ATTACHMENT 1

SUMMARY OF PROPOSED CHANGES

SUMMARY OF PROPOSED CHANGES

Section	Description of Change
4.8	Deleted, replaced by new Section 8.0.
5.8	Deleted, replaced by new Section 8.0.
6.3	Provided additional information regarding radioactive effluent pathways and general site layout.
7.1	Added subsections j and k to specification AC 7.1.2.5 to incorporate the Plant Operations Review Committee responsibilities for reviewing the plant Radiological Emergency Response Plan and unplanned on-site releases of radioactive material to the environs.
7.5	1) Entire section is submitted due to reformatting. 2) Added a new section, 7.5.1.d, regarding the Annual Radiological Environmental Monitoring Report. 3) Added a new section, 7.5.1.e, regarding the Semi-Annual Radioactive Effluent Release Report. 4) Corrected a typographical error in the second line of Section 7.5.2. 5) Added a new section, 7.5.4, regarding Non-Routine Radiological Reports.
8.0	Added entirely new section to address the total environmental monitoring program, the radiological effluent disposal system, and the radiological monitoring program.

ATTACHMENT 2

PROPOSED CHANGES

4.8 RADIOACTIVE EFFLUENT DISPOSAL SYSTEM - LIMITING CONDITIONS FOR OPERATION

(These requirements have been deleted. Refer to Section 8.0 for Radiological Technical Specifications.)

5.8 RADIOACTIVE EFFLUENT DISPOSAL SYSTEMS - SURVEILLANCE REQUIREMENTS

(These requirements have been deleted. Refer to Section 8.0 for Radiological Technical Specifications.)

6.3 SITE DESIGN FEATURES

Applicability

Applies to the location and extent of the Reactor Site.

Objective

To define those aspects of the site which affect the overall safety of the installation.

Specification DF 6.3 - Site, Design Features

The Fort St. Vrain Nuclear Generating Station, Unit No. 1, is situated on a tract of land located about 3.5 miles northwest from the center of Platteville, Colorado. The tract is situated in Weld County, Colorado (See FSAR Section 2.1).

The exclusion area is approximately 1 mile square and is defined in Figure 6.3-1. The closest distance from the reactor building to the boundary of the exclusion area is 1,935 feet. The limits of 10 CFR 20 shall apply at the boundary of this exclusion area. The Low Population Zone (LPZ) is defined by a radius of 16,000 meters. The exclusion area is zoned industrial, and the area surrounding the exclusion area is zoned agricultural. Agricultural activities may continue on the site including a portion of the exclusion area, and an evacuation

procedure will be maintained. There are no permanent residences located within the exclusion area.

A security fence surrounds the plant area, as shown in FSAR Fig. 1.2-2. Fences inside the security fence limit routine access into the plant from the parking lot inside the main gate to the main plant entrance. The main gate is electrically operated and controllable from within the plant.

An Information Center is located within the exclusion area, but outside the main gate. An evacuation procedure will be maintained for the Information Center.

Points where radioactive gaseous and liquid effluents are released are shown on Figure 6.3-2 as are the liquid effluent pathways leaving the site.

Basis for Specification DF 6.3

The site offers adequate distances and favorable seismologic, meteorologic, geologic, hydrologic, and population characteristics as described in Section 2 of the FSAR. The favorable characteristics of the site and the design of the plant ensure that 10 CFR 100 and 10 CFR 20 requirements can be met satisfactorily.

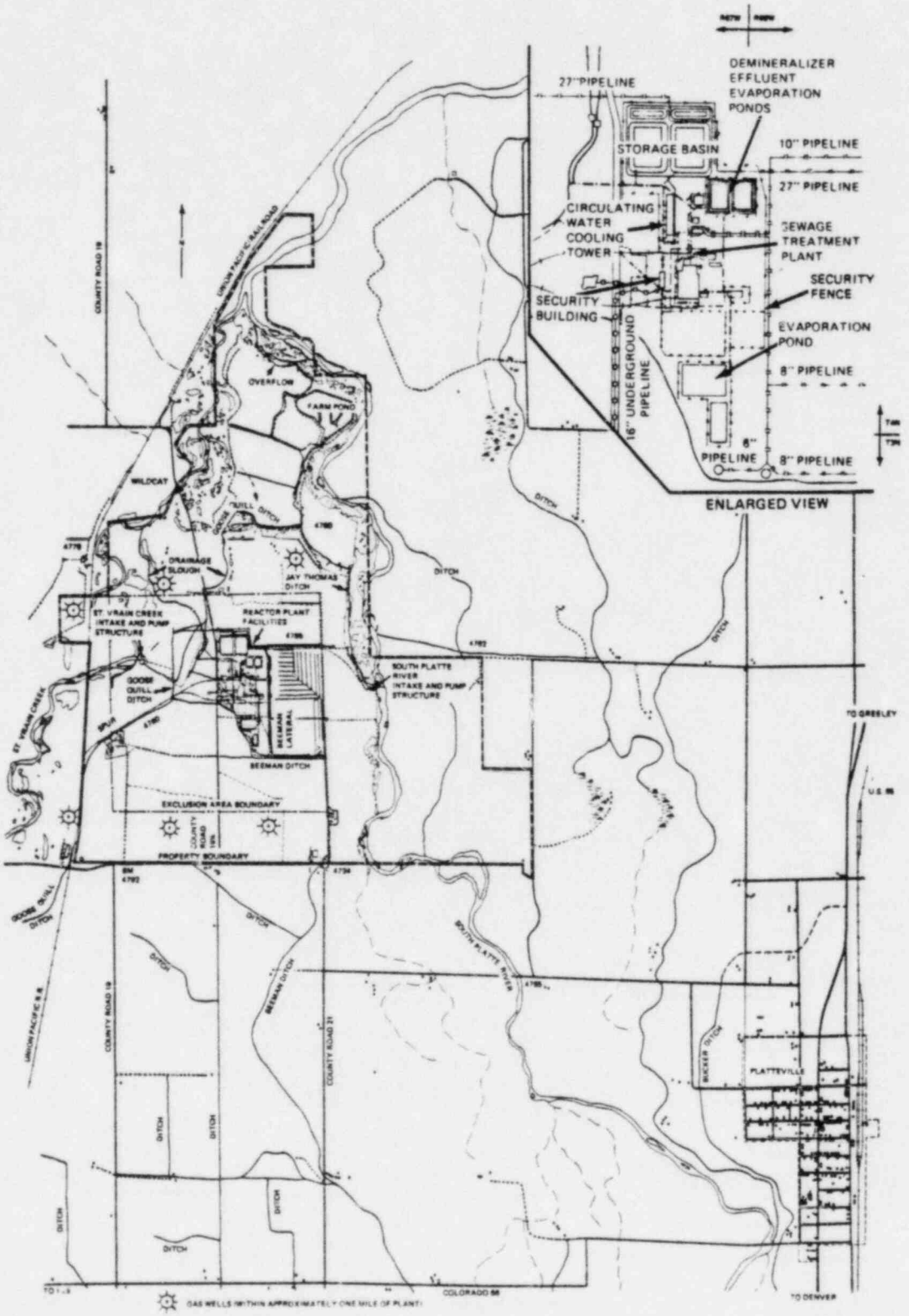

FIGURE 6.3-1

Site of Fort St. Vrain Nuclear
Generating Station

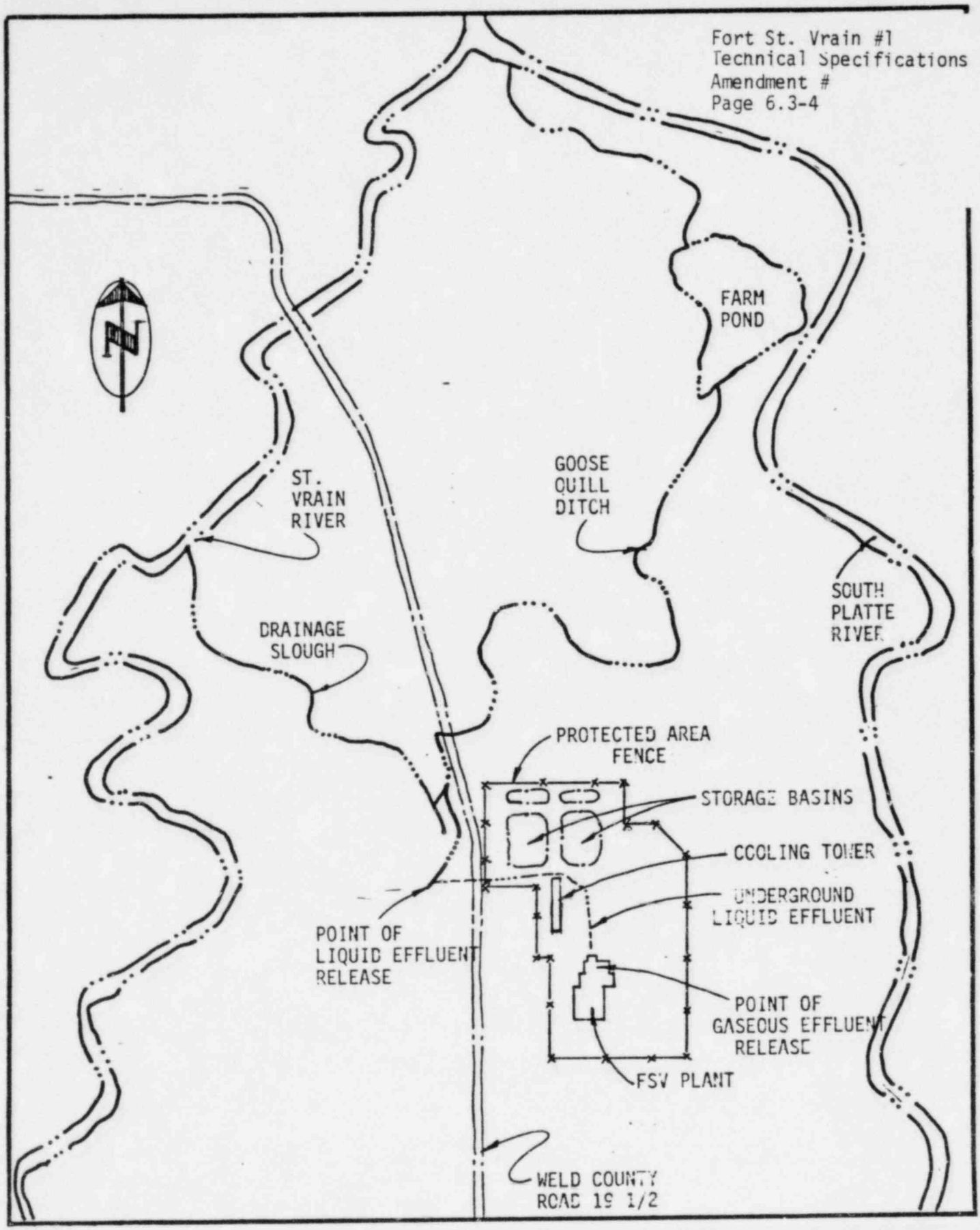

FIGURE 6.3-2

Fort St. Vrain Site Detail

f. Review of events requiring 24-hour notification to the Commission.

g. Review of facility operations to detect potential nuclear safety hazards.

h. Performance of special reviews, investigations and reports thereon as requested by the Chairman of the Nuclear Facility Safety Committee.

i. Review of the Plant Security Plan and implementing procedures and submittal of recommended changes to the Chairman of the Fort St. Vrain Security Committee.

j. Review of the Plant Radiological Emergency Response Plan and implementing procedures.

k. Review of every unplanned on-site release of radioactive material to the environs, including the preparation of reports concerning evaluation, recommendations, and disposition of the corrective action to prevent recurrence and the forwarding of these reports to the Manager, Nuclear Production and the Nuclear Facility Safety Committee (NFSC).

7.5 REPORTING REQUIREMENTS

In addition to the applicable reporting requirements of Title 10, Code of Federal Regulations, the following identified reports shall be submitted to the Director of the appropriate Regional Office of Inspection and Enforcement unless otherwise noted.

7.5.1 Routine Reports

a. Startup Report

A summary report of plant startup and power escalation testing shall be submitted following (1) receipt of an operating license, (2) amendment to the license involving a planned increase in power level, (3) installation of fuel that has a different design or has been manufactured by a different fuel supplier, and (4) modifications that may have significantly altered the nuclear, thermal, or hydraulic performance of the plant. The report shall address each of the tests identified in the FSAR and shall in general include a description of the measured values of the operating conditions or characteristics obtained during the test program and a comparison of these values with design predictions and specifications. Any corrective actions that were required to obtain

satisfactory operation shall also be described. Any additional specific details required in license conditions based on other commitments shall be included in this report.

Startup reports shall be submitted within (1) 90 days following completion of the startup test program, (2) 90 days following resumption or commencement of commercial power operation, or (3) 9 months following initial criticality, whichever is earliest. If the Startup Report does not cover all three events (i.e., initial criticality, completion of startup test program, and resumption or commencement of commercial power operation), supplementary reports shall be submitted at least every three months until all three events have been completed.

b. Annual Occupational Exposure Report

A tabulation on an annual basis of the number of station, utility, and other personnel (including contractors) receiving exposures greater than 100 mrem/year and their associated man-rem exposure according to work and job functions, e.g., reactor operations and surveillance, in-service inspection, routine maintenance, special maintenance (describe maintenance), waste

processing, and refueling. The dose assignment to various duty functions may be estimates based on pocket dosimeter, TLD, or film badge measurements. Small exposures totaling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the whole body dose received from external sources shall be assigned to specific major work functions.

c. Monthly Operating Report

A routine operating report covering the operation of the unit during the previous month shall be submitted prior to the fifteenth calendar day of the following month. Submittal shall be to the Director, Office of Inspection and Enforcement, U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, ATTN: Document Control Desk with a copy to the appropriate NRC Regional Administrator.

Each monthly operating report shall include:

1. A narrative summary of operating experience during the report period relating to safe operation of the facility, including major safety-related maintenance.

2. Report of any single release of radioactivity or radiation exposure which accounts for more than 10% of the allowable annual values.

3. Indications of failed fuel resulting from irradiated fuel examinations, completed during the report period.

4. The monthly statistical information contained in Regulatory Guide 1.16.

d. Annual Radiological Environmental Monitoring Report

A report on the Radiological Environmental Monitoring Program for the previous calendar year shall be submitted to the Director of the Nuclear Regulatory Commission Regional Office (with a copy to the Director, Office of Nuclear Reactor Regulation) as a separate document by May 1 of each year.

The Annual Radiological Environmental Monitoring Reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental monitoring activities for the report period, including a comparison with pre-operational

studies, operational controls (as appropriate), and previous environmental monitoring reports, and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of land-use censuses required by Specification ELCO 8.2-1.

The Annual Radiological Environmental Monitoring Reports shall include the results of analysis of all radiological environmental samples and of all measurements taken during the period pursuant to the Table and Figures in the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November, 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The reports shall also include the following: A summary description of the Radiological Environmental Monitoring Program; at least two legible maps* covering all sampling locations keyed to a table giving distances and directions from the center line of one reactor; the results of licensee participation in the interlaboratory comparison program; and discussion of all analyses in which the lower limits of detection required by Table 8.2-2 was not achievable.

If the Radiological Environmental Monitoring Program is not being conducted as specified in Table 8.2-1, in lieu of a Licensee Event Report, a description of the reasons the program was not conducted as required and the plans for preventing recurrence shall be prepared and submitted to the Nuclear Regulatory Commission in the Annual Radiological Environmental Monitoring Report.

e. Semi-annual Radioactive Effluent Release Report

Routine Radioactive Effluent Release Reports covering the operation of the unit during the previous six months of operation shall be

*One map shall cover stations near the site boundary; a second shall include the more distant stations.

submitted within 60 days after January 1 and July 1 of each year.

The Radioactive Effluent Release Reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit 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.

The Radioactive Effluent Release Report to be submitted within 60 days after January 1 of each year 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 on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric

stability.* 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 (Figure 6.3-1) 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. [For operating reactors, conservative approximate methods are acceptable.] The assessment of radiation doses shall be performed in accordance with the Offsite Dose Calculation Manual (ODCM).

*In lieu of submission with the first half year Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the Nuclear Regulatory Commission upon request.

The Radioactive Effluent Release Report to be submitted 60 days after January 1 of each year shall also include 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 40CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Revision 1, October, 1977.

The Radioactive Effluent Release Reports shall include the following information for each class of solid waste (as defined by 10CFR Part 61) shipped offsite during the report period:

1. Container volume,

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

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

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

5. Type of container (e.g., LSA, Type A, Type B, large quantity), and

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

The Radioactive Effluent Release Reports 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.

The Radioactive Effluent Release Reports shall include any changes made during the reporting period to the Process Control Program (PCP) and to 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 Specification 8.2.1.

The Semi-annual Effluent Radioactive Release Report shall contain a discussion of license initiated major changes to the radioactive waste systems (liquid, gaseous, and solid) and shall

be reported to the Commission in the Semi-annual Radioactive Effluent Release Report for the period in which the evaluation was reviewed by the Plant Operations Review Committee*. The discussion of each change shall contain:

1. A summary of the evaluation that led to the determination that the change could be made in accordance with 10CFR Part 50.59.

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;

*In lieu of submission with the first half year Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shal be provided to the Nuclear Regulatory Commission upon request.

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

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 prior to when the changes are to be made;

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

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

7.5.2 Reportable Occurrences

Reportable occurrences, including corrective actions and measures to prevent recurrence, shall be reported to the NRC. Supplemental reports may be required to fully describe final resolution of occurrence. In case of corrected or supplemental reports, a licensee event report shall be completed

and reference shall be made to the original report date.

a. Prompt Notification With Written Followup

The types of events listed below shall be reported as expeditiously as possible, but within 24 hours by telephone and confirmed by telegraph, mailgram, or facsimile transmission to the appropriate NRC Regional Administrator or his designee no later than the first working day following the event, with a written followup report within two weeks. A copy of the confirmation and the written followup report shall also be sent to the Document Control Desk, U. S. Nuclear Regulatory Commission, Washington, D. C. 20555. The written followup report shall include, as a minimum, a completed copy of a licensee event report form, and shall be supplemented, as needed, by additional narrative material to provide complete explanation of the circumstances surrounding the event.

1. Failure of the reactor protection system or other systems subject to limiting safety-system settings to initiate the required protective function by the time a monitored

parameter reaches the setpoint specified as the limiting safety-system setting in the Technical Specifications or failure to complete the required protective function.

NOTE: Instrument drift discovered as a result of testing need not be reported under this item but may be reportable under items a.5., a.6., or b.1., below.

2. Operation of the unit or affected systems when any parameter or operation subject to a limiting condition is less conservative than the least conservative aspect of the limiting condition for operation established in the Technical Specifications.

NOTE: If specified action is taken when a system is found to be operating between the most conservative and the least conservative aspects of a limiting condition for operation listed in the Technical Specifications, the limiting condition for operation is not considered to have been violated and need not be reported under this item,

but it may be reportable under item b.2. below.

3. Abnormal degradation discovered in fuel cladding or the reactor coolant pressure boundary.

   NOTE: Leakage of valve packing or gaskets within the limits for identified leakage set forth in Technical Specifications need not be reported under this item.

4. Reactivity anomalies, involving disagreement with the predicted value of reactivity balance under steady-state conditions during power operation, greater than or equal to 1% Δk/k; a calculated reactivity balance indicating a shutdown margin less conservative than specified in the Technical Specifications; short-term reactivity increases that correspond to a reactor period of less than 5 seconds or, if sub-critical, an unplanned reactivity insertion of more than 0.5% Δk/k; or occurrence of any unplanned criticality.

5. Failure or malfunction of one or more components which prevents or could prevent,

by itself, the fulfillment of the functional requirements of system(s) used to cope with accidents analyzed in the FSAR.

6. Personnel error or procedural inadequacy which prevents or could prevent, by itself, the fulfillment of the functional requirements of systems required to cope with accidents analyzed in the FSAR.

   NOTE: For items a.5. and a.6. reduced redundancy that does not result in a loss of system function need not be reported under this section but may be reportable under items b.2. and b.3. below.

7. Conditions arising from natural or man-made events that, as a direct result of the event, require plant shutdown, operation of safety systems, or other protective measures required by the Technical Specifications.

8. Errors discovered in the transient or accident analyses, or in the methods used for such analyses as described in the FSAR or in the bases for the Technical Specifications that have or could have

permitted reactor operation in a manner less conservative than assumed in the analyses.

9. Performance of structures, systems, or components that requires remedial action or corrective measures to prevent operation in a manner less conservative than that assumed in the accident analyses in the FSAR or Technical Specifications bases; or discovery during plant life of conditions not specifically considered in the FSAR or Technical Specifications that require remedial action or corrective measures to prevent the existence or development of an unsafe condition.

   NOTE: This item is intended to provide for reporting of potentially generic problems.

b. Thirty Day Written Reports

The reportable occurrences discussed below shall be the subject of written reports to the appropriate NRC Regional Administrator within thirty days of occurrence of the event. A copy of the written report shall also be sent to the Document Control Desk, U. S. Nuclear Regulatory Commission, Washington, D. C. 20555. The

written report shall include, as a minimum, a completed copy of a licensee event report form. Information provided on the licensee event report form shall be supplemented, as needed, by additional narrative material to provide complete explanation of the circumstances surrounding the event.

1. Reactor protection system or engineered safety feature instrument settings which are found to be less conservative than those established by the Technical Specifications, but which do not prevent the fulfillment of the functional requirements of affected systems.

2. Conditions leading to operation in a degraded mode permitted by a limiting condition for operation or plant shutdown required by a limiting condition for operation.

   NOTE: Routine surveillance testing, instrument calibration, or preventative maintenance which require system configurations, as described in items b.1. and b.2., need not be reported except where

test results themselves reveal a degraded mode as described above.

3. Observed inadequacies in the implementation of administrative or procedural controls which threaten to cause reduction of degree of redundancy provided in reactor protection systems or engineered safety feature systems.

4. Abnormal degradation of systems other than those specified in item a.3. above designed to contain radioactive material resulting from the fission process.

NOTE: Sealed sources or calibration sources are not included under this item. Leakage of valve packing or gaskets within the limit for identified leakage set forth in the Technical Specifications need not be reported under this item.

7.5.3 Environmental Qualification

A. By no later than June 30, 1982, all safety-related electrical equipment in the facility shall be qualified in accordance with the provisions of: Division of Operating Reactors

"Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors" (DOR Guidelines; or, NUREG-0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment", December 1979, to the extent applicable to a gas cooled reactor. Copies of these documents are attached to Order for Modification, of License No. DPR-34 dated October 27, 1980.

B. By no later than December 1, 1980, complete and auditible records must be available and maintained at a central location which describe the environmental qualification method used for all safety-related electrical equipment in sufficient detail to document the degree of compliance with the DOR Guidelines or NUREG-0588, to the extent applicable to a gas cooled reactor. Thereafter, such records should be updated and maintained current as equipment is replaced, further tested, or otherwise further qualified.

7.5.4 Non-Routine Radiological Reports

a. Radioactive Gaseous Effluent

1. If the calculated dose from the release of gaseous effluents pursuant to ESR 8.1.1.h) exceeds any of the limits in ELCO 8.1.1.i), in lieu of a Licensee Event Report, 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 will be prepared and submitted to the NRC within 30 days.

2. If gaseous waste is discharged without treatment pursuant to ELCO 8.1.1.c) and in excess of the limits, in lieu of a Licensee Event Report, a special report that includes the following information shall be prepared and submitted to the NRC within 30 days:

(a) Explanation of why gaseous radwaste was being discharged without treatment, 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

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

b. Radioactive Liquid Effluent

1. If the calculated dose from the release of radioactive materials in liquid effluents pursuant to ESR 8.1.2.e) exceeds any of the limits specified in ELCO 8.1.2.g), in lieu of a Licensee Event Report, 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 will be prepared and submitted to the NRC within 30 days.

2. If radioactive liquid waste is discharged without treatment pursuant to ELCO 8.1.2.h), and in excess of the limits, in lieu of a Licensee Event Report, a special report that includes the following information shall be prepared and submitted to the NRC within 30 days:

   (a) Explanation of why liquid radwaste was being discharged without treatment, 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

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

c. Radioactive Effluents - Total Dose

1. If the limits of ELCO 8.1.5.a) have been exceeded, in lieu of a Licensee Event Report, 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 shall be prepared and submitted to the NRC within 30 days. This special report, as defined in 10CFR 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. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40CFR Part 190 has not already been corrected, the special report shall include a request for a variance in accordance with the provisions of 40CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

d. Radiological Environmental Monitoring (ELCO 8.1.1.e))

1. If the level of radioactivity as a result of plant effluents in an environmental sample medium at a specified location exceeds the reporting levels of Table 8.2-3 of ELCO 8.2.1, when averaged over any calendar quarter, in lieu of a Licensee Event Report, pursuant to Specification ELCO 8.2.1.c), 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 such that the potential annual dose to a member of the public is less than the calendar year limits of Specifications ELCO 8.1.1.i) and ELCO 8.1.2.g) will be prepared and submitted to the NRC within 30 days. When more than one of the radionuclides in Table 8.2-3 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{Concentration (1)}}{\text{Reporting Level (1)}} + \frac{\text{Concentration (2)}}{\text{Reporting Level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 8.2-3 are detected and are the result of plant effluents, a 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 ELCO 8.1.1.j and ELCO 8.1.2.g. 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 Monitoring Report.

8.0 RADIOLOGICAL AND ENVIRONMENTAL TECHNICAL SPECIFICATIONS

These Radiological and Environmental Technical Specifications apply to the Fort St. Vrain Nuclear Generating Station Unit No. 1. These specifications address the total environmental monitoring program; the radiological effluent disposal system, and the Radiological Monitoring Program. The administrative controls pertinent to these Technical Specifications are found in Section 7.0, "Administrative Controls."

The following frequently used terms are defined to provide a uniform basis for interpretation of the Technical Specifications.

Alternate Liquid Effluent Discharge Path

Alternate effluent discharge path is the effluent discharge path along the Goosequill Ditch through a drainage slough into the St. Vrain River.

Background

Background is the naturally occurring radiation not attributable to plant operations.

Blowdown

Blowdown is that effluent released from the open circulating water systems to control the concentration of chemical constituents. The release is normally made from the hot water side returning to the cooling towers. Provisions have been made

to facilitate release of the blowdown from the cold water side, leaving the circulating water cooling tower.

Composite Sample

A composite sample is one comprised of two or more individual samples which are combined for purposes of analysis.

Continuous Release

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

Dose Equivalent I-131

The dose equivalent I-131 shall be that concentration of I-131 (microcurie/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites" [or in Table E-7 of Nuclear Regulatory Commission Regulatory Guide 1.109, Revision 1, October, 1977].

Equivalent Curies of Kr-88

The equivalent curies of Kr-88 shall be that quantity of Kr-88 (curies) which alone would produce the same whole body dose as the quantity and isotopic mixture of the noble gas isotopes

actually present. The whole body dose conversion factors for noble gas isotopes are contained in the Offsite Dose Calculation Manual (ODCM).

Exclusion Area

Exclusion area is a one square mile area within the site boundary with the plant located near the center of the area, as defined in Figure 6.3-1.

Member(s) of the Public

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 utility, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

Non-Radioactive Effluent

Non-radioactive effluent is an effluent released from the plant containing only background radioactivity; effluent not released from the plant radioactive effluent treatment system.

Normal Liquid Effluent Discharge Path

Normal effluent discharge path is the effluent discharge path along the Goosequill Ditch, the Jay Thomas Ditch, through the farm pond into the South Platte River.

Offsite Dose Calculation Manual (ODCM)

The Offsite Dose Calculation Manual shall contain the current methodology and parameters used in the calculation of off-site doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program.

Process Control Program (PCP)

The Process Control Program shall contain the current formula, sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10CFR Part 20, 10CFR Part 71, and Federal and State regulations and other requirements governing the disposal of the radioactive waste.

Radioactive Effluent

Radioactive effluent is an effluent released from the plant containing radioactivity above the background level in the environs of the plant.

Representative Sample

To be representative of the quantities and concentrations of radioactive materials in effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream.

Site Boundary

The site boundary shall be that line beyond which the land is neither owned, or leased, nor otherwise controlled by the licensee.

Solidification

Solidification shall be the conversion of wet wastes into a form that meets shipping and burial ground requirements.

Source Check

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

Unrestricted Area

Unrestricted area is the area outside the protected area as defined in Figure 6.3-2.

8.1 RADIOLOGICAL EFFLUENT DISPOSAL SYSTEM

Applicability

Applies to the configuration, characteristics, and surveillance of the radiological effluent disposal system.

Objective

To assure that the quantity of radioactive effluent released from the plant is maintained as low as reasonably achievable and in any event within the limits of 10CFR20 and in accordance with 10CFR50.

The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of these specifications.

Specification ELCO 8.1.1 - Radioactive Gaseous Effluent, Limiting Conditions for Operation

a) Analysis of gaseous effluents from the gas waste surge tanks shall be made on an isotopic basis and releases shall be limited in accordance with the following equation:

$$\Sigma_i r \frac{C_i}{(MPC)_i} \leq 3 \times 10^{10} \frac{cm^3}{sec}$$

Where r is the release rate in std. cc/sec; C_i is the concentration in µCi/std. cc of any radioisotope, i; and $(MPC)_i$ is the maximum permissible concentration of any radioisotope i, as defined in Table II, Column 1, of Appendix B to 10CFR20 and is in units of microcuries per cubic centimeter.

b) For purposes of calculating permissible release rates by the above formula, MPC for halogens and particulates with half-lives longer than eight days will be reduced by a factor of 700 from their listed value in Table II, Column 1, of Appendix B to 10CFR20.

If conditions a) and b) cannot be met, immediate action shall be taken to terminate release from the gas waste system. If conditions a) and b) cannot be met with this termination of gas waste system releases, the reactor shall be shutdown immediately.

c) Except for air ejector discharge, secondary coolant system relief valves, and deaerator vent, all normal releases of gaseous waste from the plant shall be processed through the Reactor Building ventilation exhaust particulate filters and charcoal adsorbers.

d) The maximum amount of gaseous radioactivity in a gas waste surge tank shall not exceed 370 equivalent curies of Kr-88.

If condition d) cannot be met, immediate action shall be taken to terminate any operations which result in the production of radioactive gases for storage in the tank.

e) Prior to the release of gaseous radioactivity from the gas waste surge tanks, the contents shall be sampled and analyzed for tritium, and a gamma spectral analysis shall be performed to determine that releases will be in compliance with conditions a) and b).

f) Under normal operating conditions, tritium from the hydrogen getters shall be disposed of as solid waste on an adsorbent material.

g) At least one Reactor Building exhaust fan shall be operating whenever releases from the gas waste system are taking place.

h) Gaseous radioactive effluents released from the plant shall be continuously monitored and recorded.

1) During power operation and/or a release from the gaseous waste holdup system, one noble gas monitor, one halogen monitor, and one particulate monitor and their associated recorders shall be operable.

2) If the halogen monitor or the particulate monitor or their associated recorder becomes inoperable, gaseous effluent releases from the Reactor Building

ventilation system may continue, provided the effluent stream is continuously monitored with auxiliary sampling equipment.

3) If both noble gas monitors or their recorder become inoperable, gaseous effluent releases from the Reactor Building ventilation system, exclusive of releases from the gas waste holdup system, may continue, provided grab samples are taken at least once per eight hours and these samples are analyzed for gross beta activity within 24 hours, or the release is continuously monitored using auxiliary sampling equipment.

4) If both noble gas monitors or their recorder become inoperable, gaseous effluent releases from the gas waste holdup system may continue, provided that prior to the release:

   (a) Duplicate samples of the gas waste holdup system contents are analyzed per ELCO 8.1.1.e) and

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

5) If the gaseous waste holdup system effluent flow rate measuring devices or the Reactor Building exhaust stack flow rate measuring device becomes inoperable, releases may continue, provided the flow rate is estimated at least once per four hours.

6) If the gas waste header noble gas activity monitor becomes inoperable, gaseous effluent releases may continue, provided a daily grab sample is taken and analyzed within 24 hours for gamma activity or the effluents are diverted to the gas waste surge tank.

i) The air dose due to noble gases released in gaseous effluents at the unrestricted area will be limited to 5 millirad gamma and 10 millirad beta during any calendar quarter and 10 millirad gamma and 20 mrad beta during any calendar year. In addition, the dose to a member of the public due to I-131, tritium, and radioactive particulates with half-lives longer than eight days in gaseous effluents will be limited to 7.5 millirem to any organ during any calendar quarter and 15 millirem to any organ during any calendar year.

j) 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:

For noble gases - less than or equal to 500 millirems per year to the total body and less than or equal to 3,000 millirems per year to the skin.

For I-131, for tritium, and for all radionuclides in particulate form with half-lives greater than eight days - less than or equal to 1,500 millirems per year to any organ.

k) The alarm/trip setpoints of radioactive gaseous effluent activity monitors shall be determined and adjusted in accordance with the Offsite Dose Calculation Manual (ODCM).

Specification ESR 8.1.1 - Radioactive Gaseous Effluent, Surveillance Requirements

a) The gas waste header noble gas activity monitor and exhaust vent monitors shall be channel checked daily, source checked monthly, functionally tested quarterly, and calibrated once per 18 months and following maintenance on the detector system.

b) Automatic vent exhaust high activity blocking and transfer functions of the gaseous waste system, including termination of the Reactor Building

ventilation exhaust, shall be tested prior to each controlled release or once a month, whichever is more frequent.

c) Gaseous waste and reactor plant ventilation system flow recorders and flow indicators shall be channel checked during each release, functionally tested quarterly, and calibrated once per 18 months.

NOTE: The channel functional test shall also demonstrate the 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. Instrument indicates a downscale failure.

4. Instrument controls not set in operate mode.

The initial channel calibration shall be performed using one or more reference standards certified by the National Bureau of Standards (NBS) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its

intended range of energy and measurement. For subsequent channel calibration, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

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.

d) A sample from the gas waste tank in service shall be obtained weekly and a gamma spectral analysis performed as soon as practicable.

e) The on-line vent iodine/particulate monitor filter shall be analyzed for gross alpha activity, gross beta activity, and principal gamma emitting nuclides once per week to determine that releases are in compliance with ELCO 8.1.1.a) and b). Analysis for Sr-89 and Sr-90 will be done when the gross beta activity exceeds three times minimum detectable activity.

f) The on-line vent iodine/particulate monitor charcoal cartridge shall be analyzed for I-131 to determine that releases are in compliance with ELCO 8.1.1.b).

g) The lower limits of detection (LLD) for the radioactive gaseous waste sampling and analysis program shall satisfy the following:

Principle Gamma Emitters (gas)	1×10^{-4} µci/ml
Principle Gamma Emitters (particulate sample)	1×10^{-11} µci/ml
^{3}H (gas)	1×10^{-6} µci/ml
^{131}I (charcoal sample)	1×10^{-12} µci/ml
Gross Alpha (particulate sample)	1×10^{-11} µci/ml
^{89}Sr, ^{90}Sr (particulate sample)	1×10^{-11} µci/ml
Noble Gas Monitor	1×10^{-6} µci/ml

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:

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

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

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

The principal gamma emitters for which the lower limits of detection (LLD) specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. 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 Semi-annual Radioactive Effluent Release Report pursuant to Specification 7.5.1.e.

h) Dose Calculations Cumulative dose contributions for noble gases, I-131, tritium, and radionuclides in particulate form with half-lives longer than eight days for the current calendar quarter and current calendar year, shall be determined in accordance with the ODCM at least once per 31 days and reported to the Nuclear Regulatory Commission as described in Sections 7.5.1 and/or 7.5.4.

Basis for Specification ELCO 8.1.1

The major source of gaseous radioactive waste will be the regeneration of the low temperature filter adsorbers of the helium purification system. The design objective for the plant's radioactive gas releases is 4160 curies per year;

4120 curies of this are predicted to be long-lived Kr-85 (half-life is 10.8 years).

Redundant noble gas, iodine, and particulate monitors are available; during power operations and/or release from the gas waste holdup system, only one of each type of monitor is required to be operational.

The limiting value for radioactive gaseous release is based on (1/annual average dilution factor). The estimated 800 curies per year of tritium evolved from hydrogen getter utilization will normally be disposed of as solid waste. Under unusual conditions, such as a steam generator tube leak, it may be necessary to release the tritium to the atmosphere.

The limitation on the curie inventory of a gas waste surge tank is to limit potential site exclusion radius annual whole body doses to less than 0.5 millirem in the event of a tank rupture.

It is the intent that through these operating limits, the annual releases from this plant will be as low as reasonably achievable. At the same time, the licensee is permitted flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power, even under unusual operation conditions, which may temporarily result in releases higher than small fractions of, but still

within, limits specified in 20.106 of 10CFR20. It is expected that in using this operational flexibility under unusual operating conditions, the licensee will exert his best efforts to keep levels of radioactive material in effluents as low as reasonably achievable.

Specification ELCO 8.1.2 - Radioactive Liquid Effluent, Limiting Conditions for Operation

a) The maximum instantaneous release rate of radioactive liquid effluents from the site shall be such that the concentration of radionuclides in the cooling tower blowdown does not exceed the values specified in Table II, Column 2, of Appendix B to 10CFR20. The corresponding limit for dissolved and entrained gases is 2×10^{-4} microcuries per milliliter. If plant conditions exist such that the concentration of radioactivity in the liquid effluent from the plant exceeds the specified limits, immediate action shall be taken to terminate the release.

b) 1) Prior to release, two representative samples of liquid effluent from the radioactive liquid waste system shall be analyzed for gross alpha activity, gross beta activity, principal gamma emitters, I-131, tritium, dissolved and entrained gases (gamma emitters), and the samples will be analyzed

for other radioisotopes of concern, as identified by previous operating experience.

2) 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:

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

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

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

3) The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137,

Ce-141, and Ce-144 for particulate emissions. 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 Semi-annual Radioactive Effluent Release Report pursuant to Specification AC 7.5.1.e.

c) All liquid effluent releases from the radioactive liquid waste holdup system shall be continuously monitored by two activity monitors and their associated recorder. Equipment shall be operable to automatically terminate the release on high specific activity or low cooling water blowdown flow and give a Control Room alarm.

d) If one or both of the two activity monitors become inoperable, liquid effluent releases may continue, provided that prior to initiating the release, at least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup.

e) If the recorder associated with the two activity monitors becomes inoperable, liquid effluent releases may continue, provided a gamma spectral analysis is performed at least once per four hours during actual releases.

f) If the blowdown flow measuring devices become inoperable, liquid effluent releases may continue, provided the flow rate is estimated at least once per four hours during actual releases.

g) The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released from each reactor unit to unrestricted areas shall be limited as follows:

1) During any calendar quarter to less than or equal to 1.5 millirems to the total body and to less than or equal to 5 millirems to any organ, and

2) During any calendar year to less than or equal to 3 millirems to the total body and to less than or equal to 10 millirems to any organ.

h) The liquid radwaste treatment system shall be utilized to the maximum extent practicable to process radioactive liquids prior to their discharge. Discharge of liquid that has not been treated shall be reported as described in Section 7.5.4.

i) The alarm/trip setpoints of radioactive liquid effluent activity monitors shall be determined and adjusted in accordance with the Offsite Dose Calculation Manual (ODCM).

Specification ESR 8.1.2 - Radioactive Liquid Effluent, Surveillance Requirements

a) The level alarms and pump interlocks on the two liquid waste receiver tanks and monitoring tank shall be tested once per year.

b) The liquid effluent discharge blocking valve shall be functionally tested prior to each release or once a month, whichever is more frequent.

c) The activity monitors of the liquid effluent discharge line and the low cooling water blowdown flow switch shall be functionally tested quarterly. The activity monitors shall be source checked prior to each release and calibrated once per 18 months and following maintenance on the detector system.

d) Flow rate monitors and activity recorders shall be channel checked during each release, functionally tested quarterly, and calibrated once per 18 months.

NOTE: 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. Instrument indicates a downscale failure.

4. Instrument controls not set in operate mode.

The initial channel calibration shall be performed using one or more reference standards certified by the National Bureau of Standards (NBS) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its intended range of energy and measurement. For subsequent channel calibration, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

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.

e) Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the

methodology and parameters in the ODCM at least once per 31 days and reported to the Nuclear Regulatory Commission as described in Section 7.5.1 and/or 7.5.4.

Basis for Specification ELCO 8.1.2

Liquid waste from the radioactive effluent discharge system is diluted in the cooling tower blowdown flow. Interlocks between the waste treatment system discharge valve, the discharge line activity monitors, and the cooling tower blowdown flow meter will terminate the discharge of waste in the event of high activity and/or low blowdown flow.

It is expected that plant releases of radioactive materials and effluents will be small fractions of the limits specified in 10CFR20.106 and will be held as near to background levels as reasonably achievable.

The design objective of the liquid waste treatment system was to limit annual liquid waste discharge from the plant to 0.2 curies (excluding tritium and dissolved noble gas). The liquid waste discharged from the plant will normally flow to a farm pond (Goosequill Pond) on the north end of the Public Service Company property near the confluence of the St. Vrain Creek and the South Platte River. The Goosequill Pond drains to the South Platte River. An alternate flow path is to a slough which drains to the St. Vrain Creek. The operational environmental surveillance program directs special attention to these areas so that

possible buildup of radioactivity will be detected. It is expected that releases of radioactive materials in effluents will be only small fractions of the limits specified in 20.106 of 10CFR20. At the same time, flexibility of operation, compatible with considerations of health and safety, assure that the public is provided a dependable source of power, even under unusual operating conditions which may temporarily result in releases higher than small fractions of, but still within, the limits specified in 20.106 of 10CFR20.

It is expected that, in using this operational flexibility under unusual operating conditions, the licensee will exert his best efforts to keep levels of radioactivity in effluents as low as reasonably achievable.

Specification ELCO 8.1.3 - Reactor Building Sump Effluent, Limiting Conditions for Operation

a) The discharge from the Reactor Building sump pumps shall be continuously sampled, filtered, and the flow limited to less than or equal to 10 gallons per minute when operated in the automatic mode. An analysis shall be performed as soon as practical on the composite sample per ELCO 8.1.2.b).

b) If effluent discharges from the Reactor Building sump at flow rates greater than 10 gallons per minute are to be made, two grab samples shall be taken and analyzed

per ELCO 8.1.2.b) prior to the start of the discharge. During the discharge, the pump outlet shall be continuously sampled. An analysis shall be performed as soon as practical on the sample per ELCO 8.1.2.b).

c) Effluent discharge from the Reactor Building sump shall not occur simultaneously with discharge from the radioactive liquid waste system.

d) All liquid effluent releases from the Reactor Building sump shall be continuously monitored by two activity monitors and their associated recorder. Equipment shall be operable to automatically terminate the release on high specific activity or low cooling water blowdown flow.

e) If one or both of the two activity monitors become inoperable, liquid effluent releases may continue, provided that grab samples are taken every 12 hours and analyzed for principal gamma emitters, I-131, and tritium.

f) If the recorder associated with the two activity monitors becomes inoperable, liquid effluent releases may continue, provided a gamma spectral analysis is performed at least once per four hours during actual releases.

g) If the blowdown flow measuring device becomes inoperable, liquid effluent releases may continue, provided the flow rate is estimated at least once per four hours during actual releases.

h) If the continuous sampler should be inoperable, automatic discharge from the sump would be permitted provided daily samples are taken from the sump and analyses made as soon as practical as described in ELCO 8.1.2.b).

Specification ESR 8.1.3 - Reactor Building Sump Effluent, Surveillance Requirements

a) An analysis per ELCO 8.1.2.b) of the Reactor Building sump composite sample shall be made three times per week.

b) The continuous composite sampler will be channel checked daily, functionally tested quarterly, and calibrated once per 18 months, .

Basis for Specification ELCO 8.1.3

Limiting the discharge flow rate from the Reactor Building sump to less than or equal to 10 gallons per minute provides for effluent monitoring sensitivity to assure conformance with the limits of 10CFR20, in the highly unlikely event that the sump should contain any radioactive liquid.

Sampling and analysis performed prior to discharging from the sump at flow rates greater than 10 gallons per minute and prohibiting discharge to the radioactive liquid waste discharge line simultaneously with a discharge from the radioactive liquid waste system will assure conformance with the limits of 10CFR20.

Specification ELCO 8.1.4 - Solid Radioactive Waste, Limiting Conditions for Operation

The solid radwaste system shall be used in accordance with a Process Control Program, as appropriate, to process wet radioactive wastes to meet shipping and burial ground requirements.

If the provisions of the Process Control Program are not satisfied, shipments of solid radioactive wastes from the site shall be suspended immediately.

Specification ESR 8.1.4 - Solid Radioactive Waste, Surveillance Requirements

The Process Control Program shall be used to verify the solidification of at least one representative test specimen from at least every tenth batch of each type of wet radioactive waste (e.g., filter sludges, spent resins, etc.).

a) If any test specimen fails to verify solidification, the solidification of the batch under test shall be

suspended until such time as additional test specimens can be obtained, alternative solidification parameters can be determined in accordance with the Process Control Program, and a subsequent test verifies solidification. Solidification of the batch may then be resumed using the alternative solidification parameters determined by the Process Control Program.

b) If the initial test specimen from a batch of waste fails to verify solidification, the Process Control Program shall provide for the collection and testing of representative test specimens from each consecutive batch of the same type of wet waste until at least three consecutive initial test specimens demonstrate solidification. The Process Control Program shall be modified as required to assure solidification of subsequent batches of waste.

Specification ELCO 8.1.5 - Total Dose, Limiting Conditions for Operation

a) 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 less than or equal to 25 millirems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 millirems.

b) If the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceed twice the limits of Specification ELCO 8.1.1.i) or ELCO 8.1.2.g), calculations shall be made, including direct radiation contributions from the reactor unit and from outside storage tanks to determine whether the limits of ELCO 8.1.5.a) have been exceeded. The results of these calculations shall be reported to the Nuclear Regulatory Commission as described in Section 7.5.4.

Specification ESR 8.1.5 - Total Dose, Surveillance Requirements

a) Cumulative dose contributions from gaseous and liquid effluents shall be determined in accordance with Specifications ESR 8.1.1 and ESR 8.1.2 and in accordance with the methodology and parameters in the ODCM.

b) Cumulative dose contributions from direct radiation from the reactor unit and from radwaste outside storage tanks shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under the conditions set forth in Specification ELCO 8.1.5.

8.2 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Applicability

Applies to the characteristics and surveillance of the Radiological Environmental Monitoring Program.

Objective

A Radiological Environmental Monitoring Program shall be conducted to provide data on levels of radiation and radioactive material in the site environs. The program shall discriminate between those changes in environmental radiation and radioactivity levels resulting from radioactive releases from the nuclear generating station and those changes attributed to other sources, such as world-wide fallout from weapons testing. The program shall evaluate the relationship between quantities of radioactive material released in liquid and gaseous effluents, and resultant radiation doses to individuals from principal pathways of exposure. The results of this program shall be used to verify the effectiveness of in-plant measures applied to control the release of radioactive materials.

Specification ELCO 8.2.1 - Radiological Environmental Monitoring Program, Limiting Conditions for Operation

a) A Radiological Environmental Monitoring Program shall be conducted in accordance with Table 8.2-1.

b) The radiological environmental monitoring samples shall be collected pursuant to Table 8.2-1 from the specific locations given in the table and figure(s) in the ODCM, and shall be analyzed pursuant to the requirements of Table 8.2-1 and the detection capabilities required by Table 8.2-2.

c) If a confirmed measured radionuclide concentration in an environmental sampling medium averaged over any quarter sampling period exceeds the reporting level given in Table 8.2-3, a special report shall be submitted to the Nuclear Regulatory Commission within 30 days as described in Section 7.5.4.

d) Analytical techniques used shall be such that the detection capabilities in Table 8.2-2 are achieved.

e) Radiological sampling station locations shall be delineated in maps and in written descriptions contained in each Annual Radiological Environmental Monitoring Report. All changes in sampling station locations which occur through the year shall be explained in each annual report.

f) 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 report.

If milk or fresh leafy vegetable samples are unavailable from one or more of the sample locations required by Table 8.2-1, locations for obtaining replacement samples shall be identified and added 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. In lieu of a Licensee Event Report and pursuant to Specification 7.5.1, the cause of the unavailability of samples and the new location(s) for obtaining replacement samples shall be identified in the next Annual Radiological Environmental Monitoring Report. The report shall also include a revised figure(s) and table for the ODCM reflecting the new location(s).

g) Analyses shall be performed on radioactive materials supplied as part of an interlaboratory comparison program that has been approved by the Nuclear Regulatory Commission.

1) If analyses are not being performed as required, corrective actions taken to prevent a recurrence shall be reported to the Nuclear Regulatory

Commission in the Annual Radiological Environmental Monitoring Report.

2) The interlaboratory comparison program shall be described in the ODCM. A summary of the results obtained as part of the above required interlaboratory comparison program shall be included in the Annual Radiological Environmental Monitoring Report.

h) A census shall be conducted annually during the growing season to determine the location of the nearest milk animal and nearest garden greater than 50 square meters (500 square feet) producing broad leaf vegetation in each of the 16 meteorological sectors within a distance of 8 kilometers (5 miles).

1) When the land-use census identifies a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Specification ESR 8.1.1.h), in lieu of a Licensee Event Report, the new location(s) will be identified in the next Semi-annual Radioactive Effluent Release Report, pursuant to Specification 7.5.1.e.

2) If it is learned from this census that the milk animals or gardens are present at a location which yields a calculated dose or dose commitment 20%

greater than those previously calculated, or if the census results in changes in the sampling location, a written report shall be submitted in the next annual report submitted per Specification 7.5.1, identifying the new location (distance and direction). Milk animals or garden locations resulting in 20% higher calculated doses shall be added to the monitoring program within 30 days or as soon as practicable.

3) The sampling location (excluding the control sample location) having the lowest calculated dose may then be dropped from the surveillance program at the end of the grazing or growing season during which the census was conducted. Any location from which milk can no longer be obtained may be dropped from the monitoring program after notifying the Nuclear Regulatory Commission in writing that milk samples are no longer obtainable at that location. The results of the land-use census shall be reported in the annual report submitted per Specification 7.5.1.

Basis for Specification ELCO 8.2.1

A pre-operational environmental radiation surveillance program for the Fort St. Vrain Station environs has been conducted for the Public Service Company of Colorado by Colorado State University. Continuous operation of this program since March of 1969 has provided baseline data which will be utilized as control values for statistical analysis of the results of the operational radiological surveillance program.

These Environmental Technical Specifications specify the requirements for the Radiological Environmental Monitoring Program which will continue to be the responsibility of Public Service Company of Colorado. Additional monitoring in the vicinity of the facility is conducted or coordinated by other organizations, notably the Colorado Department of Health.

The results of the radiological environmental monitoring are intended to supplement the results of the radiological effluent monitoring by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Thus, the specified environmental monitoring program provides measurements of radiation and of radioactive materials in those exposure pathways and for

those radionuclides which lead to the highest potential radiation exposures to individuals resulting from the station operation. Sampling locations were selected on the basis of local meteorological conditions and airborne concentrations calculated from those conditions, proximity to the reactor of residences and communities, and other considerations in accordance with Table 8.2-1. Each radiological environmental monitoring report shall contain a map and tables which present detailed information regarding sampling station locations.

The sampling and collection frequencies indicated in Table 8.2-1 were selected on the basis of filter loading, crop harvest time, calculated potential human doses from plant effluents, and other considerations.

Samples will be analyzed in accordance with Table 8.2-1 for radionuclides which may be attributable to effluents released from the facility. Table 8.2-2 indicates the achievable detection capabilities for environmental sample analysis based upon the instrumentation and analytical procedures utilized.

The requirement for participation in the Environmental Protection Agency cross-check program, or similar program, is based on the need for independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices as part of the

quality assurance program for environmental monitoring, in order to demonstrate that the results are reasonably valid.

The census of milk animals and gardens producing broad leaf vegetation is based on the requirement in Appendix I of 10CFR Part 50 to "Identify changes in the use of unrestricted areas (e.g., for agricultural purposes) to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure." The consumption of milk from animals grazing on contaminated pasture and of leafy vegetation contaminated by airborne radioiodine is a major potential source of exposure. Samples from milk animals are considered a better indicator of radioiodine in the environment than vegetation.

The 50 square meter garden, considering 20% used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and a vegetation yield of 2 kilograms per square meters, will produce the 26 kilograms per year assumed in Regulatory Guide 1.109 for child consumption of leafy vegetation.

TABLE 8.2-1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling Collection Frequency	Type and Frequency of Analysis
AIRBORNE			
Tritium Oxide Radioiodine and Particulates	Samples from seven locations: Four samples from off-site locations (in different sectors) of the highest calculated annual average ground level D/Q and airborne X/Q. One sample from the vicinity of a community having the highest calculated annual average ground level D/Q. Two samples from control locations 15 to 30 kilometers (10 to 20 miles) distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly or as required by dust loading, whichever is more frequent.	Radioiodine Canister: Analyze weekly for I-131 liquid scintillation counting for tritium on water vapor extracted from silica gel on each sample collected. Particulate Sampler: Gross beta radioactivity following filter change, composite (by location) for gamma isotopic quarterly.[a]
DIRECT RADIATION	Forty stations with two or more dosimeters or one instrument for measuring and recording dose rate continuously to be placed as follows: 1) an inner ring of stations in the general area of the site boundary and an outer ring in the 4 to 5 mile range from the site with a station in each sector of each ring (16 sectors x 2 rings = 32 stations). The balance of the stations, eight, shall be placed in special interest areas such as population centers, nearby residences, schools, and in two or three areas to serve as control stations.	Quarterly exposure.	Gamma dose quarterly.

[a]If gross beta activity in air or water is greater than ten times the yearly mean of control sample for any medium, gamma isotopic analysis should be performed on the individual samples.

TABLE 8.2-1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling Collection Frequency	Type and Frequency of Analysis
WATERBORNE			
Surface	One sample upstream, each stream, one sample downstream.	Samples collected monthly.	Gamma isotopic analysis and tritium monthly.
Surface (Farm Pond)	One sample in immediate area of discharge.	Composite sample over one week period. The weekly composites will be combined for the monthly sample.	Gamma isotopic analysis and composite for tritium monthly.
Ground	Samples from two sources most likely to be affected.	Quarterly	Gamma isotopic and tritium.
Drinking	One sample from the nearest water supply which could be affected by facility's discharge. One sample from a control location.	Composite sample over two week period.	Composite for tritium, gross beta, and gamma isotopic analyses every two weeks.
Sediment from Shoreline	One sample from downstream area with existing or potential recreational value.	Semi-annually	Gamma isotopic analyses semi-annually.
INGESTION			
Milk	Samples from milking animals in all locations, up to a total of three locations, within 5 kilometers.	Semi-monthly when animals are on pasture, monthly at other times.	Gamma isotopic and I-131 analysis semi-monthly when animals are on pasture; monthly at other times.

TABLE 8.2-1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling Collection Frequency	Type and Frequency of Analysis
Milk (Cont'd)	One sample from milking animals in each of three areas btween 5 to 8 kilometers distnt having the highest dose potential.[b]		
	One sample from milking animals at a control location (15 to 30 kilometers distant and in the least prevalent wind direction).	Semi-monthly when animals are on pasture, monthly at other times.	Gamma isotopic and I-131 analysis semi-monthly when animals are on pasture; monthly at other times.
Aquatic Biota	Sample fish in vicinity of discharge point, upstream and downstream.	Sample semi-annually.	Gamma isotopic analyses.
Food Products	One sample of each principal class of food products from any area which is irrigated by water in which liquid plant wastes have been discharged.	At time of harvest.	Gamma isotopic analyses.

[b] The dose shall be calculated for the maximum organ and age group using the methodology contained in Regulatory Guide 1.109 and the actual parameters particular to the site.

TABLE 8.2-2

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

LOWER LIMIT OF DETECTION[a]

Analysis	Water (pCi/ℓ)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/ℓ)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4	1×10^{-2}				
^{3}H	2000					
^{95}Zr	30					
^{131}Nb	15					
^{131}I	1[b]	7×10^{-2}		1	60	
^{134}Cs	15	5×10^{-2}	130	15	60	150
^{137}Cs	18	6×10^{-2}	150	18	80	180
^{54}Mn	15		130			
^{59}Fe	30		260			
^{58}, ^{60}Co	15		130			
^{65}Zn	30		260			
^{140}Ba	60			60		
^{140}La	15			15		

NOTE: This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

[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:

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

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

Δt for plant effluents is the elapsed time between the midpoint of sample collection 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 LLD's 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 LLD's unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Monitoring Report pursuant to Specification 7.5.1.d of Appendix A of the Fort St. Vrain Technical Specifications.

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

TABLE 3.2-3

REPORTING LEVELS FOR NONROUTINE OPERATING REPORTS

REPORTING LEVEL (RL)

Analysis	Water (pCi/ℓ)	Airborne Particulate of Gas (pCi/m³)	Fish (pCi/kg, wet)	Milk (pCi/ℓ)	Broad Leaf Vegetation (pCi/kg, wet)
^{3}H	2×10^{4}[a]				
^{54}Mn	1×10^{3}		3×10^{4}		
^{59}Fe	4×10^{2}		1×10^{4}		
^{58}Co	1×10^{3}		3×10^{4}		
^{60}Co	3×10^{2}		1×10^{4}		
^{65}Zn	3×10^{2}		2×10^{4}		
^{95}Zr, Nb	4×10^{2}				
^{131}I	2	0.9		3	1×10^{2}
^{134}Cs	30	10	1×10^{3}	60	1×10^{3}
^{137}Cs	50	20	2×10^{3}	70	2×10^{3}
^{140}Ba, La	2×10^{2}			3×10^{2}	

[a] For drinking water samples. This is 40CFR Part 141 value.

ATTACHMENT 3

PROCEDURE DRAFTS:

OFFSITE DOSE CALCULATION MANUAL (ODCM)

AND

PROCESS CONTROL PROGRAM

TITLE: OFFSITE DOSE CALCULATION MANUAL

ISSUANCE AUTHORIZED BY			
PORC REVIEW			EFFECTIVE DATE

1.0 PURPOSE

This Offsite Dose Calculational Manual (ODCM) provides the information and methodologies to be used by Fort St. Vrain (FSV) to assure compliance with FSV's Technical Specifications related to liquid and gaseous radiological effluents. They are intended to show compliance with 10 CFR 20, 10 CFR 50.361, 10 CFR 50, Appendix A (GDC 60 & 64) and Appendix I, and 40 CFR 190.

This ODCM is based on "Radiological Effluent Technical Specifications for PWR's (NUREG-0472, Draft)," "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (NUREG-0133)," and other inputs from the Nuclear Regulatory Commission (USNRC). Specific plant procedures for implementation of this manual are provided elsewhere. These procedures will be utilized by the operating staff of FSV to assure compliance with the Technical Specifications.

Also included in this manual is information related to the Radiological Environmental Monitoring Program (REMP) in ATTACH. RPAP-2F. This attachment designates specific sample types and locations currently used to satisfy the Technical Specification requirements for the REMP. They are subject to change based on the results of the periodic land use census.

This ODCM has been prepared as generically as possible in order to minimize the need for future revisions. Some changes to the ODCM will be needed in the future. Any such changes will be properly reviewed and approved as indicated in the Administrative Control Section of the FSV Technical Specifications.

2.0 APPLICABILITY

This procedure is applicable to all routine, planned liquid and gaseous effluent releases made pursuant to the FSV Technical Specifications.

3.0 GENERAL

The Radiation Protection Manager (RPM) shall be responsible to assure that the ODCM is utilized in accordance with the FSV Technical Specifications. The RPM is also responsible for ensuring that all radioactive waste is handled, stored, and disposed of in accordance with NRC Requirements and FSV procedures.

4.0 PROCEDURE

4.1 LIQUID EFFLUENTS

4.1.1 Monitor Alarm Setpoint Determination

Monitor alarm setpoints will be determined in order to assure compliance with 10CFR20. The setpoints will indicate if the concentration of radionuclides in the liquid effluent at the site boundary exceeds the concentrations specified in 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. The setpoints will also assure that a concentration of 2×10^{-4} µCi/ml for dissolved or entrained noble gases is not exceeded.

a) Liquid Waste Activity Monitors

Monitor alarm setpoints will be calculated prior to each batch release from the liquid waste monitor tank or receivers. Prior to release, the contents of the tank to be released shall be passed through the liquid waste activity monitors, and the monitors' response documented. The monitor response (CPM) will be correlated with the gamma isotopic analysis performed prior to each released (µci/cc) to arrive at a monitor sensitivity (µci/cc/cpm) for each release. Having obtained an observed count rate above background for the liquid to be released, the monitor alarm setpoint will be set at 25% above the observed count rate to avoid spurious trips. In all cases, it will be determined prior to release that this 25% increase will not results in exceeding the MPC of the unrestricted area.

For continuous releases from the Reactor Building Sump, the liquid waste activity monitor setpoints will be determined based on an NBS traceable ^{131}I isotopic calibration of the monitors. Based on the sensitivity of the monitor (µci/cc/cpm), a monitor response (cpm) corresponding to the unrestricted area MPC will be determined. The alarm setpoint for continuous Reactor Building Sump releases will be obtained by reducing the above response by a factor of 5. This is done in the interest of ALARA.

b) Multiple Release Points

All liquid waste from FSV is discharged via a common line. FSV Technical Specifications prohibit simultaneous releases from the Liquid Waste System and the reactor building sump. All releases are monitored by the Liquid Waste Activity monitors. There are therefore no multiple release points and monitor settings do not have to be reduced to account for multiple releases.

4.1.2 Compliance With 10 CFR 20

In order to show compliance with 10 CFR 20, the concentrations of radionuclides in liquid effluents will be determined and compared with maximum permissable concentrations (MPC) as defined in Appendix B, Table II of 10 CFR 20 (Reference 5.2). Concentrations of radioactivity in effluents prior to dilution will be determined. Concentration in diluted effluent will be calculated using these results prior to each batch release, and following each batch release.

a) Batch Releases

1. Prerelease

The radioactivity content of each batch release will be determined prior to release. FSV will show compliance with 10 CFR 20 in the following manner:

The concentration of the various radionuclides in the batch release prior to dilution, is divided by the minimum dilution flow to obtain the concentration at the unrestricted area. This calculation is shown in the following equation:

$$Conc_i = \frac{C_i \ R}{MDF} \qquad (4.5)$$

where:

$Conc_i$ = Concentration of radionuclide i at the unrestricted area, µCi/ml;

C_i = Concentration of radionuclide i in the potential batch release, µCi/ml,

R = Release rate of the batch, gpm;

MDF = Minimum dilution flow, gpm.

The projected concentration in the unrestricted area is compared to the concentrations in Appendix B, Table II of 10 CFR 20. These concentrations are given in Table 4.1-1. Before a release may occur, equation 4.6 must be met for all isotopes. For FSV the MDF is 1,100 gpm. The maximum release rate is 10 gpm.

$$\sum_i \left| \frac{\bar{}\ Conc_i\ \bar{}}{MPC_i} \right| \leq 1 \qquad (4.6)$$

where

MCP_i = Maximum permissible concentration of radionuclide i from Table 4.1-1 and REFERENCE 5.2, µCi/ml.

4.1.3 Liquid Effluent Doses - Compliance with 10 CFR 50

Doses resulting from liquid effluents will be calculated monthly to show compliance with 10 CFR 50. A cumulative summation of total body and organ doses for each calendar quarter and calendar year will be maintained as well as projected doses for the next month.

a) Determination of Liquid Effluent Dilution

To determine doses from liquid effluents the near field average dilution factor for the period of release must be calculated. This dilution factor must be calculated for each batch release. The dilution factor is determined by:

$$F_k = \frac{R_k}{X\ ADF_k} \qquad (4.7)$$

where:

R_k = Release rate of the batch during time period k, gpm;

ADF_k = Actual dilution flow during the time period of release k, gpm.

The value of X is the site specific value for the mixing effect of the FSV discharge structure. This value is 1.0 for FSV.

b) Dose Calculations

The dose contribution from the release of liquid effluents will be calculated monthly. The dose contribution will be calculated using the following equation:

$$D_\tau = \sum_k \sum_i A_{i\tau}\, t_k\, C_{ik}\, F_k \qquad (4.8)$$

where:

D_τ = The dose commitment to the total body or any organ, from the liquid effluents for the 31 day period, mrem;

C_{ik} = The average concentration of radionuclide, i, in undiluted liquid effluent for the release k, μCi/ml;

$A_{i\tau}$ = The site related ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter, mrem/hr per μCi/ml;

F_k = The near field average dilution factor for C_{ik} during liquid effluent release k, as defined in Section 4.1.3 a)

t_k = The length of time for release k, hours

The dose factor $A_{i\tau}$ was calculated for an adult for each isotope using the following equation:

$$A_{i\tau} = 1.14 \times 10^5 \ (21BF_i) \ DF_{i\tau} \qquad (4.9)$$

where

$$1.14 \times 10^5 = 10^6 \frac{pCi}{\mu Ci} \times 10^3 \frac{ml}{l} \times \frac{1 \ yr;}{8760 \ hr}$$

21 = Adult fish consumption, kg/yr;

BF_i = Bioaccumulation factor for radionuclide i in fish from Table A-1 of Regulatory Guide 1.109 Rev. 1, pCi/Kg per pCi/l; (REFERENCE 5.3)

$DF_{i\tau}$ = Dose conversion factor for radionuclide i for adults for particular organ τ from Table E-11 of REFERENCE 5.2, mrem/pCi.

$A_{i\tau}$ values for an adult at FSV are present in ATTACH. RPAP-2A. The potable water pathway does not exist at FSV. Therefore, the potable water term was excluded from the calculation of $A_{i\tau}$ values.

c) Cumulation of Doses

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results should be added to the doses cumulated from the other months in the quarter of interest and in the year of interest. The following relationships should hold:

For the quarter,

Dose < 1.5 mrem total body

Dose < 5 mrem any organ

For the Calendar year,

Dose < 3 mrem total body

Dose < 10 mrem any organ

The quarterly limits given above represent one half of the annual design objective. If these quarterly or annual limits are exceeded, a special report should be submitted stating the reason and corrective action to be taken. If twice these limits are exceeded, a special report will be submitted showing compliance with 40 CFR 190.

4.2 GASEOUS EFFLUENTS

4.2.1 Monitor Alarm Setpoint Determination

Monitor alarm setpoints will be determined in order to assure compliance with 10CFR20. The setpoints will indicate if the dose rate at or beyond the site boundary due to noble gas radionuclides in the gaseous effluent released from the site exceeds 500 mrem/year to the whole body or exceeds 3000 mrem/year to the skin.

Monitor alarm setpoints will be calculated for the Reactor Building Exhaust Stack Noble Gas monitors once per month. These calculations will be based on the noble gas isotopes in releases made during the previous month.

a) Reactor Building Exhaust Stack Noble Gas Monitors

The following method applies to gaseous releases via the Reactor Building Exhaust Stack when determining the alarm setpoint for the Reactor Building Exhaust Stack Noble Gas Monitors which initiate isolation of Reactor Building releases.

1) Batch Releases

The monitors will be calibrated using an NBS traceable ^{85}Kr gas stream. Utilizing this method, the sensitivity (µci/cc/cpm) of the monitors will be established. The expected count rate (cpm) for the monitors from a batch gas waste release will be determined based on the isotopic analysis of the tank to be released (µci/cc) and the monitor sensitivity (µci/cc/cpm). Having obtained the expected count rate above background for the gas to be released, the monitor alarm set point will be set at 25% above the expected count rate to avoid spurious trips. In all cases it wil be determined prior to release that this 25% increase will not result in exceeding the MPC at the unrestricted area.

The gas waste header noble gas activity monitor wil be calibrated with an NBS traceable ^{85}Kr gas stream. Based on the monitor sensitivity (µci/cc/cpm) and the MPC's of the noble gas isotopes which the monitor would detect (µci/cc), a setpoint (cpm) will be determined so that the MPC at the unrestricted area will not be exceeded.

4.2.2 Gaseous Effluent Dose Rate - Compliance with 10CFR20

Dose rates resulting from the release of noble gases, and radioiodines and particulates must be calculated to show compliance with 10CFR20. The limits of 10CFR20 are conservatively applied on an instantaneous basis at the hypothetical worst case location.

a) Noble Gases

The dose rate in unrestricted areas resulting from noble gas effluents is limited to 500 mrem/yr to the total body and 3000 mrem/yr to the skin. The set point determinations discussed in the previous section are based on the dose calculational method presented in NUREG-0133 (REFERENCE 5.4). They represent a backward solution to the limiting dose equations in NUREG-0133. Setting alarm set trip points in this manner will assure that the limits of 10 CFR 20 are met for noble gas releases. Therefore, no routine dose calculations for noble gases will be needed to show compliance with this part. Routine calculations will be made for doses from noble gas releases to show compliance with 10 CFR 50, Appendix I.

b) Radioiodine and Particulates and Other Radionuclides

The dose rate in unrestricted areas resulting from the release of radioiodines and particulates with half lives greater than 8 days is limited to 1500 mrem/yr to any organ. The calculation of dose rate from radioiodines and particulates will be performed weekly for all releases. The calculations will be based on the the results of analyses obtained pursuant to the FSV Technical Specifications. To show compliance with 10 CFR 20, Equation 4.15 will be evaluated for I-131, tritium, and radioactive particulates with half lives greater than eight days.

$$\sum_{i} P_i \left| \left(X/Q_s \right) Q_{is} \right| < 1500 \text{ mrem/yr} \qquad (4.15)$$

where:

P_i = Infant critical organ dose parameter for radionuclide i for the inhalation pathway mrem/yr per µCi/m³ (ATTACH. RPAP-2D);

$(X/S)_s$ = Annual average relative concentration for long-term releases from the stack at the critical location, sec/m³

Q_{is} = The release rate of radionuclide i from the stack for the week of interest, µCi/sec.

Dose calculations using Equation 4.15 will be made once per week. The source term Q_{is} will be determined from the results of analysis of weekly reactor stack particulate filters and charcoal cartridges. These source terms include all gaseous releases from FSV. They will be recorded and reported as the total dose for compliance with 10 CFR 20.

4.2.3 Gaseous Effluents - Compliance with 10 CFR 50

Doses resulting from the release of noble gases, and radioiodines and particulates must be calculated to show compliance with Appendix I of 10 CFR 50. The calculations will be performed monthly for all gaseous effluents.

a) Noble Gas

1. Dose Equations

The air dose at the critical receptor due to noble gases released in gaseous effluents is determined by Equations 4.16 and 4.17.

For gamma radiation:

$$3.17 \times 10^{-8} \sum_i \left\{ M_i \left| (X/Q)_s \cdot \bar{Q}_{is} \right| \right\} \quad (4.16)$$

< 5 mrad for any calendar quarter
< 10 mrad for any calendar year

For beta radiation:

$$3.17 \times 10^{-8} \sum_i \left\{ N_i \left| (X/Q)_s \bar{Q}_{is} \right| \right\} \quad (4.17)$$

< 10 mrad for any calendar quarter
< 20 marad for any calendar year

where:

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$, from ATTACH. RPAP-2C;

N_i = The air dose factor due to beta emissions for each identifed noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$, from ATTACH. RPAP-2C;

$(X/Q)_s$ = The annual average relative concentration for areas at or beyond the site boundary for stack releases (= 1.37×10^{-6} scc/m^3 from ATTACH. RPAP-2B)

3.17×10^{-8} = The inverse of the number of seconds in a year.

2. Cumulation of Doses

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results will be added to the doses cumulated from the other months in the quarter of interest and in the year of interest and compared to the limits given in Equations 4.16 and 4.17. If these limits are exceeded, a Special Report will be submitted to the USNRC in accordance with the FSV Technical Specifications. If twice the limits are exceeded, a Special Report showing compliance with 40 CFR 190 will be submitted.

b) Radioiodine, Particulates, and Other Radionuclides

1. Dose Equations

The worst case dose to an individual from I-131, tritium, and radioactive particulates with half-lives greater than eight days in gaseous effluents released to unrestricted areas is determined by the following expressions:

During any calendar quarter or year:

$$3.17 \times 10^{-8} \sum_{j} \sum_{i} R_{ijak} \left| W_s \bar{Q}_{is} \right|$$

$$< 7.5 \text{ mrem (per quarter)}$$
$$< \text{mrem (per calendar year)} \qquad (4.18)$$

where:

Q_{is} = Release of radionuclide i for stack releases, μCi;

W_s = Dispersion parameter (X/Q or D/Q depending on pathway) for estimating dose to an individual from stack releases;

3.17×10^{-8} = The inverse of the number of seconds in a year;

R_{ijak} = The dose factor for each identified radionuclide i, pathway j, age group a, and organ k, m^2 mrem/yr per Ci/sec or merem/yr per $\mu Ci/m^3$ (REFERENCE 5.3).

The above equation will be applied to each combination of age group and organ. Values of R_{ijak} have been calculated using the methodology given in NUREG-0133 and are given in ATTACH. RPAP-2E. The equation will be applied to a controlling location which will be one of the following: residence, vegetable garden, meat animal, milk animal. The selection of the receptor is discussed in Section 4.2.3.c.

2. Cumulation of Doses

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results will be added to the doses cumulated from the other months in the quarter of interest and in the year of interest and compared with the limits in Equation 4.18. If these limits are exceeded, a Special Report will be submitted in accordance with the FSV Technical Specifications. If twice the limits are exceeded, a Special Report showing compliance with 40 CFR 190 will be submitted.

c) Critical Receptor Identification

The critical receptors for compliance with 10 CFR 50, Appendix I will be identified. For the noble gas specification the critical location will be based on the external dose pathway only. This location will be the off-site location with the highest X/Q and will be selected using the X/Q values given in (ATTACH. RPAP-2B). This location will be that used for showing compliance with 10 CFR 20 and remain the same unless meteorological data is re-evaluated or the site boundary changes.

The critical location for the radioiodine and particulate pathway will be selected once per year. This selection will follow the annual land use census performed within 5 miles of FSV. Each of the following locations will be evaluated as potential critical receptors:

1. Residences in each sector

2. Vegetable garden producing leafy green vegetables

3. All identified milk animal locations.

The critical receptor will be selected based on this evaluation. Following the annual survey, doses will be calculated using Equation 4.18 for all newly identified receptors and those receptors whose characteristics have changed significantly. The calculation will include appropriate information shown to exist at each location. The dispersion parameters given in this manual should be employed. The total releases reported for the previous calendar year should be used as the source term.

4.3 INFORMATION RELATED TO 40 CFR 190 and 40 CFR 141

The Technical Specifications require that when the calculated doses associated with the effluent releases exceed twice the limits of any section, the licensee shall prepare and submit a Special Report to the Commission and limit subsequent releases such that the dose or dose commitment to a real individual from all uranium fuel cycle sources if limited to < 25 mrem to the total body or any organ (except the thyroid, which is limited to < 75 mrem) over 12 consecutive months. This Special Report is to include an analysis which demonstrates that radiation exposures to all real individuals from all uranium fuel cycle sources (including all liquid and gaseous effluent pathways and direct radiation) are less than the standards in 40 CFR Part 190, Environmental Radiation Protection STandards for Nuclear Power Operations. If analysis indicates that releases resulting in doses that exceed the 40 CFR 190 Standard may have occurred, then a variance from the Commission to permit such releases will be requested or if possible, action will be taken to reduce subsequent releases. The Technical Specifications consider doses to a real individual and apply to each reactor but do not include any other portion of the uranium fuel cycle or direct shine from the reactor.

The "Uranium fuel cycle" is defined in 40 CFR Part 190.02(b) as:

> "Uranium fuel cycle means the operations of milling of uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel, and reprocessing of spent uranium fuel, to the extent that these directly support the production of electrical power for public use utilizing nuclear energy, but excludes mining operations, operations at waste disposal sites, transportation of any radioactive material in support of these operations, and the reuse of recovered non-uranium special nuclear and by-product materials from the cycle."

For the purposes of this ODCM, gas-cooled nuclear power plants shall be construed to be part of the "Uranium Fuel Cycle".

The Special Report will contain:

1) A determination of which uranium fuel cycle facilities or operations, in addition to the nuclear power reactor units at the site, contribute to the annual dose to the maximum exposed member of the public. Nuclear fuel facilities over five miles from FSV need not be considered in this determination.

2) A determination of the maximum exposed member of the public.

3) A determination of the total annual dose to this person from all existing pathways and sources of radioactive effluents and direct radiation using the methodologies described in this ODCM. Where additional information on pathways and nuclides is needed, the best available information will be used and documented.

4) A determination of the dose resulting from direct radiation from the plant and storage facilities.

The total body and organ doses resulting from liquid effluents from FSV will be summed with the doses resulting from releases of noble gases, radioiodines and particulates. These doses will be based upon releases from FSV during the past 3 quarters and from the quarter in which twice the specification was exceeded. The doses from FSV will be summed with the doses to the maximum exposed individual contributed from other operation of the uranium fuel cycle. The direct dose components will be determined by either calculation or actual measurement.

4.4 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

4.1.1 Sampling

ATTACH. RPAP-2F specifies the current sampling locations based on the latest land use census.

If it is learned from an annual census that milk animals or gardens are present at a location which yields a calculated thyroid dose greater than those previously sampled, the new milk animal or garden locations resulting in higher calculated doses shall be added to the surveillance program as soon as practicable. Sample locations (except the control) having lower calculated doses may be dropped from the program at the end of the grazing or growing season (October 31) to keep the total number of sample locations constant.

4.4.2 Interlaboratory Comparison Program

Analyses shall be performed on radioactive samples supplied by the EPA crosscheck program. This program involves the analyses of samples provided by a control laboratory and comparison of results with those of the control laboratory as well as with other laboratories which receive portions of the same samples. Media used in this program (air, milk, water, etc.) may be limited to those found in the radiation environmental monitoring program. The results of analyses performed as a part of the crosscheck program shall be included in the Annual Radiological Environmental Monitoring Report.

5.0 REFERENCES

5.1 FSV FSAR

5.2 10CFR20

5.3 RG 1.109, "Calculation of Annual Doses to man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I", October 1977.

5.4 NUREG - 0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October, 1978.

6.0 ATTACHMENTS

RPAP-2A	$A_{i\tau}$ Values for Fort St. Vrain
RPAP-2B	Annual Average Dilution Factors for FSV
RPAP-2C	Dose Factors for FSV
RPAP-2D	P_i Values for an Infant for FSV
RPAP-2E	R Values for FSV
RPAP-2F	Radiological Environmental Monitoring Program Sampling Site Descriptions

A. VALUES FOR FORT ST. VRAIN
$A_{i\tau}$ (MREM/HR PER µCI/ML)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
1H 3	0.00E-01	1.47E 00	1.47E 00	1.47E 00	1.47E 00	1.47E 00	1.47E 00
6C 14	3.13E 04	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03
11NA 24	4.27E 02	4.27E 02	4.27E 02	4.27E 02	4.27E 02	4.27E 02	4.27E 02
24CR 51	0.00E-01	0.00E-01	1.31E 00	1.90E-01	2.39E-01	1.73E 00	3.28E 02
25MN 54	0.00E-01	4.43E 03	8.45E 02	0.00E-01	1.32E 03	0.00E-01	1.36E 04
25MN 56	0.00E-01	1.11E 02	1.98E 01	0.00E-01	1.42E 02	0.00E-01	3.56E 03
26FE 55	6.91E 02	4.77E 02	1.11E 02	0.00E-01	0.00E-01	2.66E 02	2.74E 02
26FE 59	1.09E 03	2.56E 03	9.83E 02	0.00E-01	0.00E-01	7.16E 02	8.54E 03
27CO 58	0.00E-01	9.80E 01	2.20E 02	0.00E-01	0.00E-01	0.00E-01	1.99E 03
28NI 63	3.27E 04	2.26E 03	1.10E 03	0.00E-01	0.00E-01	0.00E-01	4.72E 02
28NI 65	1.33E 02	1.72E 01	7.87E 00	0.00E-01	0.00E-01	0.00E-01	4.37E 02
29CU 64	0.00E-01	1.10E 01	5.15E 00	0.00E-01	2.76E 01	0.00E-01	9.34E 02
30ZN 65	2.32E 04	7.39E 04	3.34E 04	0.00E-01	4.94E 04	0.00E-01	4.66E 04
30ZN 69	4.94E 01	9.46E 01	6.58E 00	0.00E-01	6.14E 01	0.00E-01	1.42E 01
35BR 83	0.00E-01	0.00E-01	4.09E 01	0.00E-01	0.00E-01	0.00E-01	5.89E 01
35BR 84	0.00E-01	0.00E-01	5.30E 01	0.00E-01	0.00E-01	0.00E-01	4.16E-04
35BR 85	0.00E-01	0.00E-01	2.18E 00	0.00E-01	0.00E-01	0.00E-01	1.02E-15
37RB 86	0.00E-01	1.01E 05	4.72E 04	0.00E-01	0.00E-01	0.00E-01	2.00E 04
37RB 38	0.00E-01	2.90E 02	1.54E 02	0.00E-01	0.00E-01	0.00E-01	4.01E-09
37RB 89	0.00E-01	1.92E 02	1.35E 02	0.00E-01	0.00E-01	0.00E-01	1.12E-11
38SR 89	2.58E 04	0.00E-01	7.40E 02	0.00E-01	0.00E-01	0.00E-01	4.14E 03
38SR 90	6.35E 05	0.00E-01	1.56E 05	0.00E-01	0.00E-01	0.00E-01	1.83E 04
38SR 91	4.75E 02	0.00E-01	1.92E 01	0.00E-01	0.00E-01	0.00E-01	2.26E 03
38SR 92	1.80E 02	0.00E-01	7.78E 00	0.00E-01	0.00E-01	0.00E-01	3.57E 03
39Y 90	6.90E-01	0.00E-01	1.35E-02	0.00E-01	0.00E-01	0.00E-01	7.32E 03
39Y 92M	6.52E-03	0.00E-01	2.53E-04	0.00E-01	0.00E-01	0.00E-01	1.92E-02
39Y 91	1.01E 01	0.00E-01	2.70E-01	0.00E-01	0.00E-01	0.00E-01	5.57E 03
39Y 92	6.06E-02	0.00E-01	1.77E-03	0.00E-01	0.00E-01	0.00E-01	1.06E 03
39Y 93	1.92E-01	0.00E-01	5.31E-03	0.00E-01	0.00E-01	0.00E-01	6.10E 03
40ZR 95	6.02E-01	1.93E-01	1.31E-01	0.00E-01	3.03E-01	0.00E-01	6.11E 02
40ZR 97	3.32E-02	6.71E-03	3.07E-03	0.00E-01	1.01E-02	0.00E-01	2.08E 03
41NB 95	4.47E 02	2.49E 02	1.34E 02	0.00E-01	2.46E 02	0.00E-01	1.51E 06
42ND 99	0.00E-01	1.54E 02	2.94E 01	0.00E-01	3.50E 02	0.00E-01	3.58E 02
43TC 99M	1.19E-02	3.34E-02	4.25E-01	0.00E-01	5.07E-01	1.63E-02	1.97E 01
42TC101	1.21E-02	1.75E-02	1.72E-01	0.00E-01	3.15E-01	8.94E-03	5.26E-14
44RU103	6.63E 00	0.00E-01	2.86E 00	0.00E-01	2.53E 01	0.00E-01	7.74E 02
44RU105	5.52E-01	0.00E-01	2.18E-01	0.00E-01	7.13E 00	0.00E-01	3.38E 02
44RU106	9.85E 01	0.00E-01	1.25E 01	0.00E-01	1.90E 02	0.00E-01	6.39E 03
47AG110M	2.78E 00	2.57E 00	1.53E 00	0.00E-01	5.06E 00	0.00E-01	1.05E 03
52TE125M	2.60E 03	9.41E 02	3.48E 02	1.81E 02	1.06E 04	0.00E-01	1.04E 04
52TE127M	6.56E 03	2.35E 03	8.00E 02	1.68E 03	2.67E 04	0.00E-01	2.20E 04
52TE127	1.07E 02	3.83E 01	2.31E 01	1.90E 01	4.34E 02	0.00E-01	3.42E 03
52TE129M	1.11E 04	4.16E 03	1.76E 03	3.83E 03	4.65E 04	0.00E-01	5.61E 04

$A_{i\tau}$ VALUES FOR FORT ST. VRAIN
(MREM/HR PER µCI/ML)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
52TE129	3.04E 01	1.14E 01	7.42E 00	2.34E 01	1.29E 02	0.00E-01	2.30E 01
52TE131M	1.68E 03	8.20E 02	6.83E 02	1.30E 03	8.31E 03	0.00E-01	3.14E 04
52TE131	1.91E 01	7.98E 00	6.03E 00	1.57E 01	8.37E 01	0.00E-01	2.70E 00
52TE132	2.44E 03	1.58E 03	1.48E 03	1.75E 03	1.52E 04	0.00E-01	7.47E 04
53I 130	3.61E 01	1.07E 02	4.21E 01	9.03E 03	1.66E 02	0.00E-01	9.18E 01
53I 131	1.99E 02	2.84E 02	1.63E 02	9.32E 04	4.88E 02	0.00E-01	7.50E 01
53I 132	9.70E 00	2.60E 01	9.08E 00	9.08E 02	4.13E 01	0.00E-01	4.88E 00
53I 133	6.79E 01	1.18E 02	3.60E 01	1.74E 04	2.06E 02	0.00E-01	1.06E 02
53I 134	5.07E 00	1.38E 01	4.92E 00	2.39E 02	2.19E 01	0.00E-01	1.20E-02
53I 135	2.12E 01	5.54E 01	2.05E 01	3.66E 03	8.89E 01	0.00E-01	6.26E 01
55CS134	2.99E 05	7.10E 05	5.81E 05	0.00E-01	2.30E 05	7.63E 04	1.24E 04
55CS136	3.12E 04	1.23E 05	8.88E 04	0.00E-01	6.86E 04	9.41E 03	1.40E 04
55CS137	3.83E 05	5.23E 05	3.43E 05	0.00E-01	1.78E 05	5.90E 04	1.01E 04
55CS138	2.65E 02	5.23E 01	2.59E 02	0.00E-01	3.84E 02	3.80E 01	2.23E-03
56BA139	2.08E 00	1.48E-03	6.10E-02	0.00E-01	1.39E-03	8.41E-04	3.69E 00
56BA140	4.36E 02	5.47E-01	2.85E 01	0.00E-01	1.86E-01	3.13E-01	8.97E 02
56BA141	1.01E 00	7.64E-04	3.41E-02	0.00E-01	7.10E-04	4.34E-04	4.77E-10
57LA140	1.79E-01	9.04E-02	2.39E-02	0.00E-01	0.00E-01	0.00E-01	6.64E 03
57LA142	9.18E-03	4.18E-03	1.04E-03	0.00E-01	0.00E-01	0.00E-01	3.05E 01
58CE141	1.34E-01	9.04E-02	1.03E-02	0.00E-01	4.20E-02	0.00E-01	3.46E 02
58CE143	2.36E-02	1.74E 01	1.93E-03	0.00E-01	7.67E-03	0.00E-01	6.51E 02
58CE144	6.97E 00	2.91E 00	3.74E-01	0.00e-01	1.73E 00	0.00E-01	2.36E 03
59PR143	6.60E-01	2.65E-01	3.27E-02	0.00E-01	1.53E-01	0.00E-01	2.89E 03
59PR144	2.16E-03	8.97E-04	1.10E-04	0.00E-01	5.06E-04	0.00E-01	3.11E-10
60ND147	4.51E-01	5.22E-01	3.12E-02	0.00E-01	3.05E-01	0.00E-01	2.50E 03
74W 187	2.97E 02	2.48E 02	8.68E 01	0.00E-01	0.00E-01	0.00E-01	8.13E 04
93NP239	4.26E-02	4.19E-03	2.31E-03	0.00e-01	1.31E-02	0.00E-01	8.60E 02

AVERAGE ANNUAL DILUTION FACTORS FOR FSV

DILUTION FACTORS (10^{-7} SEC/M^3)

Wind Direction	590 m	8000 m	16 km	22.5 km	f( )	Corrected for "calm" 590 m	8000 m	16 km	22.5 km
N	13.33	0.3138	0.0919	0.0508	17.02	13.71	0.3227	0.0945	0.0522
NNE	7.29	0.1716	0.0503	0.0278	8.40	7.51	0.1767	0.0518	0.0286
NE	7.49	0.1764	0.0517	0.0285	7.44	7.70	0.1812	0.0531	0.0293
ENE	7.61	0.1792	0.0515	0.0290	6.48	7.82	0.1841	0.0539	0.0298
E	6.34	0.1493	0.0438	0.0242	5.83	6.52	0.1535	0.0450	0.0248
ESE	4.65	0.1094	0.0321	0.0177	4.10	4.79	0.1127	0.0330	0.0182
SE	6.01	0.1414	0.0414	0.0229	5.00	6.18	0.1455	0.0426	0.0235
SSE	5.91	0.1391	0.0408	0.0225	4.94	6.08	0.1432	0.0420	0.0232
S	8.22	0.1936	0.0567	0.0313	6.18	8.44	0.1987	0.0582	0.0322
SSW	9.27	0.2183	0.0640	0.0353	7.00	9.60	0.2260	0.0662	0.0366
SW	9.82	0.2312	0.0677	0.0374	7.78	10 11	0.2379	0.0697	0.0385
WSW	5.18	0.1220	0.0357	0.0197	5.26	5.33	0.1256	0.0368	0.0204
W	3.16	0.0744	0.0218	0.0120	3.96	3.25	0.0766	0.0244	0.0124
WNW	1.93	0.0454	0.0133	0.0073	2.96	1.98	0.0467	0.0137	0.0076
NW	2.56	0.0611	0.0194	0.0107	3.51	2.90	0.0683	0.0200	0.0110
NNW	2.70	0.0870	0.0255	0.0141	4.14	3.81	0.0896	0.0263	0.0145

DOSE FACTORS FOR FSV

Radio-nuclide	Total Body Dose Factor K_i (mrem/yr per $\mu Ci/m^3$)	Skin Dose Factor L_i (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor M_i (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor N_i (mrad/yr per $\mu Ci/m^3$)
Kr-83m	7.56E-02**	--------	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.336E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

**7.56E-02 = 7.56 x 10

P_i VALUES FOR AN INFANT FOR FSV

Isotope	Inhalation	Ground Plane	Cow Milk	Goat Milk
H-3	6.47E2	0	2.38E3	4.86E3
P-32	2.03E6	0	1.60E11	1.93E11
Cr-51	1.28E4	6.67E6	4.79E6	5.65E5
Mn-54	1.00E6	1.09E9	3.89E7	4.68E6
Fe-59	1.02E6	3.92E8	3.93E8	5.11E6
Co-58	7.77E5	5.29E8	6.0[illegible]7	7.28E6
Co-60	4.51E6	4.40E9	2.10E8	2.52E7
Zn-65	6.47E5	6.89E8	1.90E10	2.29E9
Rb-86	1.90E5	1.28E7	2.22E10	2.67E9
Sr-89	2.03E6	3.16E4	1.27E10	2.66E10
Sr-90	4.09E7	-	1.21E11	2.55E11
Y-91	2.45E6	1.52E6	5.26E6	6.32E5
Zr-95	1.75E6	3.48E8	8.28E5	9.95E4
Nb-95	4.79E5	1.95E8	2.06E8	2.48E7
Ru-103	5.52E5	1.55E8	1.05E5	1.27E4
Ru-106	1.16E7	2.99E8	1.44E6	1.73E5
Ag-110m	3.67E6	3.14E9	1.46E10	1.75E9
Te-127m	1.31E6	1.18E5	1.04E9	1.24E8
Te-129m	1.68E6	2.86E7	1.40E9	1.68E8
Cs-134	7.03E5	2.81E9	6.79E10	2.04E11
Cs-136	1.35E5	2.13E8	5.76E9	1.73E10
Cs-137	6.12E5	1.15E9	6.02E10	1.81E11
Ba-140	1.60E6	2.94E7	2.41E8	2.89E7
Ce-141	5.17E5	1.98E7	1.37E7	1.65E6
Ce-144	9.84E6	5.84E7	1.33E8	1.60E7
I-131	1.48E7	2.46E7	1.06E12	1.27E12
I-132	1.69E5	1.78E6	1.39E2	1.64E2
I-133	3.56E6	3.54E6	9.80E9	1.18E10
I-135	6.96E5	3.67E6	2.27E7	2.68E7

Units are mrem/yr per $\mu Ci/m^3$ for H-3 and the inhalation pathway and mrem/yr per $\mu Ci/sec$ per m^{-2} for the food and ground plane pathways.

R VALUES FOR FSV*

PATHWAY = GROUND

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
CR 51	4.66E 06	4.66E 06	4.66E 06	4.66E 06	4.66E 06	4.66E 06	4.66E 06	5.51E 06
MN 54	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.57E 09
FE 59	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	3.23E 08
CO 58	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	4.44E 08
CO 60	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.52E 10
ZN 65	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	8.61E 08
SR 89	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.58E 04
ZR 95	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.89E 08
I 131	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	2.09E 07
I 133	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	3.00E 06
CS134	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	7.96E 09
CS 136	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.69E 08
CS137	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.20E 10
BA140	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.34E 07
CE141	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.53E 07

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = VEGET
AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.28E 03	2.28E 03	0.00E-01	2.28E 03	2.28E 03	2.28E 03	2.28E 03	2.28E 03
CR 51	4.60E 04	1.16E 07	0.00E-01	0.00E-01	1.01E 04	2.75E 04	6.10E 04	0.00E-01
MN 54	5.83E 07	9.36E 08	0.00E-01	3.05E 08	9.09E 07	0.00E-01	0.00E-01	0.00E-01
FE 59	1.12E 08	9.75E 08	1.24E 08	2.93E 08	0.00E-01	0.00E-01	8.17E 07	0.00E-01
CO 58	6.17E 07	6.07E 08	0.00E-01	2.99E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	3.67E 08	3.12E 09	0.00E-01	1.66E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	5.77E 08	8.04E 08	4.01E 08	1.28E 09	8.54E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	2.87E 08	1.60E 09	1.00E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.64E 11	1.93E 10	6.70E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.51E 05	1.17E 09	1.16E 06	3.71E 05	5.82E 05	0.00E-01	0.00E-01	0.00E-01
I 131	6.61E 07	3.04E 07	8.07E 07	1.15E 08	1.98E 08	3.78E 10	0.00E-01	0.00E-01
I 133	1.12E 06	3.30E 06	2.11E 06	3.67E 06	6.40E 06	5.39E 08	0.00e-01	0.00E-01
CS134	8.83E 09	1.89E 08	4.54E 09	1.08E 10	3.49E 09	0.00E-01	1.16E 09	0.00E-01
CS136	1.19E 08	1.88E 07	4.19E 07	1.66E 08	9.21E 07	0.00E-01	1.26E 07	0.00E-01
CS137	5.94E 09	1.76E 08	6.63E 09	9.07E 09	3.08E 09	0.00E-01	1.02E 09	0.00E-01
BA140	8.40E 06	2.64E 08	1.28E 08	1.61E 05	5.47E 04	0.00E-01	9.22E 04	0.00E-01
CE141	1.48E 04	4.99E 08	1.93E 05	1.31E 05	6.07E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV

PATHWAY = VEGET
AGE GROUP EQUALS TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.61E 03	2.61E 03	0.00E-01	2.61E 03	2.61E 03	2.61E 03	2.61E 03	2.61E 03
CR 51	6.11E 04	1.03E 07	0.00E-01	0.00E-01	1.34E 04	3.39E 04	8.72E 04	0.00E-01
MN 54	8.79E 07	9.09E 08	0.00E-01	4.43E 08	1.32E 08	0.00E-01	0.00E-01	0.00E-01
FE 59	1.60E 08	9.78E 08	1.77E 08	4.14E 08	0.00E-01	0.00E-01	1.30E 08	0.00E-01
CO 58	9.79E 07	5.85E 08	0.00E-01	4.25E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	5.57E 08	3.22E 09	0.00E-01	2.47E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	8.68E 08	7.88E 08	5.36E 08	1.86E 09	1.19E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	4.36E 08	1.81E 09	1.52E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	2.05E 11	2.33E 10	8.32E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	3.68E 05	1.23E 09	1.69E 06	5.35E 05	7.86E 05	0.00E-01	0.00E-01	0.00E-01
I 131	5.77E 07	2.13E 07	7.68E 07	1.07E 08	1.85E 08	3.14E 10	0.00E-01	0.00E-01
I 133	1.01E 06	2.51E 06	1.96E 06	3.32E 06	5.83E 06	4.64E 08	0.00E-01	0.00E-01
CS134	7.54E 09	2.02E 08	6.90E 09	1.62E 10	5.16E 09	0.00E-01	1.97E 09	0.00E-01
CS136	1.13E 08	1.35E 07	4.28E 07	1.68E 08	9.16E 07	0.00E-01	1.44E 07	0.00E-01
CS137	4.90E 09	2.00E 08	1.06E 10	1.41E 10	4.78E 09	0.00E-01	1.86E 09	0.00E-01
BA140	8.88E 06	2.12E 08	1.38E 08	1.69E 05	5.72E 04	0.00E-01	1.14E 05	0.00E-01
CE141	2.12E 04	5.29E 08	2.77E 05	1.85E 05	8.70E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = VEGET
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.04E 03	4.04E 03	0.00E-01	4.04E 03	4.04E 03	4.04E 03	4.04E 03	4.04E 03
CR 51	1.16E 05	6.15E 06	0.00E-01	0.00E-01	1.76E 04	6.44E 04	1.18E 05	0.00E-01
MN 54	1.73E 08	5.44E 08	0.00E-01	6.49E 08	1.82E 08	0.00E-01	0.00E-01	0.00E-01
FE 59	3.17E 08	6.62E 08	3.93E 08	6.36E 08	0.00E-01	0.00E-01	1.84E 08	0.00E-01
CO 58	1.92E 08	3.66E 08	0.00E-01	6.27E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.11E 09	.208E 09	0.00E-01	3.76E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.70E 09	4.81E 08	1.03E 09	2.74E 09	1.73E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	1.03E 09	1.40E 09	3.62E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.49E 11	1.86E 10	1.38E 12	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	7.44E 05	8.71E 08	3.80E 06	8.35E 05	1.20E 06	0.00E-01	0.00E-01	0.00E-01
I 131	8.16E 07	1.28E 07	1.43E 08	1.44E 08	2.36E 08	4.75E 10	0.00E-01	0.00E-01
I 133	1.67E 06	1.78E 06	3.57E 06	4.42E [illegible]	7.36E 06	8.21E 08	0.00E-01	0.00E-01
CS134	5.40E 09	1.38E 08	1.56E 10	2.56E 10	7.93E 09	0.00E-01	2.84E 09	0.00E-01
CS136	1.43E 08	7.77E 06	8.04E 07	2.21E 08	1.18E 08	0.00E-01	1.76E 07	0.00E-01
CS137	3.52E 09	1.50E 08	2.48E 10	2.39E 10	7.78E 09	0.00E-01	2.80E 09	0.00E-01
BA140	1.61E 07	1.40E 08	2.76E 08	2.42E 05	7.87E 04	0.00E-01	1.44E 05	0.00E-01
CE141	4.75E 04	3.99E 08	6.42E 05	3.20E 05	1.40E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = MEAT
AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.27E 02	3.27E 02	0.00E-01	3.27E 02	3.27E 02	3.27E 02	3.27E 02	3.27E 02
CR 51	3.26E 03	8.21E 05	0.00E-01	0.00E-01	7.19E 02	1.95E 03	4.33E 03	0.00E-01
MN 54	8.98E 05	1.44E 07	0.00E-01	4.71E 06	1.40E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	1.12E 08	9.73E 08	1.24E 08	2.92E 08	0.00E-01	0.00E-01	8.16E 07	0.00E-01
CO 58	1.95E 07	1.76E 08	0.00E-01	8.68E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	8.87E 07	7.55E 08	0.00E-01	4.02E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	3.06E 08	4.27E 08	2.13E 08	6.78E 08	4.53E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	4.12E 06	2.30E 07	1.43E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.76E 09	2.07E 08	7.17E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.94E 05	9.07E 08	8.92E 05	2.86E 05	4.49E 05	0.00E-01	0.00E-01	0.00E-01
I 131	4.33E 06	1.99E 06	5.28E 06	7.55E 06	1.29E 07	2.48E 09	0.00E-01	0.00E-01
I 133	1.13E-01	3.34E-01	2.14E-01	3.72E-01	6.49E-01	5.46E 01	0.00E-01	0.00E-01
CS134	6.68E 08	1.43E 07	2.32E 08	8.17E 08	2.64E 08	0.00E-01	8.78E 07	0.00E-01
CS136	1.61E 07	2.53E 06	5.65E 06	2.23E 07	1.24E 07	0.00E-01	1.70E 06	0.00E-01
CS137	4.33E 08	1.28E 07	4.83E 08	6.61E 08	2.24E 08	0.00E-01	7.46E 07	0.00E-01
BA140	9.01E 05	2.83E 07	1.38E 07	1.73E 04	5.87E 03	0.00E-01	9.89E 03	0.00E-01
CE141	4.96E 02	1.67E 07	6.47E 03	4.38E 03	2.03E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = MEAT
AGE GROUP EQUALS TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.95E 02	1.95E 02	0.00E-01	1.95E 02	1.95E 02	1.95E 02	1.95E 02	1.95E 02
CR 51	2.61E 03	4.39E 05	0.00E-01	0.00E-01	5.72E 02	1.45E 03	3.73E 03	0.00E-01
MN 54	7.12E 05	7.37E 06	0.00E-01	3.59E 06	1.07E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	8.95E 07	5.48E 08	9.93E 07	2.32E 08	0.00E-01	0.00E-01	7.31E 07	0.00E-01
CO 58	1.54E 07	9.22E 07	0.00E-01	6.69E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	7.03E 07	4.06E 08	0.00E-01	3.12E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.43E 08	2.20E 08	1.50E 08	5.20E 08	3.33E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	3.47E 06	1.44E 07	1.21E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.15E 09	1.30E 08	4.64E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.55E 05	5.20E 08	7.15E 05	2.25E 05	3.31E 05	0.00E-01	0.00E-01	0.00E-01
I 131	3.30E 06	1.22E 06	4.38E 06	6.14E 06	1.06E 07	1.79E 09	0.00E-01	0.00E-01
I 133	9.25E-02	2.30E-01	1.79E-01	3.03E-01	5.32E-01	4.23E 01	0.00E-01	0.00E-01
CS134	2.98E 08	7.99E 06	2.73E 08	6.42E 08	2.04E 08	0.00E-01	7.78E 07	0.00E-01
CS136	1.16E 07	1.40E 06	4.41E 06	1.73E 07	9.44E 06	0.00E-01	1.49E 06	0.00E-01
CS137	1.86E 08	7.59E 06	4.01E 08	5.34E 08	1.82E 08	0.00E-01	7.06E 07	0.00E-01
BA140	7.33E 05	1.75E 07	1.14E 07	1.39E 04	4.72E 03	0.00E-01	9.37E 03	0.00E-01
CE141	4.17E 02	1.04E 07	5.43E 03	3.63E 03	1.71E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = MEAT
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.36E 02	2.36E 02	0.00E-01	2.36E 02	2.36E 02	2.36E 02	2.36E 02	2.36E 02
CR 51	4.07E 03	2.16E 05	0.00E-01	0.00E-01	6.17E 02	2.26E 03	4.12E 03	0.00E-01
MN 54	1.09E 06	3.45E 06	0.00E-01	4.11E 06	1.15E 06	0.00e-01	0.00E-01	0.00E-01
FE 59	1.42E 08	2.97E 08	1.76E 08	2.85E 08	0.00E-01	0.00E-01	8.26E 07	0.00E-01
CO 58	2.39E 07	4.56E 07	0.00E-01	7.82E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.09E 08	2.05E 08	0.00E-01	3.70E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	3.72E 08	1.05E 08	2.25E 08	5.99E 08	3.77E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	6.55E 06	8.87E 06	2.29E 08	0.00e-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.52E 09	8.08E 07	6.00E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.48E 05	2.91E 08	1.27E 06	2.79E 05	3.99E 05	0.00E-01	0.00E-01	0.00E-01
I 131	4.65E 06	7.29E 05	8.14E 06	8.19E 06	1.34E 07	2.71E 09	0.00E-01	0.00E-01
I 133	1.55E-01	1.66E-01	3.32E-01	4.11E-01	6.85E-01	7.63E 01	0.00E-01	0.00E-01
CS134	1.67E 08	4.26E 06	4.81E 08	7.90E 08	2.45E 08	0.00E-01	8.78E 07	0.00E-01
CS136	1.35E 07	7.34E 05	7.60E 06	2.09E 07	1.11E 07	0.00E-01	1.66E 06	0.00E-01
CS137	1.04E 08	4.43E 06	7.38E 08	7.07E 08	2.30E 08	0.00E-01	8.29E 07	0.00E-01
BA140	1.22E 06	1.06E 07	2.10E 07	1.84E 04	5.98E 03	0.00E-01	1.10E 04	0.00E-01
CE141	7.57E 02	6.36E 06	1.02E 04	5.10E 03	2.24E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = COW MILK
AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
CR 51	1.32E 04	3.32E 06	0.00E-01	0.00E-01	2.91E 03	7.90E 03	1.78E 04	0.00E-01
MN 54	8.25E 05	1.32E 07	0.00E-01	4.32E 06	1.29E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	1.25E 07	1.09E 08	1.39E 07	3.26E 07	0.00e-01	0.00E-01	9.10E 06	0.00E-01
CO 58	5.03E 06	4.55E 07	0.00E-01	2.24E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.93E 07	1.65E 08	0.00E-01	8.77E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.18E 09	1.65E 09	8.21E 08	2.61E 09	1.75E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	1.97E 07	1.10E 08	6.85E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	6.62E 09	7.80E 08	2.70E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	9.72E 01	4.55E 05	4.48E 02	1.44E 02	2.25E 02	0.00E-01	0.00E-01	0.00E-01
I 131	1.19E 08	5.49E 07	1.45E 08	2.08E 08	2.57E 08	6.82E 10	0.00E-01	0.00E-01
I 133	1.05E 06	3.09E 06	1.98E 06	3.44E 06	6.01E 06	5.06E 08	0.00E-01	0.00E-01
CS134	5.74E 09	1.23E 08	2.95E 09	7.02E 09	2.27E 09	0.00E-01	7.54E 08	0.00E-01
CS136	3.55E 08	5.60E 07	1.25E 08	4.93E 08	2.74E 08	0.00E-01	3.76E 07	0.00E-01
CS137	3.66E 09	1.08E 08	4.09E 09	5.59E 09	1.90E 09	0.00E-01	6.31E 08	0.00E-01
BA140	8.43E 05	2.65E 07	1.29E 07	1.62E 04	5.49E 03	0.00E-01	9.25E 03	0.00E-01
CE141	1.71E 02	5.78E 06	2.24E 03	1.51E 03	7.02E 02	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = COW MILK
AGE GROUP EQUALS TEEN

NUCLIDE !!!st;_!x	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.00E 03	1.00E 03	0.00E-01	1.00E 03	1.00E 03	1.00E 03	1.00E 03	1.00E 03
CR 51	2.31E 04	3.88E 06	0.00E-01	0.00E-01	5.06E 03	1.28E 04	3.30E 04	0.00E-01
MN 54	1.43E 06	1.48E 07	0.00E-01	7.20E 06	2.15E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	2.18E 07	1.34E 08	2.42E 07	5.65E 07	0.00E-01	0.00E-01	1.78E 07	0.00E-01
CO 58	8.70E 06	5.21E 07	0.00E-01	3.78E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	3.35E 07	1.94E 08	0.00E-01	1.49E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.04E 09	1.85E 09	1.26E 09	4.38E 09	2.80E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	3.62E 07	1.50E 08	1.26E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	9.42E 09	1.07E 09	3.81E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.70E 02	5.70E 05	7.83E 02	2.47E 02	3.63E 02	0.00E-01	0.00E-01	0.00E-01
I 131	1.98E 08	7.31E 07	2.64E 08	3.69E 08	6.36E 08	1.08E 11	0.00E-01	0.00E-01
I 133	1.87E 06	4.64E 06	3.61E 06	6.13E 06	1.08E 07	8.56E 08	0.00E-01	0.00E-01
CS134	5.60E 09	1.50E 08	5.12E 09	1.21E 10	3.83E 09	0.00E-01	1.46E 09	0.00E-01
CS136	5.62E 08	6.73E 07	2.13E 08	8.37E 08	4.55E 08	0.00E-01	7.18E 07	0.00E-01
CS137	3.44E 09	1.40E 08	7.42E 09	9.87E 09	3.36E 09	0.00e-01	1.30E 09	0.00E-01
BA140	1.50E 06	3.58E 07	2.32E 07	2.84E 04	9.65E 03	0.00E-01	1.91E 04	0.00E-01
CE141	3.14E 02	7.83E 06	4.10E 03	2.74E 03	1.29E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = COW MILK
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.58E 03	1.58E 03	0.00E-01	1.58E 03	1.58E 03	1.58E 03	1.58E 03	1.58E 03
CR 51	4.71E 04	2.50E 06	0.00E-01	0.00E-01	7.14E 03	2.61E 04	4.77E 04	0.00E-01
MN 54	2.87E 06	9.04E 06	0.00E-01	1.08E 07	3.02E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	4.52E 07	9.45E 07	5.61E 07	9.08E 07	0.00E-01	0.00E-01	2.63E 07	0.00E-01
CO 58	1.77E 07	3.37E 07	0.00E-01	5.77E 06	0.00E-01	0.00e-01	0.00E-01	0.00E-01
CO 60	6.81E 07	1.28E 08	0.00E-01	2.31E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	4.10E 09	1.16E 09	2.47E 09	6.59E 09	4.15E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	8.93E 07	1.21E 08	3.13E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.63E 10	8.68E 08	6.44E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	3.56E 02	4.17E 05	1.82E 03	4.00E 02	5.72E 02	0.00E-01	0.00E-01	0.00E-01
I 131	3.66E 08	5.73E 07	6.40E 08	6.44E 08	1.06E 09	2.13E 11	0.00E-01	0.00E-01
I 133	4.11E 06	4.38E 06	8.78E 06	1.09E 07	1.81E 07	2.02E 09	0.00E-01	0.00E-01
CS134	4.09E 09	1.05E 08	1.18E 10	1.94E 10	6.01E 09	0.00E-01	2.16E 09	0.00E-01
CS136	8.53E 08	4.63E 07	4.80E 08	1.32E 09	7.02E 08	0.00E-01	1.05E 08	0.00E-01
CS137	2.52E 09	1.07E 08	1.79E 10	1.71E 10	5.57E 09	0.00E-01	2.00E 09	0.00E-01
BA140	3.27E 06	2.84E 07	5.60E 07	4.91E 04	1.60E 04	0.00E-01	2.93E 04	0.00E-01
CE141	7.47E 02	6.28E 06	1.01E 04	5.03E 03	2.21E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = COW MILK
AGE GROUP EQUALS INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.40E 03	2.40E 03	0.00E-01	2.40E 03	2.40E 03	2.40E 03	2.40E 03	2.40E 03
CR 51	7.46E 04	2.17E 06	0.00E-01	0.00E-01	1.06E 04	4.87E 04	9.47E 04	0.00E-01
MN 54	4.54E 06	7.36E 06	0.00E-01	2.00E 07	4.44E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	7.21E 07	8.74E 07	1.05E 08	1.83E 08	0.00E-01	0.00E-01	5.41E 07	0.00E-01
CO 58	2.88E 07	2.88E 07	0.00E-01	1.15E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.11E 08	1.12E 08	0.00E-01	4.71E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	5.26E 09	9.63E 09	3.32E 09	1.14E 10	5.53E 09	0.00E-01	0.00E-01	0.00E-01
SR 89	1.70E 08	1.22E 08	5.94E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00e-01
SR 90	1.79E 10	8.75E 08	7.01E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	5.58E 02	3.92E 05	3.23E 03	7.87E 02	8.48E 02	0.00E-01	0.00E-01	0.00E-01
I 131	6.92E 08	5.62E 07	1.34E 09	1.57E 09	1.84E 09	5.17E 11	0.00E-01	0.00E-01
I 133	7.91E 06	4.57E 06	1.85E 07	2.70E 07	3.17E 07	4.91E 09	0.00E-01	0.00E-01
CS134	3.59E 09	9.65E 07	1.90E 10	3.55E 10	9.14E 09	0.00E-01	3.75E 09	0.00E-01
CS136	1.03E 09	4.19E 07	9.37E 08	2.76E 09	1.10E 09	0.00E-01	2.25E 08	0.00E-01
CS137	2.37E 09	1.04E 08	2.85E 10	3.34E 10	8.96E 09	0.00E-01	3.63E 09	0.00E-01
BA140	5.94E 06	2.83E 07	1.15E 08	1.15E 08	2.74E 04	0.00E-01	7.08E 04	0.00E-01
CE141	1.44E 03	6.30E 06	2.00E 04	1.22E 04	3.76E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = GOATMILK
AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVERKIDNEY	THYROID	LUNG	SKIN	
H 3	1.57E 03	1.57E 03	0.00E-01	1.57E 03	1.57E 03	1.57E 03	1.57E 03	1.57E 03
CR 51	1.59E 03	3.99E 05	0.00E-01	0.00E-01	3.49E 02	9.48E 02	2.11E 03	0.00E-01
MN 54	9.89E 04	1.59E 06	0.00E-01	5.19E 05	1.54E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	1.62E 05	1.41E 06	1.80E 05	4.23E 05	0.00E-01	0.00E-01	1.18E 05	0.00E-01
CO 58	6.03E 05	5.46E 06	0.00E-01	2.69E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	2.32E 06	1.98E 07	0.00E-01	1.05E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.42E 08	1.97E 08	9.85E 07	3.14E 08	2.10E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	4.13E 07	2.31E 08	1.44E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.39E 10	1.64E 09	5.67E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.17E 01	5.46E 04	5.37E 01	1.72E 01	2.70E 01	0.00E-01	0.00E-01	0.00E-01
I 131	1.43E 08	6.59E 07	1.74E 08	2.50E 08	4.28E 08	8.18E 10	0.00E-01	0.00E-01
I 133	1.26E 06	3.71E 06	2.37E 06	4.13E 06	7.21E 06	6.07E 08	0.00E-01	0.00E-01
CS134	1.72E 10	3.69E 08	8.85E 09	2.11E 10	6.82E 09	0.00E-01	2.26E 09	0.00E-01
CS136	1.06E 09	1.68E 08	3.75E 08	1.48E 09	8.23E 08	0.00E-01	1.13E 08	0.00E-01
CS137	1.10E 10	3.25E 08	1.25E 10	1.68E 10	5.70E 09	0.00E-01	1.89E 09	0.00E-01
BA140	1.01E 05	3.18E 06	1.54E 06	1.84E 03	6.59E 02	0.00E-01	1.11E 03	0.00E-01
CE141	2.06E 01	6.94E 05	2.68E 02	1.81E 02	8.43E 01	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = GOATMILK
AGE GROUP EQUALS TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.04E 03	2.04E 03	0.00E-01	2.04E 03	2.04E 03	2.04E 03	2.04E 03	2.04E 03
CR 51	2.77E 03	4.66E 05	0.00E-01	0.00E-01	6.07E 02	1.54E 03	3.95E 03	0.00E-01
MN 54	1.71E 05	1.77E 06	0.00E-01	8.64E 05	2.58E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	2.83E 05	1.74E 06	3.14E 05	7.34E 05	0.00E-01	0.00E-01	2.31E 05	0.00E-01
CO 58	1.04E 06	6.25E 06	0.00E-01	4.53E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	4.02E 06	2.32E 07	0.00E-01	1.78E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.45E 08	2.22E 08	1.51E 08	5.25E 08	3.36E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	7.59E 07	3.16E 08	2.65E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.98E 10	2.25E 09	8.01E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.04E 01	6.84E 04	9.40E 01	2.97E 01	4.36E 01	0.00E-01	0.00E-01	0.00E-01
I 131	2.38E 08	8.77E 07	3.17E 08	4.43E 08	7.63E 08	1.29E 11	0.00E-01	0.00E-01
I 133	2.24E 06	5.57E 06	4.34E 06	7.36E 06	1.29E 07	1.03E 09	0.00E-01	0.00E-01
CS134	1.68E 10	4.50E 08	1.54E 10	3.62E 10	1.15E 10	0.00E-01	4.39E 09	0.00E-01
CS136	1.69E 09	2.02E 08	6.38E 08	2.51E 09	1.37E 09	0.00E-01	2.15E 08	0.00E-01
CS137	1.03E 10	4.21E 08	2.22E 10	2.96E 10	1.01E 10	0.00E-01	3.91E 09	0.00E-01
BA140	1.80E 05	4.30E 06	2.79E 06	3.41E 03	1.16E 03	0.00E-01	2.30E 03	0.00E-01
CE141	3.77E 01	9.39E 05	4.92E 02	3.28E 02	1.55E 02	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = GOATMILK
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.23E 03	3.23E 03	0.00E-01	3.23E 03	3.23E 03	3.23E 03	3.23E 03	3.23E 03
CR 51	5.65E 03	3.00E 05	0.00E-01	0.00E-01	8.57E 02	3.14E 03	5.73E 03	0.00E-01
MN 54	3.44E 05	1.08E 06	0.00E-01	1.29E 06	3.62E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	5.88E 05	1.23E 06	7.29E 05	1.18E 06	0.00E-01	0.00E-01	3.42E 05	0.00E-01
CO 58	2.12E 06	4.04E 06	0.00E-01	6.92E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	8.17E 06	1.53E 07	0.00E-01	2.77E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	4.92E 08	1.39E 08	2.97E 08	7.91E 08	4.98E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	1.87E 08	2.54E 08	6.56E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.43E 10	1.82E 09	1.35E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	4.27E 01	5.01E 04	2.18E 02	4.80E 01	6.87E 01	0.00E-01	0.00E-01	0.00E-01
I 131	4.39E 08	6.88E 07	7.68E 08	7.72E 08	1.27E 09	2.55E 11	0.00E-01	0.00E-01
I 133	4.93E 06	5.25E 06	1.05E 07	1.30E 07	2.17E 07	2.42E 09	0.00E-01	0.00E-01
CS134	1.23E 10	3.14E 08	3.55E 10	5.82E 10	1.80E 10	0.00E-01	6.47E 09	0.00E-01
CS136	2.56E 09	1.39E 08	1.44E 09	3.96E 09	2.11E 09	0.00E-01	3.14E 08	0.00E-01
CS137	7.57E 09	3.21E 08	5.36E 10	5.13E 10	1.67E 10	0.00E-01	6.01E 09	0.00E-01
BA140	3.92E 05	3.41E 06	6.72E 06	5.89E 03	1.92E 03	0.00E-01	3.51E 03	0.00E-01
CE141	8.97E 01	7.54E 05	1.21E 03	6.04E 02	2.65E 02	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = GOATMILK
AGE GROUP EQUALS INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.90E 03	4.90E 03	0.00E-01	4.90E 03	4.90E 03	4.90E 03	4.90E 03	4.90E 03
CR 51	8.95E 03	2.61E 05	0.00E-01	0.00E-01	1.28E 03	5.84E 03	1.14E 04	0.00E-01
MN 54	5.45E 05	8.83E 05	0.00E-01	2.40E 06	5.35E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	9.37E 05	1.14E 06	1.36E 06	2.38E 06	0.00E-01	0.00E-01	7.03E 05	0.00E-01
CO 58	3.45E 06	3.45E 06	0.00E-01	1.38E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.34E 07	1.35E 07	0.00E-01	5.65E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	6.31E 08	1.16E 09	3.99E 08	1.37E 09	6.63E 08	0.00E-01	0.00E-01	0.00E-01
SR 89	3.58E 08	2.57E 08	1.25E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.75E 10	1.84E 09	1.47E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	6.70E 01	4.70E 04	3.88E 02	9.45E 01	1.02E 02	0.00E-01	0.00E-01	0.00E-01
I 131	8.31E 08	6.74E 07	1.60E 09	1.89E 09	2.21E 09	6.21E 11	0.00E-01	0.00E-01
I 133	9.49E 06	5.48E 06	2.23E 07	3.24E 07	3.81E 07	5.89E 09	0.00E-01	0.00E-01
CS134	1.08E 10	2.89E 08	5.71E 10	1.07E 11	2.74E 10	0.00E-01	1.12E 10	0.00E-01
CS136	3.09E 09	1.26E 08	2.81E 09	8.27E 09	3.30E 09	0.00E-01	6.74E 08	0.00E-01
CS137	7.10E 09	3.13E 08	8.55E 10	1.00E 11	2.69E 10	0.00E-01	1.09E 10	0.00E-01
BA140	7.13E 05	3.40E 06	1.38E 07	1.38E 04	3.29E 03	0.00E-01	8.50E 03	0.00E-01
CE141	1.72E 02	7.57E 05	2.40E 05	1.46E 03	4.52E 02	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = INHAL
AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.26E 03	1.26E 03	0.00E-01	1.26E 03	1.26E 03	1.26E 03	1.26E 03	1.26E 03
CR 51	9.99E 01	3.32E 03	0.00E-01	0.00E-01	2.28E 01	5.94E 01	1.44E 04	0.00E-01
MN 54	6.29E 03	7.72E 04	0.00E-01	3.95E 04	9.83E 03	0.00E-01	1.40E 06	0.00E-01
FE 59	1.05E 04	1.88E 05	1.17E 04	2.77E 04	0.00E-01	0.00E-01	1.01E 06	0.00E-01
CO 58	2.07E 03	1.06E 05	0.00E-01	1.58E 03	0.00E-01	0.00E-01	9.27E 05	0.00E-01
CO 60	1.48E 04	2.84E 05	0.00E-01	1.15E 04	0.00E-01	0.00E-01	5.96E 06	0.00E-01
ZN 65	4.65E 04	5.34E 04	3.24E 04	1.03E 05	6.89E 04	0.00E-01	8.63E 05	0.00E-01
SR 89	8.71E 03	3.49E 05	3.04E 05	0.00E-01	0.00E-01	0.00E-01	1.40E 06	0.00E-01
SR 90	6.09E 06	7.21E 05	9.91E 07	0.00E-01	0.00E-01	0.00E-01	9.59E 06	0.00E-01
ZR 95	2.32E 04	1.50E 05	1.07E 05	3.44E 04	5.41E 04	0.00E-01	1.77E 06	0.00E-01
I 131	2.05E 04	6.27E 03	2.52E 04	3.57E 04	6.12E 04	1.19E 07	0.00E-01	0.00E-01
I 133	4.51E 03	8.87E 03	8.63E 03	1.48E 04	2.58E 04	2.15E 06	0.00E-01	0.00E-01
CS134	7.27E 05	1.04E 04	3.72E 05	8.47E 05	2.87E 05	0.00E-01	9.75E 04	0.00E-01
CS136	1.10E 05	1.17E 04	3.90E 04	1.46E 05	8.55E 04	0.00E-01	1.20E 04	0.00E-01
CS137	4.27E 05	8.39E 03	4.78E 05	6.20E 05	2.22E 05	0.00E-01	7.51E 04	0.00E-01
BA140	2.56E 03	2.18E 05	3.90E 04	4.90E 01	1.67E 01	0.00E-01	1.27E 06	0.00E-01
CE141	1.53E 03	1.20E 05	1.99E 04	1.35E 04	6.25E 03	0.00E-01	3.61E 05	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = INHAL
AGE GROUP EQUALS TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.27E 03	1.27E 03	0.00E-01	1.27E 03	1.27E 03	1.27E 03	1.27E 03	1.27E 03
CR 51	1.35E 02	3.00E 03	0.00E-01	0.00E-01	3.07E 01	7.49E 01	2.09E 04	0.00E-01
MN 54	8.39E 03	6.67E 04	0.00E-01	5.10E 04	1.27E 04	0.00E-01	1.98E 06	0.00E-01
FE 59	1.43E 04	1.78E 05	1.59E 04	3.69E 04	0.00E-01	0.00E-01	1.53E 06	0.00E-01
CO 58	2.77E 03	9.51E 04	0.00E-01	2.07E 03	0.00E-01	0.00E-01	1.34E 06	0.00E-01
CO 60	1.98E 04	2.59E 05	0.00E-01	1.51E 04	0.00E-01	0.00E-01	8.71E 06	0.00E-01
ZN 65	6.23E 04	4.66E 04	3.85E 04	1.33E 05	8.63E 04	0.00E-01	1.24E 06	0.00E-01
SR 89	1.85E 04	3.71E 05	4.34E 05	0.00E-01	0.00E-01	0.00E-01	2.41E 06	0.00E-01
SR 90	6.67E 06	7.64E 05	1.08E 08	0.00E-01	0.00E-01	0.00E-01	1.65E 07	0.00E-01
ZR 95	3.15E 04	1.49E 05	1.45E 05	4.58E 04	6.73E 04	0.00E-01	2.68E 06	0.00E-01
I 131	2.64E 04	6.48E 03	3.54E 04	4.90E 04	8.39E 04	1.46E 07	0.00E-01	0.00E-01
I 133	6.21E 03	1.03E 04	1.21E 04	2.05E 04	3.59E 04	2.92E 06	0.00E-01	0.00E-01
CS134	5.48E 05	9.75E 03	5.02E 05	1.13E 06	3.75E 05	0.00E-01	1.46E 05	0.00E-01
CS136	1.37E 05	1.09E 04	5.14E 04	1.93E 05	1.10E 05	0.00E-01	1.77E 04	0.00E-01
CS137	3.11E 05	8.47E 03	6.69E 05	8.47E 05	3.04E 05	0.00E-01	1.21E 05	0.00E-01
BA140	3.51E 03	2.28E 05	5.46E 04	6.69E 01	2.28E 01	0.00E-01	2.03E 06	0.00E-01
CE141	2.16E 03	1.26E 05	2.84E 04	1.89E 04	8.87E 03	0.00E-01	6.13E 05	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = INHAL
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.12E 03	1.12E 03	0.00E-01	1.12E 03	1.12E 03	1.12E 03	1.12E 03	1.12E 03
CR 51	1.54E 02	1.08E 03	0.00E-01	0.00E-01	2.43E 01	8.53E 01	1.70E 04	0.00E-01
MN 54	9.50E 03	2.29E 04	00.00E-01	4.29E 04	1.00E 04	0.00E-01	1.57E 06	0.00E-01
FE 59	1.67E 04	7.06E 04	2.07E 04	3.34E 04	0.00E-01	0.00E-01	1.27E 06	0.00E-01
CO 58	3.16E 03	3.43E 04	0.00E-01	1.77E 03	0.00E-01	0.00E-01	1.10E 06	0.00E-01
CO 60	2.26E 04	9.61E 04	0.00E-01	1.31E 04	0.00E-01	0.00E-01	7.06E 06	0.00E-01
ZN 65	7.02E 04	1.63E 04	4.25E 04	1.13E 05	7.13E 04	0.00E-01	9.94E 05	0.00E-01
SR 89	1.72E 04	1.67E 05	5.99E 05	0.00E-01	0.00E-01	0.00E-01	2.15E 06	0.00E-01
SR 90	6.43E 06	3.43E 05	1.01E 08	0.00E-01	0.00E-01	0.00E-01	1.47E 07	0.00E-01
ZR 95	3.69E 04	6.10E 04	1.90E 05	4.17E 04	5.95E 04	0.00E-01	2.23$ 06	0.00E-01
I 131	2.72E 04	2.84E 03	4.80E 04	4.80E 04	7.87E 04	1.62E 07	0.00E-01	0.00E-01
I 133	7.68E 03	5.47E 03	1.66E 04	2.03E 04	3.37E 04	3.84E 06	0.00E-01	0.00E-01
CS134	2.24E 05	3.84E 03	6.50E 05	1.01E 06	3.30E 05	0.00E-01	1.21E 05	0.00E-01
CS136	1.16E 05	4.17E 03	6.50E 04	1.71E 05	9.53E 04	0.00E-01	1.45E 04	0.00E-01
CS137	1.28E 05	3.61E 03	9.05E 05	8.24E 05	2.82E 05	0.00E-01	1.04E 05	0.00E-01
BA140	4.32E 03	1.02E 05	7.39E 04	6.47E 01	2.11E 01	0.00E-01	1.74E 06	0.00E-01
CE141	2.89E 03	5.65E 04	3.92E 04	1.95E 04	8.53E 03	0.00E-01	5.43E 05	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

R VALUES FOR FSV*

PATHWAY = INHAL
AGE GROUP EQUALS INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	6.45E 02	6.46E 02	0.00E-01	6.46R 02	6.46E 02	6.46E 02	6.46E 02	6 46E 02
CR 51	8.93E 01	3.56E 02	0.00E-01	0.00E-01	1.32E 01	5.75E 01	1.28E 04	0.00E-01
MN 54	4.98E 03	7.05E 03	0.00E-01	2.53E 04	4.98E 03	0.00E-01	9.98E 05	0.00E-01
FE 59	9.46E 03	2.47E 04	1.35E 04	2.35E 04	0.00E-01	0.00E-01	1.01E 06	0.00E-01
CO 58	1.82E 03	1.11E 04	0.00E-01	1.22E 03	0.00E-01	0.00E-01	7.76E 05	0.00E-01
CO 60	1.18E 04	3.18E 04	0.00E-01	8.01E 03	0.00E-01	0.00E-01	4.50E 06	0.00E-01
ZN 65	3.10E 04	5.13E 04	1.93E 04	6.25E 04	3.24E 04	0.00E-01	6.46E 05	0.00E-01
SR 89	1.14E 04	6.39E 04	3.97E 05	0.00E-01	0.00E-01	0.00E-01	2.03E 06	0.00E-01
SR 90	2.59E 06	1.31E 05	4.08E 07	0.00E-01	0.00E-01	0.00E-01	1.12E 07	0.00E-01
ZR 95	2.03E 04	2.17E 04	1.15E 05	2.78E 04	3.10E 04	0.00E-01	1.75E 06	0.00E-01
I 131	1.96E 04	1.06E 03	3.79E 04	4.43E 04	5.17E 04	1.48E 07	0.00E-01	0.00E-01
I 133	5.59E 03	2.15E 03	1.32E 04	1.92E 04	2.24E 04	3.55E 06	0.00E-01	0.00E-01
CS134	7.44E 04	1.35E 03	3.96E 05	7.02E 05	1.90E 05	0.00E-01	7.95E 04	0.00E-01
CS136	5.28E 04	1.43E 03	4.82E 04	1.34E 05	5.63E 04	0.00E-01	1.17E 04	0.00E-01
CS137	4.54E 04	1.35E 03	5.48E 05	6.11E 05	1.72E 05	0.00E-01	7.12E 04	0.00E-01
BA140	2.89E 03	3.83E 04	5.59E 04	5.59E 01	1.34E 01	0.00E-01	1.59E 06	0.00E-01
CE141	1.99E 03	2.15E 04	2.77E 04	1.66E 04	5.24E 03	0.00E-01	5.16E 05	0.00E-01

*R values in units of mrem/yr per micro-Ci/m**3 for inhalation and tritium, and in units of M**2-mrem/yr per micro-Ci/sec for all others

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLING SITE DESCRIPTIONS

(F: Facility Area 0-1.6 km, A: Adjacent Area 1.6-8 km, R: Reference Area)

Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Airborne	F-16	F-1	Potato cellar	16	1.2
	A-19	F-2	Hunting cabin	1	1.7
	F-7	F-3	Old dairy shed	7	1.2
	F-9	F-4	First shed along drive	8	1.5
	A-20		Roof of PSC Office, 13 1/2 Main Street Johnstown, CO		10.5
	R-3		Colorado State University Dairy W Drake Road, Ft. Collins, CO		45.1
	R-4		Intersection of US 66 and US 287		21.7

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

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Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Direct Radiation	F-1	F-?	1.3 km NNE, pole by gate at corner of Goosequill Road	1	1.3
	F-2		0.5 km. NE pole on top level	2	1.1
	F-3		On first pole N of E-W road	3	0.7
	F-4		Pole 19, 71 100 ml N of E line 2nd pole S of pump road	4	0.7
	F-5	F-47	Pole near drive to pump house	5	0.6
	F-6		Pole on E-W concrete ditch, S of bridge	6	0.8
	F-7	F-3	Old dairy barn, 1st pole N of drive	7	1.2
	F-8	F-9	2nd pole W of pump house	8	1.3
	F-9	F-4	First shed along drive	9	1.5
	F-10	F-11	0.5 km W of intersectio of 19 1/2 and 34	10	1.5
	F-11	F-12	7th pole N of intersection	11	1.2
	F-12	F-13	Pole nearest intersection	12	1.0
	F-13		On metal staircase, road S of Visitor Center across RR track	13	0.5

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Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Direct Radiation	F-14	F-14	Pole nearest corner	14	1.5
	F-15		1st pole on E side of road, No of side road 5th pole from corner	15	1.8
	F-16	F-1	Pole on NE corner of barn	16	1.2
	F-17		Visitor Center, N side of building	13	0.2
	F-18		Turkey farm S of reactor	10	2.5
	A-1		Corner of CO 46 and 21 1/2, pole on SE corner	1	8.4
	A-2		Dent, CO, pole S of house, E of intersection of highway and RR tracks	2	8.4
	A-3	A-30	1.6 km S of 256 on 60, pole on NE corner	3	7.5
	A-4		1st pole S of intersection of 29 and 38	4	7.4
	A-5	A-32	NW corner of 34 and 29	5	7.2
	A-6	A-50	Pole on S side of 32 near drive to dairy	6	6.7
	A-7	A-33	Niles Miller dairy, 0.4 km, E of US 85	7	7.3
	A-8	A-35n	On CO 66, farm on S side of road on end of chicken coop, 1 km E of 19	8	4.7
	A-9	A-35o	Corner of CO 66 and 19, Miller produce stand, pole on SW corner	9	4.6
	A-10		Pole on 26 1/2; on pole SW of old FSV school	10	7.8
	A-11		Corner of CO 66 and 13, pole on NE corner, opposite 13 road sign	11	7.2

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Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
	A-12		On 34, pole E of white house (4998) N of Lake Thomas	12	7.2
	A-13		Pole opposite lake, N of silage pites, E side of road	13	5.8
Direct Radiation	A-14		Intersection of 13 and 40, NW corner	14	6.9
	A-15		Intersection of 42 and 15, NW corner	15	6.7
	A-16		Corner of 44 and 19, SW corner	16	6.8
	R-1		Milliken School, on 21 1/2, pole on SW corner of school lot		9.3
	A-17		Behind Gilcrest School auditorium, pole on S end of school property		9.3
	A-18		Platteville School, NW corner just outside school yard		5.9
	R-2		Johnstown School (elementary), pole on S end of drive		10.8
	R-3		CSU air sampler, dairy farm on W Drake		45.1
	R-4		Air sampler location corner of US 287 and CO 66		19.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLING SITE DESCRIPTIONS

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Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Waterborne					
Surface	F-19	U-43	S Platte at dam and inlet pond	4	1.2
	A-21	U-42	St. Vrain Creek at bridge on 34	11	2.4
	A-22	D-40	S Platte at CO 60	2	10.1
	F-20	D-45	St. Vrain Creek on 19 1/2, 0.3 km from discharge	16	1.5
	A-25	E-38	Goosequill Pond outlet	1	2.2
Ground	A-19	F-2	Well supply to hunting cabin	1	1.7
	R-5		Milliken City well, behind Town Hall		9.8
Drinking	R-3		CSU dairy W Drake Road, Ft. Collins, CO		45.1
	R-6	D-39	Gilcrest City water, US Post Office		9.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLING SITE DESCRIPTIONS

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Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Waterborne					
Sediment from Shoreline	A-22	D-40	S Platte at CO 60	2	10.0
Ingestion					
Milk	A-23	F-44	Leroy Odenbaugh dairy	5	2.9
	A-24	A-6	C. Wissler dairy 4.0 km S of Platteville	8	8.8
	A-6	A-50	Hendrickson dairy on 32, 1.3 km E of Platteville	6	6.6
	R-7	A-48	Bill Ray dairy, 17376 Weld County Road 46, 0.8 km E of US 85 on 46	3	9.6
	R-8	R-16	Mountain View Famrs, N side of CO 402 W of I-25		22.5
	R-9	R-22	Hagan Brothers Dairy, 6.8 km S of Platteville		17.9
	R-3		CSU dairy, W Drake Road, Fort Collins, CO		45.1
Aquatic Biota	A-25	E-38	Goosequill Pond outlet	1	2.2
	F-19	U-43	S Platte at dam and inlet pond	4	1.1
	A-22	D-40	S Platte at CO 60	2	10.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLING SITE DESCRIPTIONS

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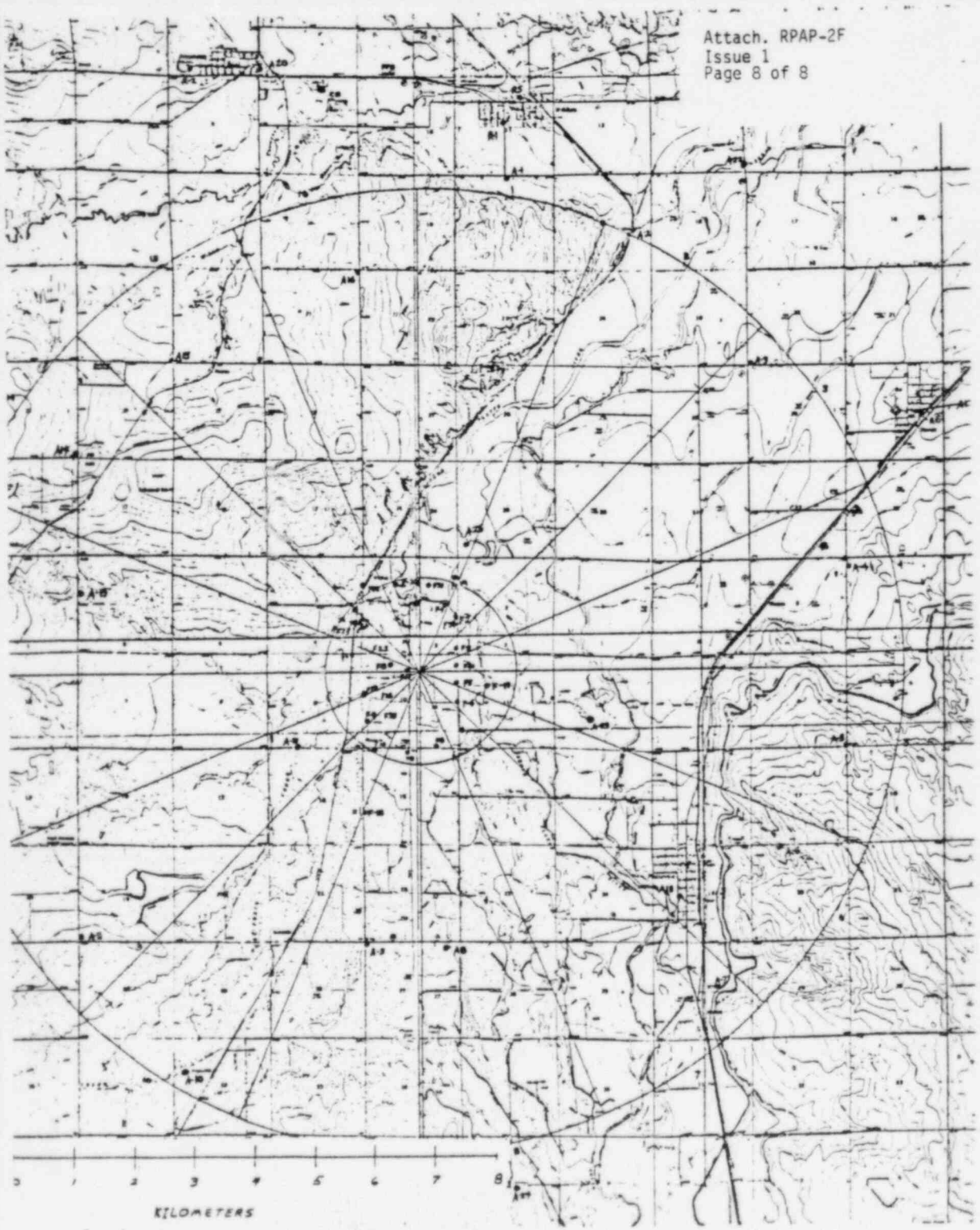
Exposure Pathway	Site No.	(Old Site No.)	Location Description (see map)	Sector	Distance, km
Food Products	F-21		Farm, N of F-1	1	1.5
	F-22, 23		Farm at F-14, fields S and E	15, 16	0.8, 1.5
	F-24, 25, 26		Farm plots	2, 10, 11	0.9, 0.9, 0.8
	R-9	R-22	Hagan Brothers Dairy, 6.8 km S of Platteville		6.8

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING SITE DESCRIPTIONS



TITLE: PROCESS CONTROL PROGRAM

ISSUANCE AUTHORIZED BY			
PORC REVIEW			EFFECTIVE DATE

1.0 PURPOSE

To describe the process control of radioactive waste material that would require solidification or similar processing prior to packaging and transport for disposal.

2.0 APPLICABILITY

This procedure applies to that radioactive material such as liquids, resins, etc., which may require special processing prior to packaging and transport for disposal.

3.0 GENERAL REQUIREMENTS

Processing, packaging and transport of radioactive material for disposal shall meet the requirements of the NRC, DOT, and the disposal facility to be utilized which are applicable at the time of transporting for disposal.

4.0 PORCEDURE

4.1 Determine the appropriate processing requirements from NRC and DOT regulations and burial site licensing requirements.

4.2 Develop an approved procedure for processing the material in accordance with 4.1 above.

4.3 Process and dispose of material.

5.0 REFERENCES

5.1 10CFR

5.2 49CFR

5.3 HPP-26

5.4 HPP-30

6.0 ATTACHMENTS

None