequency is:

a. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 microcurie/gram DOSE EQUIVALENT I-131, or

TABLE 5.6-1 (Continued)

TABLE NOTATIONS

b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microcurie/gram DOSE EQUIVALENT I-131.

ACTION 30 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

TABLE 5.6-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL SOURCE CHECK	CHANNEL CALIBRATION	FUNCTIONAL TEST
1. RADIOACTIVITY MONITORS PROVIDING ALARMS AND AUTOMATIC TERMINATION OF RELEASE				
a. Boric Acid Condensate Discharge	P	P	R(3)	Q(1)
b. Waste, Waste Condensate and Laundry Discharge	P	P	R(3)	Q(1)
c. Dry Cooling Tower Sumps	D	M	R(3)	Q(5)
d. Turbine Building Industrial Waste Sump	D	M	R(3)	Q(5)
e. Circulating Water Discharge (Blowdown Heat Exchanger Auxiliary Component Cooling Water Pumps) #	D	M	R(3)	Q(5)
2. CONTINUOUS COMPOSITE SAMPLERS				
a. Steam Generator Blowdown Effluent Line	D(6)	N.A.	R	Q
3. FLOW RATE MEASUREMENT DEVICES				
a. Boric Acid Condensate Discharge	D(4)	N.A.	R	Q
b. Waste, Waste Condensate and Laundry Discharge	D(4)	N.A.	R	Q
c. Turbine Building Industrial Waste Sump	N.A.	N.A.	N.A.	N.A.
d. Dry Cooling Tower Sumps	N.A.	N.A.	N.A.	N.A.
e. Circulating Water Discharge (Blowdown and Blowdown Heat Exchangers and Auxiliary Component Cooling Water Pumps)	N.A.	N.A.	N.A.	N.A.

#Automatic termination of Blowdown discharge only

TABLE 5.6-2 (Continued)

TABLE NOTATION

1. The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists.

    1. Instrument indicates measured levels above the alarm/trip setpoint.

    2. Circuit failure

    3. Instrument indicates a downscale failure.

2. The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

    1. Instrument indicates measured levels above the alarm setpoint.

    2. Circuit failure.

3. The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system for over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

4. CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

5. The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway occurs if the instrument indicates measured levels above the alarm/trip setpoint and that control room alarm annunciation occurs if any of the following conditions exists:

    1. Instrument indicates measured levels above the alarm set.

    2. Circuit failure.

    3. Instrument controls not set in operate mode.

6. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous releases are made to the Circulating Water System or Waterford 3 waste pond.

5.6 INSTRUMENTATION (cont'd)

5.6.2 Radioactive Gaseous Effluent Monitoring Instrumentation Specifications

The radioactive gaseous effluent monitoring instrumentation channels shown in Table 5.6.3 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 5.4.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in Section 5.4.8.

APPLICABILITY: As shown in Table 5.6-3

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Specification, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

5.6 INSTRUMENTATION (cont'd)

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 5.6-3. Restore the inoperable instrumentation to OPERABLE status within 30 days or, if unsuccessful, explain in the next Annual Radioactive Effluent Release Report, pursuant to Technical Specification 6.9.1.8, why this inoperability was not corrected within the time specified. Releases need not be terminated after 30 days provided the specified ACTIONS are continued.

SURVEILLANCE REQUIREMENTS:

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 5.6-4.

TABLE 5.6-3
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
WASTE GAS HOLDUP SYSTEM			
a. Noble Gas Activity Monitor Providing Alarm and Automatic Termination of Release	1	**	35
b. Effluent System Flow Rate Measuring Device	1	**	36
MAIN CONDENSER EVACUATION AND TURBINE GLAND SEALING SYSTEM			
a. Noble Gas Activity Monitor	1	****	37
b. Iodine Sampler#	1	****	39
c. Particulate Sampler#	1	****	39
d. Sampler Flow Rate Monitor	1	****	36

#If a primary to secondary leak exists or if the noble gas monitors in the main condenser evacuation and turbine gland sealing system or if the steam generator blowdown monitor indicates the presence of radioactivity in the secondary system, the flow from this release point shall be diverted immediately to the plant stack. These instruments are in the plant stack and sampling for radioiodines and particulates shall occur at the plant vent when this occurs. Effluent flow may be redirected to the normal exhaust path with activity in the secondary system provided that the requirements of specifications 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.6.1, 5.6.2 are satisfied. When any of the limits in in specification 5.4.4 will be exceeded and effluent flow is via the normal exhaust path, effluent flow should be diverted to the plant stack for treatment.

TABLE 5.6-3 (Continued)
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
REACTOR AUXILIARY BUILDING VENTILATION SYSTEM (PLANT STACK)			
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release#	1	*	37
b. Iodine Sampler	1	*	39
c. Particulate Sampler	1	*	39
d. Flow Rate Monitor	1	*	36
e. Sampler Flow Rate Monitor	1	*	36
FUEL HANDLING BUILDING VENTILATION SYSTEM (NORMAL)			
a. Noble Gas Activity Monitor	1	***	37
b. Iodine Sampler	1	***	39
c. Particulate Sampler	1	***	39
d. Flow Rate Monitor	1	***	36
e. Sampler Flow Rate Monitor	1	***	36

#Automatic termination of containment purge only.

TABLE 5.6-3 (Continued)

TABLE NOTATIONS

*At all times.

**During gas waste decay tank discharge.

***With irradiated fuel in the storage pool.

****When the main condenser is under a vacuum.

ACTION STATEMENTS

ACTION 35 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment provided best efforts are made to repair the instrument and that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup;

TABLE 5.6-3 (Continued)

TABLE NOTATIONS

ACTION 36 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that the flow rate is estimated at least once per 4 hours. For the waste gas holdup tank this action item is applicable only during periods of release. For the main condenser evacuation and turbine gland sealing systems, this action item applies only during release via the discharge silencer and only during turbine gland sealing operations and/or vacuum pump operation.

ACTION 37 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. However, containment purging of radioactive effluents must be immediately suspended during this condition for the plant stack only.

ACTION 39 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue provided best efforts are made to repair the instrument and that samples are continuously collected with auxiliary sampling equipment as required in Table 5.4-1.

TABLE 5.6-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE IS REQUIRED
1. WASTE GAS HOLDUP SYSTEM					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release	P	P	R(3)	Q(1)	*
b. Effluent System Flow Rate Measuring Device	P	N.A.	R	Q	*
2. MAIN CONDENSER EVACUATION AND TURBINE GLANDS SEALING SYSTEM					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 5.6-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE IS REQUIRED
4. REACTOR AUXILIARY BUILDING VENTILATION SYSTEM (PLANT STACK)					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release	D	M	R(3)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
5. FUEL HANDLING BUILDING VENTILATION SYSTEM (NORMAL)					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	***
b. Iodine Sampler	W	N.A.	N.A.	N.A.	***
c. Particulate Sampler	W	N.A.	N.A.	N.A.	***
d. Flow Rate Monitor	D	N.A.	R	Q	***
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	***

#Automatic termination of containment purge only.

TABLE 5.6-4 (Continued)
TABLE NOTATIONS

*At all times.
***When irradiated fuel is in the spent fuel pool.

1. The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:

   1. Instrument indicates measured levels above the alarm/trip setpoint.
   2. Circuit failure.
   3. Instrument indicates a downscale failure.

2. The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

   1. Instrument indicates measured levels above the alarm setpoint.
   2. Circuit failure.

3. The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

6. The CHANNEL FUNCTION TEST shall also demonstrate that automatic isolation of this pathway occurs if the instrument indicates measured levels above the alarm/trip setpoint and that control room alarm annunciation occurs if any of the following conditions exists:

   1. Instrument indicates measured levels above the alarm set.
   2. Circuit failure.
   3. Instrument controls not set in operate mode.

5.6 INSTRUMENTATION (Cont'd)

5.6.3 Instrumentation Bases

a. RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION (5.6.1)

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section 5.3.5 to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

5.6 INSTRUMENTATION (Cont'd)

b. RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION (5.6.3)

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section 5.4.8 to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also include provisions for monitoring (and controlling) the concentrations of potentially explosive gas mixtures in the WASTE GAS HOLDUP SYSTEM. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

5.7 LIQUID AND GASEOUS RADWASTE PROCESSES

The block flow diagrams of the radwaste systems are shown in Attachments 6.11 and 6.12. In order to obtain a more detailed description, see the appropriate sections of the FSAR.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS

5.8.1 Radiological Environmental Program Specification

The radiological environmental monitoring program shall be conducted as specified in Table 5.8-1.

APPLICABILITY: At all times.

ACTION:

a. With the radiological environmental monitoring program not being conducted as specified in Table 5.8-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Technical Specification 6.9.1.7, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 5.8-2 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than the calendar year limits of Specifications 5.3.2, 5.4.2, and 5.4.3.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

When more than one of the radionuclides in Table 5.8-2 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

*The methodology and parameters used to estimate the potential annual dose to A MEMBER OF THE PUBLIC shall be indicated in this report.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

When radionuclides other than those in Table 5.8-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to A MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits of Specifications 5.3.2, 5.4.2, and 5.4.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 5.8-1, identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days.

The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification 6.9.1.8, identify the cause of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the next Semiannual Radioactive Effluent Release Report and also include in the report revisions of Attachments 6.13, 6.14, 6.16, 6.17 and 6.18 reflecting the new location(s).

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

SURVEILLANCE REQUIREMENTS:

The radiological environmental monitoring samples shall be collected pursuant to Table 5.8-1 from the specific locations given in Attachments 6.13 and 6.14, and shall be analyzed pursuant to the requirements of Table 5.8-1 and the detection capabilities required by Table 5.8-3.

TABLE 5.8-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. DIRECT RADIATION[b]	31 routine monitoring stations either with 2 or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: an inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY, an outer ring of stations, 1 in 10 of the meteorological sectors in the 6 - to 8-km range from the site; the balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations	Quarterly	Gamma dose quarterly.

*The number, media, frequency, and location of samples may vary from site to site. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and should be included in the sampling program.

TABLE 5.8-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. AIRBORNE Radioiodine and Particulates	Samples from 5 locations: 3 samples from close to the 3 SITE BOUNDARY locations, in different sectors, of the highest calculated annual average ground-level D/Q. 1 sample from the vicinity of a community having the highest calculated annual average ground-level D/Q. 1 sample from a control location, as for example 15-30 km distant and in the least prevalent wind direction.[c]	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canister I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change; Gamma isotopic analysis[e] of composite (by location) quarterly.

TABLE 5.8-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. WATERBORNE			
a. Surface[f]	1 sample upstream 1 sample downstream	Composite sample over 1-month period[gk].	Gamma isotopic analysis[ek] monthly. Composite for tritium analysis quarterly.
b. Ground	Samples from 1 or 2 sources only if likely to be affected[h].	Quarterly	Gamma isotopic[e] and tritium analysis quarterly.
c. Drinking	1 sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge.	Composite sample over 2-week period[g] when I-131 analysis is performed, monthly[k] composite otherwise	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year. [i] Composite for gross beta and gamma isotopic analyses[e] monthly[k]. Composite for tritium analysis quarterly.
d. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value.	Semiannually	Gamma isotopic analysis[e] semiannually.

TABLE 5.8-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION			
a. Milk	Samples from milking animals in 3 locations within 5 km distance having the highest dose potential. If there are none, then, 1 sample from milking animals in each of 3 areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per yr.[i] 1 sample from milking animals at a control location 15-30 km distant and in the least prevalent wind direction.[c]	Semimonthly when animals are on pasture; monthly at other times.	Gamma isotopic[e] and I-131 analysis semimonthly when animals are on pasture; monthly at other times.
b. Fish and Invertebrates	1 sample of each commercially and recreational important species in vicinity of plant discharge area. 1 sample of same species in areas not influenced by plant discharge.	Sample in season, or semiannually if they are not seasonal	Gamma isotopic analysis[e] on edible portions.

TABLE 5.8-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
c. Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have discharged.	At time of harvest[j]	Gamma isotopic analysis[e] on edible portion.
	Samples of 1 to 3 different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed.	Monthly when available	Gamma isotopic[e] and I-131 analysis.
	1 sample of each of the similar broad leaf vegetation grown 15-30 km distant in the least prevalent wind direction if milk sampling is not performed.	Monthly when available	Gamma isotopic[e] and I-131 analysis.

TABLE 5.8-1 (Continued)

TABLE NOTATIONS

[a]Specific parameters of distance and direction sector from the centerline of one reactor, and additional description where pertinent, shall be provided for each and every sample location in Attachments 6.14, 6.16, 6.17 and 6.18. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, corrective action shall be completed prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Specification 6.9.1.7. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. Pursuant to Specification 6.9.1.8, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in the next Semiannual Radioactive Effluent Release Report and also include in the report a revised figure(s) and table reflecting the new location(s).

TABLE 5.8-1 (Continued)

TABLE NOTATIONS

[b]One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

[c]The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites that provide valid background data may be substituted.

[d]Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

[e]Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

TABLE 5.8-1 (Continued)

TABLE NOTATIONS

[f]The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone. "Upstream" samples in an estuary must be taken far enough upstream to be beyond the plant influence. Salt water shall be sampled only when the receiving water is utilized for recreational activities.

[g]A composite sample is one in which the quantity (aliquot) of liquid sampled is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

[h]Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

[i]The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in this document.

[j]If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

[k]Composite samples for surface and/or Drinking Water gross beta and gamma isotopic analysis should be performed every four weeks. The maximum frequency is monthly.

TABLE 5.8-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

ANALYSIS	WATER (pCi/ℓ)	AIRBORNE PARTICULATE OR GASES (pCi/m³)	FISH (pCi/kg, wet)	MILK (pCi/ℓ)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

TABLE 5.8-3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

Lower Limits of Detection (LLD)[bc]

ANALYSIS	WATER (pCi/ℓ)	AIRBORNE PARTICULATE OR GASES (pCi/m³)	FISH (pCi/kg, wet)	MILK (pCi/ℓ)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg,dry
gross beta	4	0.01				
H-3	2000					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131	1[d]	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15			15		

TABLE 5.8-3

TABLE NOTATIONS

[a]This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.7.

[b]Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.

[c]The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot e^{-\lambda \Delta t}}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

TABLE 5.8-3

TABLE NOTATIONS

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an _a priori_ (before the fact) limit representing the capability of a measurement system and not as an _a posteriori_ (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.7.

[d]LLD for drinking water samples. If no drinking water pathway exists, the LLD of gamma isotopic analysis may be used.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.2 Interlaboratory Comparison Program Specification

Analyses shall be performed on all radioactive materials supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission.

APPLICABILITY: At all times.

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.7.

SURVEILLANCE REQUIREMENTS

The Interlaboratory comparison Program shall be described in Section 5.8.5. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.7.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.3 Land Use Census Specification

A land use census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

APPLICABILITY: At all times.

ACTION:

a. With a land use census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Specification 5.4.3, identify the new location(s) in the next Annual Radioactive Effluent Release Report, pursuant to Specification 6.9.1.8.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

b. With a land use census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Specification 5.8.1, add the new location(s) to the radiological environmental monitoring program within 30 days. The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted. Pursuant to Technical Specification 6.9.1.8 identify the new location(s) in the next Semiannual Radioactive Effluent Release Report and also include in the report revision of Attachments 6.13, 6.14, 6.16, 6.17, and 5.18 reflecting the new locations(s).

SURVEILLANCE REQUIREMENTS

The land use census shall be conducted during the growing season at least once per 12 months using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the land use census shall be included in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.7.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

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*Broad leaf vegetation sampling of different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Specifications for broad leaf vegetation sampling in Table 5.8-1 Part 4.c. shall be followed, including analysis of control samples.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.4 Discription of the Radiological Environmental Monitoring Program

The Radiological Environmental Monitoring Program (REMP) is expounded on in Attachment 6.13, and the Sample Location Table, Attachment 6.14. Attachment 6.15 explains the sector and zone designations for the sample locations. Attachments 6.16, 6.17 and 6.18 show the sample locations within the 2,10, and 50 mile radius of Waterford 3.

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practical continue to obtain samples of the media of choice at the most desired location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the Radiological Environmental Monitoring Programs.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.5 Description of the Interlaboratory Comparison Program

As described in Section 5.8.2 the quality assurance in radiological environmental sampling will be maintained through participation in the Environmental Protection Agency's Radiological Laboratory Quality Assurance Program. The summary of results will be presented in tabular form and will include the type of analysis, the preparation (collection) date, the date the results are returned, the mean of the analyses (usually triplicate), the standard deviation, the date the values are released for information, the known value, the three standard deviation limit, and a two standard deviation/three standard deviation warning/action flag. If the sample analysis indicates results outside the three standard deviation range, then the corrective actions taken to prevent a recurrence will be documented and submitted along with all results when the Annual Radiological Environmental Operating Report is submitted.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.6 Dispersion Parameters For Critical Locations

As per Requirements 5.8.3, the dispersion parameters for the site boundary and where necessary, as identified by the Annual Land Use Census, are listed in Attachment 6.2. This table will be subject to changes based on the Annual Land Use Census and historical data.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

5.8.7 Radiological Environmental Monitoring Bases

a. INTERLABORATORY COMPARISON PROGRAM (Section 5.8.2)

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

5.8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS (Cont'd)

b. LAND USE CENSUS (Section 5.8.3)

This specification is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/yr) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

5.9 TECHNICAL SPECIFICATION CROSS-REFERENCES

Changes to the Technical Specifications (TS) recommended by Generic Letter 89-01 (Reference 2.8) resulted in programmatic controls for radiological effluents, radiological environmental monitoring, and effluent radiation monitoring instrumentation being relocated to the Offsite Dose Calculation Manual. All references of the former version of the TS that are contained in current plant operating procedures shall be cross-referenced to specifications contained in the ODCM using Attachment 6.20. Relocated requirements set forth in the ODCM should be incorporated into current plant operating procedures as they undergo routine review and revision.

5.10 ROUTINE EFFLUENT RELEASE REPORTS

5.10.1 Annual Radioactive Effluent Release Report

A routine radioactive effluent release report covering the operation of the unit during the previous Twelve months shall be submitted as specified in Waterford 3 SES, Technical Specification 6.9.1.8.

5.10.1.1 The radioactive effluent release report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the units as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants", Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

5.10.1.2 The Annual Radioactive Effluent Release Report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

In lieu of submission with the Radioactive Effluent Release Report, the summary of required meteorological data may be filed on site and provided to the NRC when requested. This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to members of the public due to their activities inside the site boundary during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in this manual.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

5.10.1.3 The Annual Radioactive Effluent Release Report shall also include once a year an assessment of radiation doses to the likely most exposed member of the public from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40CFR190, Environmental Radiation Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

5.10.1.4 The Annual Radioactive Effluent Release Report shall include the following information for each class of solid waste (as defined by 10CFR 61) shipped off site during the report period:

A. Container volume

B. Total curie quantity (specify whether determined by measurement or estimate),

C. Principal radionuclides (specify whether determined by measurement or estimate),

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

D. Source of waste and processing employed (e.g., dewatered spent resin, compacted dry waste, evaporator bottoms),

E. Type of container (e.g., Type A, Type B), and

F. Solidification agent or absorbent (e.g., cement, urea formaldehyde).

5.10.1.5 The Annual Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to unrestricted areas of radioactive materials in gaseous and liquid effluents made during the reporting period.

5.10.1.6 The Annual Radioactive Effluent Release Report shall include any changes to the Process Control Program (PCP) or the Offsite Dose Calculation Manual (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the land use census pursuant to ODCM Specification 5.8.3. The Annual Radioactive Release Report shall include information of Major Changes to Radioactive Waste Systems if the information is not submitted as part of the annual FSAR update.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

A. The submittal providing information on ODCM changes shall contain:

1. Sufficiently detailed information to totally support the rationale for the change without benefit of additional or supplemental information. Information submitted should consist of a complete legible copy of the ODCM together with appropriate analyses or evaluations justifying the change(s), if applicable.

2. A determination that the change did not reduce the accuracy or reliability of dose calculations or setpoint determinations.

3. Documentation of the fact that the change has been reviewed and found acceptable by the Plant Operations Review Committee (PORC).

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

B. The submittal providing information on PCP changes shall contain:

1. Information submitted should consist of a complete legible copy of the PCP, together with appropriate analyses or evaluations, justifying the changes(s), if applicable.

2. Documentation of the fact that the change has been reviewed and found acceptable by the Plant Operations Review Committee (PORC).

NOTE
Radioactive Waste System change information may be submitted as part of the annual FSAR update in lieu of the Annual Radioactive Effluent Release Report.

C. The submittal providing information on licensee initiated major changes to the radioactive waste systems (liquid, gaseous, and solid) shall contain:

1. A summary of the evaluation that led to the the determination that the change could be made in accordance with 10CFR50.59

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

2. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information.

3. A detailed description of the equipment, components and processes involved and the interfaces with other plant systems.

4. An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the license application and amendments thereto.

5. An evaluation of the change which shows the expected maximum exposures a member of the Public in the unrestricted area and to the general population that differ from those previously estimated in the license application and amendments thereto.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

6. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period before the changes are to be made.

7. An estimate of the exposure to plant operating personnel as a result of the change.

8. Documentation of the fact that the change was reviewed and found acceptable by the Plant Operating Review Committee.

9. Changes to Radioactive Waste Systems performed using the plant design change process will be reported as per design change procedures.

5.10.1.7 The Annual Radioactive Effluent Release Report shall include, if applicable, a description of events which led to exceeding the following limiting condition for operation:

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

A. The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following:

1. For noble gases: 500 mrem/yr or less to the total body and 3,000 mrem/yr or less to the skin, and

2. For iodine-131, iodine-133, tritium, and all radioactive materials in particulate form with half-lives greater than 8 days: 1,500 mrem/yr or less to any organ.

5.10.1.8 The Annual Radioactive Effluent Release Report shall include, if applicable, a description of events which led to exceeding the following limiting condition for operation:

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

A. The quantity of radioactive material contained in each of the following unprotected tanks shall be limited to less than or equal to 1.57×10^{-2} curies, excluding tritium and dissolved or entrained noble gases. For outside temporary storage tanks, the curie content shall be limited such that a rupture will not result in exceeding 10CFR Part 20 limits at the unrestricted area boundary.

1. PWST

2. Outside temporary tank

5.10.1.9 The Annual Radioactive Effluent Release Report shall, if applicable, identify the cause of the unavailability of milk or fresh leafy vegetable samples at locations required by ODCM Spec. Table 5.8.1. The new location(s) for obtaining replacement samples shall be identified. Revised figure(s) and table for the ODCM reflecting the new locations shall be included in the report.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

5.10.1.10 The Annual Radioactive Effluent Release Report shall identify the new location(s), if a land use census pursuant to ODCM Specification 5.8.3 identifies an environmental sampling location that yields a calculated dose or dose commitment greater than the values currently being calculated pursuant to ODCM Specification 5.4.3.

5.10.1.11 The Annual Radioactive Effluent Release Report shall identify the new location(s) and include a revised figure(s) and table for the ODCM reflecting the new location(s) if a land use census identifies an environmental sampling location(s) that yield a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained pursuant to ODCM Specification 5.7.1.

5.10.1.12 With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels operable as required by ODCM Specification Table 5.6-1 for 30 days or longer, explain in the next Annual Radioactive Effluent Release Report, pursuant to Specification 6.9.1.8, why this inoperability was not corrected within the time specified.

5.10 ROUTINE EFFLUENT RELEASE REPORTS (cont'd)

5.10.1.13 With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels operable as required by ODCM Specification Table 5.6-3 for 30 days or longer, explain in the next Annual Radioactive Effluent Release Report, pursuant to Specification 6.9.1.8, why this in operability was not corrected within the time specified.

NOTE
The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever an effluent sample is late or missing in accordance with applicable Specifications.

5.10.1.14 The Annual Radioactive Effluent Release Report shall identify any missing or late analysis results for radioactive effluent samples collected during the reporting period.

5.11 SPECIAL EFFLUENT REPORTS

5.11.1 Abnormal Operation of Radioactive Gaseous Waste Treatment System

5.11.1.1 The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever the following limiting condition for operation is exceeded:

5.11.1.2 The VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be OPERABLE and appropriate portions of these systems shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases to areas at and beyond the SITE BOUNDARY would exceed either:

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

A. A Special Report shall be prepared for submittal to the NRC within 30 days if gaseous waste is being discharged without treatment and in excess of the above limits.

B. The Special Report shall include the following information:

1. Identification of the inoperable equipment or subsystems and the reason for inoperability

2. Action(s) taken to restore the inoperable equipment to operable status, and

3. Summary description of action(s) taken to prevent a recurrence.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.2 Abnormal Operation of Radioactive Liquid Waste Treatment System

5.11.2.1 The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever the following limiting condition for operation is exceeded:

The LIQUID RADWASTE TREATMENT system shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent to unrestricted areas would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31 day period.

A. A Special Report shall be prepared for submittal to the NRC within 30 days if radioactive liquid waste is being discharged without treatment and in excess of the above limits.

B. The Special Report shall include the following information:

1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

2. Action(s) taken to restore the inoperable equipment to operable status

3. Summary description of action(s) taken to prevent a recurrence.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.3 Radioactive Liquid Effluent Dose Reports

5.2.4.1 The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever the following limiting condition for operation is exceeded:

The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

a. During any calendar quarter, to 1.5 mrem or less to the total body and to 5 mrem or less to any organ, and

b. During any calendar year, to 3 mrem or less to the total body and to 10 mrem or less to any organ.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

A. A Special Report shall be prepared for submittal to the NRC within 30 days.

B. The Special Report shall identify the cause(s) for exceeding the limit(s) and define the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

NOTE
The following step is applicable only if drinking water supply is taken from the receiving water.

C. The Special Report shall also include the results of radiological analyses of the drinking water and the radiological impact on finished drinking water supplies with regard to the requirements of Code of Federal Regulations, title 40 part 141.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.4 Radioactive Gaseous Effluent Dose Report - Noble Gases

5.11.4.1 The Shift Supervisor shall be immediately notified and a Condition Report initiated whenever the following limiting condition for operation is exceeded:

The air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:

a. During any calendar quarter, to 5 mrad or less gamma radiation and to 10 mrad or less for beta radiation and

b. During any calendar year, to 10 mrad or less for gamma radiation and to 20 mrad or less for beta radiation.

A. A Special Report shall be prepared for submittal to the NRC within 30 days.

B. The Special Report shall identify the cause(s) for exceeding the limit(s) and define the corrective actions that have been taken to reduce the releases and the proposed actions to be taken to assure that subsequent releases will be in compliance with the above limits.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.5 Radioactive Gaseous Dose Report Non-Noble Gases

5.11.5.1 The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever the following limited condition for operation is exceeded:

The dose to a member of the public from iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at an beyond the site boundary shall be limited to the following:

a. During any calendar quarter, to 7.5 mrem or less to any organ and

b. During any calendar year, to 15 mrem or less to any organ.

A. A Special Report shall be prepared for submittal to the NRC within 30 days.

B. The Special Report shall identify the cause(s) for exceeding the limit(s) and define the corrective actions that have been taken to reduce the releases and subsequent releases will be in compliance with the above limits.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.6 <u>Radioactive Effluent Dose Report - Uranium Fuel Cycle</u>

5.11.6.1 The Shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever the following limiting condition for operation is exceeded:

The annual (calendar year) dose or dose commitment to any member of the public, due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to 25 mrem or less to the total body or any organ except the thyroid, which shall be limited to 75 mrem.

A. A Special Report shall be prepared for submittal to the NRC within 30 days.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

B. The Special Report shall define the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. The Special Report, as defined in 10 CFR Part 20.405c, shall include an analysis that estimates the radiation exposure (dose) to a member of the public from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations.

C. If the estimated doses exceed the above limits, and if the release condition resulting in violation of 40CFR190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of Code of Federal Regulations, Title 40 Part 190.

5.11 SPECIAL EFFLUENT REPORTS (cont'd)

5.11.7 Environmental Protection Agency Reportable Quantities

5.11.7.1 If any of ODCM specifications, 5.3.1, 5.3.2, 5.4.1, 5.4.2, or 5.4.3 have been exceeded, an evaluation of the Radioactivity released verses EPA Reportable Quantities (RQ's) shall be performed as soon as practical.

The shift Supervisor shall be immediately notified and a Condition Report promptly initiated whenever any radionuclide released over a 24 hour period is greater than or equal to the EPA RQ. Notification requirements shall be performed as per UNT-006-010, Event Evaluation and Reporting. Recipients of notification are: The National Response Center, the State Emergency Response Commission, and the Local Emergency Planning Committee. Methods for determination of reportability and the Reportable Quantities values for radionuclides are contained within 40CFR302.

5.12 SECONDARY RELEASE PATHS

5.12.1 This section addresses potential release pathways which should not contribute more than 10% of the doses evaluated in this manual. The ODCM methodology for calculation of doses will be applied to an applicable release path of a likely potential arises for contributing more than 10% of the doses evaluated in this manual.

5.12.2 Secondary Release Paths are expected to release trivial quantities of radionuclides. Some examples of Secondary Release Paths are listed below:

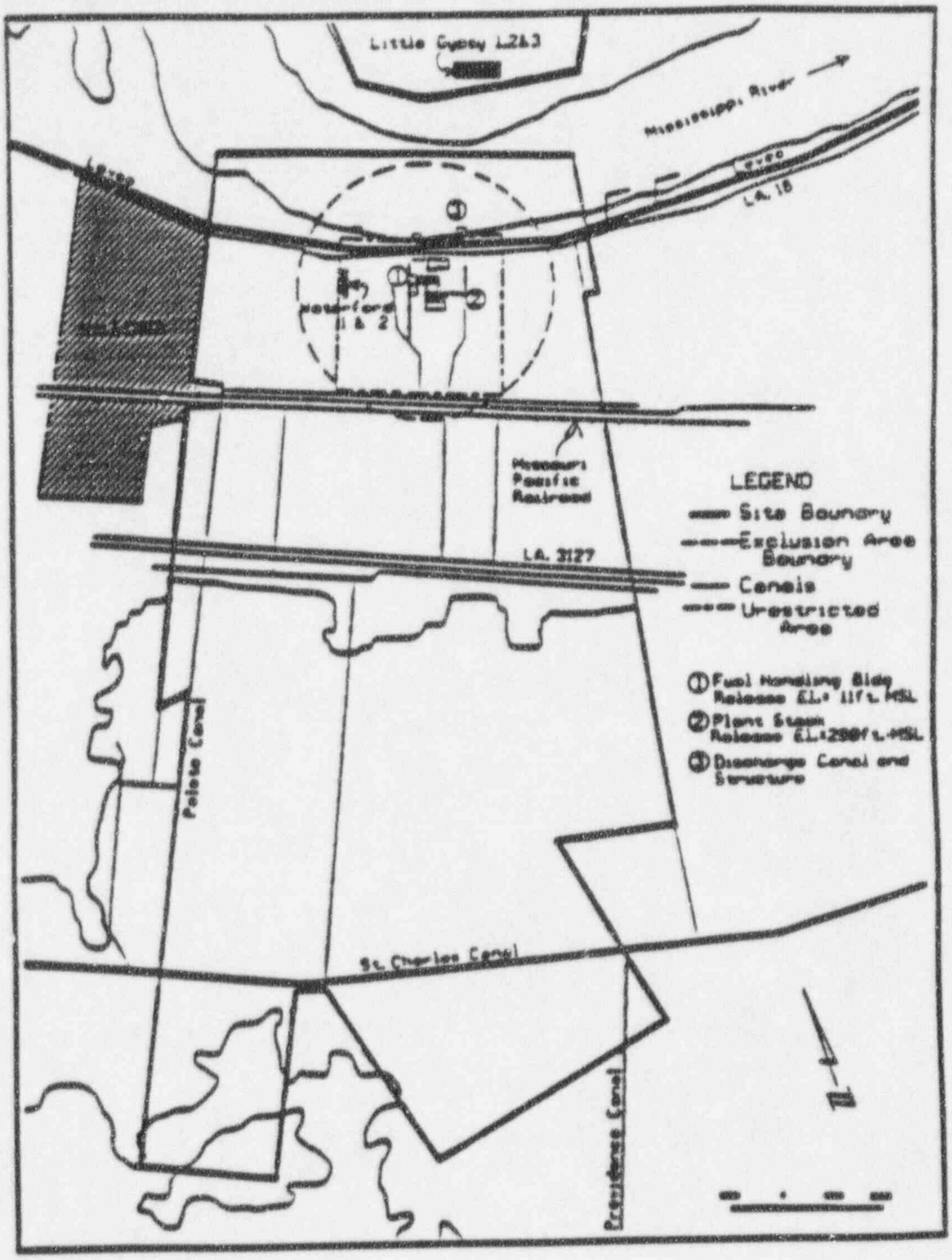
- Unmonitored Secondary System Steam Vents/Reliefs
- Decon Shop/Hot Machine Shop Exhaust
- Turbine Building Ventilation Exhaust
- Unmonitored Tank Atmospheric Vents
- Radioactive Waste Compactor Building
- Radioactive Waste Solidification Building
- Cooling Tower Atmospheric Entrainment

6.0 <u>ATTACHMENTS</u>

Refer to Table of Contents

SITE BOUNDARY FOR

RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS



HISTORICAL AVERAGE DISPERSION AND DEPOSITION PARAMETERS FOR AREAS AT OR BEYOND THE UNRESTRICTED AREA BOUNDARY

ANNUAL AVERAGE ATMOSPHERIC DISPERSION AND DEPOSITION PARAMETERS
BASED ON HISTORICAL METEOROLOGICAL DATA AND CURRENT LAND USE CENSUS

Receptor Type or Location	Direction from Site	Sector Location	Distance from Site (miles)	Distance from Site (meters)	X/Q No Decay Undepleted (sec/m3)	D/Q (1/m2)
Site Boundary	N[a]	A	0.8	1287	1.0e-05	2.4e-08
	NNE[a]	B	0.6	966	1.6e-05	3.4e-08
	NE[a]	C	0.6	966	1.5e-05	2.8e-08
	ENE[a]	D	0.6	966	1.6e-05	2.5e-08
	E	E	0.8	1287	6.9e-06	1.3e-08
	ESE	F	0.6	966	1.1e-05	2.3e-08
	SE	G	0.6	966	1.1e-05	3.1e-08
	SSE	H	0.8	1287	6.3e-06	2.4e-08
	S	J	1.6	2575	8.9e-07	2.7e-09
	SSW	K	3.1	4989	3.0e-07	7.9e-10
	SW	L	3.4	5472	3.3e-07	9.1e-10
	WSW	M	1.5	2414	1.7e-06	4.9e-09
	W	N	1.0	1609	2.3e-06	7.3e-09
	WNW	P	0.8	1287	7.5e-06	2.7e-08
	NW	Q	0.8	1287	1.0e-05	3.2e-08
	NNW	R	0.9	1448	9.6e-06	2.4e-08
Residence	N	A	0.9	1448	7.8e-06	1.8e-08
	NNE	B	1.3	2092	3.0e-06	5.8e-09
	NE	C	0.9	1448	6.3e-06	1.2e-08
	ENE	D	0.9	1448	6.8e-06	1.1e-08
	E	E	2.2	3541	7.4e-07	1.0e-09
	ESE	F	3.1	4989	3.7e-07	4.8e-10
	SE	G	4.0	6437	2.3e-07	3.6e-10
	W	N	1.0	1609	2.3e-06	7.3e-09
	WNW	P	0.9	1448	5.6e-06	2.0e-08
	NW	Q	0.9	1448	7.7e-06	2.3e-08
	NNW	R	3.0	4828	7.7e-07	1.3e-09
Milk Cow	NW[b]	Q	0.9	1448	7.7e-06	2.3e-08
	NW	Q	4.9	7886	2.6e-07	4.1e-10
Vegetable Garden	N	A	1.0	1609	6.1e-06	1.4e-08
	NNE	B	1.3	2092	3.0e-06	5.8e-09
	NE	C	0.9	1448	6.3e-06	1.2e-08
	ENE	D	0.9	1448	6.8e-06	1.1e-08
	E	E	2.2	3541	7.4e-07	1.0e-09
	ESE	F	2.2	3541	7.0e-07	1.1e-09
	SE	G	2.3	3701	6.2e-07	1.3e-09
	WSW	M	1.5	2414	1.7e-06	4.9e-09
	W	N	1.1	1770	1.9e-06	5.7e-09
	WNW	P	0.9	1448	5.6e-06	2.0e-08
	NW	Q	0.9	1448	7.7e-06	2.3e-08
	NNW	R	3.0	4828	7.7e-06	1.3e-09
Beef Cow	E	E	3.2	5150	3.7e-07	4.2e-10
	ESE	F	3.5	5633	3.0e-07	3.6e-1[illegible]
	SE	G	4.5	7242	1.9e-07	2.8e-10
	WSW	M	1.2	1931	2.7e-06	8.6e-09
	WNW	P	0.9	1448	5.6e-06	2.0e-08
	NW	Q	0.9	1448	7.7e-06	2.3e-08
	NNW	R	2.3	3701	1.3e-06	2.4e-09

Notes: [a] The site boundary in this sector is located over water. The location cannot be occupied continuously for the life of the plant.

[b] The animals at this location do not produce milk for human consumption.

SITE RELATED LIQUID INGESTION DOSE COMMITMENT FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT
DISCHARGE POINT: CIRCULATING WATER (into Mississippi River)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.66E-01	2.66E-01	2.66E-01	2.66E-01	2.66E-01	2.66E-01
C-14	3.13E+04	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03
NA-24	4.08E+02	4.08E+02	4.08E+02	4.08E+02	4.08E+02	4.08E+02	4.08E+02
P-32	4.62E+07	2.87E+06	1.79E+06	0.00E+00	0.00E+00	0.00E+00	5.19E+06
CR-51	0.00E+00	0.00E+00	1.27E+00	7.62E-01	2.81E-01	1.69E+00	3.21E+02
MN-54	0.00E+00	4.38E+03	8.35E+02	0.00E+00	1.30E+03	0.00E+00	1.34E+04
MN-56	0.00E+00	1.10E+02	1.95E+01	0.00E+00	1.40E+02	0.00E+00	3.52E+03
FE-55	6.59E+02	4.56E+02	1.06E+02	0.00E+00	0.00E+00	2.54E+02	2.61E+02
FE-59	1.04E+03	2.45E+03	9.38E+02	0.00E+00	0.00E+00	6.83E+02	8.15E+03
CO-58	0.00E+00	8.95E+01	2.01E+02	0.00E+00	0.00E+00	0.00E+00	1.81E+03
CO-60	0.00E+00	2.57E+02	5.67E+02	0.00E+00	0.00E+00	0.00E+00	4.83E+03
NI-63	3.12E+04	2.16E+03	1.05E+03	0.00E+00	0.00E+00	0.00E+00	4.51E+02
NI-65	1.27E+02	1.64E+01	7.51E+00	0.00E+00	0.00E+00	0.00E+00	4.17E+02
CU-64	0.00E+00	1.00E+01	4.70E+00	0.00E+00	2.52E+01	0.00E+00	8.53E+02
ZN-65	2.32E+04	7.37E+04	3.33E+04	0.00E+00	4.93E+04	0.00E+00	4.64E+04
ZN-69	4.93E+01	9.43E+01	6.56E+00	0.00E+00	6.13E+01	0.00E+00	1.42E+01
BR-83	0.00E+00	0.00E+00	4.04E+01	0.00E+00	0.00E+00	0.00E+00	5.82E+01
BR-84	0.00E+00	0.00E+00	5.24E+01	0.00E+00	0.00E+00	0.00E+00	4.11E-04
BR-85	0.00E+00	0.00E+00	2.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.01E+05	4.71E+04	0.00E+00	0.00E+00	0.00E+00	1.99E+04
RB-88	0.00E+00	2.90E+02	1.54E+02	0.00E+00	0.00E+00	0.00E+00	4.00E-09
RB-89	0.00E+00	1.92E+02	1.35E+02	0.00E+00	0.00E+00	0.00E+00	1.12E-11
SR-89	2.22E+04	0.00E+00	6.38E+02	0.00E+00	0.00E+00	0.00E+00	3.57E+03
SR-90	5.47E+05	0.00E+00	1.34E+05	0.00E+00	0.00E+00	0.00E+00	1.58E+04
SR-91	4.09E+02	0.00E+00	1.65E+01	0.00E+00	0.00E+00	0.00E+00	1.95E+03
SR-92	1.55E+02	0.00E+00	6.71E+00	0.00E+00	0.00E+00	0.00E+00	3.08E+03
Y-90	5.79E-01	0.00E+00	1.55E-02	0.00E+00	0.00E+00	0.00E+00	6.14E+03
Y-91M	5.47E-03	0.00E+00	2.12E-04	0.00E+00	0.00E+00	0.00E+00	1.61E-02
Y-91	8.49E+00	0.00E+00	2.27E-01	0.00E+00	0.00E+00	0.00E+00	4.67E+03
Y-92	5.09E-02	0.00E+00	1.49E-03	0.00E+00	0.00E+00	0.00E+00	8.91E+02

Conversion factors are in units of mrem/hr per uCi/ml

SITE RELATED LIQUID INGESTION DOSE COMMITMENT FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT

DISCHARGE POINT: CIRCULATING WATER (into Mississippi River)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.61E-01	0.00E+00	4.46E-03	0.00E+00	0.00E+00	0.00E+00	5.12E+03
ZR-95	2.52E-01	8.07E-02	5.46E-02	0.00E+00	1.27E-01	0.00E+00	2.56E+02
ZR-97	1.39E-02	2.81E-03	1.28E-03	0.00E+00	4.24E-03	0.00E+00	8.69E+02
NB-95	4.47E+00	2.49E+00	1.34E+00	0.00E+00	2.46E+00	0.00E+00	1.51E+04
MO-99	0.00E+00	1.05E+02	1.99E+01	0.00E+00	2.37E+02	0.00E+00	2.43E+02
TC-99M	8.96E-03	2.53E-02	3.23E-01	0.00E+00	3.85E-01	1.24E-02	1.50E+01
TC-101	9.22E-03	1.33E-02	1.30E-01	0.00E+00	2.39E-01	6.79E-03	3.99E-14
RU-103	4.50E+00	0.00E+00	1.94E+00	0.00E+00	1.72E+01	0.00E+00	5.25E+02
RU-105	3.75E-01	0.00E+00	1.48E-01	0.00E+00	4.84E+00	0.00E+00	2.29E+02
RU-106	6.69E+01	0.00E+00	8.46E+00	0.00E+00	1.29E+02	0.00E+00	4.33E+03
AG-110M	8.27E-01	7.65E-01	4.54E-01	0.00E+00	1.50E+00	0.00E+00	3.12E+02
TE-125M	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.00E+00	1.03E+04
TE-127M	6.49E+03	2.32E+03	7.90E+02	1.66E+03	2.63E+04	0.00E+00	2.17E+04
TE-127	1.05E+02	3.78E+01	2.28E+01	7.81E+01	4.29E+02	0.00E+00	8.32E+03
TE-129M	1.10E+04	4.11E+03	1.74E+03	3.78E+03	4.60E+04	0.00E+00	5.55E+04
TE-129	3.01E+01	1.13E+01	7.33E+00	2.31E+01	1.26E+02	0.00E+00	2.27E+01
TE-131M	1.66E+03	8.10E+02	6.75E+02	1.28E+03	8.21E+03	0.00E+00	8.05E+04
TE-131	1.89E+01	7.88E+00	5.96E+00	1.55E+01	8.27E+01	0.00E+00	2.67E+00
TE-132	2.41E+03	1.56E+03	1.47E+03	1.72E+03	1.50E+04	0.00E+00	7.39E+04
I-130	2.74E+01	8.09E+01	3.19E+01	6.86E+03	1.26E+02	0.00E+00	6.97E+01
I-131	1.51E+02	2.16E+02	1.24E+02	7.08E+04	3.70E+02	0.00E+00	5.70E+01
I-132	7.37E+00	1.97E+01	6.89E+00	6.89E+02	3.14E+01	0.00E+00	3.70E+00
I-133	5.15E+01	8.96E+01	2.73E+01	1.32E+04	1.56E+02	0.00E+00	8.06E+01
I-134	3.85E+00	1.05E+01	3.74E+00	1.81E+02	1.66E+01	0.00E+00	9.11E-03
I-135	1.61E+01	4.21E+01	1.55E+01	2.78E+03	6.75E+01	0.00E+00	4.75E+01
CS-134	2.98E+05	7.09E+05	5.79E+05	0.00E+00	2.29E+05	7.61E+04	1.24E+04
CS-136	3.12E+04	1.23E+05	8.86E+04	0.00E+00	6.85E+04	9.39E+03	1.40E+04
CS-137	3.82E+05	5.22E+05	3.42E+05	0.00E+00	1.77E+05	5.89E+04	1.01E+04
CS-138	2.64E+02	5.22E+02	2.59E+02	0.00E+00	3.84E+02	3.79E+01	2.23E-03
BA-139	9.66E-01	6.88E-04	2.83E-02	0.00E+00	6.43E-04	3.90E-04	1.71E+00

Conversion factors are in units of mrem/hr per uCi/ml

SITE RELATED LIQUID INGESTION DOSE COMMITMENT FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT
DISCHARGE POINT: CIRCULATING WATER (into Mississippi River)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.02E+02	2.54E-01	1.32E+01	0.00E+00	8.63E-02	1.45E-01	4.16E+02
BA-141	[illegible].69E-01	3.54E-04	1.58E-02	0.00E+00	3.29E-04	2.01E-04	2.21E-10
BA-142	2.12E-01	2.18E-04	1.33E-02	0.00E+00	1.84E-04	1.23E-04	2.99E-19
LA-140	1.5[illegible]E-01	7.59E-02	2.01E-02	0.00E+00	0.00E+00	0.00E+00	5.57E+03
LA-142	7.71E-03	3.51E-03	8.73E-04	0.00E+00	0.00E+00	0.00E+00	2.56E+01
CE-141	2.59E-02	1.75E-02	1.99E-03	0.00E+00	8.15E-03	0.00E+00	6.71E+01
CE-143	4.57E-03	3.38E+00	3.74E-04	0.00E+00	1.49E-03	0.00E+00	1.26E+02
CE-144	1.35E+[illegible]	5.66E-01	7.26E-02	0.00E+00	3.35E-01	0.00E+00	4.57E+02
PR-143	5.54E-01	2.22E-01	2.75E-02	0.00E+00	1.28E-01	0.00E+00	2.43E+03
PR-144	1.81E-03	[illegible].53E-04	9.21E-05	0.00E+00	4.25E-04	0.00E+00	2.61E-10
ND-147	3.79E-01	[illegible].38E-01	2.62E-02	0.00E+00	2.56E-01	0.00E+00	2.10E+03
W-187	2.96E+02	2.47E+02	8.65E+01	0.00E+00	0.00E+00	0.00E+00	8.10E+04
NP-239	2.89E-02	2.85E-03	1.57E-03	0.00E+00	8.88E-03	0.00E+00	5.84E+02

Conversion factors are in units of mrem/hr per uCi/ml

SITE RELATED LIQUID INGESTION DOSE COMMITMENT FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT

DISCHARGE POINT: ALL OTHERS (into 40 Arpent Canal)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS					
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00	8.96E+00
C-14	3.15E+04	6.30E+03	6.30E+03	6.30E+03	6.30E+03	6.30E+03	6.30E+03
NA-24	5.48E+02	5.48E+02	5.48E+02	5.48E+02	5.48E+02	5.48E+02	5.48E+02
P-32	4.62E+07	2.87E+06	1.79E+06	0.00E+00	0.00E+00	0.00E+00	5.20E+06
CR-51	0.00E+00	0.00E+00	1.49E+00	8.94E-01	3.29E-01	1.98E+00	3.76E+02
MN-54	0.00E+00	4.76E+03	9.08E+02	0.00E+00	1.42E+03	0.00E+00	1.46E+04
MN-56	0.00E+00	1.20E+02	2.12E+01	0.00E+00	1.52E+02	0.00E+00	3.82E+03
FE-55	8.87E+02	6.13E+02	1.43E+02	0.00E+00	0.00E+00	3.42E+02	3.52E+02
FE-59	1.40E+03	3.29E+03	1.26E+03	0.00E+00	0.00E+00	9.19E+02	1.10E+04
CO-58	0.00E+00	1.51E+02	3.39E+02	0.00E+00	0.00E+00	0.00E+00	3.06E+03
CO-60	0.00E+00	4.34E+02	9.58E+02	0.00E+00	0.00E+00	0.00E+00	8.16E+03
NI-63	4.19E+04	2.91E+03	1.41E+03	0.00E+00	0.00E+00	0.00E+00	6.07E+02
NI-65	1.70E+02	2.21E+01	1.01E+01	0.00E+00	0.00E+00	0.00E+00	5.61E+02
CU-64	0.00E+00	1.69E+01	7.93E+00	0.00E+00	4.26E+01	0.00E+00	1.44E+03
ZN-65	2.36E+04	7.50E+04	3.39E+04	0.00E+00	5.02E+04	0.00E+00	4.73E+04
ZN-69	5.02E+01	9.60E+01	6.67E+00	0.00E+00	6.24E+01	0.00E+00	1.44E+01
BR-83	0.00E+00	0.00E+00	4.38E+01	0.00E+00	0.00E+00	0.00E+00	6.30E+01
BR-84	0.00E+00	0.00E+00	5.67E+01	0.00E+00	0.00E+00	0.00E+00	4.45E-04
BR-85	0.00E+00	0.00E+00	2.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.03E+05	4.79E+04	0.00E+00	0.00E+00	0.00E+00	2.03E+04
RB-88	0.00E+00	2.95E+02	1.56E+02	0.00E+00	0.00E+00	0.00E+00	4.07E-09
RB-89	0.00E+00	1.95E+02	1.37E+02	0.00E+00	0.00E+00	0.00E+00	1.13E-11
SR-89	4.78E+04	0.00E+00	1.37E+03	0.00E+00	0.00E+00	0.00E+00	7.66E+03
SR-90	1.18E+06	0.00E+00	2.88E+05	0.00E+00	0.00E+00	0.00E+00	3.40E+04
SR-91	8.79E+02	0.00E+00	3.55E+01	0.00E+00	0.00E+00	0.00E+00	4.19E+03
SR-92	3.33E+02	0.00E+00	1.44E+01	0.00E+00	0.00E+00	0.00E+00	6.60E+03
Y-90	1.38E+00	0.00E+00	3.69E-02	0.00E+00	0.00E+00	0.00E+00	1.46E+04
Y-91M	1.30E-02	0.00E+00	5.04E-04	0.00E+00	0.00E+00	0.00E+00	3.82E-02
Y-91	2.02E+01	0.00E+00	5.39E-01	0.00E+00	0.00E+00	0.00E+00	1.11E+04
Y-92	1.21E-01	0.00E+00	3.53E-03	0.00E+00	0.00E+00	0.00E+00	2.12E+03

Conversion factors are in units of mrem/hr per uCi/ml

SITE RELATED LIQUID INGESTION DOSE COMMITMENT FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT
DISCHARGE POINT: ALL OTHERS (into 40 Arpent Canal)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	3.83E-01	0.00E+00	1.06E-02	0.00E+00	0.00E+00	0.00E+00	1.22E+04
ZR-95	2.77E+00	8.88E-01	6.01E-01	0.00E+00	1.39E+00	0.00E+00	2.82E+03
ZR-97	1.53E-01	3.09E-02	1.41E-02	0.00E+00	4.67E-02	0.00E+00	9.57E+03
NB-95	4.98E+00	2.77E+00	1.49E+00	0.00E+00	2.74E+00	0.00E+00	1.68E+04
MO-99	0.00E+00	4.62E+02	8.79E+01	0.00E+00	1.05E+03	0.00E+00	1.07E+03
TC-99M	2.94E-02	8.32E-02	1.06E+00	0.00E+00	1.26E+00	4.07E-02	4.92E+01
TC-101	3.03E-02	4.36E-02	4.28E-01	0.00E+00	7.85E-01	2.23E-02	1.31E-13
RU-103	1.98E+01	0.00E+00	8.54E+00	0.00E+00	7.57E+01	0.00E+00	2.31E+03
RU-105	1.65E+00	0.00E+00	6.52E-01	0.00E+00	2.13E+01	0.00E+00	1.01E+03
RU-106	2.95E+02	0.00E+00	3.73E+01	0.00E+00	5.69E+02	0.00E+00	1.91E+04
AG-110M	1.41E+01	1.30E+01	7.74E+00	0.00E+00	2.56E+01	0.00E+00	5.32E+03
TE-125M	2.79E+03	1.01E+03	3.74E+02	8.39E+02	1.13E+04	0.00E+00	1.11E+04
TE-127M	7.05E+03	2.52E+03	8.59E+02	1.80E+03	2.86E+04	0.00E+00	2.36E+04
TE-127	1.14E+02	4.11E+01	2.48E+01	8.48E+01	4.66E+02	0.00E+00	9.03E+03
TE-129M	1.20E+04	4.47E+03	1.89E+03	4.11E+03	5.00E+04	0.00E+00	6.03E+04
TE-129	3.27E+01	1.23E+01	7.96E+00	2.51E+01	1.37E+02	0.00E+00	2.47E+01
TE-131M	1.80E+03	8.81E+02	7.34E+02	1.39E+03	8.92E+03	0.00E+00	8.74E+04
TE-131	2.05E+01	8.57E+00	6.47E+00	1.69E+01	8.98E+01	0.00E+00	2.90E+00
TE-132	2.62E+03	1.70E+03	1.59E+03	1.87E+03	1.63E+04	0.00E+00	8.02E+04
I-130	9.01E+01	2.66E+02	1.05E+02	2.25E+04	4.15E+02	0.00E+00	2.29E+02
I-131	4.96E+02	7.09E+02	4.06E+02	2.32E+05	1.22E+03	0.00E+00	1.87E+02
I-132	2.42E+01	6.47E+01	2.26E+01	2.26E+03	1.03E+02	0.00E+00	1.22E+01
I-133	1.69E+02	2.94E+02	8.97E+01	4.32E+04	5.13E+02	0.00E+00	2.64E+02
I-134	1.26E+01	3.43E+01	1.23E+01	5.94E+02	5.46E+0[illegible]	0.00E+00	2.99E-02
I-135	5.28E+01	1.38E+02	5.10E+01	9.11E+03	2.22E+[illegible]	0.00E+00	1.56E+02
CS-134	3.03E+05	7.21E+05	5.89E+05	0.00E+00	2.33E+05	7.75E+04	1.26E+04
CS-136	3.17E+04	1.25E+05	9.01E+04	0.00E+00	6.97E+04	9.55E+03	1.42E+04
CS-137	3.88E+05	5.31E+05	3.48E+05	0.00E+00	1.[illegible]E+05	5.99E+04	1.03E+04
CS-138	2.69E+02	5.31E+02	2.63E+02	0.00E+00	3.90E+02	3.85E+01	2.27E-03
BA-139	9.00E+00	6.41E-03	2.64E-01	0.00E+00	5.99E-03	3.64E-03	1.60E+01

Conversion factors are in units of mrem/hr per uCi/ml

SITE RELATED LIQUID INGESTION DOSE COMMITMENT

FACTORS (A_i) FOR INDIVIDUAL NUCLIDES

AGE GROUP: ADULT

DISCHARGE POINT: ALL OTHERS (into 40 Arpent Canal)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.88E+03	2.37E+00	1.23E+02	0.00E+00	8.05E-01	1.35E+00	3.88E+03
BA-141	4.37E+00	3.30E-03	1.48E-01	0.00E+00	3.07E-03	1.87E-03	2.06E-09
BA-142	1.98E+00	2.03E-03	1.24E-01	0.00E+00	1.72E-03	1.15E-03	2.78E-18
LA-140	3.58E-01	1.80E-01	4.76E-02	0.00E+00	0.00E+00	0.00E+00	1.32E+04
LA-142	1.83E-02	8.33E-03	2.07E-03	0.00E+00	0.00E+00	0.00E+00	6.08E+01
CE-141	8.01E-01	5.42E-01	6.15E-02	0.00E+00	2.52E-01	0.00E+00	2.07E+03
CE-143	1.41E-01	1.04E+02	1.16E-02	0.00E+00	4.60E-02	0.00E+00	3.90E+03
CE-144	4.18E+01	1.75E+01	2.24E+00	0.00E+00	1.04E+01	0.00E+00	1.41E+04
PR-143	1.32E+00	5.28E-01	6.52E-02	0.00E+00	3.05E-01	0.00E+00	5.77E+03
PR-144	4.31E-03	1.79E-03	2.19E-04	0.00E+00	1.01E-03	0.00E+00	6.19E-10
ND-147	9.00E-01	1.04E+00	6.22E-02	0.00E+00	6.08E-01	0.00E+00	4.99E+03
W-187	3.04E+02	2.55E+02	8.90E+01	0.00E+00	0.00E+00	0.00E+00	8.34E+04
NP-239	1.28E-01	1.25E-02	6.91E-03	0.00E+00	3.91E-02	0.00E+00	2.57E+03

Conversion factors are in units of mrem/hr per uCi/ml

DOSE FACTORS FOR EXPOSURE TO A SEMI-INFINITE CLOUD OF NOBLE GASES

Nuclide	β-air*(N_i)	β-Skin**(L_i)	γ-air*(M_i)	γ-Body**(K_i)
Kr-83m	2.88E-04	---	1.93E-05	7.56E-08
Kr-85m	1.97E-03	1.46E-03	1.23E-03	1.17E-03
Kr-85	1.95E-03	1.34E-03	1.72E-05	1.61E-05
Kr-87	1.03E-02	9.73E-03	6.17E-03	5.92E-03
Kr-88	2.93E-03	2.37E-03	1.52E-02	1.47E-02
Kr-89	1.06E-02	1.01E-02	1.73E-02	1.66E-02
Kr-90	7.83E-03	7.29E-03	1.63E-02	1.56E-02
Xe-131m	1.11E-03	4.76E-04	1.56E-04	9.15E-05
Xe-133m	1.48E-03	9.94E-04	3.27E-04	2.51E-04
Xe-133	1.05E-03	3.06E-04	3.53E-04	2.94E-04
Xe-135m	7.39E-04	7.11E-04	3.36E-03	3.12E-03
Xe-135	2.46E-03	1.86E-03	1.92E-03	1.81E-03
Xe-137	1.27E-02	1.22E-02	1.51E-03	1.42E-03
Xe-138	4.75E-03	4.13E-03	9.21E-03	8.83E-03
Ar-41	3.28E-03	2.69E-03	9.30E-03	8.84E-03

* $\frac{mrad - m^3}{pCi - yr}$

** $\frac{mrem - m^3}{pCi - yr}$

Extracted from Table B-1 of Regulatory Guide 1.109, Revision 1, 1977

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION

AGE GROUP: ADULT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
C-14	1.82E+04	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03
NA-24	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04
P-32	1.32E+06	7.71E+04	5.01E+04	0.00E+00	0.00E+00	0.00E+00	8.64E+04
CR-51	0.00E+00	0.00E+00	1.00E+02	5.95E+01	2.28E+01	1.44E+04	3.32E+03
MN-54	0.00E+00	3.96E+04	6.30E+03	0.00E+00	9.84E+03	1.40E+06	7.74E+04
MN-56	0.00E+00	1.24E+00	1.83E-01	0.00E+00	1.30E+00	9.44E+03	2.02E+04
FE-55	2.46E+04	1.70E+04	3.94E+03	0.00E+00	0.00E+00	7.21E+04	6.03E+03
FE-59	1.18E+04	2.78E+04	1.06E+04	0.00E+00	0.00E+00	1.02E+06	1.88E+05
CO-58	0.00E+00	1.58E+03	2.07E+03	0.00E+00	0.00E+00	9.28E+05	1.06E+05
CO-60	0.00E+00	1.15E+04	1.48E+04	0.00E+00	0.00E+00	5.97E+06	2.85E+05
NI-63	4.32E+05	3.14E+04	1.45E+04	0.00E+00	0.00E+00	1.78E+05	1.34E+04
NI-65	1.54E+00	2.10E-01	9.12E-02	0.00E+00	0.00E+00	5.60E+03	1.23E+04
CU-64	0.00E+00	1.46E+00	6.15E-01	0.00E+00	4.62E+00	6.78E+03	4.90E+04
ZN-65	3.24E+04	1.03E+05	4.66E+04	0.00E+00	6.90E+04	8.64E+05	5.34E+04
ZN-69	3.46E-02	6.51E-02	4.52E-03	0.00E+00	4.22E-02	9.20E+02	1.63E+01
BR-83	0.00E+00	0.00E+00	2.41E+02	0.00E+00	0.00E+00	0.00E+00	2.32E+02
BR-84	0.00E+00	0.00E+00	3.13E+02	0.00E+00	0.00E+00	0.00E+00	1.64E-03
BR-85	0.00E+00	0.00E+00	1.28E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.35E+05	5.90E+04	0.00E+00	0.00E+00	0.00E+00	1.66E+04
RB-88	0.00E+00	3.87E+02	1.93E+02	0.00E+00	0.00E+00	0.00E+00	3.34E-09
RB-89	0.00E+00	2.56E+02	1.70E+02	0.00E+00	0.00E+00	0.00E+00	9.28E-12
SR-89	3.04E+05	0.00E+00	8.72E+03	0.00E+00	0.00E+00	1.40E+06	3.50E+05
SR-90	9.92E+07	0.00E+00	6.10E+06	0.00E+00	0.00E+00	9.60E+06	7.22E+05
SR-91	6.19E+01	0.00E+00	2.50E+00	0.00E+00	0.00E+00	3.65E+04	1.91E+05
SR-92	6.74E+00	0.00E+00	2.91E-01	0.00E+00	0.00E+00	1.65E+04	4.30E+04
Y-90	2.09E+03	0.00E+00	5.61E+01	0.00E+00	0.00E+00	1.70E+05	5.06E+05
Y-91M	2.61E-01	0.00E+00	1.02E-02	0.00E+00	0.00E+00	1.92E+03	1.33E+00
Y-91	4.62E+05	0.00E+00	1.24E+04	0.00E+00	0.00E+00	1.70E+06	3.85E+05
Y-92	1.03E+01	0.00E+00	3.02E-01	0.00E+00	0.00E+00	1.57E+04	7.35E+04

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: ADULT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	9.44E+01	0.00E+00	2.61E+00	0.00E+00	0.00E+00	4.85E+04	4.22E+05
ZR-95	1.07E+05	3.44E+04	2.33E+04	0.00E+00	5.42E+04	1.77E+06	1.50E+05
ZR-97	9.68E+01	1.96E+01	9.04E+00	0.00E+00	2.97E+01	7.87E+04	5.23E+05
NB-95	1.41E+04	7.82E+03	4.21E+03	0.00E+00	7.74E+03	5.05E+05	1.04E+05
MO-99	0.00E+00	1.21E+02	2.30E+01	0.00E+00	2.91E+02	9.12E+04	2.48E+05
TC-99M	1.03E-03	2.91E-03	3.70E-02	0.00E+00	4.42E-02	7.64E+02	4.16E+03
TC-101	4.18E-05	6.02E-05	5.90E-04	0.00E+00	1.08E-03	3.99E+02	1.09E-11
RU-103	1.53E+03	0.00E+00	6.58E+02	0.00E+00	5.83E+03	5.05E+05	1.10E+05
RU-105	7.90E-01	0.00E+00	3.11E-01	0.00E+00	1.02E+00	1.10E+04	4.82E+04
RU-106	6.91E+04	0.00E+00	8.72E+03	0.00E+00	1.34E+05	9.36E+06	9.12E+05
AG-110M	1.08E+04	1.00E+04	5.94E+03	0.00E+00	1.97E+04	4.63E+06	3.02E+05
TE-125M	3.42E+03	1.58E+03	4.67E+02	1.05E+03	1.24E+04	3.14E+05	7.06E+04
TE-127M	1.26E+04	5.77E+03	1.57E+03	3.29E+03	4.58E+04	9.60E+05	1.50E+05
TE-127	1.40E+00	6.42E-01	3.10E-01	1.06E+00	5.10E+00	6.51E+03	5.74E+04
TE-129M	9.76E+03	4.67E+03	1.58E+03	3.44E+03	3.66E+04	1.16E+06	3.83E+05
TE-129	4.98E-02	2.39E-02	1.24E-02	3.90E-02	1.87E-01	1.94E+03	1.57E+02
TE-131M	6.99E+01	4.36E+01	2.90E+01	5.50E+01	3.09E+02	1.46E+05	5.56E+05
TE-131	1.11E-02	5.95E-03	3.59E-03	9.36E-03	4.37E-02	1.39E+03	1.84E+01
TE-132	2.60E+02	2.15E+02	1.62E+02	1.90E+02	1.46E+03	2.88E+05	5.10E+05
I-130	4.58E+03	1.34E+04	5.28E+03	1.14E+06	2.09E+04	0.00E+00	7.69E+03
I-131	2.52E+04	3.58E+04	2.05E+04	1.19E+07	6.13E+04	0.00E+00	6.28E+03
I-132	1.16E+03	3.26E+03	1.16E+03	1.14E+05	5.18E+03	0.00E+00	4.06E+02
I-133	8.64E+03	1.48E+04	4.52E+03	2.15E+06	2.58E+04	0.00E+00	8.88E+03
I-134	6.44E+02	1.73E+03	6.15E+02	2.98E+04	2.75E+03	0.00E+00	1.01E+00
I-135	2.68E+03	6.98E+03	2.57E+03	4.48E+05	1.11E+04	0.00E+00	5.25E+03
CS-134	3.73E+05	8.48E+05	7.28E+05	0.00E+00	2.80E+05	9.76E+04	1.04E+04
CS-136	3.90E+04	1.46E+05	1.10E+05	0.00E+00	8.56E+04	1.20E+04	1.17E+04
CS-137	4.78E+05	6.21E+05	4.28E+05	0.00E+00	2.22E+05	7.52E+04	8.40E+03
CS-138	3.31E+02	6.21E+02	3.24E+02	0.00E+00	4.80E+02	4.86E+01	1.86E-03
BA-139	9.36E-01	6.66E-04	2.74E-02	0.00E+00	6.22E-04	3.76E+03	8.96E+02

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO
RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: ADULT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	3.90E+04	4.90E+01	2.57E+03	0.00E+00	1.67E+01	1.27E+06	2.18E+05
BA-141	1.00E-01	7.53E-05	3.36E-03	0.00E+00	7.00E-05	1.94E+03	1.16E-07
BA-142	2.63E-02	2.70E-05	1.66E-03	0.00E+00	2.29E-05	1.19E+03	1.57E-16
LA-140	3.44E+02	1.74E+02	4.58E+01	0.00E+00	0.00E+00	1.36E+05	4.58E+05
LA-142	6.83E-01	3.10E-01	7.72E-02	0.00E+00	0.00E+00	6.33E+03	2.11E+03
CE-141	1.99E+04	1.35E+04	1.53E+03	0.00E+00	6.26E+03	3.62E+05	1.20E+05
CE-143	1.86E+02	1.38E+02	1.53E+01	0.00E+00	6.08E+01	7.98E+04	2.26E+05
CE-144	3.43E+06	1.43E+06	1.84E+05	0.00E+00	8.48E+05	7.78E+06	8.16E+05
PR-143	9.36E+03	3.75E+03	4.64E+02	0.00E+00	2.16E+03	2.81E+05	2.00E+05
PR-144	3.01E-02	1.25E-02	1.53E-03	0.00E+00	7.05E-03	1.02E+03	2.15E-08
ND-147	5.27E+03	6.10E+03	3.65E+02	0.00E+00	3.56E+03	2.21E+05	1.73E+05
W-187	8.48E+00	7.08E+00	2.48E+00	0.00E+00	0.00E+00	2.90E+04	1.55E+05
NP-239	2.30E+02	2.26E+01	1.24E+01	0.00E+00	7.00E+01	3.76E+04	1.19E+05

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: TEEN (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
C-14	2.60E+04	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03
NA-24	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04
P-32	1.89E+06	1.10E+05	7.16E+04	0.00E+00	0.00E+00	0.00E+00	9.28E+04
CR-51	0.00E+00	0.00E+00	1.35E+02	7.50E+01	3.07E+01	2.10E+04	3.00E+03
MN-54	0.00E+00	5.11E+04	8.40E+03	0.00E+00	1.27E+04	1.98E+06	6.68E+04
MN-56	0.00E+00	1.70E+00	2.52E-01	0.00E+00	1.79E+00	1.52E+04	5.74E+04
FE-55	3.34E+04	2.38E+04	5.54E+03	0.00E+00	0.00E+00	1.24E+05	6.39E+03
FE-59	1.59E+01	3.70E+04	1.43E+04	0.00E+00	0.00E+00	1.53E+06	1.78E+05
CO-58	0.00E+00	2.07E+03	2.78E+03	0.00E+00	0.00E+00	1.34E+06	9.52E+04
CO-60	0.00E+00	1.51E+04	1.98E+04	0.00E+00	0.00E+00	8.72E+06	2.59E+05
NI-63	5.80E+05	4.34E+04	1.98E+04	0.00E+00	0.00E+00	3.07E+05	1.42E+04
NI-65	2.18E+00	2.93E-01	1.27E-01	0.00E+00	0.00E+00	9.36E+03	3.67E+04
CU-64	0.00E+00	2.03E+00	8.48E-01	0.00E+00	6.41E+00	1.11E+04	6.14E+04
ZN-65	3.86E+04	1.34E+05	6.24E+04	0.00E+00	8.64E+04	1.24E+06	4.66E+04
ZN-69	4.83E-02	9.20E-02	6.46E-03	0.00E+00	6.02E-02	1.58E+03	2.85E+02
BR-83	0.00E+00	0.00E+00	3.44E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	4.33E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.90E+05	8.40E+04	0.00E+00	0.00E+00	0.00E+00	1.77E+04
RB-88	0.00E+00	5.46E+02	2.72E+02	0.00E+00	0.00E+00	0.00E+00	2.92E-05
RB-89	0.00E+00	3.52E+02	2.33E+02	0.00E+00	0.00E+00	0.00E+00	3.38E-07
SR-89	4.34E+05	0.00E+00	1.25E+04	0.00E+00	0.00E+00	2.42E+06	3.71E+05
SR-90	1.08E+08	0.00E+00	6.68E+06	0.00E+00	0.00E+00	1.65E+07	7.65E+05
SR-91	8.80E+01	0.00E+00	3.51E+00	0.00E+00	0.00E+00	6.07E+04	2.59E+05
SR-92	9.52E+00	0.00E+00	4.06E-01	0.00E+00	0.00E+00	2.74E+04	1.19E+05
Y-90	2.98E+03	0.00E+00	8.00E+01	0.00E+00	0.00E+00	2.93E+05	5.59E+05
Y-91M	3.70E-01	0.00E+00	1.42E-02	0.00E+00	0.00E+00	3.20E+03	3.02E+01
Y-91	6.61E+05	0.00E+00	1.77E+04	0.00E+00	0.00E+00	2.94E+06	4.09E+05
Y-92	1.47E+01	0.00E+00	4.29E-01	0.00E+00	0.00E+00	2.68E+04	1.65E+05

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: TEEN (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.35E+02	0.00E+00	3.72E+00	0.00E+00	0.00E+00	8.32E+04	5.79E+05
ZR-95	1.46E+05	4.58E+04	3.15E+04	0.00E+00	6.74E+04	2.69E+06	1.49E+05
ZR-97	1.38E+02	2.72E+01	1.26E+01	0.00E+00	4.12E+01	1.30E+05	6.30E+05
NB-95	1.86E+04	1.03E+04	5.66E+03	0.00E+00	1.00E+04	7.51E+05	9.68E+04
MO-99	0.00E+00	1.69E+02	3.22E+01	0.00E+00	4.11E+02	1.54E+05	2.69E+05
TC-99M	1.38E-03	3.86E-03	4.99E-02	0.00E+00	5.76E-02	1.15E+03	6.13E+03
TC-101	5.92E-05	8.40E-05	8.24E-04	0.00[illegible]	1.52E-03	6.67E+02	8.72E-07
RU-103	2.10E+03	0.00E+00	8.96E+02	0.00E+00	7.43E+03	7.83E+05	1.09E+05
RU-105	1.12E+00	0.00E+00	4.34E-01	0.00E+00	1.41E+00	1.82E+04	9.04E+04
RU-106	9.84E+04	0.00E+00	1.24E+04	0.00E+00	1.90E+05	1.61E+07	9.60E+05
AG-110M	1.38E+04	1.31E+04	7.99E+03	0.00E+00	2.50E+04	6.75E+06	2.73E+05
TE-125M	4.88E+03	2.24E+03	6.67E+02	1.40E+03	0.00E+00	5.36E+05	7.50E+04
TE-127M	1.80E+04	8.16E+03	1.78E+03	4.38E+03	6.54E+04	1.66E+06	1.59E+05
TE-127	2.01E+00	9.12E-01	4.42E-01	1.42E+00	7.28E+00	1.12E+04	8.08E+04
TE-129M	1.39E+04	6.58E+03	2.25E+03	4.58E+03	5.19E+04	1.98E+06	4.05E+05
TE-129	7.10E-02	3.38E-02	1.76E-02	5.18E-02	2.66E-01	3.30E+03	1.62E+03
TE-131M	9.84E+01	6.01E+01	4.02E+01	7.25E+01	4.39E+02	2.38E+05	6.21E+05
TE-131	1.58E-02	8.32E-03	5.04E-03	1.24E-02	6.18E-02	2.34E+03	1.51E+01
TE-132	3.60E+02	2.90E+02	2.19E+02	2.46E+02	1.95E+03	4.49E+05	4.63E+05
I-130	6.24E+03	1.79E+04	7.17E+03	1.49E+06	2.75E+04	0.00E+00	9.12E+03
I-131	3.54E+04	4.91E+04	2.64E+04	1.46E+07	8.40E+04	0.00E+00	6.49E+03
I-132	1.59E+03	4.38E+03	1.58E+03	1.51E+05	6.92E+03	0.00E+00	1.27E+03
I-133	1.22E+04	2.05E+04	6.22E+03	2.92E+06	3.59E+04	0.00E+00	1.03E+04
I-134	8.88E+02	2.32E+03	8.40E+02	3.95E+04	3.66E+03	0.00E+00	2.04E+01
I-135	3.70E+03	9.44E+03	3.49E+03	6.21E+05	1.49E+04	0.00E+00	6.95E+03
CS-134	5.02E+05	1.13E+06	5.49E+05	0.00E+00	3.75E+05	1.46E+05	9.76E+03
CS-136	5.15E+04	1.94E+05	1.37E+05	0.00E+00	1.10E+05	1.78E+04	1.09E+04
CS-137	6.70E+05	8.48E+[illegible]	3.11E+05	0.00E+00	3.04E+05	1.21E+05	8.48E+03
CS-138	4.66E+02	8.56E+02	4.46E+02	0.00E+00	6.62E+02	7.87E+01	2.70E-01
BA-139	1.34E+00	9.44E-04	3.90E-02	0.00E+00	8.88E-04	6.46E+03	6.45E+03

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO
RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: TEEN (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	5.47E+04	6.70E+01	3.52E+03	0.00E+00	2.28E+01	2.03E+06	2.29E+05
BA-141	1.42E-01	1.06E-04	4.74E-03	0.00E+00	9.84E-05	3.29E+03	7.46E-04
BA-142	3.70E-02	3.70E-05	2.27E-03	0.00E+00	3.14E-05	1.91E+03	4.79E-10
LA-140	4.79E+02	2.36E+02	6.26E+01	0.00E+00	0.00E+00	2.14E+05	4.87E+05
LA-142	9.60E-01	4.25E-01	1.06E-01	0.00E+00	0.00E+00	1.02E+04	1.20E+04
CE-141	2.84E+04	1.90E+04	2.17E+03	0.00E+00	8.88E+03	6.14E+05	1.26E+05
CE-143	2.66E+02	1.94E+02	2.16E+01	0.00E+00	8.64E+01	1.30E+05	2.55E+05
CE-144	4.89E+06	2.02E+06	2.62E+05	0.00E+00	1.21E+06	1.34E+07	8.64E+05
PR-143	1.34E+04	5.31E+03	6.62E+02	0.00E+00	3.09E+03	4.83E+05	2.14E+05
PR-144	4.30E-02	1.76E-02	2.18E-03	0.00E+00	1.01E-02	1.75E+03	2.35E-04
ND-147	7.86E+03	8.56E+03	5.13E+02	0.00E+00	5.02E+03	3.72E+05	1.82E+05
W-187	1.20E+01	9.76E+00	3.43E+00	0.00E+00	0.00E+00	4.74E+04	1.77E+05
NP-239	3.38E+02	3.19E+01	1.77E+01	0.00E+00	1.00E+02	6.49E+04	1.32E+05

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO
RADIONUCLIDES OTHER THAN NOBLE GASES. R_i

PATHWAY: INHALATION
AGE GROUP: CHILD (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
C-14	3.59E+04	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03
NA-24	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04
P-32	2.60E+06	1.14E+05	9.88E+04	0.00E+00	0.00E+00	0.00E+00	4.22E+04
CR-51	0.00E+00	0.00E+00	1.54E+02	8.55E+01	2.43E+01	1.70E+04	1.08E+03
MN-54	0.00E+00	4.29E+04	9.51E+03	0.00E+00	1.00E+04	1.58E+06	2.29E+04
MN-56	0.00E+00	1.66E+00	3.12E-01	0.00E+00	1.67E+00	1.31E+04	1.23E+05
FE-55	4.74E+04	2.52E+04	7.77E+03	0.00E+00	0.00E+00	1.11E+05	2.87E+03
FE-59	2.07E+04	3.34E+04	1.67E+04	0.00E+00	0.00E+00	1.27E+06	7.07E+04
CO-58	0.00E+00	1.77E+03	3.16E+03	0.00E+00	0.00E+00	1.11E+06	3.44E+04
CO-60	0.00E+00	1.31E+04	2.26E+04	0.00E+00	0.00E+00	7.07E+06	9.62E+04
NI-63	8.21E+05	4.63E+04	2.80E+04	0.00E+00	0.00E+00	2.75E+05	6.33E+03
NI-65	2.99E+00	2.96E-01	1.64E-01	0.00E+00	0.00E+00	8.18E+03	8.40E+04
CU-64	0.00E+00	1.99E+00	1.07E+00	0.00E+00	6.03E+00	9.58E+03	3.67E+04
ZN-65	4.26E+04	1.13E+05	7.03E+04	0.00E+00	7.14E+04	9.95E+05	1.63E+04
ZN-69	6.70E-02	9.66E-02	8.92E-03	0.00E+00	5.85E-02	1.42E+03	1.02E+04
BR-83	0.00E+00	0.00E+00	4.74E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	5.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	2.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.98E+05	1.14E+05	0.00E+00	0.00E+00	0.00E+00	7.99E+03
RB-88	0.00E+00	5.62E+02	3.66E+02	0.00E+00	0.00E+00	0.00E+00	1.72E+01
RB-89	0.00E+00	3.45E+02	2.90E+02	0.00E+00	0.00E+00	0.00E+00	1.89E+00
SR-89	5.99E+05	0.00E+00	1.72E+04	0.00E+00	0.00E+00	2.16E+06	1.67E+05
SR-90	1.01E+08	0.00E+00	6.44E+06	0.00E+00	0.00E+00	1.48E+07	3.43E+05
SR-91	1.21E+02	0.00E+00	4.59E+00	0.00E+00	0.00E+00	5.33E+04	1.74E+05
SR-92	1.31E+01	0.00E+00	5.25E-01	0.00E+00	0.00E+00	2.40E+04	2.42E+05
Y-90	4.11E+03	0.00E+00	1.11E+02	0.00E+00	0.00E+00	2.62E+05	2.68E+05
Y-91M	5.07E-01	0.00E+00	1.84E-02	0.00E+00	0.00E+00	2.81E+03	1.72E+03
Y-91	9.14E+05	0.00E+00	2.44E+04	0.00E+00	0.00E+00	2.63E+06	1.84E+05
Y-92	2.04E+01	0.00E+00	5.81E-01	0.00E+00	0.00E+00	2.39E+04	2.39E+05

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: CHILD (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.86E+02	0.00E+00	5.11E+00	0.00E+00	0.00E+00	7.44E+04	3.89E+05
ZR-95	1.90E+05	4.18E+04	3.70E+04	0.00E+00	5.96E+04	2.23E+06	6.11E+04
ZR-97	1.88E+02	2.72E+01	1.60E+01	0.00E+00	3.88E+01	1.13E+05	3.51E+05
NB-95	2.35E+04	9.18E+03	6.55E+03	0.00E+00	8.62E+03	6.14E+05	3.70E+04
MO-99	0.00E+00	1.72E+02	4.25E+01	0.00E+00	3.92E+02	1.35E+05	1.27E+05
TC-99M	1.78E-03	3.48E-03	5.77E-02	0.00E+00	5.07E-02	9.51E+02	4.81E+03
TC-101	8.10E-05	8.51E-05	1.08E-03	0.00E+00	1.45E-03	5.85E+02	1.63E+01
RU-103	2.79E+03	0.00E+00	1.07E+03	0.00E+00	7.03E+03	6.62E+05	4.48E+04
RU-105	1.53E+00	0.00E+00	5.55E-01	0.00E+00	1.34E+00	1.59E+04	9.95E+04
RU-106	1.36E+05	0.00E+00	1.69E+04	0.00E+00	1.84E+05	1.43E+07	4.29E+05
AG-110M	1.69E+04	1.14E+04	9.14E+03	0.00E+00	2.12E+04	5.48E+06	1.00E+05
TE-125M	6.73E+03	2.33E+03	9.14E+02	1.92E+03	0.00E+00	4.77E+05	3.38E+04
TE-127M	2.49E+04	8.55E+03	3.02E+03	6.07E+03	6.36E+04	1.48E+06	7.14E+04
TE-127	2.77E+00	9.51E-01	6.10E-01	1.96E+00	7.07E+00	1.00E+04	5.62E+04
TE-129M	1.92E+04	6.85E+03	3.04E+03	6.33E+03	5.03E+04	1.76E+06	1.82E+05
TE-129	9.77E-02	3.50E-02	2.38E-02	7.14E-02	2.57E-01	2.93E+03	2.55E+04
TE-131M	1.34E+02	5.92E+01	5.07E+01	9.77E+01	4.00E+02	2.06E+05	3.08E+05
TE-131	2.17E-02	8.44E-03	6.59E-03	1.70E-02	5.88E-02	2.05E+03	1.33E+03
TE-132	4.81E+02	2.72E+02	2.63E+02	3.17E+02	1.77E+03	3.77E+05	1.38E+05
I-130	8.18E+03	1.64E+04	8.44E+03	1.85E+06	2.45E+04	0.00E+00	5.11E+03
I-131	4.81E+04	4.81E+04	2.73E+04	1.62E+07	7.88E+04	0.00E+00	2.84E+03
I-132	2.12E+03	4.07E+03	1.88E+03	1.94E+05	6.25E+03	0.00E+00	3.20E+03
I-133	1.66E+04	2.03E+04	7.70E+03	3.85E+06	3.38E+04	0.00E+00	5.48E+03
I-134	1.17E+03	2.16E+03	9.95E+02	5.07E+04	3.30E+03	0.00E+00	9.55E+02
I-135	4.92E+03	8.73E+03	4.14E+03	7.92E+05	1.34E+04	0.00E+00	4.44E+03
CS-134	6.51E+05	1.01E+06	2.25E+05	0.00E+00	3.30E+05	1.21E+05	3.85E+03
CS-136	6.51E+04	1.71E+05	1.16E+05	0.00E+00	9.55E+04	1.45E+04	4.18E+03
CS-137	9.07E+05	8.25E+05	1.28E+05	0.00E+00	2.82E+05	1.04E+05	3.62E+03
CS-138	6.33E+02	8.40E+02	5.55E+02	0.00E+00	6.22E+02	6.81E+01	2.70E+02
BA-139	1.84E+00	9.84E-04	5.36E-02	0.00E+00	8.62E-04	5.77E+03	5.77E+04

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO
RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: CHILD (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	7.60E+04	6.48E+01	4.33E+03	0.00E+00	2.11E+01	1.74E+06	1.02E+05
BA-141	1.96E-01	1.09E-04	6.36E-03	0.00E+00	9.47E-05	2.92E+03	2.75E+02
BA-142	4.99E-02	3.60E-05	2.79E-03	0.00E+00	2.91E-05	1.64E+03	2.74E+00
LA-140	6.44E+02	2.25E+02	7.55E+01	0.00E+00	0.00E+00	1.83E+05	2.26E+05
LA-142	1.29E+00	4.11E-01	1.29E-01	0.00E+00	0.00E+00	8.70E+03	7.59E+04
CE-141	3.92E+04	1.95E+04	2.90E+03	0.00E+00	8.55E+03	5.44E+05	5.66E+04
CE-143	3.66E+02	1.99E+02	2.87E+01	0.00E+00	8.36E+01	1.15E+05	1.27E+05
CE-144	6.77E+06	2.12E+06	3.61E+05	0.00E+00	1.17E+06	1.20E+07	3.89E+05
PR-143	1.85E+04	5.55E+03	9.14E+02	0.00E+00	3.00E+03	4.33E+05	9.73E+04
PR-144	5.96E-02	1.85E-02	3.00E-03	0.00E+00	9.77E-03	1.57E+03	1.97E+02
ND-147	1.08E+04	8.73E+03	6.81E+02	0.00E+00	4.81E+03	3.28E+05	8.21E+04
W-187	1.63E+01	9.66E+00	4.33E+00	0.00E+00	0.00E+00	4.11E+04	9.10E+04
NP-239	4.66E+02	3.34E+01	2.35E+01	0.00E+00	9.73E+01	5.81E+04	6.40E+04

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO

RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: INFANT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	6.47E+02	6.47E+02	6.47E+02	6.47E+02	6.47E+02	6.47E+02
C-14	2.65E+04	5.31E+03	5.31E+03	5.31E+03	5.31E+03	5.31E+03	5.31E+03
NA-24	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04
P-32	2.03E+06	1.12E+05	7.74E+04	0.00E+00	0.00E+00	0.00E+00	1.61E+04
CR-51	0.00E+00	0.00E+00	8.95E+01	5.75E-01	1.32E+01	1.28E+04	3.57E+02
MN-54	0.00E+00	2.53E+04	4.98E+03	0.00E+00	4.98E+03	1.00E+06	7.06E+03
MN-56	0.00E+00	1.54E+00	2.21E-01	0.00E+00	1.10E+00	1.25E+04	7.17E+04
FE-55	1.97E+04	1.17E+04	3.33E+03	0.00E+00	0.00E+00	8.69E+04	1.09E+03
FE-59	1.36E+04	2.35E+04	9.48E+03	0.00E+00	0.00E+00	1.02E+06	2.48E+04
CO-58	0.00E+00	1.22E+03	1.82E+03	0.00E+00	0.00E+00	7.77E+05	1.11E+04
CO-60	0.00E+00	8.02E+03	1.18E+04	0.00E+00	0.00E+00	4.51E+06	3.19E+04
NI-63	3.39E+05	2.04E+04	1.16E+04	0.00E+00	0.00E+00	2.09E+05	2.42E+03
NI-65	2.39E+00	2.84E-01	1.23E-01	0.00E+00	0.00E+00	8.12E+03	5.01E+04
CU-64	0.00E+00	1.88E+00	7.74E-01	0.00E+00	3.98E+00	9.30E+03	1.50E+04
ZN-65	1.93E+04	6.26E+04	3.11E+04	0.00E+00	3.25E+04	6.47E+05	5.14E+04
ZN-69	5.39E-02	9.67E-02	7.18E-03	0.00E+00	4.02E-02	1.47E+03	1.32E+04
BR-83	0.00E+00	0.00E+00	3.81E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	4.00E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	2.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.90E+05	8.82E+04	0.00E+00	0.00E+00	0.00E+00	3.04E+03
RB-88	0.00E+00	5.57E+02	2.87E+02	0.00E+00	0.00E+00	0.00E+00	3.39E+02
RB-89	0.00E+00	3.21E+02	2.06E+02	0.00E+00	0.00E+00	0.00E+00	6.82E+01
SR-89	3.98E+05	0.00E+00	1.14E+04	0.00E+00	0.00E+00	2.03E+06	6.40E+04
SR-90	4.09E+07	0.00E+00	2.59E+06	0.00E+00	0.00E+00	1.12E+07	1.31E+05
SR-91	9.56E+01	0.00E+00	3.46E+00	0.00E+00	0.00E+00	5.26E+04	7.34E+04
SR-92	1.05E+01	0.00E+00	3.91E-01	0.00E+00	0.00E+00	2.38E+04	1.40E+05
Y-90	3.29E+03	0.00E+00	8.82E+01	0.00E+00	0.00E+00	2.69E+05	1.04E+05
Y-91M	4.07E-01	0.00E+00	1.39E-02	0.00E+00	0.00E+00	2.79E+03	2.35E+03
Y-91	5.88E+05	0.00E+00	1.57E+04	0.00E+00	0.00E+00	2.45E+06	7.03E+04
Y-92	1.64E+01	0.00E+00	4.61E-01	0.00E+00	0.00E+00	2.45E+04	1.27E+05

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: INFANT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.50E+02	0.00E+00	4.07E+00	0.00E+00	0.00E+00	7.64E+04	1.67E+05
ZR-95	1.15E+05	2.79E+04	2.03E+04	0.00E+00	3.11E+04	1.75E+06	2.17E+04
ZR-97	1.50E+02	2.56E+01	1.17E+01	0.00E+00	2.59E+01	1.10E+05	1.40E+05
NB-95	1.57E+04	6.43E+03	3.78E+03	0.00E+00	4.72E+03	4.79E+05	1.27E+04
MO-99	0.00E+00	1.65E+02	3.23E+01	0.00E+00	2.65E+02	1.35E+05	4.87E+04
TC-99M	1.40E-03	2.88E-03	3.72E-02	0.00E+00	3.11E-02	8.11E+02	2.03E+03
TC-101	6.51E-05	8.23E-05	8.12E-04	0.00E+00	9.79E-04	5.84E+02	8.44E+02
RU-103	2.02E+03	0.00E+00	6.79E+02	0.00E+00	4.24E+03	5.52E+05	1.61E+04
RU-105	1.22E+00	0.00E+00	4.10E-01	0.00E+00	8.99E-01	1.57E+04	4.84E+04
RU-106	8.68E+04	0.00E+00	1.09E+04	0.00E+00	1.07E+05	1.16E+07	1.64E+05
AG-110M	9.98E+03	7.22E+03	5.00E+03	0.00E+00	1.09E+04	3.67E+06	3.30E+04
TE-125M	4.76E+03	1.99E+03	6.58E+02	1.62E+03	0.00E+00	4.47E+05	1.29E+04
TE-127M	1.67E+04	6.90E+03	2.07E+03	4.87E+03	3.75E+04	1.31E+06	2.73E+04
TE-127	2.23E+00	9.53E-01	4.89E-01	1.85E+00	4.86E+00	1.03E+04	2.44E+04
TE-129M	1.41E+04	6.09E+03	2.23E+03	5.47E+03	3.18E+04	1.68E+06	6.90E+04
TE-129	7.88E-02	3.47E-02	1.88E-02	6.75E-02	1.75E-01	3.00E+03	2.63E+04
TE-131M	1.07E+02	5.50E+01	3.63E+01	8.93E+01	2.65E+02	1.99E+05	1.19E+05
TE-131	1.74E-02	8.22E-03	5.00E-03	1.58E-02	3.99E-02	2.06E+03	8.22E+03
TE-132	3.72E+02	2.37E+02	1.76E+02	2.79E+02	1.03E+03	3.40E+05	4.41E+04
I-130	6.36E+03	1.39E+04	5.57E+03	1.60E+06	1.53E+04	0.00E+00	1.99E+03
I-131	3.79E+04	4.44E+04	1.96E+04	1.48E+07	5.18E+04	0.00E+00	1.06E+03
I-132	1.69E+03	3.54E+03	1.26E+03	1.69E+05	3.95E+03	0.00E+00	1.90E+03
I-133	1.32E+04	1.92E+04	5.60E+03	3.56E+06	2.24E+04	0.00E+00	2.16E+03
I-134	9.21E+02	1.88E+03	6.65E+02	4.45E+04	2.09E+03	0.00E+00	1.29E+03
I-135	3.86E+03	7.60E+03	2.77E+03	6.96E+05	8.47E+03	0.00E+00	1.83E+03
CS-134	3.96E+05	7.03E+05	7.45E+04	0.00E+00	1.90E+05	7.97E+04	1.33E+03
CS-136	4.83E+04	1.35E+05	5.29E+04	0.00E+00	5.64E+04	1.18E+04	1.43E+03
CS-137	5.49E+05	6.12E+05	4.55E+04	0.00E+00	1.72E+05	7.13E+04	1.33E+03
CS-138	5.05E+02	7.81E+02	3.98E+02	0.00E+00	4.10E+02	6.54E+01	8.76E+02
BA-139	1.48E+00	9.84E-04	4.30E-02	0.00E+00	5.92E-04	5.95E+03	5.10E+04

Conversion factors are in units of mrem/yr per uCi/cubic meter.

INHALATION PATHWAY DOSES DUE TO
RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: INHALATION
AGE GROUP: INFANT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	5.60E+04	5.60E+01	2.90E+03	0.00E+00	1.34E+01	1.60E+06	3.84E+04
BA-141	1.57E-01	1.08E-04	4.97E-03	0.00E+00	6.50E-05	2.97E+03	4.75E+03
BA-142	3.98E-02	3.30E-05	1.96E-03	0.00E+00	1.90E-05	1.55E+03	6.93E+02
LA-140	5.05E+02	2.00E+02	5.15E+01	0.00E+00	0.00E+00	1.68E+05	8.48E+04
LA-142	1.03E+00	3.77E-01	9.04E-02	0.00E+00	0.00E+00	8.22E+03	5.95E+04
CE-141	2.77E+04	1.67E+04	1.99E+03	0.00E+00	5.25E+03	5.17E+05	2.16E+04
CE-143	2.93E+02	1.93E+02	2.21E+01	0.00E+00	5.64E+01	1.16E+05	4.97E+04
CE-144	3.19E+06	1.21E+06	1.76E+05	0.00E+00	5.38E+05	9.84E+06	1.48E+05
PR-143	1.40E+04	5.24E+03	6.99E+02	0.00E+00	1.97E+03	4.33E+05	3.72E+04
PR-144	4.79E-02	1.85E-02	2.41E-03	0.00E+00	6.72E-03	1.61E+03	4.28E+03
ND-147	7.94E+03	8.13E+03	5.00E+02	0.00E+00	3.15E+03	3.22E+05	3.12E+04
W-187	1.30E+01	9.02E+00	3.12E+00	0.00E+00	0.00E+00	3.96E+04	3.56E+04
NP-239	3.71E+02	3.32E+01	1.88E+01	0.00E+00	6.62E+01	5.95E+04	2.49E+04

Conversion factors are in units of mrem/yr per uCi/cubic meter.

GROUND - PLANE DEPOSITION PATHWAY

DOSE* FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GROUND DEPOSTION

AGE GROUP: ALL (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS	
	T. BODY	SKIN
H-3	0.00E+00	0.00E+00
C-14	0.00E+00	0.00E+00
NA-24	1.19E+07	1.39E+07
P-32	0.00E+00	0.00E+00
CR-51	4.66E+06	5.51E+06
MN-54	1.39E+09	1.63E+09
MN-56	9.03E+05	1.07E+06
FE-55	0.00E+00	0.00E+00
FE-59	2.73E+08	3.21E+08
CO-58	3.79E+08	4.44E+08
CO-60	2.15E+10	2.53E+10
NI-63	0.00E+00	0.00E+00
NI-65	2.97E+05	3.45E+05
CU-64	6.07E+05	6.88E+05
ZN-65	7.47E+08	8.59E+08
ZN-69	0.00E+00	0.00E+00
BR-83	4.87E+03	7.08E+03
BR-84	2.03E+05	2.36E+05
BR-85	0.00E+00	0.00E+00
RB-86	8.99E+06	1.03E+07
RB-88	3.31E+04	3.78E+04
RB-89	1.23E+05	1.48E+05
SR-89	2.16E+04	2.51E+04
SR-90	0.00E+00	0.00E+00
SR-91	2.15E+05	2.51E+06
SR-92	7.77E+05	8.63E+05
Y-90	4.49E+03	5.31E+03
Y-91M	1.00E+05	1.16E+05
Y-91	1.07E+06	1.21E+06
Y-92	1.80E+05	2.14E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec.

GROUND - PLANE DEPOSITION PATHWAY

DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GROUND DEPOSTION
AGE GROUP: ALL (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS	
	T. BODY	SKIN
Y-93	1.83E+05	2.51E+05
ZR-95	2.45E+08	2.84E+08
ZR-97	2.96E+06	3.44E+06
NB-95	1.37E+08	1.61E+08
MO-99	3.99E+06	4.63E+06
TC-99M	1.84E+05	2.11E+05
TC-101	2.04E+04	2.26E+04
RU-103	1.08E+08	1.26E+08
RU-105	6.36E+05	7.21E+05
RU-106	4.22E+08	5.07E+08
AG-110M	3.44E+09	4.01E+09
TE-125M	1.55E+06	2.13E+06
TE-127M	9.16E+04	1.08E+05
TE-127	2.98E+03	3.28E+03
TE-129M	1.98E+07	2.31E+07
TE-129	2.62E+04	3.10E+04
TE-131M	8.03E+06	9.46E+06
TE-131	2.92E+04	3.45E+07
TE-132	4.23E+06	4.98E+06
I-130	5.51E+06	6.69E+06
I-131	1.72E+07	2.09E+07
I-132	1.25E+06	1.46E+06
I-133	2.45E+06	2.98E+06
I-134	4.47E+05	5.30E+05
I-135	2.53E+06	2.95E+06
CS-134	6.86E+09	8.00E+09
CS-136	1.51E+08	1.71E+08
CS-137	1.03E+10	1.20E+10
CS-138	3.59E+05	4.10E+05
BA-139	1.06E+05	1.19E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec.

GROUND - PLANE DEPOSITION PATHWAY

DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GROUND DEPOSTION
AGE GROUP: ALL (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS	
	T. BODY	SKIN
BA-140	2.05E+07	2.35E+07
BA-141	4.17E+04	4.75E+04
BA-142	4.49E+04	5.11E+04
LA-140	1.92E+07	2.18E+07
LA-142	7.60E+05	9.11E+05
CE-141	1.37E+07	1.54E+07
CE-143	2.31E+06	2.63E+06
CE-144	6.95E+07	8.04E+07
PR-143	0.00E+00	0.00E+00
PR-144	1.83E+03	2.11E+03
ND-147	8.39E+06	1.01E+07
W-187	2.35E+06	2.73E+06
NP-239	1.71E+06	1.98E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	7.63E+02	7.63E+02	7.63E+02	7.63E+02	7.63E+02	7.63E+02
C-14	2.63E+08	5.27E+07	5.27E+07	5.27E+07	5.27E+07	5.27E+07	5.27E+07
NA-24	2.44E+06	2.44E+06	2.44E+06	2.44E+06	2.44E+06	2.44E+06	2.44E+06
P-32	1.71E+10	1.06E+09	6.61E+08	0.00E+[illegible]	[illegible].00E+00	0.00E+00	1.92E+09
CR-51	0.00E+00	0.00E+00	2.86E+04	1.71E+04	[illegible]0E+03	3.79E+04	7.19E+06
MN-54	0.00E+00	8.41E+06	1.61E+06	0.00E+00	2.5[illegible]	0.00E+00	2.58E+07
MN-56	0.00E+00	4.15E-03	7.36E-04	0.00E+00	5.27E-03	0.00E+00	1.32E-01
FE-55	2.51E+07	1.74E+07	4.05E+06	0.00E+00	0.00E+00	9.68E+06	9.95E+06
FE-59	2.97E+07	6.98E+07	2.68E+07	0.00E+00	0.00E+00	1.95E+07	2.33E+08
CO-58	0.00E+00	4.71E+06	1.06E+07	0.00E+00	0.00E+00	0.00E+00	9.55E+07
CO-60	0.00E+00	1.64E+07	3.62E+07	0.00E+00	0.00E+00	0.00E+00	3.08E+08
NI-63	6.73E+09	4.66E+08	2.26E+08	0.00E+00	0.00E+00	0.00E+00	9.73E+07
NI-65	3.70E-01	4.81E-02	2.19E-02	0.00E+00	0.00E+00	0.00E+00	1.22E+00
CU-64	0.00E+00	2.38E+04	1.12E+04	0.00E+00	6.01E+04	0.00E+00	2.03E+06
ZN-65	1.37E+09	4.37E+09	1.97E+09	0.00E+00	2.92E+09	0.00E+00	2.75E+09
ZN-69	2.09E-12	4.00E-12	2.78E-13	0.00E+00	2.60E-12	0.00E+00	6.01E-13
BR-83	0.00E+00	0.00E+00	1.17E-02	0.00E+00	0.00E+00	0.00E+00	1.68E-02
BR-84	0.00E+00	0.00E+00	1.93E-24	0.00E+00	0.00E+00	0.00E+00	1.52E-29
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	2.59E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	5.12E+08
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	1.45E+09	0.00E+00	4.16E+07	0.00E+00	0.00E+00	0.00E+00	2.33E+08
SR-90	4.68E+10	0.00E+00	1.15E+10	0.00E+00	0.00E+00	0.00E+00	1.35E+09
SR-91	2.89E+04	0.00E+00	1.17E+03	0.00E+00	0.00E+00	0.00E+00	1.38E+05
SR-92	4.88E-01	0.00E+00	2.11E-02	0.00E+00	0.00E+00	0.00E+00	9.68E+00
Y-90	7.08E+01	0.00E+00	1.90E+00	0.00E+00	0.00E+00	0.00E+00	7.51E+05
Y-91M	5.98E-20	0.00E+00	2.32E-21	0.00E+00	0.00E+00	0.00E+00	1.76E-19
Y-91	8.59E+03	0.00E+00	2.30E+02	0.00E+00	0.00E+00	0.00E+00	4.73E+06
Y-92	5.58E-05	0.00E+00	1.63E-06	0.00E+00	0.00E+00	0.00E+00	9.77E-01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	2.23E-01	0.00E+00	6.17E-03	0.00E+00	0.00E+00	0.00E+00	7.08E+03
ZR-95	9.43E+02	3.03E+02	2.05E+02	0.00E+00	4.75E+02	0.00E+00	9.59E+05
ZR-97	4.33E-01	8.74E-02	4.00E-02	0.00E+00	1.32E-01	0.00E+00	2.71E+04
NB-95	8.26E+04	4.59E+04	2.47E+04	0.00E+00	4.54E+04	0.00E+00	2.79E+08
MO-99	0.00E+00	2.48E+07	4.71E+06	0.00E+00	5.61E+07	0.00E+00	5.74E+07
TC-99M	3.32E+00	9.38E+00	1.20E+02	0.00E+00	1.43E+02	4.60E+00	5.55E+03
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.02E+03	0.00E+00	4.39E+02	0.00E+00	3.89E+03	0.00E+00	1.19E+05
RU-105	8.57E-04	0.00E+00	3.38E-04	0.00E+00	1.11E-02	0.00E+00	5.24E-01
RU-106	2.04E+04	0.00E+00	2.58E+03	0.00E+00	3.94E+04	0.00E+00	1.32E+06
AG-110M	5.82E+07	5.39E+07	3.20E+07	0.00E+00	1.06E+08	0.00E+00	2.20E+10
TE-125M	1.63E+07	5.90E+06	2.18E+06	4.90E+06	6.63E+07	0.00E+00	6.50E+07
TE-127M	4.58E+07	1.64E+07	5.58E+06	1.17E+07	1.86E+08	0.00E+00	1.54E+08
TE-127	6.53E+02	2.34E+02	1.41E+02	4.84E+02	2.66E+03	0.00E+00	5.15E+04
TE-129M	6.02E+07	2.25E+07	9.53E+06	2.07E+07	2.51E+08	0.00E+00	3.03E+08
TE-129	2.82E-10	1.06E-10	6.88E-11	2.17E-10	1.19E-09	0.00E+00	2.13E-10
TE-131M	3.61E+05	1.77E+05	1.47E+05	2.80E+05	1.79E+06	0.00E+00	1.75E+07
TE-131	3.60E-33	1.51E-33	1.14E-33	2.96E-33	1.58E-32	0.00E+00	5.10E-34
TE-132	2.40E+06	1.55E+06	1.46E+06	1.72E+06	1.50E+07	0.00E+00	7.35E+07
I-130	4.20E+05	1.24E+06	4.89E+05	1.05E+08	1.93E+06	0.00E+00	1.07E+06
I-131	2.96E+08	4.23E+08	2.43E+08	1.39E+11	7.26E+08	0.00E+00	1.12E+08
I-132	1.64E-01	4.39E-01	1.54E-01	1.54E+01	7.00E-01	0.00E+00	8.25E-02
I-133	3.87E+06	6.73E+06	2.05E+06	9.89E+08	1.17E+07	0.00E+00	6.05E+06
I-134	2.02E-12	5.48E-12	1.96E-12	9.49E-11	8.71E-12	0.00E+00	4.77E-15
I-135	1.28E+04	3.36E+04	1.24E+04	2.22E+06	5.39E+04	0.00E+00	3.80E+04
CS-134	5.65E+09	1.35E+10	1.10E+10	0.00E+00	4.35E+09	1.45E+09	2.35E+08
CS-136	2.63E+08	1.04E+09	7.48E+08	0.00E+00	5.78E+08	7.93E+07	1.18E+08
CS-137	7.38E+09	1.01E+10	6.61E+09	0.00E+00	3.43E+09	1.14E+09	1.95E+08
CS-138	9.04E-24	1.79E-23	8.85E-24	0.00E+00	1.31E-23	1.30E-24	7.62E-29
BA-139	4.42E-08	3.15E-11	1.29E-09	0.00E+00	2.94E-11	1.79E-11	7.84E-08

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.69E+07	3.38E+04	1.76E+06	0.00E+00	1.15E+04	1.93E+04	5.53E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	4.51E+00	2.27E+00	6.01E-01	0.00E+00	0.00E+00	0.00E+00	1.67E+05
LA-142	1.86E-11	8.45E-12	2.10E-12	0.00E+00	0.00E+00	0.00E+00	6.17E-08
CE-141	4.84E+03	3.28E+03	3.72E+02	0.00E+00	1.52E+03	0.00E+00	1.25E+07
CE-143	4.16E+01	3.07E+04	3.40E+00	0.00E+00	1.35E+01	0.00E+00	1.15E+06
CE-144	3.58E+05	1.50E+05	1.92E+04	0.00E+00	8.87E+04	0.00E+00	1.21E+08
PR-143	1.58E+02	6.33E+01	7.83E+00	0.00E+00	3.66E+01	0.00E+00	6.92E+05
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	9.42E+01	1.09E+02	6.51E+00	0.00E+00	6.36E+01	0.00E+00	5.22E+05
W-187	6.51E+03	5.45E+03	1.90E+03	0.00E+00	0.00E+00	0.00E+00	1.78E+06
NP-239	4.60E+01	4.52E+00	2.49E+00	0.00E+00	1.41E+01	0.00E+00	9.27E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES. R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	9.94E+02	9.94E+02	9.94E+02	9.94E+02	9.94E+02	9.94E+02
C-14	4.86E+08	9.72E+07	9.72E+07	9.72E+07	9.72E+07	9.72E+07	9.72E+07
NA-24	4.26E+06	4.26E+06	4.26E+06	4.26E+06	4.26E+06	4.26E+06	4.26E+06
P-32	3.15E+10	1.95E+09	1.22E+09	0.00E+00	0.00E+00	0.00E+00	2.65E+09
CR-51	0.00E+00	0.00E+00	4.99E+04	2.77E+04	1.09E+04	7.13E+04	8.39E+06
MN-54	0.00E+00	1.40E+07	2.78E+06	0.00E+00	4.18E+06	0.00E+00	2.87E+07
MN-56	0.00E+00	7.36E-03	1.31E-03	0.00E+00	9.31E-03	0.00E+00	4.84E-01
FE-55	4.45E+07	3.16E+07	7.36E+06	0.00E+00	0.00E+00	2.00E+07	1.37E+07
FE-59	5.18E+07	1.21E+08	4.67E+07	0.00E+00	0.00E+00	3.81E+07	2.86E+08
CO-58	0.00E+00	7.94E+06	1.83E+07	0.00E+00	0.00E+00	0.00E+00	1.09E+08
CO-60	0.00E+00	2.78E+07	6.26E+07	0.00E+00	0.00E+00	0.00E+00	3.62E+08
NI-63	1.18E+10	8.35E+08	4.01E+08	0.00E+00	0.00E+00	0.00E+00	1.33E+08
NI-65	6.77E-01	8.65E-02	3.94E-02	0.00E+00	0.00E+00	0.00E+00	4.69E+00
CU-64	0.00E+00	4.25E+04	2.00E+04	0.00E+00	1.07E+05	0.00E+00	3.29E+06
ZN-65	2.11E+09	7.32E+09	3.41E+09	0.00E+00	4.68E+09	0.00E+00	3.10E+09
ZN-69	3.85E-12	7.34E-12	5.13E-13	0.00E+00	4.79E-12	0.00E+00	1.35E-11
BR-83	0.00E+00	0.00E+00	2.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	3.45E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	4.73E+09	2.22E+09	0.00E+00	0.00E+00	0.00E+00	7.00E+08
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	2.67E+09	0.00E+00	7.66E+07	0.00E+00	0.00E+00	0.00E+00	3.19E+08
SR-90	6.61E+10	0.00E+00	1.63E+10	0.00E+00	0.00E+00	0.00E+00	1.86E+09
SR-91	5.31E+04	0.00E+00	2.11E+03	0.00E+00	0.00E+00	0.00E+00	2.41E+05
SR-92	8.94E-01	0.00E+00	3.81E-02	0.00E+00	0.00E+00	0.00E+00	2.28E+01
Y-90	1.30E+02	0.00E+00	3.51E+00	0.00E+00	0.00E+00	0.00E+00	1.07E+06
Y-91M	1.10E-19	0.00E+00	4.19E-21	0.00E+00	0.00E+00	0.00E+00	5.17E-18
Y-91	1.58E+04	0.00E+00	4.24E+02	0.00E+00	0.00E+00	0.00E+00	6.48E+06
Y-92	1.03E-04	0.00E+00	2.98E-06	0.00E+00	0.00E+00	0.00E+00	2.83E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	4.12E-01	0.00E+00	1.13E-02	0.00E+00	0.00E+00	0.00E+00	1.26E+04
ZR-95	1.65E+03	5.20E+02	3.58E+02	0.00E+00	7.65E+02	0.00E+00	1.20E+06
ZR-97	7.88E-01	1.56E-01	7.19E-02	0.00E+00	2.37E-01	0.00E+00	4.22E+04
NB-95	1.41E+05	7.81E+04	4.30E+04	0.00E+00	7.57E+04	0.00E+00	3.34E+08
MO-99	0.00E+00	4.47E+07	8.53E+06	0.00E+00	1.02E+08	0.00E+00	8.01E+07
TC-99M	5.76E+00	1.61E+01	2.08E+02	0.00E+00	2.39E+02	8.92E+00	1.05E+04
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.81E+03	0.00E+00	7.74E+02	0.00E+00	6.38E+03	0.00E+00	1.51E+05
RU-105	1.56E-03	0.00E+00	6.07E-04	0.00E+00	1.97E-02	0.00E+00	1.26E+00
RU-106	2.89E+04	0.00E+00	4.73E+03	0.00E+00	7.24E+04	0.00E+00	1.80E+06
AG-110M	9.63E+07	9.11E+07	5.54E+07	0.00E+00	1.74E+08	0.00E+00	2.56E+10
TE-125M	3.00E+07	1.08E+07	4.02E+06	8.39E+06	0.00E+00	0.00E+00	8.86E+07
TE-127M	8.44E+07	2.99E+07	1.00E+07	2.01E+07	3.42E+08	0.00E+00	2.10E+08
TE-127	1.21E+03	4.29E+02	2.60E+02	8.35E+02	4.90E+03	0.00E+00	9.34E+04
TE-129M	1.10E+08	4.09E+07	1.74E+07	3.55E+07	4.61E+08	0.00E+00	4.13E+08
TE-129	5.20E-10	1.94E-10	1.16E-10	3.71E-10	2.18E-09	0.00E+00	2.84E-09
TE-131M	6.57E+05	3.15E+05	2.63E+05	4.74E+05	3.29E+06	0.00E+00	2.53E+07
TE-131	6.58E-33	2.71E-33	2.06E-33	5.07E-33	2.88E-32	0.00E+00	5.40E-34
TE-132	4.29E+06	2.72E+06	2.56E+06	2.87E+06	2.61E+07	0.00E+00	8.61E+07
I-130	7.38E+05	2.14E+06	8.53E+05	1.74E+08	3.29E+06	0.00E+00	1.64E+06
I-131	5.37E+08	7.52E+08	4.04E+08	2.19E+11	1.29E+09	0.00E+00	1.49E+08
I-132	2.91E-01	7.62E-01	2.74E-01	2.57E+01	1.20E+00	0.00E+00	3.32E-01
I-133	7.07E+06	1.20E+07	3.66E+06	1.67E+09	2.10E+07	0.00E+00	9.07E+06
I-134	3.58E-12	9.50E-12	3.41E-12	1.58E-10	1.50E-11	0.00E+00	1.25E-13
I-135	2.28E+04	5.87E+04	2.18E+04	3.78E+06	9.27E+04	0.00E+00	6.51E+04
CS-134	9.82E+09	2.31E+10	1.07E+10	0.00E+00	7.34E+09	2.80E+09	2.87E+08
CS-136	4.48E+08	1.76E+09	1.18E+09	0.00E+00	9.60E+08	1.51E+08	1.42E+08
CS-137	1.34E+10	1.78E+10	6.20E+09	0.00E+00	6.06E+09	2.35E+09	2.53E+08
CS-138	1.64E-23	3.15E-23	1.57E-23	0.00E+00	2.33E-23	2.71E-24	1.43E-26
BA-139	8.17E-08	5.75E-11	2.38E-09	0.00E+00	5.42E-11	3.96E-11	7.29E-07

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	4.85E+07	5.95E+04	3.13E+06	0.00E+00	2.02E+04	4.00E+04	7.48E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	8.10E+00	3.98E+00	1.06E+00	0.00E+00	0.00E+00	0.00E+00	2.29E+05
LA-142	3.35E-11	1.49E-11	3.71E-12	0.00E+00	0.00E+00	0.00E+00	4.53E-07
CE-141	8.88E+03	5.93E+03	6.81E+02	0.00E+00	2.79E+03	0.00E+00	1.70E+07
CE-143	7.64E+01	5.56E+04	6.21E+00	0.00E+00	2.49E+01	0.00E+00	1.67E+06
CE-144	6.58E+05	2.72E+05	3.54E+04	0.00E+00	1.63E+05	0.00E+00	1.66E+08
PR-143	2.90E+02	1.16E+02	1.44E+01	0.00E+00	6.73E+01	0.00E+00	9.54E+05
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	1.81E+02	1.97E+02	1.18E+01	0.00E+00	1.16E+02	0.00E+00	7.11E+05
W-187	1.19E+04	9.71E+03	3.40E+03	0.00E+00	0.00E+00	0.00E+00	2.63E+06
NP-239	8.78E+01	8.28E+00	4.60E+00	0.00E+00	2.60E+01	0.00E+00	1.33E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (1 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03
C-14	1.19E+09	2.39E+08	2.39E+08	2.39E+08	2.39E+08	2.39E+08	2.39E+08
NA-24	8.85E+06	8.85E+07	8.85E+06	8.85E+06	8.85E+06	8.85E+06	8.85E+06
P-32	7.78E+10	3.64E+09	3.00E+09	0.00E+00	0.00E+00	0.00E+00	2.15E+09
CR-51	0.00E+00	0.00E+00	1.02E+05	5.65E+04	1.54E+04	1.03E+05	5.40E+06
MN-54	0.00E+00	2.10E+07	5.59E+06	0.00E+00	5.88E+06	0.00E+00	1.76E+07
MN-56	0.00E+00	1.28E-02	2.90E-03	0.00E+00	1.55E-02	0.00E+00	1.86E+00
FE-55	1.07E+08	5.93E+07	1.84E+07	0.00E+00	0.00E+00	3.35E+07	1.10E+07
FE-59	1.20E+08	1.95E+08	9.69E+07	0.00E+00	0.00E+00	5.64E+07	2.03E+08
CO-58	0.00E+00	1.21E+07	3.71E+07	0.00E+00	0.00E+00	0.00E+00	7.07E+07
CO-60	0.00E+00	4.32E+07	1.27E+08	0.00E+00	0.00E+00	0.00E+00	2.39E+08
NI-63	2.96E+10	1.59E+09	1.04E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
NI-65	1.66E+00	1.56E-01	9.10E-02	0.00E+00	0.00E+00	0.00E+00	1.91E+01
CU-64	0.00E+00	7.46E+04	4.51E+04	0.00E+00	1.80E+05	0.00E+00	3.50E+06
ZN-65	4.13E+09	1.10E+10	6.85E+09	0.00E+00	6.94E+09	0.00E+00	1.93E+09
ZN-69	9.47E-12	1.37E-11	1.26E-12	0.00E+00	8.30E-12	0.00E+00	8.62E-10
BR-83	0.00E+00	0.00E+00	5.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	7.81E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	8.77E+09	5.39E+09	0.00E+00	0.00E+00	0.00E+00	5.64E+08
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	6.62E+09	0.00E+00	1.89E+08	0.00E+00	0.00E+00	0.00E+00	2.56E+08
SR-90	1.12E+11	0.00E+00	2.83E+10	0.00E+00	0.00E+00	0.00E+00	1.51E+09
SR-91	1.30E+05	0.00E+00	4.92E+03	0.00E+00	0.00E+00	0.00E+00	2.88E+05
SR-92	2.18E+00	0.00E+00	8.75E-02	0.00E+00	0.00E+00	0.00E+00	4.13E+01
Y-90	3.22E+02	0.00E+00	8.62E+00	0.00E+00	0.00E+00	0.00E+00	9.17E+05
Y-91M	2.68E-19	0.00E+00	9.74E-21	0.00E+00	0.00E+00	0.00E+00	5.24E-16
Y-91	3.90E+04	0.00E+00	1.04E+03	0.00E+00	0.00E+00	0.00E+00	5.20E+06
Y-92	2.53E-04	0.00E+00	7.24E-06	0.00E+00	0.00E+00	0.00E+00	7.31E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (2 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.01E+00	0.00E+00	2.78E-02	0.00E+00	0.00E+00	0.00E+00	1.51E+04
ZR-95	3.83E+03	8.42E+02	7.50E+02	0.00E+00	1.21E+03	0.00E+00	8.79E+05
ZR-97	1.92E+00	2.77E-01	1.64E-01	0.00E+00	3.98E-01	0.00E+00	4.20E+04
NB-95	3.18E+05	1.24E+05	8.84E+04	0.00E+00	1.16E+05	0.00E+00	2.29E+08
MO-99	0.00E+00	8.14E+07	2.01E+07	0.00E+00	1.74E+08	0.00E+00	6.73E+07
TC-99M	1.32E+01	2.59E+01	4.29E+02	0.00E+00	3.76E+02	1.32E+01	1.47E+04
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	4.28E+03	0.00E+00	1.65E+03	0.00E+00	1.08E+04	0.00E+00	1.11E+05
RU-105	3.82E-03	0.00E+00	1.39E-03	0.00E+00	3.36E-02	0.00E+00	2.49E+00
RU-106	9.24E+04	0.00E+00	1.15E+04	0.00E+00	1.25E+05	0.00E+00	1.44E+06
AG-110M	2.09E+08	1.41E+08	1.13E+08	0.00E+00	2.63E+08	0.00E+00	1.68E+10
TE-125M	7.38E+07	2.00E+07	9.84E+06	2.07E+07	0.00E+00	0.00E+00	7.12E+07
TE-127M	2.08E+08	5.60E+07	2.47E+07	4.97E+07	5.93E+08	0.00E+00	1.68E+08
TE-127	2.98E+03	8.02E+02	6.38E+02	2.06E+03	8.47E+03	0.00E+00	1.16E+05
TE-129M	2.71E+08	7.58E+07	4.21E+07	8.75E+07	7.97E+08	0.00E+00	3.31E+08
TE-129	1.28E-09	3.58E-10	3.04E-10	9.15E-10	3.75E-09	0.00E+00	7.98E-08
TE-131M	1.60E+06	5.53E+05	5.89E+05	1.14E+06	5.35E+06	0.00E+00	2.24E+07
TE-131	1.62E-32	4.93E-33	4.81E-33	1.24E-32	4.89E-32	0.00E+00	8.49E-32
TE-132	1.02E+07	4.53E+06	5.48E+06	6.60E+06	4.21E+07	0.00E+00	4.57E+07
I-130	1.73E+06	3.49E+06	1.80E+06	3.84E+08	5.22E+06	0.00E+00	1.63E+06
I-131	1.30E+09	1.31E+09	7.45E+08	4.33E+11	2.15E+09	0.00E+00	1.17E+08
I-132	6.89E-01	1.27E+00	5.82E-01	5.87E+01	1.94E+00	0.00E+00	1.49E+00
I-133	1.72E+07	2.12E+07	8.03E+06	3.94E+09	3.54E+07	0.00E+00	8.56E+06
I-134	8.48E-12	1.58E-11	7.25E-12	3.62E-10	2.41E-11	0.00E+00	1.04E-11
I-135	5.40E+04	9.72E+04	4.60E+04	8.61E+06	1.49E+05	0.00E+00	7.40E+04
CS-134	2.26E+10	3.72E+10	7.84E+09	0.00E+00	1.15E+10	4.13E+09	2.00E+08
CS-136	1.01E+09	2.86E+09	1.80E+09	0.00E+00	1.48E+09	2.21E+08	9.77E+07
CS-137	3.22E+10	3.09E+10	4.55E+09	0.00E+00	1.01E+10	3.62E+09	1.93E+08
CS-138	3.98E-23	5.53E-23	3.51E-23	0.00E+00	3.89E-23	4.19E-24	2.55E-23
BA-139	2.01E-07	1.07E-10	5.82E-09	0.00E+00	9.36E-11	6.30E-11	1.16E-05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (3 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.17E+08	1.03E+05	6.84E+06	0.00E+00	3.34E+04	6.12E+04	5.93E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	1.94E+01	6.78E+00	2.11E+00	0.00E+00	0.00E+00	0.00E+00	1.89E+05
LA-142	8.10E-11	2.58E-11	8.08E-12	0.00E+00	0.00E+00	0.00E+00	5.11E-06
CE-141	2.19E+04	1.09E+04	1.62E+03	0.00E+00	4.78E+04	0.00E+00	1.36E+07
CE-143	1.87E+02	1.02E+05	1.47E+01	0.00E+00	4.26E+01	0.00E+00	1.49E+06
CE-144	1.62E+06	5.09E+05	8.66E+04	0.00E+00	2.82E+05	0.00E+00	1.33E+08
PR-143	7.18E+02	2.16E+02	3.56E+01	0.00E+00	1.17E+02	0.00E+00	7.75E+05
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	4.45E+02	3.60E+02	2.79E+01	0.00E+00	1.98E+02	0.00E+00	5.70E+05
W-187	2.89E+04	1.71E+04	7.68E+03	0.00E+00	0.00E+00	0.00E+00	2.40E+06
NP-239	2.16E+02	1.55E+01	1.09E+01	0.00E+00	4.48E+01	0.00E+00	1.15E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

P▸ ·AY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.38E+03	2.38E+03	2.38E+03	2.38E+03	2.38E+03	2.38E+03
C-14	2.34E+09	5.00E+08	5.00E+08	5.00E+08	5.00E+08	5.00E+08	5.00E+08
NA-24	1.54E+07	1.54E+07	1.54E+07	1.54E+07	1.54E+07	1.54E+07	1.54E+07
P-32	1.60E+11	9.43E+09	6.21E+09	0.00E+00	0.00E+00	0.00E+00	2.17E+09
CR-51	0.00E+00	0.00E+00	1.61E+05	1.05E+05	2.30E+04	2.05E+05	4.70E+06
MN-54	0.00E+00	3.90E+07	8.84E+06	0.00E+00	8.64E+06	0.00E+00	1.43E+07
MN-56	0.00E+00	3.14E-02	5.42E-03	0.00E+00	2.70E-02	0.00E+00	2.85E+00
FE-55	1.35E+08	8.73E+07	2.33E+07	0.00E+00	0.00E+00	4.27E+07	1.11E+07
FE-59	2.24E+08	3.92E+08	1.54E+08	0.00E+00	0.00E+00	1.16E+08	1.87E+08
CO-58	0.00E+00	2.42E+07	6.05E+07	0.00E+00	0.00E+00	0.00E+00	6.04E+07
CO-60	0.00E+00	8.82E+07	2.08E+08	0.00E+00	0.00E+00	0.00E+00	2.10E+08
NI-63	3.49E+10	2.16E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
NI-65	3.50E+00	3.97E-01	1.80E-01	0.00E+00	0.00E+00	0.00E+00	3.02E+01
CU-64	0.00E+00	1.86E+05	8.59E+04	0.00E+00	3.14E+05	0.00E+00	3.81E+06
ZN-65	5.55E+09	1.90E+10	8.78E+09	0.00E+00	9.23E+09	0.00E+00	1.61E+10
ZN-69	2.02E-11	3.63E-11	2.70E-12	0.00E+00	1.51E-11	0.00E+00	2.96E-09
BR-83	0.00E+00	0.00E+00	1.12E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	1.51E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	2.23E+10	1.10E+10	0.00E+00	0.00E+00	0.00E+00	5.69E+08
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	1.26E+10	0.00E+00	3.61E+08	0.00E+00	0.00E+00	0.00E+00	2.59E+08
SR-90	1.22E+11	0.00E+00	3.10E+10	0.00E+00	0.00E+00	0.00E+00	1.52E+09
SR-91	2.72E+05	0.00E+00	9.83E+03	0.00E+00	0.00E+00	0.00E+00	3.21E+05
SR-92	4.64E+00	0.00E+00	1.72E-01	0.00E+00	0.00E+00	0.00E+00	5.00E+01
Y-90	6.81E+02	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	9.41E+05
Y-91M	5.67E-19	0.00E+00	1.93E-20	0.00E+00	0.00E+00	0.00E+00	1.89E-15
Y-91	7.33E+04	0.00E+00	1.95E+03	0.00E+00	0.00E+00	0.00E+00	5.25E+06
Y-92	5.38E-04	0.00E+00	1.51E-05	0.00E+00	0.00E+00	0.00E+00	1.03E+01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	2.16E+00	0.00E+00	5.87E-02	0.00E+00	0.00E+00	0.00E+00	1.70E+04
ZR-95	6.80E+03	1.66E+03	1.18E+03	0.00E+00	1.79E+03	0.00E+00	8.26E+05
ZR-97	4.06E+00	6.97E-01	3.18E-01	0.00E+00	7.03E-01	0.00E+00	4.45E+04
NB-95	5.93E+05	2.44E+05	1.41E+05	0.00E+00	1.75E+05	0.00E+00	2.06E+08
MO-99	0.00E+00	2.08E+08	4.06E+07	0.00E+00	3.11E+08	0.00E+00	6.85E+07
TC-99M	2.75E+01	5.67E+01	7.30E+02	0.00E+00	6.10E+02	2.96E+01	1.65E+04
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	8.67E+03	0.00E+00	2.90E+03	0.00E+00	1.80E+04	0.00E+00	1.05E+05
RU-105	8.05E-03	0.00E+00	2.71E-03	0.00E+00	5.92E-02	0.00E+00	3.20E+00
RU-106	1.90E+05	0.00E+00	2.38E+04	0.00E+00	2.25E+05	0.00E+00	1.44E+06
AG-110M	3.86E+08	2.82E+08	1.86E+08	0.00E+00	4.03E+08	0.00E+00	1.46E+10
TE-125M	1.51E+08	5.04E+07	2.04E+07	5.07E+07	0.00E+00	0.00E+00	7.18E+07
TE-127M	4.21E+08	1.40E+08	5.10E+07	1.22E+08	1.04E+09	0.00E+00	1.70E+08
TE-127	6.32E+03	2.12E+03	1.36E+03	5.14E+03	1.54E+04	0.00E+00	1.33E+05
TE-129M	5.57E+08	1.91E+08	8.58E+07	2.14E+08	1.39E+09	0.00E+00	3.33E+08
TE-129	2.72E-09	9.37E-10	6.35E-10	2.28E-09	6.77E-09	0.00E+00	2.17E-07
TE-131M	3.38E+06	1.36E+06	1.12E+06	2.75E+06	9.35E+06	0.00E+00	2.29E+07
TE-131	3.43E-32	1.27E-32	9.62E-33	3.06E-32	8.76E-32	0.00E+00	1.38E-30
TE-132	2.11E+07	1.04E+07	9.75E+06	1.54E+07	6.53E+07	0.00E+00	3.87E+07
I-130	3.55E+06	7.81E+06	3.13E+06	8.75E+08	8.58E+06	0.00E+00	1.67E+06
I-131	2.72E+09	3.20E+09	1.41E+09	1.05E+12	3.74E+09	0.00E+00	1.14E+08
I-132	1.43E+00	2.90E+00	1.03E+00	1.36E+02	3.24E+00	0.00E+00	2.35E+00
I-133	3.63E+07	5.28E+07	1.55E+07	9.60E+09	6.21E+07	0.00E+00	8.93E+06
I-134	1.76E-11	3.60E-11	1.28E-11	8.40E-10	4.03E-11	0.00E+00	3.73E-11
I-135	1.12E+05	2.23E+05	8.14E+04	2.00E+07	2.49E+05	0.00E+00	8.08E+04
CS-134	3.65E+10	6.80E+10	6.87E+09	0.00E+00	1.75E+10	7.18E+09	1.85E+08
CS-136	1.98E+09	5.81E+09	2.17E+09	0.00E+00	2.32E+09	4.74E+08	8.82E+07
CS-137	5.15E+10	6.02E+10	4.27E+09	0.00E+00	1.62E+10	6.55E+09	1.88E+08
CS-138	8.39E-23	1.36E-22	6.61E-23	0.00E+00	6.80E-23	1.06E-23	2.18E-22
BA-139	4.27E-07	2.83E-10	1.24E-08	0.00E+00	1.70E-10	1.72E-10	2.71E-05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

COW's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: COW'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.41E+08	2.41E+05	1.24E+07	0.00E+00	5.72E+04	1.48E+05	5.92E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	4.05E+01	1.60E+01	4.11E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+05
LA-142	1.70E-10	6.24E-11	1.49E-11	0.00E+00	0.00E+00	0.00E+00	1.06E-05
CE-141	4.34E+04	2.64E+04	3.11E+03	0.00E+00	8.15E+03	0.00E+00	1.37E+07
CE-143	3.97E+02	2.63E+05	3.00E+01	0.00E+00	7.67E+01	0.00E+00	1.54E+06
CE-144	2.33E+06	9.52E+05	1.30E+05	0.00E+00	3.85E+05	0.00E+00	1.33E+08
PR-143	1.49E+03	5.55E+02	7.36E+01	0.00E+00	2.06E+02	0.00E+00	7.84E+05
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	8.81E+02	9.05E+02	5.55E+01	0.00E+00	3.49E+02	0.00E+00	5.74E+05
W-187	6.08E+04	4.23E+04	1.46E+04	0.00E+00	0.00E+00	0.00E+00	2.48E+06
NP-239	4.57E+02	4.08E+01	2.31E+01	0.00E+00	8.15E+01	0.00E+00	1.18E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: ADULT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02	3.25E+02
C-14	2.41E+08	4.83E+07	4.83E+07	4.83E+07	4.83E+07	4.83E+07	4.83E+07
NA-24	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03	1.36E-03
P-32	4.66E+09	2.90E+08	1.80E+08	0.00E+00	0.00E+00	0.00E+00	5.24E+08
CR-51	0.00E+00	0.00E+00	7.05E+03	4.21E+03	1.55E+03	9.35E+03	1.77E+06
MN-54	0.00E+00	9.18E+06	1.75E+06	0.00E+00	2.73E+06	0.00E+00	2.81E+07
MN-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	2.93E+08	2.03E+08	4.72E+07	0.00E+00	0.00E+00	1.13E+08	1.16E+08
FE-59	2.66E+08	6.24E+08	2.39E+08	0.00E+00	0.00E+00	1.74E+08	2.08E+09
CO-58	0.00E+00	1.82E+07	4.09E+07	0.00E+00	0.00E+00	0.00E+00	3.69E+08
CO-60	0.00E+00	7.52E+07	1.66E+08	0.00E+00	0.00E+00	0.00E+00	1.41E+09
NI-63	1.89E+10	1.31E+09	6.33E+08	0.00E+00	0.00E+00	0.00E+00	2.73E+08
NI-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CU-64	0.00E+00	2.71E-07	1.27E-07	0.00E+00	6.84E-07	0.00E+00	2.31E-05
ZN-65	3.56E+08	1.13E+09	5.12E+08	0.00E+00	7.57E+08	0.00E+00	7.13E+08
ZN-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	4.87E+08	2.27E+08	0.00E+00	0.00E+00	0.00E+00	9.60E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	3.02E+08	0.00E+00	8.66E+06	0.00E+00	0.00E+00	0.00E+00	4.84E+07
SR-90	1.24E+10	0.00E+00	3.05E+09	0.00E+00	0.00E+00	0.00E+00	3.59E+08
SR-91	1.52E-10	0.00E+00	6.14E-12	0.00E+00	0.00E+00	0.00E+00	7.23E-10
SR-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.08E+02	0.00E+00	2.89E+00	0.00E+00	0.00E+00	0.00E+00	1.14E+06
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.13E+06	0.00E+00	3.03E+04	0.00E+00	0.00E+00	0.00E+00	6.23E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: ADULT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	4.69E-12	0.00E+00	1.30E-13	0.00E+00	0.00E+00	0.00E+00	1.49E-07
ZR-95	1.87E+06	6.01E+05	4.07E+05	0.00E+00	9.42E+05	0.00E+00	1.90E+09
ZR-97	2.07E-05	4.17E-06	1.91E-06	0.00E+00	6.30E-06	0.00E+00	1.29E+00
NB-95	2.30E+06	1.28E+06	6.87E+05	0.00E+00	1.26E+06	0.00E+00	7.76E+09
MO-99	0.00E+00	1.00E+05	1.90E+04	0.00E+00	2.26E+05	0.00E+00	2.32E+05
TC-99M	4.45E-21	1.26E-20	1.60E-19	0.00E+00	1.91E-19	6.16E-21	7.44E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.05E+08	0.00E+00	4.53E+07	0.00E+00	4.01E+08	0.00E+00	1.23E+10
RU-105	5.78E-28	0.00E+00	2.28E-28	0.00E+00	7.46E-27	0.00E+00	3.53E-25
RU-106	2.80E+09	0.00E+00	3.54E+08	0.00E+00	5.40E+09	0.00E+00	1.81E+11
AG-110M	6.68E+06	6.18E+06	3.67E+06	0.00E+00	1.22E+07	0.00E+00	2.52E+09
TE-125M	3.59E+08	1.30E+08	4.81E+07	1.08E+08	1.46E+09	0.00E+00	1.43E+09
TE-127M	1.12E+09	3.99E+08	1.36E+08	2.85E+08	4.53E+09	0.00E+00	3.74E+09
TE-127	2.12E-10	7.62E-11	4.59E-11	1.57E-10	8.64E-10	0.00E+00	1.67E-08
TE-129M	1.13E+09	4.23E+08	1.79E+08	3.90E+08	4.73E+09	0.00E+00	5.71E+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-131M	4.51E+02	2.21E+02	1.84E+02	3.49E+02	2.23E+03	0.00E+00	2.19E+04
TE-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-132	1.42E+06	9.18E+05	8.62E+05	1.01E+06	8.84E+06	0.00E+00	4.34E+07
I-130	2.11E-06	6.22E-06	2.45E-06	5.27E-04	9.71E-06	0.00E+00	5.35E-06
I-131	1.07E+07	1.54E+07	8.80E+06	5.03E+09	2.63E+07	0.00E+00	4.05E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.65E-01	6.35E-01	1.94E-01	9.34E+01	1.11E+00	0.00E+00	5.71E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	4.43E-17	1.16E-16	4.28E-17	7.64E-15	1.86E-16	0.00E+00	1.31E-16
CS-134	6.58E+08	1.56E+09	1.28E+09	0.00E+00	5.06E+08	1.68E+08	2.74E+07
CS-136	1.21E+07	4.76E+07	3.43E+07	0.00E+00	2.65E+07	3.63E+06	5.41E+06
CS-137	8.72E+08	1.19E+09	7.81E+08	0.00E+00	4.05E+08	1.35E+08	2.31E+07
CS-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES
OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: ADULT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.87E+07	3.61E+04	1.88E+06	0.00E+00	1.23E+04	2.07E+04	5.92E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	3.71E-02	1.87E-02	4.94E-03	0.00E+00	0.00E+00	0.00E+00	1.37E+03
LA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CE-141	1.40E+04	9.50E+03	1.08E+03	0.00E+00	4.41E+03	0.00E+00	3.63E+07
CE-143	2.01E-02	1.48E+01	1.64E-03	0.00E+00	6.53E-03	0.00E+00	5.55E+02
CE-144	1.46E+06	6.09E+05	7.83E+04	0.00E+00	3.61E+05	0.00E+00	4.93E+08
PR-143	[illegible]10E+04	8.41E+03	1.04E+03	0.00E+00	4.85E+03	0.00E+00	9.18E+07
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	7.07E+03	8.17E+03	4.89E+02	0.00E+00	4.78E+03	0.00E+00	3.92E+07
W-187	2.07E-02	1.73E-02	6.04E-03	0.00E+00	0.00E+00	0.00E+00	5.66E+00
NP-239	6.53E+02	6.42E+01	3.54E+01	0.00E+00	2.00E+02	0.00E+00	1.32E+07

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES
OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: TEEN (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02	1.94E+02
C-14	2.04E+08	4.08E+07	4.08E+07	4.08E+07	4.08E+07	4.08E+07	4.08E+07
NA-24	1.08E-03	1.08E-03	1.08E-03	1.08E-03	1.08E-03	1.08E-03	1.08E-03
P-32	3.93E+09	2.44E+08	1.53E+08	0.00E+00	0.00E+00	0.00E+00	3.31E+08
CR-51	0.00E+00	0.00E+00	5.64E+03	3.13E+03	1.24E+03	8.05E+03	9.47E+05
MN-54	0.00E+00	7.00E+06	1.39E+06	0.00E+00	2.09E+06	0.00E+00	1.44E+07
MN-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	2.38E+08	1.69E+08	3.94E+07	0.00E+00	0.00E+00	1.07E+08	7.31E+07
FE-59	2.12E+08	4.95E+08	1.91E+08	0.00E+00	0.00E+00	1.56E+08	1.17E+09
CO-58	0.00E+00	1.41E+07	3.24E+07	0.00E+00	0.00E+00	0.00E+00	1.94E+08
CO-60	0.00E+00	5.83E+07	1.31E+08	0.00E+00	0.00E+00	0.00E+00	7.60E+08
NI-63	1.52E+10	1.07E+09	5.15E+08	0.00E+00	0.00E+00	0.00E+00	1.71E+08
NI-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CU-64	0.00E+00	2.21E-07	1.04E-07	0.00E+00	5.60E-07	0.00E+00	1.72E-05
ZN-65	2.50E+08	8.69E+08	4.05E+08	0.00E+00	5.56E+08	0.00E+00	3.68E+08
ZN-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	4.07E+08	1.91E+08	0.00E+00	0.00E+00	0.00E+00	6.02E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	2.55E+08	0.00E+00	7.29E+06	0.00E+00	0.00E+00	0.00E+00	3.03E+07
SR-90	8.05E+09	0.00E+00	1.99E+09	0.00E+00	0.00E+00	0.00E+00	2.26E+08
SR-91	1.28E-10	0.00E+00	5.08E-12	0.00E+00	0.00E+00	0.00E+00	5.79E-10
SR-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	9.06E+01	0.00E+00	2.44E+00	0.00E+00	0.00E+00	0.00E+00	7.47E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	9.54E+05	0.00E+00	2.56E+04	0.00E+00	0.00E+00	0.00E+00	3.91E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: TEEN (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	3.96E-12	0.00E+00	1.09E-13	0.00E+00	0.00E+00	0.00E+00	1.21E-07
ZR-95	1.50E+06	4.73E+05	3.25E+05	0.00E+00	6.95E+05	0.00E+00	1.09E+09
ZR-97	1.72E-05	3.41E-06	1.57E-06	0.00E+00	5.17E-06	0.00E+00	9.23E-01
NB-95	1.79E+06	9.95E+05	5.48E+05	0.00E+00	9.65E+05	0.00E+00	4.26E+09
MO-99	0.00E+00	8.27E+04	1.58E+04	0.00E+00	1.89E+05	0.00E+00	1.48E+05
TC-99M	3.53E-21	9.86E-21	1.28E-19	0.00E+00	1.47E-19	5.47E-21	6.47E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	8.57E+07	0.00E+00	3.66E+07	0.00E+00	3.02E+08	0.00E+00	7.16E+09
RU-105	4.83E-28	0.00E+00	1.87E-28	0.00E+00	6.09E-27	0.00E+00	3.90E-25
RU-106	1.82E+09	0.00E+00	2.97E+08	0.00E+00	4.55E+09	0.00E+00	1.13E+11
AG-110M	5.06E+06	4.79E+06	2.91E+06	0.00E+00	9.13E+06	0.00E+00	1.34E+09
TE-125M	3.03E+08	1.09E+08	4.05E+07	8.47E+07	0.00E+00	0.00E+00	8.94E+08
TE-127M	9.41E+08	3.34E+08	1.12E+08	2.24E+08	3.82E+09	0.00E+00	2.35E+09
TE-127	1.80E-10	6.38E-11	3.88E-11	1.24E-10	7.29E-10	0.00E+00	1.39E-08
TE-129M	9.50E+08	3.53E+08	1.50E+08	3.07E+08	3.97E+09	0.00E+00	3.57F+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-131M	3.76E+02	1.80E+02	1.50E+02	2.71E+02	1.88E+03	0.00E+00	1.45E+04
TE-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-132	1.16E+06	7.36E+05	6.92E+05	7.76E+05	7.06E+06	0.00E+00	2.33E+07
I-130	1.70E-06	4.91E-06	1.96E-06	4.00E-04	7.56E-06	0.00E+00	3.77E-06
I-131	8.92E+06	1.25E+07	6.71E+06	3.65E+09	2.15E+07	0.00E+00	2.47E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.05E-01	5.18E-01	1.58E-01	7.23E+01	9.09E-01	0.00E+00	3.92E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	3.60E-17	9.27E-17	3.44E-17	5.96E-15	1.46E-16	0.00E+00	1.03E-16
CS-134	5.23E+08	1.23E+09	5.71E+08	0.00E+00	3.91E+08	1.49E+08	1.53E+07
CS-136	9.40E+06	3.70E+07	2.48E+07	0.00E+00	2.01E+07	3.17E+06	2.98E+06
CS-137	7.24E+08	9.63E+08	3.36E+08	0.00E+00	3.28E+08	1.27E+08	1.37E+07
CS-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: TEEN (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.38E+07	2.91E+04	1.53E+06	0.00E+00	9.87E+03	1.96E+04	3.66E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	3.05E-02	1.50E-02	3.99E-03	0.00E+00	0.00E+00	0.00E+00	8.61E+02
LA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CE-141	1.18E+04	7.87E+03	9.04E+02	0.00E+00	3.71E+03	0.00E+00	2.25E+07
CE-143	1.69E-02	1.23E+01	1.37E-03	0.00E+00	5.51E-03	0.00E+00	3.69E+02
CE-144	1.23E+06	5.08E+05	6.60E+04	0.00E+00	3.04E+05	0.00E+00	3.09E+08
PR-143	1.76E+04	7.04E+03	8.78E+02	0.00E+00	4.09E+03	0.00E+00	5.80E+07
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	6.23E+03	6.77E+03	4.06E+02	0.00E+00	3.98E+03	0.00E+00	2.44E+07
W-187	1.73E-02	1.41E-02	4.95E-03	0.00E+00	0.00E+00	0.00E+00	3.82E+00
NP-239	5.70E+02	5.38E+01	2.99E+01	0.00E+00	1.69E+02	0.00E+00	8.65E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: CHILD (1 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02	2.34E+02
C-14	3.83E+08	7.67E+07	7.67E+07	7.67E+07	7.67E+07	7.67E+07	7.67E+07
NA-24	1.72E-03	1.72E-02	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03
P-32	7.42E+09	3.47E+08	2.86E+08	0.00E+00	0.00E+00	0.00E+00	2.05E+08
CR-51	0.00E+00	0.00E+00	8.79E+03	4.88E+03	1.33E+03	8.91E+03	4.66E+05
MN-54	0.00E+00	8.01E+06	2.13E+06	0.00E+00	2.25E+06	0.00E+00	6.72E+06
MN-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	4.37E+08	2.42E+08	7.51E+07	0.00E+00	0.00E+00	1.37E+08	4.49E+07
FE-59	3.76E+08	6.09E+08	3.03E+08	0.00E+00	0.00E+00	1.77E+08	6.34E+08
CO-58	0.00E+00	1.64E+07	5.02E+07	0.00E+00	0.00E+00	0.00E+00	9.58E+07
CO-60	0.00E+00	6.93E+07	2.04E+08	0.00E+00	0.00E+00	0.00E+00	3.84E+08
NI-63	2.91E+10	1.56E+09	1.02E+09	0.00E+00	0.00E+00	0.00E+00	1.05E+08
NI-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CU-64	0.00E+00	2.97E-07	1.80E-07	0.00E+00	7.19E-07	0.00E+00	1.40E-05
ZN-65	3.75E+08	1.00E+09	6.22E+08	0.00E+00	6.30E+08	0.00E+00	1.76E+08
ZN-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	5.77E+08	3.55E+08	0.00E+00	0.00E+00	0.00E+00	3.71E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	4.82E+08	0.00E+00	1.38E+07	0.00E+00	0.00E+00	0.00E+00	1.87E+07
SR-90	1.04E+10	0.00E+00	2.64E+09	0.00E+00	0.00E+00	0.00E+00	1.40E+08
SR-91	2.40E-10	0.00E+00	9.05E-12	0.00E+00	0.00E+00	0.00E+00	5.29E-10
SR-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.71E+02	0.00E+00	4.59E+00	0.00E+00	0.00E+00	0.00E+00	4.88E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.80E+06	0.00E+00	4.82E+04	0.00E+00	0.00E+00	0.00E+00	2.40E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: CHILD (2 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	7.44E-12	0.00E+00	2.04E-13	0.00E+00	0.00E+00	0.00E+00	1.11E-07
ZR-95	2.66E+06	5.85E+05	5.21E+05	0.00E+00	8.38E+05	0.00E+00	6.11E+08
ZR-97	3.21E-05	4.63E-06	2.73E-06	0.00E+00	6.65E-06	0.00E+00	7.02E-01
NB-95	3.10E+06	1.21E+06	8.62E+05	0.00E+00	1.13E+06	0.00E+00	2.23E+09
MO-99	0.00E+00	1.15E+05	2.84E+04	0.00E+00	2.46E+0[illegible]	0.00E+00	9.51E+04
TC-99M	6.20E-21	1.22E-20	2.01E-19	0.00E+00	1.77E-19	[illegible].17E-21	6.91E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.55E+08	0.00E+00	5.96E+07	0.00E+00	3.90E+08	0.00E+00	4.01E+0[illegible]
RU-105	9.02E-28	0.00E+00	3.27E-28	0.00E+00	7.93E-27	0.00E+00	5.88E-25
RU-106	4.44E+09	0.00E+00	5.54E+08	0.00E+00	5.99E+09	0.00E+00	6.90E+10
AG-110M	8.39E+06	5.67E+06	4.53E+06	0.00E+00	1.06E+07	0.00E+00	6.74E+08
TE-125M	5.69E+08	1.54E+08	7.59E+07	1.60E+08	0.00E+00	0.00E+00	5.49E+08
TE-127M	1.77E+09	4.78E+08	2.11E+08	4.24E+08	5.06E+09	0.00E+00	1.44E+09
TE-127	3.39E-10	9.13E-11	7.26E-11	2.34E-10	9.63E-10	0.00E+00	1.32E-08
TE-129M	1.79E+09	5.00E+08	2.78E+08	5.77E+08	5.26E+09	0.00E+00	2.18E+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-131M	7.00E+02	2.42E+02	2.58E+02	4.98E+02	2.34E+03	0.00E+00	9.82E+03
TE-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TE-132	2.12E+06	9.38E+05	1.13E+06	1.37E+06	8.71E+06	0.00E+00	9.45E+06
I-130	3.04E-06	6.13E-06	3.16E-06	6.76E-04	9.17E-06	0.00E+00	2.87E-06
I-131	1.65E+07	1.66E+07	[illegible].46E+06	5.50E+09	2.73E+07	0.00E+00	1.48E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	5.67E-01	7.02E-01	2.66E-01	1.30E+02	1.17E+00	0.00E+00	2.83E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.52E-17	1.17E-16	5.55E-17	1.04E-14	1.80E-16	0.00E+00	8.94E-17
CS-134	9.22E+08	1.51E+09	3.19E+08	0.00E+00	4.69E+08	1.68E+08	8.16E+06
CS-136	1.62E+07	4.58E+07	2.88E+07	0.00E+00	2.37E+07	3.54E+06	1.57E+06
CS-137	1.33E+09	1.28E+09	1.88E+08	0.00E+00	4.16E+08	1.50E+08	7.99E+06
CS-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

MEAT PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES
OTHER THAN NOBLE GASES, R_i

PATHWAY: MEAT (CONTAMINATED FORAGE)
AGE GROUP: CHILD (3 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	4.38E+07	3.84E+04	2.56E+06	0.00E+00	1.25E+04	2.29E+04	2.22E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	5.59E-02	1.95E-02	6.08E-03	0.00E+00	0.00E+00	0.00E+00	5.44E+02
LA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CE-141	2.22E+04	1.11E+04	1.64E+03	0.00E+00	4.86E+04	0.00E+00	1.38E+07
CE-143	3.17E-02	1.72E+01	2.49E-03	0.00E+00	7.21E-03	0.00E+00	2.52E+02
CE-144	2.32E+06	7.26E+05	1.24E+05	0.00E+00	4.02E+05	0.00E+00	1.89E+08
PR-143	3.34E+04	1.00E+04	1.66E+03	0.00E+00	5.43E+03	0.00E+00	3.60E+07
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	1.17E+04	9.47E+03	7.33E+02	0.00E+00	5.19E+03	0.00E+00	1.50E+07
W-187	3.21E-02	1.90E-02	8.53E-03	0.00E+00	0.00E+00	0.00E+00	2.67E+00
NP-239	1.07E+03	7.71E+01	5.42E+01	0.00E+00	2.23E+02	0.00E+00	5.70E+06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: ADULT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.26E+03	2.26E+03	2.26E+03	2.26E+03	2.26E+03	2.26E+03
C-14	2.28E+08	4.55E+07	4.55E+07	4.55E+07	4.55E+07	4.55E+07	4.55E+07
NA-24	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05
P-32	1.40E+09	8.73E+07	5.43E+07	0.00E+00	0.00E+00	0.00E+00	1.58E+08
CR-51	0.00E+00	0.00E+00	4.64E+04	2.78E+04	1.02E+04	6.16E+04	1.17E+07
MN-54	0.00E+00	3.13E+08	5.97E+07	0.00E+00	9.31E+07	0.00E+00	9.59E+08
MN-56	0.00E+00	1.59E+01	2.82E+00	0.00E+00	2.02E+01	0.00E+00	5.07E+02
FE-55	2.10E+08	1.45E+08	3.38E+07	0.00E+00	0.00E+00	8.08E+07	8.31E+07
FE-59	1.26E+08	2.96E+08	1.14E+08	0.00E+00	0.00E+00	8.28E+07	9.88E+08
CO-58	0.00E+00	3.07E+07	6.89E+07	0.00E+00	0.00E+00	0.00E+00	6.23E+08
CO-60	0.00E+00	1.67E+08	3.69E+08	0.00E+00	0.00E+00	0.00E+00	3.14E+09
NI-63	1.04E+10	7.21E+08	3.49E+08	0.00E+00	0.00E+00	0.00E+00	1.50E+08
NI-65	6.15E+01	7.99E+00	3.64E+00	0.00E+00	0.00E+00	0.00E+00	2.03E+02
CU-64	0.00E+00	9.20E+03	4.32E+03	0.00E+00	2.32E+04	0.00E+00	7.84E+05
ZN-65	3.17E+08	1.01E+09	4.56E+08	0.00E+00	6.75E+08	0.00E+00	6.36E+08
ZN-69	5.49E-06	1.05E-05	7.31E-07	0.00E+00	6.83E-06	0.00E+00	1.58E-06
BR-83	0.00E+00	0.00E+00	3.11E+00	0.00E+00	0.00E+00	0.00E+00	4.47E+00
BR-84	0.00E+00	0.00E+00	2.48E-11	0.00E+00	0.00E+00	0.00E+00	1.94E-16
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	2.19E+08	1.02E+08	0.00E+00	0.00E+00	0.00E+00	6.33E+07
RB-88	0.00E+00	3.43E-22	1.82E-22	0.00E+00	0.00E+00	0.00E+00	4.74E-33
RB-89	0.00E+00	3.89E-26	2.73E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	9.97E+09	0.00E+00	2.86E+08	0.00E+00	0.00E+00	0.00E+00	1.60E+09
SR-90	6.05E+11	0.00E+00	1.48E+11	0.00E+00	0.00E+00	0.00E+00	1.75E+10
SR-91	3.05E+05	0.00E+00	1.23E+04	0.00E+00	0.00E+00	0.00E+00	1.45E+06
SR-92	4.27E+02	0.00E+00	1.85E+01	0.00E+00	0.00E+00	0.00E+00	8.45E+03
Y-90	1.33E+04	0.00E+00	3.57E+02	0.00E+00	0.00E+00	0.00E+00	1.41E+08
Y-91M	5.22E-09	0.00E+00	2.02E-10	0.00E+00	0.00E+00	0.00E+00	1.53E-08
Y-91	5.11E+06	0.00E+00	1.37E+05	0.00E+00	0.00E+00	0.00E+00	2.81E+09
Y-92	9.15E-01	0.00E+00	2.68E-02	0.00E+00	0.00E+00	0.00E+00	1.60E+04

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: ADULT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.70E+02	0.00E+00	4.68E+00	0.00E+00	0.00E+00	0.00E+00	5.38E+06
ZR-95	1.17E+06	3.77E+05	2.55E+05	0.00E+00	5.91E+05	0.00E+00	1.19E+09
ZR-97	3.37E+02	6.81E+01	3.11E+01	0.00E+00	1.03E+02	0.00E+00	2.11E+07
NB-95	1.42E+05	7.92E+04	4.26E+04	0.00E+00	7.83E+04	0.00E+00	4.81E+08
MO-99	0.00E+00	6.15E+06	1.17E+06	0.00E+00	1.39E+07	0.00E+00	1.43E+07
TC-99M	3.10E+00	8.77E+00	1.12E+02	0.00E+00	1.33E+02	4.30E+00	5.19E+03
TC-101	8.22E-31	1.18E-30	1.16E-29	0.00E+00	2.13E-29	6.05E-31	0.00E+00
RU-103	4.77E+06	0.00E+00	2.06E+06	0.00E+00	1.82E+07	0.00E+00	5.57E+08
RU-105	5.39E+01	0.00E+00	2.13E+01	0.00E+00	6.96E+02	0.00E+00	3.29E+04
RU-106	1.93E+08	0.00E+00	2.44E+07	0.00E+00	3.72E+08	0.00E+00	1.25E+10
AG-110M	1.05E+07	9.75E+06	5.79E+06	0.00E+00	1.92E+07	0.00E+00	3.98E+09
TE-125M	9.66E+07	3.50E+07	1.29E+07	2.90E+07	3.93E+08	0.00E+00	3.86E+08
TE-127M	3.49E+08	1.25E+08	4.26E+07	8.92E+07	1.42E+09	0.00E+00	1.17E+09
TE-127	5.66E+03	2.03E+03	1.22E+03	4.19E+03	2.31E+04	0.00E+00	4.47E+05
TE-129M	2.51E+08	9.38E+07	3.98E+07	8.63E+07	1.05E+09	0.00E+00	1.27E+09
TE-129	7.62E-04	2.87E-04	1.86E-04	5.85E-04	3.20E-03	0.00E+00	5.75E-04
TE-131M	9.12E+05	4.46E+05	3.72E+05	7.06E+05	4.52E+06	0.00E+00	4.43E+07
TE-131	1.50E-15	6.27E-16	4.74E-16	1.23E-15	6.57E-15	0.00E+00	2.13E-16
TE-132	4.30E+06	2.78E+06	2.61E+06	3.07E+06	2.68E+07	0.00E+00	1.32E+08
I-130	3.92E+05	1.16E+06	4.57E+05	9.81E+07	1.81E+06	0.00E+00	9.96E+05
I-131	8.08E+07	1.16E+08	6.62E+07	3.79E+10	1.98E+08	0.00E+00	3.05E+07
I-132	5.76E+01	1.54E+02	5.39E+01	5.39E+03	2.45E+02	0.00E+00	2.89E+01
I-133	2.09E+06	3.63E+06	1.11E+06	5.33E+08	6.33E+06	0.00E+00	3.26E+06
I-134	9.65E-05	2.62E-04	9.38E-05	4.54E-03	4.17E-04	0.00E+00	2.29E-07
I-135	3.90E+04	1.02E+05	3.77E+04	6.73E+06	1.64E+05	0.00E+00	1.15E+05
CS-134	4.67E+09	1.11E+10	9.08E+09	0.00E+00	3.59E+09	1.19E+09	1.94E+08
CS-136	4.27E+07	1.68E+08	1.21E+08	0.00E+00	9.38E+07	1.29E+07	1.91E+07
CS-137	6.36E+09	8.70E+09	5.70E+09	0.00E+00	2.95E+09	9.81E+08	1.68E+08
[illegible]	3.91E-11	7.73E-11	3.83E-11	0.00E+00	5.68E-11	5.61E-12	3.30E-16
[illegible]	2.86E-02	2.03E-05	8.36E-04	0.00E+00	1.90E-05	1.15E-05	5.07E-02

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: ADULT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.28E+08	1.61E+05	8.42E+06	0.00E+00	5.49E+04	9.24E+04	2.65E+08
BA-141	1.15E-21	8.70E-25	3.89E-23	0.00E+00	8.09E-25	4.94E-25	5.43E-31
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	1.98E+03	9.97E+02	2.63E+02	0.00E+00	0.00E+00	0.00E+00	7.32E+07
LA-142	2.02E-04	9.19E-05	2.29E-05	0.00E+00	0.00E+00	0.00E+00	6.71E-01
CE-141	1.97E+05	1.33E+05	1.51E+04	0.00E+00	6.19E+04	0.00E+00	5.10E+08
CE-143	9.98E+02	7.38E+05	8.16E+01	0.00E+00	3.25E+02	0.00E+00	2.76E+07
CE-144	3.29E+07	1.38E+07	1.77E+06	0.00E+00	8.16E+06	0.00E+00	1.11E+10
PR-143	6.26E+04	2.51E+04	3.10E+03	0.00E+00	1.45E+04	0.00E+00	2.74E+08
PR-144	3.09E-26	1.28E-26	1.57E-27	0.00E+00	7.23E-27	0.00E+00	4.44E-33
ND-147	3.33E+04	3.85E+04	2.31E+03	0.00E+00	2.25E+04	0.00E+00	1.85E+08
W-187	3.80E+04	3.18E+04	1.11E+04	0.00E+00	0.00E+00	0.00E+00	1.04E+07
NP-239	9.54E+04	9.38E+03	5.17E+03	0.00E+00	2.93E+04	0.00E+00	1.92E+09

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: TEEN (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.59E+03	2.59E+03	2.59E+03	2.59E+03	2.59E+03	2.59E+03
C-14	3.69E+08	7.38E+07	7.38E+07	7.38E+07	7.38E+07	7.38E+07	7.38E+07
NA-24	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05
P-32	1.61E+09	9.97E+07	6.24E+07	0.00E+00	0.00E+00	0.00E+00	1.35E+08
CR-51	0.00E+00	0.00E+00	6.17E+04	3.43E+04	1.35E+04	8.81E+04	1.04E+07
MN-54	0.00E+00	4.54E+08	9.01E+07	0.00E+00	1.36E+08	0.00E+00	9.32E+08
MN-56	0.00E+00	1.43E+01	2.55E+00	0.00E+00	1.81E+01	0.00E+00	9.44E+02
FE-55	3.26E+08	2.31E+08	5.39E+07	0.00E+00	0.00E+00	1.47E+08	1.00E+08
FE-59	1.79E+08	4.19E+08	1.62E+08	0.00E+00	0.00E+00	1.32E+08	9.90E+08
CO-58	0.00E+00	4.36E+07	1.00E+08	0.00E+00	0.00E+00	0.00E+00	6.01E+08
CO-60	0.00E+00	2.49E+08	5.60E+08	0.00E+00	0.00E+00	0.00E+00	3.24E+09
NI-63	1.61E+10	1.13E+09	5.45E+08	0.00E+00	0.00E+00	0.00E+00	1.81E+08
NI-65	5.72E+01	7.31E+00	3.33E+00	0.00E+00	0.00E+00	0.00E+00	3.97E+02
CU-64	0.00E+00	8.34E+03	3.92E+03	0.00E+00	2.11E+04	0.00E+00	6.47E+05
ZN-65	4.24E+08	1.47E+09	6.87E+08	0.00E+00	9.42E+08	0.00E+00	6.23E+08
ZN-69	5.15E-06	9.80E-06	6.36E-07	0.00E+00	6.41E-06	0.00E+00	1.81E-05
BR-83	0.00E+00	0.00E+00	2.91E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	2.25E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	2.74E+08	1.29E+08	0.00E+00	0.00E+00	0.00E+00	4.05E+07
RB-88	0.00E+00	3.17E-22	1.69E-22	0.00E+00	0.00E+00	0.00E+00	2.71E-29
RB-89	0.00E+00	3.50E-26	2.47E-26	0.00E+00	0.00E+00	0.00E+00	5.36E-35
SR-89	1.51E+10	0.00E+00	4.34E+08	0.00E+00	0.00E+00	0.00E+00	1.80E+09
SR-90	7.59E+11	0.00E+00	1.85E+11	0.00E+00	0.00E+00	0.00E+00	2.11E+10
SR-91	2.85E+05	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	1.29E+06
SR-92	3.97E+02	0.00E+00	1.69E+01	0.00E+00	0.00E+00	0.00E+00	1.01E+04
Y-90	1.24E+04	0.00E+00	3.35E+02	0.00E+00	0.00E+00	0.00E+00	1.02E+08
Y-91M	4.86E-09	0.00E+00	1.86E-10	0.00E+00	0.00E+00	0.00E+00	2.29E-07
Y-91	7.84E+06	0.00E+00	2.10E+05	0.00E+00	0.00E+00	0.00E+00	3.21E+09
Y-92	8.60E-01	0.00E+00	2.49E-02	0.00E+00	0.00E+00	0.00E+00	2.36E+04

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: TEEN (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.59E+02	0.00E+00	4.36E+00	0.00E+00	0.00E+00	0.00E+00	4.86E+06
ZR-95	1.72E+06	5.43E+05	3.73E+05	0.00E+00	7.98E+05	0.00E+00	1.25E+09
ZR-97	3.12E+02	6.18E+01	2.85E+01	0.00E+00	9.37E+01	0.00E+00	1.67E+07
NB-95	1.92E+05	1.07E+05	5.87E+04	0.00E+00	1.03E+05	0.00E+00	4.56E+08
MO-99	0.00E+00	5.65E+06	1.08E+06	0.00E+00	1.29E+07	0.00E+00	1.01E+07
TC-99M	2.74E+00	7.63E+00	9.89E+01	0.00E+00	1.14E+02	4.24E+00	5.01E+03
TC-101	7.64E-31	1.09E-30	1.07E-29	0.00E+00	1.97E-29	6.62E-31	0.00E+00
RU-103	6.82E+06	0.00E+00	2.92E+06	0.00E+00	2.40E+07	0.00E+00	5.70E+08
RU-105	5.00E+01	0.00E+00	1.94E+01	0.00E+00	6.31E+02	0.00E+00	4.04E+04
RU-106	2.38E+08	0.00E+00	3.90E+07	0.00E+00	5.97E+08	0.00E+00	1.48E+10
AG-110M	1.52E+07	1.43E+07	8.72E+06	0.00E+00	2.74E+07	0.00E+00	4.03E+09
TE-125M	1.48E+08	5.34E+07	1.98E+07	4.14E+07	0.00E+00	0.00E+00	4.37E+08
TE-127M	5.51E+08	1.96E+08	6.56E+07	1.31E+08	2.24E+09	0.00E+00	1.37E+09
TE-127	5.34E+03	1.89E+03	1.15E+03	3.68E+03	2.16E+04	0.00E+00	4.12E+05
TE-129M	3.62E+08	1.34E+08	5.73E+07	1.17E+08	1.51E+09	0.00E+00	1.36E+09
TE-129	7.14E-04	2.66E-04	1.59E-04	5.10E-04	3.00E-03	0.00E+00	3.90E-03
TE-131M	8.44E+05	4.05E+05	3.38E+05	6.09E+05	4.22E+06	0.00E+00	3.25E+07
TE-131	1.39E-15	5.75E-16	4.36E-16	1.07E-15	6.10E-15	0.00E+00	1.14E-16
TE-132	3.91E+06	2.47E+06	2.33E+06	2.61E+06	2.37E+07	0.00E+00	7.84E+07
I-130	3.51E+05	1.01E+06	4.05E+05	8.28E+07	1.56E+06	0.00E+00	7.80E+05
I-131	7.69E+07	1.08E+08	5.78E+07	3.14E+10	1.85E+08	0.00E+00	2.13E+07
I-132	5.19E+01	1.36E+02	4.88E+01	4.58E+03	2.14E+02	0.00E+00	5.92E+01
I-133	1.94E+06	3.29E+06	1.00E+06	4.59E+08	5.76E+06	0.00E+00	2.49E+06
I-134	8.73E-05	2.31E-04	8.31E-05	3.85E-03	3.65E-04	0.00E+00	3.05E-06
I-135	3.52E+04	9.07E+04	3.36E+04	5.83E+06	1.43E+05	0.00E+00	1.00E+05
CS-134	7.10E+09	1.67E+10	7.75E+09	0.00E+00	5.31E+09	2.03E+09	2.08E+08
CS-136	4.37E+07	1.72E+08	1.16E+08	0.00E+00	9.37E+07	1.48E+07	1.38E+07
CS-137	1.01E+10	1.35E+10	4.69E+09	0.00E+00	4.59E+09	1.78E+09	1.92E+08
CS-138	3.61E-11	6.93E-11	3.47E-11	0.00E+00	5.12E-11	5.96E-12	3.15E-14
BA-139	2.69E-02	1.89E-05	7.83E-04	0.00E+00	1.78E-05	1.30E-05	2.40E-01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: TEEN (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.38E+08	1.69E+05	8.90E+06	0.00E+00	5.74E+04	1.14E+05	2.13E+08
BA-141	1.08E-21	8.04E-25	3.59E-23	0.00E+00	7.46E-25	5.50E-25	2.29E-27
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	1.81E+03	8.88E+02	2.36E+02	0.00E+00	0.00E+00	0.00E+00	5.10E+07
LA-142	1.85E-04	8.23E-05	2.05E-05	0.00E+00	0.00E+00	0.00E+00	2.51E+00
CE-141	2.83E+05	1.89E+05	2.17E+04	0.00E+00	8.89E+04	0.00E+00	5.40E+08
CE-143	9.33E+02	6.79E+05	7.58E+01	0.00E+00	3.04E+02	0.00E+00	2.04E+07
CE-144	5.27E+07	2.18E+07	2.83E+06	0.00E+00	1.30E+07	0.00E+00	1.33E+10
PR-143	7.00E+04	2.80E+04	3.49E+03	0.00E+00	1.63E+04	0.00E+00	2.30E+08
PR-144	2.89E-26	1.18E-26	1.47E-2[illegible]	0.00E+00	6.80E-27	0.00E+00	3.19E-29
ND-147	3.62E+04	3.94E+04	2.36E+03	0.00E+00	2.31E+04	0.00E+00	1.42E+08
W-187	3.54E+04	2.88E+04	1.01E+04	0.00E+00	0.00E+00	0.00E+00	7.80E+06
NP-239	1.60E+05	1.51E+04	8.38E+03	0.00E+00	4.74E+04	0.00E+00	2.43E+09

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: CHILD (1 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS					
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	4.01E+03	4.01E+03	4.01E+03	4.01E+03	4.01E+03	4.01E+03
C-14	8.89E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08
NA-24	3.73E+05	3.73E+06	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05
P-32	3.37E+09	1.58E+08	1.30E+08	0.00E+00	0.00E+00	0.00E+00	9.31E+07
CR-51	0.00E+00	0.00E+00	1.17E+05	6.50E+04	1.78E+04	1.19E+05	6.21E+06
MN-54	0.00E+00	6.65E+08	1.77E+08	0.00E+00	1.86E+08	0.00E+00	5.58E+08
MN-56	0.00E+00	1.88E+01	4.24E+00	0.00E+00	2.27E+01	0.00E+00	2.72E+03
FE-55	7.66E+08	4.25E+08	1.32E+08	0.00E+00	0.00E+00	2.40E+08	7.87E+07
FE-59	3.98E+08	6.43E+08	3.20E+08	0.00E+00	0.00E+00	1.86E+08	6.70E+08
CO-58	0.00E+00	6.44E+07	1.97E+08	0.00E+00	0.00E+00	0.00E+00	3.76E+08
CO-60	0.00E+00	3.78E+08	1.12E+09	0.00E+00	0.00E+00	0.00E+00	2.10E+09
NI-63	3.95E+10	2.11E+09	1.38E+09	0.00E+00	0.00E+00	0.00E+00	1.42E+08
NI-65	1.05E+02	9.89E+00	5.77E+00	0.00E+00	0.00E+00	0.00E+00	1.21E+03
CU-64	0.00E+00	1.10E+04	6.64E+03	0.00E+00	2.66E+04	0.00E+00	5.16E+05
ZN-65	8.13E+08	2.16E+09	1.35E+09	0.00E+00	1.36E+09	0.00E+00	3.80E+08
ZN-69	9.49E-06	1.37E-05	1.27E-06	0.00E+00	8.32E-06	0.00E+00	8.65E-04
BR-83	0.00E+00	0.00E+00	5.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	3.82E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	4.52E+08	2.78E+08	0.00E+00	0.00E+00	0.00E+00	2.91E+07
RB-88	0.00E+00	4.37E-22	3.04E-22	0.00E+00	0.00E+00	0.00E+00	2.15E-23
RB-89	0.00E+00	4.61E-26	4.10E-26	0.00E+00	0.00E+00	0.00E+00	4.02E-28
SR-89	3.60E+10	0.00E+00	1.03E+09	0.00E+00	0.00E+00	0.00E+00	1.39E+09
SR-90	1.24E+12	0.00E+00	3.15E+11	0.00E+00	0.00E+00	0.00E+00	1.67E+10
SR-91	5.24E+05	0.00E+00	1.98E+04	0.00E+00	0.00E+00	0.00E+00	1.16E+06
SR-92	7.28E+02	0.00E+00	2.92E+01	0.00E+00	0.00E+00	0.00E+00	1.38E+04
Y-90	2.31E+04	0.00E+00	6.18E+02	0.00E+00	0.00E+00	0.00E+00	6.57E+07
Y-91M	8.91E-09	0.00E+00	3.24E-10	0.00E+00	0.00E+00	0.00E+00	1.74E-05
Y-91	1.86E+07	0.00E+00	4.99E+05	0.00E+00	0.00E+00	0.00E+00	2.48E+09
Y-92	1.58E+00	0.00E+00	4.53E-02	0.00E+00	0.00E+00	0.00E+00	4.58E+04

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: CHILD (2 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	2.93E+02	0.00E+00	8.04E+00	0.00E+00	0.00E+00	0.00E+00	4.37E+06
ZR-95	3.86E+06	8.48E+05	7.55E+05	0.00E+00	1.21E+06	0.00E+00	8.85E+08
ZR-97	5.70E+02	8.24E+01	4.86E+01	0.00E+00	1.18E+02	0.00E+00	1.25E+07
NB-95	4.10E+05	1.60E+05	1.14E+05	0.00E+00	1.50E+05	0.00E+00	2.96E+08
MO-99	0.00E+00	7.71E+06	1.91E+06	0.00E+00	1.65E+07	0.00E+00	6.38E+06
TC-99M	4.71E+00	9.24E+00	1.53E+02	0.00E+00	1.34E+02	4.69E+00	5.26E+03
TC-101	1.41E-30	1.47E-30	1.87E-29	0.00E+00	2.51E-29	7.78E-31	4.68E-30
RU-103	1.53E+07	0.00E+00	5.90E+06	0.00E+00	3.86E+07	0.00E+00	3.97E+08
RU-105	9.16E+01	0.00E+00	3.32E+01	0.00E+00	8.05E+02	0.00E+00	5.98E+04
RU-106	7.45E+08	0.00E+00	9.30E+07	0.00E+00	1.01E+09	0.00E+00	1.16E+10
AG-110M	3.21E+07	2.17E+07	1.73E+07	0.00E+00	4.04E+07	0.00E+00	2.58E+09
TE-125M	3.51E+08	9.50E+07	4.67E+07	9.84E+07	0.00E+00	0.00E+00	3.38E+08
TE-127M	1.32E+09	3.56E+08	1.57E+08	3.16E+08	3.77E+09	0.00E+00	1.07E+09
TE-127	9.85E+03	2.65E+03	2.11E+03	6.81E+03	2.80E+04	0.00E+00	3.85E+05
TE-129M	8.41E+08	2.35E+08	1.31E+08	2.71E+08	2.47E+09	0.00E+00	1.03E+09
TE-129	1.32E-03	3.69E-04	3.14E-04	9.43E-04	3.87E-03	0.00E+00	8.23E-02
TE-131M	1.54E+06	5.33E+05	5.68E+05	1.10E+06	5.16E+06	0.00E+00	2.16E+07
TE-131	2.57E-15	7.83E-16	7.64E-16	1.97E-15	7.77E-15	0.00E+00	1.35E-14
TE-132	7.00E+06	3.10E+06	3.74E+06	4.51E+06	2.88E+07	0.00E+00	3.12E+07
I-130	6.16E+05	1.24E+06	6.41E+05	1.37E+08	1.86E+06	0.00E+00	5.82E+05
I-131	1.43E+08	1.44E+08	8.17E+07	4.75E+10	2.36E+08	0.00E+00	1.28E+07
I-132	9.22E+01	1.69E+02	7.79E+01	7.86E+03	2.59E+02	0.00E+00	1.99E+02
I-133	3.53E+06	4.37E+06	1.65E+06	8.11E+08	7.28E+06	0.00E+00	1.76E+06
I-134	1.55E-04	2.88E-04	1.32E-04	6.62E-03	4.40E-04	0.00E+00	1.91E-04
I-135	6.26E+04	1.13E+05	5.33E+04	9.97E+06	1.73E+05	0.00E+00	8.58E+04
CS-134	1.60E+10	2.63E+10	5.55E+09	0.00E+00	8.15E+09	2.93E+09	1.42E+08
CS-136	8.24E+07	2.33E+08	1.47E+08	0.00E+00	1.21E+08	1.80E+07	7.96E+06
CS-137	2.39E+10	2.29E+10	3.38E+09	0.00E+00	7.46E+09	2.68E+09	1.43E+08
CS-138	6.57E-11	9.13E-11	5.79E-11	0.00E+00	6.43E-11	6.91E-12	4.21E-11
BA-139	4.95E-02	2.64E-05	1.44E-03	0.00E+00	2.31E-05	1.56E-05	2.86E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LEAFY VEGETABLE PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: LEAFY VEGETABLES
AGE GROUP: CHILD (3 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.77E+08	2.42E+05	1.61E+07	0.00E+00	7.89E+04	1.45E+05	1.40E+08
BA-141	1.99E-21	1.11E-24	6.47E-23	0.00E+00	9.62E-25	6.53E-24	1.13E-21
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	3.25E+03	1.13E+03	3.53E+02	0.00E+00	0.00E+00	0.00E+00	3.16E+07
LA-142	3.36E-04	1.07E-04	3.35E-05	0.00E+00	0.00E+00	0.00E+00	2.12E+01
CE-141	6.56E+05	3.27E+05	4.86E+04	0.00E+00	1.43E+06	0.00E+00	4.08E+08
CE-143	1.72E+03	9.31E+05	1.35E+02	0.00E+00	3.91E+02	0.00E+00	1.36E+07
CE-144	1.27E+08	3.98E+07	6.78E+06	0.00E+00	2.21E+07	0.00E+00	1.04E+10
PR-143	1.46E+05	4.37E+04	7.23E+03	0.00E+00	2.37E+04	0.00E+00	1.57E+08
PR-144	5.37E-26	1.66E-26	2.70E-27	0.00E+00	8.79E-27	0.00E+00	3.58E-23
ND-147	7.15E+04	5.79E+04	4.48E+03	0.00E+00	3.18E+04	0.00E+00	9.17E+07
W-187	6.43E+04	3.81E+04	1.71E+04	0.00E+00	0.00E+00	0.00E+00	5.35E+06
NP-239	3.86E+05	2.77E+04	1.95E+04	0.00E+00	8.01E+04	0.00E+00	2.05E+09

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.56E+03	1.56E+03	1.56E+03	1.56E+03	1.56E+03	1.56E+03
C-14	2.63E+08	5.27E+07	5.27E+07	5.27E+07	5.27E+07	5.27E+07	5.27E+07
NA-24	2.93E+05	2.93E+05	2.93E+05	2.93E+05	2.93E+05	2.93E+05	2.93E+05
P-32	2.05E+10	1.28E+09	7.93E+08	0.00E+00	0.00E+00	0.00E+00	2.31E+09
CR-51	0.00E+00	0.00E+00	3.43E+03	2.05E+03	7.55E+02	4.55E+03	8.62E+05
MN-54	0.00E+00	1.01E+06	1.93E+05	0.00E+00	3.00E+05	0.00E+00	3.09E+06
MN-56	0.00E+00	4.98E-04	8.84E-05	0.00E+00	6.32E-04	0.00E+00	1.59E-02
FE-55	3.26E+05	2.26E+05	5.26E+04	0.00E+00	0.00E+00	1.26E+05	1.29E+05
FE-59	3.86E+05	9.07E+05	3.48E+05	0.00E+00	0.00E+00	2.54E+05	3.02E+06
CO-58	0.00E+00	5.66E+05	1.27E+06	0.00E+00	0.00E+00	0.00E+00	1.15E+07
CO-60	0.00E+00	1.97E+06	4.34E+06	0.00E+00	0.00E+00	0.00E+00	3.70E+07
NI-63	8.07E+08	5.60E+07	2.71E+07	0.00E+00	0.00E+00	0.00E+00	1.17E+07
NI-65	[illegible].44E-02	5.77E-03	2.63E-03	0.00E+00	0.00E+00	0.00E+00	1.46E-01
CU-64	0.00E+00	2.66E+03	1.25E+03	0.00E+00	6.70E+03	0.00E+00	2.26E+05
ZN-65	1.65E+08	5.24E+08	2.37E+08	0.00E+00	3.50E+08	0.00E+00	3.30E+08
ZN-69	2.51E-13	4.80E-13	3.34E-14	0.00E+00	3.12E-13	0.00E+00	7.21E-14
BR-83	0.00E+00	0.00E+00	1.40E-03	0.00E+00	0.00E+00	0.00E+00	2.02E-03
BR-84	0.00E+00	0.00E+00	2.32E-25	0.00E+00	0.00E+00	0.00E+00	1.82E-30
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	3.11E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	6.14E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	3.05E+09	0.00E+00	8.75E+07	0.00E+00	0.00E+00	0.00E+00	4.89E+08
SR-90	9.83E+10	0.00E+00	2.41E+10	0.00E+00	0.00E+00	0.00E+00	2.84E+09
SR-[illegible]1	6.07E+04	0.00E+00	2.45E+03	0.00E+00	0.00E+00	0.00E+00	2.89E+05
[illegible]-92	1.03E+00	0.00E+00	4.44E-02	0.00E+00	0.00E+00	0.00E+00	2.03E+01
Y-90	8.50E+00	0.00E+00	2.28E-01	0.00E+00	0.00E+00	0.00E+00	9.01E+04
Y-91M	7.18E-21	0.00E+00	2.78E-22	0.00E+00	0.00E+00	0.00E+00	2.11E-20
Y-91	1.03E+03	0.00E+00	2.76E+01	0.00E+00	0.00E+00	0.00E+00	5.67E+05
Y-92	6.69E-06	0.00E+00	1.96E-07	0.00E+00	0.00E+00	0.00E+00	1.17E-01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	2.68E-02	0.00E+00	7.40E-04	0.00E+00	0.00E+00	0.00E+00	8.50E+02
ZR-95	1.13E+02	3.63E+01	2.46E+01	0.00E+00	5.70E+01	0.00E+00	1.15E+05
ZR-97	5.20E-02	1.05E-02	4.80E-03	0.00E+00	1.58E-02	0.00E+00	3.25E+03
NB-95	9.91E+03	5.51E+03	2.96E+03	0.00E+00	5.45E+03	0.00E+00	3.34E+07
MO-99	0.00E+00	2.97E+06	5.66E+05	0.00E+00	6.73E+06	0.00E+00	6.89E+06
TC-99M	3.98E-01	1.13E+00	1.43E+01	0.00E+00	1.71E+01	5.52E-01	6.66E+02
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.22E+02	0.00E+00	5.26E+01	0.00E+00	4.66E+02	0.00E+00	1.43E+04
RU-105	1.03E-04	0.00E+00	4.06E-05	0.00E+00	1.33E-03	0.00E+00	6.29E-02
RU-106	2.45E+03	0.00E+00	3.10E+02	0.00E+00	4.73E+03	0.00E+00	1.58E+05
AG-110M	6.99E+06	6.46E+06	3.84E+06	0.00E+00	1.27E+07	0.00E+00	2.64E+09
TE-125M	1.95E+06	7.08E+05	2.62E+05	5.88E+05	7.95E+06	0.00E+00	7.80E+06
TE-127M	5.49E+06	1.96E+06	6.69E+05	1.40E+06	2.23E+07	0.00E+00	1.84E+07
TE-127	7.83E+01	2.81E+01	1.70E+01	5.80E+01	3.19E+02	0.00E+00	6.18E+03
TE-129M	7.22E+06	2.69E+06	1.14E+06	2.48E+06	3.02E+07	0.00E+00	3.64E+07
TE-129	3.39E-11	1.27E-11	8.25E-12	2.60E-11	1.42E-10	0.00E+00	2.56E-11
TE-131M	4.33E+04	2.12E+04	1.77E+04	3.36E+04	2.15E+05	0.00E+00	2.10E+06
TE-131	4.32E-34	1.81E-34	1.37E-34	3.56E-34	1.89E-33	0.00E+00	6.12E-35
TE-132	2.88E+05	1.86E+05	1.75E+05	2.06E+05	1.80E+06	0.00E+00	8.82E+06
I-130	5.04E+05	1.49E+06	5.87E+05	1.26E+08	2.32E+06	0.00E+00	1.28E+06
I-131	3.55E+08	5.08E+08	2.91E+08	1.67E+11	8.71E+08	0.00E+00	1.34E+08
I-132	1.97E-01	5.27E-01	1.84E-01	1.84E+01	8.40E-01	0.00E+00	9.90E-02
I-133	4.64E+06	8.08E+06	2.46E+06	1.19E+09	1.41E+07	0.00E+00	7.26E+06
I-134	2.42E-12	6.57E-12	2.35E-12	1.14E-10	1.05E-11	0.00E+00	5.73E-15
I-135	1.54E+04	4.03E+04	1.49E+04	2.66E+06	6.47E+04	0.00E+00	4.56E+04
CS-134	1.70E+10	4.04E+10	3.30E+10	0.00E+00	1.31E+10	4.34E+09	7.06E+08
CS-136	7.90E+08	3.12E+09	2.24E+09	0.00E+00	1.73E+09	2.38E+08	3.54E+08
CS-137	2.21E+10	3.03E+10	1.98E+10	0.00E+00	1.03E+10	3.42E+09	5.86E+08
CS-138	2.71E-23	5.36E-23	2.65E-23	0.00E+00	3.94E-23	3.89E-24	2.29E-28
BA-139	5.30E-09	3.78E-12	1.55E-10	0.00E+00	3.53E-12	2.14E-12	9.40E-09

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: ADULT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	3.23E+06	4.05E+03	2.11E+05	0.00E+00	1.38E+03	2.32E+03	6.64E+06
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	5.41E-01	2.73E-01	7.21E-02	0.00E+00	0.00E+00	0.00E+00	2.00E+04
LA-142	2.23E-12	1.01E-12	2.53E-13	0.00E+00	0.00E+00	0.00E+00	7.40E-09
CE-141	5.81E+02	3.93E+02	4.46E+01	0.00E+00	1.83E+02	0.00E+00	1.50E+06
CE-143	4.99E+00	3.69E+03	4.08E-01	0.00E+00	1.62E+00	0.00E+00	1.38E+05
CE-144	4.29E+04	1.79E+04	2.30E+03	0.00E+00	1.06E+04	0.00E+00	1.45E+07
PR-143	1.89E+01	7.60E+00	9.39E-01	0.00E+00	4.39E+00	0.00E+00	8.30E+04
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	1.13E+01	1.31E+01	7.81E-01	0.00E+00	7.63E+00	0.00E+00	6.27E+04
W-187	7.82E+02	6.53E+02	2.28E+02	0.00E+00	0.00E+00	0.00E+00	2.14E+05
NP-239	5.52E+00	5.43E-01	2.99E-01	0.00E+00	1.69E+00	0.00E+00	1.11E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.03E+03	2.03E+03	2.03E+03	2.03E+03	2.03E+03	2.03E+03
C-14	4.86E+08	9.72E+07	9.72E+07	9.72E+07	9.72E+07	9.72E+07	9.72E+07
NA-24	5.11E+05	5.11E+05	5.11E+05	5.11E+05	5.11E+05	5.11E+05	5.11E+05
P-32	3.78E+10	2.34E+09	1.47E+09	0.00E+00	0.00E+00	0.00E+00	3.18E+09
CR-51	0.00E+00	0.00E+00	5.99E+03	3.33E+03	1.31E+03	8.55E+03	1.01E+06
MN-54	0.00E+00	1.68E+06	3.34E+05	0.00E+00	5.02E+05	0.00E+00	3.45E+06
MN-56	0.00E+00	8.83E-04	1.57E-04	0.00E+00	1.12E-03	0.00E+00	5.81E-02
FE-55	5.79E+05	4.11E+05	9.57E+04	0.00E+00	0.00E+00	2.60E+05	1.78E+05
FE-59	6.74E+05	1.57E+06	6.07E+05	0.00E+00	0.00E+00	4.96E+05	3.72E+06
CO-58	0.00E+00	9.52E+05	2.19E+06	0.00E+00	0.00E+00	0.00E+00	1.31E+07
CO-60	0.00E+00	3.34E+06	7.52E+06	0.00E+00	0.00E+00	0.00E+00	4.35E+07
NI-63	1.42E+09	1.00E+08	4.81E+07	0.00E+00	0.00E+00	0.00E+00	1.59E+07
NI-65	8.12E-02	1.04E-02	4.73E-03	0.00E+00	0.00E+00	0.00E+00	5.63E-01
CU-64	0.00E+00	4.73E+03	2.23E+03	0.00E+00	1.20E+04	0.00E+00	3.67E+05
ZN-65	2.53E+08	8.78E+08	4.10E+08	0.00E+00	5.62E+08	0.00E+00	3.72E+08
ZN-69	4.62E-13	8.80E-13	6.16E-14	0.00E+00	5.75E-13	0.00E+00	1.62E-12
BR-83	0.00E+00	0.00E+00	2.58E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	4.14E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	5.67E+08	2.67E+08	0.00E+00	0.00E+00	0.00E+00	8.40E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	5.62E+09	0.00E+00	1.61E+08	0.00E+00	0.00E+00	0.00E+00	6.69E+08
SR-90	1.39E+11	0.00E+00	3.43E+10	0.00E+00	0.00E+00	0.00E+00	3.90E+09
SR-91	1.12E+05	0.00E+00	4.44E+03	0.00E+00	0.00E+00	0.00E+00	5.06E+05
SR-92	1.88E+00	0.00E+00	8.00E-02	0.00E+00	0.00E+00	0.00E+00	4.78E+01
Y-90	1.56E+01	0.00E+00	4.21E-01	0.00E+00	0.00E+00	0.00E+00	1.29E+05
Y-91M	1.31E-20	0.00E+00	5.02E-22	0.00E+00	0.00E+00	0.00E+00	6.21E-19
Y-91	1.90E+03	0.00E+00	5.08E+01	0.00E+00	0.00E+00	0.00E+00	7.77E+05
Y-92	1.24E-05	0.00E+00	3.58E-07	0.00E+00	0.00E+00	0.00E+00	3.39E-01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	4.94E-02	0.00E+00	1.36E-03	0.00E+00	0.00E+00	0.00E+00	1.51E+03
ZR-95	1.98E+02	6.25E+01	4.30E+01	0.00E+00	9.18E+01	0.00E+00	1.44E+05
ZR-97	9.46E-02	1.87E-02	8.62E-03	0.00E+00	2.84E-02	0.00E+00	5.07E+03
NB-95	1.69E+04	9.37E+03	5.16E+03	0.00E+00	9.08E+03	0.00E+00	4.01E+07
MO-99	0.00E+00	5.37E+06	1.02E+06	0.00E+00	1.23E+07	0.00E+00	9.61E+06
TC-99M	6.91E-01	1.93E+00	2.50E+01	0.00E+00	2.87E+01	1.07E+00	1.27E+03
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	2.17E+02	0.00E+00	9.29E+01	0.00E+00	7.66E+02	0.00E+00	1.81E+04
RU-105	1.88E-04	0.00E+00	7.29E-05	0.00E+00	2.37E-03	0.00E+00	1.52E-01
RU-106	3.47E+03	0.00E+00	5.67E+02	0.00E+00	8.68E+03	0.00E+00	2.16E+05
AG-110M	1.16E+07	1.09E+07	6.65E+06	0.00E+00	2.08E+07	0.00E+00	3.07E+09
TE-125M	3.60E+06	1.30E+06	4.82E+05	1.01E+06	0.00E+00	0.00E+00	1.06E+07
TE-127M	1.01E+07	3.59E+06	1.20E+06	2.41E+06	4.10E+07	0.00E+00	2.52E+07
TE-127	1.45E+02	5.15E+01	3.12E+01	1.00E+02	5.88E+02	0.00E+00	1.12E+04
TE-129M	1.32E+07	4.90E+06	2.09E+06	4.26E+06	5.53E+07	0.00E+00	4.96E+07
TE-129	6.24E-11	2.33E-11	1.39E-11	4.46E-11	2.62E-10	0.00E+00	3.41E-10
TE-131M	7.88E+04	3.78E+04	3.15E+04	5.69E+04	3.94E+05	0.00E+00	3.03E+06
TE-131	7.90E-34	3.26E-34	2.47E-34	6.09E-34	3.45E-33	0.00E+00	6.49E-35
TE-132	5.15E+05	3.26E+05	3.07E+05	3.44E+05	3.13E+06	0.00E+00	1.03E+07
I-130	8.86E+05	2.56E+06	1.02E+06	2.09E+08	3.95E+06	0.00E+00	1.97E+06
I-131	6.45E+08	9.03E+08	4.85E+08	2.63E+11	1.55E+09	0.00E+00	1.79E+08
I-132	3.50E-01	9.15E-01	3.28E-01	3.08E+01	1.44E+00	0.00E+00	3.98E-01
I-133	8.48E+06	1.44E+07	4.39E+06	2.01E+09	2.52E+07	0.00E+00	1.09E+07
I-134	4.30E-12	1.14E-11	4.09E-12	1.90E-10	1.80E-11	0.00E+00	1.50E-13
I-135	2.74E+04	7.04E+04	2.61E+04	4.53E+06	1.11E+05	0.00E+00	7.81E+04
CS-134	2.94E+10	6.93E+10	3.22E+10	0.00E+00	2.20E+10	8.41E+09	8.62E+08
CS-136	1.34E+09	5.29E+09	3.55E+09	0.00E+00	2.88E+09	4.54E+08	4.26E+08
CS-137	4.02E+10	5.34E+10	1.86E+10	0.00E+00	1.82E+10	7.06E+09	7.60E+08
CS-138	4.92E-23	9.45E-23	4.72E-23	0.00E+00	6.98E-23	8.12E-24	4.29E-26
BA-139	9.81E-09	6.90E-12	2.86E-10	0.00E+00	6.50E-12	4.75E-12	8.75E-08

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: TEEN (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	5.82E+06	7.13E+03	3.75E+05	0.00E+00	2.42E+03	4.80E+03	8.98E+06
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	9.72E-01	4.78E-01	1.27E-01	0.00E+00	0.00E+00	0.00E+00	2.74E+04
LA-142	4.02E-12	1.79E-12	4.45E-13	0.00E+00	0.00E+00	0.00E+00	5.44E-08
CE-141	1.07E+03	7.12E+02	8.17E+01	0.00E+00	3.35E+02	0.00E+00	2.04E+06
CE-143	9.17E+00	6.67E+03	7.45E-01	0.00E+00	2.99E+00	0.00E+00	2.00E+05
CE-144	7.90E+04	3.27E+04	4.24E+03	0.00E+00	1.95E+04	0.00E+00	1.99E+07
PR-143	3.42E+01	1.39E+01	1.73E+00	0.00E+00	8.08E+00	0.00E+00	1.15E+05
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	2.17E+01	2.36E+01	1.42E+00	0.00E+00	1.39E+01	0.00E+00	8.53E+04
W-187	1.43E+03	1.17E+03	4.08E+02	0.00E+00	0.00E+00	0.00E+00	3.15E+05
NP-239	1.05E+01	9.93E-01	5.52E-01	0.00E+00	3.12E+00	0.00E+00	1.60E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (1 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	3.20E+03	3.20E+03	3.20E+03	3.20E+03	3.20E+03	3.20E+03
C-14	1.19E+09	2.39E+08	2.39E+08	2.39E+08	2.39E+08	2.39E+08	2.39E+08
NA-24	1.06E+06	1.06E+07	1.06E+06	1.06E+06	1.06E+06	1.06E+06	1.06E+06
P-32	9.33E+10	4.37E+09	3.60E+09	0.00E+00	0.00E+00	0.00E+00	2.58E+09
CR-51	0.00E+00	0.00E+00	1.22E+04	6.78E+03	1.85E+03	1.24E+04	6.48E+05
MN-54	0.00E+00	2.52E+06	6.70E+05	0.00E+00	7.06E+05	0.00E+00	2.11E+06
MN-56	0.00E+00	1.54E-03	3.48E-04	0.00E+00	1.86E-03	0.00E+00	2.23E-01
FE-55	1.39E+06	7.71E+05	2.39E+05	0.00E+00	0.00E+00	4.36E+05	1.43E+05
FE-59	1.56E+06	2.53E+06	1.26E+06	0.00E+00	0.00E+00	7.33E+05	2.63E+06
CO-58	0.00E+00	1.45E+06	4.45E+06	0.00E+00	0.00E+00	0.00E+00	8.49E+06
CO-60	0.00E+00	5.18E+06	1.53E+07	0.00E+00	0.00E+00	0.00E+00	2.87E+07
NI-63	3.56E+09	1.90E+08	1.24E+08	0.00E+00	0.00E+00	0.00E+00	1.28E+07
NI-65	1.99E-01	1.87E-02	1.09E-02	0.00E+00	0.00E+00	0.00E+00	2.29E+00
CU-64	0.00E+00	8.32E+03	5.02E+03	0.00E+00	2.01E+04	0.00E+00	3.90E+05
ZN-65	4.96E+08	1.32E+09	8.22E+08	0.00E+00	8.33E+08	0.00E+00	2.32E+08
ZN-69	1.14E-12	[illegible].64E-12	1.52E-13	0.00E+00	9.96E-13	0.00E+00	1.03E-10
BR-83	0.00E+00	0.00E+00	6.34E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	9.37E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	1.05E+09	6.47E+08	0.00E+00	0.00E+00	0.00E+00	6.77E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	1.39E+10	0.00E+00	3.97E+08	0.00E+00	0.00E+00	0.00E+00	5.38E+08
SR-90	2.35E+11	0.00E+00	5.95E+10	0.00E+00	0.00E+00	0.00E+00	3.16E+09
SR-91	2.74E+05	0.00E+00	1.03E+04	0.00E+00	0.00E+00	0.00E+00	6.04E+05
SR-92	4.58E+00	0.00E+00	1.84E-01	0.00E+00	0.00E+00	0.00E+00	8.68E+01
Y-90	3.87E+01	0.00E+00	1.03E+00	0.00E+00	0.00E+00	0.00E+00	1.10E+05
Y-91M	3.21E-20	0.00E+00	1.17E-21	0.00E+00	0.00E+00	0.00E+00	6.29E-17
Y-91	4.68E+03	0.00E+00	1.25E+02	0.00E+00	0.00E+00	0.00E+00	6.24E+05
Y-92	3.04E-05	0.00E+00	8.69E-07	0.00E+00	0.00E+00	0.00E+00	8.77E-01

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (2 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	1.21E-01	0.00E+00	3.33E-03	0.00E+00	0.00E+00	0.00E+00	1.81E+03
ZR-95	4.60E+02	1.01E+02	9.00E+01	0.00E+00	1.45E+02	0.00E+00	1.05E+05
ZR-97	2.30E-01	3.33E-02	1.96E-02	0.00E+00	4.78E-02	0.00E+00	5.04E+03
NB-95	3.81E+04	1.49E+04	1.06E+04	0.00E+00	1.40E+04	0.00E+00	2.75E+07
MO-99	0.00E+00	9.76E+06	2.42E+06	0.00E+00	2.09E+07	0.00E+00	8.08E+06
TC-99M	1.59E+00	3.11E+00	5.15E+01	0.00E+00	4.52E+01	1.58E+00	1.77E+03
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	5.14E+02	0.00E+00	1.98E+02	0.00E+00	1.29E+03	0.00E+00	1.33E+04
RU-105	4.58E-04	0.00E+00	1.66E-04	0.00E+00	4.03E-03	0.00E+00	2.99E-01
RU-106	1.11E+04	0.00E+00	1.38E+03	0.00E+00	1.50E+04	0.00E+00	1.72E+05
AG-110M	2.51E+07	1.69E+07	1.35E+07	0.00E+00	3.15E+07	0.00E+00	2.01E+09
TE-125M	8.85E+06	2.40E+06	1.18E+06	2.48E+06	0.00E+00	0.00E+00	8.54E+06
TE-127M	2.50E+07	6.72E+06	2.96E+06	5.97E+06	7.12E+07	0.00E+00	2.02E+07
TE-127	3.57E+02	9.63E+01	7.66E+01	2.47E+02	1.02E+03	0.00E+00	1.40E+04
TE-129M	3.26E+07	9.09E+06	5.06E+06	1.05E+07	9.56E+07	0.00E+00	3.97E+07
TE-129	1.54E-10	4.30E-11	3.65E-11	1.10E-10	4.50E-10	0.00E+00	9.58E-09
TE-131M	1.92E+05	6.64E+04	7.06E+04	1.36E+05	6.42E+05	0.00E+00	2.69E+06
TE-131	1.94E-33	5.91E-34	5.77E-34	1.48E-33	5.86E-33	0.00E+00	1.02E-32
TE-132	1.23E+06	5.44E+05	6.57E+05	7.93E+05	5.05E+06	0.00E+00	5.48E+06
I-130	2.07E+06	4.19E+06	2.16E+06	4.61E+08	6.26E+06	0.00E+00	1.96E+06
I-131	1.56E+09	1.57E+09	8.94E+08	5.20E+11	2.58E+09	0.00E+00	1.40E+08
I-132	8.27E-01	1.52E+00	6.99E-01	7.05E+01	2.33E+00	0.00E+00	1.79E+00
I-133	2.06E+07	2.55E+07	9.64E+06	4.73E+09	4.25E+07	0.00E+00	1.03E+07
I-134	1.02E-11	1.89E-11	8.70E-12	4.35E-10	2.89E-11	0.00E+00	1.25E-11
I-135	6.48E+04	1.17E+05	5.52E+04	1.03E+07	1.79E+05	0.00E+00	8.88E+04
CS-134	6.79E+10	1.11E+11	2.35E+10	0.00E+00	3.45E+10	1.24E+10	6.01E+08
CS-136	3.03E+09	8.58E+09	5.40E+09	0.00E+00	4.44E+09	6.63E+08	2.93E+08
CS-137	9.67E+10	9.26E+10	1.37E+10	0.00E+00	3.02E+10	1.09E+10	5.80E+08
CS-138	1.19E-22	1.66E-22	1.05E-22	0.00E+00	1.17E-22	1.26E-23	7.64E-23
BA-139	2.41E-08	1.29E-11	6.98E-10	0.00E+00	1.12E-11	7.57E-12	1.39E-06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: CHILD (3 OF 3)

NUCLIDES	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.41E+07	1.23E+04	8.20E+05	0.00E+00	4.01E+03	7.34E+03	7.12E+06
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	2.33E+00	8.14E-01	2.54E-01	0.00E+00	0.00E+00	0.00E+00	2.27E+04
LA-142	9.72E-12	3.10E-12	9.70E-13	0.00E+00	0.00E+00	0.00E+00	6.14E-07
CE-141	2.62E+03	1.31E+03	1.94E+02	0.00E+00	5.74E+03	0.00E+00	1.63E+06
CE-143	2.25E+01	1.22E+04	1.77E+00	0.00E+00	5.12E+00	0.00E+00	1.79E+05
CE-144	1.95E+05	6.11E+04	1.04E+04	0.00E+00	3.38E+04	0.00E+00	1.59E+07
PR-143	8.62E+01	2.59E+01	4.28E+00	0.00E+00	1.40E+01	0.00E+00	9.30E+04
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	5.33E+01	4.32E+01	3.35E+00	0.00E+00	2.37E+01	0.00E+00	6.85E+04
W-187	3.47E+03	2.05E+03	9.21E+02	0.00E+00	0.00E+00	0.00E+00	2.88E+05
NP-239	2.59E+01	1.86E+00	1.31E+00	0.00E+00	5.38E+00	0.00E+00	1.38E+05

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (1 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	4.86E+03	4.86E+03	4.86E+03	4.86E+03	4.86E+03	4.86E+03
C-14	2.34E+09	5.00E+08	5.00E+08	5.00E+08	5.00E+08	5.00E+08	5.00E+08
NA-24	1.85E+06	1.85E+06	1.85E+06	1.85E+06	1.85E+06	1.85E+06	1.85E+06
P-32	1.92E+11	1.13E+10	7.46E+09	0.00E+00	0.00E+00	0.00E+00	2.60E+09
CR-51	0.00E+00	0.00E+00	1.94E+04	1.26E+04	2.76E+03	2.46E+04	5.64E+05
MN-54	0.00E+00	4.68E+06	1.06E+06	0.00E+00	1.04E+06	0.00E+00	1.72E+06
MN-56	0.00E+00	3.77E-03	6.50E-04	0.00E+00	3.24E-03	0.00E+00	3.43E-01
FE-55	1.76E+06	1.13E+06	3.03E+05	0.00E+00	0.00E+00	5.55E+05	1.44E+05
FE-59	2.92E+06	5.10E+06	2.01E+06	0.00E+00	0.00E+00	1.51E+06	2.43E+06
CO-58	0.00E+00	2.91E+06	7.26E+06	0.00E+00	0.00E+00	0.00E+00	7.25E+06
CO-60	0.00E+00	1.06E+07	2.50E+07	0.00E+00	0.00E+00	0.00E+00	2.52E+07
NI-63	4.19E+09	2.59E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	1.29E+07
NI-65	4.21E-01	4.76E-02	2.17E-02	0.00E+00	0.00E+00	0.00E+00	3.62E+00
CU-64	0.00E+00	2.07E+04	9.57E+03	0.00E+00	3.50E+04	0.00E+00	4.24E+05
ZN-65	6.66E+08	2.28E+09	1.05E+09	0.00E+00	1.11E+09	0.00E+00	1.93E+09
ZN-69	2.42E-12	4.36E-12	3.24E-13	0.00E+00	1.81E-12	0.00E+00	3.55E-10
BR-83	0.00E+00	0.00E+00	1.34E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-84	0.00E+00	0.00E+00	1.81E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BR-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-86	0.00E+00	2.67E+09	1.32E+09	0.00E+00	0.00E+00	0.00E+00	6.83E+07
RB-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RB-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	2.64E+10	0.00E+00	7.58E+08	0.00E+00	0.00E+00	0.00E+00	5.43E+08
SR-90	2.55E+11	0.00E+00	6.50E+10	0.00E+00	0.00E+00	0.00E+00	3.19E+09
SR-91	5.70E+05	0.00E+00	2.06E+04	0.00E+00	0.00E+00	0.00E+00	6.75E+05
SR-92	9.75E+00	0.00E+00	3.62E-01	0.00E+00	0.00E+00	0.00E+00	1.05E+02
Y-90	8.17E+01	0.00E+00	2.19E+00	0.00E+00	0.00E+00	0.00E+00	1.13E+05
Y-91M	6.81E-20	0.00E+00	2.32E-21	0.00E+00	0.00E+00	0.00E+00	2.27E-16
Y-91	8.79E+03	0.00E+00	2.34E+02	0.00E+00	0.00E+00	0.00E+00	6.30E+05
Y-92	6.45E-05	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	1.23E+00

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (2 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	2.59E-01	0.00E+00	7.05E-03	0.00E+00	0.00E+00	0.00E+00	2.04E+03
ZR-95	8.17E+02	1.99E+02	1.41E+02	0.00E+00	2.14E+02	0.00E+00	9.91E+04
ZR-97	4.87E-01	8.37E-02	3.82E-02	0.00E+00	8.43E-02	0.00E+00	5.34E+C3
NB-95	7.12E+04	2.93E+04	1.70E+04	0.00E+00	2.10E+04	0.00E+00	2.48E+07
MO-99	0.00E+00	2.50E+07	4.87E+06	0.00E+00	3.73E+07	0.00E+00	8.22E+06
TC-99M	3.30E+00	6.80E+00	8.76E+01	0.00E+00	7.32E+01	3.56E+00	1.98E+03
TC-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	1.04E+03	0.00E+00	3.48E+02	0.00E+00	2.17E+03	0.00E+00	1.27E+04
RU-105	9.66E-04	0.00E+00	3.25E-04	0.00E+00	7.11E-03	0.00E+00	3.84E-01
RU-106	2.28E+04	0.00E+00	2.85E+03	0.00E+00	2.70E+04	0.00E+00	1.73E+05
AG-110M	4.63E+07	3.38E+07	2.24E+07	0.00E+00	4.83E+07	0.00E+00	1.75E+09
TE-125M	1.81E+07	6.05E+06	2.45E+06	6.09E+06	0.00E+00	0.00E+00	8.62E+06
TE-127M	5.05E+07	1.68E+07	6.12E+06	1.46E+07	1.24E+08	0.00E+00	2.04E+07
TE-127	7.58E+02	2.54E+02	1.63E+02	6.17E+02	1.85E+03	0.00E+00	1.59E+04
TE-129M	6.69E+07	2.29E+07	1.03E+07	2.57E+07	1.67E+08	0.00E+00	3.99E+07
TE-129	3.26E-10	1.12E-10	7.62E-11	2.73E-10	8.12E-10	0.00E+00	2.61E-08
TE-131M	4.05E+05	1.63E+05	1.35E+05	3.31E+05	1.12E+06	0.00E+00	2.75E+06
TE-131	4.11E-33	1.52E-33	1.15E-33	3.67E-33	1.05E-32	0.00E+00	1.66E-31
TE-132	2.53E+06	1.25E+06	1.17E+06	1.85E+06	7.84E+06	0.00E+00	4.64E+06
I-130	4.26E+06	9.37E+06	3.76E+06	1.05E+09	1.03E+07	0.00E+00	2.01E+06
I-131	3.26E+09	3.85E+09	1.69E+09	1.26E+12	4.49E+09	0.00E+00	1.37E+08
I-132	1.72E+00	3.48E+00	1.24E+00	1.63E+02	3.89E+00	0.00E+00	2.82E+00
I-133	4.35E+07	6.34E+07	1.86E+07	1.15E+10	7.45E+07	0.00E+00	1.07E+07
I-134	2.11E-11	4.33E-11	1.54E-11	1.01E-09	4.84E-11	0.00E+00	4.47E-11
I-135	1.35E+05	2.68E+05	9.77E+04	2.40E+07	2.99E+05	0.00E+00	9.70E+04
CS-134	1.09E+11	2.04E+11	2.06E+10	0.00E+00	5.25E+10	2.15E+10	5.54E+08
CS-136	5.93E+09	1.74E+10	6.51E+09	0.00E+00	6.95E+09	1.42E+09	2.65E+08
CS-137	1.54E+11	1.81E+11	1.28E+10	0.00E+00	4.85E+10	1.96E+10	5.65E+08
CS-138	2.52E-22	4.09E-22	1.98E-22	0.00E+00	2.04E-22	3.19E-23	6.54E-22
BA-139	5.13E-08	3.40E-11	1.48E-09	0.00E+00	2.04E-11	2.06E-11	3.25E-06

Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

GOAT's MILK PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES, R_i

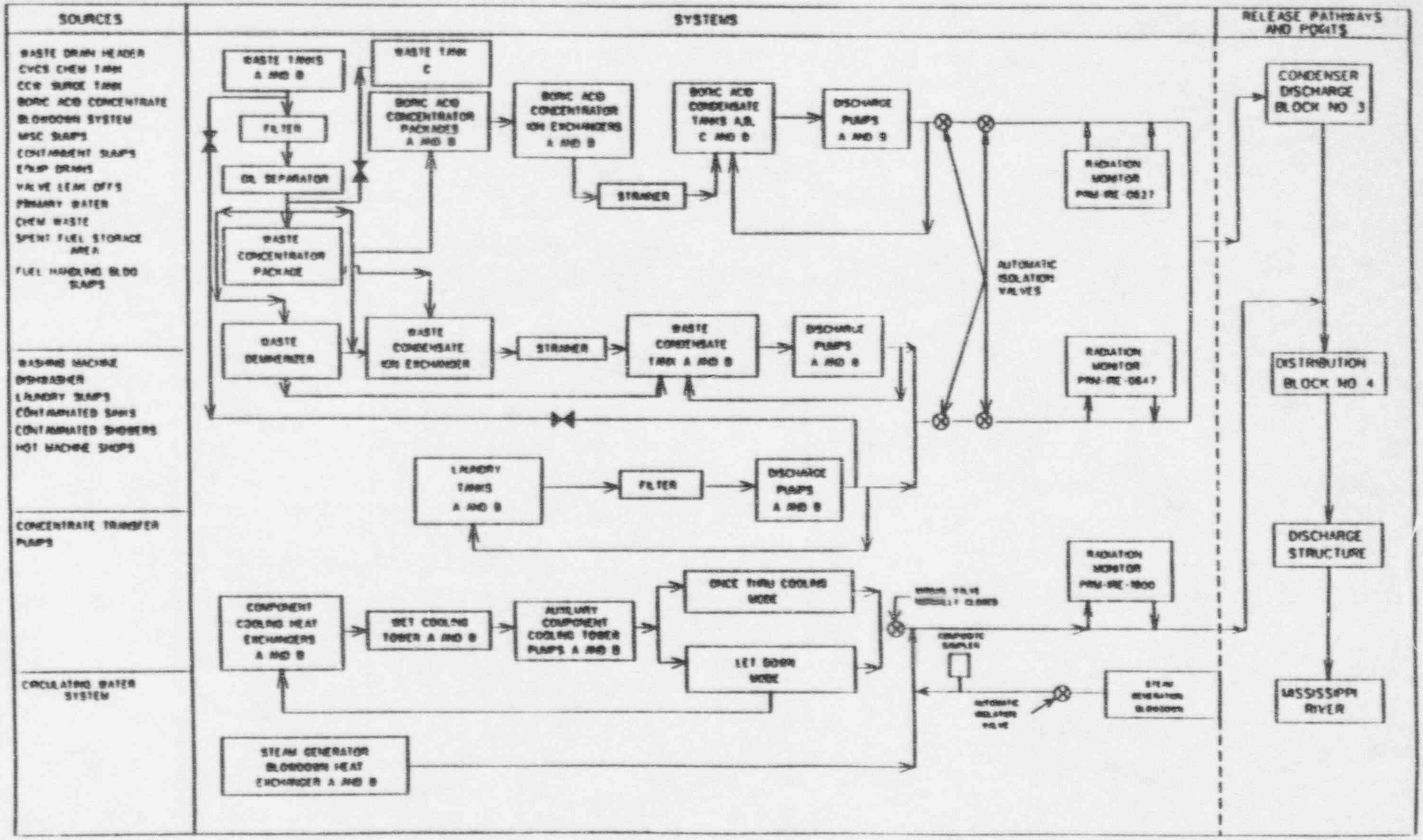
PATHWAY: GOAT'S MILK (CONTAMINATED FORAGE)
AGE GROUP: INFANT (3 OF 3)

NUCLIDE	ORGAN DOSE CONVERSION FACTORS						
	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	2.89E+07	2.89E+04	1.49E+06	0.00E+00	6.87E+03	1.78E+04	7.10E+06
BA-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA-140	4.86E+00	1.92E+00	4.93E-01	0.00E+00	0.00E+00	0.00E+00	2.25E+04
LA-142	2.04E-11	7.49E-12	1.79E-12	0.00E+00	0.00E+00	0.00E+00	1.27E-06
CE-141	5.20E+03	3.17E+03	3.74E+02	0.00E+00	9.79E+02	0.00E+00	1.64E+06
CE-143	4.76E+01	3.16E+04	3.60E+00	0.00E+00	9.20E+00	0.00E+00	1.84E+05
CE-144	2.79E+05	1.14E+05	1.56E+04	0.00E+00	4.62E+04	0.00E+00	1.60E+07
PR-143	1.78E+02	6.67E+01	8.84E+00	0.00E+00	2.48E+01	0.00E+00	9.41E+04
PR-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ND-147	1.06E+02	1.09E+02	6.65E+00	0.00E+00	4.19E+01	0.00E+00	6.88E+04
W-187	7.30E+03	5.07E+03	1.75E+03	0.00E+00	0.00E+00	0.00E+00	2.98E+05
NP-239	5.48E+01	4.90E+00	2.77E+00	0.00E+00	9.77E+00	0.00E+00	1.42E+05

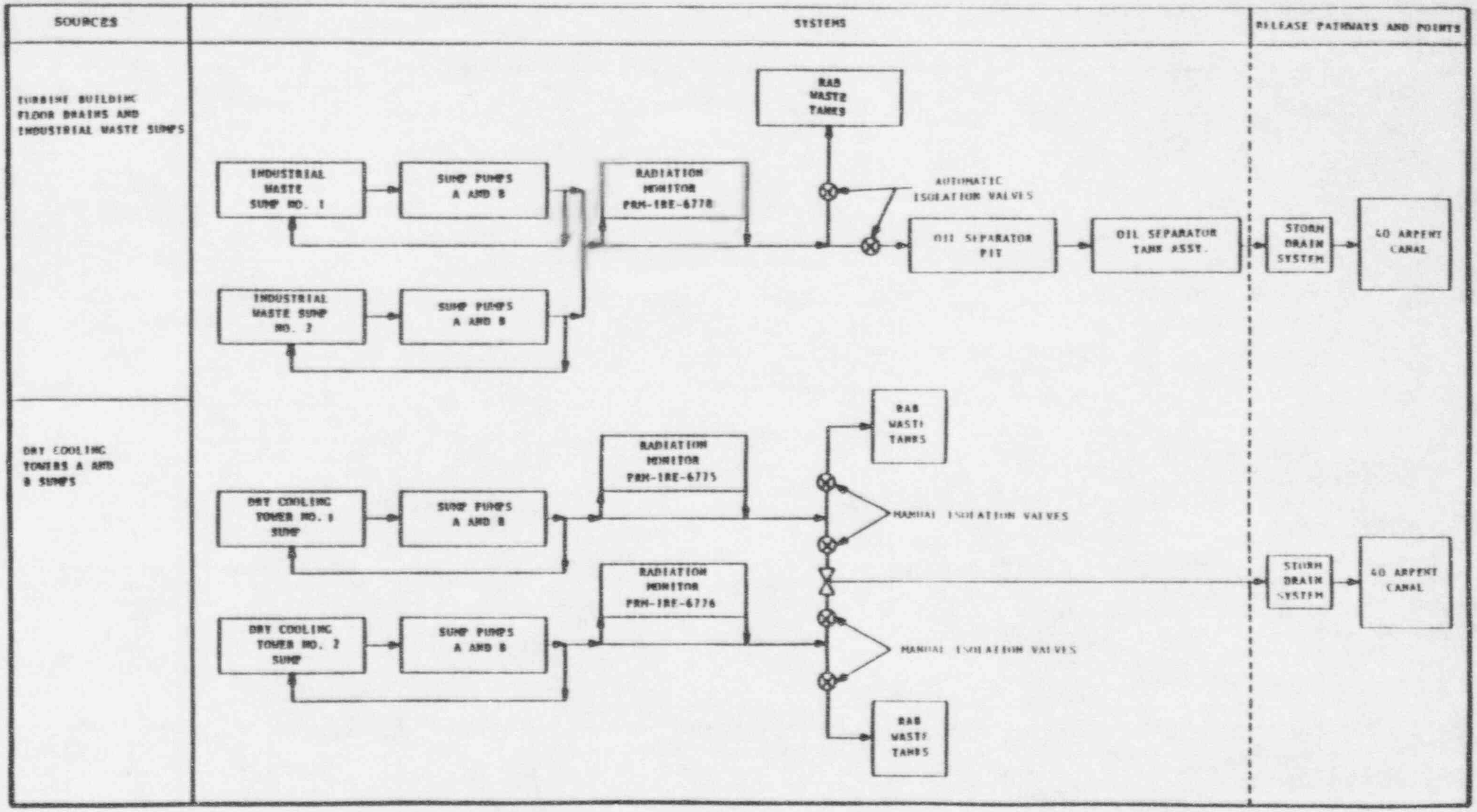
Conversion factors are in units of square meter-mrem/yr per uCi/sec for all nuclides except H-3 which is in units of mrem/yr per uCi/cubic meter.

LIQUID WASTE MANAGEMENT SYSTEM EFFLUENT SOURCES

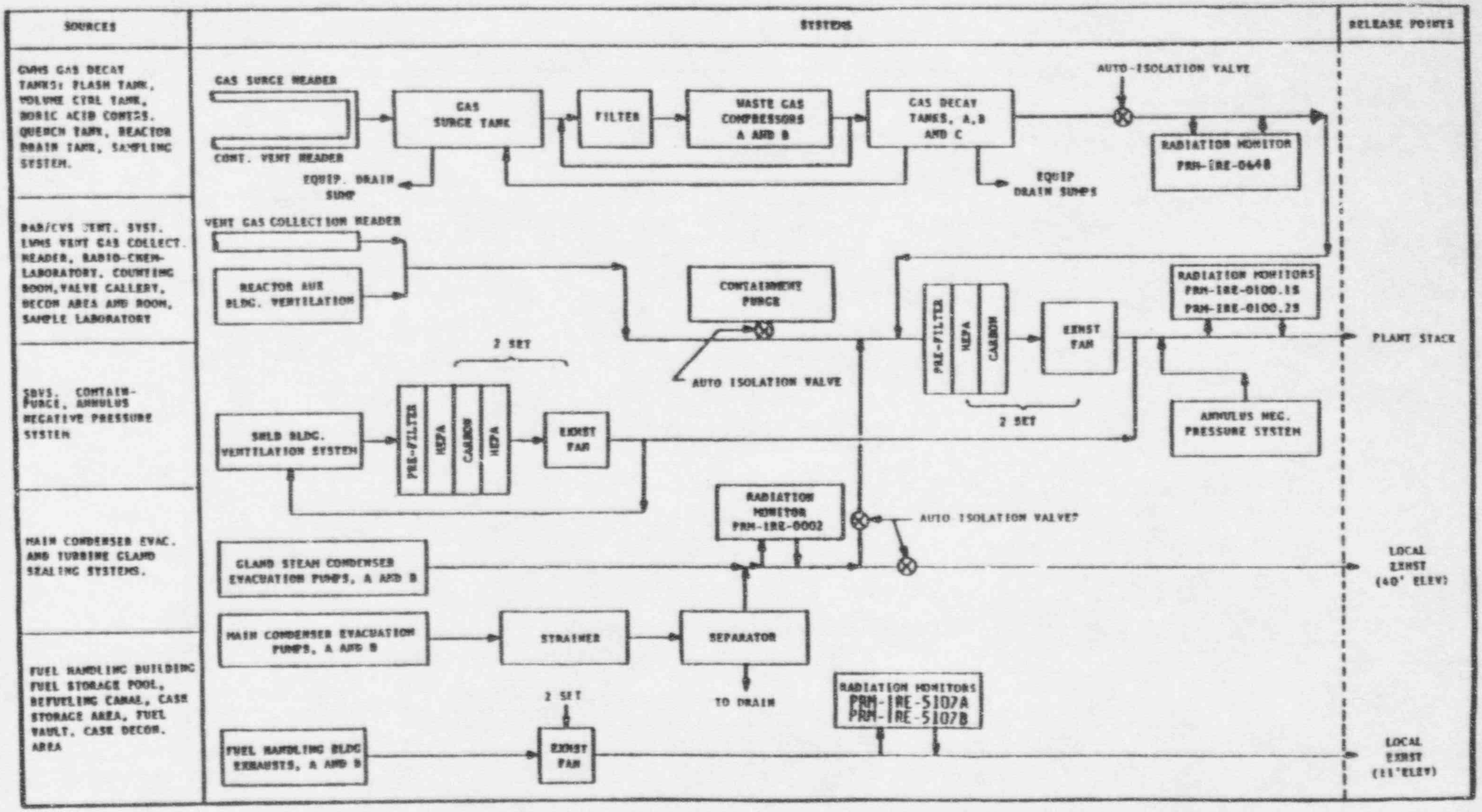
AND RELEASE PATHWAYS AND POINTS



LIQUID WASTE MANAGEMEN. .YSTEM EFFLUENT SOURCES
AND RELEASE PATHWAYS AND POINTS



GASEOUS EFFLUENT SOURCES, GASEOUS WASTE MANAGEMENT
SYSTEM EFFLUENT SOURCES AND EXHAUST RELEASE POINTS



RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLE	LOCATION	ANALYSIS	FREQUENCY	VOLUME
TLD	A-2, B-1, C-1, D-2, E-1, F-2, G-2, H-2, J-2, K-1, L-1, M-1, N-1, P-1, Q-1, R-1, A-5, B-4, D-5, E-5 F-4, G-4, H-6, P-6, Q-5 R-6, F-9, G-9, E-15, J-15 E-30	TLD[a]	Quarterly	N/A
Radioiodine and Particulates	APP-1, APQ-1, APG-1, APC-1, APE-30	Gross beta, I-131 γ isotopic [b]	Weekly Quarterly composite	$285 m^3/wk$ $3700 m^3/qr$
Ground Water[f]	GWK-1	γ ISOTOPIC, H-3	Quarterly	4 liters
Drinking Water[c]	DWG-2, DWE-5d, DWP-7	H-3 Gross beta, γ isotopic I-131[g]	Quarterly composite Monthly composite[k] Semi-monthly composite	Homogeneous 4 liters
Surface Water[c]	SWG-2, SWE-5[d], SWP-7	H-3 γ isotopic	Quarterly composite Monthly composite[k]	Homogeneous 4 liters
Shoreline Sediment	SHWE-3, SHWK-1	γ isotopic	Semi-annually	2 Kilograms
Milk	MKQ-5, MKQ-45, MKQ-1	γ isotopic, I-131	Semi-monthly/monthly[h]	4 liters
Fish	FH-1, FH-2	γ isotopic	In season or semi-annually[i]	500 grams
Food Products	*FPP-1, FPG-1	γ isotopic	At harvest time[j]	500 grams
Broad Leaf	BLQ-1, BLB-1, BLK-15	γ isotopic, I-131	Monthly When milk samples not collected	500 grams

* Irrigated Food Pathway does not exist. However, food products grown within the site boundary are sampled and analyzed.

a. One or more instrument, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. A TLD is considered one phosphor, two or more phosphors in a packet are considered two or more dosimeters. Geographical limitations affect siting of dosimeters.

b. Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopes analysis shall be performed on the individual samples. Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

c. Drinking Water and Surface Water samples are identical samples.

d. The downstream sample is beyond the mixing zone.

e. A composite sample will contain aliquots of sample taken proportional to the quantity of flowing liquid that results in a specimen representative of the liquid flow.

f. Ground water samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

g. This analysis will be performed when the dose calculated for the consumption of water is greater than 1 mrem per year as calculated for maximum organ and age group.

h. Milk will be collected semimonthly when animals are on pasture, monthly otherwise. If milk sampling is not performed, broad leafy vegetation will be sampled.

i. Striped mullet, gizzard shad, freshwater drum, and catfish will be collected. If they are not available, substitute species will be collected and identified in reporting.

j. One sample of each principal class of food products will be sampled in an area irrigated by water in which plant wastes have been inadvertently discharged. If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvesting occurs continuously, sampling shall be monthly. Tuberous and root products will be sampled when available.

k. An anaylsis frequency of Every 4 Weeks satisfies this requirement. The maximum frequency is monthly.

SAMPLE LOCATION TABLE

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
DIRECT RADIATION (TLD)			
A-2	(Eastbank) Located on a utility pole on River Road (La. 628) at the south corner of the Zephrin L. Perriloux Fire Station (Station 5) in Montz, La.	1.1	N
B-1	(Eastbank) On fence enclosing the transmission tower 0.3 miles west (up-river) from Little Gyspy. Access from River Road (LA 628). TLD's are located at SW corner of fence enclosure.	0.8	NNE
C-1	(Eastbank) On fence enclosing the Little Gyspy Cooling Water Intake. Access is from River Road (LA 628) across from Little Gypsy Power Station entrance. TLD's are on the south side (inside) of the Cooling Water Intake fence enclosure, directly opposite the entrance gate.	0.8	NE
D-2	(Eastbank) Located approximately 0.3 miles east of Little Gypsy Power Station. Access from River Road (LA 628) near the west end of the Bonne Carre Spillway. TLD's are on the fence at the West entrance to the spillway (located on levee).	1.1	ENE

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
E-1	(Westbank) Located on utility pole along River Road (LA 18) approximately 0.3 miles east of Waterford 3 plant entrance. Access from LA 18. TLD's are on the third utility pole east of the construction entrance road.	0.2	E
F-2	(Westbank) Located on fence enclosure surrounding the LP&L substation on LA 3142. Access from LA 3142 approximately 0.2 miles south of LA 18. TLD's are on the southeast corner of the fence enclosure.	1.1	ESE
G-2	(Westbank) Located on fence near utility pole on East side of LA 3142 (Next to Union Carbide Star Plant Gate 3). Access from LA 3142 approximately 0.2 miles north of railroad overpass.	1.2	SE
H-2	(Westbank) Located on fence enclosure to shell road off of LA 3142. Access from LA 3142 south of railroad overpass on east side of LA 3142. TLD's are on the south side of the gate for shell road. (Just south of Texaco pipeline station).	1.2	SSE

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
J-2	(Westbank) Located on northeast corner of fence enclosing Texaco valve station south of LA 3127. Access from LA 3127, approxmiately 0.6 miles west of LA 3127/3142 intersection.	1.3	S
K-1	(Westbank) Located on fence at Gate 92 entrance off of LA 3127. Access from LA 3127, approximately 1.3 miles west of LA 3127/3142 intersection. (Gate 92 is the access to the Waterford 3 switchyard station and Training Center).	1.0	SSW
L-1	(Westbank) Located next to "Private Road" sign at Gate 97 entrance off of LA 3127, approximtely 1.6 miles west of LA 3127/3142 intersection. (Gate 97 is an access road for Waterford 3).	1.0	SW
M-1	(Westbank) Located on south gate of the Waterford 1 and 2 fuel oil storage tank enclosure. Access is either thru LP&L Gate 92, Gate 97 off of LA 3127, the shell access road from LA 18 between Waterford 3, or thru the Waterford 1 and 2 access road.	0.7	WSW
N-1	(Westbank) Located behind the "No Trespassing" sign off on Short Street, in Killona just south of the Killona Elementary School.	0.9	W

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
P-1	(Westbank) Located on Short Street, TLD is inside fence at air sample station APP-1.	0.8	WNW
Q-1	(Westbank) Located on fence enclosing air sample station approximately 0.5 miles west of Waterford 1 and 2 on River Road (LA 18).	0.8	NW
R-1	(Westbank) Located on fence enclosure for Waterford 1 and 2 Cooling Water Intake Structure. Access is from River Road (LA 18) opposite Waterford 1 and 2. TLD's are on the southwest corner of fence.	0.5	NNW
A-5	(Eastbank) Located on utility pole just east of the Shady Nook Trailer Park on Hwy 61 in LaPlace. TLD's are on second utility pole east of trailer park on north side of Hwy 61 (eastern end of LaPlace).	4.5	N
B-4	(Eastbank) Located on utility pole guidewire west of shell access road to South Central Bell transmission tower on south side of Hwy 61. Transmission tower is just east of Weigh Station at St. John/St. Charles Parish line. TLD's are on first utility pole west of access road.	3.8	NNE

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
D-5	(Eastbank) Located on fence gate on shell access road to Big 3 Chemical Plant. Shell access road is approximately 0.1 miles west of Hwy 61/48 intersection (at black and yellow gate). TLD's are on fence gate 0.1 miles north on shell access road from Hwy 61.	4.2	ENE
E-5	(Eastbank) Located on the Norco Substation fence enclosure. Access from River Road (LA 48) onto Wesco St. (adjacent to Norco Shell Chemical Plant), take Wesco St. to the dead end. TLD's are located on fence beside of the north substation gate.	4.2	E
F-4	(Westbank) Located on utility pole behind blonde brick house on Aquarius St. in Hahnville. Access from River Road (LA 18) and turn onto Oak St. Follow Oak St. to Hickory St., turn right on Hickory St. and follow to Aquarius St. and turn left. Blonde brick house is second house on right (west) side of Aquarius St. heading south.	3.5	ESE
G-4	(Westbank) Located on railroad sign northwest side of LA 3160/railroad track intersection. Access from either LA 3127 or River Road (LA 18) onto LA 3160.	3.2	SE

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
H-6	(Westbank) Located on a road sign on the Northwest side of the second canal bridge east of LA 3160 along LA 3127.	5.7	SSE
P-6	(Westbank) Located on a fence surrounding the Union Pacific communications tower at the LA 640/railroad track intersection. Tower is located approximately 500 feet west of LA 640.	5.5	WNW
Q-5	(Westbank) Located on fence surrounding (green) river marker on levee just east of Edgard. Fence post is located along River Road (LA 18) across from the Webre's house.	5.0	NW
R-6	(Eastbank) Located on fence enclosing LP&L Laydown Yard on LA 3223 in LaPlace. Access from Hwy 61 onto Elm St. (LA 3223), take Elm St. to the northeast corner of LA 3223/railroad intersection. TLD's are located at the entrance of the fence enclosure.	5.3	NNW
F-9	(Eastbank) Located on entrance gate to Destrehan Substation. Access from River Road (LA 48), approximate 1.5 miles east of Luling-Destrehan Bridge, onto Jonathan Street (west of Bunge Corp. Grain Elevator), and proceed to substation gate.	8.2	ESE

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
G-9	(Westbank) Located on back fence of LP&L District Office in Luling. Access via Ellington St. from either River Road (LA 18); or Second or Third S. from Paul Mallard Rd. (LA 52) to Ellington St.	8.1	SE
E-15	(Eastbank) Located on Kenner Substation fence enclosure. Access from either River Road (LA 48) or Hwy 61, turn onto Alliance Ave. TLD's are located at the entrance of the fence enclosure.	11.8	E
J-15	(Westbank) Located on fence enclosure surrounding LP&L switchyard at LA 631/Hwy 90 intersection in Des Allemands. TLD's are on the northwest corner of fence. Access from LA 631 via shell road.	12.0	S
E-30*	(Westbank) Located at LP&L General Office or Delaronde St. in Algiers. TLD's are on a tree in the courtyard at the south entrance to the building.	27.0	E

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
Airborne			
APP-1	(Westbank) Located in soybean/sugarcane field at northwest corner of Short St. in Killona.	0.8	WNW
APQ-1	(Westbank) Located at northwest corner of soybean/sugarcane field on east side of Killona Access from River Road (LA 18) approximately 0.6 miles east of LA 18/3141 intersection.	0.8	NW
APG-1	(Westbank) Located at the north side of the Secondary Meteorological Tower.	0.5	SE
APC-1	(Eastbank) Located inside the Little Gypsy Cooling Water Intake Structure fence enclosure.	0.8	NE
APE-30*	(Westbank) Located on the roof of the LP&L General Office building on Delaronde St. in Algiers.	27.0	E
Food Products			
FPP-1	(Westbank) Located in field on eastern edge of Killona, between air sample stations APP-1 and APQ-1. The crops grown alternate between soybeans and sugar cane.	0.8	WNW

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
FPG-1	(Westbank) Located in field east of Waterford 3 near the Back-up Meteorological Tower and air sample station APG-1. The crops grown alternate between soybeans and sugar-cane.	0.4	SE
Broad Leaf			
BLQ-1	(Westbank) Located between LA 18 and soybean field on eastern edge Killona, near air sample station APQ-1.	0.8	NW
BLB-1	(Eastbank) Located at wooded area at the southwestern corner of the LP&L Little Gypsy plant along River Road.	0.8	NNE
BLK-15*	(Westbank) Located 3.5 miles SSW of Des Allemands on Hwy. 90.	15.0	SSW
Ingestion			
Milk			
MKQ-5	(Westbank) Located at the Webre's house, just across LA 18 from river marker, at the eastern end of Edgard.	5.0	NW

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
MKQ-45*	(Eastbank) Located off of I-12 in Denham Springs. Take LA 3002 south of LA 1034 then right to LA 1032. Turn left and go to farm 1 mile on the right.	42	NW
MKQ-1	(Westbank) 1.0 miles west of Waterford 3 at the corner of River Road and Post Street in Killona.	1.0	NW
Fish			
FH-1*	Upstream of the plant intake structure.	N/A	N/A
FH-2	Downstream of the plant discharge structure.	N/A	N/A
Waterborne			
GWK-1	(Westbank) Located at 40 Arpent Canal south of the plant. Access from LA 3127 through LP&L Gate 92 which is at the Waterford-3 Training Center. The canal is northwest of the shell access road/railroad track intersection.	0.5	SSW
DWG-2 SWG-2	(Westbank) Located at the Union Carbide drinking water canal. Access from LA 3142 through Gate 28.	2.0	SE

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	MILES FROM PLANT	SECTOR DIRECTION
SHWE-3	(Westbank) Located at the Foot Ferry Landing off of LA 18 in Taft.	3.0	E
SHWK-1	(Westbank) Located at 40 arpent canal south of plant. Access thru LP&L gate 92 off of LA 3127.	0.5	SSW
DWE-5 SWE-5	(Eastbank) Located at the St. Charles Parish Waterworks off of River Road (LA 48) near New Sarpy.	4.5	E
DWP-7* SWP-7*	(Westbank) Located at the St. John Parish Waterworks off of LA 18 in Edgard.	6.5	WNW

* DENOTES CONTROL LOCATIONS

N/A - Not Applicable for this sampling location.

SECTOR AND ZONE DESIGNATC_ _ FOR RADIOLOGICAL SAMPLING AND MONITORING POINTS

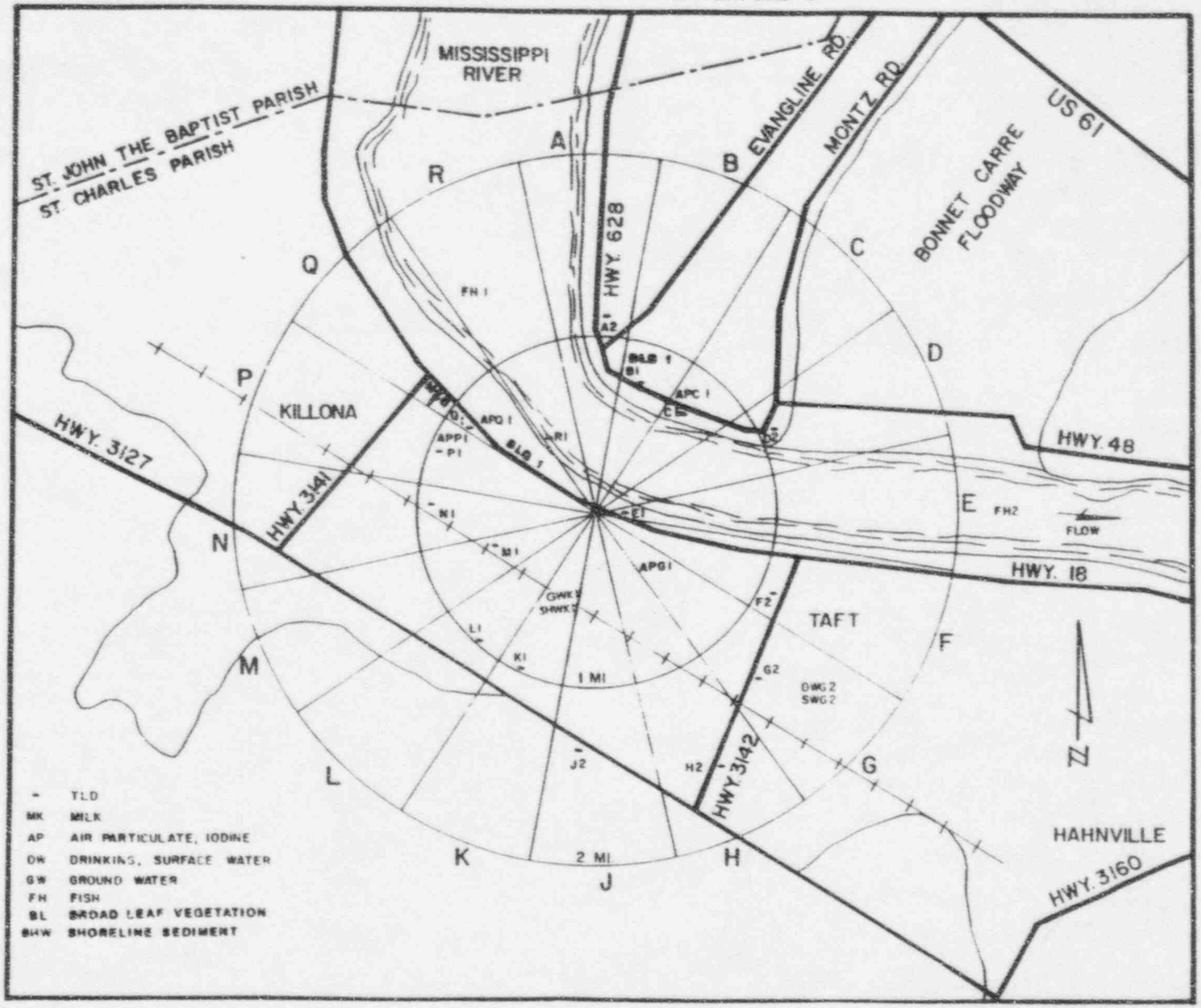
SECTOR NOMENCLATURE		ZONE NOMENCLATURE	
CENTERLINE OF SECTOR IN DEGREES TRUE NORTH FROM FACILITY	22 1/2° SECTOR	MILES FROM FACILITY	ZONE
0 & 360	*A N	0-1	1
22 1/2	B NNE	1-2	2
45	C NE	2-3	3
67 1/2	D ENE	3-4	4
90	E E	4-5	5
112 1/2	F ESE	5-6	6
135	G SE	6-7	7
157 1/2	H OR SSE	7-8	8
180	J S	8-9	9
202 1/2	K SSW	9-10	10
225	L SW	10-15	15
247 1/2	M WSW	15-20	20
270	N W	20-25	25
292 1/2	P WNW	25-30	30
315	Q NW	30-35	35
337 1/2	R NNW	35-40	40
		40-45	45
		45-50	50

<u>AREA SEGMENT</u> - An area is identified by a Sector and Zone designator. Thus, area N-1 is that area which lies between 348 3/4 and 11¼ degrees true north from the facility out to a radius of 1 mile. Area G-4 would be that area between 123 3/4 to 146¼ degrees and the 3- and 4-mile arcs from the facility. For Airborne, Ingestion (milk), and Food Products pathways, the sector designator will be preceded by acronyms AP, MK, and FP, respectively.

* The letters I and O have been omitted from these sector designators so as to eliminate possible confusion between letters and numbers.

REMP SAMPLING LOCATIONS

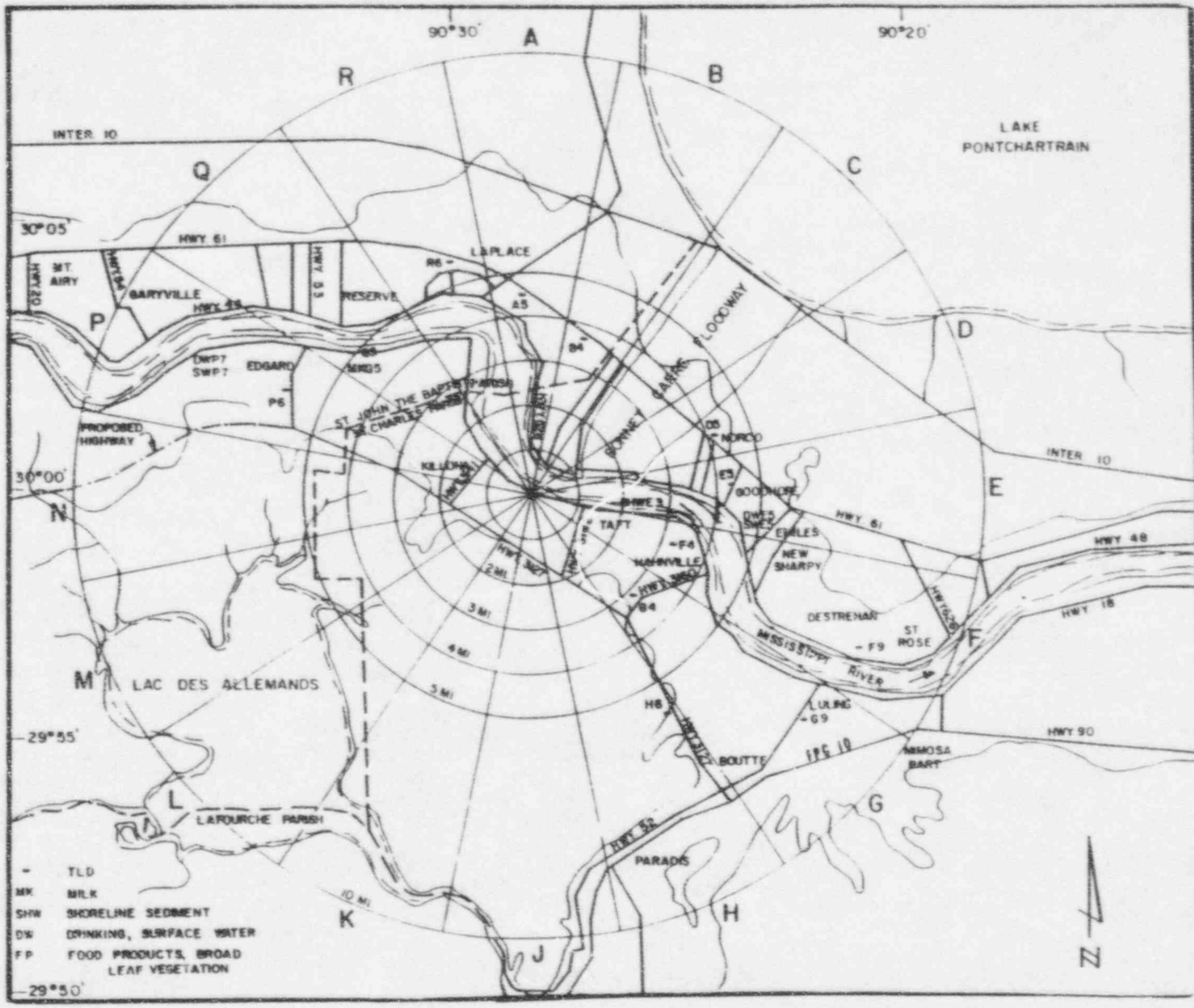
WITHIN 2 MILES OF WATERFORD 3



UNT-005-014 Revision 3

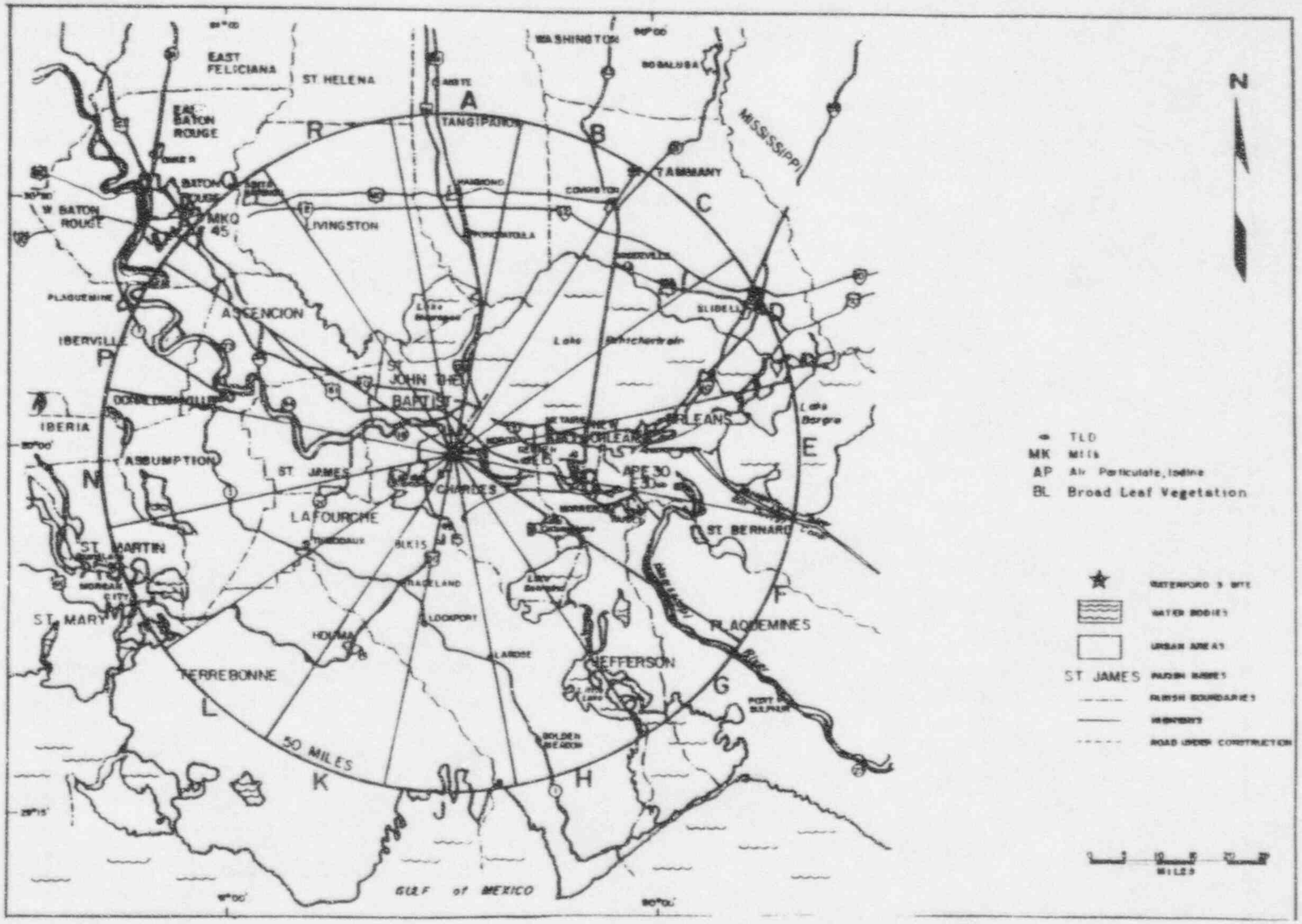
Attachment 6.16 (1 of 1)

REMP SAMPL LOCATIONS
WITHIN 10 MILES OF WATERFORD 3



REMP SAM. IG LOCATIONS

WITHIN 50 MILES OF WATERFORD 3



UNT-005-014 Revision 3

Attachment 6.18 (1 of 1)

SPECIFICATION CROSS REFERENCE TABLE

Specification Section	Requirement	Methodology Section
5.3.1	Liquid Effluent Concentration	5.3.5 & 5.3.6
5.3.2	Dose due to Liquid Effluents	5.3.4
5.3.3	Dose Projections for Liquid Releases	5.3.7
5.4.1	Dose Rate Due to Noble Gases	5.4.5 & 5.4.8
5.4.1	Dose Rate Due to Iodine, Tritum And Particulates with Half Lives Greater than Eight Days	5.4.5 & 5.4.8
5.4.2	Air Doses due to Noble Gases	5.4.6
5.4.3	Doses Due to Iodines, Tritium and Particulates with Half-Lives Greater than Eight Days.	5.4.7
5.4.4	Dose Projections for Gaseous Releases	5.4.9
5.5.1	Total Dose	5.5.2
5.6.1	Radioactive Liquid Effluent Monitoring Channels Alarm/Trip Setpoints	5.3.5
5.6.2	Radioactive Gaseous Effluent Monitoring Channels Alarm/Trip Setpoints	5.4.8
5.8.1	Radiological Environmental Monitoring Program	5.8.4
5.8.2	Interlaboratory Comparison Program	5.8.5
5.8.3	Land Use Census	5.8.3

TECHNICAL SPECIFICATION CROSS REFERENCE TABLE

Specification Section	Requirement	Methodology Section
5.3.1	Liquid Effluent Concentration	3.11.1.1, 4.11.1.1.1, 4.11.1.1.2
5.3.2	Dose due to Liquid Effluents	3.11.1.2 & 4.11.1.2
5.3.3	Dose Projections for Liquid Releases	3.11.1.3, 4.11.1.3.1 & 4.11.1.3.2
5.4.1	Dose Rate Due to Noble Gases	3.11.2.1, 4.11.2.1.1, 4.11.2.1.2 & 4.11.2.1.3
5.4.1	Dose Rate Due to Iodine, Tritum And Particulates with Half Lives Greater than Eight Days	3.11.2.1, 4.11.2.1.1, 4.11.2.1.2 & 4.11.2.1.3
5.4.2	Air Doses due to Noble Gases	3.11.2.2 & 4.11.2.2
5.4.3	Doses Due to Iodines, Tritium and Particulates with Half-Lives Greater than Eight Days.	3.11.2.3 & 4.11.2.3
5.4.4	Dose Projections for Gaseous Releases	3.11.2.4, 4.11.2.4.1 & 4.11.2.4.2

TECHNICAL SPECIFICATION CROSS REFERENCE TABLE

Specification Section	Requirement	Methodology Section
5.5.1	Total Dose	3.11.4, 4.11.4.1 & 4.11.4.2
5.8.1	Radiological Environmental Monitoring Program	3.12.1 & 4.12.1
5.8.2	Interlaboratory Comparison Program	3.12.3 & 4.12.3
5.8.3	Land Use Census	3.12.2 & 4.12.2
5.6.1	Radioactive Liquid Effluent Monitoring Channels Alarm/Trip Setpoints	3.3.3.10 & 4.3.3.10
5.6.2	Radioactive Gaseous Effluent Monitoring Channels Alarm/Trip Setpoints	3.3.3.11 & 4.3.3.11

SPECIFIC FACTORS USED TO DETERMINE A_i and R_i VALUES FOR THE OFFSITE DOSE CALCULATION MANUAL

Values for A_i and R_i were calculated as per NUREG-0133. Recommended values for various factors in the calculations were as specified in NUREG-0133. The location of most of the recommended factors are contained in Regulatory Guide 1.109. All factors used in Waterford-3 SES's calculations are for the maximum individual and are not site specific. The various factors are discussed below.

- Stable element transfer coefficients for vegetation, cow's milk, and meat were obtained from Regulatory Guide 1.109 Table E-1.

- Stable element transfer coefficients for goat's milk were obtained from Regulatory Guide 1.109 Table E-2.

- Animal consumption rates were obtained from Regulatory Guide 1.109 Table E-3.

- Usage or consumption rates for adult, teen, child, and infant age groups were obtained from Regulatory Guide 1.109 Table E-5. These values are for the maximum exposed individual.

- External dose factors for standing on contaminated ground were obtained from Regulatory Guide 1.109 Table E-6.

- Inhalation and ingestion dose factors for adult, teen, child, and infant age groups were obtained from Regulatory Guide 1.109 Tables E-7 through E-14.

- Other factors used were obtained from Regulatory Guide 1.109 Table E-15 for various parameters.

- Bioaccumulation factors for freshwater and saltwater vertebrates and invertebrates are listed on the following page.

SPECIFIC FACTORS USED TO DETERMINE A_i and R_i VALUES FOR THE OFFSITE DOSE CALCULATION MANUAL

BIOACCUMULATION FACTORS FOR VARIOUS ELEMENTS IN AN AQUATIC ENVIRONMENT

Element	Fresh-water Fish	Fresh-water Inverterbrates	Salt-water Fish	Salt-water Inverterbrates
H	9.00e-1	9.00e-1	9.00e-1	9.30e-1
C	4.60e+3	9.10e+3	1.80e+3	1.40e+3
Na	1.00e+2	2.00e+2	6.70e-2	1.90e-1
P	1.00e+5	2.00e+4	2.90e+4	3.00e+4
Cr	2.00e+2	2.00e+3	4.00e+2	2.00e+3
Mn	4.00e+2	9.00e+4	5.50e+2	4.00e+2
Fe	1.00e+2	3.20e+3	3.00e+3	2.00e+4
Co	5.00e+1	2.00e+2	1.00e+2	1.00e+3
Ni	1.00e+2	1.00e+2	1.00e+2	2.50e+2
Cu	5.00e+1	4.00e+2	6.70e+2	1.70e+3
Zn	2.00e+3	1.00e+4	2.00e+3	5.00e+4
Br	4.20e+2	3.30e+2	1.50e-2	3.10e+0
Rb	2.00e+3	1.00e+3	8.30e+0	1.70e+1
Sr	3.00e+1	1.00e+2	2.00e+0	2.00e+1
Y	2.50e+1	1.00e+3	2.50e+1	1.00e+3
Zr	3.30e+0	6.70e+0	2.00e+2	8.00e+1
Nb	3.00e+2	1.00e+2	3.00e+2	1.00e+2
Mo	1.00e+1	1.00e+1	1.00e+1	1.00e+1
Tc	1.50e+1	5.00e+0	1.00e+1	5.00e+1
Ru	1.00e+1	3.00e+2	3.00e+0	1.00e+3
Ag	2.00e+0	8.00e+2	3.00e+3	3.00e+3
Te	4.00e+2	6.10e+3	1.00e+1	1.00e+2
I	1.50e+1	5.00e+0	1.00e+1	5.00e+1
Cs	2.00e+3	1.00e+3	4.00e+1	2.50e+1
Ba	4.00e+0	2.00e+2	1.00e+1	1.00e+2
La	2.50e+1	1.00e+3	2.50e+1	1.00e+3
Ce	1.00e+0	1.00e+3	1.00e+1	6.00e+2
Pr	2.50e+1	1.00e+3	2.50e+1	1.00e+3
Nd	2.50e+1	1.00e+3	2.50e+1	1.00e+3
W	1.20e+3	1.00e+1	3.00e+1	3.00e+1
Np	1.00e+1	4.00e+2	1.00e+1	1.00e+1

Data obtained from Regulatory Guide 1.109 Table A-1 for all elements except Silver(Ag) which is from "Models and Parameters for Environmental Radiological Assessments" (DOE/TIC-11468) and Niobium(Nb) which is from the International Atomic Energy Agency(IAEA) Safety Series No. 57, Generic Models and Parameters for Assessing the Environmental Transfer of Radionuclides from Routine Releases, Exposures of Critical Groups.