Nebraska Public Power District
Nebraska's Energy Leader

50.90

NLS2001085
September 14, 2001

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

Gentlemen:

Subject: Proposed License Amendment Related to the Design Basis Accident Radiological Assessment Calculational Methodology - Supplemental Information
Cooper Nuclear Station, NRC Docket 50-298, DPR-46

Reference: 1. Letter (NLS2001011) from J. H. Swailes (the District) to USNRC, dated February 28, 2001, "Proposed License Amendment Related to the Design Basis Accident Radiological Assessment Calculational Methodology."

The Nebraska Public Power District (the District) herein provides revised calculations for the dispersion factors (χ/Q) used for determining control room dose and for the fuel handling accident (FHA) to support the Reference 1 amendment request for License No. DPR-46. The amendment request included a revision to the Cooper Nuclear Station (CNS) design basis accident (DBA) radiological assessment calculational methodology. The District has subsequently identified an error in how the meteorological data was processed for use as input to the ARCON96 computer code. This code determines the dispersion factors used for determining control room dose. This processing error resulted in a nonconservative χ/Q being calculated by ARCON96 for the reactor building release point and directly impacts the CNS FHA radiological assessment results. The enclosed calculations replace the two counterpart calculations (provided in Reference 1) in their entirety.

Attachment 1 provides a general description of the differences between the enclosed revised calculations and the previously submitted calculations. Attachment 2 provides additional information related to the removal of the control room air inlet high radiation monitoring function from the proposed CNS Technical Specifications (TS) 3.3.7.1 as requested in Reference 1. There are no required revisions to the proposed CNS TS changes submitted in Reference 1. The revised calculations do not affect the Reference 1 provided significant hazards consideration (10 CFR 50.92) or environmental impact evaluations (10 CFR 51.22).

The calculated radiological dose assessment consequences continue to satisfy 10 CFR 100.11 and GDC 19 dose acceptance criteria. This supplemental information supporting the proposed license

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amendment revision has been reviewed by the necessary safety review committees and incorporates amendments to the CNS Facility Operating License through Amendment No. 185 issued March 13, 2001. The District has concluded that the proposed changes do not involve a significant hazards consideration. Additionally, the District has concluded that the proposed changes do not have a significant adverse impact on the environment, and are justified for categorical exclusion from the requirement for an environmental assessment as provided by 10 CFR 51.21.

The District requests issuance of the proposed license amendment prior to Refueling Outage 20 (currently scheduled to begin November 3, 2001), to ensure that the DBA radiological assessment calculational methodology is approved on a permanent basis prior to CNS entry into Mode 4 in preparation for Refueling Outage 20 (which is identified as the point at which CNS License Amendment No. 183 expires).

The District anticipates an implementation period for this amendment beginning with the initiation of handling of irradiated GE14 fuel (currently anticipated during Refueling Outage 20 in the fall of 2001), or the initiation of handling of loads over irradiated GE14 fuel which have the potential to damage the irradiated GE14 fuel. The implementation, for District controlled documents, will be completed as necessary to support scheduled activities. Any related Updated Safety Analysis Report changes will be processed pursuant to 10 CFR 50.71(e), and the TS Bases changes will be processed per CNS TS 5.5.10 pending approval of this proposed license amendment.

By copy of this letter and attachments the appropriate State of Nebraska official is being notified in accordance with 10 CFR 50.91(b)(1). Copies to the Region IV Office and the CNS Resident Inspector are also being sent in accordance with 10 CFR 50.4(b)(1).

Should you have any questions concerning this matter, please contact David F. Kunsemiller at (402) 825-5236.

Sincerely,

John H. Swailes
Vice President of Nuclear Energy

/erg

Attachments
Enclosures

cc: Regional Administrator w/attachments w/o enclosures
USNRC - Region IV

Senior Project Manager w/attachments & enclosures
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/attachments w/o enclosures
USNRC - Cooper Nuclear Station

Nebraska Health and Human Services w/attachments w/o enclosures
Department of Regulation and Licensure

NPG Distribution w/ attachments w/o enclosures

Records w/ attachments and enclosures

STATE OF NEBRASKA)
)
NEMAHA COUNTY)

John H. Swailes, being first duly sworn, deposes and says that he is an authorized representative of the Nebraska Public Power District, a public corporation and political subdivision of the State of Nebraska; that he is duly authorized to submit this correspondence on behalf of Nebraska Public Power District; and that the statements contained herein are true to the best of his knowledge and belief.

John H. Swailes

Subscribed in my presence and sworn to before me this 13th day of September, 2001.

GENERAL NOTARY-State of Nebraska
LUANN BRAY
My Comm. Exp. May 11, 2002

LuAnn Bray
NOTARY PUBLIC

PROPOSED LICENSE AMENDMENT TO REVISE THE DESIGN
BASIS RADIOLOGICAL ASSESSMENT CALCULATIONAL METHODOLOGY
REVISED INFORMATION

COOPER NUCLEAR STATION
NRC DOCKET NO. 50-298, LICENSE DPR-46

DESCRIPTION OF THE CHANGES TO PREVIOUSLY SUBMITTED CALCULATIONS

Scientech Engineering Calculation 17080-M-01, Revision 3, χ/Q Values for Control Room Intake Using ARCON96, (CNS Calculation NEDC 99-031, Revision 4, Attachment 1)

The calculation was revised (from the Reference 1 submitted version) in the following areas:

- Corrected formatting of the ARCON96 input data files,
- Used five years of met data for each run (previous revisions used one year of met data for each run and selected the run for the year resulting in the highest values of χ/Q),
- Removed the reactor building vent mode runs that are no longer used at CNS,
- Revised the ARCON96 default value of surface roughness length to 0.2 m as recommended by Nuclear Energy Institute (NEI) 99-03, "Control Room Habitability Assessment Guidance," and
- Incorporated reactor building exhaust flow rates applicable to the fuel handling accident dose analyses performed in CNS Calculation NEDC 99-032, Revision 2.

Control Room Habitability and Offsite Dose for a Fuel Handling Accident, (Cooper Nuclear Station Calculation NEDC 99-032, Revision 2)

This calculation was revised in the following areas (from the Reference 1 submitted version):

- The χ/Q calculation contained in the revised Scientech Engineering calculation discussed above resulted in higher χ/Q values for the reactor building exhaust point and lower χ/Q values for the elevated release point. This revision of NEDC 99-032 corrects the reactor building exhaust control room χ/Q data. The elevated release point data was not updated as it was already conservative (i.e., higher χ/Q values than those calculated in the revised Scientech

Engineering calculation) and contributes only a small amount to the overall control room personnel dose.

In order to remain within GDC 19 dose limitations with the higher χ/Q data the following additional concurrent changes were required throughout NEDC 99-032:

- Reduced radial peaking factor from 1.9 to 1.8 which essentially changes the source term for the runs in Section A.0,
- Reduced CREF System initiation from 11 to 10 seconds,
- Revised time steps in the AXIDENT runs to better match the CREF System 10 second initiation,
- Updated average reactor building flows for the time steps between 0 and 90 seconds to better match the 10 second CREF System initiation,
- Deleted average reactor building flow data not used,
- Updated data input files for the seven AXIDENT runs based on the changes discussed above, and
- Replaced the seven AXIDENT runs with AXIDENT runs using the updated data.

The following table summarize the changes in radiological dose consequences between the calculations submitted under Reference 1 and those submitted in this supplemental information.

TABLE 1: SUMMARY OF FHA DOSES

Doses in Rem	Control Room (30 days)			EAB (2 hours)		LPZ (30 days)	
	Thyroid	Whole Body	Beta	Thyroid	Whole Body	Thyroid	Whole Body
Reference 1 Dose	29.4	1.72E-2	0.681	4.07	2.43E-2	2.80	3.57E-2
Updated Dose	29.5	1.80E-2	0.715	4.39	2.48E-2	2.64	3.37E-2

SUMMARY AND CONCLUSION

As indicated above, the input revisions for the χ/Q calculations resulted in minimal change to the control room (30 day) projected doses. The EAB (2 hour) and LPZ (30 day) projected doses are revised slightly, but remain within the criteria of 10 CFR 100.11.

The No Significant Hazards Consideration Evaluation provided in Reference 1 is not impacted by this supplemental information.

The Environmental Impact Evaluation provided in Reference 1 is not impacted by this supplemental information.

PROPOSED LICENSE AMENDMENT TO REVISE THE DESIGN
BASIS RADIOLOGICAL ASSESSMENT CALCULATIONAL METHODOLOGY
REVISED INFORMATION

COOPER NUCLEAR STATION
NRC DOCKET NO. 50-298, LICENSE DPR-46

OTHER CHANGES TO PREVIOUSLY SUBMITTED INFORMATION

I. Potassium Iodide (KI) Tablets

The Nebraska Public Power District (the District) is continuing to make potassium iodide (KI) tablets available to control room personnel. The District will continue to provide the KI tablets until the dose calculations associated with the Reference 1 license amendment request are approved and the seismic capabilities of the main steam line leakage path are determined to be, or made, acceptable for crediting plate-out as considered in the pertinent dose calculations.

II. Comparison to 50.36(c)(2)(ii) Screening Criteria for Removal:

Criterion 1. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

The Control Room Air Inlet Radiation - High function is not used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary. Other instrumentation is provided which provides adequate detection, and indication in the control room, of significant abnormal degradation of the reactor coolant pressure boundary prior to a design basis accident (see TS 3.4.5, Reactor Coolant System Leakage Detection Instrumentation).

Criterion 2. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

The Control Room Air Inlet Radiation - High function is not a process variable, design feature, or operating restriction that represents an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. High radiation in the control room air inlet is not assumed as an initial condition of any design basis accident or transient analysis.

Criterion 3. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

The Control Room Air Inlet Radiation - High function is not a structure, system, or component that is part of the primary success path which functions or actuates to mitigate a DBA or transient since this function is no longer credited for protection of the control room personnel. Control room personnel protection is provided by actuation of the CREF System on Reactor Vessel Water Level–Low (Level 3), Drywell Pressure–High, and Reactor Building Ventilation Exhaust Plenum Radiation–High.

Criterion 4. A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The Control Room Air Inlet Radiation - High function is not a structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety. Recent information, i.e., operating experience, indicates that automatic control room isolation on high radiation in the control room air intake is not significant with more realistic source terms. Additionally, the proposed change does not result in a degraded control room environment following an accident or transient and therefore does not affect any risk significant prevention or mitigation activity in the control room. Finally, since there is no direct impact on the automatic operation or recovery of front-line core or containment cooling systems, the removal of control room isolation at high radiation levels has no impact on probabilistic risk significance.

Conclusion: Since the screening criteria have not been satisfied, the Control Room Air Inlet Radiation - High function may be removed from the CNS TS.

Correspondence No: NLS2001085

The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
The District will continue to provide the KI tablets (in the control room) until the dose calculations associated with the February 28, 2001 (NLS2001011) dose calculation license amendment request are approved and the seismic capabilities of the main steam line leakage path are determined to be, or made, acceptable for crediting plate-out as considered in the pertinent dose calculations.	As indicated

NLS2001085
Enclosure

PROPOSED LICENSE AMENDMENT TO REVISE THE DESIGN
BASIS RADIOLOGICAL ASSESSMENT CALCULATIONAL METHODOLOGY

DESIGN BASIS ACCIDENT RADIOLOGICAL ASSESSMENT CALCULATIONS
COOPER NUCLEAR STATION
NRC DOCKET NO. 50-298, LICENSE DPR-46

ENCLOSURE 1

Scientech Engineering Calculation 17080-M-01, Revision 3, X/Q Values for Control Room Intake Using ARCON96, (Cooper Nuclear Station Calculation NEDC 99-031, Revision 4, Attachment 1, Pages 2 through 30).

ENGINEERING CALCULATION

CLIENT/PROJECT NPPD/Cooper Nuclear Station CALC. NO. 17080-M-01 REV. 3

TITLE $\frac{\chi}{Q}$ Values for Control Room Intake Using ARCON96

AUTHOR/DATE:	VERIFIED BY/DATE:	APPROVED BY/DATE:
Harry A. Wagage 8/29/2001	8/29/2001	8/29/2001

Purpose

The objective of this analysis is to determine the atmospheric dispersion factors (X/Q values) for Cooper Nuclear Station (CNS) control room intake for release of radionuclides from the Reactor Building, Turbine Building, and Elevated Release Point (ERP) using the ARCON96 computer code. [5.1]

Revision 1 of this calculation was made to satisfy an NRC request which was made during the resolution of NRC Request for Additional Information. The NRC requested changing the calculation of the initial diffusion coefficients for diffuse releases to building dimensions divided by a factor of 6.

Revision 2 of this calculation was made to incorporate ARCON96 generated ground level release mode X/Qs for releases emanating from the Reactor Building ventilation exhaust point. These X/Qs will be used to replace the ARCON96 vent release mode X/Qs previously used in the fuel handling accident.

Revision 3 of this calculation was made to 1) correct formatting error that was found in the ARCON96 input data files, 2) use five years of met data for each run (previous revisions used one year of met data for each run and selected the run for the year resulting in the highest values of X/Q), 3) remove the reactor building vent mode runs that are no longer used at CNS, 4) change the ARCON96 default value of surface roughness length to 0.2 m as recommended by NEI 99-03, and 5) incorporate reactor building exhaust flow rates, which are applicable for performing dose calculations for the fuel handling accident.

Results

Table 2 summarizes the results. Note that the X/Q values calculated for elevated release point release and turbine building diffuse release are lower than those reported in rev. 2 of this report. The X/Q values calculated for the reactor building ground level release are *higher* than those reported in rev. 2 of this report.

SUPERSEDED BY REV. SUPPLEMENTED BY CALC. NO.:	QUALITY CLASS ■ SAFETY-RELATED ❑ NON-SR ❑ OTHER	DISTRIBUTION ■ PROJECT ■ DCC ❑ OTHER	VERIFICATION METHOD ■ REVIEW ❑ ALT. ANALYSIS

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Attachment A – ARCON96 output files (11 pages)

1. Purpose of Analysis

The objective of this analysis is to determine the atmospheric dispersion factors ($\frac{\chi}{Q}$ values) for Cooper Nuclear Station (CNS) control room intake for release of radionuclides from the Reactor Building, Turbine Building, and Elevated Release Point (ERP) using the ARCON96 computer code. [5.1]

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2. Intended Use of Analysis Results

The results of this analysis are to be used to perform control room habitability analysis for CNS following different design basis accidents.

3. Technical Approach

3.1 Introduction

The relative concentrations of radionuclides due to hypothetical releases from the containment were assessed using the ARCON96 computer code. [5.1] The basic diffusion model implemented in the ARCON96 code is a straight-line Gaussian model that assumes the release rate is constant for the entire period of release. This assumption is made to permit evaluation of potential effects of accidental releases without having to specify a complete release sequence.

ARCON96 permits evaluation of ground level, vent, and elevated releases. Building wake effects are considered in the evaluation of relative concentrations from ground-level releases. Vent releases are treated as a mixed ground level and elevated release but are not used at CNS. The proportions of the mixture are determined by the ratio between the effluent vertical velocity and

the release height wind speed. Elevated releases are treated with corrections for downwash and differences in terrain elevation between the stack and the control room intake.

ARCON96 calculates relative concentrations using hourly meteorological data. It then combines the hourly averages to estimate concentrations for periods ranging in duration from 2 hours to 30 days. Wind direction is considered as the averages are formed. As a result, the averages account for persistence in both diffusion conditions and wind direction. Cumulative frequency distributions are prepared from the average relative concentrations. Relative concentrations that are exceeded no more than five percent of the time (95th percentile relative concentrations) are determined from the cumulative frequency distributions for each averaging period. The relative concentrations from five standard averaging periods used in control room habitability assessments are calculated from the 95th percentile relative concentrations.

Section 3.2 reproduces discussion of the ARCON96 code model from the code user's manual.
Section 3.3 describes the calculation of initial diffusion coefficients for diffuse releases.
Section 3.4 describes different radioactive release configurations analyzed.

3.2 ARCON96 Modeling

3.2.1 Diffusion Model

The ARCON96 code implements a straight-line Gaussian diffusion model. The basic model for a ground-level release is:

$$\chi/Q = [1/(\pi\sigma_y\sigma_z U)] \exp[-0.5(y/\sigma_y)^2] \quad (1)$$

where χ/Q = relative concentration (concentration divided by release rate) [(ci/m^3) /(ci/s)]

σ_y, σ_z = diffusion coefficients) (m)

U = wind speed (m/s)

y = distance from the center of the plume (m)

This equation assumes that the release is continuous, constant, and of sufficient duration to establish a representative mean-concentration. It also assumes that the ground reflects the material being released. Diffusion coefficients are typically determined from atmospheric stability and distance from the release point using empirical relationships. A diffusion coefficient parameterization from the NRC PAVAN [5.2] and XOQDOQ [5.3] codes is used for σ_y and σ_z.

3.2.1.1 Diffusion Coefficient Adjustments for Wakes and Low Wind Speeds

To estimate diffusion in building wakes, composite wake diffusion coefficients, Σy and Σz. replace σy and σz. The composite wake diffusion coefficients are defined by

$$\Sigma_y = (\sigma_y^2 + \Delta\sigma^2_{y1} + \Delta\sigma^2_{y2})^{1/2}$$
$$\Sigma_z = (\sigma_z^2 + \Delta\sigma^2_{z1} + \Delta\sigma^2_{z2})^{1/2} \qquad (2)$$

where σ_y and σ_z are the normal diffusion coefficients, $\Delta\sigma_{y1}$ and $\Delta\sigma_{z1}$ are the low wind speed corrections, and $\Delta\sigma_{y2}$ and $\Delta\sigma_{z2}$ are the building wake corrections. These corrections are described and evaluated in Ramsdell and Fosmire. [5.11] The form of the low wind speed corrections is

$$\Delta\sigma^2_{y1} = 9.13 \times 10^5 [1 - (1 + x/1000U) \exp(-x/1000U)]$$
$$\Delta\sigma^2_{z1} = 6.67 \times 10^2 [1 - (1 + x/100U) \exp(-x/100U)] \qquad (3)$$

where x is the distance from the release point to the receptor, in meters, and U is the wind speed in meters per second. It is appropriate to use the slant range distance for x because these corrections are made only when the release is assumed to be at ground level and the receptor is assumed to be on the axis of the plume. The diffusion coefficient corrections that account for enhanced diffusion in the wake have a similar form. These corrections are

$$\Delta\sigma^2_{y2} = 5.24 \times 10^{-2} U^2 A [1 - (1 + x/10 \text{ sqrt}(A)) \exp(-x/10 \text{ sqrt}(A))]$$
$$\Delta\sigma^2_{z2} = 1.17 \times 10^{-2} U^2 A [1 - (1 + x/10 \text{ sqrt}(A)) \exp(-x/10 \text{ sqrt}(A))] \qquad (4)$$

where A is the cross-sectional area of the building in square meters.

An upper limit is placed on Σ_y as a conservative measure. This limit is the standard deviation associated with a concentration uniformly distributed across a sector with width equal to the circumference of a circle with radius equal to the distance between the source and receptor. This value is

$$\Sigma_{ymax} = 2\pi x/\text{sqrt}(12) = 1.81x \qquad (5)$$

The model described in equations 1 through 4 is a replacement for the dispersion model in the procedure for control room habitability assessment developed by Murphy and Campe. [5.4] Earlier building wake diffusion model studies conducted for the NRC showed that the Murphy-Campe model did not predict the variations of the concentrations in the vicinity of buildings particularly well. [5.5, 5.6] The studies also showed that one of the primary reasons was that it

overpredicted concentrations during low wind speed conditions. The code described above overcomes these problems.

3.2.1.2 Sector-Average Diffusion Model

Equations 1 through 4 are appropriate for estimating relative concentrations for 1-hour periods. A sector-average relative concentration model is used to estimate concentrations for periods after the initial 0 - 8-hour period. Integrating the concentrations across the normal plume model to obtain a crosswind-integrated concentration, CIC, derives the sector-average plume model as follows:

$$CIC/Q' = 2/ [sqrt(2\pi)\Sigma_z U] \quad (6)$$

The relative concentration is then calculated by dividing CIC/Q' by the width of the sector, Ws,

$$\chi_{sa} /Q' = 2/ [sqrt(2\pi)\Sigma_z UW_s]= 0.80/ [\Sigma_z UW_s] \quad (7)$$

In most cases, the sector width is defined as the width of a 22.5-degree sector, which is a function of the distance downwind. This procedure works well except for small distances in unstable atmospheric conditions. In unstable atmospheric conditions the procedure gives sector average concentrations that are greater than the centerline concentration at small distances. This problem can be avoided by redefining the definition of the sector width. For the ARCON96 code, the sector width is the larger of $\alpha\Sigma_y$, where α is a numerical constant with a value of 4, and $\pi x/8$, where x is the distance between the source and receptor. Values of α in the range 4 and 6 are reasonable. The default value of 4 used in the code was selected to be conservative. Approximately 95% of the material in a Gaussian plume is within +/- 2 Σ_y of the plume axis. To be consistent with the centerline model, and to be conservative, the sector width is limited to a maximum value. This maximum value is the circumference of a circle with a radius equal to the distance between the source and receptor; i. e.,

$$W_{smax} = 2\pi x \quad (8)$$

3.2.1.3 Elevated Release Diffusion Models

For elevated releases, the relative concentration is given by

$$\chi/Q' = [1/(\pi\sigma_y\sigma_z U)] \exp[-0.5(y/\sigma_y)^2]\exp [-0.5 ((h_e - h_i)/ \sigma_z)^2] \quad (9)$$

where h_e is the effective stack height and h_i is the height of the intake. Wake corrections are not made to diffusion coefficients used in calculating concentrations in elevated plumes. Effective stack height is determined from the actual stack height (h_s), the difference in terrain elevation between the stack and intake locations ($t_s - t_i$) and stack downwash (Δh_d) by

$$h_e = h_s + (t_s - t_i) + \Delta h_d \tag{10}$$

where the stack downwash is computed as

$$\Delta h_d = 4r_s[(W_o/U(h_s)) - 1.5] \tag{11}$$

and r_s is the radius of the stack, W_o is the vertical velocity of the effluent, and $U(h_s)$ is the wind speed at stack height. A release is considered elevated if the actual stack height is more than 2.5 times the height of structures in the immediate vicinity of the stack. Plume rise is not considered in calculating effective stack height in ARCON96.

The sector-average model is used in calculating relative concentrations for elevated releases for averaging periods longer than 8 hours. The sector-average plume model for elevated releases may be derived in the same manner as the sector-average plume for ground-level releases. It is

$$\chi_{sa}/Q' = \{2/[\mathrm{sqrt}(2\pi)\sigma_z U W_s]\} \exp[-0.5((h_e - h_i)/\sigma_z)^2] \tag{12}$$

3.2.1.4 Vent Release Diffusion Model (Not Used at CNS)

ARCON96 treats vent releases in addition to ground level and elevated releases. A vent release is a release that takes place through a rooftop vent with an uncapped vertical opening. The treatment of these releases depends on the vertical velocity of the effluent and the wind speed at roof height. If the vertical velocity (W_o) is more than 5 times the wind speed (U), the release is treated as an elevated release with a stack height equal to the height of the vent. If the vertical velocity is less than the wind speed, the release is treated as a ground-level release. Finally, if the vertical velocity is less than 5 times the wind speed but greater than the wind speed, the release is treated as a mixed-mode release based on the discussion in Regulatory Guide 1.111 [5.7] and the implementation in XOQDOQ. [5.3]

The relative concentration for a mixed-mode release is a weighted average of the relative concentrations for elevated and ground level releases. The weights for the mixed-mode release are determined as follows. An entrainment coefficient, E_t, is determined for those hours when W_o/U is between one and five:

$$E_t = 2.58 - 1.58\,(W_o/U) \text{ for } 1 < W_o/U \leq 1.5$$
$$E_t = 0.3 - 0.06\,(W_o/U) \text{ for } 1.5 < W_o/U < 5 \tag{13}$$

The weight given to the concentration from the ground-level plume is E_t, and the weight given to the elevated plume is $1 - E_t$.

3.2.1.5 Area Source Diffusion Model

The diffusion models incorporated in ARCON96 are Gaussian models that assume that the release is from a point source. This assumption is reasonable for receptors (e.g., control room air intakes) that are "far downwind" from the release location. For area sources or a group of closely spaced release points, "far downwind" may be defined in terms of a characteristic dimension associated with the source or combination of sources, although the selection of the characteristic dimension is subjective. For an area source the characteristic dimension could be the square root of the area. Similarly, for a group of closely spaced release points, the characteristic dimension could be the radius of a circle that just encompasses the release points. If the distance between the source and the receptor is greater than about ten times the characteristic dimension of the source, a point source approximation is generally acceptable. If, however, the distance between the source and receptor is less than ten times the characteristic dimension, χ /Qs calculated with point source models will be too large because the models do not account for the finite dimensions of the source.

In ARCON96 one may specify initial horizontal and vertical diffusion coefficients that are related to the characteristic dimensions of a source. The area source adjustment is made to the point source diffusion coefficients.

The ARCON96 code uses the initial diffusion coefficients to determine the distance from the center of the real source to the virtual point source located upwind of the real source. The distance from the virtual point source to the center of the area source (virtual distance, X_v) is

$$X_v = [(\sigma_0 - c)/\alpha]^{1/b} \qquad (14)$$

where σ_0 is the initial diffusion coefficient, and α, b and c are functions of stability. Virtual distances are calculated for both horizontal and vertical diffusion. It is unlikely that these two distances will be the same. The distances used in calculating σ_y and σ_z (the effective distances, x_c) are the sums of actual distance and the virtual distance.

3.2.2 Calm Winds

ARCON96 treats calm wind diffusion explicitly. The common derivation of the Gaussian plume model involves assumptions that eliminate the portion of the solution of the diffusion equation that describes diffusion when the winds speed approaches zero. An alternative, equally reasonable, derivation has been published by Frenkiel. [5.8] The basic assumptions in the derivation are that the diffusion coefficients are proportional to standard deviations of the wind fluctuations and the time following release. Kao describes Frankiel's model. [5.12] Concentrations calculated by Frenkiel's model have a local minimum at U = 0. The

concentration increases until it reaches a maximum at U = 1 m/s, and then it decreases as the U continues to increase. At high wind speeds, the concentration decreases proportional to 1/U as in the usual formulation of the Gaussian plume model. The exact wind speed at which the maximum occurs is a function of distance between source and receptor. It occurs at lower wind speeds for small distances.

The diffusion model described by equation 1 has approximately the same behavior at low wind speeds as the Frenkiēl model when the low wind speed corrections given by equation 3 are applied to the normal diffusion coefficients. Therefore, ARCON96 uses equation 1 with the low wind speed correction for calm wind conditions. Winds are defined as calm when the wind speed falls below the minimum speed defined for the meteorological data. The minimum speed is used for calculations when the wind speeds are calm. This assumption yields concentrations that are within a few percent of the maximum for all distances.

Wind direction is not considered during calm winds. In all cases of calm winds the receptor is assumed to be directly downwind of the release point. This assumption is conservative because it substitutes non-zero values of χ/Q for values that would normally be zero if wind direction were considered.

3.2.3 Vent/Stack Flow

The diffusion equations presented in § 3.2.1 and 3.2.2 assume point sources. Use of these equations to calculate concentrations at receptors near short stacks and vents can result in physically unreal concentration estimates. The concentrations calculated at the receptors can be higher than the concentrations in the stack or vent. ARCON96 limits the concentrations at receptors by allowing the user to specify the volumetric flow through the stack. Given an initial concentration estimate calculated using the equations previously described, relative concentrations corrected for stack flow, are calculated as

$$(\chi/Q')^* = 1/[1/(\chi/Q') + F] \qquad (15)$$

where $(\chi/Q')^*$ is the corrected relative concentration and F is the volumetric flow rate through the vent/stack.

3.2.4 Exposure Window

In computing average relative concentrations at the intake, ARCON96 assumes that material travels directly from the release point to the intake if the wind direction is within a window specified by the user. The wind direction window is based on the direction from the intake to the release point and the angular width of the window. The default width of the window is 90° (± 45° from the line between the release point and the intake).

3.2.5 Averaging Methods

Average relative concentrations are computed as running mean values. Overlapping mean values are used in compiling the χ/Q cumulative frequency distributions. For periods 8 hours or less in duration, the average is based entirely on χ/Q values calculated using the centerline model:

$$(\chi/Q')_{avg} = (1/N)\sum_{I=1}^{N}(\chi/Q')_I \qquad (16)$$

where N = averaging period in hours.

For longer periods, the averages include both centerline and sector-average (χ/Q)s. They are calculated as:

$$(\chi/Q')_{avg} = (1/N)[\sum_{I=1}^{8}(\chi/Q')_I + \sum_{I=9}^{N}(\chi_{sa}/Q')_I] \qquad (17)$$

3.2.6 Relative Concentrations for Standard Intervals

Standard Review Plan 6.4 [5.9] and various regulatory guides related to estimation of consequences of radionuclide releases following an accident require relative concentration estimates for various periods following the start of release. ARCON96 calculates concentrations for the following standard periods: 0 to 2 hours, 2 to 8 hours, 8 to 24 hours, 1 to 4 days, and 4 to 30 days. These values are calculated from the 95th percentile average relative concentrations. The larger of the 1- and 2-hour average relative concentration is used for the 0-to-2-hour period. Average relative concentrations for the 2- to 8-hour period are calculated as

$$(\chi/Q')avg_{95}(2 \text{ to } 8 \text{ hr}) = [8\,(\chi/Q')avg_{95}(0 \text{ to } 8 \text{ hr}) - 2(\chi/Q')avg_{95}(0 \text{ to } 2 \text{ hr})]/6 \text{ hr} \qquad (18)$$

where $\chi/Q'avg95$ (0 to 8hr) and $\chi/Q'avg95$ (0 to 2 hr) are 95th percentile average values for 8 and 2 hours, respectively. The 6 hours in the denominator is the length of the averaging period. Relative concentrations for the remaining standard periods are calculated in the same manner.

3.3 Initial Diffusion Coefficients

Consistent with ARCON96 code manual, Calculation 17080-M-01, Rev. 0 defined the initial horizontal and vertical diffusion coefficients, Σ_y and Σ_z, as given by equations 19 and 20. [5.1, 5.16]

$$\Sigma_y = \frac{w}{8.6} \qquad (19)$$

$$\Sigma_z = \frac{h}{2} \tag{20}$$

where w and h are building width and height.

However, NRC Request of Additional Information recommended using the diffusion coefficients given by equations 21 and 22, which were also used in reference 5.17.

$$\Sigma_y = \frac{w}{6} \tag{21}$$

$$\Sigma_z = \frac{h}{6} \tag{22}$$

This analysis (Rev. 1) used equations 21 and 22 to calculate the initial diffusion coefficients for the Turbine Building diffuse release.

3.4 Different Release Configurations Analyzed

The ARCON96 code was used to calculate dispersion factors for three release points: the reactor building roof discharge vent (release point 1), the elevated release point (ERP) (release point 2), and the turbine building wall adjacent to the control room (release point 3). The reactor building roof discharge vent is a release point for activity in the secondary containment during the time period that the RB ventilation system is still in operation. The reactor building vent release case was analyzed as a ground level release and for three release rates through the reactor-building vent. The reactor building release rate was used as an input to ARCON96 in order to ensure that the calculation does not result in physically unreal concentrations for receptors near the release point (section 3.2.3). The ERP is used to discharge post-accident (loss-of-coolant accident and fuel handling accident) release via the standby gas treatment system (SGTS). The turbine building wall is a diffuse release point for the activity that passes through the main steam lines and is released to the environment via the turbine building.

4. Design-Input Information

The input data consists of meteorological data, and source geometry data relative to the source and receptors.

4.1 Three different values of RB vent flow rate were used: 51333, 9500, and 1780 cfm (24.2, 4.48, 0.840 m^3/s).

4.2 Figure 1 shows the following for the reasons given (CNS, Burns & Roe Drawings: 2209 Rev. 3, 2217 Rev. N08, 2194 Rev. N03, 4005 Rev. N01, 2037 Rev. N55, and 4506 Rev. N06): [5.10]

- Dimensions for calculating the orientation (angle) and the distance between release points and the control room intake.
- Elevations of release points and general grade elevation to calculate height of release points.
- Elevation of the control room intake to calculate its height above grade elevation
- Turbine and reactor building dimensions and roof elevations to calculate the cross-sectional areas of the buildings in order to model building wake effects.
- Height of the elevated release point.
- Cross-sectional dimensions of reactor building and ERP vents to calculate cross-sectional areas, which are used to calculate, release velocities.
- Difference between the true north and the site north directions to calculate orientation angles between release points and the control room intake with respect to the true north direction.

4.3 The minimum stack (ERP) flow is 552 cfm (0.26 m^3/s) which occurs during SGTS operation. This is approximately equal to the evacuation flow rate of the refueling floor. [5.14] It is conservative to use this flow rate because it is significantly lower than the SGTS flow rate of 1780 cfm. [5.15]

4.4 Meteorological data for the five-year period 1994 through 1998 were obtained from the onsite meteorological program.

4.5 In lieu of the default value of 0.1 m for the surface roughness length suggested in ref. 5.1 a value of 0.2 m was used (table D-1). [5.18]

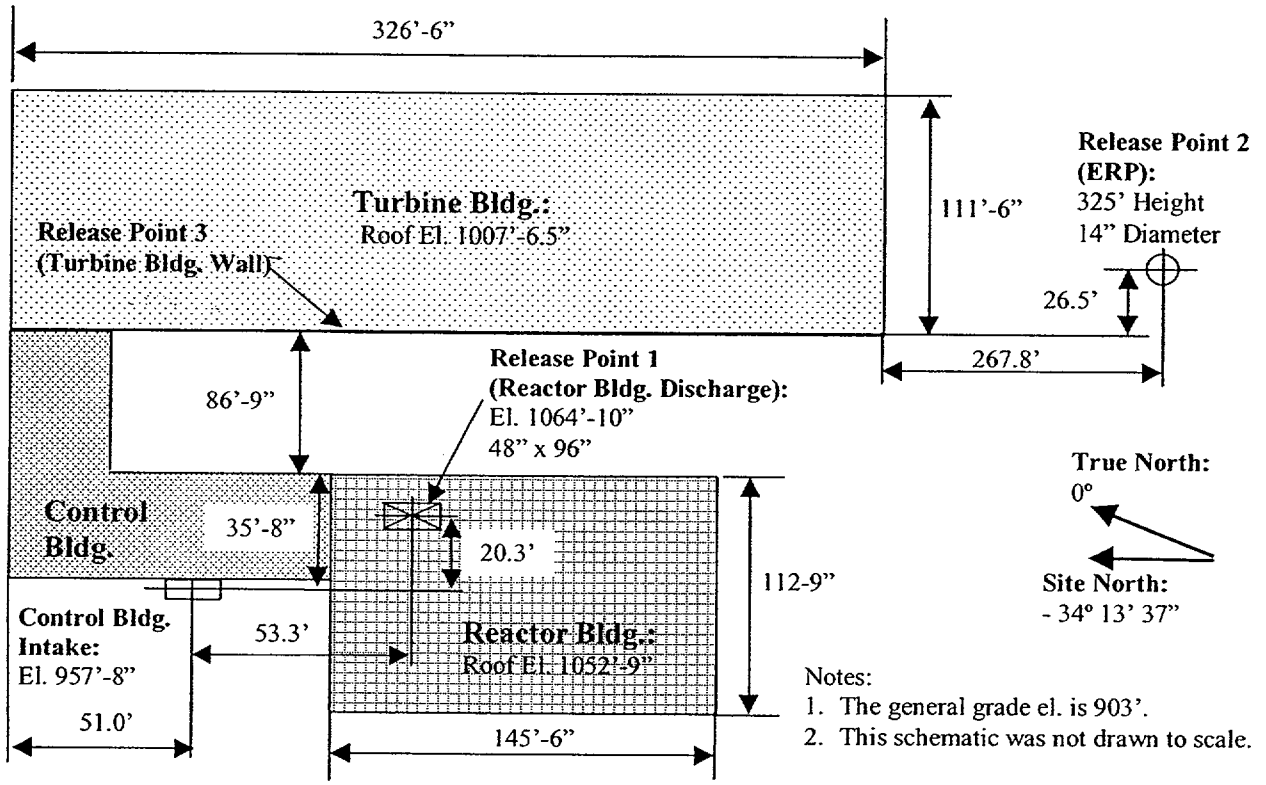

Figure 1. Schematic layout of release points and control room intake showing design input information.

5. References

5.1 J. V. Ramsdell Jr. and C. A. Simonen, "Atmospheric Relative Concentrations in Building Wakes," NUREG/CR-6331, PNNL-10521, Revision 1, U.S. Nuclear Regulatory Commission, Washington, D.C., 1997.

5.2 T. J Bander, PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accident Releases of Radioactive Materials from Nuclear Power Stations, NUREG/CR-2858, U.S. Nuclear Regulatory Commission, Washington D.C., 1982

5.3 J. F Sagendorf, J. T. Goll, and W. F. Sandusky. 1982. XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Releases at Nuclear Power Stations. NUREG/CR-2919, U.S. Nuclear Regulatory Commission, Washington, D.C.

5.4 K. G. Murphy and K. M. Campe, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19," Proceedings of the 13th AEC Air Cleaning Conference, August 12-15, 1974, San Francisco, California. CONF-740807, U.S. Atomic Energy Commission, Washington, D.C.

5.5 J. V Ramsdell Jr, "Atmospheric Diffusion for Control Room Air Habitablity Assessments," NUREG/CR-5055, U.S. Nuclear Regulatory Commission, Washington, D.C., 1988

5.6 J. V. Ramsdell Jr, Diffusion in Building Wakes for Ground-Level Releases. Atmospheric Environment 24B: 377-388, 1990.

5.7 U.S. Nuclear Regulatory Commission, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors. Regulatory Guide 1.111, Revision 1. U.S. Nuclear Regulatory Commission, Washington, D.C., 1977

5.8 F. N. Frankiel "Turbulent Diffusion: Mean Concentration in a Flow Field of Homogeneous Turbulence." Advances in Applied Mechanics 3:61-107, 1953.

5.9 NUREG-0800, Standard Review Plan, Rev. 2, July 1981: § 6.4, "Control Room Habitability Systems,"

5.10 CNS, Burns & Roe Drawings: 2037 Rev. N55, 2209 Rev. 3, 2217 Rev. N08, 2194 Rev. N03, 4005 Rev. N01, and 4506 Rev. N06):

5.11 J. V. Ramsdell Jr. and C. J. Fosmire, Atmospheric Dispersion Estimates in the Vicinity of Buildings. PNL-10286. Pacific Northwest Laboratory, Richland, Washington, 1995.

5.12 S. K. Kao, "Atmospheric Science and Power Production: Theories of Atmospheric Transport and Diffusion," DOE/TIC-27601, D. Randerson, ed. U.S. Department of Energy, Washington, D.C. pp. 189-239,1984.

5.13 H. Wagage, ARCON96 Software Verification Memo from to T. Bladen dated 8/27/01.

5.14 Burns and Roe Calculation, "System Sizing, Standby Gas Treatment System," Book 4, Retrieval 00103-0487.

5.15 CNS Design Change 94-102.

5.16 Calculation 17080-M-01, Rev. 0, "$\frac{\chi}{Q}$ Values for Control Room Intake Using ARCON96."

5.17 SER for Amendment No. 215 to Facility Operating License No. DPR-50, Three Mile Island Nuclear Station, Unit No. 1, Docket No. 50-289, 8/24/99.

5.18 Nuclear Energy Institute, "Control Room Habitability Assessment Guidance," NEI 99-03, June 2001.

5.19 Reg. Guide 1.23 (Safety Guide 23).

6. Major Assumptions

6.1 The release height is equal to the height of the control room intake for diffuse release cases, i.e., for release from the turbine building. This assumption is conservative because the actual release can occur at a higher elevation, which vary from the floor to the roof of the turbine building, resulting in lower values of $\frac{\chi}{Q}$.

7. Computer Codes and Computer Used

The ARCON96 computer code was used as the basis for the analyses for this report. The code was obtained from the Energy Science and Technology Software Center and was provided on two IBM compatible floppy disks. The program was installed and executed on a Dell Latitude computer running on Windows NT Version 4.0 operating system as currently assigned to Hanry Wagage (owned by Matrix Leasing, no. 210158). Satisfactory operation of the ARCON96 code on this computer has been confirmed by verification. [5.13]

8. Detailed Calculations

8.1 Meteorological Data

The meteorological data used in this assessment were provided by Cooper Nuclear Station. These data have been obtained from the 100-meter onsite meteorological tower at Cooper and represent hourly averages for wind speed, wind direction, and temperature difference between two levels. Wind speed and wind direction data were available at 10-, 60-, and 100-meter levels and temperature difference data were available between 100 to 10m, 100 to 60 m, and 60 to 10 m levels. The data were compiled for the five-year period 1994 through 1998.

The meteorological data files developed for the reactor-building exhaust and turbine building diffuse release cases used wind speed and wind direction data from the 10-meter and 60-meter levels. Stability class for these release cases was determined from temperature differential between the 60-meter and 10-meter levels. (See Reg. Guide 1.23.) [5.19] The meteorological data files developed for the stack release case used wind speed and wind directions from the 10-meter and 100-meter levels. Stability class for this case was determined from temperature differential between the 100-meter and 10-meter levels. (See Reg. Guide 1.23.) [5.19] Data was formatted in accordance with the description provided in § 4.4.2 of ARCON96.

8.2 Source Geometry

Figure 2 gives a schematic layout of release points and control room intake showing input data for the ARCON96 code. Data shown on figure 2 were calculated using those shown on figure 1.

The above diagram and source geometry used in this assessment was obtained from CNS, Burns & Roe drawings 2209 Rev 3, 2217 Rev N08, 2194 Rev N03, and 4506 Rev N06. [5.10] The ARCON 96 code requires the following source configuration information: vent release height, building area, effluent vertical velocity, vent or stack flow, vent or stack radius, direction from true north from the control room intake to the source, distance to the control room intake from the source, and the control room intake height. [5.1] It is indicated in CNS drawing 2209 Rev 3 that the reactor building vent is not capped; however, the fans are tripped during an FHA and the flow could coast down to zero before the discharge damper is closed, effectively reducing the flow to zero. The effect of the coast down of the fan is modeled by parametrically changing the flow rate.

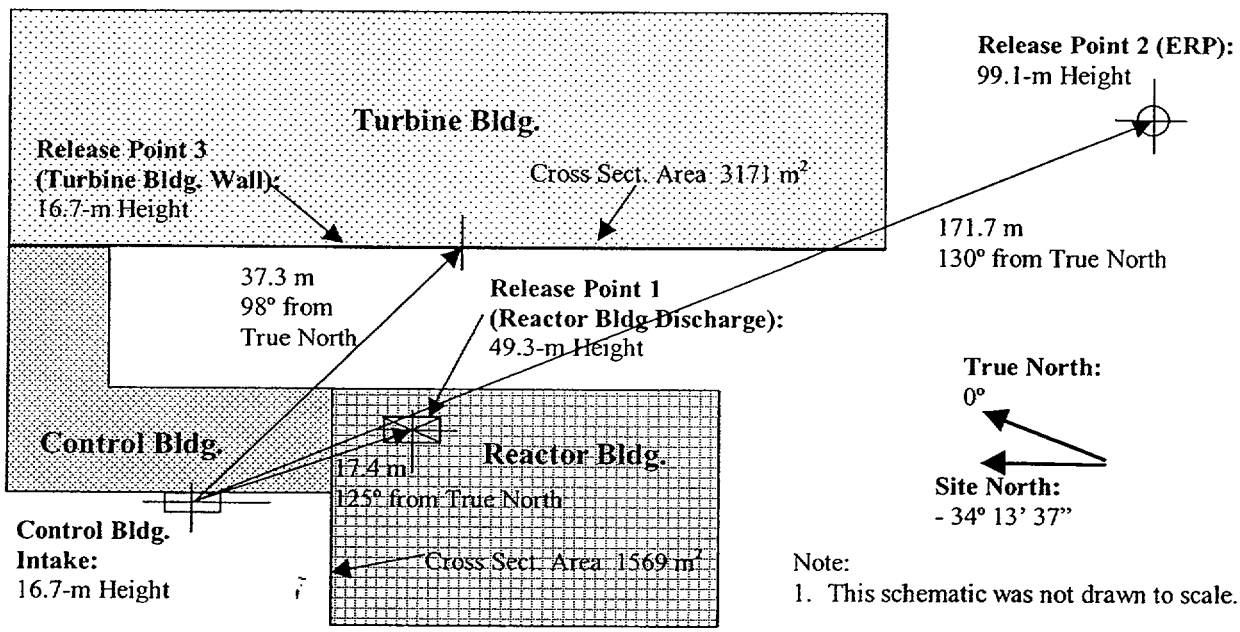

Figure 2. Schematic layout of release points and control room intake showing input data for the ARCON96 code. ***(Note: The height of Release Point 3 was conservatively assumed to be the same as the height of control building intake.)***

The minimum stack (ERP) flow is 552 cfm (0.26 m^3/s) which occurs during SGTS operation (§ 4.3). As seen from equation 15, a lower stack flow would result in a higher value for $\frac{\chi}{Q}$. Therefore, the lower bound of stack flow of 552 cfm (0.26 m^3/s) was conservatively used in the calculation.

The building area as used in ARCON96 controls the distance downwind at which the wake effect

will exist and has influence on containment dispersion. For this analysis the turbine building structure was used. This is conservative since other adjacent structures will enhance the effect of the wake and ensure greater dispersion. As presented in the ARCON96 manual a characteristic length representing the distance the wake effect will be felt is determined as the square root of the building area. [5.1] Considering the cross-sectional area of the turbine building, the control room intake locations are clearly within the wake zones of the respective containment structure. The input calculation of area presented below is for the purposes of satisfying the input requirements of ARCON96 and providing a somewhat real estimate of containment cross-sectional area.

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Reference-angles and distances between the intake and release were obtained from the referenced drawings.

Σ_y was calculated using equation 21 as follows:

$\Sigma_y = (326'\text{-}6'') / 6 = 54.4' = 16.6$ m

The height of the exposed area is taken as the height of the turbine building, which is 1007'-6½". Plant general grade elevation is 903'. Therefore the height of the exposed area is 107.6'. Σ_z for units is therefore calculated using equation 22 as follows:

$\Sigma_z = (1007'\text{-}6.5'' - 903') / 6 = 17.4' = 5.3$ m.

Table 1 presents a list of source input parameters for the above cases.

9. Computer Input and Output

Attachment-A gives computer output files, which list the input files at the beginning.

10. Summary of results

Table 2 summarizes the results. The X/Q values calculated for elevated release point release and turbine building diffuse release are lower than those reported in rev. 2 of this report. The X/Q values calculated for the reactor building ground level release is higher than those reported in rev. 2 of this report.

11. Conclusions

Table 2 summarizes the results. Note that the X/Q values calculated for release points 2 and 3, i.e., elevated release and turbine building diffuse release are lower than those reported in rev. 2 of this report. The X/Q values calculated for release point 1 is *higher* than those reported in rev. 2 of this report.

Table 1. Source Input Parameters to ARCON96

Release Configuration	Release Point 1: Reactor Building Release for Different Flow Rates			Release Point 2: Elevated Release Point Release	Release Point 3: Turbine Generator Building Diffuse Release
	51,333 cfm	9,500 cfm	1,780 cfm		
Release Mode	Ground Level			Stack	Ground Level
Height of lower wind instrument (m)	10				
Height of upper wind instrument (m)	60			100	60
Vent Release Height (m)	49.3			99.1	16.7
Bldg., X-sect. Area (m^2)	1569			0	3171
Effluent Vertical Velocity (m/s)	0			2.62	0
Stack Flow (m^3/s)	24.2	4.48	0.840	0.26	0
Stack Radius (m)	0			0.18	0
Σ_y (m)	0			0	16.6
Σ_z (m)	0			0	5.3
Direction from True North- Intake to Source (deg)	125			130	98
Wind Direction Sector Width (deg)	90				
Distance to Intake (m)	17.4			171.7	37.3
Intake Height (m)	16.7				
Surface Roughness Length (m)	0.2				

Table 2. $\frac{\chi}{Q}$ Values Calculated by ARCON96 for Different Release Cases (s/m^3)

Release Point	RB Exhaust Flow rate (cfm)	0 – 2 hours	2 – 8 hours	8 – 24 hours	1 – 4 days	4 – 30 days
1	51,333	3.77E-3	2.99E-3	1.25E-3	8.71E-4	6.87E-4
	9,500	4.07E-3	3.21E-3	1.30E-3	8.97E-4	7.17E-4
	1,780	4.15E-3	3.24E-3	1.32E-3	9.01E-4	7.22E-4
2	-	1.00E-10	8.58E-10	1.41E-8	5.62E-9	5.69E-9
3	-	8.64E-4	4.66E-4	2.32E-4	1.53E-4	1.25E-4

Release Point 1: Reactor Building Ground Level Release, 51,333 cfm release rate 2
Release Point 1: Reactor Building Ground Level Release, 9,500 cfm release rate 4
Release Point 1: Reactor Building Ground Level Release, 1,780 cfm release rate 6
Release Point 2: Elevated Release Point Release 8
Release Point 3: Turbine Generator Building Diffuse Release 10

Release Point 1: Reactor Building Ground Level Release, 51,333 cfm release rate

Program Title: ARCON96.

Developed For: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Reactor Program Management

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page 21 of 30

Date: June 25, 1997 11:00 a.m.

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Code Developer: J. V. Ramsdell Phone: (509) 372 6316
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Code Documentation: NUREG/CR-6331 Rev. 1

The program was prepared for an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibilities for any third party's use, or the results of such use, of any portion of this program or represents that its use by such third party would not infringe privately owned rights.

Program Run 8/27/2001 at 13:30:01

```
******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     hmGND94.MET
     hmGND95.MET
     hmGND96.MET
     hmGND97.MET
     hmGND98.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as miles per hour

   Ground-level release
   Release height (m)                   =     49.3
   Building Area (m^2)                  =   1569.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =     24.20
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      125
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   080 - 170
   Distance to intake (m)               =     17.4
   Intake height  (m)                   =     16.7
   Terrain elevation difference (m)     =       .0
```

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```
Output file names
  1r1.log
  1r1.cfd

Minimum Wind Speed (m/s)                =      .5
Surface roughness length (m)            =      .20
Sector averaging constant               =     4.0

Initial value of sigma y                =      .00
Initial value of sigma z                =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43800
Hours of missing data                   =   5677
Hours direction in window               =  10131
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    493
Hours direction not in window or calm   =  27499

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
   AVER. PER.          1          2          4          8         12         24
96        168        360        720
   UPPER LIM.    1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
1.00E-02   1.00E-02   1.00E-02   1.00E-02
     LOW LIM.    1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
1.00E-06   1.00E-06   1.00E-06   1.00E-06
  ABOVE RANGE          0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
     IN RANGE      10624.     12095.     14019.     16333.     18358.     21697.
26785.     29431.     28756.     29164.
  BELOW RANGE          0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
         ZERO      27499.     25665.     23032.     19353.     17005.     11401.
1441.        72.         0.         0.
   TOTAL X/Qs      38123.     37760.     37051.     35686.     35363.     33098.
28226.     29503.     28756.     29164.
   % NON ZERO       27.87      32.03      37.84      45.77      51.91      65.55
94.89      99.76     100.00     100.00

95th PERCENTILE X/Q VALUES
                 3.77E-03   3.65E-03   3.48E-03   3.18E-03   2.63E-03   1.90E-03
1.13E-03   9.53E-04   8.25E-04   7.46E-04

95% X/Q for standard averaging intervals

0 to 2 hours        3.77E-03
2 to 8 hours        2.99E-03
8 to 24 hours       1.25E-03
1 to 4 days         8.71E-04
4 to 30 days        6.87E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
     CENTERLINE        5.02E-03             2.38E-04
     SECTOR-AVERAGE    3.30E-03             1.50E-04

NORMAL PROGRAM COMPLETION
```

Release Point 1: Reactor Building Ground Level Release, 9,500 cfm release rate

Program Title: ARCON96.

Developed For: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Reactor Program Management

Date: June 25, 1997 11:00 a.m.

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L. A Brown Phone: (301) 415 1232
e-mail: lab2@nrc.gov

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NEDC 99-031 Rev 4 Att 1 page 22 of 30

Code Documentation: NUREG/CR-6331 Rev. 1

The program was prepared for an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibilities for any third party's use, or the results of such use, of any portion of this program or represents that its use by such third party would not infringe privately owned rights.

Program Run 8/27/2001 at 13:30:03

```
******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     hmGND94.MET
     hmGND95.MET
     hmGND96.MET
     hmGND97.MET
     hmGND98.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as miles per hour

   Ground-level release
   Release height (m)                   =     49.3
   Building Area (m^2)                  =   1569.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =      4.48
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      125
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   080 - 170
   Distance to intake (m)               =     17.4
   Intake height  (m)                   =     16.7
   Terrain elevation difference (m)     =       .0
```

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```
Output file names
  2r1.log
  2r1.cfd

Minimum Wind Speed (m/s)                =      .5
Surface roughness length (m)            =      .20
Sector averaging constant               =     4.0

Initial value of sigma y                =      .00
Initial value of sigma z                =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43800
Hours of missing data                   =   5677
Hours direction in window               =  10131
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    493
Hours direction not in window or calm   =  27499

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
   AVER. PER.          1          2          4          8         12         24
96        168        360        720
   UPPER LIM.   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
1.00E-02   1.00E-02   1.00E-02   1.00E-02
     LOW LIM.   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
1.00E-06   1.00E-06   1.00E-06   1.00E-06
  ABOVE RANGE         0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
     IN RANGE     10624.     12095.     14019.     16333.     18358.     21697.
26785.     29431.     28756.     29164.
  BELOW RANGE         0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
         ZERO     27499.     25665.     23032.     19353.     17005.     11401.
1441.        72.         0.         0.
   TOTAL X/Qs     38123.     37760.     37051.     35686.     35363.     33098.
28226.     29503.     28756.     29164.
   % NON ZERO      27.87      32.03      37.84      45.77      51.91      65.55
94.89      99.76     100.00     100.00

95th PERCENTILE X/Q VALUES
                4.07E-03   3.95E-03   3.74E-03   3.42E-03   2.81E-03   2.01E-03
1.18E-03   9.94E-04   8.59E-04   7.78E-04

95% X/Q for standard averaging intervals

0 to 2 hours        4.07E-03
2 to 8 hours        3.21E-03
8 to 24 hours       1.30E-03
1 to 4 days         8.97E-04
4 to 30 days        7.17E-04

                          HOURLY VALUE RANGE
                         MAX X/Q              MIN X/Q
     CENTERLINE         5.58E-03             2.40E-04
     SECTOR-AVERAGE     3.53E-03             1.50E-04

NORMAL PROGRAM COMPLETION
```

Release Point 1: Reactor Building Ground Level Release, 1,780 cfm release rate

Program Title: ARCON96.

Developed For: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Reactor Program Management

NEDC 99-023 Rev 4 Att 1
page 25 of 30

Date: June 25, 1997 11:00 a.m.

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Code Documentation: NUREG/CR-6331 Rev. 1

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Program Run 8/27/2001 at 13:30:04

```
******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     hmGND94.MET
     hmGND95.MET
     hmGND96.MET
     hmGND97.MET
     hmGND98.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as miles per hour

   Ground-level release
   Release height (m)                   =     49.3
   Building Area (m^2)                  =   1569.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .84
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      125
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   080 - 170
   Distance to intake (m)               =     17.4
   Intake height  (m)                   =     16.7
   Terrain elevation difference (m)     =       .0
```

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```
Output file names
  3r1.log
  3r1.cfd

Minimum Wind Speed (m/s)                =      .5
Surface roughness length (m)            =      .20
Sector averaging constant               =     4.0

Initial value of sigma y                =      .00
Initial value of sigma z                =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43800
Hours of missing data                   =   5677
Hours direction in window               =  10131
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    493
Hours direction not in window or calm   =  27499

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
   AVER. PER.          1          2          4          8         12         24
96        168        360        720
   UPPER LIM.    1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
1.00E-02   1.00E-02   1.00E-02   1.00E-02
     LOW LIM.    1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
1.00E-06   1.00E-06   1.00E-06   1.00E-06
  ABOVE RANGE          0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
     IN RANGE      10624.     12095.     14019.     16333.     18358.     21697.
26785.     29431.     28756.     29164.
  BELOW RANGE          0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
         ZERO      27499.     25665.     23032.     19353.     17005.     11401.
1441.        72.         0.         0.
   TOTAL X/Qs      38123.     37760.     37051.     35686.     35363.     33098.
28226.     29503.     28756.     29164.
   % NON ZERO       27.87      32.03      37.84      45.77      51.91      65.55
94.89      99.76     100.00     100.00

95th PERCENTILE X/Q VALUES
                   4.15E-03   3.99E-03   3.80E-03   3.47E-03   2.85E-03   2.03E-03
1.18E-03   1.00E-03   8.68E-04   7.84E-04

95% X/Q for standard averaging intervals

0 to 2 hours        4.15E-03
2 to 8 hours        3.24E-03
8 to 24 hours       1.32E-03
1 to 4 days         9.01E-04
4 to 30 days        7.22E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
     CENTERLINE        5.69E-03             2.40E-04
     SECTOR-AVERAGE    3.57E-03             1.50E-04

NORMAL PROGRAM COMPLETION
```

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Release Point 2: Elevated Release Point Release

Program Title: ARCON96.

Developed For: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Reactor Program Management

Date: June 25, 1997 11:00 a.m.

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Code Documentation: NUREG/CR-6331 Rev. 1

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Program Run 8/27/2001 at 13:30:05

```
******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     hmelev94.MET
     hmelev95.MET
     hmelev96.MET
     hmelev97.MET
     hmelev98.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =    100.0
   Wind speeds entered as miles per hour

   Elevated release
   Release height (m)                   =     99.1
   Building Area (m^2)                  =       .0
   Effluent vertical velocity (m/s)     =      2.62
   Vent or stack flow  (m^3/s)          =       .26
   Vent or stack radius (m)             =       .18

   Direction .. intake to source (deg)  =      130
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   085 - 175
   Distance to intake (m)               =    171.7
   Intake height  (m)                   =     16.7
   Terrain elevation difference (m)     =       .0
```

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```
Output file names
   r2.log
   r2.cfd

Minimum Wind Speed (m/s)                =      .5
Surface roughness length (m)            =      .20
Sector averaging constant               =     4.0

Initial value of sigma y                =      .00
Initial value of sigma z                =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43800
Hours of missing data                   =   7146
Hours direction in window               =  10254
Hours elevated plume w/ dir. in window  =   5203
Hours of calm winds                     =     29
Hours direction not in window or calm   =  26371

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
   AVER. PER.          1          2          4          8         12         24
96        168        360        720
   UPPER LIM.    1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
1.00E-06   1.00E-06   1.00E-06   1.00E-06
      LOW LIM.    1.00E-10   1.00E-10   1.00E-10   1.00E-10   1.00E-10   1.00E-10
1.00E-10   1.00E-10   1.00E-10   1.00E-10
   ABOVE RANGE          3.         1.         0.         0.         0.         0.
0.         0.         0.         0.
      IN RANGE        963.      1322.      1893.      2881.      3694.      5127.
7830.     11690.     16848.     19956.
   BELOW RANGE          0.         0.         0.         8.       262.      1270.
4932.      6060.      5692.      6335.
          ZERO      35688.     35040.     33897.     31785.     30483.     26124.
15831.     12074.      7928.      3987.
   TOTAL X/Qs       36654.     36363.     35790.     34674.     34439.     32521.
28593.     29824.     30468.     30278.
   % NON ZERO        2.64       3.64       5.29       8.33      11.49      19.67
44.63      59.52      73.98      86.83

95th PERCENTILE X/Q VALUES
                  1.00E-10   1.00E-10   3.26E-10   6.69E-10   7.71E-09   9.65E-09
6.63E-09   6.09E-09   5.62E-09   5.81E-09

95% X/Q for standard averaging intervals

0 to 2 hours        1.00E-10
2 to 8 hours        8.58E-10
8 to 24 hours       1.41E-08
1 to 4 days         5.62E-09
4 to 30 days        5.69E-09

                          HOURLY VALUE RANGE
                         MAX X/Q              MIN X/Q
     CENTERLINE         1.21E-06             9.19E-30
     SECTOR-AVERAGE     7.57E-07             5.24E-30

NORMAL PROGRAM COMPLETION
```

Release Point 3: Turbine Generator Building Diffuse Release

Program Title: ARCON96.

Developed For: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Reactor Program Management

Date: June 25, 1997 11:00 a.m.

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NEDC 99-031 Rev 4 Att 1
page 29 of 30

Code Documentation: NUREG/CR-6331 Rev. 1

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Program Run 8/27/2001 at 13:30:07

```
******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     hmGND94.MET
     hmGND95.MET
     hmGND96.MET
     hmGND97.MET
     hmGND98.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as miles per hour

   Ground-level release
   Release height (m)                   =     16.7
   Building Area (m^2)                  =   3171.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      098
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   053 - 143
   Distance to intake (m)               =     37.3
   Intake height  (m)                   =     16.7
   Terrain elevation difference (m)     =       .0
```

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```
Output file names
   r3.log
   r3.cfd

Minimum Wind Speed (m/s)                =      .5
Surface roughness length (m)            =      .20
Sector averaging constant               =     4.0

Initial value of sigma y                =    16.60
Initial value of sigma z                =     5.30

Expanded output for code testing not selected

Total number of hours of data processed =  43800
Hours of missing data                   =   5677
Hours direction in window               =   6948
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    416
Hours direction not in window or calm   =  30759

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
   AVER. PER.          1          2          4          8         12         24
96        168        360        720
   UPPER LIM.   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
1.00E-02   1.00E-02   1.00E-02   1.00E-02
      LOW LIM.   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
1.00E-06   1.00E-06   1.00E-06   1.00E-06
   ABOVE RANGE         0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
      IN RANGE      7364.      9031.     11214.     13932.     16290.     20298.
26676.     29434.     28756.     29164.
   BELOW RANGE         0.         0.         0.         0.         0.         0.
0.         0.         0.         0.
          ZERO     30759.     28729.     25837.     21754.     19073.     12800.
1550.        69.        0.         0.
   TOTAL X/Qs      38123.     37760.     37051.     35686.     35363.     33098.
28226.     29503.     28756.     29164.
   % NON ZERO      19.32      23.92      30.27      39.04      46.07      61.33
94.51      99.77     100.00     100.00

95th PERCENTILE X/Q VALUES
                 8.64E-04   6.86E-04   6.30E-04   5.65E-04   4.66E-04   3.43E-04
2.00E-04   1.73E-04   1.49E-04   1.35E-04

95% X/Q for standard averaging intervals

0 to 2 hours        8.64E-04
2 to 8 hours        4.66E-04
8 to 24 hours       2.32E-04
1 to 4 days         1.53E-04
4 to 30 days        1.25E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
      CENTERLINE       1.29E-03             1.06E-04
      SECTOR-AVERAGE   8.07E-04             6.67E-05

NORMAL PROGRAM COMPLETION
```

NLS2001085
Enclosure

PROPOSED LICENSE AMENDMENT TO REVISE THE DESIGN
BASIS RADIOLOGICAL ASSESSMENT CALCULATIONAL METHODOLOGY

DESIGN BASIS ACCIDENT RADIOLOGICAL ASSESSMENT CALCULATIONS
COOPER NUCLEAR STATION
NRC DOCKET NO. 50-298, LICENSE DPR-46

ENCLOSURE 2

Cooper Nuclear Station Calculation NEDC 99-032, Revision 2, Control Room Habitability and Offsite Dose for a Fuel Handling Accident, Pages 6 through 99.

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J. Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J. Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1.0 PURPOSE OF ANALYSIS

The purpose of this calculation is to determine the doses to the control room operator and to a person at the EAB and the LPZ of the Cooper Nuclear Station following a design basis Fuel Handling Accident (FHA). Calculations are performed with the X/Q values discussed in Section 4.

The purpose of this calculation is to determine the doses to the control room operator and to a person at the Exclusion Area Boundary (EAB) and at the Low Population Zone (LPZ) of the Cooper Nuclear Station (CNS) following a design basis Fuel Handling Accident (FHA).

Revision 1 considers 1% bypass of the SGTS and Control Room filters by decreasing filter efficiencies by 1% for all forms of iodine.

Revision 1 replaces the TID-14844 based core inventory source term with General Electric's GE14 Amendment 22 based core inventory source term. The GE14 Amendment 22 core inventory source term was calculated using the isotope generation and depletion code ORIGEN2, incorporating the the BWR extended burnup library BWRUE. [Reference 34]

Revision 1 also replaces the ARCON96 generated elevated release X/Q value for the Control Room, during the first 30 minutes following the accident, with the CNS License Basis Control Room habitability fumigation X/Q value contained in the CNS post TMI requirements/action plan letter dated December 30, 1980. [Reference 35] Several other methods such as tracer testing, wind tunnel studies or using a proposed revision to ARCON96 were considered with regard to re-evaluating the onsite fumigation asumptions, but none were considered feasible in the near term. Thus the control room fumigation assumptions of the CNS post TMI requirements/action plan letter were used as design input.

Revision 1 revises the Control Room Emergency Filtration System flow to its minimum flow value as an additional conservatism. This has the net effect of reducing the Control Room Emergency Filtration System Filter efficiency.

Revision 1 revises the time elapsed since fuel irradiation from 72 hours to 67 hours.

Revision 1 reduces the Control Room Emergency Filtration (CREF) System isolation time from 1 minute to 11 seconds. The change in isolation time will be accomplished by reducing the stroke time of the CREF System automatic dampers and replacing the initiating signal for CREF System initiation and control room isolation from the Control Room Ventilation Radiation Monitor to the Reactor Building Ventilation Exhaust Plenum Radiation-High automatic isolation signal. The reactor building ventilation exhaust radiation signal is indicative of an FHA and is the same signal used for secondary containment isolation and Standby Gas Treatment System initiation for the FHA. (Note: The function of the Reactor Building Ventilation Exhaust Plenum Radiation-High signal to result in CREF System initiation and the reduction in CREF System damper stroke times are being added to the CNS design in accordance with 10 CFR 50.59).

Revision 1 incorporates the Scientech Engineering Calculation No. 17080-M-02 into NEDC 99-032

in its entirety. The body of the calculation is now performed by CNS under Procedure 3.4.7 rather than by a consultant. Revision 1 has been prepared as a Status 2 calculation for NRC review and will be as-built upon receipt of a License Amendment which incorporates this calculation.

Revision 2 of NEDC 99-032 is being made as a result of data input format errors identified in the vendor supplied calculation Scientech Calculation 17080-M-01 Revision 2 (NEDC 99-031, Rev 3). Scientech Calculation 17080-M-01 provides the Control Room receptor X/Q data for NEDC 99-032. The data format errors were corrected in Scientech Calculation17080-M-01 and Revision 3 of 17080-M-1 was issued. The X/Q data in the corrected calculation resulted in higher X/Q values for the Reactor Building exhaust point and lower X/Q values for the elevated release point. This revision of NEDC 99-032 corrects the reactor building exhaust Control Room X/Q data. The elevated release point data was not updated as it was already conservative and contributes only a small amount to the overall Control Room personnel dose. In order to remain within GDC 19 dose limitations with the higher X/Q data the following additional concurrent changes were required throughout NEDC 99-032: reduced radial peaking factor from 1.9 to 1.8 which essentially changes the source term for all runs in Section A.0, reduced CREFS initiation from 11 to 10 seconds, revised time steps in the AXIDENT runs to better match the CREFS 10 second initiation, updated average Reactor Building flows for a given time period to better match the 10 second CREFS initiation, deleted average Reactor Building flow data not used, updated data files for all 7 AXIDENT runs based on the changes discussed above, and reran all 7 AXIDENT runs with the updated data.

2.0 INTENDED USE OF ANALYSIS RESULTS

The results of this analysis are to be used to reevaluate the design basis of CNS by comparing the calculated doses for the control room operator, a person at the EAB, and a person at the LPZ to the regulatory dose limits.

3.0 TECHNICAL APPROACH

3.1. General Description

The radiological consequences of a FHA are based on the fuel failure due to the drop of a fuel assembly onto the core in conjunction with a conservative transport methodology based on Standard Review Plan (SRP) 15.7.4 (Reference 1). Doses are calculated for control room operators and individuals at the site boundary beginning 67 hours after fuel irradiation.

The radiological consequences for the control room operators are assessed using the SCIENTECH-NUS computer code AXIDENT. This code calculates individual whole body (beta and gamma) and thyroid doses resulting from any postulated accident which releases radioactivity within the containment. AXIDENT models the transport of radioactivity to the environment and to the control room. This code includes the time dependent effects of containment sprays, recirculation, purge and intake filters, atmospheric dispersion and natural decay. The AXIDENT code is discussed in Reference 2. The principal application of the AXIDENT code is to determine the control room, LPZ and EAB dose due to a loss of coolant accident (LOCA).

The original AXIDENT code used very conservative dose conversion factors (DCFs) that were in effect and used for the design basis 10 CFR 100 type reactor siting analyses (i.e., TID 14844,

Reference 16, and ICRP Publication 2, Reference 32). For this analysis, more accurate DCFs are used that are obtained from ICRP 30, Reference 31.

3.2. *Fuel Handling Accident Event*

The postulated FHA event begins with a drop of a fuel assembly into the core during refueling operations from a height of 32.95 feet (Reference 3), which is the maximum height allowed by the fuel handling equipment. The resulting impact of the fuel assembly onto the top of the core will damage a number of fuel rods sufficiently to cause a release of radionuclides to the water pool above the core. Subsequently, the radionuclides will be released to the refueling area and to the environment. Release of radionuclides to the environment can result in a dose to the control room operators due to intake of contaminated air from the environment via the control room ventilation system. Since both the primary containment and reactor vessel are open during refueling, the main barrier to release of radionuclides to the environment is the refueling area structure which is part of secondary containment. The water pool above the core also serves as a barrier to release of radioiodine.

3.3. *Modeling Approach for the AXIDENT Code*

The AXIDENT code computes individual whole body, beta, and thyroid doses resulting from any postulated accident which releases radionuclides to the containment. This code incorporates models to determine doses to both control room personnel and individuals at the site boundary. The AXIDENT code incorporates models for the primary and secondary containment. The time dependent effects of containment sprays, HVAC recirculation, filtration, atmospheric dispersion, and decay are included in the models. Further details are found in the AXIDENT User's Manual.

In AXIDENT, all releases are presumed to be to the primary containment. In the case of the FHA, the release occurs while the drywell head is removed, so that the primary containment is not considered in the AXIDENT model. To bypass the primary containment (essentially releasing the nuclides to the secondary containment), a primary containment leak rate of 1 volume/sec is used.

Assumptions on the fraction of the core inventory of various radionuclide groups available for release are incorporated into the AXIDENT code (100 percent of the noble gases and 25 percent of the iodines). To obtain the correct release for the FHA, the iodine source term used in AXIDENT must be increased by a factor of 4 to compensate for the AXIDENT modeling assumptions. The radionuclide release to the secondary containment for input to the AXIDENT code is discussed in Section 4.

The secondary containment, removal and filtration AXIDENT models are selectively used. Because SGTS and Control Room filter efficiencies are treated as a constant by AXIDENT, it is necessary to perform several runs for each combination of SGTS and Control Room filtration to determine the Control Room and LPZ dose. The runs made are contained in Section A.0

4.0 DESIGN INPUT INFORMATION

4.1. Source Term

The general FHA analysis assumptions and methodology are based on the accident information from the Cooper USAR and a very conservative transport methodology based on Standard Review Plan (SRP) Section 15.7.4.

The radionuclide source term during a fuel handling accident is based on the total number of fuel rods in the reactor core damaged as a result of the accident and the maximum radial peaking factor of the fuel, each of which depends on the type of fuel used. This analysis addresses the worst fuel drop combination of GE 8x8NB fuel and GE14 10x10 fuel . In this case a GE14 bundle dropped over GE14 bundles results in the highest source term for the fuel handling accident primarily due to the significantly higher radial peaking factor of the GE14 fuel.

The activity released in a FHA for a 10x10 core is based on 151 rods assumed to have been damaged (Reference 26). Each bundle has an equivalent of 87.333 full length fuel rods (Reference 26). With 548 fuel bundles in the core the fraction of the core failed is calculated to be 151/(548 x 87.333) or 0.003155.

The core is assumed to have operated at the design power level plus 2%, to account for uncertainties in power measurement (Section 15.6.5 of the SRP (Reference 1), for a sufficiently extended period (approximately 3 years) such that fission produt equilibrium is reached. For radionuclides which have not reached equilibrium the core inventory at time of shutdown is used. The source term used for this accident is based on General Electric's GE14 Amendment 22 core inventory source term. The GE14 Amendment 22 core inventory source term was calculated using the isotope generation and depletion code ORIGEN2, incorporating the the BWR extended burnup library BWRUE.

In addition, a radial peaking factor of 1.8 is applied to the radionuclide inventory calculation to reflect the typical peaking factor in GE14 fuel. Note that this radial peaking factor value is higher than the 1.5 value suggested in Regulatory Guide 1.25 (Reference 5). The combination of the 102% power factor and a radial peaking factor of 1.8 results in a very conservative source term.

The fraction of radionuclides released from the damaged rods is 10% of the total noble gases (other than Kr-85, 30% of the Kr-85), and 10% of the total radioactive iodine (other than I-131) in the rods at the time of the accident per the assumptions of Regulatory Guide 1.25. For I-131, the release fraction is increased to 12% to account for extended fuel burnup in accordance with NUREG/CR-5009 (Reference 22). These release fractions are more conservative than those used in the original FHA analysis contained in the USAR. A conservative effective refueling pool decontamination factor of 100 is applied to determine the release of iodine to the refueling area in this analysis per the guidance of Regulatory Guide 1.25. Actual pool decontamination factors are expected to be orders of magnitude in excess of 100.

The source terms calculated below are based on a 67-hour decay period since the fuel was last irradiated prior to the FHA event.

Because AXIDENT is intended for LOCA dose analysis applications, assumptions on the fraction of the core inventory of various radionuclide groups available for release are incorporated into the

AXIDENT code (100 percent of the noble gases and 25 percent of the iodine). To obtain the correct release for the FHA, the iodine source term used in AXIDENT must be increased by a factor of 4 to compensate for the AXIDENT modeling assumptions. The radionuclide release to the refueling area for input to the AXIDENT code is computed below and is based on the GE14 Amendment 22 ORIGEN2 generated core inventory.

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The radionuclide release to the refueling area used in AXIDENT is based on the ORIGEN2 generated source term and is computed in the following table. The decay constants are from Table 1 of the AXIDENT Manual.

Isotope	ORIGEN 2 Ci/MWt	MWt	Uncertainity Factor	Total Core Inventory	Decay Constant	Time After Shutdown	Core Inventory at Time After Shutdown	Fraction of Core Inventory Released	Water Pool Decon Factor	AXIDENT Correction Factor	Radial Peaking Factor	Fraction of Core Failed	FHA Source Term
I-131	2.72E+04	2381	1.02	6.61E+07	9.97E-07	241200	5.19E+07	0.12	0.01	4	1.8	0.003155123	1.416E+03
I-132	3.93E+04	2381	1.02	9.54E+07	8.37E-05	241200	1.63E-01	0.1	0.01	4	1.8	0.003155123	3.701E-06
I-133	5.51E+04	2381	1.02	1.34E+08	9.17E-06	241200	1.47E+07	0.1	0.01	4	1.8	0.003155123	3.329E+02
I-134	6.04E+04	2381	1.02	1.47E+08	2.22E-04	241200	8.16E-16	0.1	0.01	4	1.8	0.003155123	1.853E-20
I-135	5.16E+04	2381	1.02	1.25E+08	2.87E-05	241200	1.23E+05	0.1	0.01	4	1.8	0.003155123	2.805E+00
Xe-131m	3.04E+02	2381	1.02	7.38E+05	6.79E-07	241200	6.27E+05	0.1	1	1	1.8	0.003155123	3.560E+02
Xe-133m	1.58E+03	2381	1.02	3.84E+06	3.55E-06	241200	1.63E+06	0.1	1	1	1.8	0.003155123	9.256E+02
Xe-133	5.26E+04	2381	1.02	1.28E+08	1.52E-06	241200	8.85E+07	0.1	1	1	1.8	0.003155123	5.028E+04
Xe-135m	1.09E+04	2381	1.02	2.65E+07	7.40E-04	241200	8.06E-71	0.1	1	1	1.8	0.003155123	4.578E-74
Xe-135	1.86E+04	2381	1.02	4.52E+07	2.11E-05	241200	2.78E+05	0.1	1	1	1.8	0.003155123	1.581E+02
Xe-138	4.50E+04	2381	1.02	1.09E+08	6.60E-04	241200	7.99E-62	0.1	1	1	1.8	0.003155123	4.536E-65
Kr-83m	3.27E+03	2381	1.02	7.94E+06	1.03E-04	241200	1.29E-04	0.1	1	1	1.8	0.003155123	7.324E-08
Kr-85m	6.81E+03	2381	1.02	1.65E+07	4.38E-05	241200	4.27E+02	0.1	1	1	1.8	0.003155123	2.425E-01
Kr-85	3.66E+02	2381	1.02	8.89E+05	2.04E-09	241200	8.88E+05	0.3	1	1	1.8	0.003155123	1.514E+03
Kr-87	1.30E+04	2381	1.02	3.16E+07	1.52E-04	241200	3.78E-09	0.1	1	1	1.8	0.003155123	2.144E-12
Kr-88	1.83E+04	2381	1.02	4.44E+07	6.88E-05	241200	2.76E+00	0.1	1	1	1.8	0.003155123	1.567E-03

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4.2. Release Rate from the Refueling Area

Immediately after the fuel bundle drop, radionuclides (principally the noble gases) are assumed to be released from the refueling pool to the refueling floor in sufficient quantities to initiate secondary containment isolation due to high radiation. The normal reactor building HVAC system is tripped, SGTS operation commences and the Control Emergency Filtration System starts. Air from the normal HVAC exhaust is released through the RB exhaust vent, which is not charcoal-filtered. After HVAC system fan coastdown occurs, all air from the secondary containment, which includes the refueling area, is exhausted through the SGTS filters (charcoal and HEPA) to the elevated release point (ERP). The release rate of radionuclides to the environment is based on the refueling area free air volume, the reactor building HVAC fan coastdown rate during the first 90-second damper closure period after the FHA and the SGTS ventilation rate after the 90 second closure period.

The effective free volume of the refueling floor area is 7.95×10^5 ft^3 (Reference 6). Radionuclides released to the refueling area are assumed to be diluted in 50 percent of the air volume of the refueling area for the purposes of determining the radionuclide release rate to the environment. This assumption increases the rate of activity that is released and thus is conservative.

The period of time that the release from the secondary containment is unfiltered by the SGTS is based on the most limiting closure time of the reactor building HVAC exhaust isolation dampers HV-MO-258 and 260. This analysis is conservatively based on a 90-second closure time, which yields approximately 30% margin over the IST Retest Limit. As a note, this delay only occurs in the event of a single failure of the quick acting Reactor Building exhaust isolation damper. Furthermore, the reactor building ventilation system design includes a "6-second" hold-up duct section to allow the fast-acting isolation damper to close to minimize the unfiltered activity released from the building. Reference 27 determines the Reactor Building release rate as a function of time for the scenario that includes a failure of the fast-acting isolation damper. Reference 27 considers the factors such as the 90-second closure period, fan coastdown, coincident damper closure, radiation monitor detection time and the effective hold-up time.

The Reactor Building ventilation system response to the event includes a trip of the supply and exhaust fans and an isolation signal that initiates closure of the redundant exhaust isolation dampers (one of which is an MOV and one of which is the fast-acting AOV). The design intent of the isolation dampers, assuming no single failure, is to minimize the amount of unfiltered activity discharged during the FHA (the exhaust ductwork is routed back and forth across the reactor building ceiling to allow for a "6-second" delay). However, during a single failure of the fast-acting AOV, unfiltered activity will be released via the RB vent due to the closure time of the MOV.

For this analysis, it is assumed that over a 90-second period, the RB exhaust fan coasts down in accordance with the manufacturer's curve and the MOV closes in accordance with its closure characteristics (Reference 27).

Reference 27 calculates the flowrate that leaves the RB after an isolation signal as a function of time. Reference 27 also calculates the time it takes for the "clean air" that was in the exhaust system at the time of the event to traverse the system. The flow

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leaving the RB exhaust after receiving an isolation signal and the transit time computations from Reference 27 are presented in the following summary:

$Q = (Qo/No)N$

where

Qo = initial exhaust flow rate prior to fan trip, cfm
No = initial fan speed prior to trip = 587 rpm
N = fan speed as a function of time during coastdown, rpm

Substituting this into equation 12 gives:

$Vol = Qo/(60*No) \int(N)dt$ (14)

However, the volume of air exhausted must be increased to account for the 3 second time delay of the radiation monitor prior to fan trip. The exhaust flow rate during this 3 second period is equal to the initial flow rate so that the total volume of air exhausted becomes:

$Vol = Qo/(60*No) \int(N)dt + 3*Qo/60$ (15)

Substituting the fan speed N into equation 15 and performing the integration gives:

$Vol = (Qo/60)[3+(2.016E-05*t5 - 4.288E-03*t4 + 0.3633*t3 - 16.77*t2 + 586.1*t)/No]$ (16)

Therefore, the effective holdup time with fan coastdown can be determined by setting equation 16 equal to the total RB exhaust ductwork volume of 7874 ft3 and iteratively solving for time. The following table documents these results These results give the effective hold up time from fan trip, which occurs at time zero on the time scale used in this calculation.

EFFECTIVE HOLD UP TIME WITH VARIABLE EXHAUST FLOW RATE
(From Reference 27, Table 7)

Exhaust Flow Rate (cfm)	Delay Time (sec)
74,025	3.8

REACTOR BUILDING HVAC EXHAUST FLOW RATE DURING ISOLATION
(From Reference 27, Table 8)

TIME AFTER FAN TRIP (SEC)	REACTOR BUILDING EXHAUST FLOW RATE (CFM)
	Qo = 74,025 CFM
0	73912
10	43338
20	29059
30	18470
40	10736
50	5588
60	2629
70	1284
80	551
90	0

Using the flows from Table 8 of Reference 27 the average Reactor Building flow rate can be calculated for various time segments during the first 90 seconds of release. The release rate can then be calculated per the methodology described in section 4.2 of this calculation.The results are summarized in the following table:

TIME PERIOD (sec)	FLOW (cfm)	Release Rate (sec^{-1})
0 to 3.8	67001	Clean air, modeled as 0
3.8 to10	53016	2.22E-03
0 to 90	16161	6.78E-04
10 to 90	10890	4.57E-04

Atmospheric dispersion factors using ARCON96 and site specific meteorological data have been calculated for the RB exhaust vent in Reference 9. The RB exhaust vent was modeled as a single release point using the ground level release mode of ARCON96 These results are discussed in Section 4.4. The release rates (sec^{-1}) from the Reactor Building are computed for input to AXIDENT code as follows:

- $\lambda_{Release}$ = (RB Flow (cfm))(1/60 min/sec)(1/0.5)(1/7.95 x 10^5 cubic feet)

The SGTS flow rate consists of two components that are summarized below (Reference 10 and Reference 11):

- operating train – 1492 cfm **
- idle train – 288 cfm **

** SGT design flow is 1780 cfm and maximum crosstie flow is 280 cfm. For conservative computation of SGT filtration, operating train flow is reduced and crosstie flow (conservatively assumed to be unheated) is increased.

However, the initial SGTS flowrate may be much higher (See Section 6). Both SGTS trains will start upon a secondary containment isolation signal. Once an operator verifies that the secondary containment is at a negative pressure of 0.25" H_2O with respect to the outside, he/she will secure one system and make necessary flow adjustments in the operating train to maintain the negative pressure. The flow with both trains operating will be somewhere between 1780 cfm (single train) and 3560 cfm (arithmetic sum of both trains). With a constant system resistance curve, the two parallel fans operate at less than 1.1 times the single fan operation (Reference 29). For this analysis, a conservative flowrate of 2984 cfm or 49.73 ft^3/sec was used. This flow corresponds to 2 times the flow through a single operating SGT filter, which is approximately 1 2/3 times the total SGT design flow for a single train. The flow used for this analysis conservatively bounds the maximum flow resulting from a Group 6 signal in which, per DC 89-245 (Reference 30), the SGT flow control valves move to their full open position. After one hour, the SGTS flow is reduced to its single fan mode of operation (Reference 28).

The following SGTS flow rates are used for input to AXIDENT for the analysis:

LS_1 = 2984/60/0.5/7.95 x 10^5

= 1.25 x 10^{-4} sec^{-1} (> 90 sec to 1 hr after FHA, i.e., SGTS release)

LS_2 = 1780/60/0.5/7.95 x 10^5

= 7.46 x 10^{-5} sec^{-1} (> 1 hr after FHA, i.e., SGTS release)

The filtration efficiency of the operating train of the SGTS is 95 percent for all iodine species (Reference 12). The filtration efficiency for an idle SGTS train is assumed to be 90 percent for elemental iodine, 30 percent for organic iodine and 95 percent for particulate iodine. Since this analysis already assumes the single failure of the faster acting AOV RB exhaust valve, a heater failure in one operating train of SBGT is not assumed.The filter efficiencies for both the operating and non-operating trains are reduced by 1% for all forms of iodine to account for 1% bypass leakage (Ref. 33).

Different flow rates and removal efficiencies are assumed for the operating- and idle-SGTS trains.

AXIDENT does not provide for two removal pathways from secondary containment with different filter efficiencies. Each train is modeled as a single pathway with net removal efficiency. The net (resultant) iodine removal efficiencies are calculated using equation 4, which is derived using conservation of mass.

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$$\eta_{i\,res} = \frac{\left(\eta_i \overset{o}{V}\right)_1 + \left(\eta_i \overset{o}{V}\right)_2}{\left(\overset{o}{V}\right)_1 + \left(\overset{o}{V}\right)_2} \qquad (4)$$

where:

$\eta_{i\,res}$ Resultant value of SGTS filter efficiency for iodine isotope of form "i".

η_i Individual efficiency of idle or operating train of SGTS for iodine isotope of form "i".

$\overset{o}{V}$ Airflow rate through idle or operating train of SGTS.

Subscripts 1 and 2 in equation 4 refer to idle and operating trains for SGTS.

The results for the three assumed iodine species is summarized in the following table:

Table 4-1. Resultant Iodine Removal Efficiencies and Non-Removal Factors for SGTS Filters

	Train Flow	Train Flow	Total	
0 – 1 h: both trains operate				
Flow rate (cfm)	1492	1492	2984	
	Efficiency	Efficiency	Efficiency	NRF (1)
Elemental Iodine	94%	94%	94%	6.00E-2
Particulate Iodine	94%	94%	94%	6.00E-2
Organic Iodine	94%	94%	94%	6.00E-2
> 1 h: one train operates; one train secured				
Flow rate (cfm)	1492	288	1780	
	Efficiency	Efficiency	Efficiency	NRF (1)
Elemental Iodine	94%	89%	93.2%	6.81E-2
Particulate Iodine	94%	94%	94.0%	6.00E-2
Organic Iodine	94%	29%	83.5%	0.165

Notes:

1. NRF = non-removal factor = 1 – efficiency.

Note that full SGTS operation is not assumed to commence until 90 seconds after the high radiation containment isolation signal occurs as discussed above. During that time, the air discharge rate is based on reactor building HVAC system fan coastdown and no filtration of iodine is assumed.

Note that the chemical/physical form of iodine released to the refueling area in AXIDENT is apportioned among the three iodine species as given below:

- 0.91 for elemental iodine

- 0.05 for particulate iodine
- 0.04 for organic iodine

This apportionment is not part of the user-specified input, but is incorporated into the AXIDENT coding. Regulatory Guide 1.25 guidance specifies that only 0.25 percent of the iodine is treated as organic species (the remainder is inorganic). As identified in regulatory Guide 1.25, this analysis uses an effective pool decontamination factor of 100 (as opposed to a DF for inorganic and organic species of 133 and 1, respectively). As such, the net percentage of organic species released to the environment would be above 4%. However, since the dose contribution from the SGTS operating mode is negligible, the use of the default 4% is acceptable.

4.3. Control Room Parameters

The air intake rate to the control room, the control room HVAC system filter efficiency, and the control room volume is needed to determine the control room dose.

The dimensions of the control room and the cable spreading room are obtained from References 14 and 15 to obtain the control room volume. The calculation of volume is shown below (rounded to 3 significant figures), assuming 20% of the total volume is occupied by walls, floors, equipment, etc.

Control Room (proper) drawing takeoff

Width = 72' (Reference 14)

Length = 80' 9" - 13' 3" = 67.5' (Reference 15)

Floor El = 932' 6" (Reference 15)

High point of roof slab = 949' 1.5"

Cable Room

west of column H7

Outside wall to H7 = 80' 9" - 13' 3" = 67.5' (Reference 15)

N-S = 72' (Reference 14)

Floor El = 918' (Reference 14)

column H7 to G

H7 to G = 35' + 13' 3" = 48.25' (Reference 15)

E-W = 37' 3" (Reference 14)

Floor El = 918' (Reference 14)

Control Room proper

Height = 949' 1.5" - 932' 6" = 16.625'

Volume = 72' · 67.5' · 16.625' = 80,800 ft^3

Cable Room

Height = 932' 6" - 918' = 14.5'

Volume = (72' · 67.5' · 14.5') + (37.25' · 48.25' · 14.5') = 96,530 ft^3

Total volume = 80,800 ft^3 + 96,530 ft^3 = 177,330 ft^3

Assuming 20% of the volumes include walls, floors, and equipment, the net volumes are:

Control Room proper = 64,640 ft^3

Control Center = 141,860 ft^3

The air intake rate to the control room prior to isolation is summarized below:

- 3235 cfm – normal air intake flow (Reference 17)
- 71 cfm – infiltration inleakage (this inleakage rate was based on tracer gas testing documented in Reference 18)
- 10 cfm – inleakage through opening and closing doors (SRP, Section 6.4 (Reference 1))

The total air intake rate is 3316 cfm prior to isolation. After the normal intake is isolated, the control room is summarized below:

- 900±10% cfm – emergency supply air intake rate (Reference 18 and Reference 19)
- 71 cfm – unfiltered inleakage
- 10 cfm – ingress/egress inleakage

After isolation, the analysis conservatively uses 891 cfm to maximize the trapping of the activity in the CR (900 cfm minus 10% plus 81 cfm).

Before control room isolation, the normal ventilation flow rate is applied in the AXIDENT analysis and no filtration is assumed in the analysis during this period.

The control room ventilation system filter efficiency is specified as 95 percent for all iodine species (Reference 12). This is reduced by 1% to account for bypass (Ref. 33). To account for inleakage, the effective non-removal factor is calculated as follows:

$$\text{Non-removal Factor} = \frac{810 * 0.06 + 81}{810 + 81}$$

Effective Non-removal Factor = 0.145

4.4. *X/Q values for the Control Room Intake*

AXIDENT calculations are performed considering X/Q values for two release points. For the first 90 seconds until reactor building isolation with the SGTS is complete, the release point is the reactor building vent (conservatively modeled as a ground level type release). After 90 seconds, the release

point is the SGTS elevated release point. The ARCON96 generated elevated release X/Q value for the Control Room, during the first 30 minutes following the accident, was replaced by the CNS License Basis Control Room habitability fumigation X/Q value contained in the CNS post TMI requirements/action plan letter dated December 30, 1980. [Reference 35]

Occupancy factors for the operators after 1 day are applied to the X/Q values to allow for the actual time that the operator is assumed to be present in the control room (SRP Section 6.4 (Reference 1)). The revised X/Q values are tabulated below.

Table 4-3

Revised X/Q Values (sec/m3) for the Control Room Intake (Reference 9)

Time Period	X/Q Value (sec/m3)	Occupancy Factor	X/Q Value (sec/m3) Adjusted for Occupancy	Comments
3.8 – 10 Sec 10 – 90 Sec See Table Note for 0 to 3.8 sec	3.77E-03 4.07E-03	1 1	3.77E-03 4.07E-03	Reactor Building Exhaust modeled as ground level release
90 Sec – 0.5 Hours	3.03E-4	1	3.03E-4	SGTS Elevated Release Point With fumigation [Ref 35]
0.5 - 1 Hour	1.00E-09	1	1.00E-09	SGTS Elevated Release Point
1 – 2 Hours	1.00E-09	1	1.00E-09	SGTS Elevated Release Point
2 – 8 Hours	2.65E-09	1	2.65E-09	SGTS Elevated Release Point
8 – 24 Hours	6.41E-8	1	6.41E-8	SGTS Elevated Release Point
1 – 4 Days	2.00E-8	0.6	1.20E-08	SGTS Elevated Release Point
4 – 30 Days	1.66E-8	0.4	6.64E-09	SGTS Elevated Release Point

Note – for the AXIDENT models, t = 3.8 is defined as the moment that activity leaves the RB exhaust release point and simultaneously enters the CR intake (the model conservatively neglects the transit time from the release point to the CR intake). Prior to 3.8 seconds no activity has left the RB exhaust release point, thus the X/Q is 0.0.

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4.5. *X/Q values for the EAB and LPZ*

The X/Q values for the LPZ are summarized in the following table:

Table 4-4 X/Q Values for the LPZ (Reference 20)		
Time Period	X/Q Value (sec/m3)	Comments
0-90 Sec	2.9E-4	RB Vent (Ground level release)
90 Sec – 0.5 Hrs	1.4E-4	SGTS Elevated Release Point
0.5 to 1 Hrs	4.0E-5	SGTS Elevated Release Point
1 to 2 Hrs	4.0E-5	SGTS Elevated Release Point
2 to 8 Hrs	4.0E-5	SGTS Elevated Release Point
8 – 24 Hrs	1.6E-5	SGTS Elevated Release Point
1 – 4 Days	5.8E-6	SGTS Elevated Release Point
4 – 30 Days	1.7E-6	SGTS Elevated Release Point

The X/Q values for the EAB are summarized in the following table:

Table 4-5 X/Q Values for the EAB (Reference 20)		
Time Period	X/Q Value (sec/m3)	Comments
0-90 Sec	5.2E-4	RB Vent (Ground level release)
90 Sec – 0.5 Hrs	1.2E-4	SGTS Release Stack (elevated)
0.5 to 2 Hrs	1.6E-5	SGTS Release Stack (elevated)

5.0 REFERENCES

1. NUREG-0800, Standard Review Plan, Rev. 1, July 1981 (Sections 6.4, 6.5.3, 15.6.5, and 15.7.4).
2. S.J. Nathan, "AXIDENT – A Digital Computer Dose Calculation Model," NUS-1954, Revision 2
3. Cooper Nuclear Station Updated Safety Analysis Report (USAR), Chapter XIV, Section 6.4
4. Cooper Technical Specifications, Section 1.1
5. U.S. Nuclear Regulatory Commission, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel handling and Storage Facility for Boiling and Pressurized Water Reactors," Regulatory Guide 1.25, 3/23/72
6. Burns and Roe Calculation – System Sizing, Standby Gas Treatment System, Book 4, Retrieval 00103-0487
7. CNS Procedure 6.SC.201, Secondary Containment Valve Operability Test, Revision 14

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8. B&R Dwg 2037, Rev. N55
9. NEDC 99-031, "Review of SCIENTECH Calculation 17080-M-01, "Control Room X/Q Values for Control Room Intake Using ARCON96," Rev 4.
10. Burns and Roe Drawing 2020, Rev. N47
11. DC 94-102, "SGT System Crosstie Valve Modification / Heater Setpoint Change"
12. Cooper Technical Specifications, Section 5.5.7 as suplemented by NPPD Response to Generic Letter 99-02, NLS990117, December 2, 1999.
13. Regulatory Guide 1.52, Design, Testing, And Maintenance Criteria For Post-Accident Engineered Safety Feature Atmosphere Cleanup System Air Filtration And Adsorption Units Of Light Water Cooled Nuclear Power Plants, Revision 2.
14. Burns and Roe Drawing 2051, Rev. N17
15. Burns and Roe Drawing 2052, Rev N16
16. TID 14844, "Calculation of Distance Factors for Power and Test Reactor Sites," 1962
17. Burns and Roe Drawing 2019, Sheet 1, Rev. N35
18. CNS Test Procedure
    STP-94-199, Control Room Envelope Unfiltered Inleakage Test
    STP-94-199-1, Control Room Envelope Unfiltered Inleakage Test (Amendment 1)
19. Cooper Technical Specifications, Section 3.7.4
20. NEDC 99-036, "EAB and LPZ Meteorological Dispersion- Accident Analyses", Rev 2.
21. GE Letter REK:99-211, R.E. Kingston to J.L. Lewis, dated November 9, 1999.
22. NUREG/CR-5009, "Assessment Of The Use Of Extended Burnup Fuel In Light Water Power Reactors"
23. GE Letter REK:99-152, R.E. Kingston to J.L. Lewis, dated September 1, 1999.
24. Not used
25. Not used
26. GE NEDC-32868P, Rev.0, GE14 Compliance With Amendment 22 of NEDE-24011-P-A (GESTAR II).
27. NEDC 99-080, Rev. 0, "Reactor Building HVAC Exhaust Duct Hold Up Time and Exhaust Flow Variation During Reactor Building Isolation"
28. CNS System Operating Procedure 2.2.73, "Standby Gas Treatment System"
29. NEDC 90-113, Rev. 0, "Reactor Building Pressure For Standby Gas Treatment Plant Operation"
30. DC 89-245, "Removal of Instrument Air Connections to SGT Solenoid Valves"
31. ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers," 1979.

32. ICRP Publication 2, "Report of Committee II, Permissible Dose for Internal Radiation," 1959.

33. CNS Technical Specification 5.5.7, Ventilation Filter Testing Program (VFTP).

34. GE letter GE-MIG-1H69L-062, Erik Stromqvist to Paul Ballinger, dated February 29, 2000, GE14 Source Term Letter Report.

35. CNS Post TMI Requirements/Action Plan, Jay M. Pilant (NPPD) to Darrell G. Eisenhut (NRC), dated December 30, 1980, (NPPD Letter LQA8000581).

36. Cooper Nuclear Station Minor Software Alteration Number 53796, 11/02/00.

6.0 MAJOR ASSUMPTIONS

The major assumptions used in this calculation are summarized below:

6.1. After secondary containment isolation, all airflow is filtered through the SGTS system. This is consistent with the SGTS design basis.

6.2. The activity released in a FHA for a 10x10 core is based on 151 rods assumed to have been damaged (Reference 26). Each bundle has an equivalent of 87.333 full length fuel rods (Reference 26). With 548 fuel bundles in the core the fraction of the core failed is calculated to be 151/(548 x 87.333) or 0.003155.

6.3. A radial peaking factor of 1.8 is applied to the fuel to determine the initial core inventory to bound different fuel designs that may be used at Cooper (Reference 23). 9/4/01 2

6.4. A factor of 1.02 increase in core thermal power is assumed based on the Standard Review Plan, Section 15.6.5 (Reference 1). This 1.02 factor is a LOCA analysis requirement that is conservatively being extended to the FHA (the 1.8 radial peaking factor should be sufficient to account for instrument uncertainties). 9/4/01 2

6.5. It is assumed that radionuclide mixing takes place in 50 percent of the refueling area volume (Regulatory Guide 1.25, Section C.1.k (Reference 5), also see SRP Section 6.5.3 (Reference 1)). Assuming mixing in a portion of the area increases the dose consequences of the FHA.

6.6. It is assumed that unfiltered inleakage continues to occur after control room ventilation system isolation even when the CR is at positive pressure.

6.7. It is assumed that both SGTS trains operate for the first hour. Filter efficiency is based on 95 percent for the operating trains. The filter efficiencies for both the operating and non-operating trains are reduced by 1% for all forms of iodine to account for 1% bypass leakage (Ref. 33).

6.8. It is assumed that the event occurs 67 hours after fuel irradiation.

7.0 COMPUTER CODES AND COMPUTER USED

The SCIENTECH-NUS code ***AXIDENT***, Version 2, Mod 4 is used for this analysis. The AXIDENT program was executed on a Gateway Solo laptop computer running a Windows 98 operating system as currently assigned to Robert L. Beilke. Satisfactory operation of the AXIDENT code on this computer has been confirmed by CNS software testing validation (Reference 36).

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8.0 DETAILED CALCULATIONS

The analysis is performed using the AXIDENT code and the calculations that were done to develop the AXIDENT input are discussed in Section 4. Notes on the AXIDENT input preparation are summarized below:

- Development of the radionuclide release to the refueling area is discussed in Section 4.1. A spreadsheet was used to perform the actual calculations using the ORIGEN2 generated source term model.
- X/Q values for the control room intake are taken from Table 4-3. X/Q values for the LPZ are taken from Table 4-4. X/Q values for the EAB are taken from Table 4-5.
- Release rate data based on reactor building HVAC flow and SGTS flow is taken from Section 4.2. Filter non-removal factors for the SGTS are taken from Table 4-1.
- Control room data is taken from Section 4.3.

A tabulation of the input requirements for AXIDENT is provided in Section A.0 for reference.

9.0 SUMMARY OF RESULTS

The results of the dose analysis are summarized in the following tables:

Table 9-1
Control Room Doses (rem) Over 30 days Following a FHA

Run Number	Thyroid	Whole Body	Beta
0-10 sec Run #1	2.65E+01	8.85E-03	3.47E-01
10-90 sec Run #2	2.94E+00	6.57E-03	2.63E-01
90 sec – 1 hour Run #3	7.02E-02	2.60E-03	1.05E-01
1 hour-30 days Run #4	1.58E-05	4.86E-07	1.95E-05
Total	**2.95E+01**	**1.80E-02**	**7.15E-01**
Criteria	**30.0**	**5.0**	**30.0**

Table 9-2
LPZ Doses (rem) Over 30 days Following a FHA

Run Number	Thyroid	Whole Body	Beta
0-10 sec Run#1	5.54E-01	1.74E-03	7.29E-03
10-90 sec Run #2	1.46E+00	4.58E-03	1.92E-02
90 sec – 1 hour Run #3	2.81E-01	1.33E-02	6.09E-02
1 hour-30 days Run #4	3.47E-01	1.41E-02	6.47E-02
Total	**2.64E+00**	**3.37E-02**	**1.52E-01**
Criteria	75.0	6.0	N/A

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Table 9-3 EAB Doses (rem) Over 2 Hours Following a FHA			
Run Number	Thyroid	Whole Body	Beta
0-90 sec Run #5	4.14E+00	1.30E-02	5.45E-02
90 sec – 1 hrs Run #6	2.16E-01	1.03E-02	4.68E-02
1 hour – 2 hours Run #7	3.76E-02	1.49E-03	6.81E-03
Total	**4.39E+00**	**2.48E-02**	**1.08E-01**
Criteria	75.0	6.0	N/A

10.0 CONCLUSIONS

All calculated doses are below the stipulated limits. It is concluded that, using a conservative model, that the regulatory dose limits will not be exceeded following a design basis FHA.

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A.0 COMPUTER INPUT AND OUTPUT

The inputs to the ***AXIDENT*** code followed by the ***AXIDENT*** output for each ***AXIDENT*** run are summarized below:

Run #1: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated
2	TIME	10	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	2	Analysis Option: Site boundary dose plus control room dose are to be calculated.
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSP0	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.

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Line	Word	Value	Description
5	T1	3.8	Times at which time dependent parameters change (sec).
	T2	10.0	
	T3	90.0	
	T4	1.8E3	
	T5	3.6E3	
	T6	7.2E3	
	T7	2.88E4	
	T8	8.64E4	
	T9	3.456E5	
	T10	2.592E6	
6	LP 1 – 10	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1	0.0	Leak rate from secondary containment (sec^{-1}).
	LS 2	2.22E-03	
	LS 3-10	0	
8	BP 1-10	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1	3316.0	Intake rate to control center (cfm).
	VCFM 2	3316.0	
	VCFM 3	891.0	
	VCFM 4	891.0	
	VCFM 5	891.0	
	VCFM 6	891.0	
	VCFM 7	891.0	
	VCFM 8	891.0	
	VCFM 9	891.0	
	VCFM 10	891.0	

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Line	Word	Value	Description
10	XQ 1	0.0	Site boundary X/Q (sec/m^3).
	XQ 2	2.90E-4	
	XQ 3	2.90E-4	
	XQ 4	1.40E-4	
	XQ 5	4.00E-5	
	XQ 6	4.00E-5	
	XQ 7	4.00E-5	
	XQ 8	1.60E-5	
	XQ 9	5.80E-6	
	XQ 10	1.70E-6	
11	XQC 1	0.0	X/Q to control center intake (sec/m^3).
	XQC 2	3.77E-3	
	XQC 3	4.07E-3	
	XQC 4	3.03E-4	
	XQC 5	1.00E-9	
	XQC 6	1.00E-9	
	XQC 7	2.65E-9	
	XQC 8	6.41E-8	
	XQC 9	1.20E-8	
	XQC 10	6.64E-9	
12	CPE 1-10	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1-10	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1-10	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1-10	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1-10	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1-10	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1-10	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1-10	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1-10	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	1.0	Combined filter non-removal factors for elemental iodine released to environment.

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Line	Word	Value	Description
	RFP	1.0	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	1.0	Combined filter non-removal factors for organic iodine released to environment.
	IFE	1.0	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	1.0	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	1.0	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

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AXIDENT VER 2 MOD 4
PRODUCTION DATE 02/18/92
BEGIN EXECUTION DATE: 09/01/2001
BEGIN EXECUTION TIME: 15:22:29.18

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```
 1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated
 2 10 2 0.0 1.0
 3 -1 2.6E6 1.4186E5 6.464E4
 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
 5 3.8 10.0 90.0 1.8E3 3.6E3 7.2E3 2.88E4 8.64E4 3.456E5 2.592E6
 6 10*1.0
 7 0 2.22E-03 8*0
 8 10*1.0
 9 2*3316 8*891
10 0.0 2*2.90E-4 1.40E-4 4.00E-5 4.00E-5 4.00E-5 1.60E-5 5.80E-6 1.70E-6
11 0.0 3.77E-3 4.07E-3 3.03E-4 1.00E-9 1.00E-9 2.65E-9 6.41E-8 1.20E-8 6.64E-9
12 10*0.0
13 10*0.0
14 10*0.0
15 10*0.0
16 10*0.0
17 10*0.0
18 10*0.0
19 10*0.0
20 10*0.0
21 1.0 1.0 1.0 1.0 1.0 1.0
22 1.0 1.0 1.0
23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

                    INITIAL CONTAINMENT INVENTORY

                    ISOTOPE    ACTIVITY (CURIES)

                    I-131          1.416E+03
                    I-132          3.701E-06
                    I-133          3.329E+02
                    I-134          1.853E-20
                    I-135          2.805E+00
                    XE-131M        3.560E+02
                    XE-133M        9.256E+02
                    XE-133         5.028E+04
                    XE-135M        4.578E-74
                    XE-135         1.581E+02
                    XE-138         4.536E-65
                    KR-83M         7.324E-08
                    KR-85M         2.425E-01
                    KR-85          1.514E+03
                    KR-87          2.144E-12
                    KR-88          1.567E-03
1   FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON:    1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS

                      1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL,     1. CFM MIXING,   00.00 PCT REL TO SPRAYED VOL

AT     .001 HOURS:   X/Q(SITE)= .00E+00 SEC/M3     PRIMARY LEAK RATE=****** PERCENT/DAY     CONTROL ROOM INTAKE=3316.0 CFM

                     X/Q CONT ROOM= .00E+00 SEC/M3   SEC RELEASE RATE=  .00E+00 VOL/DAY     PCT PRI LKG TO ATM =   00.00

                              CLEANUP RATES  (HR-1)                  FILTER NON-REMOVAL FACTORS
                          ==============================================  ==========================
                          SPRAY        PRIMARY      SECONDARY    CONT CENTER    RELEASE   CONT CENTER

          ELEMENTAL        .000         .000         .000         .000          1.000      1.000
          PARTICULATE      .000         .000         .000         .000          1.000      1.000
          ORGANIC          .000         .000         .000         .000          1.000      1.000

             ACTIVITY  (CURIES)          CONTROL ROOM      SITE BOUNDARY DOSES (REM)      CONTROL ROOM DOSES (REM)
 ISOTOPE  PRIMARY  SECONDARY  RELEASE   (CURIES) (UCI/CM3)  THYROID   WH BODY    BETA    THYROID   WH BODY    BETA

ELEMENTAL
I-131     7.21E+00  3.15E+02  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.88E-08  8.23E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     1.69E+00  7.40E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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I-134	9.42E-23	4.12E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.43E-02	6.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	3.96E-01	1.73E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.03E-09	4.52E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	9.31E-02	4.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						--------	--------	--------	--------	--------	--------
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .003 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .38E-02 SEC/M3 SEC RELEASE RATE= .19E+03 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	1.46E-02	3.18E+02	4.39E+00	2.59E-02	6.44E-06	4.86E-01	1.18E-04	5.77E-05	7.62E-03	6.85E-08	9.04E-07
I-132	3.82E-11	8.30E-07	1.15E-08	6.75E-11	1.68E-14	7.27E-12	1.99E-12	3.42E-13	1.14E-13	1.00E-15	5.37E-15
I-133	3.44E-03	7.47E+01	1.03E+00	6.08E-03	1.51E-06	1.87E-02	3.57E-05	2.91E-05	2.93E-04	2.59E-08	4.56E-07
I-134	1.91E-25	4.15E-21	5.73E-23	3.38E-25	8.40E-29	6.35E-27	8.06E-27	1.74E-27	9.95E-29	5.37E-30	2.73E-29
I-135	2.90E-05	6.29E-01	8.69E-03	5.12E-05	1.27E-08	2.71E-05	1.12E-06	1.79E-07	4.25E-07	4.43E-10	2.80E-09
PARTICULATE											
I-131	8.04E-04	1.75E+01	2.41E-01	1.42E-03	3.54E-07	2.67E-02	6.48E-06	3.17E-06	4.19E-04	3.76E-09	4.97E-08
I-132	2.10E-12	4.56E-08	6.30E-10	3.71E-12	9.24E-16	3.99E-13	1.10E-13	1.88E-14	6.26E-15	5.50E-17	2.95E-16
I-133	1.89E-04	4.10E+00	5.67E-02	3.34E-04	8.31E-08	1.03E-03	1.96E-06	1.60E-06	1.61E-05	1.43E-09	2.51E-08
I-134	1.05E-26	2.28E-22	3.15E-24	1.86E-26	4.62E-30	3.49E-28	4.43E-28	9.56E-29	5.47E-30	2.95E-31	1.50E-30
I-135	1.59E-06	3.46E-02	4.77E-04	2.81E-06	7.00E-10	1.49E-06	6.16E-08	9.81E-09	2.34E-08	2.43E-11	1.54E-10
ORGANIC											
I-131	6.43E-04	1.40E+01	1.93E-01	1.14E-03	2.83E-07	2.13E-02	5.19E-06	2.53E-06	3.35E-04	3.01E-09	3.97E-08
I-132	1.68E-12	3.65E-08	5.04E-10	2.97E-12	7.39E-16	3.19E-13	8.77E-14	1.51E-14	5.01E-15	4.40E-17	2.36E-16
I-133	1.51E-04	3.28E+00	4.53E-02	2.67E-04	6.65E-08	8.21E-04	1.57E-06	1.28E-06	1.29E-05	1.14E-09	2.01E-08
I-134	8.39E-27	1.82E-22	2.52E-24	1.48E-26	3.69E-30	2.79E-28	3.54E-28	7.65E-29	4.37E-30	2.36E-31	1.20E-30
I-135	1.27E-06	2.77E-02	3.82E-04	2.25E-06	5.60E-10	1.19E-06	4.93E-08	7.85E-09	1.87E-08	1.95E-11	1.23E-10
NOBLE GASES											
XE-131M	1.62E-02	3.51E+02	4.85E+00	2.86E-02	7.11E-06	0.00E+00	7.73E-06	4.37E-05	0.00E+00	1.96E-08	6.85E-07
XE-133M	4.20E-02	9.13E+02	1.26E+01	7.43E-02	1.85E-05	0.00E+00	3.02E-05	1.30E-04	0.00E+00	2.26E-08	2.04E-06
XE-133	2.28E+00	4.96E+04	6.85E+02	4.04E+00	1.00E-03	0.00E+00	1.49E-03	6.67E-03	0.00E+00	2.75E-06	1.05E-04
XE-135M	2.06E-78	4.48E-74	6.20E-76	3.65E-78	9.08E-82	0.00E+00	1.90E-80	4.01E-81	0.00E+00	1.13E-83	6.29E-83
XE-135	7.18E-03	1.56E+02	2.15E+00	1.27E-02	3.16E-06	0.00E+00	3.84E-05	4.62E-05	0.00E+00	2.23E-08	7.25E-07
XE-138	2.05E-69	4.44E-65	6.15E-67	3.62E-69	9.00E-73	0.00E+00	1.28E-70	3.28E-71	0.00E+00	1.97E-74	5.14E-73
KR-83M	3.32E-12	7.22E-08	9.97E-10	5.87E-12	1.46E-15	0.00E+00	3.61E-16	2.26E-15	0.00E+00	3.12E-18	3.55E-17
KR-85M	1.10E-05	2.39E-01	3.30E-03	1.95E-05	4.84E-09	0.00E+00	3.73E-08	5.13E-08	0.00E+00	2.33E-11	8.05E-10

RB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

KR-85	6.87E-02	1.49E+03	2.06E+01	1.22E-01	3.03E-05	0.00E+00	3.14E-06	3.07E-04	0.00E+00	1.86E-09	4.81E-06
KR-87	9.72E-17	2.11E-12	2.92E-14	1.72E-16	4.28E-20	0.00E+00	2.91E-18	2.04E-18	0.00E+00	8.42E-22	3.20E-20
KR-88	7.11E-08	1.54E-03	2.13E-05	1.26E-07	3.13E-11	0.00E+00	2.70E-09	4.85E-10	0.00E+00	1.34E-12	7.61E-12
						5.54E-01	1.74E-03	7.29E-03	8.69E-03	2.92E-06	1.14E-04

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .41E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.18E+02	0.00E+00	2.56E-02	6.38E-06	0.00E+00	0.00E+00	0.00E+00	1.96E-01	1.76E-06	2.32E-05
I-132	6.85E-46	8.24E-07	0.00E+00	6.65E-11	1.66E-14	0.00E+00	0.00E+00	0.00E+00	2.92E-12	2.56E-14	1.38E-13
I-133	6.20E-38	7.46E+01	0.00E+00	6.02E-03	1.50E-06	0.00E+00	0.00E+00	0.00E+00	7.53E-03	6.66E-07	1.17E-05
I-134	3.39E-60	4.08E-21	0.00E+00	3.29E-25	8.19E-29	0.00E+00	0.00E+00	0.00E+00	2.53E-27	1.37E-28	6.95E-28
I-135	5.22E-40	6.28E-01	0.00E+00	5.07E-05	1.26E-08	0.00E+00	0.00E+00	0.00E+00	1.09E-05	1.14E-08	7.19E-08
PARTICULATE											
I-131	1.45E-38	1.75E+01	0.00E+00	1.41E-03	3.51E-07	0.00E+00	0.00E+00	0.00E+00	1.08E-02	9.67E-08	1.28E-06
I-132	3.76E-47	4.53E-08	0.00E+00	3.65E-12	9.10E-16	0.00E+00	0.00E+00	0.00E+00	1.60E-13	1.41E-15	7.56E-15
I-133	3.41E-39	4.10E+00	0.00E+00	3.31E-04	8.24E-08	0.00E+00	0.00E+00	0.00E+00	4.14E-04	3.66E-08	6.44E-07
I-134	1.86E-61	2.24E-22	0.00E+00	1.81E-26	4.50E-30	0.00E+00	0.00E+00	0.00E+00	1.39E-28	7.51E-30	3.82E-29
I-135	2.87E-41	3.45E-02	0.00E+00	2.78E-06	6.93E-10	0.00E+00	0.00E+00	0.00E+00	6.00E-07	6.24E-10	3.95E-09
ORGANIC											
I-131	1.16E-38	1.40E+01	0.00E+00	1.13E-03	2.81E-07	0.00E+00	0.00E+00	0.00E+00	8.60E-03	7.74E-08	1.02E-06
I-132	3.01E-47	3.62E-08	0.00E+00	2.92E-12	7.28E-16	0.00E+00	0.00E+00	0.00E+00	1.28E-13	1.13E-15	6.05E-15
I-133	2.73E-39	3.28E+00	0.00E+00	2.65E-04	6.59E-08	0.00E+00	0.00E+00	0.00E+00	3.31E-04	2.93E-08	5.15E-07
I-134	1.49E-61	1.79E-22	0.00E+00	1.45E-26	3.60E-30	0.00E+00	0.00E+00	0.00E+00	1.11E-28	6.01E-30	3.05E-29
I-135	2.29E-41	2.76E-02	0.00E+00	2.23E-06	5.54E-10	0.00E+00	0.00E+00	0.00E+00	4.80E-07	4.99E-10	3.16E-09
NOBLE GASES											
XE-131M	2.92E-37	3.51E+02	0.00E+00	2.83E-02	7.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.03E-07	1.76E-05
XE-133M	7.58E-37	9.13E+02	0.00E+00	7.37E-02	1.83E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.80E-07	5.25E-05
XE-133	4.12E-35	4.96E+04	0.00E+00	4.00E+00	9.96E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E-05	2.69E-03
XE-135M	3.51-113	4.22E-74	0.00E+00	3.41E-78	8.49E-82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.82E-82	1.57E-81
XE-135	1.29E-37	1.56E+02	0.00E+00	1.26E-02	3.13E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.73E-07	1.86E-05
XE-138	3.50-104	4.22E-65	0.00E+00	3.40E-69	8.47E-73	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.92E-73	1.29E-71
KR-83M	5.95E-47	7.16E-08	0.00E+00	5.78E-12	1.44E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.97E-17	9.07E-16
KR-85M	1.98E-40	2.38E-01	0.00E+00	1.92E-05	4.79E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.98E-10	2.06E-08
KR-85	1.24E-36	1.49E+03	0.00E+00	1.21E-01	3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.79E-08	1.24E-04
KR-87	1.73E-51	2.09E-12	0.00E+00	1.68E-16	4.19E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-20	8.18E-19
KR-88	1.28E-42	1.54E-03	0.00E+00	1.24E-07	3.09E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E-11	1.95E-10
						0.00E+00	0.00E+00	0.00E+00	2.23E-01	7.50E-05	2.94E-03

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .14E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .30E-03 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER

9/4/01 EJ

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.17E+02	0.00E+00	2.14E-02	5.33E-06	0.00E+00	0.00E+00	0.00E+00	3.81E+00	3.43E-05	4.52E-04
I-132	0.00E+00	7.14E-07	0.00E+00	4.82E-11	1.20E-14	0.00E+00	0.00E+00	0.00E+00	5.29E-11	4.65E-13	2.49E-12
I-133	0.00E+00	7.35E+01	0.00E+00	4.96E-03	1.23E-06	0.00E+00	0.00E+00	0.00E+00	1.46E-01	1.29E-05	2.27E-04
I-134	0.00E+00	2.79E-21	0.00E+00	1.88E-25	4.68E-29	0.00E+00	0.00E+00	0.00E+00	4.09E-26	2.21E-27	1.12E-26
I-135	0.00E+00	5.98E-01	0.00E+00	4.03E-05	1.00E-08	0.00E+00	0.00E+00	0.00E+00	2.07E-04	2.16E-07	1.37E-06
PARTICULATE											
I-131	0.00E+00	1.74E+01	0.00E+00	1.18E-03	2.93E-07	0.00E+00	0.00E+00	0.00E+00	2.09E-01	1.88E-06	2.49E-05
I-132	0.00E+00	3.93E-08	0.00E+00	2.65E-12	6.59E-16	0.00E+00	0.00E+00	0.00E+00	2.91E-12	2.55E-14	1.37E-13
I-133	0.00E+00	4.04E+00	0.00E+00	2.72E-04	6.78E-08	0.00E+00	0.00E+00	0.00E+00	8.00E-03	7.08E-07	1.25E-05
I-134	0.00E+00	1.53E-22	0.00E+00	1.03E-26	2.57E-30	0.00E+00	0.00E+00	0.00E+00	2.25E-27	1.21E-28	6.17E-28
I-135	0.00E+00	3.28E-02	0.00E+00	2.22E-06	5.52E-10	0.00E+00	0.00E+00	0.00E+00	1.14E-05	1.19E-08	7.51E-08
ORGANIC											
I-131	0.00E+00	1.39E+01	0.00E+00	9.41E-04	2.34E-07	0.00E+00	0.00E+00	0.00E+00	1.68E-01	1.51E-06	1.99E-05
I-132	0.00E+00	3.14E-08	0.00E+00	2.12E-12	5.27E-16	0.00E+00	0.00E+00	0.00E+00	2.33E-12	2.04E-14	1.10E-13
I-133	0.00E+00	3.23E+00	0.00E+00	2.18E-04	5.42E-08	0.00E+00	0.00E+00	0.00E+00	6.40E-03	5.66E-07	9.96E-06
I-134	0.00E+00	1.23E-22	0.00E+00	8.27E-27	2.06E-30	0.00E+00	0.00E+00	0.00E+00	1.80E-27	9.72E-29	4.93E-28
I-135	0.00E+00	2.63E-02	0.00E+00	1.77E-06	4.41E-10	0.00E+00	0.00E+00	0.00E+00	9.12E-06	9.50E-09	6.00E-08
NOBLE GASES											
XE-131M	0.00E+00	3.51E+02	0.00E+00	2.37E-02	5.89E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.80E-06	3.43E-04
XE-133M	0.00E+00	9.07E+02	0.00E+00	6.12E-02	1.52E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-05	1.02E-03
XE-133	0.00E+00	4.95E+04	0.00E+00	3.34E+00	8.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-03	5.23E-02
XE-135M	0.00E+00	1.19E-74	0.00E+00	8.04E-79	2.00E-82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-81	1.71E-80
XE-135	0.00E+00	1.50E+02	0.00E+00	1.01E-02	2.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-05	3.56E-04
XE-138	0.00E+00	1.36E-65	0.00E+00	9.20E-70	2.29E-73	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.69E-72	1.49E-70
KR-83M	0.00E+00	6.00E-08	0.00E+00	4.05E-12	1.01E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-15	1.62E-14
KR-85M	0.00E+00	2.21E-01	0.00E+00	1.49E-05	3.71E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-08	3.87E-07
KR-85	0.00E+00	1.49E+03	0.00E+00	1.01E-01	2.51E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.34E-07	2.41E-03
KR-87	0.00E+00	1.61E-12	0.00E+00	1.09E-16	2.70E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E-19	1.40E-17
KR-88	0.00E+00	1.37E-03	0.00E+00	9.21E-08	2.29E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.31E-10	3.58E-09
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	4.35E+00	1.46E-03	5.72E-02

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1) SPRAY	PRIMARY	SECONDARY	CONT CENTER	FILTER NON-REMOVAL FACTORS RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.17E+02	0.00E+00	1.77E-02	4.40E-06	0.00E+00	0.00E+00	0.00E+00	3.33E+00	3.00E-05	3.96E-04
I-132	0.00E+00	6.14E-07	0.00E+00	3.43E-11	8.55E-15	0.00E+00	0.00E+00	0.00E+00	4.00E-11	3.52E-13	1.89E-12
I-133	0.00E+00	7.23E+01	0.00E+00	4.04E-03	1.01E-06	0.00E+00	0.00E+00	0.00E+00	1.25E-01	1.11E-05	1.95E-04
I-134	0.00E+00	1.87E-21	0.00E+00	1.04E-25	2.60E-29	0.00E+00	0.00E+00	0.00E+00	2.43E-26	1.31E-27	6.67E-27
I-135	0.00E+00	5.68E-01	0.00E+00	3.17E-05	7.90E-09	0.00E+00	0.00E+00	0.00E+00	1.73E-04	1.80E-07	1.14E-06
PARTICULATE											
I-131	0.00E+00	1.74E+01	0.00E+00	9.72E-04	2.42E-07	0.00E+00	0.00E+00	0.00E+00	1.83E-01	1.65E-06	2.17E-05
I-132	0.00E+00	3.38E-08	0.00E+00	1.89E-12	4.70E-16	0.00E+00	0.00E+00	0.00E+00	2.20E-12	1.93E-14	1.04E-13
I-133	0.00E+00	3.97E+00	0.00E+00	2.22E-04	5.52E-08	0.00E+00	0.00E+00	0.00E+00	6.89E-03	6.10E-07	1.07E-05
I-134	0.00E+00	1.03E-22	0.00E+00	5.74E-27	1.43E-30	0.00E+00	0.00E+00	0.00E+00	1.34E-27	7.22E-29	3.66E-28
I-135	0.00E+00	3.12E-02	0.00E+00	1.74E-06	4.34E-10	0.00E+00	0.00E+00	0.00E+00	9.50E-06	9.89E-09	6.25E-08
ORGANIC											
I-131	0.00E+00	1.39E+01	0.00E+00	7.78E-04	1.94E-07	0.00E+00	0.00E+00	0.00E+00	1.47E-01	1.32E-06	1.74E-05
I-132	0.00E+00	2.70E-08	0.00E+00	1.51E-12	3.76E-16	0.00E+00	0.00E+00	0.00E+00	1.76E-12	1.55E-14	8.30E-14

9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	3.18E+00	0.00E+00	1.78E-04	4.42E-08	0.00E+00	0.00E+00	0.00E+00	5.51E-03	4.88E-07	8.59E-06
I-134	0.00E+00	8.22E-23	0.00E+00	4.59E-27	1.14E-30	0.00E+00	0.00E+00	0.00E+00	1.07E-27	5.77E-29	2.93E-28
I-135	0.00E+00	2.50E-02	0.00E+00	1.39E-06	3.47E-10	0.00E+00	0.00E+00	0.00E+00	7.60E-06	7.91E-09	5.00E-08
NOBLE GASES											
XE-131M	0.00E+00	3.50E+02	0.00E+00	1.96E-02	4.87E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.58E-06	3.00E-04
XE-133M	0.00E+00	9.01E+02	0.00E+00	5.04E-02	1.25E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.81E-06	8.88E-04
XE-133	0.00E+00	4.93E+04	0.00E+00	2.76E+00	6.86E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	4.57E-02
XE-135M	0.00E+00	3.15E-75	0.00E+00	1.76E-79	4.38E-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.43E-82	4.13E-81
XE-135	0.00E+00	1.45E+02	0.00E+00	8.08E-03	2.01E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-06	3.01E-04
XE-138	0.00E+00	4.16E-66	0.00E+00	2.32E-70	5.78E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-72	4.12E-71
KR-83M	0.00E+00	4.99E-08	0.00E+00	2.79E-12	6.94E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-15	1.18E-14
KR-85M	0.00E+00	2.04E-01	0.00E+00	1.14E-05	2.84E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.11E-09	3.14E-07
KR-85	0.00E+00	1.49E+03	0.00E+00	8.35E-02	2.08E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.18E-07	2.11E-03
KR-87	0.00E+00	1.22E-12	0.00E+00	6.84E-17	1.70E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-19	9.41E-18
KR-88	0.00E+00	1.21E-03	0.00E+00	6.74E-08	1.68E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-10	2.78E-09
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						0.00E+00	0.00E+00	0.00E+00	3.80E+00	1.27E-03	5.00E-02

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.15E+02	0.00E+00	1.21E-02	3.01E-06	0.00E+00	0.00E+00	0.00E+00	5.03E+00	4.53E-05	5.98E-04
I-132	0.00E+00	4.55E-07	0.00E+00	1.74E-11	4.34E-15	0.00E+00	0.00E+00	0.00E+00	4.88E-11	4.29E-13	2.30E-12
I-133	0.00E+00	6.99E+01	0.00E+00	2.68E-03	6.67E-07	0.00E+00	0.00E+00	0.00E+00	1.85E-01	1.64E-05	2.89E-04
I-134	0.00E+00	8.41E-22	0.00E+00	3.22E-26	8.02E-30	0.00E+00	0.00E+00	0.00E+00	2.10E-26	1.13E-27	5.76E-27
I-135	0.00E+00	5.12E-01	0.00E+00	1.96E-05	4.89E-09	0.00E+00	0.00E+00	0.00E+00	2.43E-04	2.53E-07	1.60E-06
PARTICULATE											
I-131	0.00E+00	1.73E+01	0.00E+00	6.65E-04	1.65E-07	0.00E+00	0.00E+00	0.00E+00	2.77E-01	2.49E-06	3.28E-05
I-132	0.00E+00	2.50E-08	0.00E+00	9.58E-13	2.38E-16	0.00E+00	0.00E+00	0.00E+00	2.68E-12	2.36E-14	1.27E-13
I-133	0.00E+00	3.84E+00	0.00E+00	1.47E-04	3.67E-08	0.00E+00	0.00E+00	0.00E+00	1.02E-02	9.02E-07	1.59E-05
I-134	0.00E+00	4.62E-23	0.00E+00	1.77E-27	4.41E-31	0.00E+00	0.00E+00	0.00E+00	1.15E-27	6.23E-29	3.17E-28
I-135	0.00E+00	2.81E-02	0.00E+00	1.08E-06	2.68E-10	0.00E+00	0.00E+00	0.00E+00	1.33E-05	1.39E-08	8.79E-08
ORGANIC											
I-131	0.00E+00	1.39E+01	0.00E+00	5.32E-04	1.32E-07	0.00E+00	0.00E+00	0.00E+00	2.21E-01	1.99E-06	2.63E-05
I-132	0.00E+00	2.00E-08	0.00E+00	7.66E-13	1.91E-16	0.00E+00	0.00E+00	0.00E+00	2.15E-12	1.88E-14	1.01E-13
I-133	0.00E+00	3.07E+00	0.00E+00	1.18E-04	2.93E-08	0.00E+00	0.00E+00	0.00E+00	8.15E-03	7.22E-07	1.27E-05
I-134	0.00E+00	3.70E-23	0.00E+00	1.42E-27	3.53E-31	0.00E+00	0.00E+00	0.00E+00	9.24E-28	4.99E-29	2.53E-28
I-135	0.00E+00	2.25E-02	0.00E+00	8.63E-07	2.15E-10	0.00E+00	0.00E+00	0.00E+00	1.07E-05	1.11E-08	7.03E-08
NOBLE GASES											
XE-131M	0.00E+00	3.49E+02	0.00E+00	1.34E-02	3.33E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-05	4.53E-04
XE-133M	0.00E+00	8.90E+02	0.00E+00	3.41E-02	8.49E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-05	1.33E-03
XE-133	0.00E+00	4.91E+04	0.00E+00	1.88E+00	4.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-03	6.89E-02
XE-135M	0.00E+00	2.19E-76	0.00E+00	8.40E-81	2.09E-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-82	1.10E-81
XE-135	0.00E+00	1.34E+02	0.00E+00	5.14E-03	1.28E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-05	4.31E-04
XE-138	0.00E+00	3.86E-67	0.00E+00	1.48E-71	3.69E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-73	1.30E-71
KR-83M	0.00E+00	3.44E-08	0.00E+00	1.32E-12	3.28E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-15	1.38E-14
KR-85M	0.00E+00	1.75E-01	0.00E+00	6.69E-06	1.67E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-08	4.25E-07
KR-85	0.00E+00	1.49E+03	0.00E+00	5.72E-02	1.43E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-06	3.20E-03
KR-87	0.00E+00	7.08E-13	0.00E+00	2.71E-17	6.76E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.54E-19	9.66E-18
KR-88	0.00E+00	9.42E-04	0.00E+00	3.61E-08	8.99E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.21E-10	3.52E-09
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	5.74E+00	1.92E-03	7.53E-02

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

9/4/01 2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 8.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .27E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.09E+02	0.00E+00	1.23E-03	3.07E-07	0.00E+00	0.00E+00	0.00E+00	9.77E+00	8.78E-05	1.16E-03
I-132	0.00E+00	7.46E-08	0.00E+00	2.98E-13	7.42E-17	0.00E+00	0.00E+00	0.00E+00	4.95E-11	4.34E-13	2.33E-12
I-133	0.00E+00	5.74E+01	0.00E+00	2.29E-04	5.71E-08	0.00E+00	0.00E+00	0.00E+00	3.35E-01	2.96E-05	5.22E-04
I-134	0.00E+00	6.95E-24	0.00E+00	2.78E-29	6.92E-33	0.00E+00	0.00E+00	0.00E+00	9.37E-27	5.06E-28	2.57E-27
I-135	0.00E+00	2.75E-01	0.00E+00	1.10E-06	2.74E-10	0.00E+00	0.00E+00	0.00E+00	3.72E-04	3.87E-07	2.45E-06
PARTICULATE											
I-131	0.00E+00	1.70E+01	0.00E+00	6.78E-05	1.69E-08	0.00E+00	0.00E+00	0.00E+00	5.37E-01	4.83E-06	6.37E-05
I-132	0.00E+00	4.10E-09	0.00E+00	1.64E-14	4.07E-18	0.00E+00	0.00E+00	0.00E+00	2.72E-12	2.39E-14	1.28E-13
I-133	0.00E+00	3.15E+00	0.00E+00	1.26E-05	3.14E-09	0.00E+00	0.00E+00	0.00E+00	1.84E-02	1.63E-06	2.87E-05
I-134	0.00E+00	3.82E-25	0.00E+00	1.53E-30	3.80E-34	0.00E+00	0.00E+00	0.00E+00	5.15E-28	2.78E-29	1.41E-28
I-135	0.00E+00	1.51E-02	0.00E+00	6.05E-08	1.51E-11	0.00E+00	0.00E+00	0.00E+00	2.04E-05	2.13E-08	1.35E-07
ORGANIC											
I-131	0.00E+00	1.36E+01	0.00E+00	5.42E-05	1.35E-08	0.00E+00	0.00E+00	0.00E+00	4.29E-01	3.86E-06	5.10E-05
I-132	0.00E+00	3.28E-09	0.00E+00	1.31E-14	3.26E-18	0.00E+00	0.00E+00	0.00E+00	2.18E-12	1.91E-14	1.03E-13
I-133	0.00E+00	2.52E+00	0.00E+00	1.01E-05	2.51E-09	0.00E+00	0.00E+00	0.00E+00	1.47E-02	1.30E-06	2.29E-05
I-134	0.00E+00	3.06E-25	0.00E+00	1.22E-30	3.04E-34	0.00E+00	0.00E+00	0.00E+00	4.12E-28	2.22E-29	1.13E-28
I-135	0.00E+00	1.21E-02	0.00E+00	4.84E-08	1.20E-11	0.00E+00	0.00E+00	0.00E+00	1.63E-05	1.70E-08	1.08E-07
NOBLE GASES											
XE-131M	0.00E+00	3.44E+02	0.00E+00	1.38E-03	3.43E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-05	8.82E-04
XE-133M	0.00E+00	8.24E+02	0.00E+00	3.29E-03	8.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E-05	2.53E-03
XE-133	0.00E+00	4.75E+04	0.00E+00	1.90E-01	4.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-03	1.33E-01
XE-135M	0.00E+00	2.51E-83	0.00E+00	1.00E-88	2.49E-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.93E-84	5.52E-83
XE-135	0.00E+00	8.49E+01	0.00E+00	3.39E-04	8.45E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-05	7.03E-04
XE-138	0.00E+00	2.49E-73	0.00E+00	9.94E-79	2.47E-82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.39E-74	8.87E-73
KR-83M	0.00E+00	3.72E-09	0.00E+00	1.49E-14	3.70E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-15	1.22E-14
KR-85M	0.00E+00	6.78E-02	0.00E+00	2.71E-07	6.74E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-08	5.77E-07
KR-85	0.00E+00	1.49E+03	0.00E+00	5.97E-03	1.49E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-06	6.25E-03
KR-87	0.00E+00	2.66E-14	0.00E+00	1.06E-19	2.64E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-19	6.33E-18
KR-88	0.00E+00	2.13E-04	0.00E+00	8.52E-10	2.12E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.99E-10	3.97E-09
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	1.11E+01	3.70E-03	1.45E-01

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 24.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .64E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.92E+02	0.00E+00	2.80E-06	6.98E-10	0.00E+00	0.00E+00	0.00E+00	1.11E+00	9.95E-06	1.31E-04
I-132	0.00E+00	6.01E-10	0.00E+00	5.78E-18	1.44E-21	0.00E+00	0.00E+00	0.00E+00	8.61E-13	7.55E-15	4.06E-14

9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	3.38E+01	0.00E+00	3.25E-07	8.10E-11	0.00E+00	0.00E+00	0.00E+00	3.13E-02	2.77E-06	4.87E-05
I-134	0.00E+00	1.94E-29	0.00E+00	1.87E-37	4.65E-41	0.00E+00	0.00E+00	0.00E+00	8.08E-30	4.36E-31	2.22E-30
I-135	0.00E+00	5.27E-02	0.00E+00	5.07E-10	1.26E-13	0.00E+00	0.00E+00	0.00E+00	2.21E-05	2.30E-08	1.45E-07
PARTICULATE											
I-131	0.00E+00	1.60E+01	0.00E+00	1.54E-07	3.83E-11	0.00E+00	0.00E+00	0.00E+00	6.08E-02	5.47E-07	7.22E-06
I-132	0.00E+00	3.30E-11	0.00E+00	3.17E-19	7.90E-23	0.00E+00	0.00E+00	0.00E+00	4.73E-14	4.15E-16	2.23E-15
I-133	0.00E+00	1.86E+00	0.00E+00	1.79E-08	4.45E-12	0.00E+00	0.00E+00	0.00E+00	1.72E-03	1.52E-07	2.68E-06
I-134	0.00E+00	1.07E-30	0.00E+00	1.03E-38	2.56E-42	0.00E+00	0.00E+00	0.00E+00	4.44E-31	2.40E-32	1.22E-31
I-135	0.00E+00	2.90E-03	0.00E+00	2.79E-11	6.94E-15	0.00E+00	0.00E+00	0.00E+00	1.21E-06	1.26E-09	7.99E-09
ORGANIC											
I-131	0.00E+00	1.28E+01	0.00E+00	1.23E-07	3.07E-11	0.00E+00	0.00E+00	0.00E+00	4.87E-02	4.38E-07	5.78E-06
I-132	0.00E+00	2.64E-11	0.00E+00	2.54E-19	6.32E-23	0.00E+00	0.00E+00	0.00E+00	3.78E-14	3.32E-16	1.78E-15
I-133	0.00E+00	1.49E+00	0.00E+00	1.43E-08	3.56E-12	0.00E+00	0.00E+00	0.00E+00	1.37E-03	1.22E-07	2.14E-06
I-134	0.00E+00	8.55E-31	0.00E+00	8.22E-39	2.05E-42	0.00E+00	0.00E+00	0.00E+00	3.55E-31	1.92E-32	9.74E-32
I-135	0.00E+00	2.32E-03	0.00E+00	2.23E-11	5.55E-15	0.00E+00	0.00E+00	0.00E+00	9.71E-07	1.01E-09	6.39E-09
NOBLE GASES											
XE-131M	0.00E+00	3.31E+02	0.00E+00	3.18E-06	7.93E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-06	1.01E-04
XE-133M	0.00E+00	6.72E+02	0.00E+00	6.46E-06	1.61E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.98E-06	2.70E-04
XE-133	0.00E+00	4.35E+04	0.00E+00	4.18E-04	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E-04	1.49E-02
XE-135M	0.00E+00	7.72-102	0.00E+00	7.42-110	1.85-113	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-91	6.59E-91
XE-135	0.00E+00	2.52E+01	0.00E+00	2.42E-07	6.03E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-06	4.97E-05
XE-138	0.00E+00	7.68E-90	0.00E+00	7.39E-98	1.84-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-81	5.95E-80
KR-83M	0.00E+00	9.86E-12	0.00E+00	9.48E-20	2.36E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E-17	1.39E-16
KR-85M	0.00E+00	5.44E-03	0.00E+00	5.23E-11	1.30E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E-10	2.43E-08
KR-85	0.00E+00	1.49E+03	0.00E+00	1.44E-05	3.57E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-07	7.26E-04
KR-87	0.00E+00	4.19E-18	0.00E+00	4.03E-26	1.00E-29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-22	2.49E-20
KR-88	0.00E+00	4.05E-06	0.00E+00	3.90E-14	9.70E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-11	9.58E-11
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						0.00E+00	0.00E+00	0.00E+00	1.25E+00	4.13E-04	1.62E-02

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 96.000 HOURS: X/Q(SITE)= .58E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .12E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.25E+02	0.00E+00	3.56E-18	8.87E-22	0.00E+00	0.00E+00	0.00E+00	2.52E-03	2.27E-08	2.99E-07
I-132	0.00E+00	2.27E-19	0.00E+00	3.60E-39	8.95E-43	0.00E+00	0.00E+00	0.00E+00	1.67E-17	1.46E-19	7.87E-19
I-133	0.00E+00	3.14E+00	0.00E+00	4.97E-20	1.24E-23	0.00E+00	0.00E+00	0.00E+00	4.44E-05	3.93E-09	6.92E-08
I-134	0.00E+00	1.99E-54	0.00E+00	3.15E-74	7.83E-78	0.00E+00	0.00E+00	0.00E+00	5.44E-38	2.94E-39	1.49E-38
I-135	0.00E+00	3.10E-05	0.00E+00	4.90E-25	1.22E-28	0.00E+00	0.00E+00	0.00E+00	1.02E-08	1.06E-11	6.70E-11
PARTICULATE											
I-131	0.00E+00	1.24E+01	0.00E+00	1.96E-19	4.87E-23	0.00E+00	0.00E+00	0.00E+00	1.38E-04	1.25E-09	1.64E-08
I-132	0.00E+00	1.25E-20	0.00E+00	1.98E-40	4.92E-44	0.00E+00	0.00E+00	0.00E+00	9.17E-19	8.05E-21	4.32E-20
I-133	0.00E+00	1.73E-01	0.00E+00	2.73E-21	6.80E-25	0.00E+00	0.00E+00	0.00E+00	2.44E-06	2.16E-10	3.80E-09
I-134	0.00E+00	1.09E-55	0.00E+00	1.73E-75	4.30E-79	0.00E+00	0.00E+00	0.00E+00	2.99E-39	1.61E-40	8.19E-40
I-135	0.00E+00	1.70E-06	0.00E+00	2.69E-26	6.71E-30	0.00E+00	0.00E+00	0.00E+00	5.59E-10	5.82E-13	3.68E-12
ORGANIC											
I-131	0.00E+00	9.90E+00	0.00E+00	1.57E-19	3.90E-23	0.00E+00	0.00E+00	0.00E+00	1.11E-04	9.96E-10	1.32E-08
I-132	0.00E+00	9.99E-21	0.00E+00	1.58E-40	3.93E-44	0.00E+00	0.00E+00	0.00E+00	7.34E-19	6.44E-21	3.46E-20
I-133	0.00E+00	1.38E-01	0.00E+00	2.18E-21	5.44E-25	0.00E+00	0.00E+00	0.00E+00	1.95E-06	1.73E-10	3.04E-09
I-134	0.00E+00	8.74E-56	0.00E+00	1.38E-75	3.44E-79	0.00E+00	0.00E+00	0.00E+00	2.39E-39	1.29E-40	6.55E-40
I-135	0.00E+00	1.36E-06	0.00E+00	2.16E-26	5.37E-30	0.00E+00	0.00E+00	0.00E+00	4.47E-10	4.66E-13	2.95E-12
NOBLE GASES											
XE-131M	0.00E+00	2.78E+02	0.00E+00	4.39E-18	1.09E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.68E-09	2.34E-07
XE-133M	0.00E+00	2.68E+02	0.00E+00	4.23E-18	1.05E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.85E-09	5.30E-07
XE-133	0.00E+00	2.93E+04	0.00E+00	4.64E-16	1.15E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.65E-07	3.29E-05
XE-135M	0.00E+00	3.86-185	0.00E+00	6.11-205	1.52-208	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.78-113	4.88-112
XE-135	0.00E+00	1.06E-01	0.00E+00	1.68E-21	4.18E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-09	3.55E-08
XE-138	0.00E+00	3.89-164	0.00E+00	6.15-184	1.53-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69-100	4.43E-99
KR-83M	0.00E+00	2.51E-23	0.00E+00	3.97E-43	9.88E-47	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.81E-23	8.89E-22

RB 7/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

KR-85M	0.00E+00	6.38E-08	0.00E+00	1.01E-27	2.51E-31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-13	4.70E-12
KR-85	0.00E+00	1.49E+03	0.00E+00	2.36E-17	5.88E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.79E-10	1.75E-06
KR-87	0.00E+00	3.25E-35	0.00E+00	5.13E-55	1.28E-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.48E-28	9.43E-27
KR-88	0.00E+00	7.29E-14	0.00E+00	1.15E-33	2.87E-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.72E-16	4.38E-15
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	2.82E-03	9.08E-07	3.59E-05

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 720.000 HOURS: X/Q(SITE)= .17E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .66E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-15	2.88E-20	3.80E-19
I-132	0.00E+00	5.00-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-38	9.12E-41	4.90E-40
I-133	0.00E+00	3.55E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.78E-18	6.01E-22	1.06E-20
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.15E-75	4.94E-76	2.51E-75
I-135	0.00E+00	3.10E-33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.84E-24	1.03E-26	6.48E-26
PARTICULATE											
I-131	0.00E+00	1.32E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-16	1.58E-21	2.09E-20
I-132	0.00E+00	2.75-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-40	5.01E-42	2.69E-41
I-133	0.00E+00	1.95E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E-19	3.30E-23	5.81E-22
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.03E-76	2.71E-77	1.38E-76
I-135	0.00E+00	1.70E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.41E-25	5.63E-28	3.56E-27
ORGANIC											
I-131	0.00E+00	1.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-16	1.27E-21	1.67E-20
I-132	0.00E+00	2.20-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.57E-40	4.01E-42	2.15E-41
I-133	0.00E+00	1.56E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.98E-19	2.64E-23	4.65E-22
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E-76	2.17E-77	1.10E-76
I-135	0.00E+00	1.36E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.33E-25	4.51E-28	2.85E-27
NOBLE GASES											
XE-131M	0.00E+00	6.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.22E-21	3.22E-19
XE-133M	0.00E+00	9.21E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.83E-21	3.47E-19
XE-133	0.00E+00	9.65E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.59E-19	3.65E-17
XE-135M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22-208	4.01-207
XE-135	0.00E+00	2.76E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.58E-24	2.46E-22
XE-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41-186	3.69-185
KR-83M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.27E-46	3.72E-45
KR-85M	0.00E+00	1.18E-50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-30	9.07E-29
KR-85	0.00E+00	1.49E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-21	2.88E-18
KR-87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E-57	1.20E-55
KR-88	0.00E+00	5.52E-81	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-35	1.30E-34
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	3.53E-15	1.01E-18	4.05E-17
						========	========	========	========	========	========
				TOTAL DOSES 0-30 DAYS		5.54E-01	1.74E-03	7.29E-03	2.65E+01	8.85E-03	3.47E-01

1 FHA - CR, LPZ, 0-10 sec, CR not isolated, Sec not isolated

ISOTOPE	ACTIVITY RELEASED (CURIES)					
	2. HRS	8. HRS	24. HRS	96. HRS	720. HRS	
ELEMENTAL						
I-131	4.39E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E+00
I-132	1.15E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-08
I-133	1.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E+00
I-134	5.73E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.73E-23
I-135	8.69E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.69E-03
PARTICULATE						
I-131	2.41E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-01

RD 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-132	6.30E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E-10
I-133	5.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E-02
I-134	3.15E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E-24
I-135	4.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.77E-04
ORGANIC						
I-131	1.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-01
I-132	5.04E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.04E-10
I-133	4.53E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.53E-02
I-134	2.52E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-24
I-135	3.82E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.82E-04
NOBLE GASES						
XE-131M	4.85E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.85E+00
XE-133M	1.26E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E+01
XE-133	6.85E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+02
XE-135M	6.20E-76	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.20E-76
XE-135	2.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E+00
XE-138	6.15E-67	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.15E-67
KR-83M	9.97E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.97E-10
KR-85M	3.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-03
KR-85	2.06E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.06E+01
KR-87	2.92E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E-14
KR-88	2.13E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E-05

END EXECUTION DATE: 09/01/2001
END EXECUTION TIME: 15:22:29.46

RB 9/4/01 2

Run #2: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – CR, LPZ, 10-90 sec, CR isolated, Sec not isolated
2	TIME	10	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	2	Analysis Option: Site boundary dose plus control room dose are to be calculated.
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory. –
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).

RB 9/4/01 2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	LSP0	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1	3.8	Times at which time dependent parameters change (sec).
	T2	10.0	
	T3	90.0	
	T4	1.8E3	
	T5	3.6E3	
	T6	7.2E3	
	T7	2.88E4	
	T8	8.64E4	
	T9	3.456E5	
	T10	2.592E6	
6	LP 1 – 10	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1	0.0	Leak rate from secondary containment (sec^{-1}).
	LS 2	0.0	
	LS 3	4.57E-04	
	LS 4-10	0	
8	BP 1-10	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1	3316.0	Intake rate to control center (cfm).
	VCFM 2	3316.0	
	VCFM 3	891.0	
	VCFM 4	891.0	
	VCFM 5	891.0	
	VCFM 6	891.0	
	VCFM 7	891.0	
	VCFM 8	891.0	
	VCFM 9	891.0	
	VCFM 10	891.0	

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
10	XQ 1	0.0	Site boundary X/Q (sec/m^3).
	XQ 2	2.90E-4	
	XQ 3	2.90E-4	
	XQ 4	1.40E-4	
	XQ 5	4.00E-5	
	XQ 6	4.00E-5	
	XQ 7	4.00E-5	
	XQ 8	1.60E-5	
	XQ 9	5.80E-6	
	XQ 10	1.70E-6	
11	XQC 1	0.0	X/Q to control center intake (sec/m^3).
	XQC 2	3.77E-3	
	XQC 3	4.07E-3	
	XQC 4	3.03E-4	
	XQC 5	1.00E-9	
	XQC 6	1.00E-9	
	XQC 7	2.65E-9	
	XQC 8	6.41E-8	
	XQC 9	1.20E-8	
	XQC 10	6.64E-9	
12	CPE 1-10	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1-10	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1-10	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1-10	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1-10	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1-10	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1-10	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1-10	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1-10	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	1.0	Combined filter non-removal factors for elemental iodine released to environment.

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	RFP	1.0	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	1.0	Combined filter non-removal factors for organic iodine released to environment.
	IFE	0.145	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	0.145	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	0.145	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

9/4/01

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AXIDENT VER 2 MOD 4
          PRODUCTION DATE 02/18/92
          BEGIN EXECUTION DATE:  08/30/2001
          BEGIN EXECUTION TIME:  14:10:17.37

           1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated
           2 10 2 0.0 1.0
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Nebraska Public Power District

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NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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 3 -1 2.6E6 1.4186E5 6.464E4
 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
 5 3.8 10.0 90.0 1.8E3 3.6E3 7.2E3 2.88E4 8.64E4 3.456E5 2.592E6
 6 10*1.0
 7 2*0 4.57E-04 7*0
 8 10*1.0
 9 2*3316 8*891
10 0.0 2*2.90E-4 1.40E-4 4.00E-5 4.00E-5 4.00E-5 1.60E-5 5.80E-6 1.70E-6
11 0.0 3.77E-3 4.07E-3 3.03E-4 1.00E-9 1.00E-9 2.65E-9 6.41E-8 1.20E-8 6.64E-9
12 10*0.0
13 10*0.0
14 10*0.0
15 10*0.0
16 10*0.0
17 10*0.0
18 10*0.0
19 10*0.0
20 10*0.0
21 1.0 1.0 1.0 0.145 0.145 0.145
22 1.0 1.0 1.0
23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

                    INITIAL CONTAINMENT INVENTORY

                    ISOTOPE    ACTIVITY (CURIES)

                    I-131          1.416E+03
                    I-132          3.701E-06
                    I-133          3.329E+02
                    I-134          1.853E-20
                    I-135          2.805E+00
                    XE-131M        3.560E+02
                    XE-133M        9.256E+02
                    XE-133         5.028E+04
                    XE-135M        4.578E-74
                    XE-135         1.581E+02
                    XE-138         4.536E-65
                    KR-83M         7.324E-08
                    KR-85M         2.425E-01
                    KR-85          1.514E+03
                    KR-87          2.144E-12
                    KR-88          1.567E-03
1   FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON:    1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS

                      1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL,     1. CFM MIXING,   00.00 PCT REL TO SPRAYED VOL

AT     .001 HOURS:  X/Q(SITE)= .00E+00 SEC/M3     PRIMARY LEAK RATE=****** PERCENT/DAY     CONTROL ROOM INTAKE=3316.0 CFM

                    X/Q CONT ROOM= .00E+00 SEC/M3   SEC RELEASE RATE=  .00E+00 VOL/DAY     PCT PRI LKG TO ATM =   00.00

                          CLEANUP RATES  (HR-1)                  FILTER NON-REMOVAL FACTORS
                    ==============================================  ==========================
                    SPRAY       PRIMARY     SECONDARY   CONT CENTER    RELEASE   CONT CENTER

          ELEMENTAL    .000        .000        .000        .000          1.000      .145
          PARTICULATE  .000        .000        .000        .000          1.000      .145
          ORGANIC      .000        .000        .000        .000          1.000      .145

            ACTIVITY  (CURIES)        CONTROL ROOM      SITE BOUNDARY DOSES (REM)      CONTROL ROOM DOSES (REM)
 ISOTOPE  PRIMARY  SECONDARY  RELEASE  (CURIES) (UCI/CM3)  THYROID   WH BODY    BETA    THYROID   WH BODY    BETA

ELEMENTAL
I-131     7.21E+00  3.15E+02  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.88E-08  8.23E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     1.69E+00  7.40E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-134     9.42E-23  4.12E-21  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-135     1.43E-02  6.24E-01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
PARTICULATE
I-131     3.96E-01  1.73E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.03E-09  4.52E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     9.31E-02  4.07E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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RLB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .003 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .38E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	1.46E-02	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.82E-11	8.41E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.44E-03	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.91E-25	4.21E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.90E-05	6.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	8.04E-04	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	2.10E-12	4.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.89E-04	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.05E-26	2.31E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.59E-06	3.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	6.43E-04	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.68E-12	3.70E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.51E-04	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	8.39E-27	1.85E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.27E-06	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	1.62E-02	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	4.20E-02	9.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	2.28E+00	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	2.06E-78	4.54E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	7.18E-03	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	2.05E-69	4.51E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	3.32E-12	7.32E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.10E-05	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	6.87E-02	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	9.72E-17	2.14E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	7.11E-08	1.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RLB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .41E-02 SEC/M3 SEC RELEASE RATE= .39E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.11E+02	1.16E+01	2.86E-03	7.11E-07	1.28E+00	3.11E-04	1.52E-04	1.09E-02	9.84E-08	1.30E-06
I-132	6.85E-46	8.06E-07	3.01E-08	7.41E-12	1.85E-15	1.91E-11	5.24E-12	8.99E-13	1.63E-13	1.43E-15	7.68E-15
I-133	6.20E-38	7.30E+01	2.72E+00	6.71E-04	1.67E-07	4.92E-02	9.40E-05	7.67E-05	4.21E-04	3.72E-08	6.55E-07
I-134	3.39E-60	3.98E-21	1.50E-22	3.67E-26	9.13E-30	1.66E-26	2.10E-26	4.54E-27	1.41E-28	7.62E-30	3.87E-29
I-135	5.22E-40	6.14E-01	2.29E-02	5.65E-06	1.41E-09	7.14E-05	2.95E-06	4.70E-07	6.10E-07	6.35E-10	4.02E-09
PARTICULATE											
I-131	1.45E-38	1.71E+01	6.35E-01	1.57E-04	3.91E-08	7.03E-02	1.71E-05	8.35E-06	6.01E-04	5.41E-09	7.14E-08
I-132	3.76E-47	4.43E-08	1.65E-09	4.07E-13	1.01E-16	1.05E-12	2.88E-13	4.94E-14	8.95E-15	7.86E-17	4.22E-16
I-133	3.41E-39	4.01E+00	1.49E-01	3.69E-05	9.18E-09	2.70E-03	5.16E-06	4.21E-06	2.31E-05	2.05E-09	3.60E-08
I-134	1.86E-61	2.19E-22	8.22E-24	2.01E-27	5.01E-31	9.10E-28	1.16E-27	2.50E-28	7.76E-30	4.19E-31	2.13E-30
I-135	2.87E-41	3.37E-02	1.26E-03	3.10E-07	7.72E-11	3.92E-06	1.62E-07	2.58E-08	3.35E-08	3.49E-11	2.21E-10
ORGANIC											
I-131	1.16E-38	1.37E+01	5.08E-01	1.26E-04	3.13E-08	5.63E-02	1.37E-05	6.68E-06	4.81E-04	4.33E-09	5.71E-08
I-132	3.01E-47	3.54E-08	1.32E-09	3.26E-13	8.11E-17	8.39E-13	2.30E-13	3.95E-14	7.16E-15	6.29E-17	3.38E-16
I-133	2.73E-39	3.21E+00	1.19E-01	2.95E-05	7.35E-09	2.16E-03	4.13E-06	3.37E-06	1.85E-05	1.64E-09	2.88E-08
I-134	1.49E-61	1.75E-22	6.58E-24	1.61E-27	4.01E-31	7.28E-28	9.25E-28	2.00E-28	6.21E-30	3.35E-31	1.70E-30
I-135	2.29E-41	2.70E-02	1.01E-03	2.48E-07	6.18E-11	3.14E-06	1.30E-07	2.07E-08	2.68E-08	2.79E-11	1.77E-10
NOBLE GASES											
XE-131M	2.92E-37	3.43E+02	1.28E+01	2.18E-02	5.42E-06	0.00E+00	2.04E-05	1.15E-04	0.00E+00	1.94E-07	6.78E-06
XE-133M	7.58E-37	8.92E+02	3.32E+01	5.66E-02	1.41E-05	0.00E+00	7.95E-05	3.43E-04	0.00E+00	2.24E-07	2.02E-05
XE-133	4.12E-35	4.85E+04	1.80E+03	3.08E+00	7.66E-04	0.00E+00	3.93E-03	1.76E-02	0.00E+00	2.72E-05	1.04E-03
XE-135M	3.51-113	4.13E-74	1.58E-75	2.62E-78	6.52E-82	0.00E+00	4.85E-80	1.03E-80	0.00E+00	1.08E-82	5.98E-82
XE-135	1.29E-37	1.52E+02	5.67E+00	9.65E-03	2.40E-06	0.00E+00	1.01E-04	1.22E-04	0.00E+00	2.21E-07	7.18E-06
XE-138	3.50-104	4.12E-65	1.58E-66	2.62E-69	6.51E-73	0.00E+00	3.28E-70	8.41E-71	0.00E+00	1.88E-73	4.91E-72
KR-83M	5.95E-47	7.00E-08	2.62E-09	4.44E-12	1.11E-15	0.00E+00	9.48E-16	5.93E-15	0.00E+00	3.07E-17	3.49E-16
KR-85M	1.98E-40	2.33E-01	8.69E-03	1.48E-05	3.68E-09	0.00E+00	9.82E-08	1.35E-07	0.00E+00	2.31E-10	7.95E-09
KR-85	1.24E-36	1.46E+03	5.44E+01	9.26E-02	2.31E-05	0.00E+00	8.28E-06	8.08E-04	0.00E+00	1.85E-08	4.77E-05
KR-87	1.73E-51	2.04E-12	7.64E-14	1.29E-16	3.22E-20	0.00E+00	7.62E-18	5.35E-18	0.00E+00	8.27E-21	3.15E-19
KR-88	1.28E-42	1.50E-03	5.61E-05	9.53E-08	2.37E-11	0.00E+00	7.08E-09	1.28E-09	0.00E+00	1.32E-11	7.51E-11
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						1.46E+00	4.58E-03	1.92E-02	1.25E-02	2.80E-05	1.12E-03

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .14E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .30E-03 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

ACTIVITY (CURIES) CONTROL ROOM SITE BOUNDARY DOSES (REM) CONTROL ROOM DOSES (REM)

NB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.10E+02	0.00E+00	2.39E-03	5.94E-07	0.00E+00	0.00E+00	0.00E+00	4.25E-01	3.82E-06	5.04E-05
I-132	0.00E+00	6.98E-07	0.00E+00	5.37E-12	1.34E-15	0.00E+00	0.00E+00	0.00E+00	5.90E-12	5.18E-14	2.78E-13
I-133	0.00E+00	7.18E+01	0.00E+00	5.53E-04	1.38E-07	0.00E+00	0.00E+00	0.00E+00	1.62E-02	1.44E-06	2.53E-05
I-134	0.00E+00	2.73E-21	0.00E+00	2.10E-26	5.22E-30	0.00E+00	0.00E+00	0.00E+00	4.56E-27	2.46E-28	1.25E-27
I-135	0.00E+00	5.84E-01	0.00E+00	4.50E-06	1.12E-09	0.00E+00	0.00E+00	0.00E+00	2.31E-05	2.41E-08	1.52E-07
PARTICULATE											
I-131	0.00E+00	1.70E+01	0.00E+00	1.31E-04	3.26E-08	0.00E+00	0.00E+00	0.00E+00	2.33E-02	2.10E-07	2.77E-06
I-132	0.00E+00	3.84E-08	0.00E+00	2.95E-13	7.35E-17	0.00E+00	0.00E+00	0.00E+00	3.24E-13	2.84E-15	1.53E-14
I-133	0.00E+00	3.95E+00	0.00E+00	3.04E-05	7.56E-09	0.00E+00	0.00E+00	0.00E+00	8.91E-04	7.89E-08	1.39E-06
I-134	0.00E+00	1.50E-22	0.00E+00	1.15E-27	2.87E-31	0.00E+00	0.00E+00	0.00E+00	2.51E-28	1.35E-29	6.87E-29
I-135	0.00E+00	3.21E-02	0.00E+00	2.47E-07	6.15E-11	0.00E+00	0.00E+00	0.00E+00	1.27E-06	1.32E-09	8.37E-09
ORGANIC											
I-131	0.00E+00	1.36E+01	0.00E+00	1.05E-04	2.61E-08	0.00E+00	0.00E+00	0.00E+00	1.87E-02	1.68E-07	2.22E-06
I-132	0.00E+00	3.07E-08	0.00E+00	2.36E-13	5.88E-17	0.00E+00	0.00E+00	0.00E+00	2.59E-13	2.28E-15	1.22E-14
I-133	0.00E+00	3.16E+00	0.00E+00	2.43E-05	6.05E-09	0.00E+00	0.00E+00	0.00E+00	7.13E-04	6.31E-08	1.11E-06
I-134	0.00E+00	1.20E-22	0.00E+00	9.22E-28	2.29E-31	0.00E+00	0.00E+00	0.00E+00	2.01E-28	1.08E-29	5.50E-29
I-135	0.00E+00	2.57E-02	0.00E+00	1.98E-07	4.92E-11	0.00E+00	0.00E+00	0.00E+00	1.02E-06	1.06E-09	6.69E-09
NOBLE GASES											
XE-131M	0.00E+00	3.43E+02	0.00E+00	1.82E-02	4.53E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E-06	2.63E-04
XE-133M	0.00E+00	8.87E+02	0.00E+00	4.70E-02	1.17E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.66E-06	7.84E-04
XE-133	0.00E+00	4.83E+04	0.00E+00	2.57E+00	6.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-03	4.02E-02
XE-135M	0.00E+00	1.16E-74	0.00E+00	6.18E-79	1.54E-82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-81	1.32E-80
XE-135	0.00E+00	1.47E+02	0.00E+00	7.79E-03	1.94E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-06	2.74E-04
XE-138	0.00E+00	1.33E-65	0.00E+00	7.07E-70	1.76E-73	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.37E-72	1.14E-70
KR-83M	0.00E+00	5.87E-08	0.00E+00	3.11E-12	7.75E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-15	1.24E-14
KR-85M	0.00E+00	2.16E-01	0.00E+00	1.15E-05	2.85E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.63E-09	2.98E-07
KR-85	0.00E+00	1.46E+03	0.00E+00	7.74E-02	1.93E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-07	1.85E-03
KR-87	0.00E+00	1.57E-12	0.00E+00	8.34E-17	2.08E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.83E-19	1.08E-17
KR-88	0.00E+00	1.33E-03	0.00E+00	7.08E-08	1.76E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.85E-10	2.75E-09
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						0.00E+00	0.00E+00	0.00E+00	4.85E-01	1.09E-03	4.35E-02

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.09E+02	0.00E+00	1.97E-03	4.91E-07	0.00E+00	0.00E+00	0.00E+00	3.72E-01	3.34E-06	4.41E-05
I-132	0.00E+00	6.01E-07	0.00E+00	3.83E-12	9.53E-16	0.00E+00	0.00E+00	0.00E+00	4.46E-12	3.92E-14	2.10E-13
I-133	0.00E+00	7.06E+01	0.00E+00	4.50E-04	1.12E-07	0.00E+00	0.00E+00	0.00E+00	1.40E-02	1.24E-06	2.18E-05
I-134	0.00E+00	1.83E-21	0.00E+00	1.16E-26	2.90E-30	0.00E+00	0.00E+00	0.00E+00	2.71E-27	1.46E-28	7.43E-28
I-135	0.00E+00	5.55E-01	0.00E+00	3.54E-06	8.80E-10	0.00E+00	0.00E+00	0.00E+00	1.93E-05	2.01E-08	1.27E-07
PARTICULATE											
I-131	0.00E+00	1.70E+01	0.00E+00	1.08E-04	2.70E-08	0.00E+00	0.00E+00	0.00E+00	2.04E-02	1.84E-07	2.42E-06
I-132	0.00E+00	3.30E-08	0.00E+00	2.10E-13	5.23E-17	0.00E+00	0.00E+00	0.00E+00	2.45E-13	2.15E-15	1.16E-14
I-133	0.00E+00	3.88E+00	0.00E+00	2.47E-05	6.16E-09	0.00E+00	0.00E+00	0.00E+00	7.68E-04	6.80E-08	1.20E-06
I-134	0.00E+00	1.00E-22	0.00E+00	6.40E-28	1.59E-31	0.00E+00	0.00E+00	0.00E+00	1.49E-28	8.04E-30	4.08E-29
I-135	0.00E+00	3.05E-02	0.00E+00	1.94E-07	4.84E-11	0.00E+00	0.00E+00	0.00E+00	1.06E-06	1.10E-09	6.97E-09
ORGANIC											
I-131	0.00E+00	1.36E+01	0.00E+00	8.67E-05	2.16E-08	0.00E+00	0.00E+00	0.00E+00	1.63E-02	1.47E-07	1.94E-06
I-132	0.00E+00	2.64E-08	0.00E+00	1.68E-13	4.19E-17	0.00E+00	0.00E+00	0.00E+00	1.96E-13	1.72E-15	9.25E-15
I-133	0.00E+00	3.11E+00	0.00E+00	1.98E-05	4.93E-09	0.00E+00	0.00E+00	0.00E+00	6.15E-04	5.44E-08	9.57E-07
I-134	0.00E+00	8.03E-23	0.00E+00	5.12E-28	1.27E-31	0.00E+00	0.00E+00	0.00E+00	1.19E-28	6.43E-30	3.27E-29
I-135	0.00E+00	2.44E-02	0.00E+00	1.55E-07	3.87E-11	0.00E+00	0.00E+00	0.00E+00	8.47E-07	8.82E-10	5.58E-09
NOBLE GASES											
XE-131M	0.00E+00	3.42E+02	0.00E+00	1.50E-02	3.75E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-06	2.31E-04
XE-133M	0.00E+00	8.81E+02	0.00E+00	3.87E-02	9.64E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E-06	6.83E-04

MB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

XE-133	0.00E+00	4.82E+04	0.00E+00	2.12E+00	5.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.23E-04	3.51E-02
XE-135M	0.00E+00	3.07E-75	0.00E+00	1.35E-79	3.36E-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-82	3.18E-81
XE-135	0.00E+00	1.41E+02	0.00E+00	6.21E-03	1.55E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E-06	2.31E-04
XE-138	0.00E+00	4.06E-66	0.00E+00	1.79E-70	4.45E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-72	3.17E-71
KR-83M	0.00E+00	4.87E-08	0.00E+00	2.14E-12	5.33E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E-16	9.10E-15
KR-85M	0.00E+00	2.00E-01	0.00E+00	8.78E-06	2.18E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.00E-09	2.42E-07
KR-85	0.00E+00	1.46E+03	0.00E+00	6.41E-02	1.60E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-07	1.62E-03
KR-87	0.00E+00	1.20E-12	0.00E+00	5.26E-17	1.31E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-19	7.23E-18
KR-88	0.00E+00	1.18E-03	0.00E+00	5.18E-08	1.29E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-10	2.14E-09
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						0.00E+00	0.00E+00	0.00E+00	4.24E-01	9.50E-04	3.80E-02

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.08E+02	0.00E+00	1.35E-03	3.36E-07	0.00E+00	0.00E+00	0.00E+00	5.61E-01	5.05E-06	6.66E-05
I-132	0.00E+00	4.44E-07	0.00E+00	1.94E-12	4.84E-16	0.00E+00	0.00E+00	0.00E+00	5.44E-12	4.78E-14	2.57E-13
I-133	0.00E+00	6.84E+01	0.00E+00	2.99E-04	7.44E-08	0.00E+00	0.00E+00	0.00E+00	2.07E-02	1.83E-06	3.22E-05
I-134	0.00E+00	8.22E-22	0.00E+00	3.59E-27	8.94E-31	0.00E+00	0.00E+00	0.00E+00	2.34E-27	1.26E-28	6.42E-28
I-135	0.00E+00	5.00E-01	0.00E+00	2.19E-06	5.45E-10	0.00E+00	0.00E+00	0.00E+00	2.71E-05	2.82E-08	1.78E-07
PARTICULATE											
I-131	0.00E+00	1.69E+01	0.00E+00	7.41E-05	1.84E-08	0.00E+00	0.00E+00	0.00E+00	3.08E-02	2.77E-07	3.66E-06
I-132	0.00E+00	2.44E-08	0.00E+00	1.07E-13	2.66E-17	0.00E+00	0.00E+00	0.00E+00	2.99E-13	2.63E-15	1.41E-14
I-133	0.00E+00	3.76E+00	0.00E+00	1.64E-05	4.09E-09	0.00E+00	0.00E+00	0.00E+00	1.14E-03	1.01E-07	1.77E-06
I-134	0.00E+00	4.52E-23	0.00E+00	1.97E-28	4.91E-32	0.00E+00	0.00E+00	0.00E+00	1.29E-28	6.95E-30	3.53E-29
I-135	0.00E+00	2.75E-02	0.00E+00	1.20E-07	2.99E-11	0.00E+00	0.00E+00	0.00E+00	1.49E-06	1.55E-09	9.79E-09
ORGANIC											
I-131	0.00E+00	1.36E+01	0.00E+00	5.93E-05	1.48E-08	0.00E+00	0.00E+00	0.00E+00	2.47E-02	2.22E-07	2.93E-06
I-132	0.00E+00	1.95E-08	0.00E+00	8.54E-14	2.13E-17	0.00E+00	0.00E+00	0.00E+00	2.39E-13	2.10E-15	1.13E-14
I-133	0.00E+00	3.00E+00	0.00E+00	1.31E-05	3.27E-09	0.00E+00	0.00E+00	0.00E+00	9.09E-04	8.04E-08	1.42E-06
I-134	0.00E+00	3.61E-23	0.00E+00	1.58E-28	3.93E-32	0.00E+00	0.00E+00	0.00E+00	1.03E-28	5.56E-30	2.82E-29
I-135	0.00E+00	2.20E-02	0.00E+00	9.62E-08	2.39E-11	0.00E+00	0.00E+00	0.00E+00	1.19E-06	1.24E-09	7.84E-09
NOBLE GASES											
XE-131M	0.00E+00	3.42E+02	0.00E+00	1.03E-02	2.56E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.97E-06	3.48E-04
XE-133M	0.00E+00	8.70E+02	0.00E+00	2.62E-02	6.53E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-05	1.02E-03
XE-133	0.00E+00	4.79E+04	0.00E+00	1.45E+00	3.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-03	5.30E-02
XE-135M	0.00E+00	2.14E-76	0.00E+00	6.46E-81	1.61E-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-82	8.46E-82
XE-135	0.00E+00	1.31E+02	0.00E+00	3.95E-03	9.83E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-05	3.31E-04
XE-138	0.00E+00	3.78E-67	0.00E+00	1.14E-71	2.83E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.83E-73	1.00E-71
KR-83M	0.00E+00	3.36E-08	0.00E+00	1.01E-12	2.52E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.29E-16	1.06E-14
KR-85M	0.00E+00	1.71E-01	0.00E+00	5.14E-06	1.28E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.47E-09	3.26E-07
KR-85	0.00E+00	1.46E+03	0.00E+00	4.40E-02	1.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-07	2.46E-03
KR-87	0.00E+00	6.92E-13	0.00E+00	2.09E-17	5.19E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-19	7.42E-18
KR-88	0.00E+00	9.21E-04	0.00E+00	2.78E-08	6.91E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.77E-10	2.71E-09
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						0.00E+00	0.00E+00	0.00E+00	6.39E-01	1.43E-03	5.73E-02

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 8.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .27E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

9/4/01 NP 2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.02E+02	0.00E+00	1.38E-04	3.42E-08	0.00E+00	0.00E+00	0.00E+00	1.09E+00	9.79E-06	1.29E-04
I-132	0.00E+00	7.29E-08	0.00E+00	3.32E-14	8.27E-18	0.00E+00	0.00E+00	0.00E+00	5.52E-12	4.84E-14	2.60E-13
I-133	0.00E+00	5.61E+01	0.00E+00	2.55E-05	6.36E-09	0.00E+00	0.00E+00	0.00E+00	3.73E-02	3.30E-06	5.81E-05
I-134	0.00E+00	6.80E-24	0.00E+00	3.10E-30	7.71E-34	0.00E+00	0.00E+00	0.00E+00	1.04E-27	5.64E-29	2.86E-28
I-135	0.00E+00	2.69E-01	0.00E+00	1.23E-07	3.05E-11	0.00E+00	0.00E+00	0.00E+00	4.15E-05	4.32E-08	2.73E-07
PARTICULATE											
I-131	0.00E+00	1.66E+01	0.00E+00	7.56E-06	1.88E-09	0.00E+00	0.00E+00	0.00E+00	5.98E-02	5.38E-07	7.10E-06
I-132	0.00E+00	4.00E-09	0.00E+00	1.82E-15	4.54E-19	0.00E+00	0.00E+00	0.00E+00	3.03E-13	2.66E-15	1.43E-14
I-133	0.00E+00	3.08E+00	0.00E+00	1.40E-06	3.49E-10	0.00E+00	0.00E+00	0.00E+00	2.05E-03	1.82E-07	3.19E-06
I-134	0.00E+00	3.73E-25	0.00E+00	1.70E-31	4.24E-35	0.00E+00	0.00E+00	0.00E+00	5.74E-29	3.10E-30	1.57E-29
I-135	0.00E+00	1.48E-02	0.00E+00	6.74E-09	1.68E-12	0.00E+00	0.00E+00	0.00E+00	2.28E-06	2.37E-09	1.50E-08
ORGANIC											
I-131	0.00E+00	1.33E+01	0.00E+00	6.04E-06	1.50E-09	0.00E+00	0.00E+00	0.00E+00	4.78E-02	4.30E-07	5.68E-06
I-132	0.00E+00	3.20E-09	0.00E+00	1.46E-15	3.63E-19	0.00E+00	0.00E+00	0.00E+00	2.42E-13	2.13E-15	1.14E-14
I-133	0.00E+00	2.46E+00	0.00E+00	1.12E-06	2.80E-10	0.00E+00	0.00E+00	0.00E+00	1.64E-03	1.45E-07	2.56E-06
I-134	0.00E+00	2.99E-25	0.00E+00	1.36E-31	3.39E-35	0.00E+00	0.00E+00	0.00E+00	4.59E-29	2.48E-30	1.26E-29
I-135	0.00E+00	1.18E-02	0.00E+00	5.39E-09	1.34E-12	0.00E+00	0.00E+00	0.00E+00	1.82E-06	1.90E-09	1.20E-08
NOBLE GASES											
XE-131M	0.00E+00	3.37E+02	0.00E+00	1.06E-03	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-05	6.78E-04
XE-133M	0.00E+00	8.06E+02	0.00E+00	2.53E-03	6.30E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-05	1.94E-03
XE-133	0.00E+00	4.64E+04	0.00E+00	1.46E-01	3.63E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E-03	1.02E-01
XE-135M	0.00E+00	2.45E-83	0.00E+00	7.70E-89	1.92E-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.63E-84	4.25E-83
XE-135	0.00E+00	8.30E+01	0.00E+00	2.61E-04	6.49E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-05	5.40E-04
XE-138	0.00E+00	2.43E-73	0.00E+00	7.64E-79	1.90E-82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-74	6.82E-73
KR-83M	0.00E+00	3.64E-09	0.00E+00	1.14E-14	2.84E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.26E-16	9.40E-15
KR-85M	0.00E+00	6.62E-02	0.00E+00	2.08E-07	5.18E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-08	4.43E-07
KR-85	0.00E+00	1.46E+03	0.00E+00	4.59E-03	1.14E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-06	4.81E-03
KR-87	0.00E+00	2.60E-14	0.00E+00	8.16E-20	2.03E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-19	4.87E-18
KR-88	0.00E+00	2.08E-04	0.00E+00	6.55E-10	1.63E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.37E-10	3.05E-09
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	1.24E+00	2.76E-03	1.10E-01

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 24.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .64E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.85E+02	0.00E+00	3.12E-07	7.78E-11	0.00E+00	0.00E+00	0.00E+00	1.23E-01	1.11E-06	1.46E-05
I-132	0.00E+00	5.87E-10	0.00E+00	6.44E-19	1.60E-22	0.00E+00	0.00E+00	0.00E+00	9.59E-14	8.42E-16	4.52E-15
I-133	0.00E+00	3.31E+01	0.00E+00	3.63E-08	9.03E-12	0.00E+00	0.00E+00	0.00E+00	3.48E-03	3.08E-07	5.43E-06
I-134	0.00E+00	1.90E-29	0.00E+00	2.08E-38	5.19E-42	0.00E+00	0.00E+00	0.00E+00	9.01E-31	4.86E-32	2.47E-31
I-135	0.00E+00	5.15E-02	0.00E+00	5.65E-11	1.41E-14	0.00E+00	0.00E+00	0.00E+00	2.46E-06	2.56E-09	1.62E-08
PARTICULATE											
I-131	0.00E+00	1.57E+01	0.00E+00	1.72E-08	4.27E-12	0.00E+00	0.00E+00	0.00E+00	6.78E-03	6.10E-08	8.05E-07
I-132	0.00E+00	3.23E-11	0.00E+00	3.54E-20	8.81E-24	0.00E+00	0.00E+00	0.00E+00	5.27E-15	4.63E-17	2.48E-16

NB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	1.82E+00	0.00E+00	1.99E-09	4.96E-13	0.00E+00	0.00E+00	0.00E+00	1.91E-04	1.69E-08	2.98E-07
I-134	0.00E+00	1.04E-30	0.00E+00	1.15E-39	2.85E-43	0.00E+00	0.00E+00	0.00E+00	4.95E-32	2.67E-33	1.36E-32
I-135	0.00E+00	2.83E-03	0.00E+00	3.11E-12	7.73E-16	0.00E+00	0.00E+00	0.00E+00	1.35E-07	1.41E-10	8.91E-10
ORGANIC											
I-131	0.00E+00	1.25E+01	0.00E+00	1.37E-08	3.42E-12	0.00E+00	0.00E+00	0.00E+00	5.42E-03	4.88E-08	6.44E-07
I-132	0.00E+00	2.58E-11	0.00E+00	2.83E-20	7.05E-24	0.00E+00	0.00E+00	0.00E+00	4.22E-15	3.70E-17	1.99E-16
I-133	0.00E+00	1.45E+00	0.00E+00	1.59E-09	3.97E-13	0.00E+00	0.00E+00	0.00E+00	1.53E-04	1.36E-08	2.39E-07
I-134	0.00E+00	8.35E-31	0.00E+00	9.16E-40	2.28E-43	0.00E+00	0.00E+00	0.00E+00	3.96E-32	2.14E-33	1.09E-32
I-135	0.00E+00	2.27E-03	0.00E+00	2.48E-12	6.18E-16	0.00E+00	0.00E+00	0.00E+00	1.08E-07	1.13E-10	7.13E-10
NOBLE GASES											
XE-131M	0.00E+00	3.24E+02	0.00E+00	2.45E-06	6.09E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E-06	7.74E-05
XE-133M	0.00E+00	6.57E+02	0.00E+00	4.97E-06	1.24E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-06	2.07E-04
XE-133	0.00E+00	4.25E+04	0.00E+00	3.21E-04	8.00E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-04	1.15E-02
XE-135M	0.00E+00	7.55-102	0.00E+00	5.71-110	1.42-113	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.10E-92	5.06E-91
XE-135	0.00E+00	2.46E+01	0.00E+00	1.86E-07	4.64E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-06	3.82E-05
XE-138	0.00E+00	7.51E-90	0.00E+00	5.68E-98	1.41-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-81	4.58E-80
KR-83M	0.00E+00	9.64E-12	0.00E+00	7.29E-20	1.81E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.41E-18	1.07E-16
KR-85M	0.00E+00	5.31E-03	0.00E+00	4.02E-11	1.00E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.42E-10	1.87E-08
KR-85	0.00E+00	1.46E+03	0.00E+00	1.10E-05	2.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-07	5.58E-04
KR-87	0.00E+00	4.09E-18	0.00E+00	3.09E-26	7.70E-30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.02E-22	1.91E-20
KR-88	0.00E+00	3.96E-06	0.00E+00	2.99E-14	7.45E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-11	7.37E-11
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	1.39E-01	3.08E-04	1.24E-02

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 96.000 HOURS: X/Q(SITE)= .58E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .12E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.20E+02	0.00E+00	3.97E-19	9.88E-23	0.00E+00	0.00E+00	0.00E+00	2.81E-04	2.53E-09	3.33E-08
I-132	0.00E+00	2.22E-19	0.00E+00	4.01E-40	9.98E-44	0.00E+00	0.00E+00	0.00E+00	1.86E-18	1.63E-20	8.77E-20
I-133	0.00E+00	3.07E+00	0.00E+00	5.54E-21	1.38E-24	0.00E+00	0.00E+00	0.00E+00	4.95E-06	4.38E-10	7.71E-09
I-134	0.00E+00	1.94E-54	0.00E+00	3.51E-75	8.73E-79	0.00E+00	0.00E+00	0.00E+00	6.06E-39	3.27E-40	1.66E-39
I-135	0.00E+00	3.03E-05	0.00E+00	5.47E-26	1.36E-29	0.00E+00	0.00E+00	0.00E+00	1.13E-09	1.18E-12	7.47E-12
PARTICULATE											
I-131	0.00E+00	1.21E+01	0.00E+00	2.18E-20	5.43E-24	0.00E+00	0.00E+00	0.00E+00	1.54E-05	1.39E-10	1.83E-09
I-132	0.00E+00	1.22E-20	0.00E+00	2.20E-41	5.48E-45	0.00E+00	0.00E+00	0.00E+00	1.02E-19	8.97E-22	4.82E-21
I-133	0.00E+00	1.69E-01	0.00E+00	3.04E-22	7.57E-26	0.00E+00	0.00E+00	0.00E+00	2.72E-07	2.41E-11	4.24E-10
I-134	0.00E+00	1.07E-55	0.00E+00	1.93E-76	4.79E-80	0.00E+00	0.00E+00	0.00E+00	3.33E-40	1.80E-41	9.13E-41
I-135	0.00E+00	1.66E-06	0.00E+00	3.00E-27	7.48E-31	0.00E+00	0.00E+00	0.00E+00	6.23E-11	6.49E-14	4.11E-13
ORGANIC											
I-131	0.00E+00	9.67E+00	0.00E+00	1.74E-20	4.34E-24	0.00E+00	0.00E+00	0.00E+00	1.23E-05	1.11E-10	1.47E-09
I-132	0.00E+00	9.77E-21	0.00E+00	1.76E-41	4.39E-45	0.00E+00	0.00E+00	0.00E+00	8.18E-20	7.18E-22	3.85E-21
I-133	0.00E+00	1.35E-01	0.00E+00	2.43E-22	6.06E-26	0.00E+00	0.00E+00	0.00E+00	2.18E-07	1.93E-11	3.39E-10
I-134	0.00E+00	8.54E-56	0.00E+00	1.54E-76	3.84E-80	0.00E+00	0.00E+00	0.00E+00	2.66E-40	1.44E-41	7.31E-41
I-135	0.00E+00	1.33E-06	0.00E+00	2.40E-27	5.98E-31	0.00E+00	0.00E+00	0.00E+00	4.99E-11	5.19E-14	3.28E-13
NOBLE GASES											
XE-131M	0.00E+00	2.71E+02	0.00E+00	3.38E-18	8.41E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.14E-09	1.80E-07
XE-133M	0.00E+00	2.62E+02	0.00E+00	3.26E-18	8.10E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-09	4.07E-07
XE-133	0.00E+00	2.87E+04	0.00E+00	3.57E-16	8.88E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.65E-07	2.53E-05
XE-135M	0.00E+00	3.77-185	0.00E+00	4.69-205	1.17-208	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75-113	3.75-112
XE-135	0.00E+00	1.04E-01	0.00E+00	1.29E-21	3.21E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.40E-10	2.73E-08
XE-138	0.00E+00	3.80-164	0.00E+00	4.73-184	1.18-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30-100	3.40E-99
KR-83M	0.00E+00	2.45E-23	0.00E+00	3.05E-43	7.59E-47	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-23	6.83E-22
KR-85M	0.00E+00	6.23E-08	0.00E+00	7.76E-28	1.93E-31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E-13	3.61E-12
KR-85	0.00E+00	1.46E+03	0.00E+00	1.81E-17	4.52E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.22E-10	1.35E-06
KR-87	0.00E+00	3.17E-35	0.00E+00	3.95E-55	9.82E-59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-28	7.25E-27
KR-88	0.00E+00	7.13E-14	0.00E+00	8.87E-34	2.21E-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.94E-16	3.37E-15
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	3.14E-04	6.79E-07	2.73E-05

RB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 720.000 HOURS: X/Q(SITE)= .17E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .66E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	.145
PARTICULATE	.000	.000	.000	.000	1.000	.145
ORGANIC	.000	.000	.000	.000	1.000	.145

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.34E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.57E-16	3.21E-21	4.24E-20
I-132	0.00E+00	4.89-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-39	1.02E-41	5.46E-41
I-133	0.00E+00	3.47E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.56E-19	6.69E-23	1.18E-21
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-75	5.50E-77	2.80E-76
I-135	0.00E+00	3.03E-33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-24	1.14E-27	7.23E-27
PARTICULATE											
I-131	0.00E+00	1.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.96E-17	1.76E-22	2.33E-21
I-132	0.00E+00	2.69-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.36E-41	5.58E-43	3.00E-42
I-133	0.00E+00	1.91E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E-20	3.68E-24	6.47E-23
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.60E-77	3.02E-78	1.54E-77
I-135	0.00E+00	1.67E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.03E-26	6.28E-29	3.97E-28
ORGANIC											
I-131	0.00E+00	1.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-17	1.41E-22	1.86E-21
I-132	0.00E+00	2.15-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.09E-41	4.47E-43	2.40E-42
I-133	0.00E+00	1.53E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E-20	2.94E-24	5.18E-23
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.48E-77	2.42E-78	1.23E-77
I-135	0.00E+00	1.33E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.82E-26	5.02E-29	3.18E-28
NOBLE GASES											
XE-131M	0.00E+00	5.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.09E-21	2.48E-19
XE-133M	0.00E+00	9.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E-21	2.67E-19
XE-133	0.00E+00	9.43E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.37E-19	2.81E-17
XE-135M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55-208	3.09-207
XE-135	0.00E+00	2.70E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.82E-24	1.89E-22
XE-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08-186	2.83-185
KR-83M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51E-46	2.86E-45
KR-85M	0.00E+00	1.16E-50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.02E-30	6.97E-29
KR-85	0.00E+00	1.45E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.58E-22	2.21E-18
KR-87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-57	9.24E-56
KR-88	0.00E+00	5.39E-81	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-35	9.98E-35
						--------	--------	--------	--------	--------	--------
						0.00E+00	0.00E+00	0.00E+00	3.93E-16	7.52E-19	3.08E-17
						========	========	========	========	========	========
				TOTAL DOSES 0-30 DAYS		1.46E+00	4.58E-03	1.92E-02	2.94E+00	6.57E-03	2.63E-01

1 FHA - CR, LPZ, 10-90 sec, CR not isolated, Sec not isolated

ISOTOPE	ACTIVITY RELEASED (CURIES) 2. HRS	8. HRS	24. HRS	96. HRS	720. HRS	
ELEMENTAL						
I-131	1.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01
I-132	3.01E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-08
I-133	2.72E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E+00
I-134	1.50E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-22
I-135	2.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-02
PARTICULATE						
I-131	6.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.35E-01
I-132	1.65E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-09
I-133	1.49E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E-01
I-134	8.22E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.22E-24
I-135	1.26E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-03
ORGANIC						
I-131	5.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-01

RLB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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I-132      1.32E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.32E-09
I-133      1.19E-01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.19E-01
I-134      6.58E-24  0.00E+00  0.00E+00  0.00E+00  0.00E+00  6.58E-24
I-135      1.01E-03  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.01E-03
NOBLE GASES
XE-131M    1.28E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.28E+01
XE-133M    3.32E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  3.32E+01
XE-133     1.80E+03  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.80E+03
XE-135M    1.58E-75  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.58E-75
XE-135     5.67E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  5.67E+00
XE-138     1.58E-66  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.58E-66
KR-83M     2.62E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00  2.62E-09
KR-85M     8.69E-03  0.00E+00  0.00E+00  0.00E+00  0.00E+00  8.69E-03
KR-85      5.44E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  5.44E+01
KR-87      7.64E-14  0.00E+00  0.00E+00  0.00E+00  0.00E+00  7.64E-14
KR-88      5.61E-05  0.00E+00  0.00E+00  0.00E+00  0.00E+00  5.61E-05

END EXECUTION DATE:  08/30/2001
END EXECUTION TIME:  14:10:17.65
```

RB 9/4/01 2

Run #3: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – CR, LPZ, 90 sec- 1 hour, CR isolated, Sec isolated
2	TIME	10	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	2	Analysis Option: Site boundary dose plus control room dose are to be calculated.
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSP0	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1	3.8	Times at which time dependent parameters change (sec).
	T2	10.0	
	T3	90.0	
	T4	1.8E3	
	T5	3.6E3	
	T6	7.2E3	
	T7	2.88E4	
	T8	8.64E4	
	T9	3.456E5	
	T10	2.592E6	
6	LP 1-10	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1 – 3	0.0	Leak rate from secondary containment (sec^{-1}).
	LS 4	1.25E-04	
	LS 5	1.25E-04	
	LS 6 – 10	0	
8	BP 1-10	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1	3316.0	Intake rate to control center (cfm).
	VCFM 2	3316.0	
	VCFM 3	891.0	
	VCFM 4	891.0	
	VCFM 5	891.0	
	VCFM 6	891.0	
	VCFM 7	891.0	
	VCFM 8	891.0	
	VCFM 9	891.0	
	VCFM 10	891.0	

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NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
10	XQ 1	0.0	Site boundary X/Q (sec/m^3).
	XQ 2	2.90E-4	
	XQ 3	2.90E-4	
	XQ 4	1.40E-4	
	XQ 5	4.00E-5	
	XQ 6	4.00E-5	
	XQ 7	4.00E-5	
	XQ 8	1.60E-5	
	XQ 9	5.80E-6	
	XQ 10	1.70E-6	
11	XQC 1	0.0	X/Q to control center intake (sec/m^3).
	XQC 2	3.77E-3	
	XQC 3	4.07E-3	
	XQC 4	3.03E-4	
	XQC 5	1.00E-9	
	XQC 6	1.00E-9	
	XQC 7	2.65E-9	
	XQC 8	6.41E-8	
	XQC 9	1.20E-8	
	XQC 10	6.64E-9	
12	CPE 1-10	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1-10	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1-10	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1-10	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1-10	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1-10	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1-10	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1-10	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1-10	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	0.06	Combined filter non-removal factors for elemental iodine released to environment.

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NEDC: 99-032 Preparer: Robert L. Beilken Reviewer: J.J Drasler

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Line	Word	Value	Description
	RFP	0.06	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	0.06	Combined filter non-removal factors for organic iodine released to environment.
	IFE	0.145	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	0.145	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	0.145	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

AB 9/4/01

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AXIDENT VER 2 MOD 4
          PRODUCTION DATE 02/18/92
          BEGIN EXECUTION DATE:  08/31/2001
          BEGIN EXECUTION TIME:  12:23:33.89

           1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated
           2 10 2 0.0 1.0
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NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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 3 -1 2.6E6 1.4186E5 6.464E4
 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
 5 3.8 10.0 90.0 1.8E3 3.6E3 7.2E3 2.88E4 8.64E4 3.456E5 2.592E6
 6 10*1.0
 7 3*0.0 2*1.25E-04 5*0
 8 10*1.0
 9 2*3316 8*891
10 0.0 2*2.90E-4 1.40E-4 4.00E-5 4.00E-5 4.00E-5 1.60E-5 5.80E-6 1.70E-6
11 0.0 3.77E-3 4.07E-3 3.03E-4 1.00E-9 1.00E-9 2.65E-9 6.41E-8 1.20E-8 6.64E-9
12 10*0.0
13 10*0.0
14 10*0.0
15 10*0.0
16 10*0.0
17 10*0.0
18 10*0.0
19 10*0.0
20 10*0.0
21 0.06 0.06 0.06 0.145 0.145 0.145
22 1.0 1.0 1.0
23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

                    INITIAL CONTAINMENT INVENTORY

                    ISOTOPE    ACTIVITY (CURIES)

                    I-131          1.416E+03
                    I-132          3.701E-06
                    I-133          3.329E+02
                    I-134          1.853E-20
                    I-135          2.805E+00
                    XE-131M        3.560E+02
                    XE-133M        9.256E+02
                    XE-133         5.028E+04
                    XE-135M        4.578E-74
                    XE-135         1.581E+02
                    XE-138         4.536E-65
                    KR-83M         7.324E-08
                    KR-85M         2.425E-01
                    KR-85          1.514E+03
                    KR-87          2.144E-12
                    KR-88          1.567E-03
1   FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON:   1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS

                     1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL,   1. CFM MIXING,   00.00 PCT REL TO SPRAYED VOL

AT    .001 HOURS:  X/Q(SITE)= .00E+00 SEC/M3   PRIMARY LEAK RATE=****** PERCENT/DAY   CONTROL ROOM INTAKE=3316.0 CFM

                   X/Q CONT ROOM= .00E+00 SEC/M3   SEC RELEASE RATE=  .00E+00 VOL/DAY   PCT PRI LKG TO ATM =   00.00

                          CLEANUP RATES  (HR-1)                 FILTER NON-REMOVAL FACTORS
                     ==============================================  ==========================
                     SPRAY       PRIMARY     SECONDARY   CONT CENTER    RELEASE   CONT CENTER

          ELEMENTAL    .000        .000        .000        .000          .060       .145
          PARTICULATE  .000        .000        .000        .000          .060       .145
          ORGANIC      .000        .000        .000        .000          .060       .145

            ACTIVITY  (CURIES)          CONTROL ROOM     SITE BOUNDARY DOSES (REM)     CONTROL ROOM DOSES (REM)
 ISOTOPE  PRIMARY  SECONDARY  RELEASE   (CURIES) (UCI/CM3)  THYROID   WH BODY    BETA    THYROID   WH BODY    BETA

ELEMENTAL
I-131     7.21E+00  3.15E+02  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.88E-08  8.23E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     1.69E+00  7.40E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-134     9.42E-23  4.12E-21  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-135     1.43E-02  6.24E-01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
PARTICULATE
I-131     3.96E-01  1.73E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.03E-09  4.52E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     9.31E-02  4.07E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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RB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .003 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .38E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	1.46E-02	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.82E-11	8.41E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.44E-03	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.91E-25	4.21E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.90E-05	6.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	8.04E-04	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	2.10E-12	4.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.89E-04	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.05E-26	2.31E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.59E-06	3.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	6.43E-04	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.68E-12	3.70E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.51E-04	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	8.39E-27	1.85E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.27E-06	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	1.62E-02	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	4.20E-02	9.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	2.28E+00	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	2.06E-78	4.54E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	7.18E-03	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	2.05E-69	4.51E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	3.32E-12	7.32E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.10E-05	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	6.87E-02	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	9.72E-17	2.14E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	7.11E-08	1.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RLB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .41E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	6.85E-46	8.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	6.20E-38	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	3.39E-60	4.13E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	5.22E-40	6.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	1.45E-38	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.76E-47	4.59E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.41E-39	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.86E-61	2.27E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.87E-41	3.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	1.16E-38	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.01E-47	3.67E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	2.73E-39	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.49E-61	1.82E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.29E-41	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	2.92E-37	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	7.58E-37	9.25E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	4.12E-35	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	3.51-113	4.28E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	1.29E-37	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	3.50-104	4.27E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	5.95E-47	7.26E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.98E-40	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	1.24E-36	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	1.73E-51	2.11E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	1.28E-42	1.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .14E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .30E-03 SEC/M3 SEC RELEASE RATE= .11E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

ACTIVITY (CURIES) CONTROL ROOM SITE BOUNDARY DOSES (REM) CONTROL ROOM DOSES (REM)

RB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.60E+02	3.72E+00	6.26E-05	1.56E-08	1.99E-01	4.83E-05	2.36E-05	5.44E-03	4.89E-08	6.46E-07
I-132	0.00E+00	5.85E-07	9.01E-09	1.41E-13	3.51E-17	2.76E-12	7.57E-13	1.30E-13	7.37E-14	6.47E-16	3.47E-15
I-133	0.00E+00	6.02E+01	8.67E-01	1.45E-05	3.61E-09	7.58E-03	1.45E-05	1.18E-05	2.07E-04	1.83E-08	3.23E-07
I-134	0.00E+00	2.28E-21	4.00E-23	5.50E-28	1.37E-31	2.14E-27	2.71E-27	5.86E-28	5.47E-29	2.95E-30	1.50E-29
I-135	0.00E+00	4.89E-01	7.18E-03	1.18E-07	2.94E-11	1.08E-05	4.47E-07	7.12E-08	2.94E-07	3.06E-10	1.93E-09
PARTICULATE											
I-131	0.00E+00	1.43E+01	2.04E-01	3.44E-06	8.56E-10	1.09E-02	2.65E-06	1.30E-06	2.99E-04	2.69E-09	3.55E-08
I-132	0.00E+00	3.21E-08	4.95E-10	7.75E-15	1.93E-18	1.52E-13	4.16E-14	7.14E-15	4.05E-15	3.56E-17	1.91E-16
I-133	0.00E+00	3.31E+00	4.76E-02	7.97E-07	1.98E-10	4.17E-04	7.96E-07	6.49E-07	1.14E-05	1.01E-09	1.77E-08
I-134	0.00E+00	1.25E-22	2.20E-24	3.02E-29	7.53E-33	1.17E-28	1.49E-28	3.22E-29	3.01E-30	1.62E-31	8.24E-31
I-135	0.00E+00	2.69E-02	3.94E-04	6.48E-09	1.61E-12	5.94E-07	2.46E-08	3.91E-09	1.61E-08	1.68E-11	1.06E-10
ORGANIC											
I-131	0.00E+00	1.14E+01	1.63E-01	2.75E-06	6.85E-10	8.73E-03	2.12E-06	1.04E-06	2.39E-04	2.15E-09	2.84E-08
I-132	0.00E+00	2.57E-08	3.96E-10	6.20E-15	1.54E-18	1.21E-13	3.33E-14	5.72E-15	3.24E-15	2.84E-17	1.53E-16
I-133	0.00E+00	2.64E+00	3.81E-02	6.38E-07	1.59E-10	3.33E-04	6.36E-07	5.19E-07	9.11E-06	8.06E-10	1.42E-08
I-134	0.00E+00	1.00E-22	1.76E-24	2.42E-29	6.02E-33	9.39E-29	1.19E-28	2.57E-29	2.40E-30	1.30E-31	6.59E-31
I-135	0.00E+00	2.15E-02	3.16E-04	5.19E-09	1.29E-12	4.75E-07	1.96E-08	3.13E-09	1.29E-08	1.34E-11	8.50E-11
NOBLE GASES											
XE-131M	0.00E+00	2.87E+02	6.85E+01	7.96E-03	1.98E-06	0.00E+00	5.27E-05	2.98E-04	0.00E+00	1.61E-06	5.62E-05
XE-133M	0.00E+00	7.43E+02	1.78E+02	2.06E-02	5.12E-06	0.00E+00	2.05E-04	8.86E-04	0.00E+00	1.85E-06	1.67E-04
XE-133	0.00E+00	4.05E+04	9.66E+03	1.12E+00	2.79E-04	0.00E+00	1.01E-02	4.54E-02	0.00E+00	2.25E-04	8.58E-03
XE-135M	0.00E+00	9.76E-75	4.78E-75	2.70E-79	6.73E-83	0.00E+00	7.06E-80	1.49E-80	0.00E+00	4.00E-82	2.23E-81
XE-135	0.00E+00	1.23E+02	2.98E+01	3.41E-03	8.48E-07	0.00E+00	2.57E-04	3.09E-04	0.00E+00	1.79E-06	5.81E-05
XE-138	0.00E+00	1.12E-65	5.03E-66	3.09E-70	7.70E-74	0.00E+00	5.05E-70	1.30E-70	0.00E+00	7.59E-73	1.98E-71
KR-83M	0.00E+00	4.91E-08	1.28E-08	1.36E-12	3.39E-16	0.00E+00	2.25E-15	1.41E-14	0.00E+00	2.26E-16	2.58E-15
KR-85M	0.00E+00	1.81E-01	4.48E-02	5.02E-06	1.25E-09	0.00E+00	2.45E-07	3.36E-07	0.00E+00	1.82E-09	6.28E-08
KR-85	0.00E+00	1.22E+03	2.91E+02	3.39E-02	8.43E-06	0.00E+00	2.14E-05	2.09E-03	0.00E+00	1.53E-07	3.95E-04
KR-87	0.00E+00	1.32E-12	3.60E-13	3.65E-17	9.09E-21	0.00E+00	1.73E-17	1.22E-17	0.00E+00	5.77E-20	2.20E-18
KR-88	0.00E+00	1.12E-03	2.83E-04	3.10E-08	7.71E-12	0.00E+00	1.73E-08	3.11E-09	0.00E+00	1.01E-10	5.76E-10
						2.27E-01	1.08E-02	4.91E-02	6.21E-03	2.31E-04	9.26E-03

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .11E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.07E+02	3.14E+00	5.18E-05	1.29E-08	4.79E-02	1.16E-05	5.68E-06	9.75E-03	8.77E-08	1.16E-06
I-132	0.00E+00	4.02E-07	6.58E-09	1.00E-13	2.50E-17	5.76E-13	1.58E-13	2.71E-14	1.17E-13	1.03E-15	5.52E-15
I-133	0.00E+00	4.73E+01	7.22E-01	1.18E-05	2.94E-09	1.80E-03	3.44E-06	2.81E-06	3.67E-04	3.25E-08	5.72E-07
I-134	0.00E+00	1.22E-21	2.29E-23	3.06E-28	7.61E-32	3.50E-28	4.44E-28	9.59E-29	7.12E-29	3.84E-30	1.95E-29
I-135	0.00E+00	3.71E-01	5.77E-03	9.28E-08	2.31E-11	2.48E-06	1.03E-07	1.64E-08	5.06E-07	5.27E-10	3.33E-09
PARTICULATE											
I-131	0.00E+00	1.14E+01	1.72E-01	2.84E-06	7.08E-10	2.63E-03	6.39E-07	3.12E-07	5.36E-04	4.82E-09	6.36E-08
I-132	0.00E+00	2.21E-08	3.62E-10	5.52E-15	1.37E-18	3.16E-14	8.68E-15	1.49E-15	6.44E-15	5.65E-17	3.03E-16
I-133	0.00E+00	2.60E+00	3.96E-02	6.49E-07	1.62E-10	9.90E-05	1.89E-07	1.54E-07	2.02E-05	1.79E-09	3.14E-08
I-134	0.00E+00	6.72E-23	1.26E-24	1.68E-29	4.18E-33	1.92E-29	2.44E-29	5.27E-30	3.91E-30	2.11E-31	1.07E-30
I-135	0.00E+00	2.04E-02	3.17E-04	5.10E-09	1.27E-12	1.36E-07	5.64E-09	8.99E-10	2.78E-08	2.89E-11	1.83E-10
ORGANIC											
I-131	0.00E+00	9.10E+00	1.38E-01	2.28E-06	5.66E-10	2.10E-03	5.11E-07	2.50E-07	4.29E-04	3.85E-09	5.09E-08
I-132	0.00E+00	1.77E-08	2.89E-10	4.42E-15	1.10E-18	2.53E-14	6.94E-15	1.19E-15	5.15E-15	4.52E-17	2.43E-16
I-133	0.00E+00	2.08E+00	3.17E-02	5.19E-07	1.29E-10	7.92E-05	1.51E-07	1.23E-07	1.61E-05	1.43E-09	2.51E-08
I-134	0.00E+00	5.37E-23	1.01E-24	1.34E-29	3.35E-33	1.54E-29	1.95E-29	4.22E-30	3.13E-30	1.69E-31	8.58E-31
I-135	0.00E+00	1.63E-02	2.54E-04	4.08E-09	1.02E-12	1.09E-07	4.51E-09	7.19E-10	2.22E-08	2.31E-11	1.46E-10
NOBLE GASES											
XE-131M	0.00E+00	2.29E+02	5.78E+01	6.58E-03	1.64E-06	0.00E+00	1.27E-05	7.18E-05	0.00E+00	2.88E-06	1.01E-04
XE-133M	0.00E+00	5.89E+02	1.49E+02	1.69E-02	4.22E-06	0.00E+00	4.92E-05	2.13E-04	0.00E+00	3.30E-06	2.99E-04

2
RD 9/4/01
JJ 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

XE-133	0.00E+00	3.22E+04	8.15E+03	9.27E-01	2.31E-04	0.00E+00	2.44E-03	1.09E-02	0.00E+00	4.04E-04	1.54E-02
XE-135M	0.00E+00	2.06E-75	1.11E-75	5.91E-80	1.47E-83	0.00E+00	4.70E-81	9.93E-82	0.00E+00	2.50E-82	1.39E-81
XE-135	0.00E+00	9.45E+01	2.43E+01	2.72E-03	6.76E-07	0.00E+00	5.98E-05	7.20E-05	0.00E+00	3.11E-06	1.01E-04
XE-138	0.00E+00	2.72E-66	1.35E-66	7.81E-71	1.94E-74	0.00E+00	3.86E-71	9.90E-72	0.00E+00	5.30E-73	1.39E-71
KR-83M	0.00E+00	3.26E-08	9.07E-09	9.37E-13	2.33E-16	0.00E+00	4.53E-16	2.84E-15	0.00E+00	3.50E-16	3.98E-15
KR-85M	0.00E+00	1.34E-01	3.51E-02	3.84E-06	9.56E-10	0.00E+00	5.48E-08	7.53E-08	0.00E+00	3.06E-09	1.06E-07
KR-85	0.00E+00	9.76E+02	2.46E+02	2.81E-02	6.99E-06	0.00E+00	5.17E-06	5.05E-04	0.00E+00	2.75E-07	7.10E-04
KR-87	0.00E+00	8.00E-13	2.33E-13	2.30E-17	5.72E-21	0.00E+00	3.21E-18	2.25E-18	0.00E+00	8.31E-20	3.16E-18
KR-88	0.00E+00	7.89E-04	2.12E-04	2.27E-08	5.64E-12	0.00E+00	3.70E-09	6.66E-10	0.00E+00	1.65E-10	9.35E-10
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						5.46E-02	2.59E-03	1.18E-02	1.11E-02	4.13E-04	1.66E-02

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.06E+02	0.00E+00	3.54E-05	8.81E-09	0.00E+00	0.00E+00	0.00E+00	1.47E-02	1.32E-07	1.75E-06
I-132	0.00E+00	2.97E-07	0.00E+00	5.10E-14	1.27E-17	0.00E+00	0.00E+00	0.00E+00	1.43E-13	1.25E-15	6.74E-15
I-133	0.00E+00	4.57E+01	0.00E+00	7.84E-06	1.95E-09	0.00E+00	0.00E+00	0.00E+00	5.43E-04	4.80E-08	8.45E-07
I-134	0.00E+00	5.50E-22	0.00E+00	9.43E-29	2.35E-32	0.00E+00	0.00E+00	0.00E+00	6.15E-29	3.32E-30	1.69E-29
I-135	0.00E+00	3.35E-01	0.00E+00	5.74E-08	1.43E-11	0.00E+00	0.00E+00	0.00E+00	7.11E-07	7.40E-10	4.68E-09
PARTICULATE											
I-131	0.00E+00	1.13E+01	0.00E+00	1.94E-06	4.84E-10	0.00E+00	0.00E+00	0.00E+00	8.09E-04	7.28E-09	9.61E-08
I-132	0.00E+00	1.63E-08	0.00E+00	2.80E-15	6.97E-19	0.00E+00	0.00E+00	0.00E+00	7.85E-15	6.89E-17	3.70E-16
I-133	0.00E+00	2.51E+00	0.00E+00	4.31E-07	1.07E-10	0.00E+00	0.00E+00	0.00E+00	2.98E-05	2.64E-09	4.64E-08
I-134	0.00E+00	3.02E-23	0.00E+00	5.18E-30	1.29E-33	0.00E+00	0.00E+00	0.00E+00	3.38E-30	1.82E-31	9.26E-31
I-135	0.00E+00	1.84E-02	0.00E+00	3.15E-09	7.85E-13	0.00E+00	0.00E+00	0.00E+00	3.90E-08	4.07E-11	2.57E-10
ORGANIC											
I-131	0.00E+00	9.07E+00	0.00E+00	1.56E-06	3.87E-10	0.00E+00	0.00E+00	0.00E+00	6.47E-04	5.82E-09	7.69E-08
I-132	0.00E+00	1.31E-08	0.00E+00	2.24E-15	5.58E-19	0.00E+00	0.00E+00	0.00E+00	6.28E-15	5.51E-17	2.96E-16
I-133	0.00E+00	2.01E+00	0.00E+00	3.45E-07	8.58E-11	0.00E+00	0.00E+00	0.00E+00	2.39E-05	2.11E-09	3.72E-08
I-134	0.00E+00	2.42E-23	0.00E+00	4.15E-30	1.03E-33	0.00E+00	0.00E+00	0.00E+00	2.70E-30	1.46E-31	7.41E-31
I-135	0.00E+00	1.47E-02	0.00E+00	2.52E-09	6.28E-13	0.00E+00	0.00E+00	0.00E+00	3.12E-08	3.25E-11	2.06E-10
NOBLE GASES											
XE-131M	0.00E+00	2.28E+02	0.00E+00	4.50E-03	1.12E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.36E-06	1.52E-04
XE-133M	0.00E+00	5.82E+02	0.00E+00	1.15E-02	2.86E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.95E-06	4.48E-04
XE-133	0.00E+00	3.21E+04	0.00E+00	6.32E-01	1.57E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.09E-04	2.32E-02
XE-135M	0.00E+00	1.43E-76	0.00E+00	2.83E-81	7.03E-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.65E-83	3.70E-82
XE-135	0.00E+00	8.76E+01	0.00E+00	1.73E-03	4.30E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-06	1.45E-04
XE-138	0.00E+00	2.53E-67	0.00E+00	4.98E-72	1.24E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-73	4.38E-72
KR-83M	0.00E+00	2.25E-08	0.00E+00	4.44E-13	1.10E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.06E-16	4.62E-15
KR-85M	0.00E+00	1.14E-01	0.00E+00	2.25E-06	5.60E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-09	1.43E-07
KR-85	0.00E+00	9.76E+02	0.00E+00	1.93E-02	4.79E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-07	1.07E-03
KR-87	0.00E+00	4.63E-13	0.00E+00	9.13E-18	2.27E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.53E-20	3.25E-18
KR-88	0.00E+00	6.16E-04	0.00E+00	1.21E-08	3.02E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-10	1.19E-09
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						0.00E+00	0.00E+00	0.00E+00	1.68E-02	6.23E-04	2.50E-02

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 8.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .27E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

RB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.02E+02	0.00E+00	3.61E-06	8.99E-10	0.00E+00	0.00E+00	0.00E+00	2.86E-02	2.57E-07	3.39E-06
I-132	0.00E+00	4.87E-08	0.00E+00	8.72E-16	2.17E-19	0.00E+00	0.00E+00	0.00E+00	1.45E-13	1.27E-15	6.82E-15
I-133	0.00E+00	3.75E+01	0.00E+00	6.71E-07	1.67E-10	0.00E+00	0.00E+00	0.00E+00	9.80E-04	8.67E-08	1.53E-06
I-134	0.00E+00	4.55E-24	0.00E+00	8.13E-32	2.02E-35	0.00E+00	0.00E+00	0.00E+00	2.74E-29	1.48E-30	7.51E-30
I-135	0.00E+00	1.80E-01	0.00E+00	3.22E-09	8.02E-13	0.00E+00	0.00E+00	0.00E+00	1.09E-06	1.13E-09	7.17E-09
PARTICULATE											
I-131	0.00E+00	1.11E+01	0.00E+00	1.98E-07	4.94E-11	0.00E+00	0.00E+00	0.00E+00	1.57E-03	1.41E-08	1.86E-07
I-132	0.00E+00	2.68E-09	0.00E+00	4.79E-17	1.19E-20	0.00E+00	0.00E+00	0.00E+00	7.95E-15	6.98E-17	3.75E-16
I-133	0.00E+00	2.06E+00	0.00E+00	3.68E-08	9.17E-12	0.00E+00	0.00E+00	0.00E+00	5.38E-05	4.76E-09	8.38E-08
I-134	0.00E+00	2.50E-25	0.00E+00	4.47E-33	1.11E-36	0.00E+00	0.00E+00	0.00E+00	1.51E-30	8.13E-32	4.13E-31
I-135	0.00E+00	9.89E-03	0.00E+00	1.77E-10	4.40E-14	0.00E+00	0.00E+00	0.00E+00	5.98E-08	6.23E-11	3.94E-10
ORGANIC											
I-131	0.00E+00	8.87E+00	0.00E+00	1.59E-07	3.95E-11	0.00E+00	0.00E+00	0.00E+00	1.26E-03	1.13E-08	1.49E-07
I-132	0.00E+00	2.14E-09	0.00E+00	3.83E-17	9.54E-21	0.00E+00	0.00E+00	0.00E+00	6.36E-15	5.59E-17	3.00E-16
I-133	0.00E+00	1.65E+00	0.00E+00	2.95E-08	7.34E-12	0.00E+00	0.00E+00	0.00E+00	4.31E-05	3.81E-09	6.71E-08
I-134	0.00E+00	2.00E-25	0.00E+00	3.57E-33	8.90E-37	0.00E+00	0.00E+00	0.00E+00	1.20E-30	6.50E-32	3.30E-31
I-135	0.00E+00	7.91E-03	0.00E+00	1.42E-10	3.52E-14	0.00E+00	0.00E+00	0.00E+00	4.78E-08	4.98E-11	3.15E-10
NOBLE GASES											
XE-131M	0.00E+00	2.25E+02	0.00E+00	4.63E-04	1.15E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.48E-06	2.97E-04
XE-133M	0.00E+00	5.39E+02	0.00E+00	1.11E-03	2.76E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.38E-06	8.50E-04
XE-133	0.00E+00	3.10E+04	0.00E+00	6.38E-02	1.59E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-03	4.48E-02
XE-135M	0.00E+00	1.64E-83	0.00E+00	3.37E-89	8.38E-93	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.34E-84	1.86E-83
XE-135	0.00E+00	5.55E+01	0.00E+00	1.14E-04	2.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.28E-06	2.36E-04
XE-138	0.00E+00	1.63E-73	0.00E+00	3.34E-79	8.32E-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-74	2.98E-73
KR-83M	0.00E+00	2.43E-09	0.00E+00	5.00E-15	1.24E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.61E-16	4.11E-15
KR-85M	0.00E+00	4.43E-02	0.00E+00	9.10E-08	2.27E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E-09	1.94E-07
KR-85	0.00E+00	9.76E+02	0.00E+00	2.01E-03	5.00E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.15E-07	2.10E-03
KR-87	0.00E+00	1.74E-14	0.00E+00	3.57E-20	8.88E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.59E-20	2.13E-18
KR-88	0.00E+00	1.39E-04	0.00E+00	2.86E-10	7.13E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E-10	1.33E-09
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	3.25E-02	1.20E-03	4.83E-02

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 24.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .64E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	1.91E+02	0.00E+00	8.20E-09	2.04E-12	0.00E+00	0.00E+00	0.00E+00	3.24E-03	2.91E-08	3.84E-07
I-132	0.00E+00	3.93E-10	0.00E+00	1.69E-20	4.21E-24	0.00E+00	0.00E+00	0.00E+00	2.52E-15	2.21E-17	1.19E-16
I-133	0.00E+00	2.21E+01	0.00E+00	9.52E-10	2.37E-13	0.00E+00	0.00E+00	0.00E+00	9.15E-05	8.10E-09	1.42E-07
I-134	0.00E+00	1.27E-29	0.00E+00	5.47E-40	1.36E-43	0.00E+00	0.00E+00	0.00E+00	2.36E-32	1.28E-33	6.48E-33
I-135	0.00E+00	3.45E-02	0.00E+00	1.48E-12	3.69E-16	0.00E+00	0.00E+00	0.00E+00	6.46E-08	6.73E-11	4.26E-10
PARTICULATE											
I-131	0.00E+00	1.05E+01	0.00E+00	4.51E-10	1.12E-13	0.00E+00	0.00E+00	0.00E+00	1.78E-04	1.60E-09	2.11E-08
I-132	0.00E+00	2.16E-11	0.00E+00	9.29E-22	2.31E-25	0.00E+00	0.00E+00	0.00E+00	1.38E-16	1.21E-18	6.52E-18

RB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	1.22E+00	0.00E+00	5.23E-11	1.30E-14	0.00E+00	0.00E+00	0.00E+00	5.03E-06	4.45E-10	7.83E-09
I-134	0.00E+00	6.98E-31	0.00E+00	3.01E-41	7.48E-45	0.00E+00	0.00E+00	0.00E+00	1.30E-33	7.01E-35	3.56E-34
I-135	0.00E+00	1.89E-03	0.00E+00	8.15E-14	2.03E-17	0.00E+00	0.00E+00	0.00E+00	3.55E-09	3.70E-12	2.34E-11
ORGANIC											
I-131	0.00E+00	8.38E+00	0.00E+00	3.61E-10	8.97E-14	0.00E+00	0.00E+00	0.00E+00	1.42E-04	1.28E-09	1.69E-08
I-132	0.00E+00	1.73E-11	0.00E+00	7.43E-22	1.85E-25	0.00E+00	0.00E+00	0.00E+00	1.11E-16	9.72E-19	5.22E-18
I-133	0.00E+00	9.72E-01	0.00E+00	4.18E-11	1.04E-14	0.00E+00	0.00E+00	0.00E+00	4.02E-06	3.56E-10	6.26E-09
I-134	0.00E+00	5.59E-31	0.00E+00	2.40E-41	5.99E-45	0.00E+00	0.00E+00	0.00E+00	1.04E-33	5.61E-35	2.85E-34
I-135	0.00E+00	1.52E-03	0.00E+00	6.52E-14	1.62E-17	0.00E+00	0.00E+00	0.00E+00	2.84E-09	2.96E-12	1.87E-11
NOBLE GASES											
XE-131M	0.00E+00	2.16E+02	0.00E+00	1.07E-06	2.67E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-07	3.39E-05
XE-133M	0.00E+00	4.39E+02	0.00E+00	2.17E-06	5.41E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-06	9.06E-05
XE-133	0.00E+00	2.84E+04	0.00E+00	1.41E-04	3.50E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-04	5.01E-03
XE-135M	0.00E+00	5.05-102	0.00E+00	2.50-110	6.22-114	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-92	2.21E-91
XE-135	0.00E+00	1.65E+01	0.00E+00	8.15E-08	2.03E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.14E-07	1.67E-05
XE-138	0.00E+00	5.02E-90	0.00E+00	2.48E-98	6.18-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.66E-82	2.00E-80
KR-83M	0.00E+00	6.45E-12	0.00E+00	3.19E-20	7.94E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-18	4.69E-17
KR-85M	0.00E+00	3.55E-03	0.00E+00	1.76E-11	4.38E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-10	8.18E-09
KR-85	0.00E+00	9.76E+02	0.00E+00	4.83E-06	1.20E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.46E-08	2.44E-04
KR-87	0.00E+00	2.74E-18	0.00E+00	1.35E-26	3.37E-30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-22	8.36E-21
KR-88	0.00E+00	2.65E-06	0.00E+00	1.31E-14	3.26E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.68E-12	3.22E-11
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						0.00E+00	0.00E+00	0.00E+00	3.66E-03	1.34E-04	5.40E-03

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 96.000 HOURS: X/Q(SITE)= .58E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .12E-07 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	1.47E+02	0.00E+00	1.04E-20	2.59E-24	0.00E+00	0.00E+00	0.00E+00	7.37E-06	6.63E-11	8.75E-10
I-132	0.00E+00	1.49E-19	0.00E+00	1.05E-41	2.62E-45	0.00E+00	0.00E+00	0.00E+00	4.88E-20	4.29E-22	2.30E-21
I-133	0.00E+00	2.05E+00	0.00E+00	1.45E-22	3.62E-26	0.00E+00	0.00E+00	0.00E+00	1.30E-07	1.15E-11	2.02E-10
I-134	0.00E+00	1.30E-54	0.00E+00	9.20E-77	2.29E-80	0.00E+00	0.00E+00	0.00E+00	1.59E-40	8.59E-42	4.36E-41
I-135	0.00E+00	2.03E-05	0.00E+00	1.43E-27	3.57E-31	0.00E+00	0.00E+00	0.00E+00	2.98E-11	3.10E-14	1.96E-13
PARTICULATE											
I-131	0.00E+00	8.09E+00	0.00E+00	5.73E-22	1.43E-25	0.00E+00	0.00E+00	0.00E+00	4.05E-07	3.64E-12	4.81E-11
I-132	0.00E+00	8.17E-21	0.00E+00	5.78E-43	1.44E-46	0.00E+00	0.00E+00	0.00E+00	2.68E-21	2.35E-23	1.26E-22
I-133	0.00E+00	1.13E-01	0.00E+00	7.99E-24	1.99E-27	0.00E+00	0.00E+00	0.00E+00	7.14E-09	6.32E-13	1.11E-11
I-134	0.00E+00	7.14E-56	0.00E+00	5.06E-78	1.26E-81	0.00E+00	0.00E+00	0.00E+00	8.74E-42	4.72E-43	2.40E-42
I-135	0.00E+00	1.11E-06	0.00E+00	7.88E-29	1.96E-32	0.00E+00	0.00E+00	0.00E+00	1.64E-12	1.70E-15	1.08E-14
ORGANIC											
I-131	0.00E+00	6.47E+00	0.00E+00	4.58E-22	1.14E-25	0.00E+00	0.00E+00	0.00E+00	3.24E-07	2.92E-12	3.85E-11
I-132	0.00E+00	6.53E-21	0.00E+00	4.62E-43	1.15E-46	0.00E+00	0.00E+00	0.00E+00	2.15E-21	1.88E-23	1.01E-22
I-133	0.00E+00	9.02E-02	0.00E+00	6.39E-24	1.59E-27	0.00E+00	0.00E+00	0.00E+00	5.71E-09	5.06E-13	8.90E-12
I-134	0.00E+00	5.71E-56	0.00E+00	4.04E-78	1.01E-81	0.00E+00	0.00E+00	0.00E+00	6.99E-42	3.78E-43	1.92E-42
I-135	0.00E+00	8.91E-07	0.00E+00	6.31E-29	1.57E-32	0.00E+00	0.00E+00	0.00E+00	1.31E-12	1.36E-15	8.62E-15
NOBLE GASES											
XE-131M	0.00E+00	1.82E+02	0.00E+00	1.48E-18	3.68E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.25E-09	7.86E-08
XE-133M	0.00E+00	1.75E+02	0.00E+00	1.42E-18	3.55E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-09	1.78E-07
XE-133	0.00E+00	1.92E+04	0.00E+00	1.56E-16	3.88E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-07	1.11E-05
XE-135M	0.00E+00	2.52-185	0.00E+00	2.05-205	5.11-209	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95-113	1.64-112
XE-135	0.00E+00	6.94E-02	0.00E+00	5.65E-22	1.41E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.67E-10	1.19E-08
XE-138	0.00E+00	2.54-164	0.00E+00	2.07-184	5.15-188	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.69-101	1.49E-99
KR-83M	0.00E+00	1.64E-23	0.00E+00	1.33E-43	3.32E-47	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-23	2.99E-22
KR-85M	0.00E+00	4.17E-08	0.00E+00	3.39E-28	8.45E-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.58E-14	1.58E-12
KR-85	0.00E+00	9.76E+02	0.00E+00	7.94E-18	1.98E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-10	5.89E-07
KR-87	0.00E+00	2.12E-35	0.00E+00	1.73E-55	4.30E-59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.33E-29	3.17E-27
KR-88	0.00E+00	4.77E-14	0.00E+00	3.88E-34	9.66E-38	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-16	1.47E-15
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						0.00E+00	0.00E+00	0.00E+00	8.25E-06	2.96E-07	1.19E-05

NB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 720.000 HOURS: X/Q(SITE)= .17E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .66E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.060	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	1.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.37E-18	8.43E-23	1.11E-21
I-132	0.00E+00	3.27-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-41	2.67E-43	1.43E-42
I-133	0.00E+00	2.32E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-20	1.76E-24	3.09E-23
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-77	1.44E-78	7.34E-78
I-135	0.00E+00	2.03E-33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-26	3.00E-29	1.90E-28
PARTICULATE											
I-131	0.00E+00	8.61E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-19	4.63E-24	6.11E-23
I-132	0.00E+00	1.80-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-42	1.47E-44	7.87E-44
I-133	0.00E+00	1.28E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-21	9.65E-26	1.70E-24
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-78	7.94E-80	4.03E-79
I-135	0.00E+00	1.11E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-27	1.65E-30	1.04E-29
ORGANIC											
I-131	0.00E+00	6.89E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-19	3.70E-24	4.89E-23
I-132	0.00E+00	1.44-102	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-42	1.17E-44	6.30E-44
I-133	0.00E+00	1.02E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.73E-22	7.72E-26	1.36E-24
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-78	6.35E-80	3.23E-79
I-135	0.00E+00	8.91E-35	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-27	1.32E-30	8.34E-30
NOBLE GASES											
XE-131M	0.00E+00	3.95E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E-21	1.08E-19
XE-133M	0.00E+00	6.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-21	1.17E-19
XE-133	0.00E+00	6.31E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E-19	1.23E-17
XE-135M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43-208	1.35-207
XE-135	0.00E+00	1.80E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E-24	8.28E-23
XE-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.74-187	1.24-185
KR-83M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-46	1.25E-45
KR-85M	0.00E+00	7.74E-51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.84E-31	3.05E-29
KR-85	0.00E+00	9.71E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E-22	9.68E-19
KR-87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-57	4.04E-56
KR-88	0.00E+00	3.61E-81	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.69E-36	4.37E-35
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	1.03E-17	3.28E-19	1.35E-17
						========	========	========	========	========	========
				TOTAL DOSES 0-30 DAYS		2.81E-01	1.33E-02	6.09E-02	7.02E-02	2.60E-03	1.05E-01

1

FHA - CR, LPZ, 90 sec-1 hour, CR isolated, Sec isolated

ISOTOPE	ACTIVITY RELEASED (CURIES)					
	2. HRS	8. HRS	24. HRS	96. HRS	720. HRS	
ELEMENTAL						
I-131	6.85E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+00
I-132	1.56E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-08
I-133	1.59E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E+00
I-134	6.29E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-23
I-135	1.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-02
PARTICULATE						
I-131	3.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-01
I-132	8.57E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.57E-10
I-133	8.73E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.73E-02
I-134	3.46E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.46E-24
I-135	7.12E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E-04
ORGANIC						
I-131	3.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-01

NB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-132	6.86E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E-10
I-133	6.98E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E-02
I-134	2.76E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-24
I-135	5.69E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.69E-04
NOBLE GASES						
XE-131M	1.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E+02
XE-133M	3.27E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.27E+02
XE-133	1.78E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.78E+04
XE-135M	5.89E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.89E-75
XE-135	5.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.42E+01
XE-138	6.37E-66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.37E-66
KR-83M	2.19E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-08
KR-85M	8.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E-02
KR-85	5.38E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.38E+02
KR-87	5.93E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-13
KR-88	4.96E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.96E-04

END EXECUTION DATE: 08/31/2001
END EXECUTION TIME: 12:23:34.16

Run #4: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – CR, LPZ, 1 hour – 30 days, CR isolated, Sec isolated
2	TIME	10	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	2	Analysis Option: Site boundary dose plus control room dose are to be calculated.
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSPO	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1	3.8	Times at which time dependent parameters change (sec).
	T2	10.0	
	T3	90.0	
	T4	1.8E3	
	T5	3.6E3	
	T6	7.2E3	
	T7	2.88E4	
	T8	8.64E4	
	T9	3.456E5	
	T10	2.592E6	
6	LP 1-10	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1 – 5	0.0	Leak rate from secondary containment (sec^{-1}).
	LS 6 –10	7.46E-05	
8	BP 1-10	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1	3316.0	Intake rate to control center (cfm).
	VCFM 2	3316.0	
	VCFM 3	891.0	
	VCFM 4	891.0	
	VCFM 5	891.0	
	VCFM 6	891.0	
	VCFM 7	891.0	
	VCFM 8	891.0	
	VCFM 9	891.0	
	VCFM 10	891.0	

RB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
10	XQ 1	0.0	Site boundary X/Q (sec/m^3).
	XQ 2	2.90E-4	
	XQ 3	2.90E-4	
	XQ 4	1.40E-4	
	XQ 5	4.00E-5	
	XQ 6	4.00E-5	
	XQ 7	4.00E-5	
	XQ 8	1.60E-5	
	XQ 9	5.80E-6	
	XQ 10	1.70E-6	
11	XQC 1	0.0	X/Q to control center intake (sec/m^3).
	XQC 2	3.77E-3	
	XQC 3	4.07E-3	
	XQC 4	3.03E-4	
	XQC 5	1.00E-9	
	XQC 6	1.00E-9	
	XQC 7	2.65E-9	
	XQC 8	6.41E-8	
	XQC 9	1.20E-8	
	XQC 10	6.64E-9	
12	CPE 1-10	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1-10	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1-10	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1-10	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1-10	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1-10	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1-10	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1-10	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1-10	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	0.0681	Combined filter non-removal factors for elemental iodine released to environment.

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DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

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Line	Word	Value	Description
	RFP	0.06	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	0.165	Combined filter non-removal factors for organic iodine released to environment.
	IFE	0.145	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	0.145	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	0.145	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

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AXIDENT VER 2 MOD 4
                PRODUCTION DATE 02/18/92
                BEGIN EXECUTION DATE:  09/04/2001
                BEGIN EXECUTION TIME:  09:30:29.67

                 1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated
                 2 10 2 0.0 1.0
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JB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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 3 -1 2.6E6 1.4186E5 6.464E4
 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
 5 3.8 10.0 90.0 1.8E3 3.6E3 7.2E3 2.88E4 8.64E4 3.456E5 2.592E6
 6 10*1.0
 7 5*0.0 5*7.46E-05
 8 10*1.0
 9 2*3316 8*891
10 0.0 2*2.90E-4 1.40E-4 4.00E-5 4.00E-5 4.00E-5 1.60E-5 5.80E-6 1.70E-6
11 0.0 3.77E-3 4.07E-3 3.03E-4 1.00E-9 1.00E-9 2.65E-9 6.41E-8 1.20E-8 6.64E-9
12 10*0.0
13 10*0.0
14 10*0.0
15 10*0.0
16 10*0.0
17 10*0.0
18 10*0.0
19 10*0.0
20 10*0.0
21 0.0681 0.06 0.165 0.145 0.145 0.145
22 1.0 1.0 1.0
23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

                    INITIAL CONTAINMENT INVENTORY

                    ISOTOPE    ACTIVITY (CURIES)

                    I-131          1.416E+03
                    I-132          3.701E-06
                    I-133          3.329E+02
                    I-134          1.853E-20
                    I-135          2.805E+00
                    XE-131M        3.560E+02
                    XE-133M        9.256E+02
                    XE-133         5.028E+04
                    XE-135M        4.578E-74
                    XE-135         1.581E+02
                    XE-138         4.536E-65
                    KR-83M         7.324E-08
                    KR-85M         2.425E-01
                    KR-85          1.514E+03
                    KR-87          2.144E-12
                    KR-88          1.567E-03
1   FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON:    1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS

                      1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL,     1. CFM MIXING,   00.00 PCT REL TO SPRAYED VOL

AT     .001 HOURS:   X/Q(SITE)= .00E+00 SEC/M3     PRIMARY LEAK RATE=****** PERCENT/DAY     CONTROL ROOM INTAKE=3316.0 CFM

                     X/Q CONT ROOM= .00E+00 SEC/M3   SEC RELEASE RATE=  .00E+00 VOL/DAY     PCT PRI LKG TO ATM =   00.00

                                CLEANUP RATES  (HR-1)                    FILTER NON-REMOVAL FACTORS
                            ================================================  ==========================
                            SPRAY        PRIMARY      SECONDARY    CONT CENTER     RELEASE   CONT CENTER

          ELEMENTAL          .000         .000         .000         .000            .068       .145
          PARTICULATE        .000         .000         .000         .000            .060       .145
          ORGANIC            .000         .000         .000         .000            .165       .145

              ACTIVITY  (CURIES)          CONTROL ROOM      SITE BOUNDARY DOSES (REM)      CONTROL ROOM DOSES (REM)
 ISOTOPE  PRIMARY  SECONDARY  RELEASE   (CURIES) (UCI/CM3)  THYROID   WH BODY    BETA    THYROID   WH BODY    BETA

ELEMENTAL
I-131     7.21E+00  3.15E+02  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.88E-08  8.23E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     1.69E+00  7.40E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-134     9.42E-23  4.12E-21  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-135     1.43E-02  6.24E-01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
PARTICULATE
I-131     3.96E-01  1.73E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.03E-09  4.52E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     9.31E-02  4.07E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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NS 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .003 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .38E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	1.46E-02	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.82E-11	8.41E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.44E-03	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.91E-25	4.21E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.90E-05	6.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	8.04E-04	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	2.10E-12	4.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.89E-04	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.05E-26	2.31E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.59E-06	3.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	6.43E-04	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.68E-12	3.70E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.51E-04	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	8.39E-27	1.85E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.27E-06	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	1.62E-02	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	4.20E-02	9.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	2.28E+00	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	2.06E-78	4.54E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	7.18E-03	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	2.05E-69	4.51E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	3.32E-12	7.32E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.10E-05	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	6.87E-02	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	9.72E-17	2.14E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	7.11E-08	1.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .29E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .41E-02 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	6.85E-46	8.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	6.20E-38	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	3.39E-60	4.13E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	5.22E-40	6.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	1.45E-38	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.76E-47	4.59E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.41E-39	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.86E-61	2.27E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.87E-41	3.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	1.16E-38	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.01E-47	3.67E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	2.73E-39	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.49E-61	1.82E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.29E-41	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	2.92E-37	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	7.58E-37	9.25E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	4.12E-35	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	3.51-113	4.28E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	1.29E-37	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	3.50-104	4.27E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	5.95E-47	7.26E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.98E-40	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	1.24E-36	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	1.73E-51	2.11E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	1.28E-42	1.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NB 9/4/01

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .14E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .30E-03 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

ACTIVITY (CURIES) CONTROL ROOM SITE BOUNDARY DOSES (REM) CONTROL ROOM DOSES (REM)

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	7.24E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	7.45E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.83E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	6.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.98E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.55E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.33E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.18E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.27E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.24E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	9.20E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	5.01E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	1.21E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.52E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	1.38E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	6.08E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	2.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.63E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.21E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	6.23E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	7.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.90E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	5.75E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.42E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.04E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	8.33E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.53E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	9.14E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

XE-133	0.00E+00	5.00E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	3.19E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.47E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	4.21E-66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	5.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	2.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.24E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.22E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .10E-08 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.45E+02	5.14E+00	2.58E-10	6.43E-14	7.85E-02	1.91E-05	9.31E-06	4.94E-08	4.44E-13	5.87E-12
I-132	0.00E+00	3.52E-07	8.68E-09	3.72E-19	9.27E-23	7.59E-13	2.08E-13	3.58E-14	4.54E-19	3.99E-21	2.14E-20
I-133	0.00E+00	5.42E+01	1.16E+00	5.73E-11	1.43E-14	2.89E-03	5.52E-06	4.50E-06	1.81E-09	1.60E-13	2.82E-12
I-134	0.00E+00	6.52E-22	2.13E-23	6.89E-34	1.71E-37	3.25E-28	4.13E-28	8.92E-29	1.78E-34	9.59E-36	4.87E-35
I-135	0.00E+00	3.97E-01	8.79E-03	4.19E-13	1.04E-16	3.78E-06	1.56E-07	2.49E-08	2.34E-12	2.44E-15	1.54E-14
PARTICULATE											
I-131	0.00E+00	1.34E+01	2.49E-01	1.25E-11	3.11E-15	3.80E-03	9.23E-07	4.51E-07	2.39E-09	2.15E-14	2.84E-13
I-132	0.00E+00	1.94E-08	4.20E-10	1.80E-20	4.49E-24	3.68E-14	1.01E-14	1.73E-15	2.20E-20	1.93E-22	1.04E-21
I-133	0.00E+00	2.98E+00	5.60E-02	2.77E-12	6.90E-16	1.40E-04	2.67E-07	2.18E-07	8.77E-11	7.76E-15	1.37E-13
I-134	0.00E+00	3.58E-23	1.03E-24	3.33E-35	8.30E-39	1.57E-29	2.00E-29	4.32E-30	8.60E-36	4.64E-37	2.36E-36
I-135	0.00E+00	2.18E-02	4.26E-04	2.03E-14	5.05E-18	1.83E-07	7.57E-09	1.21E-09	1.13E-13	1.18E-16	7.46E-16
ORGANIC											
I-131	0.00E+00	1.07E+01	5.47E-01	2.75E-11	6.85E-15	8.36E-03	2.03E-06	9.92E-07	5.26E-09	4.73E-14	6.25E-13
I-132	0.00E+00	1.55E-08	9.25E-10	3.97E-20	9.87E-24	8.09E-14	2.22E-14	3.81E-15	4.84E-20	4.24E-22	2.28E-21
I-133	0.00E+00	2.38E+00	1.23E-01	6.10E-12	1.52E-15	3.08E-04	5.88E-07	4.80E-07	1.93E-10	1.71E-14	3.00E-13
I-134	0.00E+00	2.86E-23	2.27E-24	7.34E-35	1.83E-38	3.46E-29	4.40E-29	9.50E-30	1.89E-35	1.02E-36	5.18E-36
I-135	0.00E+00	1.74E-02	9.36E-04	4.47E-14	1.11E-17	4.03E-07	1.67E-08	2.65E-09	2.49E-13	2.60E-16	1.64E-15
NOBLE GASES											
XE-131M	0.00E+00	2.71E+02	8.35E+01	2.90E-08	7.22E-12	0.00E+00	1.84E-05	1.04E-04	0.00E+00	1.29E-11	4.51E-10
XE-133M	0.00E+00	6.90E+02	2.14E+02	7.38E-08	1.84E-11	0.00E+00	7.06E-05	3.05E-04	0.00E+00	1.46E-11	1.32E-09
XE-133	0.00E+00	3.80E+04	1.17E+04	4.07E-06	1.01E-09	0.00E+00	3.52E-03	1.58E-02	0.00E+00	1.80E-09	6.85E-08
XE-135M	0.00E+00	1.70E-76	2.77E-76	1.82E-86	4.53E-90	0.00E+00	1.17E-81	2.47E-82	0.00E+00	1.16E-88	6.45E-88
XE-135	0.00E+00	1.04E+02	3.33E+01	1.11E-08	2.77E-12	0.00E+00	8.19E-05	9.86E-05	0.00E+00	1.30E-11	4.23E-10
XE-138	0.00E+00	2.99E-67	3.98E-67	3.20E-77	7.98E-81	0.00E+00	1.14E-71	2.93E-72	0.00E+00	3.10E-79	8.10E-78
KR-83M	0.00E+00	2.67E-08	1.00E-08	2.85E-18	7.11E-22	0.00E+00	5.01E-16	3.14E-15	0.00E+00	1.12E-21	1.28E-20
KR-85M	0.00E+00	1.35E-01	4.53E-02	1.45E-11	3.60E-15	0.00E+00	7.07E-08	9.71E-08	0.00E+00	1.19E-14	4.11E-13
KR-85	0.00E+00	1.16E+03	3.57E+02	1.24E-07	3.08E-11	0.00E+00	7.49E-06	7.32E-04	0.00E+00	1.23E-12	3.18E-09
KR-87	0.00E+00	5.49E-13	2.28E-13	5.87E-23	1.46E-26	0.00E+00	3.13E-18	2.20E-18	0.00E+00	2.28E-25	8.68E-24
KR-88	0.00E+00	7.30E-04	2.57E-04	7.81E-14	1.94E-17	0.00E+00	4.47E-09	8.05E-10	0.00E+00	5.90E-16	3.35E-15
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						9.40E-02	3.73E-03	1.70E-02	5.92E-08	1.84E-09	7.39E-08

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 8.000 HOURS: X/Q(SITE)= .40E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .27E-08 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

RB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	4.78E+01	1.32E+01	6.49E-10	1.62E-13	2.02E-01	4.91E-05	2.40E-05	1.57E-06	1.41E-11	1.86E-10
I-132	0.00E+00	1.15E-08	1.09E-08	1.57E-19	3.90E-23	9.56E-13	2.62E-13	4.51E-14	5.73E-18	5.03E-20	2.70E-19
I-133	0.00E+00	8.87E+00	2.75E+00	1.21E-10	3.00E-14	6.87E-03	1.31E-05	1.07E-05	5.20E-08	4.60E-12	8.10E-11
I-134	0.00E+00	1.08E-24	1.11E-23	1.46E-35	3.64E-39	1.70E-28	2.16E-28	4.66E-29	7.20E-34	3.89E-35	1.97E-34
I-135	0.00E+00	4.26E-02	1.74E-02	5.79E-13	1.44E-16	7.49E-06	3.10E-07	4.94E-08	5.33E-11	5.55E-14	3.51E-13
PARTICULATE											
I-131	0.00E+00	2.62E+00	6.40E-01	3.14E-11	7.82E-15	9.77E-03	2.37E-06	1.16E-06	7.60E-08	6.83E-13	9.02E-12
I-132	0.00E+00	6.34E-10	5.29E-10	7.59E-21	1.89E-24	4.63E-14	1.27E-14	2.18E-15	2.77E-19	2.43E-21	1.31E-20
I-133	0.00E+00	4.88E-01	1.33E-01	5.84E-12	1.45E-15	3.32E-04	6.35E-07	5.18E-07	2.52E-09	2.23E-13	3.92E-12
I-134	0.00E+00	5.91E-26	5.39E-25	7.08E-37	1.76E-40	8.24E-30	1.05E-29	2.26E-30	3.48E-35	1.88E-36	9.55E-36
I-135	0.00E+00	2.34E-03	8.43E-04	2.80E-14	6.98E-18	3.63E-07	1.50E-08	2.39E-09	2.58E-12	2.69E-15	1.70E-14
ORGANIC											
I-131	0.00E+00	2.10E+00	1.41E+00	6.91E-11	1.72E-14	2.15E-02	5.22E-06	2.55E-06	1.67E-07	1.50E-12	1.98E-11
I-132	0.00E+00	5.07E-10	1.16E-09	1.67E-20	4.16E-24	1.02E-13	2.80E-14	4.80E-15	6.10E-19	5.36E-21	2.88E-20
I-133	0.00E+00	3.90E-01	2.93E-01	1.28E-11	3.20E-15	7.31E-04	1.40E-06	1.14E-06	5.54E-09	4.90E-13	8.63E-12
I-134	0.00E+00	4.73E-26	1.19E-24	1.56E-36	3.88E-40	1.81E-29	2.30E-29	4.97E-30	7.67E-35	4.14E-36	2.10E-35
I-135	0.00E+00	1.87E-03	1.85E-03	6.17E-14	1.54E-17	7.98E-07	3.30E-08	5.26E-09	5.68E-12	5.91E-15	3.74E-14
NOBLE GASES											
XE-131M	0.00E+00	5.33E+01	2.16E+02	7.33E-08	1.83E-11	0.00E+00	4.74E-05	2.68E-04	0.00E+00	4.11E-10	1.44E-08
XE-133M	0.00E+00	1.28E+02	5.37E+02	1.76E-07	4.37E-11	0.00E+00	1.77E-04	7.65E-04	0.00E+00	4.49E-10	4.07E-08
XE-133	0.00E+00	7.34E+03	3.01E+04	1.01E-05	2.52E-09	0.00E+00	9.02E-03	4.04E-02	0.00E+00	5.68E-08	2.16E-06
XE-135M	0.00E+00	3.88E-84	1.56E-77	5.34E-93	1.33E-96	0.00E+00	6.56E-83	1.39E-83	0.00E+00	4.20E-89	2.34E-88
XE-135	0.00E+00	1.31E+01	7.07E+01	1.81E-08	4.50E-12	0.00E+00	1.74E-04	2.09E-04	0.00E+00	3.24E-10	1.05E-08
XE-138	0.00E+00	3.85E-74	3.04E-68	5.30E-83	1.32E-86	0.00E+00	8.73E-73	2.24E-73	0.00E+00	1.51E-79	3.95E-78
KR-83M	0.00E+00	5.75E-10	1.10E-08	7.92E-19	1.97E-22	0.00E+00	5.48E-16	3.43E-15	0.00E+00	1.18E-20	1.34E-19
KR-85M	0.00E+00	1.05E-02	7.86E-02	1.44E-11	3.59E-15	0.00E+00	1.23E-07	1.69E-07	0.00E+00	2.28E-13	7.87E-12
KR-85	0.00E+00	2.31E+02	9.26E+02	3.18E-07	7.92E-11	0.00E+00	1.95E-05	1.90E-03	0.00E+00	3.96E-11	1.02E-07
KR-87	0.00E+00	4.11E-15	1.79E-13	5.65E-24	1.41E-27	0.00E+00	2.46E-18	1.73E-18	0.00E+00	1.56E-24	5.92E-23
KR-88	0.00E+00	3.30E-05	3.63E-04	4.54E-14	1.13E-17	0.00E+00	6.32E-09	1.14E-09	0.00E+00	8.66E-15	4.92E-14
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						2.41E-01	9.51E-03	4.36E-02	1.87E-06	5.80E-08	2.33E-06

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 24.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .64E-07 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	6.14E-01	3.17E+00	3.35E-10	8.34E-14	9.82E-03	4.70E-06	2.30E-06	1.14E-05	1.03E-10	1.36E-09
I-132	0.00E+00	1.26E-12	3.70E-10	6.90E-22	1.72E-25	6.57E-15	3.55E-15	6.10E-16	4.63E-18	4.06E-20	2.18E-19
I-133	0.00E+00	7.12E-02	5.34E-01	3.89E-11	9.68E-15	2.71E-04	1.02E-06	8.31E-07	2.96E-07	2.62E-11	4.61E-10
I-134	0.00E+00	4.09E-32	1.84E-26	2.23E-41	5.56E-45	5.71E-32	1.43E-31	3.09E-32	2.52E-35	1.36E-36	6.91E-36
I-135	0.00E+00	1.11E-04	2.09E-03	6.06E-14	1.51E-17	1.82E-07	1.49E-08	2.37E-09	1.74E-10	1.82E-13	1.15E-12
PARTICULATE											
I-131	0.00E+00	3.37E-02	1.53E-01	1.62E-11	4.04E-15	4.75E-04	2.28E-07	1.11E-07	5.53E-07	4.97E-12	6.56E-11
I-132	0.00E+00	6.95E-14	1.79E-11	3.34E-23	8.32E-27	3.18E-16	1.72E-16	2.95E-17	2.24E-19	1.97E-21	1.06E-20

RB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	3.91E-03	2.58E-02	1.88E-12	4.68E-16	1.31E-05	4.93E-08	4.02E-08	1.43E-08	1.27E-12	2.23E-11
I-134	0.00E+00	2.25E-33	8.92E-28	1.08E-42	2.69E-46	2.76E-33	6.92E-33	1.49E-33	1.22E-36	6.59E-38	3.34E-37
I-135	0.00E+00	6.10E-06	1.01E-04	2.93E-15	7.30E-19	8.83E-09	7.20E-10	1.15E-10	8.44E-12	8.79E-15	5.56E-14
ORGANIC											
I-131	0.00E+00	2.70E-02	3.37E-01	3.57E-11	8.88E-15	1.05E-03	5.01E-07	2.45E-07	1.22E-06	1.09E-11	1.44E-10
I-132	0.00E+00	5.56E-14	3.94E-11	7.35E-23	1.83E-26	6.99E-16	3.78E-16	6.50E-17	4.93E-19	4.33E-21	2.32E-20
I-133	0.00E+00	3.13E-03	5.69E-02	4.14E-12	1.03E-15	2.88E-05	1.08E-07	8.85E-08	3.15E-08	2.79E-12	4.91E-11
I-134	0.00E+00	1.80E-33	1.96E-27	2.38E-42	5.92E-46	6.08E-33	1.52E-32	3.29E-33	2.68E-36	1.45E-37	7.36E-37
I-135	0.00E+00	4.88E-06	2.23E-04	6.45E-15	1.61E-18	1.94E-08	1.58E-09	2.52E-10	1.86E-11	1.93E-14	1.22E-13
NOBLE GASES											
XE-131M	0.00E+00	6.97E-01	5.21E+01	3.85E-08	9.59E-12	0.00E+00	4.59E-06	2.59E-05	0.00E+00	3.02E-09	1.06E-07
XE-133M	0.00E+00	1.41E+00	1.20E+02	7.82E-08	1.95E-11	0.00E+00	1.59E-05	6.87E-05	0.00E+00	3.02E-09	2.74E-07
XE-133	0.00E+00	9.16E+01	7.11E+03	5.06E-06	1.26E-09	0.00E+00	8.53E-04	3.82E-03	0.00E+00	4.07E-07	1.55E-05
XE-135M	0.00E+00	1.63-104	3.55E-85	8.99-112	2.24-115	0.00E+00	5.99E-91	1.27E-91	0.00E+00	1.76E-95	9.80E-95
XE-135	0.00E+00	5.30E-02	1.02E+01	2.93E-09	7.30E-13	0.00E+00	1.00E-05	1.21E-05	0.00E+00	1.31E-09	4.25E-08
XE-138	0.00E+00	1.62E-92	3.91E-75	8.94-100	2.23-103	0.00E+00	4.49E-80	1.15E-80	0.00E+00	3.63E-85	9.48E-84
KR-83M	0.00E+00	2.08E-14	2.42E-10	1.15E-21	2.86E-25	0.00E+00	4.83E-18	3.02E-17	0.00E+00	6.02E-21	6.85E-20
KR-85M	0.00E+00	1.14E-05	6.60E-03	6.33E-13	1.57E-16	0.00E+00	4.12E-09	5.66E-09	0.00E+00	4.99E-13	1.72E-11
KR-85	0.00E+00	3.14E+00	2.28E+02	1.74E-07	4.33E-11	0.00E+00	1.91E-06	1.87E-04	0.00E+00	2.97E-10	7.67E-07
KR-87	0.00E+00	8.81E-21	1.35E-15	4.87E-28	1.21E-31	0.00E+00	7.44E-21	5.23E-21	0.00E+00	2.59E-25	9.86E-24
KR-88	0.00E+00	8.53E-09	1.71E-05	4.71E-16	1.17E-19	0.00E+00	1.20E-10	2.15E-11	0.00E+00	1.01E-14	5.71E-14
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						1.16E-02	8.92E-04	4.12E-03	1.35E-05	4.14E-07	1.67E-05

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 96.000 HOURS: X/Q(SITE)= .58E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .12E-07 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	1.90E-09	4.13E-02	2.35E-19	5.84E-23	6.11E-05	2.22E-08	1.08E-08	3.28E-07	2.95E-12	3.90E-11
I-132	0.00E+00	1.92E-30	4.06E-14	2.37E-40	5.90E-44	3.44E-19	1.41E-19	2.43E-20	2.08E-21	1.83E-23	9.80E-23
I-133	0.00E+00	2.65E-11	4.32E-03	3.28E-21	8.15E-25	1.05E-06	2.99E-09	2.44E-09	5.74E-09	5.08E-13	8.94E-12
I-134	0.00E+00	1.68E-65	7.01E-34	2.07E-75	5.16E-79	1.04E-39	1.97E-39	4.26E-40	6.65E-42	3.59E-43	1.82E-42
I-135	0.00E+00	2.61E-16	5.46E-06	3.23E-26	8.05E-30	2.28E-10	1.41E-11	2.24E-12	1.30E-12	1.35E-15	8.54E-15
PARTICULATE											
I-131	0.00E+00	1.04E-10	2.00E-03	1.14E-20	2.83E-24	2.96E-06	1.07E-09	5.25E-10	1.59E-08	1.43E-13	1.89E-12
I-132	0.00E+00	1.05E-31	1.97E-15	1.15E-41	2.86E-45	1.67E-20	6.84E-21	1.17E-21	1.01E-22	8.84E-25	4.75E-24
I-133	0.00E+00	1.45E-12	2.09E-04	1.59E-22	3.95E-26	5.06E-08	1.45E-10	1.18E-10	2.78E-10	2.46E-14	4.33E-13
I-134	0.00E+00	9.21E-67	3.39E-35	1.00E-76	2.50E-80	5.02E-41	9.54E-41	2.06E-41	3.22E-43	1.74E-44	8.82E-44
I-135	0.00E+00	1.44E-17	2.64E-07	1.56E-27	3.90E-31	1.10E-11	6.82E-13	1.09E-13	6.28E-14	6.54E-17	4.13E-16
ORGANIC											
I-131	0.00E+00	8.34E-11	4.39E-03	2.50E-20	6.23E-24	6.50E-06	2.36E-09	1.15E-09	3.50E-08	3.15E-13	4.15E-12
I-132	0.00E+00	8.42E-32	4.32E-15	2.52E-41	6.29E-45	3.66E-20	1.50E-20	2.58E-21	2.22E-22	1.94E-24	1.04E-23
I-133	0.00E+00	1.16E-12	4.60E-04	3.49E-22	8.68E-26	1.11E-07	3.18E-10	2.60E-10	6.11E-10	5.41E-14	9.52E-13
I-134	0.00E+00	7.36E-67	7.47E-35	2.21E-76	5.50E-80	1.11E-40	2.10E-40	4.53E-41	7.08E-43	3.82E-44	1.94E-43
I-135	0.00E+00	1.15E-17	5.82E-07	3.44E-27	8.57E-31	2.43E-11	1.50E-12	2.39E-13	1.38E-13	1.44E-16	9.09E-16
NOBLE GASES											
XE-131M	0.00E+00	2.34E-09	6.91E-01	2.93E-17	7.30E-21	0.00E+00	2.20E-08	1.24E-07	0.00E+00	8.82E-11	3.08E-09
XE-133M	0.00E+00	2.26E-09	1.35E+00	2.83E-17	7.04E-21	0.00E+00	6.46E-08	2.79E-07	0.00E+00	7.69E-11	6.97E-09
XE-133	0.00E+00	2.47E-07	8.97E+01	3.10E-15	7.71E-19	0.00E+00	3.90E-06	1.75E-05	0.00E+00	1.14E-08	4.34E-07
XE-135M	0.00E+00	3.25-196	1.49-105	4.08-204	1.01-207	0.00E+00	9.11-112	1.93-112	0.00E+00	1.07-114	5.96-114
XE-135	0.00E+00	8.95E-13	4.13E-02	1.12E-20	2.79E-24	0.00E+00	1.47E-08	1.78E-08	0.00E+00	1.42E-11	4.60E-10
XE-138	0.00E+00	3.28-175	1.64E-93	4.11-183	1.02-186	0.00E+00	6.84E-99	1.75E-99	0.00E+00	2.07-102	5.41-101
KR-83M	0.00E+00	2.11E-34	8.72E-15	2.65E-42	6.59E-46	0.00E+00	6.32E-23	3.96E-22	0.00E+00	9.82E-25	1.12E-23
KR-85M	0.00E+00	5.38E-19	7.21E-06	6.74E-27	1.68E-30	0.00E+00	1.63E-12	2.24E-12	0.00E+00	1.74E-15	6.01E-14
KR-85	0.00E+00	1.26E-08	3.14E+00	1.58E-16	3.92E-20	0.00E+00	9.57E-09	9.35E-07	0.00E+00	8.97E-12	2.31E-08
KR-87	0.00E+00	2.74E-46	2.90E-21	3.43E-54	8.53E-58	0.00E+00	5.78E-27	4.06E-27	0.00E+00	3.09E-30	1.18E-28
KR-88	0.00E+00	6.14E-25	4.44E-09	7.70E-33	1.92E-36	0.00E+00	1.12E-14	2.02E-15	0.00E+00	9.79E-18	5.56E-17
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						7.17E-05	4.04E-06	1.89E-05	3.86E-07	1.16E-08	4.68E-07

9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 720.000 HOURS: X/Q(SITE)= .17E-05 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .66E-08 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	.145
PARTICULATE	.000	.000	.000	.000	.060	.145
ORGANIC	.000	.000	.000	.000	.165	.145

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.36E-83	1.28E-10	2.29E-93	5.71E-97	5.53E-14	2.01E-17	9.82E-18	2.58E-16	2.32E-21	3.06E-20
I-132	0.00E+00	0.00E+00	6.15E-32	0.00E+00	0.00E+00	1.53E-37	6.27E-38	1.08E-38	7.57E-40	6.64E-42	3.57E-41
I-133	0.00E+00	4.97E-93	1.61E-12	3.40-103	8.47-107	1.14E-16	3.25E-19	2.65E-19	5.36E-19	4.74E-23	8.35E-22
I-134	0.00E+00	0.00E+00	2.87E-67	0.00E+00	0.00E+00	1.25E-73	2.37E-73	5.11E-74	6.37E-76	3.44E-77	1.75E-76
I-135	0.00E+00	0.00E+00	1.28E-17	0.00E+00	0.00E+00	1.57E-22	9.71E-24	1.55E-24	7.53E-25	7.85E-28	4.96E-27
PARTICULATE											
I-131	0.00E+00	1.84E-84	6.17E-12	1.11E-94	2.77E-98	2.68E-15	9.73E-19	4.75E-19	1.25E-17	1.12E-22	1.48E-21
I-132	0.00E+00	0.00E+00	2.98E-33	0.00E+00	0.00E+00	7.40E-39	3.04E-39	5.21E-40	3.66E-41	3.22E-43	1.73E-42
I-133	0.00E+00	2.73E-94	7.77E-14	1.65-104	4.10-108	5.52E-18	1.58E-20	1.29E-20	2.60E-20	2.30E-24	4.04E-23
I-134	0.00E+00	0.00E+00	1.39E-68	0.00E+00	0.00E+00	6.03E-75	1.14E-74	2.47E-75	3.08E-77	1.66E-78	8.45E-78
I-135	0.00E+00	0.00E+00	6.22E-19	0.00E+00	0.00E+00	7.60E-24	4.70E-25	7.49E-26	3.65E-26	3.80E-29	2.40E-28
ORGANIC											
I-131	0.00E+00	1.48E-84	1.36E-11	2.44E-94	6.08E-98	5.89E-15	2.14E-18	1.05E-18	2.74E-17	2.47E-22	3.26E-21
I-132	0.00E+00	0.00E+00	6.55E-33	0.00E+00	0.00E+00	1.63E-38	6.68E-39	1.15E-39	8.06E-41	7.08E-43	3.80E-42
I-133	0.00E+00	2.19E-94	1.71E-13	3.62-104	9.02-108	1.21E-17	3.47E-20	2.83E-20	5.71E-20	5.05E-24	8.89E-23
I-134	0.00E+00	0.00E+00	3.06E-68	0.00E+00	0.00E+00	1.33E-74	2.52E-74	5.44E-75	6.78E-77	3.66E-78	1.86E-77
I-135	0.00E+00	0.00E+00	1.37E-18	0.00E+00	0.00E+00	1.67E-23	1.03E-24	1.65E-25	8.02E-26	8.36E-29	5.28E-28
NOBLE GASES											
XE-131M	0.00E+00	8.46E-83	2.32E-09	5.86E-91	1.46E-94	0.00E+00	2.17E-17	1.22E-16	0.00E+00	7.51E-20	2.63E-18
XE-133M	0.00E+00	1.29E-85	2.15E-09	8.93E-94	2.22E-97	0.00E+00	3.02E-17	1.31E-16	0.00E+00	3.10E-20	2.81E-18
XE-133	0.00E+00	1.35E-81	2.42E-07	9.35E-90	2.33E-93	0.00E+00	3.09E-15	1.38E-14	0.00E+00	7.80E-18	2.97E-16
XE-135M	0.00E+00	0.00E+00	2.98-197	0.00E+00	0.00E+00	0.00E+00	5.34-204	1.13-204	0.00E+00	4.92-207	2.73-206
XE-135	0.00E+00	3.86-106	6.98E-13	2.67-114	6.66-118	0.00E+00	7.29E-20	8.78E-20	0.00E+00	5.94E-23	1.93E-21
XE-138	0.00E+00	0.00E+00	3.33-176	0.00E+00	0.00E+00	0.00E+00	4.06-182	1.04-182	0.00E+00	9.63-186	2.52-184
KR-83M	0.00E+00	0.00E+00	8.88E-35	0.00E+00	0.00E+00	0.00E+00	1.89E-43	1.18E-42	0.00E+00	2.39E-45	2.72E-44
KR-85M	0.00E+00	0.00E+00	3.39E-19	0.00E+00	0.00E+00	0.00E+00	2.25E-26	3.09E-26	0.00E+00	2.00E-29	6.90E-28
KR-85	0.00E+00	2.08E-81	1.26E-08	1.44E-89	3.58E-93	0.00E+00	1.12E-17	1.10E-15	0.00E+00	9.11E-21	2.35E-17
KR-87	0.00E+00	0.00E+00	9.00E-47	0.00E+00	0.00E+00	0.00E+00	5.26E-53	3.70E-53	0.00E+00	2.26E-56	8.62E-55
KR-88	0.00E+00	0.00E+00	3.20E-25	0.00E+00	0.00E+00	0.00E+00	2.37E-31	4.26E-32	0.00E+00	1.70E-34	9.67E-34
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						6.40E-14	3.18E-15	1.52E-14	2.98E-16	7.92E-18	3.26E-16
						========	========	========	========	========	========
				TOTAL DOSES 0-30 DAYS		3.47E-01	1.41E-02	6.47E-02	1.58E-05	4.86E-07	1.95E-05

1 FHA - CR, LPZ, 1 hour - 30 days, CR isolated, Sec isolated

ISOTOPE	ACTIVITY RELEASED (CURIES)					
	2. HRS	8. HRS	24. HRS	96. HRS	720. HRS	
ELEMENTAL						
I-131	5.14E+00	1.32E+01	3.17E+00	4.13E-02	1.28E-10	2.16E+01
I-132	8.68E-09	1.09E-08	3.70E-10	4.06E-14	6.15E-32	2.00E-08
I-133	1.16E+00	2.75E+00	5.34E-01	4.32E-03	1.61E-12	4.44E+00
I-134	2.13E-23	1.11E-23	1.84E-26	7.01E-34	2.87E-67	3.25E-23
I-135	8.79E-03	1.74E-02	2.09E-03	5.46E-06	1.28E-17	2.83E-02
PARTICULATE						
I-131	2.49E-01	6.40E-01	1.53E-01	2.00E-03	6.17E-12	1.04E+00
I-132	4.20E-10	5.29E-10	1.79E-11	1.97E-15	2.98E-33	9.68E-10
I-133	5.60E-02	1.33E-01	2.58E-02	2.09E-04	7.77E-14	2.15E-01
I-134	1.03E-24	5.39E-25	8.92E-28	3.39E-35	1.39E-68	1.57E-24
I-135	4.26E-04	8.43E-04	1.01E-04	2.64E-07	6.22E-19	1.37E-03
ORGANIC						
I-131	5.47E-01	1.41E+00	3.37E-01	4.39E-03	1.36E-11	2.30E+00

9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-132	9.25E-10	1.16E-09	3.94E-11	4.32E-15	6.55E-33	2.13E-09
I-133	1.23E-01	2.93E-01	5.69E-02	4.60E-04	1.71E-13	4.73E-01
I-134	2.27E-24	1.19E-24	1.96E-27	7.47E-35	3.06E-68	3.46E-24
I-135	9.36E-04	1.85E-03	2.23E-04	5.82E-07	1.37E-18	3.01E-03
NOBLE GASES						
XE-131M	8.35E+01	2.16E+02	5.21E+01	6.91E-01	2.32E-09	3.52E+02
XE-133M	2.14E+02	5.37E+02	1.20E+02	1.35E+00	2.15E-09	8.72E+02
XE-133	1.17E+04	3.01E+04	7.11E+03	8.97E+01	2.42E-07	4.90E+04
XE-135M	2.77E-76	1.56E-77	3.55E-85	1.49-105	2.98-197	2.92E-76
XE-135	3.33E+01	7.07E+01	1.02E+01	4.13E-02	6.98E-13	1.14E+02
XE-138	3.98E-67	3.04E-68	3.91E-75	1.64E-93	3.33-176	4.28E-67
KR-83M	1.00E-08	1.10E-08	2.42E-10	8.72E-15	8.88E-35	2.12E-08
KR-85M	4.53E-02	7.86E-02	6.60E-03	7.21E-06	3.39E-19	1.31E-01
KR-85	3.57E+02	9.26E+02	2.28E+02	3.14E+00	1.26E-08	1.51E+03
KR-87	2.28E-13	1.79E-13	1.35E-15	2.90E-21	9.00E-47	4.08E-13
KR-88	2.57E-04	3.63E-04	1.71E-05	4.44E-09	3.20E-25	6.36E-04

END EXECUTION DATE: 09/04/2001
END EXECUTION TIME: 09:30:30.06

RB 9/4/01

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Run #5: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – EAB, 0 - 90 sec, Sec not isolated
2	TIME	5	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	1	Analysis Option: Site boundary dose
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSPO	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1 T2 T3 T4 T5	3.8 90.0 1.8E3 3.6E3 7.2E3	Times at which time dependent parameters change (sec).
6	LP 1- 5	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1 LS 2 LS 3 – 5	0 6.78E-04 0	Leak rate from secondary containment (sec^{-1}).
8	BP 1- 5	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1 VCFM 2 VCFM 3 VCFM 4 VCFM 5	3316.0 891.0 891.0 891.0 891.0	Intake rate to control center (cfm)
10	XQ 1 XQ 2 XQ 3 XQ 4 XQ 5	0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5	Site boundary X/Q (sec/m^3).
11	XQC 1 - 5	0.0	X/Q to control center intake (sec/m^3).
12	CPE 1- 5	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1- 5	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1- 5	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1- 5	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1- 5	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1- 5	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1- 5	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1- 5	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
20	CCO 1- 5	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	1.0	Combined filter non-removal factors for elemental iodine released to environment.
	RFP	1.0	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	1.0	Combined filter non-removal factors for organic iodine released to environment.
	IFE	1.0	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	1.0	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	1.0	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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PRODUCTION DATE 02/18/92
BEGIN EXECUTION DATE:  08/31/2001
BEGIN EXECUTION TIME:  12:26:16.90

 1 FHA - EAB, 0-90 sec, Sec not isolated
 2 5 1 0.0 1.0
 3 -1 2.6E6 1.4186E5 6.464E4
 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
 5 3.8 90.0 1.8E3 3.6E3 7.2E3
 6 5*1.0
 7 0 6.78E-4 3*0
 8 5*1.0
 9 1*3316 4*891
10 0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5
11 5*0.0
12 5*0.0
13 5*0.0
14 5*0.0
15 5*0.0
16 5*0.0
17 5*0.0
18 5*0.0
19 5*0.0
20 5*0.0
21 1.0 1.0 1.0 1.0 1.0 1.0
22 1.0 1.0 1.0
23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

FHA - EAB, 0-90 sec, Sec not isolated

                    INITIAL CONTAINMENT INVENTORY

                    ISOTOPE    ACTIVITY (CURIES)

                    I-131          1.416E+03
                    I-132          3.701E-06
                    I-133          3.329E+02
                    I-134          1.853E-20
                    I-135          2.805E+00
                    XE-131M        3.560E+02
                    XE-133M        9.256E+02
                    XE-133         5.028E+04
                    XE-135M        4.578E-74
                    XE-135         1.581E+02
                    XE-138         4.536E-65
                    KR-83M         7.324E-08
                    KR-85M         2.425E-01
                    KR-85          1.514E+03
                    KR-87          2.144E-12
                    KR-88          1.567E-03
1   FHA - EAB, 0-90 sec, Sec not isolated

ANALYSIS BASED ON:   1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS

                     1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL,   1. CFM MIXING,   00.00 PCT REL TO SPRAYED VOL

AT    .001 HOURS:  X/Q(SITE)= .00E+00 SEC/M3    PRIMARY LEAK RATE=****** PERCENT/DAY    CONTROL ROOM INTAKE=3316.0 CFM

                   X/Q CONT ROOM= .00E+00 SEC/M3   SEC RELEASE RATE=  .00E+00 VOL/DAY    PCT PRI LKG TO ATM =   00.00

                              CLEANUP RATES  (HR-1)                  FILTER NON-REMOVAL FACTORS
                          ==============================================  ==========================
                          SPRAY       PRIMARY     SECONDARY   CONT CENTER   RELEASE   CONT CENTER

          ELEMENTAL        .000        .000        .000        .000         1.000     1.000
          PARTICULATE      .000        .000        .000        .000         1.000     1.000
          ORGANIC          .000        .000        .000        .000         1.000     1.000

             ACTIVITY  (CURIES)          CONTROL ROOM      SITE BOUNDARY DOSES (REM)      CONTROL ROOM DOSES (REM)
 ISOTOPE  PRIMARY  SECONDARY  RELEASE   (CURIES) (UCI/CM3)  THYROID   WH BODY    BETA    THYROID   WH BODY    BETA

ELEMENTAL
I-131     7.21E+00  3.15E+02  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-132     1.88E-08  8.23E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
I-133     1.69E+00  7.40E+01  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-134	9.42E-23	4.12E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.43E-02	6.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	3.96E-01	1.73E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.03E-09	4.52E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	9.31E-02	4.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 0-90 sec, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .52E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .59E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.04E+02	1.83E+01	0.00E+00	0.00E+00	3.63E+00	8.82E-04	4.31E-04	0.00E+00	0.00E+00	0.00E+00
I-132	6.85E-46	7.88E-07	4.76E-08	0.00E+00	0.00E+00	5.41E-11	1.49E-11	2.55E-12	0.00E+00	0.00E+00	0.00E+00
I-133	6.20E-38	7.14E+01	4.30E+00	0.00E+00	0.00E+00	1.40E-01	2.66E-04	2.17E-04	0.00E+00	0.00E+00	0.00E+00
I-134	3.39E-60	3.90E-21	2.37E-22	0.00E+00	0.00E+00	4.70E-26	5.97E-26	1.29E-26	0.00E+00	0.00E+00	0.00E+00
I-135	5.22E-40	6.00E-01	3.62E-02	0.00E+00	0.00E+00	2.02E-04	8.36E-06	1.33E-06	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	1.45E-38	1.67E+01	1.00E+00	0.00E+00	0.00E+00	1.99E-01	4.84E-05	2.37E-05	0.00E+00	0.00E+00	0.00E+00
I-132	3.76E-47	4.33E-08	2.62E-09	0.00E+00	0.00E+00	2.97E-12	8.16E-13	1.40E-13	0.00E+00	0.00E+00	0.00E+00
I-133	3.41E-39	3.92E+00	2.36E-01	0.00E+00	0.00E+00	7.67E-03	1.46E-05	1.19E-05	0.00E+00	0.00E+00	0.00E+00
I-134	1.86E-61	2.14E-22	1.30E-23	0.00E+00	0.00E+00	2.58E-27	3.28E-27	7.08E-28	0.00E+00	0.00E+00	0.00E+00
I-135	2.87E-41	3.30E-02	1.99E-03	0.00E+00	0.00E+00	1.11E-05	4.60E-07	7.32E-08	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	1.16E-38	1.34E+01	8.04E-01	0.00E+00	0.00E+00	1.60E-01	3.88E-05	1.89E-05	0.00E+00	0.00E+00	0.00E+00
I-132	3.01E-47	3.46E-08	2.09E-09	0.00E+00	0.00E+00	2.38E-12	6.53E-13	1.12E-13	0.00E+00	0.00E+00	0.00E+00
I-133	2.73E-39	3.14E+00	1.89E-01	0.00E+00	0.00E+00	6.13E-03	1.17E-05	9.55E-06	0.00E+00	0.00E+00	0.00E+00
I-134	1.49E-61	1.71E-22	1.04E-23	0.00E+00	0.00E+00	2.07E-27	2.62E-27	5.66E-28	0.00E+00	0.00E+00	0.00E+00
I-135	2.29E-41	2.64E-02	1.59E-03	0.00E+00	0.00E+00	8.89E-06	3.68E-07	5.86E-08	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	2.92E-37	3.36E+02	2.02E+01	0.00E+00	0.00E+00	0.00E+00	5.78E-05	3.26E-04	0.00E+00	0.00E+00	0.00E+00
XE-133M	7.58E-37	8.73E+02	5.25E+01	0.00E+00	0.00E+00	0.00E+00	2.25E-04	9.74E-04	0.00E+00	0.00E+00	0.00E+00
XE-133	4.12E-35	4.74E+04	2.85E+03	0.00E+00	0.00E+00	0.00E+00	1.11E-02	4.98E-02	0.00E+00	0.00E+00	0.00E+00
XE-135M	3.51-113	4.04E-74	2.51E-75	0.00E+00	0.00E+00	0.00E+00	1.38E-79	2.91E-80	0.00E+00	0.00E+00	0.00E+00
XE-135	1.29E-37	1.49E+02	8.96E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-04	3.45E-04	0.00E+00	0.00E+00	0.00E+00
XE-138	3.50-104	4.03E-65	2.50E-66	0.00E+00	0.00E+00	0.00E+00	9.32E-70	2.39E-70	0.00E+00	0.00E+00	0.00E+00
KR-83M	5.95E-47	6.84E-08	4.14E-09	0.00E+00	0.00E+00	0.00E+00	2.69E-15	1.68E-14	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.98E-40	2.28E-01	1.37E-02	0.00E+00	0.00E+00	0.00E+00	2.79E-07	3.83E-07	0.00E+00	0.00E+00	0.00E+00

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

KR-85	1.24E-36	1.43E+03	8.59E+01	0.00E+00	0.00E+00	0.00E+00	2.35E-05	2.29E-03	0.00E+00	0.00E+00	0.00E+00
KR-87	1.73E-51	1.99E-12	1.21E-13	0.00E+00	0.00E+00	0.00E+00	2.16E-17	1.52E-17	0.00E+00	0.00E+00	0.00E+00
KR-88	1.28E-42	1.47E-03	8.87E-05	0.00E+00	0.00E+00	0.00E+00	2.01E-08	3.62E-09	0.00E+00	0.00E+00	0.00E+00
						4.14E+00	1.30E-02	5.45E-02	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 0-90 sec, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .12E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.03E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	6.83E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	7.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.67E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	5.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.67E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.75E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.86E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.47E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.14E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.00E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.17E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.35E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	8.68E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	4.73E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	1.14E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.44E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	1.30E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	5.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	2.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.43E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.54E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.31E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 0-90 sec, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER

NB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.03E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	5.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	6.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.79E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	5.43E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.66E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.23E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	9.82E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.98E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.58E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.04E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	7.86E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.35E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	8.62E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	4.72E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	3.01E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.38E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	3.98E-66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	4.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.95E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.43E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.17E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.15E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 0-90 sec, Sec not isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1) SPRAY	PRIMARY	SECONDARY	CONT CENTER	FILTER NON-REMOVAL FACTORS RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	1.000	1.000
PARTICULATE	.000	.000	.000	.000	1.000	1.000
ORGANIC	.000	.000	.000	.000	1.000	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.02E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	4.35E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	6.69E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	8.04E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	4.90E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.66E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.39E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	4.42E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.91E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-133	0.00E+00	2.94E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	3.53E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.34E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	8.51E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	4.69E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	2.10E-76	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.28E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	3.69E-67	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	3.29E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.67E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.43E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	6.77E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	9.01E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						========	========	========	========	========	========
					TOTAL DOSES 0-30 DAYS	4.14E+00	1.30E-02	5.45E-02	0.00E+00	0.00E+00	0.00E+00

1

FHA - EAB, 0-90 sec, Sec not isolated

ISOTOPE	ACTIVITY RELEASED (CURIES)	
	2. HRS	
ELEMENTAL		
I-131	1.83E+01	1.83E+01
I-132	4.76E-08	4.76E-08
I-133	4.30E+00	4.30E+00
I-134	2.37E-22	2.37E-22
I-135	3.62E-02	3.62E-02
PARTICULATE		
I-131	1.00E+00	1.00E+00
I-132	2.62E-09	2.62E-09
I-133	2.36E-01	2.36E-01
I-134	1.30E-23	1.30E-23
I-135	1.99E-03	1.99E-03
ORGANIC		
I-131	8.04E-01	8.04E-01
I-132	2.09E-09	2.09E-09
I-133	1.89E-01	1.89E-01
I-134	1.04E-23	1.04E-23
I-135	1.59E-03	1.59E-03
NOBLE GASES		
XE-131M	2.02E+01	2.02E+01
XE-133M	5.25E+01	5.25E+01
XE-133	2.85E+03	2.85E+03
XE-135M	2.51E-75	2.51E-75
XE-135	8.96E+00	8.96E+00
XE-138	2.50E-66	2.50E-66
KR-83M	4.14E-09	4.14E-09
KR-85M	1.37E-02	1.37E-02
KR-85	8.59E+01	8.59E+01
KR-87	1.21E-13	1.21E-13
KR-88	8.87E-05	8.87E-05

END EXECUTION DATE: 08/31/2001
END EXECUTION TIME: 12:26:16.96

Run #6: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – EAB, 90 sec – 1 hour, Sec isolated
2	TIME	5	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	1	Analysis Option: Site boundary dose

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSP0	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1 T2 T3 T4 T5	3.8 90.0 1.8E3 3.6E3 7.2E3	Times at which time dependent parameters change (sec).
6	LP 1- 5	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1 LS 2 LS 3 – 4 LS 5	0.0 0.0 1.25E-4 0.0	Leak rate from secondary containment (sec^{-1}).
8	BP 1- 5	1.0	Fraction of primary leakage that goes through secondary containment.

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NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
9	VCFM 1 VCFM 2 VCFM 3 VCFM 4 VCFM 5	3316.0 891.0 891.0 891.0 891.0	Intake rate to control center (cfm).
10	XQ 1 XQ 2 XQ 3 XQ 4 XQ 5	0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5	Site boundary X/Q (sec/m^3).
11	XQC 1 - 5	0.0	X/Q to control center intake (sec/m^3).
12	CPE 1- 5	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1- 5	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1- 5	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).
15	CSE 1- 5	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1- 5	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1- 5	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1- 5	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1- 5	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1- 5	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	0.06	Combined filter non-removal factors for elemental iodine released to environment.
	RFP	0.06	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	0.06	Combined filter non-removal factors for organic iodine released to environment.
	IFE	1.0	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	1.0	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	1.0	Combined filter non-removal factors for organic iodine in control room intake.

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Line	Word	Value	Description
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

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AXIDENT VER 2 MOD 4
                PRODUCTION DATE 02/18/92
                BEGIN EXECUTION DATE:  08/31/2001
                BEGIN EXECUTION TIME:  12:26:43.87

                 1 FHA - EAB, 90 sec - 1 hour, Sec isolated
                 2 5 1 0.0 1.0
                 3 -1 2.6E6 1.4186E5 6.464E4
                 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
                 5 3.8 90.0 1.8E3 3.6E3 7.2E3
                 6 5*1.0
                 7 2*0 2*1.25E-4 0.0
                 8 5*1.0
                 9 1*3316 4*891
                10 0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5
                11 5*0.0
                12 5*0.0
                13 5*0.0
                14 5*0.0
                15 5*0.0
                16 5*0.0
                17 5*0.0
                18 5*0.0
                19 5*0.0
                20 5*0.0
                21 0.06 0.06 0.06 1.0 1.0 1.0
                22 1.0 1.0 1.0
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RB 9/4/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

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23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1
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FHA - EAB, 90 sec - 1 hour, Sec isolated

INITIAL CONTAINMENT INVENTORY

ISOTOPE	ACTIVITY (CURIES)
I-131	1.416E+03
I-132	3.701E-06
I-133	3.329E+02
I-134	1.853E-20
I-135	2.805E+00
XE-131M	3.560E+02
XE-133M	9.256E+02
XE-133	5.028E+04
XE-135M	4.578E-74
XE-135	1.581E+02
XE-138	4.536E-65
KR-83M	7.324E-08
KR-85M	2.425E-01
KR-85	1.514E+03
KR-87	2.144E-12
KR-88	1.567E-03

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .001 HOURS: X/Q(SITE)= .00E+00 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.060	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	7.21E+00	3.15E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.88E-08	8.23E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.69E+00	7.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	9.42E-23	4.12E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.43E-02	6.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	3.96E-01	1.73E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.03E-09	4.52E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	9.31E-02	4.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RLB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .52E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.060	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	6.85E-46	8.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	6.20E-38	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	3.39E-60	4.13E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	5.22E-40	6.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	1.45E-38	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.76E-47	4.59E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.41E-39	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.86E-61	2.27E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.87E-41	3.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	1.16E-38	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.01E-47	3.67E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	2.73E-39	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.49E-61	1.82E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.29E-41	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	2.92E-37	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	7.58E-37	9.25E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	4.12E-35	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	3.51-113	4.28E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	1.29E-37	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	3.50-104	4.27E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	5.95E-47	7.26E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.98E-40	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	1.24E-36	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	1.73E-51	2.11E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	1.28E-42	1.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .12E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .11E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.060	1.000

NB 9/9/01

RLB 9/9/01

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.60E+02	3.72E+00	0.00E+00	0.00E+00	1.70E-01	4.14E-05	2.02E-05	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	5.85E-07	9.01E-09	0.00E+00	0.00E+00	2.36E-12	6.49E-13	1.11E-13	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	6.02E+01	8.67E-01	0.00E+00	0.00E+00	6.50E-03	1.24E-05	1.01E-05	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.28E-21	4.00E-23	0.00E+00	0.00E+00	1.83E-27	2.33E-27	5.02E-28	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	4.89E-01	7.18E-03	0.00E+00	0.00E+00	9.27E-06	3.83E-07	6.10E-08	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.43E+01	2.04E-01	0.00E+00	0.00E+00	9.35E-03	2.27E-06	1.11E-06	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.21E-08	4.95E-10	0.00E+00	0.00E+00	1.30E-13	3.57E-14	6.12E-15	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.31E+00	4.76E-02	0.00E+00	0.00E+00	3.57E-04	6.82E-07	5.56E-07	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.25E-22	2.20E-24	0.00E+00	0.00E+00	1.01E-28	1.28E-28	2.76E-29	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.69E-02	3.94E-04	0.00E+00	0.00E+00	5.09E-07	2.11E-08	3.35E-09	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.14E+01	1.63E-01	0.00E+00	0.00E+00	7.48E-03	1.82E-06	8.88E-07	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.57E-08	3.96E-10	0.00E+00	0.00E+00	1.04E-13	2.85E-14	4.90E-15	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.64E+00	3.81E-02	0.00E+00	0.00E+00	2.86E-04	5.45E-07	4.45E-07	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.00E-22	1.76E-24	0.00E+00	0.00E+00	8.05E-29	1.02E-28	2.21E-29	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.15E-02	3.16E-04	0.00E+00	0.00E+00	4.07E-07	1.68E-08	2.68E-09	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	2.87E+02	6.85E+01	0.00E+00	0.00E+00	0.00E+00	4.52E-05	2.55E-04	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	7.43E+02	1.78E+02	0.00E+00	0.00E+00	0.00E+00	1.76E-04	7.60E-04	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	4.05E+04	9.66E+03	0.00E+00	0.00E+00	0.00E+00	8.70E-03	3.89E-02	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	9.76E-75	4.78E-75	0.00E+00	0.00E+00	0.00E+00	6.05E-80	1.28E-80	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.23E+02	2.98E+01	0.00E+00	0.00E+00	0.00E+00	2.20E-04	2.65E-04	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	1.12E-65	5.03E-66	0.00E+00	0.00E+00	0.00E+00	4.33E-70	1.11E-70	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	4.91E-08	1.28E-08	0.00E+00	0.00E+00	0.00E+00	1.93E-15	1.21E-14	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.81E-01	4.48E-02	0.00E+00	0.00E+00	0.00E+00	2.10E-07	2.88E-07	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.22E+03	2.91E+02	0.00E+00	0.00E+00	0.00E+00	1.84E-05	1.79E-03	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.32E-12	3.60E-13	0.00E+00	0.00E+00	0.00E+00	1.49E-17	1.04E-17	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.12E-03	2.83E-04	0.00E+00	0.00E+00	0.00E+00	1.48E-08	2.67E-09	0.00E+00	0.00E+00	0.00E+00
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						1.94E-01	9.22E-03	4.20E-02	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .11E+02 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1) SPRAY	PRIMARY	SECONDARY	CONT CENTER	FILTER NON-REMOVAL FACTORS RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.060	1.000

ISOTOPE	ACTIVITY (CURIES) PRIMARY	SECONDARY	RELEASE	CONTROL ROOM (CURIES)	(UCI/CM3)	SITE BOUNDARY DOSES (REM) THYROID	WH BODY	BETA	CONTROL ROOM DOSES (REM) THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.07E+02	3.14E+00	0.00E+00	0.00E+00	1.92E-02	4.65E-06	2.27E-06	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	4.02E-07	6.58E-09	0.00E+00	0.00E+00	2.30E-13	6.32E-14	1.09E-14	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.73E+01	7.22E-01	0.00E+00	0.00E+00	7.21E-04	1.38E-06	1.12E-06	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.22E-21	2.29E-23	0.00E+00	0.00E+00	1.40E-28	1.78E-28	3.84E-29	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.71E-01	5.77E-03	0.00E+00	0.00E+00	9.93E-07	4.11E-08	6.54E-09	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.14E+01	1.72E-01	0.00E+00	0.00E+00	1.05E-03	2.56E-07	1.25E-07	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.21E-08	3.62E-10	0.00E+00	0.00E+00	1.26E-14	3.47E-15	5.96E-16	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.60E+00	3.96E-02	0.00E+00	0.00E+00	3.96E-05	7.56E-08	6.17E-08	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	6.72E-23	1.26E-24	0.00E+00	0.00E+00	7.69E-30	9.77E-30	2.11E-30	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.04E-02	3.17E-04	0.00E+00	0.00E+00	5.46E-08	2.26E-09	3.59E-10	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	9.10E+00	1.38E-01	0.00E+00	0.00E+00	8.42E-04	2.05E-07	1.00E-07	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.77E-08	2.89E-10	0.00E+00	0.00E+00	1.01E-14	2.78E-15	4.77E-16	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.08E+00	3.17E-02	0.00E+00	0.00E+00	3.17E-05	6.05E-08	4.94E-08	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	5.37E-23	1.01E-24	0.00E+00	0.00E+00	6.15E-30	7.81E-30	1.69E-30	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	1.63E-02	2.54E-04	0.00E+00	0.00E+00	4.37E-08	1.81E-09	2.88E-10	0.00E+00	0.00E+00	0.00E+00

RB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

NOBLE GASES											
XE-131M	0.00E+00	2.29E+02	5.78E+01	0.00E+00	0.00E+00	0.00E+00	5.09E-06	2.87E-05	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	5.89E+02	1.49E+02	0.00E+00	0.00E+00	0.00E+00	1.97E-05	8.51E-05	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	3.22E+04	8.15E+03	0.00E+00	0.00E+00	0.00E+00	9.78E-04	4.38E-03	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	2.06E-75	1.11E-75	0.00E+00	0.00E+00	0.00E+00	1.88E-81	3.97E-82	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	9.45E+01	2.43E+01	0.00E+00	0.00E+00	0.00E+00	2.39E-05	2.88E-05	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	2.72E-66	1.35E-66	0.00E+00	0.00E+00	0.00E+00	1.54E-71	3.96E-72	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	3.26E-08	9.07E-09	0.00E+00	0.00E+00	0.00E+00	1.81E-16	1.13E-15	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.34E-01	3.51E-02	0.00E+00	0.00E+00	0.00E+00	2.19E-08	3.01E-08	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	9.76E+02	2.46E+02	0.00E+00	0.00E+00	0.00E+00	2.07E-06	2.02E-04	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	8.00E-13	2.33E-13	0.00E+00	0.00E+00	0.00E+00	1.28E-18	9.02E-19	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	7.89E-04	2.12E-04	0.00E+00	0.00E+00	0.00E+00	1.48E-09	2.66E-10	0.00E+00	0.00E+00	0.00E+00
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						2.18E-02	1.04E-03	4.73E-03	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.060	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.060	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.06E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.97E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	5.50E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.13E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.51E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	3.02E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	1.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	9.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.31E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.01E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.42E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	1.47E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	2.28E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	5.82E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	3.21E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	1.43E-76	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	8.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	2.53E-67	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	2.25E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	9.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	4.63E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	6.16E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						========	========	========	========	========	========
			TOTAL DOSES 0-30 DAYS			2.16E-01	1.03E-02	4.68E-02	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 90 sec - 1 hour, Sec isolated

ISOTOPE ACTIVITY RELEASED (CURIES)

2. HRS

NB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

```
ELEMENTAL
I-131      6.85E+00  6.85E+00
I-132      1.56E-08  1.56E-08
I-133      1.59E+00  1.59E+00
I-134      6.29E-23  6.29E-23
I-135      1.29E-02  1.29E-02
PARTICULATE
I-131      3.77E-01  3.77E-01
I-132      8.57E-10  8.57E-10
I-133      8.73E-02  8.73E-02
I-134      3.46E-24  3.46E-24
I-135      7.12E-04  7.12E-04
ORGANIC
I-131      3.01E-01  3.01E-01
I-132      6.86E-10  6.86E-10
I-133      6.98E-02  6.98E-02
I-134      2.76E-24  2.76E-24
I-135      5.69E-04  5.69E-04
NOBLE GASES
XE-131M    1.26E+02  1.26E+02
XE-133M    3.27E+02  3.27E+02
XE-133     1.78E+04  1.78E+04
XE-135M    5.89E-75  5.89E-75
XE-135     5.42E+01  5.42E+01
XE-138     6.37E-66  6.37E-66
KR-83M     2.19E-08  2.19E-08
KR-85M     8.00E-02  8.00E-02
KR-85      5.38E+02  5.38E+02
KR-87      5.93E-13  5.93E-13
KR-88      4.96E-04  4.96E-04

END EXECUTION DATE:  08/31/2001
END EXECUTION TIME:  12:26:43.93
```

Run #7: *Inputs to the AXIDENT Code*

Line	Word	Value	Description
1	TITLE	*	* FHA – EAB, 1 hour- 2 hours, Sec isolated
2	TIME	5	This is the number of times to be analyzed. The actual times are given on card 5.
	LOCATE	1	Analysis Option: Site boundary dose
	TIE	0.0	Time of Ingress/Egress (min) (e.g., from control room to site boundary).
	XQIE	1.0	X/Q for Ingress/Egress
3	MWT	-1	Core Power (MWt). A negative value indicates the code requires input of the core inventory.
	FRA	2.6E6	Time at which spray removal is assumed to start. The ***AXIDENT*** manual states that "the use of FRA on card 3 should be avoided". Therefore, this value is set to a time greater than the problem end time.
	VCCFT3	1.4186E5	Free volume of control center (ft^3).
	VCRFT3	6.464E4	Free volume of the control room proper (ft^3).
4	LSPE	0.0	Spray removal rate for elemental Iodine in sprayed region (hr^{-1}).

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	LSPP	0.0	Spray removal rate for particulate iodine in sprayed region (hr^{-1}).
	LSPO	0.0	Spray removal rate for organic iodine in sprayed region (hr^{-1}).
	Q	1.0	Mixing flow rate between sprayed and unsprayed regions (cfm).
	V1	1.0	Sprayed region volume (ft^3).
	V2	7.95E5	Unsprayed region volume (ft^3).
	F1	0.0	Fraction of initial fission product release to sprayed region.
5	T1 T2 T3 T4 T5	3.8 90.0 1.8E3 3.6E3 7.2E3	Times at which time dependent parameters change (sec).
6	LP 1- 5	1.0	Leak rate from primary containment (sec^{-1}).
7	LS 1 - 4 LS 5	0.0 7.46E-5	Leak rate from secondary containment (sec^{-1}).
8	BP 1- 5	1.0	Fraction of primary leakage that goes through secondary containment.
9	VCFM 1 VCFM 2 VCFM 3 VCFM 4 VCFM 5	3316.0 891.0 891.0 891.0 891.0	Intake rate to control center (cfm).
10	XQ 1 XQ 2 XQ 3 XQ 4 XQ 5	0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5	Site boundary X/Q (sec/m^3).
11	XQC 1 - 5	0.0	X/Q to control center intake (sec/m^3).
12	CPE 1- 5	0.0	Cleanup rate for elemental iodine in primary (sec^{-1}).
13	CPP 1- 5	0.0	Cleanup rate for particulate iodine in primary containment (sec^{-1}).
14	CPO 1- 5	0.0	Cleanup rate for organic iodine in primary containment (sec^{-1}).

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Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
15	CSE 1- 5	0.0	Cleanup rate for elemental iodine in secondary containment (sec^{-1}).
16	CSP 1- 5	0.0	Cleanup rate for particulate iodine in secondary containment (sec^{-1}).
17	CSO 1- 5	0.0	Cleanup rate for organic iodine in secondary containment (sec^{-1}).
18	CCE 1- 5	0.0	Cleanup rate for elemental iodine in control room (sec^{-1}).
19	CCP 1- 5	0.0	Cleanup rate for particulate iodine in control room (sec^{-1}).
20	CCO 1- 5	0.0	Cleanup rate for organic iodine in control room (sec^{-1}).
21	RFE	0.0681	Combined filter non-removal factors for elemental iodine released to environment.
	RFP	0.06	Combined filter non-removal factors for particulate iodine released to environment.
	RFO	0.165	Combined filter non-removal factors for organic iodine released to environment.
	IFE	1.0	Combined filter non-removal factors for elemental iodine in control room intake.
	IFP	1.0	Combined filter non-removal factors for particulate iodine in control room intake.
	IFO	1.0	Combined filter non-removal factors for organic iodine in control room intake.
22	PFE	1.0	Combined filter non-removal factors for elemental iodine released direct from primary.
	PFP	1.0	Combined filter non-removal factors for particulate iodine released direct from primary.
	PFO	1.0	Combined filter non-removal factors for organic iodine released direct from primary.
23	I-131	1.416E+03	I-131 activity (Curies).
	I-132	3.701E-06	I-132 activity (Curies).
	I-133	3.329E+02	I-133 activity (Curies).
	I-134	1.853E-20	I-134 activity (Curies).
	I-135	2.805E+00	I-135 activity (Curies).
	Xe-131m	3.560E+02	Xe-131m activity (Curies).
	Xe-133m	9.256E+02	Xe-133m activity (Curies).
	Xe-133	5.028E+04	Xe-133 activity (Curies).
24	Xe-135m	4.578E-74	Xe-135m activity (Curies).

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DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

Line	Word	Value	Description
	Xe-135	1.581E+02	Xe-135 activity (Curies).
	Xe-138	4.536E-65	Xe-138 activity (Curies).
	Kr-83m	7.324E-08	Kr-83m activity (Curies).
	Kr-85m	2.425E-01	Kr-85m activity (Curies).
	Kr-85	1.514E+03	Kr-85 activity (Curies).
	Kr-87	2.144E-12	Kr-87 activity (Curies).
	Kr-88	1.567E-03	Kr-88 activity (Curies).

```
AXIDENT VER 2 MOD 4
                PRODUCTION DATE 02/18/92
                BEGIN EXECUTION DATE:  08/31/2001
                BEGIN EXECUTION TIME:  12:27:07.82

                 1 FHA - EAB, 1 hour - 2 hours, Sec isolated
                 2 5 1 0.0 1.0
                 3 -1 2.6E6 1.4186E5 6.464E4
                 4 0.0 0.0 0.0 1.0 1.0 7.95E5 0.0
                 5 3.8 90.0 1.8E3 3.6E3 7.2E3
                 6 5*1.0
                 7 4*0 7.46E-5
                 8 5*1.0
                 9 1*3316 4*891
                10 0.0 5.2E-4 1.2E-4 1.6E-5 1.6E-5
                11 5*0.0
                12 5*0.0
                13 5*0.0
                14 5*0.0
                15 5*0.0
                16 5*0.0
                17 5*0.0
                18 5*0.0
                19 5*0.0
                20 5*0.0
                21 0.0681 0.06 0.165 1.0 1.0 1.0
                22 1.0 1.0 1.0
                23 1.416E+03 3.701E-06 3.329E+02 1.853E-20 2.805E+00 3.560E+02 9.256E+02 5.028E+04
                24 4.578E-74 1.581E+02 4.536E-65 7.324E-08 2.425E-01 1.514E+03 2.144E-12 1.567E-03
1

        FHA - EAB, 1 hour - 2 hours, Sec isolated

                                INITIAL CONTAINMENT INVENTORY

                                ISOTOPE    ACTIVITY (CURIES)

                                I-131            1.416E+03
                                I-132            3.701E-06
                                I-133            3.329E+02
                                I-134            1.853E-20
                                I-135            2.805E+00
                                XE-131M          3.560E+02
                                XE-133M          9.256E+02
                                XE-133           5.028E+04
                                XE-135M          4.578E-74
                                XE-135           1.581E+02
                                XE-138           4.536E-65
                                KR-83M           7.324E-08
                                KR-85M           2.425E-01
                                KR-85            1.514E+03
                                KR-87            2.144E-12
                                KR-88            1.567E-03
1       FHA - EAB, 1 hour - 2 hours, Sec isolated

   ANALYSIS BASED ON:    1 MWT, 141860. FT3 CONT CENTER VOLUME,  64640. FT3 CONTROL ROOM VOLUME,  31.37 FT EFF RADIUS
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RD 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .001 HOURS: X/Q(SITE)= .00E+00 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE=3316.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.165	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	7.21E+00	3.15E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.88E-08	8.23E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	1.69E+00	7.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	9.42E-23	4.12E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	1.43E-02	6.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	3.96E-01	1.73E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	1.03E-09	4.52E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	9.31E-02	4.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	5.18E-24	2.26E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	7.84E-04	3.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	3.17E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	8.28E-10	3.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	7.45E-02	3.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	4.14E-24	1.81E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.27E-04	2.74E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	7.96E+00	3.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	2.07E+01	9.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	1.12E+03	4.92E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	1.02E-75	4.46E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	3.54E+00	1.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	1.01E-66	4.42E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	1.64E-09	7.16E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	5.42E-03	2.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	3.39E+01	1.48E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	4.79E-14	2.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	3.50E-05	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 1 hour - 2 hours, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .025 HOURS: X/Q(SITE)= .52E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.165	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	2.64E-37	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RLB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

I-132	6.85E-46	8.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	6.20E-38	7.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	3.39E-60	4.13E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	5.22E-40	6.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	1.45E-38	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.76E-47	4.59E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.41E-39	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.86E-61	2.27E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.87E-41	3.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	1.16E-38	1.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	3.01E-47	3.67E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	2.73E-39	3.33E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	1.49E-61	1.82E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	2.29E-41	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	2.92E-37	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	7.58E-37	9.25E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	4.12E-35	5.03E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	3.51-113	4.28E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	1.29E-37	1.58E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	3.50-104	4.27E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	5.95E-47	7.26E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	1.98E-40	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	1.24E-36	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	1.73E-51	2.11E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	1.28E-42	1.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 1 hour - 2 hours, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT .500 HOURS: X/Q(SITE)= .12E-03 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.165	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	7.24E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	7.45E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.83E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	6.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.98E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.55E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.33E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.18E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.27E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.24E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.56E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	9.20E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	5.01E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	1.21E-74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.52E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	1.38E-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RLB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

KR-83M	0.00E+00	6.08E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	2.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.63E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 1 hour - 2 hours, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING, 00.00 PCT REL TO SPRAYED VOL

AT 1.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .00E+00 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	
	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.165	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	3.21E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	6.23E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	7.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.90E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	5.75E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.42E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	4.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	1.04E-22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	2.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	3.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	8.33E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.53E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	3.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	9.14E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	5.00E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	3.19E-75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.47E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	4.21E-66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	5.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	2.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.51E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	1.24E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	1.22E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						---	---	---	---	---	---
						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 FHA - EAB, 1 hour - 2 hours, Sec isolated

ANALYSIS BASED ON: 1 MWT, 141860. FT3 CONT CENTER VOLUME, 64640. FT3 CONTROL ROOM VOLUME, 31.37 FT EFF RADIUS

1. FT3 SPRAYED VOL, 795000. FT3 UNSPRAYED VOL, 1. CFM MIXING; 00.00 PCT REL TO SPRAYED VOL

AT 2.000 HOURS: X/Q(SITE)= .16E-04 SEC/M3 PRIMARY LEAK RATE=****** PERCENT/DAY CONTROL ROOM INTAKE= 891.0 CFM

X/Q CONT ROOM= .00E+00 SEC/M3 SEC RELEASE RATE= .64E+01 VOL/DAY PCT PRI LKG TO ATM = 00.00

	CLEANUP RATES (HR-1)				FILTER NON-REMOVAL FACTORS	

RB 9/4/01

2

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

	SPRAY	PRIMARY	SECONDARY	CONT CENTER	RELEASE	CONT CENTER
ELEMENTAL	.000	.000	.000	.000	.068	1.000
PARTICULATE	.000	.000	.000	.000	.060	1.000
ORGANIC	.000	.000	.000	.000	.165	1.000

	ACTIVITY (CURIES)			CONTROL ROOM		SITE BOUNDARY DOSES (REM)			CONTROL ROOM DOSES (REM)		
ISOTOPE	PRIMARY	SECONDARY	RELEASE	(CURIES)	(UCI/CM3)	THYROID	WH BODY	BETA	THYROID	WH BODY	BETA
ELEMENTAL											
I-131	0.00E+00	2.45E+02	5.14E+00	0.00E+00	0.00E+00	3.14E-02	7.63E-06	3.73E-06	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	3.52E-07	8.68E-09	0.00E+00	0.00E+00	3.04E-13	8.34E-14	1.43E-14	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	5.42E+01	1.16E+00	0.00E+00	0.00E+00	1.16E-03	2.21E-06	1.80E-06	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	6.52E-22	2.13E-23	0.00E+00	0.00E+00	1.30E-28	1.65E-28	3.57E-29	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	3.97E-01	8.79E-03	0.00E+00	0.00E+00	1.51E-06	6.25E-08	9.96E-09	0.00E+00	0.00E+00	0.00E+00
PARTICULATE											
I-131	0.00E+00	1.34E+01	2.49E-01	0.00E+00	0.00E+00	1.52E-03	3.69E-07	1.80E-07	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.94E-08	4.20E-10	0.00E+00	0.00E+00	1.47E-14	4.04E-15	6.93E-16	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.98E+00	5.60E-02	0.00E+00	0.00E+00	5.60E-05	1.07E-07	8.72E-08	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	3.58E-23	1.03E-24	0.00E+00	0.00E+00	6.30E-30	8.00E-30	1.73E-30	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	2.18E-02	4.26E-04	0.00E+00	0.00E+00	7.32E-08	3.03E-09	4.82E-10	0.00E+00	0.00E+00	0.00E+00
ORGANIC											
I-131	0.00E+00	1.07E+01	5.47E-01	0.00E+00	0.00E+00	3.34E-03	8.12E-07	3.97E-07	0.00E+00	0.00E+00	0.00E+00
I-132	0.00E+00	1.55E-08	9.25E-10	0.00E+00	0.00E+00	3.24E-14	8.88E-15	1.52E-15	0.00E+00	0.00E+00	0.00E+00
I-133	0.00E+00	2.38E+00	1.23E-01	0.00E+00	0.00E+00	1.23E-04	2.35E-07	1.92E-07	0.00E+00	0.00E+00	0.00E+00
I-134	0.00E+00	2.86E-23	2.27E-24	0.00E+00	0.00E+00	1.39E-29	1.76E-29	3.80E-30	0.00E+00	0.00E+00	0.00E+00
I-135	0.00E+00	1.74E-02	9.36E-04	0.00E+00	0.00E+00	1.61E-07	6.66E-09	1.06E-09	0.00E+00	0.00E+00	0.00E+00
NOBLE GASES											
XE-131M	0.00E+00	2.71E+02	8.35E+01	0.00E+00	0.00E+00	0.00E+00	7.35E-06	4.15E-05	0.00E+00	0.00E+00	0.00E+00
XE-133M	0.00E+00	6.90E+02	2.14E+02	0.00E+00	0.00E+00	0.00E+00	2.82E-05	1.22E-04	0.00E+00	0.00E+00	0.00E+00
XE-133	0.00E+00	3.80E+04	1.17E+04	0.00E+00	0.00E+00	0.00E+00	1.41E-03	6.31E-03	0.00E+00	0.00E+00	0.00E+00
XE-135M	0.00E+00	1.70E-76	2.77E-76	0.00E+00	0.00E+00	0.00E+00	4.67E-82	9.87E-83	0.00E+00	0.00E+00	0.00E+00
XE-135	0.00E+00	1.04E+02	3.33E+01	0.00E+00	0.00E+00	0.00E+00	3.28E-05	3.94E-05	0.00E+00	0.00E+00	0.00E+00
XE-138	0.00E+00	2.99E-67	3.98E-67	0.00E+00	0.00E+00	0.00E+00	4.56E-72	1.17E-72	0.00E+00	0.00E+00	0.00E+00
KR-83M	0.00E+00	2.67E-08	1.00E-08	0.00E+00	0.00E+00	0.00E+00	2.01E-16	1.25E-15	0.00E+00	0.00E+00	0.00E+00
KR-85M	0.00E+00	1.35E-01	4.53E-02	0.00E+00	0.00E+00	0.00E+00	2.83E-08	3.88E-08	0.00E+00	0.00E+00	0.00E+00
KR-85	0.00E+00	1.16E+03	3.57E+02	0.00E+00	0.00E+00	0.00E+00	3.00E-06	2.93E-04	0.00E+00	0.00E+00	0.00E+00
KR-87	0.00E+00	5.49E-13	2.28E-13	0.00E+00	0.00E+00	0.00E+00	1.25E-18	8.80E-19	0.00E+00	0.00E+00	0.00E+00
KR-88	0.00E+00	7.30E-04	2.57E-04	0.00E+00	0.00E+00	0.00E+00	1.79E-09	3.22E-10	0.00E+00	0.00E+00	0.00E+00
						3.76E-02	1.49E-03	6.81E-03	0.00E+00	0.00E+00	0.00E+00
TOTAL DOSES 0-30 DAYS						3.76E-02	1.49E-03	6.81E-03	0.00E+00	0.00E+00	0.00E+00

1

FHA - EAB, 1 hour - 2 hours, Sec isolated

ISOTOPE	ACTIVITY RELEASED (CURIES)	
	2. HRS	
ELEMENTAL		
I-131	5.14E+00	5.14E+00
I-132	8.68E-09	8.68E-09
I-133	1.16E+00	1.16E+00
I-134	2.13E-23	2.13E-23
I-135	8.79E-03	8.79E-03
PARTICULATE		
I-131	2.49E-01	2.49E-01
I-132	4.20E-10	4.20E-10
I-133	5.60E-02	5.60E-02
I-134	1.03E-24	1.03E-24
I-135	4.26E-04	4.26E-04
ORGANIC		
I-131	5.47E-01	5.47E-01
I-132	9.25E-10	9.25E-10
I-133	1.23E-01	1.23E-01
I-134	2.27E-24	2.27E-24
I-135	9.36E-04	9.36E-04
NOBLE GASES		
XE-131M	8.35E+01	8.35E+01
XE-133M	2.14E+02	2.14E+02
XE-133	1.17E+04	1.17E+04
XE-135M	2.77E-76	2.77E-76
XE-135	3.33E+01	3.33E+01
XE-138	3.98E-67	3.98E-67
KR-83M	1.00E-08	1.00E-08
KR-85M	4.53E-02	4.53E-02
KR-85	3.57E+02	3.57E+02
KR-87	2.28E-13	2.28E-13
KR-88	2.57E-04	2.57E-04

RB 9/4/01

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Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

RB 9/4/01

END EXECUTION DATE: 08/31/2001
END EXECUTION TIME: 12:27:07.82

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

B.0 AXIDENT Library File

AXIDENT Library File

The ***AXIDENT*** library file is a plain ASCII text file, which is read in by the code. The dose conversion factors used in the original code are very conservative. They were in effect and used for the design basis 10 CFR 100 type reactor siting analyses (i.e., TID 14844 and ICRP Publication 2). For this analysis, more realistic DCFs are used. The DCFs used are obtained from ICRP 30. This required a change to the ***AXIDENT*** library file. The changes made are shown below.

Section of original library file

I-131	9.97E-07	**1.48E+06**	2.91	0.197	0.371	9
I-132	8.37E-05	**5.35E+04**	4.33	0.448	2.40	34
I-133	9.17E-06	**4.00E+05**	6.69	0.423	0.477	6
I-134	2.22E-04	**2.50E+04**	7.8	0.455	1.939	24
I-135	2.87E-05	**1.24E+05**	6.2	0.308	1.779	25

Section of new library file

I-131	9.97E-07	**1.10E+06**	2.91	0.197	0.371	9
I-132	8.37E-05	**6.30E+03**	4.33	0.448	2.40	34
I-133	9.17E-06	**1.80E+05**	6.69	0.423	0.477	6
I-134	2.22E-04	**1.10E+03**	7.8	0.455	1.939	24
I-135	2.87E-05	**3.10E+04**	6.2	0.308	1.779	25

The complete library file used is presented below.

I-131	9.97E-07	1.10E+06	2.91	0.197	0.371	9
I-132	8.37E-05	6.30E+03	4.33	0.448	2.40	34
I-133	9.17E-06	1.80E+05	6.69	0.423	0.477	6
I-134	2.22E-04	1.10E+03	7.8	0.455	1.939	24
I-135	2.87E-05	3.10E+04	6.2	0.308	1.779	25
XE-131M	6.79E-07	0	0.022	0.135	0.022	3
XE-133M	3.55E-06	0	0.17	0.155	0.033	3
XE-133	1.52E-06	0	6.69	0.146	0.030	8
XE-135M	7.40E-04	0	1.8	0.097	0.422	3
XE-135	2.11E-05	0	6.3	0.322	0.246	13
XE-138	6.60E-04	0	5.9	0.800	2.870	9
KR-83M	1.03E-04	0	0.52	0.034	0.005	3
KR-85M	4.38E-05	0	1.3	0.233	0.156	4
KR-85	2.04E-09	0	0.27	0.223	0.0021	1
KR-87	1.52E-04	0	2.5	1.050	1.375	13
KR-88	6.88E-05	0	3.56	0.341	1.743	19

0.03	5.6	E-02	0.08016	2.5	E-02	0.17723	2.5	E-03	0.28431	5.9	E-02
0.32578	2.5	E-02	0.36447	7.97	E-01	0.503	3.6	E-03	0.637	6.8	E-02
0.7229	1.5	E-02	0.1472	2.	E-03	0.263	2.	E-02	0.285	5.	E-03
0.504	1.	E-02	0.508	2.	E-02	0.523	1.6	E-01	0.6206	4.	E-02
0.63	1.9	E-01	0.6502	4.	E-02	0.6521	4.	E-02	0.6678	9.2	E-01
0.6697	6.	E-02	0.6715	6.	E-02	0.727	3.2	E-02	0.729	3.2	E-02
0.7729	8.3	E-01	0.9547	1.94	E-01	1.138	2.	E-02	1.14	4.	E-02
1.22	7.	E-03	1.28	6.	E-02	1.36	2.	E-02	1.398	8.	E-02
1.44	3.	E-02	1.72	3.	E-03	1.77	5.	E-03	1.91	1.3	E-02
1.99	1.3	E-02	2.08	3.	E-03	2.16	2.	E-03	2.22	2.	E-03
2.39	2.	E-03	2.55	5.	E-04	2.68	2.	E-04	0.53	9.4	E-01
0.75	2.	E-02	0.86	7.	E-02	1.03	1.	E-02	1.24	2.	E-02
1.35	2.	E-02	0.136	5.	E-02	0.18	7.	E-02	0.39	7.	E-02
0.41	6.	E-03	0.43	3.	E-02	0.51	9.	E-03	0.54	8.	E-02

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

NEDC: 99-032 Preparer: Robert L. Beilke Reviewer: J.J Drasler

Rev. No: 2 Date: 9/4/01 Date: 9/4/01

0.61	2.4	E-01	0.69	7.	E-02	0.75	1.	E-02	0.77	6.	E-02
0.85	9.5	E-01	0.86	4.	E-02	0.89	7.	E-01	0.96	2.	E-02
1.	5.	E-02	1.07	1.8	E-01	1.15	1.2	E-01	1.28	1.	E-02
1.34	2.	E-02	1.46	4.	E-02	1.49	1.	E-02	1.62	5.	E-02
1.79	5.	E-02	0.2204	1.8	E-02	0.2884	3.4	E-02	0.4175	3.2	E-02
0.434	8.2	E-03	0.5269	1.49	E-01	0.5465	6.2	E-02	0.7077	5.9	E-03
0.8369	5.	E-02	0.9724	1.8	E-02	1.0387	9.	E-02	1.1017	1.7	E-02
1.1243	3.3	E-02	1.1316	1.75	E-01	1.1691	7.9	E-03	1.2604	2.58	E-01
1.4575	7.1	E-02	1.5029	1.2	E-02	1.5659	1.4	E-02	1.6785	9.5	E-02
1.707	3.8	E-02	1.7919	7.6	E-02	1.8314	6.4	E-03	2.0467	8.3	E-03
2.2567	6.3	E-03	2.4079	9.	E-03	0.005	6.	E-02	0.03	5.9	E-01
0.16398	2.3	E-02	0.0297	1.41	E-01	0.0338	3.2	E-02	0.2328	8.	E-02
0.0308	3.82	E-01	0.0353	8.6	E-02	0.0796	6.	E-03	0.081	3.7	E-01
0.1607	6.6	E-04	0.2234	2.4	E-06	0.3031	5.1	E-05	0.3841	2.3	E-04
0.0045	4.	E-04	0.0304	1.35	E-01	0.527	8.2	E-01	0.031	4.5	E-02
0.1585	2.1	E-03	0.1999	2.	E-04	0.2498	9.16	E-01	0.3586	2.2	E-03
0.3731	1.1	E-04	0.4082	3.1	E-03	0.5733	5.	E-05	0.6086	2.4	E-02
0.6546	3.2	E-04	0.7319	4.6	E-04	0.8126	5.	E-04	1.063	3.	E-05
0.03	3.	E-02	0.155	7.8	E-02	0.243	3.6	E-02	0.259	3.7	E-01
0.397	7.4	E-02	0.402	2.8	E-02	0.434	2.3	E-01	1.77	2.	E-01
2.00	1.6	E-01	0.0016	8.	E-02	0.0093	8.	E-02	0.0128	1.6	E-01
0.0016	6.5	E-04	0.0128	5.2	E-02	0.1495	7.7	E-01	0.305	1.35	E-01
0.514	4.35	E-03	0.403	5.9	E-01	0.6743	2.5	E-02	0.836	8.	E-03
0.8458	8.1	E-02	1.1755	1.4	E-02	1.338	7.5	E-03	1.384	5.5	E-03
1.741	2.	E-02	2.012	2.6	E-02	2.556	9.5	E-02	2.559	5.1	E-02
2.8112	4.	E-03	3.3098	6.	E-03	0.166	6.9	E-02	0.1961	3.81	E-01
0.3626	3.	E-02	0.3904	6.	E-03	0.4723	6.	E-03	0.8347	1.31	E-01
0.8624	5.	E-03	0.9867	1.6	E-02	1.1417	1.8	E-02	1.1833	9.	E-03
1.25	1.1	E-02	1.5185	1.5	E-02	1.5298	1.14	E-01	2.0295	4.8	E-02
2.0353	4.8	E-02	2.1959	1.51	E-01	2.2316	3.6	E-02	2.3524	2.	E-03
2.392	3.82	E-01									

0.01	4.99	0.015	1.55	0.02	0.752	0.03	0.349
0.04	0.248	0.05	0.208	0.06	0.188	0.08	0.167
0.1	0.154	0.15	0.136	0.2	0.123	0.3	0.107
0.4	0.0954	0.5	0.087	0.6	0.0805	0.8	0.0707
1.	0.0636	1.5	0.0518	2.0	0.0445	3.0	0.0358
4.0	0.0308						
4.61	1.27	0.511	0.148	0.0669	0.0406	0.0305	0.0243
0.0234	0.0250	0.0268	0.0288	0.0295	0.0297	0.0296	0.0289
0.0280	0.0257	0.0238	0.0212	0.0194			

I-131	I-132	I-133	I-134	I-135	I-131	I-132	I-133	I-134
I-135	I-131	I-132	I-133	I-134	I-135	XE-131M	XE-133M	XE-133
XE-135M	XE-135	XE-138	KR-83M	KR-85M	KR-85	KR-87	KR-88	