
Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities

Appendices A and B

Final Report

U.S. Nuclear Regulatory Commission

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ABSTRACT

The action being considered in this Final Generic Environmental Impact Statement (GEIS) is an amendment to the Nuclear Regulatory Commission's (NRC) regulations in 10 CFR Part 20 to include radiological criteria for decommissioning of lands and structures at nuclear facilities. Under the National Environmental Policy Act (NEPA), all Federal agencies must consider the effect of their actions on the environment. To fulfill NRC's responsibilities under NEPA, the Commission is preparing this GEIS which analyzes alternative courses of action and the costs and impacts associated with those alternatives.

In preparing the final GEIS, the following approach was taken: (1) a listing was developed of regulatory alternatives for establishing radiological criteria for decommissioning; (2) for each alternative, a detailed analysis and comparison of incremental impacts, both radiological and nonradiological, to workers, members of the public, and the environment, and costs were performed; and (3) based on the analysis of impacts and costs, conclusions on radiological criteria for decommissioning were provided. Contained in the GEIS are results and conclusions related to achieving, as an objective of decommissioning ALARA, reduction to preexisting background, the radiological criterion for unrestricted use, decommissioning ALARA analysis for soils and structures containing contamination, restricted use and alternative analysis for special site-specific situations and groundwater cleanup. In its analyses, the final GEIS includes consideration of comments made on the draft GEIS (NUREG-1496, August 1994) during the public comment period.

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APPENDIX A

**BACKGROUND AS AN ALTERNATIVE RESIDUAL RADIOACTIVITY
CRITERION FOR DECOMMISSIONING**

APPENDIX A

A.1 Return to Background

In a return to background alternative residual radioactivity criterion for decommissioning, criteria would be established requiring the removal of all radioactivity attributable to licensed activities. A site would be released for unrestricted use only after all radioactivity attributable to licensed activities has been removed and background levels existing prior to licensing have been achieved.

A.2 Discussion of Background

Background is comprised of various sources of ionizing radiation which collectively produce an average total effective dose equivalent of about 300 mrem/y to a U.S. resident. Radiological doses from background typically range between 100 mrem/y and 1,000 mrem/y in the United States. Although greater radiological doses are possible for people living in houses with very high radon concentrations, 1,000 mrem could be taken as a practical maximum, excepting the extremes of unusual situations. For comparison, the estimate of the average U.S. radiological dose from background is similar to the world average estimate of 240 mrem/y. NUREG-1501 (NRC, 1994) contains a detailed discussion of sources, levels, and variability of background; the following discussion summarizes Section 2 of NUREG-1501.

Table A.1 provides a breakdown of the sources of natural background. In addition to the amounts in Table A.1, relatively minor contributors to the radiological dose from background (less than 1% each) are cosmogenic radionuclides, created by the interaction of cosmic rays with otherwise stable elements present on earth, and man-made fallout radionuclides from nuclear weapons testing.

Background produces radiological doses to the U.S. population that are highly variable between locations (spatial) and also over time at the same place (temporal). For example, cosmic radiation is modulated by the 11-year solar cycle and typically varies about 10% at the same location, but at different times. Temporal variability of background is also tied to atmospheric circulation and precipitation patterns that affect the distribution of cosmogenic and fallout radionuclides. Short-term changes in external gamma exposure arise from redistribution of radon decay products in the atmosphere and washout with precipitation, resulting in changes ranging from a few percent to more than 200% over the course of a day or season. Even larger variations in indoor radon concentrations can occur because of building ventilation changes. Indoor levels of gamma radiation typically vary by about 50% due to the use of different construction materials. Outdoors, changes in soil moisture and snow cover cause external gamma radiation levels to vary seasonally by 10 to 50% at the same location. The concentration of radionuclides that produce internal doses, such as Pb-210 in body tissues, has been observed to vary by about a factor of three throughout the

United States. Spatial variability of cosmic radiation is observed to be as much as 200%, depending greatly on altitude and to a lesser extent on latitude.

Nearly all materials contain naturally occurring radioactivity due to the presence of terrestrial radionuclides, such as K-40, Rb-87, Th-232, and U-238, and cosmogenic radionuclides, such as C-14, H-3, Be-7 and Na-22. The concentration of these radionuclides in soil, water, air, and living matter can vary widely throughout the country because of geological processes, climatic changes, weather, and human activities. For example, concentrations of uranium and thorium in the soil range from as little as one-tenth to as much as four times the average value. Data contained in Table A.2 illustrate a typical range of natural radionuclide concentrations in soil throughout the United States and the world.

The concentration of the principal gamma-emitting radionuclides in soil is directly related to the external gamma radiation levels in a locale. On a nationwide scale, the concentrations of terrestrial radionuclides vary widely, which is reflected in the grouping of external gamma radiation levels into three regions: (1) the Atlantic and Gulf coastal plains, which averages about half of the level seen for Middle America (23 mrad/y); (2) Middle America which has an average level of 46 mrad/y; and (3) the Denver, Colorado area, which has an average level about twice that of Middle America (90 mrad/y). Throughout the United States, concentrations of naturally occurring radionuclides in groundwater can also vary widely. In certain areas of the midwest, for example, the concentration of uranium in water (0.35 pCi/l) is 35 times greater than that found in some eastern states (0.01 pCi/l), but even greater concentrations are reported in western areas of the country, where natural uranium concentrations in groundwater (3.5 pCi/l) are 350 times that of eastern groundwater.

On a smaller scale, such as within an individual State, background radioactivity levels can vary even more. For example, in a particular location in northwestern New Jersey, external gamma radiation levels triple across a small field and, at a nearby rock outcropping, the average soil concentration of naturally occurring radionuclides increases one-hundred-fold, yet 62 miles away from this location, gamma radiation levels fall to less than 10% of the regional average due to the presence of sandy beaches.

Spatial variability in the concentration of background radionuclides can also be caused by human activities. Fallout from a nuclear weapon test can change background abruptly and require a few months to a few decades to decay. Such testing has correspondingly increased the spatial variability of background because the distribution of fallout radionuclides in the United States is not homogeneous. Mining and milling have also increased the spatial variability of background by redistributing the preexisting concentrations of naturally occurring radionuclides in a locale. Another human activity that affects the spatial distribution of background is the combustion of fossil fuels which produces ash that redistributes natural radioactivity from the ground to the air.

In addition to naturally occurring sources of radiation, nuclear technology has led to the creation of man-made radionuclides that contribute to the background radiological dose. Man-

made sources of ionizing radiation exposure account for 18% of the total radiological dose to the U.S. population. Of the man-made sources, medical x-ray examinations are the largest source of exposure, producing 11% of the total dose (39 mrem/y). Nuclear medicine procedures account for 4% of the total population dose, followed by consumer products (3%), weapons test fallout (less than 1%) and occupational exposures (less than 1%). On average, however, 82% of the total dose to the U.S. population comes from naturally occurring radiation sources. The magnitude and variability of radiation doses is directly proportional to the background level that individuals are exposed to and the activities in which they are engaged. Because of their widely varying and ubiquitous characteristics, radiation doses to U.S. residents from background, in turn, vary widely, as well.

A.3 Impacts and Costs for a Dose Criterion of "0" mrem/y Above Background

A "return-to-background" regulatory alternative which requires removal of all residual radioactivity attributable to licensed activities would have a dose criterion value of "0" mrem/y above background. A "0" mrem/y above background alternative was not explicitly studied, but impacts and costs for a "0" mrem/y above background alternative can be analyzed by inference based on Appendices B, C, and D. Based on the low individual doses and the trends indicated in Appendix B, the rate of reduction in health impacts below approximately 3 mrem/y tends to become smaller or negative (indicating net increase in mortality). This trend is expected to continue to "0" mrem/y and suggests that there is not necessarily a further health and safety benefit in establishing a return-to-background alternative that is on the order of "0" mrem/y above background and could also result in a detriment. Appendices C and D suggest that, in general, expenditures made for soil and concrete removal and radiation surveys to reduce impacts to a dose criterion of "0" mrem/y above background may be very large.

A significant consideration in determining the effectiveness of a return-to-background alternative is whether available radiological survey instruments and procedures can measure "0" mrem/y above background at NRC-licensed sites being decommissioned. This determination must account for the sensitivity of the measurement technique in the presence of widely varying radiation levels of background. Information contained in NUREG-1501 (NRC, 1994) and Appendix D indicates that significant resources and sophisticated measurement techniques must be applied to measure very low concentrations of residual radioactivity in the presence of background.

NUREG-1501 (NRC, 1994) discusses the variation in measurement sensitivities for the principal radionuclides of concern (Co-60, Cs-137, Th-232, and natural uranium). Appendix D shows measurement sensitivity and cost trends for these radionuclides also. Based on the above studies, the range of measurement sensitivities for the principal radionuclides are: 3 mrem/y above background for Th-232; 1 mrem/y above background for Sr-90; 0.3 mrem/y above background for Cs-137 or natural uranium; and 0.03 mrem/y above background for Co-60. The increased measurement sensitivity for Co-60 is due to its strong characteristic

emissions and its absence in background, both of which enhance the ability to measure very low concentrations of this radionuclide.

In conclusion, when health impacts and cost are taken into account for a "0" mrem/y above background regulatory alternative for the principal radionuclides studied, decommissioning costs increase significantly but health impacts are not necessarily reduced. Furthermore, due to technological limitations with available radiological measurement techniques in the dose rate range of below 3 mrem/y above background, a "0" mrem/y above background regulatory alternative could present significant implementation difficulties. Thus, it does not appear reasonable to require sites on a generic basis to be returned to background. However, for certain site specific situations, it may be possible that the costs of decontamination and surveys to levels approaching background are not unreasonable compared to the benefit. Such considerations lend support to use of an ALARA approach in considering further reduction to near background levels.

Table A.1. Comparison of the Principal Components of Background Between Estimated Populations of the United States and the World

Annual Effective Dose Equivalent(mSv)			
Component	U.S. Mean¹	World Mean²	World Range²
Cosmic	0.27	0.36	0.3-2.0
Indoor radon and progeny	2.0	1.1	0.3-5.0
Internal (other inhaled, ingested)	0.4	0.5	0.2-1.0
Terrestrial gamma	0.28	0.41	0.2-1.0
Totals (rounded)	3.0	2.4	1.5-6.0

1. From NCRP (1987).

2. From UNSCEAR (1988).

**Table A.2. Typical Ranges in Average Concentration of Background Radionuclides
(Bq per kg)**

Material	Uranium-238	Thorium-232	Potassium-40	Reference
Bauxite ore	250	200	n/a	UNSCEAR, 1988
Coal, U.S.	18 (1-540)	21 (2-320)	52 (1-710)	Beck et al, 1980
Copper ore	30-80	23-110	n/a	UNSCEAR, 1988
Crustal rock, U.S.	36	44	850	NCRP, 1987b
Oil shale	56 (37-74)	24 (19-37)	481 (185-962)	Gogolak, 1982
Phosphate fertilizer, U.S.	9200	n/a	n/a	UNSCEAR, 1988
Soil, worldwide	25 (10-50)	25 (7-50)	370 (100-700)	UNSCEAR, 1988
Soil, U.S.	37 (4-141)	36 (4-126)	n/a	Myrick, 1983

A.4 References

Beck, H. L., Gogolak, C. V., Miller, K. M., and Lowder, W. M., Perturbations on the Natural Radiation Environment Due to the Utilization of Coal as an Energy Source, in "Natural Radiation Environment III," U.S. Dept. of Energy CONF-780422 (1980).

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Nuclear Regulatory Commission, Background as a Residual Radioactivity Criterion for Decommissioning, Draft Report, NUREG/1501, U.S. Nuclear Regulatory Commission (1994).

United Nations Scientific Committee on the Effects of Atomic Radiation, Sources, Effects and Risks of Ionizing Radiation, United Nations, New York (1988).

APPENDIX B
IMPACT AND COST ANALYSIS

APPENDIX B

B.1 Purpose

Health impacts and decontamination costs over a range of residual dose rate levels were evaluated for each of four reference facilities. The four reference facilities which are considered include a power reactor, uranium fuel fabrication facility, sealed source manufacturer/broad R&D facility, and rare metals processor. As discussed in Section 3.2.1 of Volume 1 and in Appendix C, these reference facilities are considered sufficiently representative of the facilities covered by this rule to be used in this generic analysis. The reference facilities are described in Appendix C.

B.2 Considerations With Regard to Public Comments

Appendix H presents a summary of comment letters received on the Draft GEIS. As noted there, some of those comment letters criticized the analysis of costs and risks as incomplete and inadequate; some of those letters submitted additional data and calculations in support of those criticisms. In general, some of the major comments suggested, and provided data on, the following:

- (a) Additional data from actual decommissionings should be included which would consider variations in site contamination characteristics, including the concentration and volume of contamination and the profile of the contamination with depth;
- (b) Reevaluation of remediation and survey costs should be conducted, including consideration of variation in waste burial charges, remediation methods, and survey procedures;
- (c) Separate analyses of the cost-effectiveness of soil removal and building removal should be performed. A commenter illustrated that such separate analyses would clarify differences between costs and impacts of cleanup of soils and structures that were not obvious in the Draft GEIS. Commenters also suggested deleting the "knee-in-curve" approach as not clearly illustrating the information regarding costs and impacts for cleanup of both soils and structures; and
- (d) Potential alternative uses of the site lands and facilities should be considered to provide a higher level of realism in the dose estimates. These alternative uses can result in variations in direct exposure and ingestion pathways and in the number of persons exposed and thus the collective exposure and net health effects.

Based on the comments and information received, additional information has been included in the GEIS. Data on contamination submitted by the commenters were reviewed, compared with other existing data, including that in the Draft GEIS, and incorporated into the Final GEIS as appropriate. Appendix C contains considerations of a range of soil and building

contamination, and Appendix D contains analysis of appropriate survey methodology using representative NRC survey approaches . Those appendices also consider a range of disposal costs and survey methods and costs.

Because it appears from a consideration of the comments that separate analysis of soil and buildings can provide added information for use in decision-making, the tables in Appendix B contain results from performing such a separate analyses. In addition, the "knee-in-curve" figures, which provided general information about behavior of costs and impacts associated with cleanup, have been replaced with a set of tables in Appendix B rather than curves. Further, in response to comments suggesting that the Final GEIS consider more realistic post decommissioning uses, Appendix B considers a range of possible uses, including residential farming, denser residential use, industrial/office use, and variations in building occupancy rates. These are described in the sections that follow.

B.3 Estimate of Radiological and Nonradiological Impacts

Impact analyses were performed for each of the reference facilities by calculating estimated incremental mortalities due to radiation exposure and conventional nonradiological accidents (construction and transportation). These calculations were completed for various alternative residual dose criteria representing the exposure to an individual at the site following decommissioning. The alternative criteria selected for these detailed analyses include: 100, 60, 25, 15, and 3 mrem per year. This range of alternative residual dose criteria are considered to be sufficiently representative to demonstrate trends in comparison of costs and impacts based on the information presented in Appendices C and D. In particular, as can be seen from the tables in Attachment C of Appendix C, volumes of soil requiring removal (and resultant costs) to reduce residual radioactivity levels below 3 mrem/y can increase significantly, especially for real world cases studied, compared to the benefit in dose reduction. A similar result can be seen for removal of concrete from a reactor bioshield in Table 7.3.1 of Appendix C. For decontamination of walls and floors in structures, as described in Appendix C (see in particular Tables 7.3.2, 7.4.1, 7.5.1, and 7.6.1), the scabbling process is such that removal of individual layers of concrete remove a large fraction of the remaining activity and thus studying a range of costs below 3 mrem/y is not necessary. Consideration of the impacts of a limit of "0" above background are discussed in Appendix A.

In assessing human health impacts from decommissioning, the analysis considers risks to individuals expressed either in terms of mrem/year when radiation exposure is involved or in accident rates when nonradiological impacts are involved. Sections B.3.1 and B.3.2 discuss the analyses related to radiological and nonradiological impacts, respectively. These assessments also consider collective risk to the population engaged in various activities related to the decommissioning which result in both long-term and short-term impacts. Collective estimated mortality resulting from radiation exposure was estimated for four population groups as described in the following sections: B.3.1.1 - members of the public living on site following decommissioning and license termination; B.3.1.2 - members of the

public assumed to be working or residing within facility buildings following completion of facility decommissioning and license termination; B.3.1.3 - workers performing decommissioning; and B.3.1.4 - persons exposed to radiation in the course of transportation of contaminated building materials and soil (including both transportation workers and the general public). The collective estimated mortality from fatal construction accidents assumed to occur during facility decontamination and soil removal (Section B.3.2.1), and estimated mortality from traffic accidents during transportation of building waste and contaminated soil to a low-level radioactive disposal site (Section B.3.2.2) were also calculated. Because these impacts can take place over different time periods and may affect different persons, a precise comparison or balancing is difficult; however, to provide a comparison of such risk, the analysis in Appendix B estimates the individual and collective risks for these disparate impacts. This is considered to be a reasonable approach in that it permits assessments and conclusions to be made with regard to all of the impacts that may result from a particular decommissioning alternative. The estimated mortalities are based on statistical data regarding probability of mortality related to the level of exposure or activity.

Individual and collective impacts are developed based on risks of exposure to radiation and to nonradiological accident risks as described in Sections B.3.1 and B.3.2. Because of the combination of different types of risks involved, the overall results of the analyses are presented as estimated mortalities.

B.3.1 Incremental Estimated Mortalities from Radiation Exposure

Total incremental estimated mortalities from radiation exposure were determined separately for exposure to soils and structures by adding the incremental estimated mortality from each of three components as follows:

soil - living on site following license termination, performing soil remediation (e.g., excavation), and transporting the resultant waste to a disposal facility;

structures - working or residing on site in facility buildings following license termination, performing structure decontamination (e.g., scabbling concrete), and transporting the resultant waste to a disposal facility.

Incremental estimated mortality from each of these components is discussed below. Parameter values used regarding the number of persons engaged in the activities, the time period over which the activities take place, and other parameters needed to assess collective impacts for each reference facility are summarized in Table A.1.

Individual impacts from radiation exposure consider the models, parameters, and assumptions contained in NUREG/CR-5512 (NRC93). NUREG/CR-5512 analyzes several important potential pathways of exposure for building occupancy, building renovation, drinking water, and residence, which are considered here. The models of NUREG/CR-5512 consider exposure based on prudently conservative but not necessarily "worst case." As indicated in

NUREG/CR-5512, the use of prudently conservative scenarios is intended to account for the vast majority of potential uses of lands and structures and to overestimate the most probable annual dose, while discounting a small fraction of highly unlikely doses that might result in higher doses but would limit the usefulness of potential criteria without providing a significant benefit in protection. The complete discussion of the models, parameters, and assumptions are not repeated in this appendix.

For the impacts associated with living or working on the site following license termination, the analysis assumes exposure of individuals to the residual dose limit, corrected for radioactive decay, over a 1,000 year time period for soil and a 70-year time period for buildings which is assumed to be the lifespan of the building following license termination (analysis of impacts and costs of building demolition after the building's lifetime are described in NUREG-0586 (NRC88)). In the estimate of impacts, a risk coefficient of $5E-4$ per rem for the risk of radiation-induced fatal cancer is used based on the cancer-to-dose relationships in the UNSCEAR (UNSCEAR88) and BEIR (BEIR90) reports.

As discussed in Section B.2, because a variety of possible land uses could occur after the facilities are released for unrestricted use, the following sections consider alternative unrestricted public uses of the site. The effect of this consideration is a variation in potential collective exposures which can occur and the resultant variation in net health impacts that can occur. Alternative unrestricted land uses included in the tables are residential farming, industrial use, and high density dwelling use. Alternative unrestricted building uses included in the tables are office use, residential use, and industrial use. Tables A.2.1 - A.2.4 and Tables A.3.1 - A.3.4 list the alternative cases considered in the analysis for soil and structure exposure, respectively. In each of the alternative unrestricted land uses it is assumed that the decommissioning activities result in reducing the residual radioactivity to the same residual contamination level but that the post-decommissioning population usage of the site can vary. For these alternative land uses, there will thus be a variation in both the individual and collective doses resulting from the residual contamination. Thus, for example, the amount of soil removal (and the resultant costs and impacts related to conducting the removal process) are the same for a given dose criteria for Cases 1, 1A, and 1B, but the individual dose received, the number of people exposed, and the collective exposures would differ and, therefore, the incremental results would also differ.

There is a wide range of possible restricted site uses. The draft GEIS (NRC94) evaluated such uses in a qualitative manner and indicated that, because of the site specific nature of restricted use, a generic approach is unlikely to yield a reasonable approximation of all the possible restricted use modes that could be used. As noted in the draft GEIS, such restricted use modes could include industrial zoning for all or part of a site, conversion of the land for parkland, restrictions on agricultural use of the site, restrictions on residence at the site, restrictions regarding length of time a facility can be used, elimination of use of the site, etc. In response to public comments and to provide additional information on restricted use, the tables in Appendices B and C of this final GEIS include a restricted industrial use as an illustration of impacts and costs associated with restricted use.

B.3.1.1 Persons Living On Site Following License Termination

For each of the reference facilities, a scenario is postulated in which a residence is established on the land following decontamination. These residents may be exposed by direct shine from the residual radiation contained in the soil and from the consumption of milk, meat, and vegetables grown in the soil. Based on the area of contaminated soil at each reference facility, the number of persons living on the land is estimated and the collective estimated mortality determined for each case. Table A.1 indicates the alternative site population densities used in the analysis.

The collective estimated mortality for persons living on site following license termination is estimated as follows:

$$\text{Collective Estimated Mortality} = R \times DF \times CF \times Y \times N$$

where:

R = Individual residual dose rate (mrem/year)

DF = Decay factor which considers the radionuclides present and the radioactive half-life of those radionuclides (dimensionless)

C = Risk conversion factor (mortality/rem) (from Section B.3.1)

Y = Exposure time (years)

N = Number of People Exposed

B.3.1.2 Working or Residing in Facility Buildings Following License Termination

For each of the reference facilities, it is assumed that the buildings will be fully utilized for nonnuclear industrial or commercial purposes. In each case, the number of persons likely to work in the facility is estimated. An alternative use case is also evaluated in which the building is used for multiple dwelling residential use. The risk conversion factor noted in Section B.3.1 is multiplied by the residual dose rate and the lifetime of the facility, which is assumed to be 70 years following license termination. Table A.1 indicates the alternative building occupancy densities used in the analysis.

As noted in Tables 7.3.2, 7.4.1, 7.5.1, and 7.6.1 of Appendix C, the actual process of scabbling concrete off walls and floors at the reference facilities is a gross removal process that removes a layer of concrete which likely contains a large fraction of the remaining radioactivity. For example, Table 7.3.2 indicates that scabbling of a layer of concrete reduces the exposure for the reference power reactor from 220 to 10.4 mrem/y. This means that, for the reference case shown in Table 7.3.2, the costs and impacts at the reference power reactor are insensitive to certain of the alternative dose criteria under consideration

(e.g., 100, 60, 25, and 15 mrem/y). Similar removal results occur for the other reference facilities. Because the values in Tables 7.3.2, 7.4.1, 7.5.1, and 7.6.1 of Appendix C are generic for the particular reference facility and thus other doses could occur in other real world situations and because they therefore give little information regarding establishing dose criteria, the analyses in this section provide an illustration of impacts and costs of reducing doses below the alternative dose criteria being considered by a composite analysis of scabbling layers of concrete below the alternative dose criteria. This analysis illustrates the impacts and costs associated with scabbling each layer, but does not include costs and impacts of wet spot and crack removal because they are highly site specific and thus do not lend themselves to generic analysis. Such costs and impacts could be taken into account in a site specific analysis.

The collective estimated mortality for persons working or residing on site in facility buildings after license termination is estimated for each alternative residual dose rate limit as follows:

$$\text{Collective Estimated Mortality} = R \times DF \times CF \times Y \times N$$

where:

R = Individual residual dose rate (mrem/year)

DF = Decay factor which considers the radionuclides present and the radioactive half-life of those radionuclides (dimensionless)

C = Risk conversion factor (mortality/rem) (from Section B.3.1)

Y = Exposure time (years)

N = Number of People Exposed (see Table A.1)

It is also assumed that there will be a small work force involved in renovation of the facility. The collective estimated mortality for these individuals is calculated in a similar manner and added to the exposure estimated above to obtain a total risk to workers.

B.3.1.3 Performing Decontamination

Appendix C discusses the estimation of exposure of workers performing the decontamination, including the evaluation of the parameters used in this analysis, such as cost, waste volume, number of shipments of radioactive waste, and labor hours. These estimates have been made as a function of residual dose rate at each reference facility.

The collective estimated mortality due to radiological exposure corresponding to performing facility decontamination to reduce residual radioactivity to alternative residual dose levels is calculated as follows:

$$\text{Collective Estimated Mortality} = D \times CF$$

where:

D = Dose received by decontamination workers in the process of achieving alternative residual dose rates (person-rem) (taken from the tables in Attachment C to Appendix C)

CF = Risk conversion factor (mortality/rem) (from Section B.3.1)

B.3.1.4 Transporting Waste

Collective estimated mortalities are calculated for transportation workers involved in transporting the waste and by the members of the general public along the route from the reference facility to the disposal site. The derivation of the doses received when transporting the waste to a low-level waste disposal facility (for an average one-way distance of 500 miles) considered amounts and radioactive characteristics of the soil and concrete waste requiring disposal for the full decontamination of each of the reference facilities as described in Section 2.4.3 of this final GEIS and more fully in NUREG-0586 (NRC88) (not simply the amounts indicated in Appendix C for remediating to the alternative residual dose criteria) and the likely combination of soil and concrete packaged together for shipment. For example, for the reference power reactor Appendix C indicates that only a small amount of soil is estimated as requiring disposal, but a very large amount of concrete will require disposal. Thus the radiation exposure caused by the transport of the packaged reference power reactor decommissioning waste was considered to be more realistically represented by the behavior of shipments of activated concrete from the bioshield. Therefore, the doses in this Appendix, as indicated by Table A.1 and Attachment B, are based on such considerations and the information presented in two references: NRC72, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," and NRC80, "Technology, Safety and Costs of Decommissioning a Reference Uranium Fuel Fabrication Plant." Two scenarios were evaluated for each facility: one in which all removed soil was assumed to be transported without any form of treatment, and one which assumes use of soil washing to reduce the amount of soil to be transported to a disposal facility.

The collective estimated mortality due to radiological exposure for shipping facility decommissioning waste is calculated as follows:

$$\text{Collective Estimated Mortality} = D \times S \times CF$$

where:

D = Dose received by workers and onlookers during shipment (person-rem per shipment) (from Table A.1)

S = Number of shipments (taken from tables in Attachment C to Appendix C)

CF = Risk Conversion Factor (mortalities/rem) (from Section B.3.1)

B.3.2 Incremental Estimated Mortality from Accidents

Impacts not associated with radiation exposure can be incurred as a result of heavy construction activities, such as those involved in the decommissioning of the reference facilities, and as a result of the transportation of materials. The total incremental estimated mortality was obtained by adding the impacts from these two components.

The analysis of individual impacts from nonradiological accidents (such as workplace accidents or highway transportation accidents) is based on published statistical data on accident rates, and as such uses the same approach as for radiation exposure. For those impacts incurred as a result of nonradiological workplace accidents while performing decontamination activities or from nonradiological highway accidents while transporting waste, estimates are made based on the statistical risks of accident fatalities and, as noted above, published statistical data on fatal accident rates.

B.3.2.1 Performing Decontamination

The collective estimated mortality due to heavy construction workplace accidents corresponding to performing facility decontamination to reduce residual radioactivity to alternative residual dose levels is calculated as follows:

$$\text{Collective Estimated Mortality} = A \times L$$

where:

A = Accident risk rate (mortalities/person-hour) (from Table A.1)

L = Labor hours (person-hours) (from tables in Attachment C to Appendix C)

B.3.2.2 Transporting Waste

The collective estimated mortality due to traffic accidents during transport of decommissioning wastes corresponding to reducing residual radioactivity to alternative residual dose levels is calculated as follows:

$$\text{Collective Estimated Mortality} = A \times T$$

where:

A = Accident risk rate (mortalities/km) (from Table A.1)

T = Total distance traveled for all waste shipments (km) (based on roundtrip distance per shipment (from Table A.1) and number of waste shipments needed (from tables in Attachment C to Appendix C))

B.4 Costs

Costs were calculated in Appendices C and D for each of the alternative residual dose criteria for the following three types of decommissioning activity and used in the tables in Appendix B to estimate incremental comparisons of impacts and costs:

- 1) For building decontamination, costs are estimated in Appendix C as a function of alternative residual dose rate. Included in these estimates are direct labor costs to perform the decontamination, overhead costs, cost of materials, and cost of waste packaging, transport, and disposal.
- 2) For soil remediation, costs are estimated in Appendix C as a function of alternative residual dose rate. Included in these estimates are costs for excavation, packaging, transportation, and disposal (with and without treatment by soil washing).
- 3) Cost estimates for performing radiological surveys at the reference facilities are provided in Appendix D for each of the alternative residual dose rates.

Two sets of total costs were calculated for each reference facility: one reflecting the cost of disposal of all soil in an untreated condition, and one reflecting the cost of disposal assuming soil washing to reduce the amount of soil shipped off site for disposal.

B.5 Results

Tables B.1 through B.47 of Attachment B of this Appendix B present, for remediation of soil, results comparing incremental impacts and costs, collective estimated mortalities based on the statistical evaluations noted above, impact and cost calculations, and costs. Tables B.47 through B.56 of Attachment B of this Appendix B present, for remediation of structures, results comparing incremental impacts and costs, collective estimated mortalities based on the statistical evaluations noted above, impact and cost calculations, and costs. For example, in Table B.1.1, the first row of data indicates the incremental impacts and costs in lowering the dose criteria from 100 to 60 mrem/y. The tables of impact and cost calculations provide the parameter values assumed for each facility and all intermediate results for each dose level and mortality component. An asterisk in the tables represents results where the value of the cost per net health benefit is negative.

As discussed in the previous sections, the costs and impacts in Attachment B of this Appendix B are taken from the concrete and soil removal analyses of Appendix C. Table A.3 indicates the source of data from Appendix C for each of the cases in Appendix B. As discussed in Section B.3.1.2, the analyses of structures provide illustrations of impacts and costs of reducing doses below the alternative dose criteria being considered by a composite analysis of scabbling layers of concrete below the alternative dose criteria. Therefore each of the Tables B.47 - B.56 are developed by assessing the incremental costs and impacts associated with scabbling a layer of concrete at each of the alternative dose levels.

Appendix B References

- BEIR90** Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR Report No. V, 1990.
- NRC72** "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear power Plants," WASH-1238, December 1972.
- NRC80** "Technology, Safety and Costs of Decommissioning a Reference Uranium Fuel Fabrication Plant," NUREG/CR-1266, Volume 1, October 1980.
- NRC88** Final Generic Environmental Input Statement on Decommissioning of Nuclear Facilities. NUREG-0586, July 1988. U.S. Nuclear Regulatory Commission, Washington, DC.
- NRC93** Residual Radioactive Contamination from Decommissioning, Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent, Final Report. NUREG/CR-5512, Vol. 1. Battelle Memorial Institute, Pacific Northwest Laboratory.
- NRC94** Draft Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for Decommissioning of NRC-Licensed Nuclear Facilities. NUREG-1496. U.S. Nuclear Regulatory Commission, Washington, D.C.
- UNSCEAR** United Nations Scientific Committee on the Effects of Atomic Radiation, "Sources, Effects, and Risks of Ionizing Radiation," United Nations, New York (1988)

ATTACHMENT A

**TABLES OF PARAMETER VALUES AND DESCRIPTION OF CASES
ANALYZED FOR REFERENCE FACILITIES**

Table A.1
Parameter Values for Reference Facilities

Values Applicable to All Facilities:

Fatal cancer risk rate:	5 x 10 ⁻⁴ per rem
Exposure duration:	1000 years for residential use of the site; 70 years for building occupancy
Disposal volume:	13.6 cubic meters per shipment
Fatal work rate:	4.2 x 10 ⁻⁸ per person-hour
Burial site distance:	1,600 kilometers
Fatal transport rate:	3.8 x 10 ⁻⁴ per kilometer

Values by Individual Facility

Facility	Building Occupancy ^a (# persons)	Building Renovation ^b (# persons)	Contaminated Land Area ^c (sq. ft.)	Land usage (#persons) ^f	Building Waste Shipment Exposure (person-rem per shipment)	Soil Shipment Exposure (person-rem per shipment)
Power Reactor	22 - 210	20	3,000	< 1 - 14	8.72E-02 ^d	8.72E-02 ^d
Uranium Fuel Fabrication Plant	80 - 1000	20	100,000	4 - 460	2.90E-02 ^e	8.00E-06 ^e
Sealed Source Manufacturer	1 - 5	5	5,000	< 1 - 23	8.67E-02 ^d	8.67E-02 ^d
Rare Metal Extraction Facility	40 - 500	10	100,000	4 - 460	2.93E-02 ^e	8.07E-06 ^e

^a Assumptions for building occupancy: for each facility assumes a range of reuses including office use at 120 ft²/person, apartment type residential use at 1000 ft²/person, and industrial use as follows:

Nuclear Power Plant - use as a coal fired power plant employing 0.25 persons per megawatt electricity (UD190), with average size of 900 megawatts. The area of occupancy is based on Table 7.1.1 of Appendix C which indicates that there is 250,000 ft² in the reference facility that is 10% contaminated.

Uranium Fuel Fabrication Facilities - use as a chemical processing facility employing the same number of people as a functioning UF₆ facility (NRC85). The area of occupancy is based on Table 7.1.1 of Appendix C which indicates that there is 240,000 ft² in the reference facility that is 50% contaminated.

Sealed Source Manufacturer Facility - use as a laboratory, with typical laboratory size of 60 m² to 80 m² (NRC81). The area of occupancy is based on Table 7.1.1 of Appendix C which indicates that there is 6,000 ft² in the reference facility that is 10% contaminated.

Rare Metal Extraction Facility - use as an industrial facility. The area of occupancy is based on Table 7.1.1 of Appendix C which indicates that there is 150,000 ft² in the reference facility that is 40% contaminated.

^b Estimated based on facility and number of persons for building occupancy scenario.

^c From Appendix C.

^d Derived from NRC72.

^e Derived from NRC80.

^f Assumptions for land occupancy: assumes alternative unrestricted site land area usages including residential agricultural usage of 400 persons/km² (about 2,500 square meters per person (NRC93), industrial use at 10,000 persons/km², and high density dwellings at 50,000 persons/km². Also assumes exposure using the unrestricted use dose conversion factor of Table A.2 of Attachment A of Appendix C for residential agricultural usage of the site; for industrial and high density dwelling alternative unrestricted usages of the site assumes exposure using the following fractions of the values in Table A.2 of Appendix C: power reactor - 0.14; uranium fabrication plant - 0.037; sealed source manufacturer - 0.14; rare metal facility - 0.067. For restricted use assumes industrial use of the site with dose conversion factors given in Table A.3 of Attachment A of Appendix C.

Table A.2.1

Cases⁽¹⁾ for Reference Power Reactor
Soil Remediation⁽²⁾

- Case 1 - Diffusion into the soil; \$50/ft³ burial cost for soil; soil removal after soil washing; unrestricted use with resident farmer use of the site
- Case 1A - Same as Case 1, but with industrial use of the site
- Case 1B - Same as Case 1, but with residential high density dwelling use

- Case 2 - Diffusion, \$50/ft³ burial cost for soil; no soil washing; unrestricted use with resident farmer use of the site
- Case 2A - Same as Case 2, but with industrial use
- Case 2B - Same as Case 2, but with residential high density dwelling

- Case 3 - Real world soil profile data; \$50/ft³ burial cost; soil removal after soil washing; unrestricted use with resident farmer use of the site
- Case 3A - Same as Case 3, but with industrial use
- Case 3B - Same as Case 3, but with residential high density dwelling

- Case 4 - Real world soil profile data; \$50/ft³ burial cost for soil; no soil washing; unrestricted use with resident farmer use of the site
- Case 4A - Same as Case 4, but with industrial use
- Case 4B - Same as Case 4, but with residential high density dwelling

- Case 5 - Same as Case 4, but with restricted industrial use of the site

Notes:

1. For some of the tables in Attachment B, additional information is provided (e.g., alternative soil disposal costs) in addition to the cases defined in this table.

2. All cases use the high soil contamination case from Attachment C of Appendix C.

Table A.2.2

**Cases⁽¹⁾ for Reference Uranium Fabrication Facility
Soil Remediation⁽²⁾**

- Case 1 - Diffusion into the soil; \$50/ft³ burial cost for soil; soil removal after soil washing; unrestricted use with resident farmer use or industrial use of the site**
- Case 1A - Same as Case 1, with \$10/ft³ burial cost for soil**
- Case 1B - Same as Case 1, but with residential high density dwelling use**

- Case 2 - Diffusion; \$50/ft³ burial cost for soil; no soil washing; unrestricted use with resident farmer or industrial use of the site**
- Case 2A - Same as Case 2, but with \$10/ft³ burial costs for soil;**
- Case 2B - Same as Case 2, but with residential high density dwelling**

- Case 3 - Same as Case 1, but with restricted industrial use of the site**

- Case 4 - Same as Case 2, but with restricted industrial use of the site**

- Case 5 - Real world soil profile data; \$50/ft³ burial cost for soil; soil removal after soil washing; unrestricted use with resident farmer or industrial use of the site**
- Case 5A - Same as Case 5, but with \$10/ft³ burial cost for soil**
- Case 5B - Same as Case 5, but with residential high density dwelling**

- Case 6 - Real world soil profile data; \$50/ft³ burial cost; no soil washing; resident farmer or industrial use**
- Case 6A - Same as Case 6, but with \$10/ft³ burial cost for soil**
- Case 6B - Same as Case 6, but with residential high density dwelling**

- Case 7 - Same as Case 6, but for restricted use industrial use of the site**

Notes:

- 1. For some of the tables in Attachment B, additional information is provided (e.g., alternative soil disposal costs) in addition to the cases defined in this table.**
- 2. All cases use the high soil contamination case from Attachment C of Appendix C.**

Table A.2.3

Cases⁽¹⁾ for Reference Sealed Source/Broad R&D Facility
Soil Remediation⁽²⁾

- Case 1 - Diffusion into the soil; \$50/ft³ burial cost for soil; soil removal after soil washing; unrestricted use with resident farmer use of the site
- Case 1A - Same as Case 1, but with industrial use of the site
- Case 1B - Same as Case 1, but with residential high density dwelling use

- Case 2 - Diffusion; \$50/ft³ burial cost; no soil washing; unrestricted use with resident farmer use of the site
- Case 2A - Same as Case 1, but with industrial use
- Case 2B - Same as Case 1, but with residential high density dwelling use

- Case 3 - Real world soil profile data; \$50/ft³ burial cost; soil removal after soil washing; unrestricted use with resident farmer use of the site
- Case 3A - Same as Case 3, but with industrial use
- Case 3B - Same as Case 3, but with residential high density dwelling use

- Case 4 - Real world soil profile data; \$50/ft³ burial cost; no soil washing; unrestricted use with resident farmer use of the site
- Case 4A - Same as Case 4, but with industrial use
- Case 4B - Same as Case 4, but with residential high density dwelling use

- Case 5 - Same as Case 4, but with restricted industrial use of the site

Notes:

1. For some of the tables in Attachment B, additional information is provided (e.g., alternative soil disposal costs) in addition to the cases defined in this table.

2. All cases use the high soil contamination case from Attachment C of Appendix C.

Table A.2.4

**Cases⁽¹⁾ for Reference Rare Metal Facility
Soil Remediation⁽²⁾**

- Case 1 - Diffusion into the soil; \$50/ft³ burial cost; no soil washing; unrestricted use with resident farmer use of the site**
- Case 1A - Same as Case 1, but with \$10/ft³ burial cost**
- Case 1B1 - Same as Case 1, but with industrial use**
- Case 1B2 - Same as Case 1, but with high density dwelling use**
- Case 1C - Same as Case 1, but with use of in-situ surveys**

- Case 2 - Real world profile data; \$50/ft³ burial cost; no soil washing; resident farmer use of the site**
- Case 2A - Same as Case 2, but with \$10/ft³ burial cost**
- Case 2B1 - Same as Case 2, but with industrial use**
- Case 2B2 - Same as Case 2, but with high density dwelling use**
- Case 2C - Same as Case 2, but with use of in-situ surveys**

- Case 3 - Same as Case 2, but with restricted industrial use of the site**

Notes:

- 1. For some of the tables in Attachment B, additional information is provided (e.g., alternative soil disposal costs) in addition to the cases defined in this table.**
- 2. All cases use the high soil contamination case from Attachment C of Appendix C**

Table A.3.1

**Cases for Reference Power Reactor
Structures Remediation⁽¹⁾**

- Case 1 - Bioshield contamination; \$350/ft³ burial cost for concrete; 50 persons working in bioshield area**
- Case 1A - Same as Case 1, but with 20 persons working in bioshield area**
- Case 2 - Floor and wall contamination; \$350/ft³ burial cost for concrete; office use of the facility (210 persons using contaminated area of facility - 25000 ft²/120 ft²/person)**
- Case 3 - Floor and wall contamination; \$350/ft³ burial cost for concrete; industrial use of facility (22 persons using contaminated areas of facility)**
- Case 4 - Floor and wall contamination; \$350/ft³ burial cost of concrete; residential use of the facility (25 persons using contaminated areas of facility)⁽²⁾**

Notes:

(1) As noted in Section B.5 of Appendix B, these cases represent a composite of studies for alternative residual dose criteria.

(2) A separate table in Attachment B was not developed because the results are similar to Case 3.

Table A.3.2
Cases for Reference Uranium Fabrication Facility
Structures Remediation⁽¹⁾

- Case 1 - Floor and wall contamination; \$350/ft³ burial cost for concrete, office use of the facility (1000 persons using contaminated area of facility - 120,000 ft²/120 ft²/person)
- Case 2 - Floor and wall contamination; \$350/ft³ burial cost for concrete; industrial use of facility (80 persons using contaminated areas of facility)
- Case 3 - Floor and wall contamination; \$350/ft³ burial cost for concrete; residential use of facility (120 persons using contaminated area of facility)⁽²⁾

Notes:

(1) As noted in Section B.5 of Appendix B, these cases represent a composite of studies for alternative residual dose criteria.

(2) A separate table in Attachment B was not developed because the results are similar to Case 2.

Table A.3.3

**Cases for Reference Sealed Source/Broad R&D Facility
Structures Remediation⁽¹⁾**

- Case 1 - Floor and wall contamination; \$350/ft³ burial cost for concrete; office use of the facility (5 persons using contaminated area of facility - 600 ft²/120 ft²/person)**
- Case 2 - Floor and wall contamination; \$350/ft³ burial cost for concrete; industrial use of facility (< 1 person using contaminated areas of facility)**
- Case 3 - Floor and wall contamination; \$350/ft³ burial cost for concrete; residential use of the facility (< 1 person using contaminated areas of facility)⁽²⁾**

Notes:

(1) As noted in Section B.5 of Appendix B, these cases represent a composite of studies for alternative residual dose criteria.

(2) A separate table in Attachment B was not developed because the results are similar to Case 2.

Table A.3.4

Cases for Reference Rare Metal Facility
Structures Remediation⁽¹⁾

- Case 1 - Floor and wall contamination; \$350/ft³ burial cost for concrete; office use of the facility (500 persons using contaminated area of facility - 60,000 ft²/120 ft²/person)
- Case 2 - Floor and wall contamination; \$350/ft³ burial cost for concrete; industrial use of facility (40 persons using contaminated areas of facility)
- Case 3 - Floor and wall contamination; \$350/ft³ burial cost for concrete; residential use of facility (60 persons using contaminated areas of facility)⁽²⁾

Notes:

(1) As noted in Section B.5 of Appendix B, these cases represent a composite of studies for alternative residual dose criteria.

(2) A separate table in Attachment B was not developed because the results are similar to Case 2.

Table A.4.1.1
Cross Reference for Tables of Soil Analyses in Appendix B
to Sources in Appendix C

Reference Power Reactor

Case	Appendix B tables	Appendix C table
1	B.1.1 - B.1.4	C.1.1
1A	B.2.1 - B.2.4	C.1.1
1B	B.3.1 - B.3.4	C.1.1
2	B.4.1 - B.4.4	C.1.2
2A	B.5.1 - B.5.4	C.1.2
2B	B.6.1 - B.6.4	C.1.2
3	B.7.1 - B.7.4	C.1.9
3A	B.8.1 - B.8.4	C.1.9
3B	B.9.1 - B.9.4	C.1.9
4	B.10.1 - B.10.4	C.1.10
4A	B.11.1 - B.11.4	C.1.10
4B	B.12.1 - B.12.4	C.1.10
5	B.13.1 - B.13.4	C.1.12

Table A.4.1.2
Cross Reference for Tables of Soil Analyses in Appendix B
to Sources in Appendix C

Reference Uranium Fuel Fabrication Facility

Case	Appendix B tables	Appendix C table
1	B.14.1 - B.14.4	C.2.1
1A	B.14.1 - B.14.4	C.2.1
1B	B.15.1 - B.15.4	C.2.1
2	B.16.1 - B.16.4	C.2.2
2A	B.16.1. - B.5.4	C.2.2
2B	B.17.1 - B.17.4	C.2.2
3	B.18.1 - B.18.4	C.2.3
4	B.19.1 - B.19.4	C.2.4
5	B.20.1 - B.20.4	C.2.5
5A	B.20.1 - B.20.4	C.2.5
5B	B.21.1 - B.21.4	C.2.5
6	B.22.1 - B.22.4	C.2.6
6A	B.22.1 - B.22.4	C.2.6
6B	B.23.1 - B.23.4	C.2.6
7	B.24.1 - B.24.4	C.2.8

Table A.4.1.3
Cross Reference for Tables of Soil Analyses in Appendix B
to Sources in Appendix C

Reference Sealed Source Manufacturing/Broad R & D Facility

Case	Appendix B tables	Appendix C table
1	B.25.1 - B.25.4	C.3.1
1A	B.26.1 - B.26.4	C.3.1
1B	B.27.1 - B.27.4	C.3.1
2	B.28.1 - B.28.4	C.3.2
2A	B.29.1 - B.29.4	C.3.2
2B	B.30.1 - B.30.4	C.3.2
3	B.31.1 - B.31.4	C.3.5
3A	B.32.1 - B.32.4	C.3.5
3B	B.33.1 - B.33.4	C.3.5
4	B.34.1 - B.34.4	C.3.6
4A	B.35.1 - B.35.4	C.3.6
4B	B.36.1 - B.36.4	C.3.6
5	B.37.1 - B.37.4	C.3.8

Table A.4.1.4
Cross Reference for Tables of Soil Analyses in Appendix B
to Sources in Appendix C

Reference Rare Metal Facility

Case	Appendix B tables	Appendix C table
1	B.38.1 - B.38.4	C.4.2
1A	B.38.1 - B.38.4	C.4.2
1B1	B.39.1 - B.39.4	C.4.2
1B2	B.40.1 - B.40.4	C.4.2
1C	B.41.1. - B.41.4	C.4.2
2	B.42.1 - B.42.4	C.4.6
2A	B.42.1 - B.42.4	C.4.6
2B1	B.43.1 - B.43.4	C.4.6
2B2	B.44.1 - B.44.4	C.4.6
2C	B.45.1 - B.45.4	C.4.6
3	B.46.1 - B.46.4	C.4.8

Table A4.2
Cross Reference for Tables of Structures Analyses in Appendix B
to Sources in Appendix C

Case	Appendix B tables	Appendix C table
Power Reactor 1	B.47.1 - B.47.4	C.7.3.1
Power Reactor 1A	B.48.1 - B.48.4	C.7.3.1
Power Reactor 2	B.49.1 - B.49.10	C.7.3.2
Power Reactor 3	B.50.1 - B.50.10	C.7.3.2
Uranium Fab. 1	B.51.1. - B.51.10	C.7.4.1
Uranium Fab. 2	B.52.1 - B.52.10	C.7.4.1
Sealed Source 1	B.53.1 - B.53.10	C.7.5.1
Sealed Source 2	B.54.1 - B.54.10	C.7.5.1
Rare Metal 1	B.55.1 - B.55.10	C.7.6.1
Rare Metal 2	B.56.1 - B.56.10	C.7.6.1

References for Attachment A of Appendix B

- NRC72** "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear power Plants," WASH-1238, December 1972.
- NRC80** "Technology, Safety and Costs of Decommissioning a Reference Uranium Fuel Fabrication Plant," NUREG/CR-1266, Volume 1, October 1980.
- NRC81** "Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities," NUREG/CR-1754, February 1981.
- NRC85** "Environmental Assessment for Renewal of Source Material License No. SUB-1010 for Sequoyah Fuels Corporation," NUREG-1157, August 1985.
- NRC93** Residual Radioactive Contamination from Decommissioning, Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent, Final Report. NUREG/CR-5512, Vol. 1. Battelle Memorial Institute, Pacific Northwest Laboratory.
- UD190** Utility Data Institute, Inc. U.S. Steam-Electric Plants: Five-Year Production Costs-UDI-021-90, January 1990.

ATTACHMENT B
SUMMARY TABLES OF RESULTS FOR REFERENCE FACILITIES

Table B.1.1

Incremental Impacts - Power Reactor Case 1

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$14,383.46	\$56,607.35	1.39E -05	1.06E -04	-9.20E -05	*	*
60 < 25	\$15,862.90	\$67,154.81	2.10E -05	1.99E -06	1.90E -05	\$833,527,121	\$3,528,695,840
25 < 15	\$48,752.68	\$73,820.58	5.47E -06	9.74E -07	4.49E -06	\$10,855,144,371	\$16,436,697,706
15 < 3	\$860,526.77	\$1,002,400.13	6.60E -06	2.14E -04	-2.08E -04	*	*

Table B.1.2

Statistical Mortality - Power Reactor Case 1

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents		TOTAL	Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste		
100	5.34E-05	2.17E-06	4.35E-05	1.83E-06	6.08E-05	1.62E-04	1.08E-04
60	3.95E-05	3.07E-06	8.70E-05	2.57E-06	1.22E-04	2.54E-04	2.14E-04
30	2.74E-05	3.93E-06	8.70E-05	3.30E-06	1.22E-04	2.43E-04	2.16E-04
25	1.85E-05	4.15E-06	8.70E-05	3.48E-06	1.22E-04	2.35E-04	2.16E-04
15	1.30E-05	4.68E-06	8.70E-05	3.93E-06	1.22E-04	2.30E-04	2.17E-04
10	1.01E-05	5.17E-06	1.31E-04	4.34E-06	1.82E-04	3.33E-04	3.22E-04
3	6.44E-06	7.67E-06	1.74E-04	6.45E-06	2.43E-04	4.38E-04	4.31E-04
1	2.42E-06	1.36E-05	2.61E-04	1.14E-05	3.65E-04	6.53E-04	6.51E-04

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Table B.1.3 - Impact and Cost Calculations - Power Reactor Case 1

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00E -04	per rem		Fatal work rate		4.2E -08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8E -08	per km		
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	8.31E -04	4.79E -04	3.55E -04	2.46E -04	1.66E -04	1.17E -04	9.06E -05	5.78E -05	2.17E -05
[Baseline soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000									
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	3,000	sq ft	# persons on land	1.11E -01	[400 persons per km2]				
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	9.27E -05	5.34E -05	3.95E -05	2.74E -05	1.85E -05	1.30E -05	1.01E -05	6.44E -06	2.42E -06
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.004	0.006	0.008	0.008	0.009	0.010	0.015	0.027
Collective mortality	0	2.17E -06	3.07E -06	3.93E -06	4.15E -06	4.68E -06	5.17E -06	7.67E -06	1.36E -05
III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure	8.70E -02	person-rem per shipment							

Table B.1.3 - Impact and Cost Calculations - Power Reactor Case 1

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	3.3	4.6	5.9	6.2	7.0	7.8	11.5	20.5
Soil volume (m ³)	0	24	34	44	46	52	58	86	152
Soil shipments	0	1	2	2	2	2	3	4	6
Soil person-rem	0	0.087	0.174	0.174	0.174	0.174	0.261	0.348	0.522
Collective mortality	0	4.35E-05	8.70E-05	8.70E-05	8.70E-05	8.70E-05	1.31E-04	1.74E-04	2.61E-04
REFERENCE									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-h	0	43	61	79	83	94	103	153	272
Collective mortality	0	1.83E-06	2.57E-06	3.30E-06	3.48E-06	3.93E-06	4.34E-06	6.45E-06	1.14E-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil shipments	0	1	2	2	2	2	3	4	6
Total distance (km)	0	1,600	3,200	3,200	3,200	3,200	4,800	6,400	9,600
Collective mortality	0	6.08E-05	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.82E-04	2.43E-04	3.65E-04

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Table B.1.4.1			
Summary Costs for Power Reactor Case 1 High Soil Contamination - Unrestricted Use Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$67,236.81	\$106,000.00	\$173,236.81
60	\$81,620.27	\$106,000.00	\$187,620.27
25	\$97,483.17	\$106,000.00	\$203,483.17
15	\$105,235.85	\$147,000.00	\$252,235.85
3	\$151,762.62	\$961,000.00	\$1,112,762.62

Table B.1.4.2

**Summary Costs for Power Reactor Case 1
High Soil Contamination - Unrestricted Use
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$170,155.36	\$106,000.00	\$276,155.36
60	\$226,762.71	\$106,000.00	\$332,762.71
25	\$293,917.52	\$106,000.00	\$399,917.52
15	\$326,738.10	\$147,000.00	\$473,738.10
3	\$515,138.23	\$961,000.00	\$1,476,138.23

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Table B.1.4.3			
Summary Costs for Power Reactor Case 1 High Soil Contamination - Unrestricted Use Disposal Cost - \$10/ft ³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$54,152.15	\$106,000.00	\$160,152.15
60	\$60,703.95	\$106,000.00	\$166,703.95
25	\$68,662.81	\$106,000.00	\$174,662.81
15	\$72,552.55	\$147,000.00	\$219,552.55
3	\$94,566.76	\$961,000.00	\$1,055,566.76

Table B.2.1

Incremental Impacts - Power Reactor Case 1A							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$14,383	\$56,607	4.89e-05	1.06e-04	-5.70e-05	*	*
60 < 25	\$15,863	\$67,155	7.40e-05	1.99e-06	7.20e-05	\$220,320,537	\$932,716,096
25 < 15	\$48,753	\$73,821	1.92e-05	9.74e-07	1.83e-05	\$2,669,843,179	\$4,042,636,722
15 < 3	\$860,527	\$1,002,40	2.32e-05	2.14e-04	-1.91e-04	*	*

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Table B.2.2							
Statistical Mortality - Power Reactor Case 1A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.88e-04	2.17e-06	4.35e-05	1.83e-06	6.08e-05	2.96e-04	1.08e-04
60	1.39e-04	3.07e-06	8.70e-05	2.57e-06	1.22e-04	3.53e-04	2.14e-04
30	9.64e-05	3.93e-06	8.70e-05	3.30e-06	1.22e-04	3.12e-04	2.16e-04
25	6.51e-05	4.15e-06	8.70e-05	3.48e-06	1.22e-04	2.81e-04	2.16e-04
15	4.59e-05	4.68e-06	8.70e-05	3.93e-06	1.22e-04	2.63e-04	2.17e-04
10	3.55e-05	5.17e-06	1.31e-04	4.34e-06	1.82e-04	3.58e-04	3.22e-04
3	2.27e-05	7.67e-06	1.74e-04	6.45e-06	2.43e-04	4.54e-04	4.31e-04
1	8.51e-06	1.36e-05	2.61e-04	1.14e-05	3.65e-04	6.59e-04	6.51e-04

Table B.2.3 Impact and Cost Calculation - Power Reactor Case 1A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+0
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed			2.79e+00	[10,000 persons per km ²]		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.26e-04	1.88e-04	1.39e-04	9.64e-05	6.51e-05	4.59e-05	3.55e-05	2.27e-05	8.51e-06

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Table B.2.4.1			
Summary Costs for Power Reactor (\$M) Case 1A Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$67,237	\$106,000	\$173,237
60	\$81,620	\$106,000	\$187,620
25	\$97,483	\$106,000	\$203,483
15	\$105,236	\$147,000	\$252,236
3	\$151,763	\$961,000	\$1,112,763

Table B.2.4.2

**Summary Costs for Power Reactor (\$M)
Case 1A
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$170,155	\$106,000	\$276,155
60	\$226,763	\$106,000	\$332,763
25	\$293,918	\$106,000	\$399,918
15	\$326,738	\$147,000	\$473,738
3	\$515,138	\$961,000	\$1,476,138

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Table B.3.1							
Incremental Impacts - Power Reactor Case 1B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$14,383	\$56,607	2.45e-04	1.06e-04	1.39e-04	\$103,777,859	\$408,426,696
60 < 25	\$15,863	\$67,155	3.70e-04	1.99e-06	3.68e-04	\$43,109,358	\$182,501,336
25 < 15	\$48,753	\$73,821	9.62e-05	9.74e-07	9.52e-05	\$512,112,801	\$775,433,565
15 < 3	\$860,527	\$1,002,40	1.16e-04	2.14e-04	-9.79e-05	*	*

Table B.3.2

Statistical Mortality - Power Reactor Case 1B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	9.40e-04	2.17e-06	4.35e-05	1.83e-06	6.08e-05	1.05e-03	1.08e-04
60	6.96e-04	3.07e-06	8.70e-05	2.57e-06	1.22e-04	9.10e-04	2.14e-04
30	4.82e-04	3.93e-06	8.70e-05	3.30e-06	1.22e-04	6.98e-04	2.16e-04
25	3.26e-04	4.15e-06	8.70e-05	3.48e-06	1.22e-04	5.42e-04	2.16e-04
15	2.30e-04	4.68e-06	8.70e-05	3.93e-06	1.22e-04	4.47e-04	2.17e-04
10	1.78e-04	5.17e-06	1.31e-04	4.34e-06	1.82e-04	5.00e-04	3.22e-04
3	1.13e-04	7.67e-06	1.74e-04	6.45e-06	2.43e-04	5.45e-04	4.31e-04
1	4.26e-05	1.36e-05	2.61e-04	1.14e-05	3.65e-04	6.93e-04	6.51e-04

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Table B.3.3 Impact and Cost Calculations - Power Reactor Case 1B

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+0	1.08e+0	7.73e+0	4.89e+0	2.80e+0	1.52e+0	8.45e+0	2.81e+0	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed		1.39e+01	[50,000 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.63e-03	9.40e-04	6.96e-04	4.82e-04	3.26e-04	2.30e-04	1.78e-04	1.13e-04	4.26e-05

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Table B.3.4.1

**Summary Costs for Power Reactor (\$M)
Case 1B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$67,237	\$106,000	\$173,237
60	\$81,620	\$106,000	\$187,620
25	\$97,483	\$106,000	\$203,483
15	\$105,236	\$147,000	\$252,236
3	\$151,763	\$961,000	\$1,112,763

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Table B.3.4.2			
Summary Costs for Power Reactor (\$M)			
Case 1B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$170,155	\$106,000	\$276,155
60	\$226,763	\$106,000	\$332,763
25	\$293,918	\$106,000	\$399,918
15	\$326,738	\$147,000	\$473,738
3	\$515,138	\$961,000	\$1,476,138

Table B.4.1

Incremental Impacts - Power Reactor Case 2

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$23,452	\$129,012	1.39e-05	1.06e-04	-9.19e-05	*	*
60 < 25	\$28,204	\$156,434	2.10e-05	1.06e-04	-8.51e-05	*	*
25 < 15	\$54,136	\$116,806	5.47e-06	8.82e-07	4.58e-06	\$11,810,591,106	\$25,482,832,561
15 < 3	\$892,322	\$1,247,005	6.60e-06	3.18e-04	-3.11e-04	*	*

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Table B.4.2							
Statistical Mortality - Power Reactor Case 2							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	5.34e-05	1.97e-06	1.31e-04	1.65e-06	1.82e-04	3.70e-04	3.17e-04
60	3.95e-05	2.77e-06	1.74e-04	2.33e-06	2.43e-04	4.62e-04	4.22e-04
30	2.74e-05	3.56e-06	2.18e-04	2.99e-06	3.04e-04	5.55e-04	5.28e-04
25	1.85e-05	3.75e-06	2.18e-04	3.15e-06	3.04e-04	5.47e-04	5.28e-04
15	1.30e-05	4.23e-06	2.18e-04	3.56e-06	3.04e-04	5.42e-04	5.29e-04
10	1.01e-05	4.68e-06	2.61e-04	3.93e-06	3.65e-04	6.45e-04	6.34e-04
3	6.44e-06	6.95e-06	3.48e-04	5.83e-06	4.86e-04	8.54e-04	8.47e-04
1	2.42e-06	1.23e-05	6.09e-04	1.03e-05	8.51e-04	1.49e-03	1.48e-03

Table B.4.3 Impact and Cost Calculations - Power Reactor Case 2

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08				
Exposure duration	1000	y		Burial site distance	q1600	44km per shipment			
Disposal volume	10.87	m ³ per		Fatal transport rate	3.8e-08	per km			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	8.31e-04	4.79e-04	3.55e-04	2.46e-04	1.66e-04	1.17e-04	9.06e-05	5.78e-05	2.17e-05

[Baseline soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons on land 1.11e-01 [400 persons per km ²]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.27e-05	5.34e-05	3.95e-05	2.74e-05	1.85e-05	1.30e-05	1.01e-05	6.44e-06	2.42e-06

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.004	0.006	0.007	0.008	0.008	0.009	0.014	0.025
Collective mortality	0	1.97e-06	2.77e-06	3.56e-06	3.75e-06	4.23e-06	4.68e-06	6.95e-06	1.23e-05

III. Transporting Waste - Mortality for Radiation Exposure

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Table B.4.3 Impact and Cost Calculations - Power Reactor Case 2									
Soil shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	3.3	4.6	5.9	6.2	7.0	7.8	11.5	20.5
Soil volume (m ³)	0	24	34	44	46	52	58	86	152
Soil shipments	0	3	4	5	5	5	6	8	14
Soil person-rem	0	0.261	0.348	0.435	0.435	0.435	0.522	0.696	1.218
Collective mortality	0	1.31e-04	1.74e-04	2.18e-04	2.18e-04	2.18e-04	2.61e-04	3.48e-04	6.09e-04
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	39	55	71	75	85	94	139	246
Collective mortality	0	1.65e-06	2.33e-06	2.99e-06	3.15e-06	3.56e-06	3.93e-06	5.83e-06	1.03e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	3	4	5	5	5	6	8	14
Total distance (km)	0	4,800	6,400	8,000	8,000	8,000	9,600	12,800	22,400
Collective mortality	0	1.82e-04	2.43e-04	3.04e-04	3.04e-04	3.04e-04	3.65e-04	4.86e-04	8.51e-04

Table B.4.4.1

**Summary Costs for Power Reactor
Case 2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$57,908	\$106,000	\$163,908
60	\$81,360	\$106,000	\$187,360
25	\$109,564	\$106,000	\$215,564
15	\$122,700	\$147,000	\$269,700
3	\$201,022	\$961,000	\$1,162,022

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Table B.4.4.2			
Summary Costs for Power Reactor Case 2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$315,204	\$106,000	\$421,204
60	\$444,216	\$106,000	\$550,216
25	\$600,649	\$106,000	\$706,649
15	\$676,456	\$147,000	\$823,456
3	\$1,109,461	\$961,000	\$2,070,461

Table B.4.4.3

**Summary Costs for Power Reactor
Case 2
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$18,384	\$106,000	\$124,384
60	\$24,244	\$106,000	\$130,244
25	\$31,363	\$106,000	\$137,363
15	\$34,842	\$147,000	\$181,842
3	\$58,632	\$961,000	\$1,019,632

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Table B.5.1

Incremental Impacts - Power Reactor Case 2A

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$23,452	\$129,012	4.89e-05	1.06e-04	-5.69e-05	*	*
60 < 25	\$28,204	\$156,434	7.40e-05	1.06e-04	-3.21e-05		*
25 < 15	\$54,136	\$116,806	1.92e-05	8.82e-07	1.84e-05	\$2,949,730,611	\$6,364,413,990
15 < 3	\$892,322	\$1,247,00	2.32e-05	3.18e-04	-2.95e-04	*	*

Table B.5.2

Statistical Mortality - Power Reactor Case 2A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.88e-04	1.97e-06	1.31e-04	1.65e-06	1.82e-04	5.05e-04	3.17e-04
60	1.39e-04	2.77e-06	1.74e-04	2.33e-06	2.43e-04	5.61e-04	4.22e-04
30	9.64e-05	3.56e-06	2.18e-04	2.99e-06	3.04e-04	6.24e-04	5.28e-04
25	6.51e-05	3.75e-06	2.18e-04	3.15e-06	3.04e-04	5.94e-04	5.28e-04
15	4.59e-05	4.23e-06	2.18e-04	3.56e-06	3.04e-04	5.75e-04	5.29e-04
10	3.55e-05	4.68e-06	2.61e-04	3.93e-06	3.65e-04	6.70e-04	6.34e-04
3	2.27e-05	6.95e-06	3.48e-04	5.83e-06	4.86e-04	8.70e-04	8.47e-04
1	8.51e-06	1.23e-05	6.09e-04	1.03e-05	8.51e-04	1.49e-03	1.48e-03

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Table B.5.3 Impact and Cost Calculations - Power Reactor Case 2A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per		
Exposure duration	1000	y		Burial site	1600	km per		
Disposal volume	10.87	m ³ per		Fatal	3.8e-08	per km		
				Alt. use	1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed	2.79e+00	[10,000 persons per km ²]				
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.26e-04	1.88e-04	1.39e-04	9.64e-05	6.51e-05	4.59e-05	3.55e-05	2.27e-05	8.51e-06

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Table B.5.4.1.1

**Summary Costs for Power Reactor (\$M)
Case 2A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$57,908	\$106,000	\$163,908
60	\$81,360	\$106,000	\$187,360
25	\$109,564	\$106,000	\$215,564
15	\$122,700	\$147,000	\$269,700
3	\$201,022	\$961,000	\$1,162,022

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Table B.5.4.1.2			
Summary Costs for Power Reactor (\$M) Case 2A Disposal Cost - \$350/ft ³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$315,204	\$106,000	\$421,204
60	\$444,216	\$106,000	\$550,216
25	\$600,649	\$106,000	\$706,649
15	\$676,456	\$147,000	\$823,456
3	\$1,109,461	\$961,000	\$2,070,461

Table B.6.1

Incremental Impacts - Power Reactor Case 2B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$23,452	\$129,012	2.45e-04	1.06e-04	1.39e-04	\$169,016,670	\$929,783,394
60 < 25	\$28,204	\$156,434	3.70e-04	1.06e-04	2.64e-04	\$106,889,873	\$592,869,785
25 < 15	\$54,136	\$116,806	9.62e-05	8.82e-07	9.53e-05	\$568,113,589	\$1,225,776,368
15 < 3	\$892,322	\$1,247,005	1.16e-04	3.18e-04	-2.02e-04	*	*

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Table B.6.2

Statistical Mortality - Power Reactor Case 2B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	9.40e-04	1.97e-06	1.31e-04	1.65e-06	1.82e-04	1.26e-03	3.17e-04
60	6.96e-04	2.77e-06	1.74e-04	2.33e-06	2.43e-04	1.12e-03	4.22e-04
30	4.82e-04	3.56e-06	2.18e-04	2.99e-06	3.04e-04	1.01e-03	5.28e-04
25	3.26e-04	3.75e-06	2.18e-04	3.15e-06	3.04e-04	8.54e-04	5.28e-04
15	2.30e-04	4.23e-06	2.18e-04	3.56e-06	3.04e-04	7.59e-04	5.29e-04
10	1.78e-04	4.68e-06	2.61e-04	3.93e-06	3.65e-04	8.12e-04	6.34e-04
3	1.13e-04	6.95e-06	3.48e-04	5.83e-06	4.86e-04	9.61e-04	8.47e-04
1	4.26e-05	1.23e-05	6.09e-04	1.03e-05	8.51e-04	1.53e-03	1.48e-03

Table B.6.3 Impact and Cost Calculations - Power Reactor Case 2B

GENERIC ASSUMPTIONS:

Fatal cancer risk	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure	1000	y		Burial site		1600	km per shipment		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed 1.39e+01 [50,000 persons per km ²]						
Residual Dose	None	100	60	30	25	15	10	3	1
Collective	1.63e-03	9.40e-04	6.96e-04	4.82e-04	3.26e-04	2.30e-04	1.78e-04	1.13e-04	4.26e-05

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Table B.6.4.1			
Summary Costs for Power Reactor (\$M) Case 2B Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$57,908	\$106,000	\$163,908
60	\$81,360	\$106,000	\$187,360
25	\$109,564	\$106,000	\$215,564
15	\$122,700	\$147,000	\$269,700
3	\$201,022	\$961,000	\$1,162,022

Table B.6.4.2

**Summary Costs for Power Reactor (\$M)
Case 2B
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$315,204	\$106,000	\$421,204
60	\$444,216	\$106,000	\$550,216
25	\$600,649	\$106,000	\$706,649
15	\$676,456	\$147,000	\$823,456
3	\$1,109,461	\$961,000	\$2,070,461

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Table B.7.1

Incremental Impacts - Power Reactor Case 3

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$21,141	\$89,499	2.86e-05	2.66e-06	2.60e-05	\$813,876,990	\$3,445,507,981
60 < 25	\$59,195	\$242,029	2.06e-05	2.16e-04	-1.95e-04	*	*
25 < 15	\$76,802	\$188,280	5.45e-06	1.09e-04	-1.03e-04	*	*
15 < 3	\$938,977	\$1,330,229	6.43e-06	3.28e-04	-3.22e-04	*	*

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Table B.7.2

Statistical Mortality - Power Reactor Case 3

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	6.26e-05	2.46e-06	8.70e-05	2.07e-06	1.22e-04	2.76e-04	2.13e-04
60	3.39e-05	3.91e-06	8.70e-05	3.28e-06	1.22e-04	2.50e-04	2.16e-04
30	1.86e-05	6.91e-06	1.31e-04	5.81e-06	1.82e-04	3.44e-04	3.26e-04
25	1.33e-05	7.77e-06	1.74e-04	6.53e-06	2.43e-04	4.45e-04	4.31e-04
15	7.88e-06	1.01e-05	2.18e-04	8.50e-06	3.04e-04	5.48e-04	5.40e-04
10	4.98e-06	1.20e-05	2.18e-04	1.01e-05	3.04e-04	5.49e-04	5.44e-04
3	1.45e-06	1.84e-05	3.48e-04	1.54e-05	4.86e-04	8.70e-04	8.68e-04
1	4.53e-07	3.13e-05	5.66e-04	2.63e-05	7.90e-04	1.41e-03	1.41e-03

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Table B.7.3 Impact and Cost Calculations - Power Reactor Case 3

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h			
Exposure duration	1000	y		Burial site	1600	km per			
Disposal volume	10.87	m ³ per shipment		Fatal transport rate	3.8e-08	per km			
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+0	3.38e+0	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	2.19e-03	5.61e-04	3.04e-04	1.67e-04	1.20e-04	7.07e-05	4.47e-05	1.30e-05	4.07e-06
[Humbolt soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000									
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	3,000	sq ft	# persons on land		1.11e-01	[400 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.44e-04	6.26e-05	3.39e-05	1.86e-05	1.33e-05	7.88e-06	4.98e-06	1.45e-06	4.53e-07
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.005	0.008	0.014	0.016	0.020	0.024	0.037	0.063
Collective mortality	0	2.46e-06	3.91e-06	6.91e-06	7.77e-06	1.01e-05	1.20e-05	1.84e-05	3.13e-05

Table B.7.3 Impact and Cost Calculations - Power Reactor Case 3

III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	4.4	8.0	17.9	20.8	28.9	35.3	54.5	91.3
Soil volume (m ³)	0	28	44	77	87	113	135	205	349
Soil shipments	0	2	2	3	4	5	5	8	13
Soil person-rem	0	0.174	0.174	0.261	0.348	0.435	0.435	0.696	1.131
Collective mortality	0	8.70e-05	8.70e-05	1.31e-04	1.74e-04	2.18e-04	2.18e-04	3.48e-04	5.66e-04
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	49	78	138	155	202	241	368	625
Collective mortality	0	2.07e-06	3.28e-06	5.81e-06	6.53e-06	8.50e-06	1.01e-05	1.54e-05	2.63e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	2	2	3	4	5	5	8	13
Total distance (km)	0	3,200	3,200	4,800	6,400	8,000	8,000	12,800	20,800
Collective mortality	0	1.22e-04	1.22e-04	1.82e-04	2.43e-04	3.04e-04	3.04e-04	4.86e-04	7.90e-04

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Table B.7.4.1			
Summary Costs for Power Reactor Case 3 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$72,818.77	\$106,000.00	\$178,818.77
60	\$93,959.74	\$106,000.00	\$199,959.74
25	\$153,154.42	\$106,000.00	\$259,154.42
15	\$188,956.08	\$147,000.00	\$335,956.08
3	\$313,932.65	\$961,000.00	\$1,274,932.65

Table B.7.4.2

**Summary Costs for Power Reactor
Case 3
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$189,502.01	\$106,000.00	\$295,502.01
60	\$279,001.25	\$106,000.00	\$385,001.25
25	\$521,030.37	\$106,000.00	\$627,030.37
15	\$668,310.59	\$147,000.00	\$815,310.59
3	\$1,184,539.77	\$961,000.00	\$2,145,539.77

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Table B.7.4.3			
Summary Costs for Power Reactor Case 3 Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$56,287.99	\$106,000.00	\$162,287.99
60	\$66,895.01	\$106,000.00	\$172,895.01
25	\$95,265.06	\$106,000.00	\$201,265.06
15	\$112,562.97	\$147,000.00	\$259,562.97
3	\$177,372.86	\$961,000.00	\$1,138,372.86

Table B.8.1

Incremental Impacts - Power Reactor Case 3A

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$21,141	\$89,499	1.01e-04	2.66e-06	9.81e-05	\$215,480,856	\$912,227,545
60 < 25	\$59,195	\$242,029	7.25e-05	2.16e-04	-1.43e-04	*	*
25 < 15	\$76,802	\$188,280	1.92e-05	1.09e-04	-8.94e-05	*	*
15 < 3	\$938,977	\$1,330,229	2.26e-05	3.28e-04	-3.05e-04	*	*

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Table B.8.2							
Statistical Mortality - Power Reactor Case 3A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	2.20e-04	2.46e-06	8.70e-05	2.07e-06	1.22e-04	4.33e-04	2.13e-04
60	1.19e-04	3.91e-06	8.70e-05	3.28e-06	1.22e-04	3.35e-04	2.16e-04
30	6.54e-05	6.91e-06	1.31e-04	5.81e-06	1.82e-04	3.91e-04	3.26e-04
25	4.69e-05	7.77e-06	1.74e-04	6.53e-06	2.43e-04	4.78e-04	4.32e-04
15	2.77e-05	1.01e-05	2.18e-04	8.50e-06	3.04e-04	5.68e-04	5.40e-04
10	1.75e-05	1.20e-05	2.18e-04	1.01e-05	3.04e-04	5.61e-04	5.44e-04
3	5.09e-06	1.84e-05	3.48e-04	1.54e-05	4.86e-04	8.73e-04	8.68e-04
1	1.60e-06	3.13e-05	5.66e-04	2.63e-05	7.90e-04	1.42e-03	1.41e-03

Table B.8.3 Impact and Cost Calculations - Power Reactor Case 3A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose ratio		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+0	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed 2.79e+00 [10,000 persons per km ²]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	8.60e-04	2.20e-04	1.19e-04	6.54e-05	4.69e-05	2.77e-05	1.75e-05	5.09e-06	1.60e-06

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Table B.8.4.1			
Summary Costs for Power Reactor (\$M)			
Case 3A			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$72,819	\$106,000	\$178,819
60	\$93,960	\$106,000	\$199,960
25	\$153,154	\$106,000	\$259,154
15	\$188,956	\$147,000	\$335,956
3	\$313,933	\$961,000	\$1,274,933

Table B.8.4.2

**Summary Costs for Power Reactor (\$M)
Case 3A
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$189,502	\$106,000	\$295,502
60	\$279,001	\$106,000	\$385,001
25	\$521,030	\$106,000	\$627,030
15	\$668,311	\$147,000	\$815,311
3	\$1,184,540	\$961,000	\$2,145,540

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Table B.9.1							
Incremental Impacts - Power Reactor Case 3B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$21,141	\$89,499	5.04e-04	2.66e-06	5.01e-04	\$42,182,471	\$178,577,407
60 < 25	\$59,195	\$242,029	3.62e-04	2.16e-04	1.47e-04	\$403,573,509	\$1,650,089,769
25 < 15	\$76,802	\$188,280	9.60e-05	1.09e-04	-1.27e-05	*	*
15 < 3	\$938,977	\$1,330,22	1.13e-04	3.28e-04	-2.15e-04	*	*

Table B.9.2

Statistical Mortality - Power Reactor Case 3B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.10e-03	2.46e-06	8.70e-05	2.07e-06	1.22e-04	1.31e-03	2.13e-04
60	5.97e-04	3.91e-06	8.70e-05	3.28e-06	1.22e-04	8.13e-04	2.16e-04
30	3.27e-04	6.91e-06	1.31e-04	5.81e-06	1.82e-04	6.53e-04	3.26e-04
25	2.35e-04	7.77e-06	1.74e-04	6.53e-06	2.43e-04	6.66e-04	4.31e-04
15	1.39e-04	1.01e-05	2.18e-04	8.50e-06	3.04e-04	6.79e-04	5.40e-04
10	8.76e-05	1.20e-05	2.18e-04	1.01e-05	3.04e-04	6.31e-04	5.44e-04
3	2.55e-05	1.84e-05	3.48e-04	1.54e-05	4.86e-04	8.94e-04	8.68e-04
1	7.98e-06	3.13e-05	5.66e-04	2.63e-05	7.90e-04	1.42e-03	1.41e-03

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Table B.9.3 Impact and Cost Calculations - Power Reactor Case 3B

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site distance		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport rate		3.8e-08	per km		
				Alt. use dose ratio		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons exposed 1.39e+01 [50,000 persons per km ²]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.30e-03	1.10e-03	5.97e-04	3.27e-04	2.35e-04	1.39e-04	8.76e-05	2.55e-05	7.98e-06

Table B.9.4.1

**Summary Costs for Power Reactor (\$M)
Case 3B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$72,819	\$106,000	\$178,819
60	\$93,960	\$106,000	\$199,960
25	\$153,154	\$106,000	\$259,154
15	\$188,956	\$147,000	\$335,956
3	\$313,933	\$961,000	\$1,274,933

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Table B.9.4.2			
Summary Costs for Power Reactor (\$M)			
Case 3B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$189,502	\$106,000	\$295,502
60	\$279,001	\$106,000	\$385,001
25	\$521,030	\$106,000	\$627,030
15	\$668,311	\$147,000	\$815,311
3	\$1,184,540	\$961,000	\$2,145,540

Table B.10.1

Incremental Impacts - Power Reactor Case 4

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$38,472	\$209,368	2.86e-05	2.11e-04	-1.82e-04	*	*
60 < 25	\$99,787	\$556,873	2.06e-05	3.19e-04	-2.99e-04	*	*
25 < 15	\$103,394	\$382,090	5.45e-06	3.17e-04	-3.11e-04	*	*
15 < 3	\$1,029,63	\$2,007,762	6.43e-06	8.48e-04	-8.42e-04	*	*

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Table B.10.2							
Statistical Mortality - Power Reactor Case 4							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	6.26e-05	2.23e-06	1.31e-04	1.87e-06	1.82e-04	3.80e-04	3.17e-04
60	3.39e-05	3.54e-06	2.18e-04	2.97e-06	3.04e-04	5.62e-04	5.28e-04
30	1.86e-05	6.26e-06	3.48e-04	5.25e-06	4.86e-04	8.64e-04	8.46e-04
25	1.33e-05	7.03e-06	3.48e-04	5.91e-06	4.86e-04	8.61e-04	8.47e-04
15	7.88e-06	9.16e-06	4.79e-04	7.70e-06	6.69e-04	1.17e-03	1.16e-03
10	4.98e-06	1.09e-05	5.66e-04	9.15e-06	7.90e-04	1.38e-03	1.38e-03
3	1.45e-06	1.66e-05	8.27e-04	1.40e-05	1.16e-03	2.01e-03	2.01e-03
1	4.53e-07	2.83e-05	1.44e-03	2.38e-05	2.01e-03	3.49e-03	3.49e-03

Table B.10.3 Impact and Cost Calculations - Power Reactor Case 4

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+0	1.09e+0	5.99e+0	3.38e+0	2.46e+0	1.49e+0	9.57e+0	2.90e+0	9.40e-01
Cumulative risk	2.19e-03	5.61e-04	3.04e-04	1.67e-04	1.20e-04	7.07e-05	4.47e-05	1.30e-05	4.07e-06

[Humbolt soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons on land	1.11e-01	[400 persons per km2]				
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.44e-04	6.26e-05	3.39e-05	1.86e-05	1.33e-05	7.88e-06	4.98e-06	1.45e-06	4.53e-07

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.004	0.007	0.013	0.014	0.018	0.022	0.033	0.057
Collective mortality	0	2.23e-06	3.54e-06	6.26e-06	7.03e-06	9.16e-06	1.09e-05	1.66e-05	2.83e-05

III. Transporting Waste - Mortality for Radiation Exposure

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Table B.10.3 Impact and Cost Calculations - Power Reactor Case 4

Soil shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	4.4	8.0	17.9	20.8	28.9	35.3	54.5	91.3
Soil volume (m ³)	0	28	44	77	87	113	135	205	349
Soil shipments	0	3	5	8	8	11	13	19	33
Soil person-rem	0	0.261	0.435	0.696	0.696	0.957	1.131	1.653	2.871
Collective mortality	0	1.31e-04	2.18e-04	3.48e-04	3.48e-04	4.79e-04	5.66e-04	8.27e-04	1.44e-03
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	45	71	125	141	183	218	333	566
Collective mortality	0	1.87e-06	2.97e-06	5.25e-06	5.91e-06	7.70e-06	9.15e-06	1.40e-05	2.38e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	3	5	8	8	11	13	19	33
Total distance (km)	0	4,800	8,000	12,800	12,800	17,600	20,800	30,400	52,800
Collective mortality	0	1.82e-04	3.04e-04	4.86e-04	4.86e-04	6.69e-04	7.90e-04	1.16e-03	2.01e-03

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Table B.10.4.1

**Summary Costs for Power Reactor
Case 4
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$65,121	\$106,000	\$171,121
60	\$103,593	\$106,000	\$209,593
25	\$203,380	\$106,000	\$309,380
15	\$265,774	\$147,000	\$412,774
3	\$481,404	\$961,000	\$1,442,404

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Table B.10.4.2			
Summary Costs for Power Reactor Case 4 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$356,829	\$106,000	\$462,829
60	\$566,197	\$106,000	\$672,197
25	\$1,123,070	\$106,000	\$1,229,070
15	\$1,464,160	\$147,000	\$1,611,160
3	\$2,657,922	\$961,000	\$3,618,922

Table B.10.4.3

**Summary Costs for Power Reactor
Case 4
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$20,294	\$106,000	\$126,294
60	\$29,781	\$106,000	\$135,781
25	\$59,257	\$106,000	\$165,257
15	\$74,728	\$147,000	\$221,728
3	\$133,129	\$961,000	\$1,094,129

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Table B.11.1							
Incremental Impacts - Power Reactor Case 4A							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$38,472	\$209,368	1.01e-04	2.11e-04	-1.10e-04	*	*
60 < 25	\$99,787	\$556,873	7.25e-05	3.19e-04	-2.47e-04	*	*
25 < 15	\$103,394	\$382,090	1.92e-05	3.17e-04	-2.98e-04	*	*
15 < 3	\$1,029,63	\$2,007,76	2.26e-05	8.48e-04	-8.26e-04	*	*

Table B.11.2

Statistical Mortality - Power Reactor Case 4A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	2.20e-04	2.23e-06	1.31e-04	1.87e-06	1.82e-04	5.37e-04	3.17e-04
60	1.19e-04	3.54e-06	2.18e-04	2.97e-06	3.04e-04	6.47e-04	5.28e-04
30	6.54e-05	6.26e-06	3.48e-04	5.25e-06	4.86e-04	9.11e-04	8.46e-04
25	4.69e-05	7.03e-06	3.48e-04	5.91e-06	4.86e-04	8.94e-04	8.47e-04
15	2.77e-05	9.16e-06	4.79e-04	7.70e-06	6.69e-04	1.19e-03	1.16e-03
10	1.75e-05	1.09e-05	5.66e-04	9.15e-06	7.90e-04	1.39e-03	1.38e-03
3	5.09e-06	1.66e-05	8.27e-04	1.40e-05	1.16e-03	2.02e-03	2.01e-03
1	1.60e-06	2.83e-05	1.44e-03	2.38e-05	2.01e-03	3.50e-03	3.49e-03

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Table B.11.3 Impact and Cost Calculations - Power Reactor Case 4A									
GENERIC ASSUMPTIONS:									
Fatal cancer risk	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			
REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use									
Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	3,000	sq ft	# persons exposed 2.79e+00 [10,000 persons per km ²]						
Residual Dose	None	100	60	30	25	15	10	3	1
Collective	8.60e-04	2.20e-04	1.19e-04	6.54e-05	4.69e-05	2.77e-05	1.75e-05	5.09e-06	1.60e-06

Table B.11.4.1

**Summary Costs for Power Reactor (\$M)
Case 4A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$65,121	\$106,000	\$171,121
60	\$103,593	\$106,000	\$209,593
25	\$203,380	\$106,000	\$309,380
15	\$265,774	\$147,000	\$412,774
3	\$481,404	\$961,000	\$1,442,404

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Table B.11.4.2			
Summary Costs for Power Reactor (\$M)			
Case 4A			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$356,829	\$106,000	\$462,829
60	\$566,197	\$106,000	\$672,197
25	\$1,123,070	\$106,000	\$1,229,070
15	\$1,464,160	\$147,000	\$1,611,160
3	\$2,657,922	\$961,000	\$3,618,922

Table B.12.1

Incremental Impacts - Power Reactor Case 4B

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$38,472	\$209,368	5.04e-04	2.11e-04	2.93e-04	\$131,379,900	\$714,977,703
60 < 25	\$99,787	\$556,873	3.62e-04	3.19e-04	4.31e-05	\$2,317,865,579	\$12,935,155,165
25 < 15	\$103,394	\$382,090	9.60e-05	3.17e-04	-2.21e-04	*	*
15 < 3	\$1,029,630	\$2,007,762	1.13e-04	8.48e-04	-7.35e-04	*	*

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Table B.12.2							
Statistical Mortality - Power Reactor Case 4B							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.10e-03	2.23e-06	1.31e-04	1.87e-06	1.82e-04	1.42e-03	3.17e-04
60	5.97e-04	3.54e-06	2.18e-04	2.97e-06	3.04e-04	1.13e-03	5.28e-04
30	3.27e-04	6.26e-06	3.48e-04	5.25e-06	4.86e-04	1.17e-03	8.46e-04
25	2.35e-04	7.03e-06	3.48e-04	5.91e-06	4.86e-04	1.08e-03	8.47e-04
15	1.39e-04	9.16e-06	4.79e-04	7.70e-06	6.69e-04	1.30e-03	1.16e-03
10	8.76e-05	1.09e-05	5.66e-04	9.15e-06	7.90e-04	1.46e-03	1.38e-03
3	2.55e-05	1.66e-05	8.27e-04	1.40e-05	1.16e-03	2.04e-03	2.01e-03
1	7.98e-06	2.83e-05	1.44e-03	2.38e-05	2.01e-03	3.50e-03	3.49e-03

Table B.12.3 Impact and Cost Calculations - Power Reactor Case 4B

GENERIC ASSUMPTIONS:

Fatal cancer risk	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			

REFERENCE FACILITY Power Reactor - High Soil Contamination - Alternative Land Use

Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area 3,000 sq ft # persons exposed 1.39e+01 [50,000 persons per km²]

Residual Dose	None	100	60	30	25	15	10	3	1
Collective mortality	4.30e-03	1.10e-03	5.97e-04	3.27e-04	2.35e-04	1.39e-04	8.76e-05	2.55e-05	7.98e-06

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Table B.12.4.1			
Summary Costs for Power Reactor (\$M)			
Case 4B			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$65,121	\$106,000	\$171,121
60	\$103,593	\$106,000	\$209,593
25	\$203,380	\$106,000	\$309,380
15	\$265,774	\$147,000	\$412,774
3	\$481,404	\$961,000	\$1,442,404

Table B.12.4.1

**Summary Costs for Power Reactor (\$M)
Case 4B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$65,121	\$106,000	\$171,121
60	\$103,593	\$106,000	\$209,593
25	\$203,380	\$106,000	\$309,380
15	\$265,774	\$147,000	\$412,774
3	\$481,404	\$961,000	\$1,442,404

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Table B.12.4.2			
Summary Costs for Power Reactor (\$M)			
Case 4B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$356,829	\$106,000	\$462,829
60	\$566,197	\$106,000	\$672,197
25	\$1,123,070	\$106,000	\$1,229,070
15	\$1,464,160	\$147,000	\$1,611,160
3	\$2,657,922	\$961,000	\$3,618,922

Table B.13.1

Incremental Impacts - Power Reactor Case 5

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$0	\$0	-6.87e-05	0.00e+00	-6.87e-05	*	*
60 < 25	\$4,637	\$20,437	5.68e-04	1.05e-04	4.63e-04	\$10,005,675	\$44,099,352
25 < 15	\$7,910	\$45,648	3.45e-04	5.31e-07	3.45e-04	\$22,953,686	\$132,458,187
15 < 3	\$128,170	\$708,023	5.93e-04	5.30e-04	6.30e-05	\$2,034,443,104	\$11,238,426,777

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Table B.13.2							
Statistical Mortality - Power Reactor Case 5							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.59e-03	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.59e-03	0.00e+00
60	1.66e-03	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.66e-03	0.00e+00
30	1.72e-03	1.42e-08	4.35e-05	1.19e-08	6.08e-05	1.82e-03	1.04e-04
25	1.09e-03	1.21e-07	4.35e-05	1.01e-07	6.08e-05	1.20e-03	1.05e-04
15	7.49e-04	4.09e-07	4.35e-05	3.44e-07	6.08e-05	8.54e-04	1.05e-04
10	4.13e-04	1.29e-06	8.70e-05	1.09e-06	1.22e-04	6.24e-04	2.11e-04
3	1.57e-04	4.84e-06	2.61e-04	4.07e-06	3.65e-04	7.91e-04	6.35e-04
1	4.86e-05	1.43e-05	7.40e-04	1.20e-05	1.03e-03	1.85e-03	1.80e-03

Table B.13.3 Impact and Cost Calculations - Power Reactor Case 5

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.07e+01	3.07e+01	3.07e+01	3.07e+01	2.01e+01	1.38e+01	7.82e+00	2.95e+00	9.47e-01
Cumulative risk	1.52e-04	5.72e-04	5.96e-04	6.16e-04	3.93e-04	2.69e-04	1.48e-04	5.62e-05	1.74e-05

[Humbolt soil profile (restricted)] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	3,000	sq ft	# persons on land 2.79e+00 [10,000 persons per km2]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.24e-04	1.59e-03	1.66e-03	1.72e-03	1.09e-03	7.49e-04	4.13e-04	1.57e-04	4.86e-05

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.000	0.000	0.000	0.000	0.001	0.003	0.010	0.029
Collective mortality	0	0.00e+00	0.00e+00	1.42e-08	1.21e-07	4.09e-07	1.29e-06	4.84e-06	1.43e-05

III. Transporting Waste - Mortality for Radiation Exposure

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Table B.13.3 Impact and Cost Calculations - Power Reactor Case 5

Soil shipment exposure	8.70e-02	person-re							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	0.0	0.0	0.1	0.5	1.8	3.0	12.8	49.3
Soil volume (m ³)	0	0	0	0	1	5	16	60	176
Soil shipments	0	0	0	1	1	1	2	6	17
Soil person-rem	0	0.000	0.000	0.087	0.087	0.087	0.174	0.522	1.479
Collective mortality	0	0.00e+00	0.00e+00	4.35e-05	4.35e-05	4.35e-05	8.70e-05	2.61e-04	7.40e-04
REFERENCE FACILITY Power Reactor - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	0	0	0	2	8	26	97	285
Collective mortality	0	0.00e+00	0.00e+00	1.19e-08	1.01e-07	3.44e-07	1.09e-06	4.07e-06	1.20e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	0	0	1	1	1	2	6	17
Total distance (km)	0	0	0	1,600	1,600	1,600	3,200	9,600	27,200
Collective mortality	0	0.00e+00	0.00e+00	6.08e-05	6.08e-05	6.08e-05	1.22e-04	3.65e-04	1.03e-03

Table B.13.4.1

**Summary Costs for Power Reactor
Case 5
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$106,000	\$106,000
60	\$0	\$106,000	\$106,000
25	\$4,637	\$106,000	\$110,637
15	\$12,547	\$106,000	\$118,547
3	\$140,717	\$106,000	\$246,717

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Table B.13.4.2			
Summary Costs for Power Reactor Case 5 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$106,000	\$106,000
60	\$0	\$106,000	\$106,000
25	\$20,437	\$106,000	\$126,437
15	\$66,085	\$106,000	\$172,085
3	\$774,107	\$106,000	\$880,107

Table B.13.4.3

**Summary Costs for Power Reactor
Case 5
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$106,000	\$106,000
60	\$0	\$106,000	\$106,000
25	\$4,977	\$106,000	\$110,977
15	\$7,072	\$106,000	\$113,072
3	\$39,263	\$106,000	\$145,263

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Table B.14.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 1 & 1A									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$141,235	\$234,493	\$796,688	7.43e-02	3.26e-04	7.40e-02	\$1,908,727	\$3,169,079	\$10,766,901
60 < 25	\$141,590	\$273,377	\$1,095,003	6.50e-02	4.58e-04	6.46e-02	\$2,192,732	\$4,233,647	\$16,957,742
25 < 15	\$266,653	\$332,953	\$755,415	1.86e-02	2.60e-04	1.83e-02	\$14,554,977	\$18,173,953	\$41,233,620
15 < 3	\$1,344,195	\$1,529,985	\$2,702,872	2.23e-02	6.54e-04	2.16e-02	\$62,109,365	\$70,693,949	\$124,887,937

Table B.14.2

Statistical Mortality for Uranium Fuel Fabrication Facility Case 1 & 1A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	1.60e-04	2.64e-07	1.34e-04	4.01e-03	1.90e-01	4.31e-03
60	1.11e-01	1.72e-04	2.84e-07	1.44e-04	4.32e-03	1.16e-01	4.63e-03
30	5.57e-02	1.86e-04	3.08e-07	1.56e-04	4.68e-03	6.08e-02	5.02e-03
25	4.65e-02	1.89e-04	3.12e-07	1.59e-04	4.74e-03	5.15e-02	5.09e-03
15	2.79e-02	1.98e-04	3.28e-07	1.67e-04	4.99e-03	3.32e-02	5.35e-03
10	1.86e-02	2.05e-04	3.40e-07	1.72e-04	5.17e-03	2.41e-02	5.55e-03
3	5.57e-03	2.23e-04	3.68e-07	1.87e-04	5.59e-03	1.16e-02	6.00e-03
0.3	1.86e-03	2.52e-04	4.16e-07	2.12e-04	6.32e-03	8.65e-03	6.79e-03

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Table B.14.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 1 & 1A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	2.51e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area 100,000 sq ft # persons on land 3.72e+00 [400 persons per sq. km]

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.33e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	0.320	0.344	0.372	0.379	0.397	0.410	0.446	0.504
Collective mortality	0	1.60e-04	1.72e-04	1.86e-04	1.89e-04	1.98e-04	2.05e-04	2.23e-04	2.52e-04

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure 8.00e-06 person-rem per shipment

Table B.14.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 1 & 1A

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	18.4	19.7	21.3	21.7	22.8	23.5	25.6	28.9
Soil volume (m ³)	0	1789	1922	2078	2115	2215	2291	2492	2817
Soil shipments	0	66	71	77	78	82	85	92	104
Soil person-rem	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Collective mortality	0	2.64e-07	2.84e-07	3.08e-07	3.12e-07	3.28e-07	3.40e-07	3.68e-07	4.16e-07
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	3202	3440	3720	3787	3965	4100	4461	5043
Collective mortality	0	1.34e-04	1.44e-04	1.56e-04	1.59e-04	1.67e-04	1.72e-04	1.87e-04	2.12e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil shipments	0	66	71	77	78	82	85	92	104
Total distance (km)	0	105,600	113,600	123,200	124,800	131,200	136,000	147,200	166,400

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Table B.14.4.1			
Summary Costs for Uranium Fuel Fabrication Facility Case 1 & 1A Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,466,067	\$184,000	\$2,650,067
60	\$2,646,560	\$238,000	\$2,884,560
25	\$2,909,937	\$248,000	\$3,157,937
15	\$3,045,891	\$445,000	\$3,490,891
3	\$3,421,876	\$1,599,000	\$5,020,876

Table B.14.4.2 Summary Costs for Uranium Fuel Fabrication Facility Case 1 & 1A Disposal Cost - \$350/ft3			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$10,047,004	\$184,000.00	\$10,231,004
60	\$10,789,692	\$238,000.00	\$11,027,692
25	\$11,874,695	\$248,000.00	\$12,122,695
15	\$12,433,110	\$445,000.00	\$12,878,110
3	\$13,981,982	\$1,599,000.00	\$15,580,982

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Table B.15.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 1B									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$141,235	\$234,493	\$796,688	3.47e-01	3.26e-04	3.47e-01	\$406,817	\$675,443	\$2,294,809
60 < 25	\$141,590	\$273,377	\$1,095,003	3.04e-01	4.58e-04	3.04e-01	\$466,369	\$900,448	\$3,606,719
25 < 15	\$266,653	\$332,953	\$755,415	8.69e-02	2.60e-04	8.66e-02	\$3,078,624	\$3,844,098	\$8,721,608
15 < 3	\$1,344,195	\$1,529,985	\$2,702,872	1.04e-01	6.54e-04	1.04e-01	\$12,975,480	\$14,768,915	\$26,090,766

Table B.15.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 1B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	8.69e-01	1.60e-04	2.64e-07	1.34e-04	4.01e-03	8.73e-01	4.31e-03
60	5.21e-01	1.72e-04	2.84e-07	1.44e-04	4.32e-03	5.26e-01	4.63e-03
30	2.61e-01	1.86e-04	3.08e-07	1.56e-04	4.68e-03	2.66e-01	5.02e-03
25	2.17e-01	1.89e-04	3.12e-07	1.59e-04	4.74e-03	2.22e-01	5.09e-03
15	1.30e-01	1.98e-04	3.28e-07	1.67e-04	4.99e-03	1.36e-01	5.35e-03
10	8.69e-02	2.05e-04	3.40e-07	1.72e-04	5.17e-03	9.24e-02	5.55e-03
3	2.61e-02	2.23e-04	3.68e-07	1.87e-04	5.59e-03	3.21e-02	6.00e-03
0.3	8.69e-03	2.52e-04	4.16e-07	2.12e-04	6.32e-03	1.55e-02	6.79e-03

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Table B.15. 3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 1B

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	20	m ² per		Fatal transport		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use dose		3.74e-02			
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Alternative Land Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	9.39e-03	1.87e-03	1.12e-03	5.61e-04	4.68e-04	2.81e-04	1.87e-04	5.61e-05	1.87e-05
Cumulative risk calculated as follows: initial dose rate * exposure duration * 5E-4 * alt. use dose ratio									
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft		# persons exposed	465	[50,000 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.36e+00	8.69e-01	5.21e-01	2.61e-01	2.17e-01	1.30e-01	8.69e-02	2.61e-02	8.69e-03
Collective mortality calculated as # persons exposed times cumulative risk									

Table B.15.4.1

Summary Costs for Uranium Fuel Fabrication Facility (\$M) Case 1B Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,466,067	\$184,000	\$2,650,067
60	\$2,646,560	\$238,000	\$2,884,560
25	\$2,909,937	\$248,000	\$3,157,937
15	\$3,045,891	\$445,000	\$3,490,891
3	\$3,421,876	\$1,599,000	\$5,020,876

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<p align="center">Table B.15.4.2</p> <p align="center">Summary Costs for Uranium Fuel Fabrication Facility (\$M)</p> <p align="center">Case 1B</p> <p align="center">Disposal Cost - \$350/ft³</p>			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$10,047,004	\$184,000	\$10,231,004
60	\$10,789,692	\$238,000	\$11,027,692
25	\$11,874,695	\$248,000	\$12,122,695
15	\$12,433,110	\$445,000	\$12,878,110
3	\$13,981,982	\$1,599,000	\$15,580,982

Table B.16.1

Incremental Impacts - Uranium Fuel Fabrication Facility Case 2 & 2A

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$140,225	\$364,510	\$1,769,995	7.43e-02	7.49e-04	7.36e-02	\$1,906,000	\$4,954,557	\$24,058,467
60 < 25	\$132,231	\$464,411	\$2,518,476	6.50e-02	1.12e-03	6.39e-02	\$2,069,133	\$7,267,022	\$39,408,677
25 < 15	\$263,832	\$430,310	\$1,486,464	1.86e-02	5.62e-04	1.80e-02	\$14,642,786	\$23,882,339	\$82,499,247
15 < 3	\$1,333,182	\$1,803,084	\$4,735,301	2.23e-02	1.62e-03	2.07e-02	\$64,486,403	\$87,215,706	\$229,047,922

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Table B.16.2							
Statistical Mortality - Uranium Fuel Fabrication Facility Case 2 & 2A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	1.45e-04	6.60e-07	1.22e-04	1.00e-02	1.96e-01	1.03e-02
60	1.11e-01	1.56e-04	7.08e-07	1.31e-04	1.08e-02	1.23e-01	1.10e-02
30	5.57e-02	1.68e-04	7.68e-07	1.41e-04	1.17e-02	6.77e-02	1.20e-02
25	4.65e-02	1.71e-04	7.80e-07	1.44e-04	1.19e-02	5.86e-02	1.22e-02
15	2.79e-02	1.79e-04	8.16e-07	1.51e-04	1.24e-02	4.06e-02	1.27e-02
10	1.86e-02	1.86e-04	8.44e-07	1.56e-04	1.28e-02	3.18e-02	1.32e-02
3	5.57e-03	2.02e-04	9.20e-07	1.70e-04	1.40e-02	1.99e-02	1.44e-02
0.3	1.86e-03	2.28e-04	1.04e-06	1.92e-04	1.58e-02	1.81e-02	1.62e-02

**Table B.16.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Case 2 & 2A**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	2.51e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	100,000	sq ft		# persons on land		3.72e+00	[400 persons per sq. km]		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.33e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	0.290	0.311	0.337	0.343	0.359	0.371	0.404	0.456
Collective mortality	0	1.45e-04	1.56e-04	1.68e-04	1.71e-04	1.79e-04	1.86e-04	2.02e-04	2.28e-04

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.00e-06 person-rem per shipment								
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Table B.16.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 2 & 2A									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	18.4	19.7	21.3	21.7	22.8	23.5	25.6	28.9
Soil volume (m ³)	0	1789	1922	2078	2115	2215	2291	2492	2817
Soil shipments	0	165	177	192	195	204	211	230	260
Soil person-rem	0	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Collective mortality	0	6.60e-07	7.08e-07	7.68e-07	7.80e-07	8.16e-07	8.44e-07	9.20e-07	1.04e-06
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	2898	3113	3366	3427	3589	3711	4037	4564
Collective mortality	0	1.22e-04	1.31e-04	1.41e-04	1.44e-04	1.51e-04	1.56e-04	1.70e-04	1.92e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil shipments	0	165	177	192	195	204	211	230	260
Total distance (km)	0	264,000	283,200	307,200	312,000	326,400	337,600	368,000	416,000
Collective mortality	0	1.00e-02	1.08e-02	1.17e-02	1.19e-02	1.24e-02	1.28e-02	1.40e-02	1.58e-02

Table B.16.4.1

**Summary Costs for Uranium Fuel Fabrication Facility Case 2 & 2A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$4,191,303	\$184,000	\$4,375,303
60	\$4,501,813	\$238,000	\$4,739,813
25	\$4,956,224	\$248,000	\$5,204,224
15	\$5,189,533	\$445,000	\$5,634,533
3	\$5,838,617	\$1,599,000	\$7,437,617

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Table B.16.4.2			
Summary Costs for Uranium Fuel Fabrication Facility			
Case 2 & 2A			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$23,143,646	\$184,000	\$23,327,646
60	\$24,859,641	\$238,000	\$25,097,641
25	\$27,368,117	\$248,000	\$27,616,117
15	\$28,657,581	\$445,000	\$29,102,581
3	\$32,238,882	\$1,599,000	\$33,837,882

Table B.16.4.3

**Summary Costs for Uranium Fuel Fabrication Facility Case 2 & 2A
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$1,158,739	\$184,000	\$1,342,739
60	\$1,244,964	\$238,000	\$1,482,964
25	\$1,367,196	\$248,000	\$1,615,196
15	\$1,434,028	\$445,000	\$1,879,028
3	\$1,613,210	\$1,599,000	\$3,212,210

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Table B.17.1

Incremental Impacts - Uranium Fuel Fabrication Facility Case 2B

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$140,225	\$364,510	\$1,769,995	3.47e-01	3.26e-04	3.47e-01	\$403,911	\$1,049,947	\$5,098,361
60 < 25	\$132,231	\$464,411	\$2,518,476	3.04e-01	4.58e-04	3.04e-01	\$435,543	\$1,529,676	\$8,295,352
25 < 15	\$263,832	\$430,310	\$1,486,464	8.69e-02	2.60e-04	8.66e-02	\$3,046,064	\$4,968,120	\$17,161,894
15 < 3	\$1,333,182	\$1,803,084	\$4,735,301	1.04e-01	6.54e-04	1.04e-01	\$12,869,176	\$17,405,130	\$45,709,759

Table B.17.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 2B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	8.69e-01	1.60e-04	2.64e-07	1.34e-04	4.01e-03	8.73e-01	4.31e-03
60	5.21e-01	1.72e-04	2.84e-07	1.44e-04	4.32e-03	5.26e-01	4.63e-03
30	2.61e-01	1.86e-04	3.08e-07	1.56e-04	4.68e-03	2.66e-01	5.02e-03
25	2.17e-01	1.89e-04	3.12e-07	1.59e-04	4.74e-03	2.22e-01	5.09e-03
15	1.30e-01	1.98e-04	3.28e-07	1.67e-04	4.99e-03	1.36e-01	5.35e-03
10	8.69e-02	2.05e-04	3.40e-07	1.72e-04	5.17e-03	9.24e-02	5.55e-03
3	2.61e-02	2.23e-04	3.68e-07	1.87e-04	5.59e-03	3.21e-02	6.00e-03
0.3	8.69e-03	2.52e-04	4.16e-07	2.12e-04	6.32e-03	1.55e-02	6.79e-03

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Table B.17.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 2B

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	20	m ² per		Fatal transport		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use dose		3.74e-02			

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	9.39e-03	1.87e-03	1.12e-03	5.61e-04	4.68e-04	2.81e-04	1.87e-04	5.61e-05	1.87e-05

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area 100,000 sq ft # persons exposed 4.65e+02 [50,000 persons per km²]

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.36e+00	8.69e-01	5.21e-01	2.61e-01	2.17e-01	1.30e-01	8.69e-02	2.61e-02	8.69e-03

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Table B.17.4.1

**Summary Costs for Uranium Fuel Fabrication Facility (SM)
Case 2B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$4,191,303	\$184,000	\$4,375,303
60	\$4,501,813	\$238,000	\$4,739,813
25	\$4,956,224	\$248,000	\$5,204,224
15	\$5,189,533	\$445,000	\$5,634,533
3	\$5,838,617	\$1,599,000	\$7,437,617

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Table B.17.4.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M)			
Case 2B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$23,143,646	\$184,000	\$23,327,646
60	\$24,859,641	\$238,000	\$25,097,641
25	\$27,368,117	\$248,000	\$27,616,117
15	\$28,657,581	\$445,000	\$29,102,581
3	\$32,238,882	\$1,599,000	\$33,837,882

Table B.17.4.3

**Summary Costs for Uranium Fuel Fabrication Facility (\$M)
Case 2B
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$1,158,739	\$184,000	\$1,342,739
60	\$1,244,964	\$238,000	\$1,482,964
25	\$1,367,196	\$248,000	\$1,615,196
15	\$1,434,028	\$445,000	\$1,879,028
3	\$1,613,210	\$1,599,000	\$3,212,210

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Table B.18.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 3									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$0	\$0	\$0	1.86e+00	0.00e+00	1.86e+00	\$0	\$0	\$0
60 < 25	\$0	\$0	\$0	1.63e+00	0.00e+00	1.63e+00	\$0	\$0	\$0
25 < 15	\$149,171	\$1,469,764	\$5,944,879	4.65e-01	2.55e-03	4.62e-01	\$322,912	\$3,181,618	\$12,868,965
15 < 3	\$161,499	\$1,088,478	\$4,313,450	5.57e-01	1.83e-03	5.56e-01	\$290,690	\$1,959,202	\$7,763,978

Table B.18.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 3

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	4.65e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.65e+00	0.00e+00
60	2.79e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.79e+00	0.00e+00
30	1.39e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.39e+00	0.00e+00
25	1.16e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.16e+00	0.00e+00
15	6.97e-01	9.45e-05	1.56e-07	7.94e-05	2.37e-03	6.99e-01	2.55e-03
10	4.65e-01	1.23e-04	2.04e-07	1.04e-04	3.10e-03	4.68e-01	3.33e-03
3	1.39e-01	1.63e-04	2.68e-07	1.37e-04	4.07e-03	1.44e-01	4.37e-03
0.3	4.65e-02	2.07e-04	3.40e-07	1.74e-04	5.17e-03	5.20e-02	5.55e-03

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Table B.18.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 3									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	2.51e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft	# persons on land	9.29e+01 [10,000 persons per sq. km]					
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.33e+01	4.65e+00	2.79e+00	1.39e+00	1.16e+00	6.97e-01	4.65e-01	1.39e-01	4.65e-02
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.89e-01	2.47e-01	3.25e-01	4.13e-01
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	9.45e-05	1.23e-04	1.63e-04	2.07e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure	8.00e-06	person-rem							

Table B.18.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 3

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	0.0	0.0	0.0	0.0	10.8	14.2	18.7	23.7
Soil volume (m ³)	0	0	0	0	0	1056	1379	1817	2308
Soil shipments	0	0	0	0	0	39	51	67	85
Soil person-rem	0	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.56e-07	2.04e-07	2.68e-07	3.40e-07

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

IV. Performing Decon - Mortality for Accidents

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	0	0	0	0	1890	2469	3252	4131
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.94e-05	1.04e-04	1.37e-04	1.74e-04

V. Transporting Waste - Mortality for Accidents

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	0	0	0	0	39	51	67	85
Total distance (km)	0	0	0	0	0	62,400	81,600	107,200	136,000
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.37e-03	3.10e-03	4.07e-03	5.17e-03

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Table B.18.4.1			
Summary Costs for Uranium Fuel Fabrication Facility Case 3 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$1,469,764	\$184,000	\$1,653,764
3	\$2,504,242	\$238,000	\$2,742,242

Table B.18.4.2

**Summary Costs for Uranium Fuel Fabrication Facility
Case 3
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$5,944,879	\$184,000	\$6,128,879
3	\$10,204,329	\$238,000	\$10,442,329

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Table B.19.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 4									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$0	\$0	\$0	1.86e+00	0.00e+00	1.86e+00	\$0	\$0	\$0
60 < 25	\$0	\$0	\$0	1.63e+00	0.00e+00	1.63e+00	\$0	\$0	\$0
25 < 15	\$682,590	\$2,474,968	\$13,662,757	4.65e-01	6.12e-03	4.58e-01	\$1,489,123	\$5,399,336	\$29,806,369
15 < 3	\$546,686	\$1,836,749	\$9,899,179	5.57e-01	4.37e-03	5.53e-01	\$988,527	\$3,321,245	\$17,899,885

Table B.19.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 4

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	4.65e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.65e+00	0.00e+00
60	2.79e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.79e+00	0.00e+00
30	1.39e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.39e+00	0.00e+00
25	1.16e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.16e+00	0.00e+00
15	6.97e-01	8.55e-05	3.92e-07	7.19e-05	5.96e-03	7.03e-01	6.12e-03
10	4.65e-01	1.12e-04	5.08e-07	9.38e-05	7.72e-03	4.72e-01	7.93e-03
3	1.39e-01	1.47e-04	6.72e-07	1.24e-04	1.02e-02	1.50e-01	1.05e-02
0.3	4.65e-02	1.87e-04	8.52e-07	1.57e-04	1.30e-02	5.97e-02	1.33e-02

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Table B.19.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 4

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	2.51e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft	# persons on land 9.29e+01 [10,000 persons per sq. km]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.33e+01	4.65e+00	2.79e+00	1.39e+00	1.16e+00	6.97e-01	4.65e-01	1.39e-01	4.65e-02
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.71e-01	2.23e-01	2.94e-01	3.74e-01
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.55e-05	1.12e-04	1.47e-04	1.87e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure	8.00e-06	person-rem per shipment							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	0.0	0.0	0.0	0.0	10.8	14.2	18.7	23.7

Table B.19.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 4

Soil volume (m ³)	0	0	0	0	0	1056	1379	1817	2308
Soil shipments	0	0	0	0	0	98	127	168	213
Soil person-rem	0	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.92e-07	5.08e-07	6.72e-07	8.52e-07
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	0	0	0	0	1711	2234	2944	3739
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.19e-05	9.38e-05	1.24e-04	1.57e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	0	0	0	0	98	127	168	213
Total distance (km)	0	0	0	0	0	156,800	203,200	268,800	340,800
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.96e-03	7.72e-03	1.02e-02	1.30e-02

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Table B.19.4.1			
Summary Costs for Uranium Fuel Fabrication Facility Case 4 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$2,474,968	\$184,000	\$2,658,968
3	\$4,257,717	\$238,000	\$4,495,717

Table B.19.4.2

**Summary Costs for Uranium Fuel Fabrication Facility
Case 4
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$13,662,757	\$184,000	\$13,846,757
3	\$23,507,936	\$238,000	\$23,745,936

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Table B.19.4.3			
Summary Costs for Uranium Fuel Fabrication Facility Case 4 Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$682,590	\$184,000	\$866,590
3	\$1,175,275	\$238,000	\$1,413,275

Table B.20.1

Incremental Impacts - Uranium Fuel Fabrication Facility Case 5 & 5A

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$733,788	\$1,407,563	\$5,630,005	7.43e-02	2.35e-03	7.20e-02	\$10,196,178	\$19,558,455	\$78,230,407
60 < 25	\$2,245,111	\$5,134,215	\$23,171,173	6.50e-02	1.02e-02	5.48e-02	\$40,982,003	\$93,719,389	\$422,963,995
25 < 15	\$1,299,888	\$2,647,909	\$11,060,644	1.86e-02	4.77e-03	1.38e-02	\$94,096,718	\$191,677,614	\$800,661,302
15 < 3	\$5,096,710	\$9,909,614	\$39,962,210	2.23e-02	1.70e-02	5.26e-03	\$969,269,152	\$1,884,565,322	\$7,599,831,722

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Table B.20.2							
Statistical Mortality - Uranium Fuel Fabrication Facility Case 5 & 5A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	3.75e-04	6.20e-07	3.15e-04	9.42e-03	1.96e-01	1.01e-02
60	1.11e-01	4.64e-04	7.64e-07	3.90e-04	1.16e-02	1.24e-01	1.25e-02
30	5.57e-02	7.77e-04	1.28e-06	6.52e-04	1.95e-02	7.66e-02	2.09e-02
25	4.65e-02	8.45e-04	1.39e-06	7.10e-04	2.12e-02	6.92e-02	2.27e-02
15	2.79e-02	1.02e-03	1.68e-06	8.59e-04	2.56e-02	5.54e-02	2.75e-02
10	1.86e-02	1.19e-03	1.96e-06	9.99e-04	2.97e-02	5.05e-02	3.19e-02
3	5.57e-03	1.66e-03	2.73e-06	1.39e-03	4.15e-02	5.01e-02	4.45e-02
0.3	1.86e-03	2.51e-03	4.12e-06	2.11e-03	6.27e-02	6.92e-02	6.73e-02

Table B.20.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 5 & 5A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	2.30e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	1.15e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	100,000	sq ft.		# persons on land		3.72e+00	[400 persons per sq. km]		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.27e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	7.50e-01	9.28e-01	1.55e+00	1.69e+00	2.05e+00	2.38e+00	3.31e+00	5.01e+00
Collective mortality	0	3.75e-04	4.64e-04	7.77e-04	8.45e-04	1.02e-03	1.19e-03	1.66e-03	2.51e-03

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.00e-06 person-rem per shipment								
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Table B.20.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 5 & 5A									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	44.2	54.9	92.4	100.6	121.9	141.9	198.1	300.1
Soil volume (m ³)	0	4188	5185	8676	9441	11426	13290	18518	28009
Soil shipments	0	155	191	320	348	421	489	682	1031
Soil person-rem	0	0.001	0.002	0.003	0.003	0.003	0.004	0.005	0.008
Collective mortality	0	6.20e-07	7.64e-07	1.28e-06	1.39e-06	1.68e-06	1.96e-06	2.73e-06	4.12e-06
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	7497	9280	15530	16899	20452	23789	33147	50137
Collective mortality	0	3.15e-04	3.90e-04	6.52e-04	7.10e-04	8.59e-04	9.99e-04	1.39e-03	2.11e-03
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	155	191	320	348	421	489	682	1031
Total distance (km)	0	248,000	305,600	512,000	556,800	673,600	782,400	1,091,200	1,649,600
Collective mortality	0	9.42e-03	1.16e-02	1.95e-02	2.12e-02	2.56e-02	2.97e-02	4.15e-02	6.27e-02

Table B.20.4.1

**Summary Costs for Uranium Fuel Fabrication Facility
Case 5 & 5A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$5,728,375	\$184,000	\$5,912,375
60	\$7,081,937	\$238,000	\$7,319,937
25	\$12,206,152	\$248,000	\$12,454,152
15	\$14,657,061	\$445,000	\$15,102,061
3	\$23,412,675	\$1,599,000	\$25,011,675

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Table B.20.4.2			
Summary Costs for Uranium Fuel Fabrication Facility Case 5 & 5A Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$23,476,516	\$184,000	\$23,660,516
60	\$29,052,522	\$238,000	\$29,290,522
25	\$52,213,695	\$248,000	\$52,461,695
15	\$63,077,339	\$445,000	\$63,522,339
3	\$101,885,549	\$1,599,000	\$103,484,549

Table B.21.1

Incremental Impacts - Uranium Fuel Fabrication Facility Case 5B

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$733,788	\$1,407,563	\$5,630,005	3.47e-01	2.35e-03	3.45e-01	\$2,126,045	\$4,078,210	\$16,312,128
60 < 25	\$2,245,111	\$5,134,215	\$23,171,173	3.04e-01	1.02e-02	2.94e-01	\$7,641,337	\$17,474,535	\$78,864,143
25 < 15	\$1,299,888	\$2,647,909	\$11,060,644	8.69e-02	4.77e-03	8.21e-02	\$15,831,405	\$32,249,009	\$134,708,132
15 < 3	\$5,096,710	\$9,909,614	\$39,962,210	1.04e-01	1.70e-02	8.72e-02	\$58,441,204	\$113,628,156	\$458,224,956

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Table B.21.2							
Statistical Mortality - Uranium Fuel Fabrication Facility Case 5B							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	8.69e-01	3.75e-04	6.20e-07	3.15e-04	9.42e-03	8.79e-01	1.01e-02
60	5.21e-01	4.64e-04	7.64e-07	3.90e-04	1.16e-02	5.34e-01	1.25e-02
30	2.61e-01	7.77e-04	1.28e-06	6.52e-04	1.95e-02	2.82e-01	2.09e-02
25	2.17e-01	8.45e-04	1.39e-06	7.10e-04	2.12e-02	2.40e-01	2.27e-02
15	1.30e-01	1.02e-03	1.68e-06	8.59e-04	2.56e-02	1.58e-01	2.75e-02
10	8.69e-02	1.19e-03	1.96e-06	9.99e-04	2.97e-02	1.19e-01	3.19e-02
3	2.61e-02	1.66e-03	2.73e-06	1.39e-03	4.15e-02	7.06e-02	4.45e-02
0.3	8.69e-03	2.51e-03	4.12e-06	2.11e-03	6.27e-02	7.60e-02	6.73e-02

**Table B.21.3 Impact and Cost Calculations - Uranium Fuel Fabrication
Facility Case 5B**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial		1600	km per		
Soil exposure rate	20	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use		3.74e-02			

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+0	2.50e+0	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	9.39e-03	1.87e-03	1.12e-03	5.61e-0	4.68e-0	2.81e-04	1.87e-04	5.61e-05	1.87e-05

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	100,000	sq ft		# persons exposed	465	[50,000 persons per			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.36e+00	8.69e-01	5.21e-01	2.61e-0	2.17e-0	1.30e-01	8.69e-02	2.61e-02	8.69e-03

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Table B.21.4.1			
Summary Costs for Uranium Fuel Fabrication Facility (\$M)			
Case 5B			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$5,728,375	\$184,000	\$5,912,375
60	\$7,081,937	\$238,000	\$7,319,937
25	\$12,206,152	\$248,000	\$12,454,152
15	\$14,657,061	\$445,000	\$15,102,061
3	\$23,412,675	\$1,599,000	\$25,011,675

Table B.21.4.2

**Summary Costs for Uranium Fuel Fabrication Facility (\$M)
Case 5B
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$23,476,516	\$184,000	\$23,660,516
60	\$29,052,522	\$238,000	\$29,290,522
25	\$52,213,695	\$248,000	\$52,461,695
15	\$63,077,339	\$445,000	\$63,522,339
3	\$101,885,549	\$1,599,000	\$103,484,549

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Table B.21.4.3			
Summary Costs for Uranium Fuel Fabrication Facility (SM) Case 5B Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,886,427	\$184,000	\$3,070,427
60	\$3,566,215	\$238,000	\$3,804,215
25	\$5,801,326	\$248,000	\$6,049,326
15	\$6,904,214	\$445,000	\$7,349,214
3	\$10,846,924	\$1,599,000	\$12,445,924

Table B.22.1

Incremental Impacts - Uranium Fuel Fabrication Facility Case 6 & 6A

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$697,422	\$2,387,284	\$12,943,390	7.43e-02	5.68e-03	6.86e-02	\$10,160,822	\$34,780,617	\$188,573,781
60 < 25	\$2,759,303	\$9,981,401	\$55,073,795	6.50e-02	2.45e-02	4.06e-02	\$68,029,347	\$246,086,871	\$1,357,819,198
25 < 15	\$1,479,382	\$4,846,720	\$25,878,560	1.86e-02	1.14e-02	7.22e-03	\$204,963,032	\$671,495,574	\$3,585,381,180
15 < 3	\$5,734,922	\$17,767,844	\$92,899,336	2.23e-02	4.08e-02	-1.85e-02	*	*	*

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Table B.22.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 6 & 6A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	3.39e-04	1.54e-06	2.85e-04	2.35e-02	2.10e-01	2.41e-02
60	1.11e-01	4.20e-04	1.91e-06	3.53e-04	2.90e-02	1.41e-01	2.98e-02
30	5.57e-02	7.03e-04	3.19e-06	5.90e-04	4.85e-02	1.06e-01	4.98e-02
25	4.65e-02	7.65e-04	3.48e-06	6.42e-04	5.28e-02	1.01e-01	5.42e-02
15	2.79e-02	9.26e-04	4.20e-06	7.77e-04	6.39e-02	9.35e-02	6.56e-02
10	1.86e-02	1.08e-03	4.89e-06	9.04e-04	7.44e-02	9.49e-02	7.63e-02
3	5.57e-03	1.50e-03	6.82e-06	1.26e-03	1.04e-01	1.12e-01	1.06e-01
0.3	1.86e-03	2.27e-03	1.03e-05	1.91e-03	1.57e-01	1.63e-01	1.61e-01

**Table B.22.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Case 6 & 6A**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	2.30e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	1.15e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area 100,000 sq ft # persons on land 3.72e+00 [400 persons per sq. km]

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.27e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-rem	0	6.78e-01	8.40e-01	1.41e+00	1.53e+00	1.85e+00	2.15e+00	3.00e+00	4.54e+00
Collective mortality	0	3.39e-04	4.20e-04	7.03e-04	7.65e-04	9.26e-04	1.08e-03	1.50e-03	2.27e-03

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure 8.00e-06 person-rem per shipment

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Table B.22.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 6 & 6A									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	44.2	54.9	92.4	100.6	121.9	141.9	198.1	300.1
Soil volume (m ³)	0	4188	5185	8676	9441	11426	13290	18518	28009
Soil shipments	0	386	477	798	869	1051	1223	1704	2576
Soil person-rem	0	0.003	0.004	0.006	0.007	0.008	0.010	0.014	0.021
Collective mortality	0	1.54e-06	1.91e-06	3.19e-06	3.48e-06	4.20e-06	4.89e-06	6.82e-06	1.03e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil person-h	0	6785	8399	14055	15294	18510	21530	29999	45375
Collective mortality	0	2.85e-04	3.53e-04	5.90e-04	6.42e-04	7.77e-04	9.04e-04	1.26e-03	1.91e-03
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	386	477	798	869	1051	1223	1704	2576
Total distance (km)	0	617,600	763,200	1,276,800	1,390,400	1,681,600	1,956,800	2,726,400	4,121,600
Collective mortality	0	2.35e-02	2.90e-02	4.85e-02	5.28e-02	6.39e-02	7.44e-02	1.04e-01	1.57e-01

Table B.22.4.1

**Summary Costs for Uranium Fuel Fabrication Facility
Case 6 & 6A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$9,812,101	\$184,000	\$9,996,101
60	\$12,145,385	\$238,000	\$12,383,385
25	\$22,116,786	\$248,000	\$22,364,786
15	\$26,766,506	\$445,000	\$27,211,506
3	\$43,380,350	\$1,599,000	\$44,979,350

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Table B.22.4.2			
Summary Costs for Uranium Fuel Fabrication Facility Case 6 & 6A Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$54,182,456	\$184,000	\$54,366,456
60	\$67,071,846	\$238,000	\$67,309,846
25	\$122,135,641	\$248,000	\$122,383,641
15	\$147,817,201	\$445,000	\$148,262,201
3	\$239,562,537	\$1,599,000	\$241,161,537

Table B.22.4.3

**Summary Costs for Uranium Fuel Fabrication Facility
Case 6 & 6A
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,709,219	\$184,000	\$2,893,219
60	\$3,352,641	\$238,000	\$3,590,641
25	\$6,101,944	\$248,000	\$6,349,944
15	\$7,384,325	\$445,000	\$7,829,325
3	\$11,965,248	\$1,599,000	\$13,564,248

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Table B.23.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 6B									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$697,422	\$2,387,284	\$12,943,390	3.47e-01	5.68e-03	3.42e-01	\$2,040,357	\$6,984,167	\$37,866,802
60 < 25	\$2,759,303	\$9,981,401	\$55,073,795	3.04e-01	2.45e-02	2.80e-01	\$9,869,143	\$35,700,278	\$196,981,348
25 < 15	\$1,479,382	\$4,846,720	\$25,878,560	8.69e-02	1.14e-02	7.55e-02	\$19,591,445	\$64,185,079	\$342,709,591
15 < 3	\$5,734,922	\$17,767,844	\$92,899,336	1.04e-01	4.08e-02	6.35e-02	\$90,332,737	\$279,867,431	\$1,463,289,434

Table B.23.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 6B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	8.69e-01	3.39e-04	1.54e-06	2.85e-04	2.35e-02	8.93e-01	2.41e-02
60	5.21e-01	4.20e-04	1.91e-06	3.53e-04	2.90e-02	5.51e-01	2.98e-02
30	2.61e-01	7.03e-04	3.19e-06	5.90e-04	4.85e-02	3.10e-01	4.98e-02
25	2.17e-01	7.65e-04	3.48e-06	6.42e-04	5.28e-02	2.71e-01	5.42e-02
15	1.30e-01	9.26e-04	4.20e-06	7.77e-04	6.39e-02	1.96e-01	6.56e-02
10	8.69e-02	1.08e-03	4.89e-06	9.04e-04	7.44e-02	1.63e-01	7.63e-02
3	2.61e-02	1.50e-03	6.82e-06	1.26e-03	1.04e-01	1.32e-01	1.06e-01
0.3	8.69e-03	2.27e-03	1.03e-05	1.91e-03	1.57e-01	1.69e-01	1.61e-01

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Table B.23.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 6B

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	20	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use		3.74e-02			
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Alternative Land Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	9.39e-03	1.87e-03	1.12e-03	5.61e-04	4.68e-04	2.81e-04	1.87e-04	5.61e-05	1.87e-05
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	100,000 sq ft		# persons exposed		465	[50,000 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	4.36e+00	8.69e-01	5.21e-01	2.61e-01	2.17e-01	1.30e-01	8.69e-02	2.61e-02	8.69e-03

Table B.23.4.1

**Summary Costs for Uranium Fuel Fabrication Facility (SM)
Case 6B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$9,812,101	\$184,000	\$9,996,101
60	\$12,145,385	\$238,000	\$12,383,385
25	\$22,116,786	\$248,000	\$22,364,786
15	\$26,766,506	\$445,000	\$27,211,506
3	\$43,380,350	\$1,599,000	\$44,979,350

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Table B.23.4.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M)			
Case 6B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$54,182,456	\$184,000	\$54,366,456
60	\$67,071,846	\$238,000	\$67,309,846
25	\$122,135,641	\$248,000	\$122,383,641
15	\$147,817,201	\$445,000	\$148,262,201
3	\$239,562,537	\$1,599,000	\$241,161,537

Table B.23.4.3

**Summary Costs for Uranium Fuel Fabrication
Facility (\$M)
Case 6B**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,709,219	\$184,000	\$2,893,219
60	\$3,352,641	\$238,000	\$3,590,641
25	\$6,101,944	\$248,000	\$6,349,944
15	\$7,384,325	\$445,000	\$7,829,325
3	\$11,965,248	\$1,599,000	\$13,564,248

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Table B.24.1									
Incremental Impacts - Uranium Fuel Fabrication Facility Case 7									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit		
	Disposal @ \$10/ft ³	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$10/ft ³	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$0	\$0	\$0	1.86e+00	0.00e+00	1.86e+00	\$0	\$0	\$0
60 < 25	\$0	\$0	\$0	1.63e+00	0.00e+00	1.63e+00	\$0	\$0	\$0
25 < 15	\$32,547	\$114,035	\$626,453	4.65e-01	3.11e-04	4.64e-01	\$70,116	\$245,665	\$1,349,565
15 < 3	\$10,765,104	\$9,420,507	\$51,778,857	5.57e-01	2.30e-02	5.34e-01	\$20,143,216	\$17,627,263	\$96,886,454

Table B.24.2

Statistical Mortality - Uranium Fuel Fabrication Facility Case 7

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	4.65e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.65e+00	0.00e+00
60	2.79e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.79e+00	0.00e+00
30	1.39e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.39e+00	0.00e+00
25	1.16e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.16e+00	0.00e+00
15	6.97e-01	3.92e-06	2.00e-08	3.29e-06	3.04e-04	6.97e-01	3.11e-04
10	4.65e-01	5.12e-06	2.40e-08	4.30e-06	3.65e-04	4.65e-01	3.74e-04
3	1.39e-01	3.28e-04	1.49e-06	2.75e-04	2.27e-02	1.63e-01	2.33e-02
0.3	4.65e-02	1.11e-03	5.05e-06	9.33e-04	7.67e-02	1.25e-01	7.88e-02

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Table B.24.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Case 7

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	5.02e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	2.51e-01	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	100,000	sq ft	# persons on land 9.29e+01 [10,000 persons per sq. km]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.33e+01	4.65e+00	2.79e+00	1.39e+00	1.16e+00	6.97e-01	4.65e-01	1.39e-01	4.65e-02

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	6.78e-01	8.40e-01	1.41e+00	1.53e+00	1.85e+00	2.15e+00	3.00e+00	4.54e+00
Collective mortality	0	3.39e-04	4.20e-04	7.03e-04	7.65e-04	9.26e-04	1.08e-03	1.50e-03	2.27e-03

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.00e-06	person-rem per shipment							
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**Table B.24.3 Impact and Cost Calculations - Uranium Fuel Fabrication
Facility Case 7**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	0.3
Soil depth removed (cm)	0	44.2	54.9	92.4	100.6	121.9	141.9	198.1	300.1
Soil volume (m ³)	0	4188	5185	8676	9441	11426	13290	18518	28009
Soil shipments	0	386	477	798	869	1051	1223	1704	2576
Soil person-rem	0	0.003	0.004	0.006	0.007	0.008	0.010	0.014	0.021
Collective mortality	0	1.54e-06	1.91e-06	3.19e-06	3.48e-06	4.20e-06	4.89e-06	6.82e-06	1.03e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	6785	8399	14055	15294	18510	21530	29999	45375
Collective mortality	0	2.85e-04	3.53e-04	5.90e-04	6.42e-04	7.77e-04	9.04e-04	1.26e-03	1.91e-03
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	386	477	798	869	1051	1223	1704	2576
Total distance (km)	0	617,600	763,200	1,276,800	1,390,400	1,681,600	1,956,800	2,726,400	4,121,600
Collective mortality	0	2.35e-02	2.90e-02	4.85e-02	5.28e-02	6.39e-02	7.44e-02	1.04e-01	1.57e-01

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Table B.24.4.1			
Summary Costs for Uranium Fuel Fabrication Facility Case 7 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$114,035	\$184,000	\$298,035
3	\$9,480,542	\$238,000	\$9,718,542

Table B.24.4.2

**Summary Costs for Uranium Fuel Fabrication Facility Case 7
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$626,453	\$184,000	\$810,453
3	\$52,351,310	\$238,000	\$52,589,310

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Table B.24.4.3			
Summary Costs for Uranium Fuel Fabrication Facility Case 7 Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$184,000	\$184,000
60	\$0	\$184,000	\$184,000
25	\$0	\$184,000	\$184,000
15	\$32,547	\$184,000	\$216,547
3	\$10,743,650	\$238,000	\$10,981,650

Table B.25.1

Incremental Impacts - Sealed Source Case 1

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$8,357.42	\$35,380.70	2.32e-05	1.05e-06	2.21e-05	\$377,973,988	\$1,600,134,185
60 < 25	\$11,477.26	\$44,304.08	3.50e-05	1.06e-04	-7.05e-05	*	*
25 < 15	\$7,961.71	\$24,005.17	9.11e-06	6.23e-07	8.49e-06	\$938,276,567	\$2,828,974,882
15 < 3	\$37,406.13	\$128,205.09	1.10e-05	1.08e-04	-9.68e-05	*	*

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Table B.25.2							
Statistical Mortality - Sealed Source Case 1							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	8.91e-05	1.39e-06	4.35e-05	1.17e-06	6.08e-05	1.96e-04	1.07e-04
60	6.59e-05	1.96e-06	4.35e-05	1.65e-06	6.08e-05	1.74e-04	1.08e-04
30	4.56e-05	2.51e-06	8.70e-05	2.11e-06	1.22e-04	2.59e-04	2.13e-04
25	3.09e-05	2.66e-06	8.70e-05	2.23e-06	1.22e-04	2.44e-04	2.13e-04
15	2.17e-05	2.99e-06	8.70e-05	2.51e-06	1.22e-04	2.36e-04	2.14e-04
10	1.68e-05	3.31e-06	8.70e-05	2.78e-06	1.22e-04	2.32e-04	2.15e-04
3	1.07e-05	4.91e-06	1.31e-04	4.13e-06	1.82e-04	3.33e-04	3.22e-04
1	4.03e-06	8.71e-06	1.74e-04	7.32e-06	2.43e-04	4.37e-04	4.33e-04

Table B.25.3 Impact and Cost Calculations - Sealed Source Case 1

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		

REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	8.31e-04	4.79e-04	3.55e-04	2.46e-04	1.66e-04	1.17e-04	9.06e-05	5.78e-05	2.17e-05

[Baseline soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons on land	1.86e-01 [400 persons per km ²]					
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	1.54e-04	8.91e-05	6.59e-05	4.56e-05	3.09e-05	2.17e-05	1.68e-05	1.07e-05	4.03e-06

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.003	0.004	0.005	0.005	0.006	0.007	0.010	0.017
Collective mortality	0	1.39e-06	1.96e-06	2.51e-06	2.66e-06	2.99e-06	3.31e-06	4.91e-06	8.71e-06

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.70e-02	person-rem per							
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Table B.25.3 Impact and Cost Calculations - Sealed Source Case 1

Table B.25.3 Impact and Cost Calculations - Sealed Source Case 1									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	3.3	4.6	5.9	6.2	7.0	7.8	11.5	20.5
Soil volume (m ³)	0	16	22	28	30	33	37	55	97
Soil shipments	0	1	1	2	2	2	2	3	4
Soil person-rem	0	0.087	0.087	0.174	0.174	0.174	0.174	0.261	0.348
Collective mortality	0	4.35e-05	4.35e-05	8.70e-05	8.70e-05	8.70e-05	8.70e-05	1.31e-04	1.74e-04
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-h	0	28	39	50	53	60	66	98	174
Collective mortality	0	1.17e-06	1.65e-06	2.11e-06	2.23e-06	2.51e-06	2.78e-06	4.13e-06	7.32e-06
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil shipments	0	1	1	2	2	2	2	3	4
Total distance (km)	0	1,600	1,600	3,200	3,200	3,200	3,200	4,800	6,400
Collective mortality	0	6.08e-05	6.08e-05	1.22e-04	1.22e-04	1.22e-04	1.22e-04	1.82e-04	2.43e-04

Table B.25.4.1

**Summary Costs for Sealed Source
Case 1
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$55,778.25	\$32,000.00	\$87,778.25
60	\$64,135.67	\$32,000.00	\$96,135.67
25	\$75,612.92	\$32,000.00	\$107,612.92
15	\$80,574.64	\$35,000.00	\$115,574.64
3	\$109,980.77	\$43,000.00	\$152,980.77

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Table B.24.4.2			
Summary Costs for Sealed Source Case 1 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$121,646.12	\$32,000.00	\$153,646.12
60	\$157,026.83	\$32,000.00	\$189,026.83
25	\$201,330.91	\$32,000.00	\$233,330.91
15	\$222,336.08	\$35,000.00	\$257,336.08
3	\$342,541.16	\$43,000.00	\$385,541.16

Table B.26.1

Incremental Impacts - Sealed Source Case 1A

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/R3	Disposal @ \$350/R3				Disposal @ \$50/R3	Disposal @ \$350/R3
100 < 60	\$8,357	\$35,381	8.15e-05	1.05e-06	8.05e-05	\$103,866,568	\$439,713,978
60 < 25	\$11,477	\$44,304	1.23e-04	1.06e-04	1.77e-05	\$646,786,874	\$2,496,702,487
25 < 15	\$7,962	\$24,005	3.21e-05	6.23e-07	3.14e-05	\$253,281,129	\$763,661,779
15 < 3	\$37,406	\$128,205	3.87e-05	1.08e-04	-6.91e-05	*	*

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Table B.26.2							
Statistical Mortality - Sealed Source Case 1A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.13e-04	1.39e-06	4.35e-05	1.17e-06	6.08e-05	4.20e-04	1.07e-04
60	2.32e-04	1.96e-06	4.35e-05	1.65e-06	6.08e-05	3.40e-04	1.08e-04
30	1.61e-04	2.51e-06	8.70e-05	2.11e-06	1.22e-04	3.74e-04	2.13e-04
25	1.09e-04	2.66e-06	8.70e-05	2.23e-06	1.22e-04	3.22e-04	2.13e-04
15	7.65e-05	2.99e-06	8.70e-05	2.51e-06	1.22e-04	2.91e-04	2.14e-04
10	5.92e-05	3.31e-06	8.70e-05	2.78e-06	1.22e-04	2.74e-04	2.15e-04
3	3.78e-05	4.91e-06	1.31e-04	4.13e-06	1.82e-04	3.60e-04	3.22e-04
1	1.42e-05	8.71e-06	1.74e-04	7.32e-06	2.43e-04	4.47e-04	4.33e-04

Table B.26.3 Impact and Cost Calculations - Sealed Source Case 1A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			

REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons exposed 4.65e+00 [10,000 persons per km ²]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	5.44e-04	3.13e-04	2.32e-04	1.61e-04	1.09e-04	7.65e-05	5.92e-05	3.78e-05	1.42e-05

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Table B.26.4.1			
Summary Costs for Sealed Source (SM)			
Case 1A			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$55,778	\$32,000	\$87,778
60	\$64,136	\$32,000	\$96,136
25	\$75,613	\$32,000	\$107,613
15	\$80,575	\$35,000	\$115,575
3	\$109,981	\$43,000	\$152,981

Table B.26.4.2

**Summary Costs for Sealed Source (\$M)
Case 1A
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$121,646	\$32,000	\$153,646
60	\$157,027	\$32,000	\$189,027
25	\$201,331	\$32,000	\$233,331
15	\$222,336	\$35,000	\$257,336
3	\$342,541	\$43,000	\$385,541

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Table B.27.1							
Incremental Impacts - Sealed Source Case 1B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$8,357	\$35,381	4.08e-04	1.05e-06	4.07e-04	\$20,558,662	\$87,034,080
60 < 25	\$11,477	\$44,304	6.17e-04	1.06e-04	5.11e-04	\$22,459,163	\$86,696,020
25 < 15	\$7,962	\$24,005	1.60e-04	6.23e-07	1.60e-04	\$49,865,025	\$150,346,825
15 < 3	\$37,406	\$128,205	1.94e-04	1.08e-04	8.59e-05	\$435,616,155	\$1,493,022,737

Table B.27.2

Statistical Mortality - Sealed Source Case 1B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.57e-03	1.39e-06	4.35e-05	1.17e-06	6.08e-05	1.67e-03	1.07e-04
60	1.16e-03	1.96e-06	4.35e-05	1.65e-06	6.08e-05	1.27e-03	1.08e-04
30	8.03e-04	2.51e-06	8.70e-05	2.11e-06	1.22e-04	1.02e-03	2.13e-04
25	5.43e-04	2.66e-06	8.70e-05	2.23e-06	1.22e-04	7.56e-04	2.13e-04
15	3.83e-04	2.99e-06	8.70e-05	2.51e-06	1.22e-04	5.97e-04	2.14e-04
10	2.96e-04	3.31e-06	8.70e-05	2.78e-06	1.22e-04	5.11e-04	2.15e-04
3	1.89e-04	4.91e-06	1.31e-04	4.13e-06	1.82e-04	5.11e-04	3.22e-04
1	7.09e-05	8.71e-06	1.74e-04	7.32e-06	2.43e-04	5.04e-04	4.33e-04

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Table B.27.3 Impact and Cost Calculations - Sealed Source Case 1B									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			
REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	5,000	sq ft	# persons exposed 2.32e+01 [50,000 persons per km ²]						
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	2.72e-03	1.57e-03	1.16e-03	8.03e-04	5.43e-04	3.83e-04	2.96e-04	1.89e-04	7.09e-05

Table B.27.4.1

**Summary Costs for Sealed Source (\$M)
Case 1B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$55,778	\$32,000	\$87,778
60	\$64,136	\$32,000	\$96,136
25	\$75,613	\$32,000	\$107,613
15	\$80,575	\$35,000	\$115,575
3	\$109,981	\$43,000	\$152,981

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Table B.27.4.2			
Summary Costs for Sealed Source (\$M)			
Case 1B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$121,646	\$32,000	\$153,646
60	\$157,027	\$32,000	\$189,027
25	\$201,331	\$32,000	\$233,331
15	\$222,336	\$35,000	\$257,336
3	\$342,541	\$43,000	\$385,541

Table B.28.1

Incremental Impacts - Sealed Source Case 2							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$15,486	\$83,044	2.32e-05	1.05e-04	-8.21e-05	*	*
60 < 25	\$17,202	\$99,269	3.50e-05	1.15e-06	3.39e-05	*	*
25 < 15	\$12,732	\$52,841	9.11e-06	1.05e-04	-9.58e-05	*	*
15 < 3	\$58,232	\$285,229	1.10e-05	2.12e-04	-2.01e-04	*	*

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Table B.28.2							
Statistical Mortality - Sealed Source Case 2							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	8.91e-05	1.26e-06	8.70e-05	1.06e-06	1.22e-04	3.00e-04	2.11e-04
60	6.59e-05	1.78e-06	1.31e-04	1.49e-06	1.82e-04	3.82e-04	3.16e-04
30	4.56e-05	2.28e-06	1.31e-04	1.91e-06	1.82e-04	3.63e-04	3.17e-04
25	3.09e-05	2.40e-06	1.31e-04	2.02e-06	1.82e-04	3.48e-04	3.17e-04
15	2.17e-05	2.71e-06	1.74e-04	2.28e-06	2.43e-04	4.44e-04	4.22e-04
10	1.68e-05	2.99e-06	1.74e-04	2.52e-06	2.43e-04	4.40e-04	4.23e-04
3	1.07e-05	4.45e-06	2.61e-04	3.73e-06	3.65e-04	6.45e-04	6.34e-04
1	4.03e-06	7.88e-06	3.92e-04	6.62e-06	5.47e-04	9.57e-04	9.53e-04

Table B.28.3 Impact and Cost Calculations - Sealed Source Case 2

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	1000	y		Burial		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+0
Cumulative risk	8.31e-04	4.79e-04	3.55e-04	2.46e-04	1.66e-04	1.17e-04	9.06e-05	5.78e-05	2.17e-05

[Baseline soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons on land	1.86e-01	[400 persons per km ²]				
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.54e-04	8.91e-05	6.59e-05	4.56e-05	3.09e-05	2.17e-05	1.68e-05	1.07e-05	4.03e-06

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.003	0.004	0.005	0.005	0.005	0.006	0.009	0.016
Collective mortality	0	1.26e-06	1.78e-06	2.28e-06	2.40e-06	2.71e-06	2.99e-06	4.45e-06	7.88e-06

III. Transporting Waste - Mortality for Radiation Exposure

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Table B.28.3 Impact and Cost Calculations - Sealed Source Case 2									
Soil shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	3.3	4.6	5.9	6.2	7.0	7.8	11.5	20.5
Soil volume (m ³)	0	16	22	28	30	33	37	55	97
Soil shipments	0	2	3	3	3	4	4	6	9
Soil person-rem	0	0.174	0.261	0.261	0.261	0.348	0.348	0.522	0.783
Collective mortality	0	8.70e-05	1.31e-04	1.31e-04	1.31e-04	1.74e-04	1.74e-04	2.61e-04	3.92e-04
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	25	36	46	48	54	60	89	158
Collective mortality	0	1.06e-06	1.49e-06	1.91e-06	2.02e-06	2.28e-06	2.52e-06	3.73e-06	6.62e-06
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	2	3	3	3	4	4	6	9
Total distance (km)	0	3,200	4,800	4,800	4,800	6,400	6,400	9,600	14,400
Collective mortality	0	1.22e-04	1.82e-04	1.82e-04	1.82e-04	2.43e-04	2.43e-04	3.65e-04	5.47e-04

Table B.28.4.1

**Summary Costs for Sealed Source
Case 2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$37,167	\$32,000	\$69,167
60	\$52,653	\$32,000	\$84,653
25	\$69,856	\$32,000	\$101,856
15	\$79,588	\$35,000	\$114,588
3	\$129,820	\$43,000	\$172,820

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Table B.28.4.2			
Summary Costs for Sealed Source Case 2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$201,837	\$32,000	\$233,837
60	\$284,881	\$32,000	\$316,881
25	\$384,151	\$32,000	\$416,151
15	\$433,992	\$35,000	\$468,992
3	\$711,221	\$43,000	\$754,221

Table B.28.4.3

**Summary Costs for Sealed Source
Case 2
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$13,242	\$32,000	\$45,242
60	\$16,992	\$32,000	\$48,992
25	\$21,548	\$32,000	\$53,548
15	\$23,775	\$35,000	\$58,775
3	\$36,376	\$43,000	\$79,376

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Table B.29.1							
Incremental Impacts - Sealed Source Case 2A							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$15,486	\$83,044	8.15e-05	1.05e-04	-2.37e-05	*	*
60 < 25	\$17,202	\$99,269	1.23e-04	1.15e-06	1.22e-04	*	*
25 < 15	\$12,732	\$52,841	3.21e-05	1.05e-04	-7.28e-05	*	*
15 < 3	\$58,232	\$285,229	3.87e-05	2.12e-04	-1.73e-04	*	*

Table B.29.2

Statistical Mortality - Sealed Source Case 2A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.13e-04	1.26e-06	8.70e-05	1.06e-06	1.22e-04	5.24e-04	2.11e-04
60	2.32e-04	1.78e-06	1.31e-04	1.49e-06	1.82e-04	5.48e-04	3.16e-04
30	1.61e-04	2.28e-06	1.31e-04	1.91e-06	1.82e-04	4.78e-04	3.17e-04
25	1.09e-04	2.40e-06	1.31e-04	2.02e-06	1.82e-04	4.26e-04	3.17e-04
15	7.65e-05	2.71e-06	1.74e-04	2.28e-06	2.43e-04	4.99e-04	4.22e-04
10	5.92e-05	2.99e-06	1.74e-04	2.52e-06	2.43e-04	4.82e-04	4.23e-04
3	3.78e-05	4.45e-06	2.61e-04	3.73e-06	3.65e-04	6.72e-04	6.34e-04
1	1.42e-05	7.88e-06	3.92e-04	6.62e-06	5.47e-04	9.67e-04	9.53e-04

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Table B.29.3 Impact and Cost Calculations - Sealed Source Case 2A

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			
REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	5,000	sq ft	# persons exposed 4.65e+00 [10,000 persons per km ²]						
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	5.44e-04	3.13e-04	2.32e-04	1.61e-04	1.09e-04	7.65e-05	5.92e-05	3.78e-05	1.42e-05

Table B.29.3 Impact and Cost Calculations - Sealed Source Case 2A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			

REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons exposed 4.65e+00 [10,000 persons per km ²]						
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	5.44e-04	3.13e-04	2.32e-04	1.61e-04	1.09e-04	7.65e-05	5.92e-05	3.78e-05	1.42e-05

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Table B.29.4.1			
Summary Costs for Sealed Source (SM)			
Case 2A			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$37,167	\$32,000	\$69,167
60	\$52,653	\$32,000	\$84,653
25	\$69,856	\$32,000	\$101,856
15	\$79,588	\$35,000	\$114,588
3	\$129,820	\$43,000	\$172,820

Table B.29.4.2

**Summary Costs for Sealed Source (\$M)
Case 2A
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$201,837	\$32,000	\$233,837
60	\$284,881	\$32,000	\$316,881
25	\$384,151	\$32,000	\$416,151
15	\$433,992	\$35,000	\$468,992
3	\$711,221	\$43,000	\$754,221

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Table B.30.1							
Incremental Impacts - Sealed Source Case 2B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$15,486	\$83,044	4.08e-04	1.05e-04	3.02e-04	\$51,225,186	\$274,694,635
60 < 25	\$17,202	\$99,269	6.17e-04	1.15e-06	6.15e-04	\$27,950,994	\$161,296,010
25 < 15	\$12,732	\$52,841	1.60e-04	1.05e-04	5.54e-05	\$229,723,959	\$953,386,574
15 < 3	\$58,232	\$285,229	1.94e-04	2.12e-04	-1.81e-05	*	*

Table B.30.2

Statistical Mortality - Sealed Source Case 2B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.57e-03	1.26e-06	8.70e-05	1.06e-06	1.22e-04	1.78e-03	2.11e-04
60	1.16e-03	1.78e-06	1.31e-04	1.49e-06	1.82e-04	1.48e-03	3.16e-04
30	8.03e-04	2.28e-06	1.31e-04	1.91e-06	1.82e-04	1.12e-03	3.17e-04
25	5.43e-04	2.40e-06	1.31e-04	2.02e-06	1.82e-04	8.60e-04	3.17e-04
15	3.83e-04	2.71e-06	1.74e-04	2.28e-06	2.43e-04	8.05e-04	4.22e-04
10	2.96e-04	2.99e-06	1.74e-04	2.52e-06	2.43e-04	7.19e-04	4.23e-04
3	1.89e-04	4.45e-06	2.61e-04	3.73e-06	3.65e-04	8.23e-04	6.34e-04
1	7.09e-05	7.88e-06	3.92e-04	6.62e-06	5.47e-04	1.02e-03	9.53e-04

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Table B.30.3 Impact and Cost Calculations - Sealed Source Case 2B									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site distance		1600	km per shipment		
Disposal	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			
REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use									
Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.59e+02	1.08e+02	7.73e+01	4.89e+01	2.80e+01	1.52e+01	8.45e+00	2.81e+00	1.03e+00
Cumulative risk	1.17e-04	6.75e-05	4.99e-05	3.46e-05	2.34e-05	1.65e-05	1.27e-05	8.13e-06	3.05e-06
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	5,000	sq ft	# persons exposed 2.32e+01 [50,000 persons per km ²]						
Residual Dose	None	100	60	30	25	15	10	3	1
Collective	2.72e-03	1.57e-03	1.16e-03	8.03e-04	5.43e-04	3.83e-04	2.96e-04	1.89e-04	7.09e-05

Table B.30.4.1

**Summary Costs for Sealed Source (\$M)
Case 2B
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$37,167	\$32,000	\$69,167
60	\$52,653	\$32,000	\$84,653
25	\$69,856	\$32,000	\$101,856
15	\$79,588	\$35,000	\$114,588
3	\$129,820	\$43,000	\$172,820

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Table B.30.4.2			
Summary Costs for Sealed Source (\$M)			
Case 2B			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$201,837	\$32,000	\$233,837
60	\$284,881	\$32,000	\$316,881
25	\$384,151	\$32,000	\$416,151
15	\$433,992	\$35,000	\$468,992
3	\$711,221	\$43,000	\$754,221

Table B.31.1

Incremental Impacts - Sealed Source Case 3

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$23,153	\$93,734	4.77e-05	1.07e-04	-5.93e-05	*	*
60 < 25	\$80,605	\$332,670	3.43e-05	2.18e-04	-1.84e-04	*	*
25 < 15	\$53,827	\$213,888	9.09e-06	1.11e-04	-1.01e-04	*	*
15 < 3	\$171,247	\$677,678	1.07e-05	5.41e-04	-5.30e-04	*	*

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Table B.31.2							
Statistical Mortality - Sealed Source Case 3							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.04e-04	1.88e-06	4.35e-05	1.58e-06	6.08e-05	2.12e-04	1.08e-04
60	5.65e-05	3.37e-06	8.70e-05	2.83e-06	1.22e-04	2.71e-04	2.15e-04
30	3.10e-05	7.49e-06	1.74e-04	6.29e-06	2.43e-04	4.62e-04	4.31e-04
25	2.22e-05	8.69e-06	1.74e-04	7.30e-06	2.43e-04	4.55e-04	4.33e-04
15	1.31e-05	1.21e-05	2.18e-04	1.01e-05	3.04e-04	5.57e-04	5.44e-04
10	8.30e-06	1.48e-05	3.05e-04	1.24e-05	4.26e-04	7.66e-04	7.57e-04
3	2.41e-06	2.28e-05	4.35e-04	1.91e-05	6.08e-04	1.09e-03	1.08e-03
1	7.55e-07	3.81e-05	6.96e-04	3.20e-05	9.73e-04	1.74e-03	1.74e-03

Table B.31.3 Impact and Cost Calculations - Sealed Source Case 3

GENERIC ASSUMPTIONS:									
Fatal cancer risk	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m^3 per		Fatal		3.8e-08	per km		
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	2.19e-03	5.61e-04	3.04e-04	1.67e-04	1.20e-04	7.07e-05	4.47e-05	1.30e-05	4.07e-06
[Humbolt soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000									
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	5,000	sq ft	# persons on land		1.86e-01 [400 persons per km2]				
Residual Dose	None	100	60	30	25	15	10	3	1
Collective	4.07e-04	1.04e-04	5.65e-05	3.10e-05	2.22e-05	1.31e-05	8.30e-06	2.41e-06	7.55e-07
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.004	0.007	0.015	0.017	0.024	0.030	0.046	0.076
Collective	0	1.88e-06	3.37e-06	7.49e-06	8.69e-06	1.21e-05	1.48e-05	2.28e-05	3.81e-05
III. Transporting Waste - Mortality for Radiation Exposure									

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Table B.31.3 Impact and Cost Calculations - Sealed Source Case 3									
Soil shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose	None	100	60	30	25	15	10	3	1
Soil depth	0	4.4	8.0	17.9	20.8	28.9	35.3	54.5	91.3
Soil volume	0	21	38	84	97	135	165	254	426
Soil shipments	0	1	2	4	4	5	7	10	16
Soil person-rem	0	0.087	0.174	0.348	0.348	0.435	0.609	0.870	1.392
Collective	0	4.35e-05	8.70e-05	1.74e-04	1.74e-04	2.18e-04	3.05e-04	4.35e-04	6.96e-04
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose	None	100	60	30	25	15	10	3	1
Soil person-h	0	38	67	150	174	241	295	455	763
Collective	0	1.58e-06	2.83e-06	6.29e-06	7.30e-06	1.01e-05	1.24e-05	1.91e-05	3.20e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose	None	100	60	30	25	15	10	3	1
Soil shipments	0	1	2	4	4	5	7	10	16
Total distance	0	1,600	3,200	6,400	6,400	8,000	11,200	16,000	25,600
Collective	0	6.08e-05	1.22e-04	2.43e-04	2.43e-04	3.04e-04	4.26e-04	6.08e-04	9.73e-04

Table B.31.4.1

**Summary Costs for Sealed Source
Case 3
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$62,873.19	\$32,000.00	\$94,873.19
60	\$86,026.45	\$32,000.00	\$118,026.45
25	\$166,631.67	\$32,000.00	\$198,631.67
15	\$217,458.36	\$35,000.00	\$252,458.36
3	\$380,705.83	\$43,000.00	\$423,705.83

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Table B.31.4.2			
Summary Costs for Sealed Source Case 3 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$151,682.20	\$32,000.00	\$183,682.20
60	\$245,416.06	\$32,000.00	\$277,416.06
25	\$578,085.65	\$32,000.00	\$610,085.65
15	\$788,973.57	\$35,000.00	\$823,973.57
3	\$1,458,652.05	\$43,000.00	\$1,501,652.05

Table B.31.4.3

**Summary Costs for Sealed Source
Case 3
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$51,962.80	\$32,000.00	\$83,962.80
60	\$62,914.65	\$32,000.00	\$94,914.65
25	\$102,026.98	\$32,000.00	\$134,026.98
15	\$126,863.37	\$35,000.00	\$161,863.37
3	\$209,545.26	\$43,000.00	\$252,545.26

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Table B.32.1							
Incremental Impacts - Sealed Source Case 3A							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$23,153	\$93,734	1.68e-04	1.07e-04	6.09e-05	\$380,170,214	\$1,539,084,400
60 < 25	\$80,605	\$332,670	1.21e-04	2.18e-04	-9.76e-05	*	*
25 < 15	\$53,827	\$213,888	3.20e-05	1.11e-04	-7.85e-05	*	*
15 < 3	\$171,247	\$677,678	3.77e-05	5.41e-04	-5.03e-04	*	*

Table B.32.2

Statistical Mortality - Sealed Source Case 3A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	(Decon & Transportation)
100	3.67e-04	1.88e-06	4.35e-05	1.58e-06	6.08e-05	4.75e-04	1.08e-04
60	1.99e-04	3.37e-06	8.70e-05	2.83e-06	1.22e-04	4.14e-04	2.15e-04
30	1.09e-04	7.49e-06	1.74e-04	6.29e-06	2.43e-04	5.40e-04	4.31e-04
25	7.82e-05	8.69e-06	1.74e-04	7.30e-06	2.43e-04	5.11e-04	4.33e-04
15	4.62e-05	1.21e-05	2.18e-04	1.01e-05	3.04e-04	5.90e-04	5.44e-04
10	2.92e-05	1.48e-05	3.05e-04	1.24e-05	4.26e-04	7.86e-04	7.57e-04
3	8.49e-06	2.28e-05	4.35e-04	1.91e-05	6.08e-04	1.09e-03	1.08e-03
1	2.66e-06	3.81e-05	6.96e-04	3.20e-05	9.73e-04	1.74e-03	1.74e-03

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Table B.32.3 Impact and Cost Calculations - Sealed Source Case 3A									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			
REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	5,000	sq ft	# persons exposed 4.65e+00 [10,000 persons per km ²]						

Table B.32.4.1

**Summary Costs for Sealed Source
(SM) Case 3A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$62,873	\$32,000	\$94,873
60	\$86,026	\$32,000	\$118,026
25	\$166,632	\$32,000	\$198,632
15	\$217,458	\$35,000	\$252,458
3	\$380,706	\$43,000	\$423,706

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Table B.32.4.2			
Summary Costs for Sealed Source (\$M)			
Case 3A			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$151,682	\$32,000	\$183,682
60	\$245,416	\$32,000	\$277,416
25	\$578,086	\$32,000	\$610,086
15	\$788,974	\$35,000	\$823,974
3	\$1,458,652	\$43,000	\$1,501,652

Table B.33.1

Incremental Impacts - Sealed Source Case 3B							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$23,153	\$93,734	8.40e-04	1.07e-04	7.33e-04	\$31,600,656	\$127,932,370
60 < 25	\$80,605	\$332,670	6.04e-04	2.18e-04	3.86e-04	\$209,052,759	\$862,791,406
25 < 15	\$53,827	\$213,888	1.60e-04	1.11e-04	4.94e-05	\$1,089,346,718	\$4,328,673,023
15 < 3	\$171,247	\$677,678	1.89e-04	5.41e-04	-3.53e-04	*	*

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Table B.33.2

Statistical Mortality - Sealed Source Case 3B

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.83e-03	1.88e-06	4.35e-05	1.58e-06	6.08e-05	1.94e-03	1.08e-04
60	9.95e-04	3.37e-06	8.70e-05	2.83e-06	1.22e-04	1.21e-03	2.15e-04
30	5.45e-04	7.49e-06	1.74e-04	6.29e-06	2.43e-04	9.76e-04	4.31e-04
25	3.91e-04	8.69e-06	1.74e-04	7.30e-06	2.43e-04	8.24e-04	4.33e-04
15	2.31e-04	1.21e-05	2.18e-04	1.01e-05	3.04e-04	7.75e-04	5.44e-04
10	1.46e-04	1.48e-05	3.05e-04	1.24e-05	4.26e-04	9.03e-04	7.57e-04
3	4.24e-05	2.28e-05	4.35e-04	1.91e-05	6.08e-04	1.13e-03	1.08e-03
1	1.33e-05	3.81e-05	6.96e-04	3.20e-05	9.73e-04	1.75e-03	1.74e-03

Table B.33.3 Impact and Cost Calculations - Sealed Source Case 3B

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			

REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

L. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons exposed	2.32e+01 [50,000 persons per km ²]
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Table B.33.4.1			
Summary Costs for Sealed Source (\$M)			
Case 3B			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$62,873	\$32,000	\$94,873
60	\$86,026	\$32,000	\$118,026
25	\$166,632	\$32,000	\$198,632
15	\$217,458	\$35,000	\$252,458
3	\$380,706	\$43,000	\$423,706

Table B.33.4.2

**Summary Costs for Sealed Source (\$M)
Case 3B
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$151,682	\$32,000	\$183,682
60	\$245,416	\$32,000	\$277,416
25	\$578,086	\$32,000	\$610,086
15	\$788,974	\$35,000	\$823,974
3	\$1,458,652	\$43,000	\$1,501,652

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Table B.34.1							
Incremental Impacts - Sealed Source Case 4							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$39,637	\$216,088	4.77e-05	2.11e-04	-1.63e-04	*	*
60 < 25	\$138,716	\$768,876	3.43e-05	5.30e-04	-4.96e-04	*	*
25 < 15	\$92,178	\$492,331	9.09e-06	4.23e-04	-4.14e-04	*	*
15 < 3	\$287,963	\$1,554,040	1.07e-05	1.17e-03	-1.15e-03	*	*

Table B.34.2

Statistical Mortality - Sealed Source Case 4

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.04e-04	1.70e-06	8.70e-05	1.43e-06	1.22e-04	3.16e-04	2.12e-04
60	5.65e-05	3.05e-06	1.74e-04	2.56e-06	2.43e-04	4.79e-04	4.23e-04
30	3.10e-05	6.78e-06	3.48e-04	5.69e-06	4.86e-04	8.78e-04	8.47e-04
25	2.22e-05	7.86e-06	3.92e-04	6.61e-06	5.47e-04	9.75e-04	9.53e-04
15	1.31e-05	1.09e-05	5.66e-04	9.18e-06	7.90e-04	1.39e-03	1.38e-03
10	8.30e-06	1.34e-05	6.96e-04	1.12e-05	9.73e-04	1.70e-03	1.69e-03
3	2.41e-06	2.06e-05	1.04e-03	1.73e-05	1.46e-03	2.54e-03	2.54e-03
1	7.55e-07	3.45e-05	1.74e-03	2.90e-05	2.43e-03	4.24e-03	4.24e-03

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Table B.34.3 Impact and Cost Calculations - Sealed Source Case 4

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per shipment		Fatal transport rate		3.8e-08	per km		

REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	2.19e-03	5.61e-04	3.04e-04	1.67e-04	1.20e-04	7.07e-05	4.47e-05	1.30e-05	4.07e-06

[Humbolt soil profile] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft	# persons on land	1.86e-01	[400 persons per km ²]				
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	4.07e-04	1.04e-04	5.65e-05	3.10e-05	2.22e-05	1.31e-05	8.30e-06	2.41e-06	7.55e-07

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.003	0.006	0.014	0.016	0.022	0.027	0.041	0.069
Collective mortality	0	1.70e-06	3.05e-06	6.78e-06	7.86e-06	1.09e-05	1.34e-05	2.06e-05	3.45e-05

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.70e-02 person-rem per shipment								
Residual Dose Limit	None	100	60	30	25	15	10	3	1

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Table B.34.3 Impact and Cost Calculations - Sealed Source Case 4

Soil depth removed	0	4.4	8.0	17.9	20.8	28.9	35.3	54.5	91.3
Soil volume (m ³)	0	21	38	84	97	135	165	254	426
Soil shipments	0	2	4	8	9	13	16	24	40
Soil person-rem	0	0.174	0.348	0.696	0.783	1.131	1.392	2.088	3.480
Collective mortality	0	8.70e-05	1.74e-04	3.48e-04	3.92e-04	5.66e-04	6.96e-04	1.04e-03	1.74e-03
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-h	0	34	61	136	157	218	267	412	690
Collective mortality	0	1.43e-06	2.56e-06	5.69e-06	6.61e-06	9.18e-06	1.12e-05	1.73e-05	2.90e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil shipments	0	2	4	8	9	13	16	24	40
Total distance (km)	0	3,200	6,400	12,800	14,400	20,800	25,600	38,400	64,000
Collective mortality	0	1.22e-04	2.43e-04	4.86e-04	5.47e-04	7.90e-04	9.73e-04	1.46e-03	2.43e-03

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Table B.34.4.1			
Summary Costs for Sealed Source Case 4 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$49,189	\$32,000	\$81,189
60	\$88,826	\$32,000	\$120,826
25	\$227,541	\$32,000	\$259,541
15	\$316,719	\$35,000	\$351,719
3	\$596,682	\$43,000	\$639,682

Table B.34.4.2

**Summary Costs for Sealed Source
Case 4
Disposal Cost - \$350/ft3**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$271,212	\$32,000	\$303,212
60	\$487,300	\$32,000	\$519,300
25	\$1,256,176	\$32,000	\$1,288,176
15	\$1,745,507	\$35,000	\$1,780,507
3	\$3,291,547	\$43,000	\$3,334,547

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Table B.35.1

Incremental Impacts - Sealed Source Case 4A

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$39,637	\$216,088	1.68e-04	2.11e-04	-4.31e-05	*	*
60 < 25	\$138,716	\$768,876	1.21e-04	5.30e-04	-4.10e-04	*	*
25 < 15	\$92,178	\$492,331	3.20e-05	4.23e-04	-3.91e-04	*	*
15 < 3	\$287,963	\$1,554,04	3.77e-05	1.17e-03	-1.13e-03	*	*

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Table B.35.2

Statistical Mortality - Sealed Source Case 4A

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.67e-04	1.70e-06	8.70e-05	1.43e-06	1.22e-04	5.79e-04	2.12e-04
60	1.99e-04	3.05e-06	1.74e-04	2.56e-06	2.43e-04	6.22e-04	4.23e-04
30	1.09e-04	6.78e-06	3.48e-04	5.69e-06	4.86e-04	9.56e-04	8.47e-04
25	7.82e-05	7.86e-06	3.92e-04	6.61e-06	5.47e-04	1.03e-03	9.53e-04
15	4.62e-05	1.09e-05	5.66e-04	9.18e-06	7.90e-04	1.42e-03	1.38e-03
10	2.92e-05	1.34e-05	6.96e-04	1.12e-05	9.73e-04	1.72e-03	1.69e-03
3	8.49e-06	2.06e-05	1.04e-03	1.73e-05	1.46e-03	2.55e-03	2.54e-03
1	2.66e-06	3.45e-05	1.74e-03	2.90e-05	2.43e-03	4.24e-03	4.24e-03

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Table B.35.3 Impact and Cost Calculations - Sealed Source Case 4A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal		3.8e-08	per km		
				Alt. use		1.41e-01			

REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft		# persons exposed		4.65e+00	[10,000 persons per km ²]		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.43e-03	3.67e-04	1.99e-04	1.09e-04	7.82e-05	4.62e-05	2.92e-05	8.49e-06	2.66e-06

Table B.35.4.1

**Summary Costs for Sealed Source (\$M)
Case 4A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$49,189	\$32,000	\$81,189
60	\$88,826	\$32,000	\$120,826
25	\$227,541	\$32,000	\$259,541
15	\$316,719	\$35,000	\$351,719
3	\$596,682	\$43,000	\$639,682

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Table B.35.4.2			
Summary Costs for Sealed Source (\$M)			
Case 4A			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$271,212	\$32,000	\$303,212
60	\$487,300	\$32,000	\$519,300
25	\$1,256,176	\$32,000	\$1,288,176
15	\$1,745,507	\$35,000	\$1,780,507
3	\$3,291,547	\$43,000	\$3,334,547

Table B.36.1

Incremental Impacts - Sealed Source Case 4B

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$39,637	\$216,088	8.40e-04	2.11e-04	6.29e-04	\$63,051,200	\$343,737,361
60 < 25	\$138,716	\$768,876	6.04e-04	5.30e-04	7.36e-05	\$1,884,623,705	\$10,446,142,067
25 < 15	\$92,178	\$492,331	1.60e-04	4.23e-04	-2.63e-04	*	*
15 < 3	\$287,963	\$1,554,040	1.89e-04	1.17e-03	-9.76e-04	*	*

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Table B.36.2							
Statistical Mortality - Sealed Source Case 4B							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.83e-03	1.70e-06	8.70e-05	1.43e-06	1.22e-04	2.05e-03	2.12e-04
60	9.95e-04	3.05e-06	1.74e-04	2.56e-06	2.43e-04	1.42e-03	4.23e-04
30	5.45e-04	6.78e-06	3.48e-04	5.69e-06	4.86e-04	1.39e-03	8.47e-04
25	3.91e-04	7.86e-06	3.92e-04	6.61e-06	5.47e-04	1.34e-03	9.53e-04
15	2.31e-04	1.09e-05	5.66e-04	9.18e-06	7.90e-04	1.61e-03	1.38e-03
10	1.46e-04	1.34e-05	6.96e-04	1.12e-05	9.73e-04	1.84e-03	1.69e-03
3	4.24e-05	2.06e-05	1.04e-03	1.73e-05	1.46e-03	2.58e-03	2.54e-03
1	1.33e-05	3.45e-05	1.74e-03	2.90e-05	2.43e-03	4.25e-03	4.24e-03

Table B.36.3 Impact and Cost Calculations - Sealed Source Case 4B

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		
				Alt. use dose		1.41e-01			

REFERENCE FACILITY Sealed Source - High Soil Contamination - Alternative Land Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	4.26e+02	1.09e+02	5.99e+01	3.38e+01	2.46e+01	1.49e+01	9.57e+00	2.90e+00	9.40e-01
Cumulative risk	3.09e-04	7.90e-05	4.28e-05	2.35e-05	1.68e-05	9.95e-06	6.29e-06	1.83e-06	5.72e-07

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft		# persons exposed		2.32e+01	[50,000 persons per		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	7.17e-03	1.83e-03	9.95e-04	5.45e-04	3.91e-04	2.31e-04	1.46e-04	4.24e-05	1.33e-05

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Table B.36.4.1			
Summary Costs for Sealed Source (\$M)			
Case 4B			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$49,189	\$32,000	\$81,189
60	\$88,826	\$32,000	\$120,826
25	\$227,541	\$32,000	\$259,541
15	\$316,719	\$35,000	\$351,719
3	\$596,682	\$43,000	\$639,682

Table B.36.4.2

**Summary Costs for Sealed Source (\$M)
Case 4B
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$271,212	\$32,000	\$303,212
60	\$487,300	\$32,000	\$519,300
25	\$1,256,176	\$32,000	\$1,288,176
15	\$1,745,507	\$35,000	\$1,780,507
3	\$3,291,547	\$43,000	\$3,334,547

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Table B.37.1

Incremental Impacts - Sealed Source Case 5

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$0	\$0	-1.15e-04	0.00e+00	-1.15e-04	\$0	\$0
60 < 25	\$6,845	\$33,178	9.47e-04	1.05e-04	8.42e-04	\$8,130,093	\$39,407,956
25 < 15	\$13,184	\$76,080	5.75e-04	8.85e-07	5.74e-04	\$22,953,686	\$132,458,187
15 < 3	\$121,024	\$666,784	9.88e-04	5.29e-04	4.59e-04	\$263,907,570	\$1,454,003,869

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Table B.37.2

Statistical Mortality - Sealed Source Case 5

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	2.66e-03	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.66e-03	0.00e+00
60	2.77e-03	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.77e-03	0.00e+00
30	2.86e-03	2.37e-08	4.35e-05	1.99e-08	6.08e-05	2.97e-03	1.04e-04
25	1.82e-03	2.01e-07	4.35e-05	1.69e-07	6.08e-05	1.93e-03	1.05e-04
15	1.25e-03	6.82e-07	4.35e-05	5.73e-07	6.08e-05	1.35e-03	1.06e-04
10	6.88e-04	1.16e-06	8.70e-05	9.74e-07	1.22e-04	8.99e-04	2.11e-04
3	2.61e-04	4.85e-06	2.61e-04	4.08e-06	3.65e-04	8.96e-04	6.35e-04
1	8.10e-05	1.86e-05	9.57e-04	1.57e-05	1.34e-03	2.41e-03	2.33e-03

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Table B.37.3 Impact and Cost Calculations - Sealed Source Case 5

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Disposal volume	10.87	m ³ per		Fatal transport		3.8e-08	per km		

REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.07e+01	3.07e+01	3.07e+01	3.07e+01	2.01e+01	1.38e+01	7.82e+00	2.95e+00	9.47e-01
Cumulative risk	1.52e-04	5.72e-04	5.96e-04	6.16e-04	3.93e-04	2.69e-04	1.48e-04	5.62e-05	1.74e-05

[Humbolt soil profile (restricted)] Cumulative risk = Initial dose rate * decay factor (1.44) * [(Co-60 % of total dose * Co-60 t 1/2) + (Sr-90 % of total dose * Sr-90 t 1/2) + (Cs-137 % of total dose * Cs-137 t 1/2)] * fatal cancer risk/1000

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	5,000	sq ft		# persons on land		4.65e+00	[10,000 persons per km ²]		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	7.06e-04	2.66e-03	2.77e-03	2.86e-03	1.82e-03	1.25e-03	6.88e-04	2.61e-04	8.10e-05

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.000	0.000	0.000	0.000	0.001	0.002	0.010	0.037
Collective mortality	0	0.00e+00	0.00e+00	2.37e-08	2.01e-07	6.82e-07	1.16e-06	4.85e-06	1.86e-05

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure	8.70e-02	person-re							
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Table B.37.3 Impact and Cost Calculations - Sealed Source Case 5

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	0.0	0.0	0.1	0.5	1.8	3.0	12.8	49.3
Soil volume (m ³)	0	0	0	0	2	8	14	60	230
Soil shipments	0	0	0	1	1	1	2	6	22
Soil person-rem	0	0.000	0.000	0.087	0.087	0.087	0.174	0.522	1.914
Collective mortality	0	0.00e+00	0.00e+00	4.35e-05	4.35e-05	4.35e-05	8.70e-05	2.61e-04	9.57e-04
REFERENCE FACILITY Sealed Source - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	0	0	0	4	14	23	97	373
Collective mortality	0	0.00e+00	0.00e+00	1.99e-08	1.69e-07	5.73e-07	9.74e-07	4.08e-06	1.57e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	0	0	1	1	1	2	6	22
Total distance (km)	0	0	0	1,600	1,600	1,600	3,200	9,600	35,200
Collective mortality	0	0.00e+00	0.00e+00	6.08e-05	6.08e-05	6.08e-05	1.22e-04	3.65e-04	1.34e-03

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Table B.37.4.1			
Summary Costs for Sealed Source Case 5 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$32,000	\$32,000
60	\$0	\$32,000	\$32,000
25	\$6,845	\$32,000	\$38,845
15	\$20,029	\$32,000	\$52,029
3	\$141,053	\$32,000	\$173,053

Table B.37.4.2

**Summary Costs for Sealed Source
Case 5
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$32,000	\$32,000
60	\$0	\$32,000	\$32,000
25	\$33,178	\$32,000	\$65,178
15	\$109,258	\$32,000	\$141,258
3	\$776,042	\$32,000	\$808,042

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Table B.37.4.3			
Summary Costs for Sealed Source Case 5 Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$32,000	\$32,000
60	\$0	\$32,000	\$32,000
25	\$5,562	\$32,000	\$37,562
15	\$9,054	\$32,000	\$41,054
3	\$39,351	\$32,000	\$71,351

Table B.38.1

Incremental Impacts - Rare Metal Case 1 & 1A									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$22,631	\$83,874	\$455,507	7.43e-02	1.88e-04	7.41e-02	\$305,281	\$1,131,415	\$6,144,515
60 < 25	\$221,152	\$271,137	\$596,316	6.50e-02	1.87e-04	6.48e-02	\$3,410,580	\$4,181,438	\$9,196,300
25 < 15	\$863,158	\$878,800	\$971,708	1.86e-02	6.21e-05	1.85e-02	\$46,612,106	\$47,456,806	\$52,474,021
15 < 3	\$5,757,722	\$5,871,556	\$6,585,279	2.23e-02	3.75e-04	2.19e-02	\$262,656,208	\$267,849,099	\$300,407,763

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Table B.38.2							
Statistical Mortality - Reference Rare Metal Extraction Plant Case 1 & 1A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	1.20e-06	8.00e-09	1.01e-06	1.22e-04	1.86e-01	1.24e-04
60	1.11e-01	4.04e-06	2.00e-08	3.40e-06	3.04e-04	1.12e-01	3.11e-04
30	5.57e-02	6.18e-06	3.20e-08	5.19e-06	4.86e-04	5.62e-02	4.98e-04
25	4.65e-02	6.53e-06	3.20e-08	5.49e-06	4.86e-04	4.69e-02	4.98e-04
15	2.79e-02	7.24e-06	3.60e-08	6.08e-06	5.47e-04	2.84e-02	5.61e-04
10	1.86e-02	7.60e-06	3.60e-08	6.38e-06	5.47e-04	1.91e-02	5.61e-04
3	5.57e-03	1.27e-05	6.00e-08	1.07e-05	9.12e-04	6.51e-03	9.35e-04
0.3	1.86e-03	1.55e-05	7.20e-08	1.30e-05	1.09e-03	2.98e-03	1.12e-03

Table B.38.3 Impact and Cost Calculations - Reference Rare Metal Extraction Plant Case 1 & 1A

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	5.85e-02	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area 100,000 sq ft # persons on land 3.72 [400 persons per km²]

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.17e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	2.41e-03	8.09e-03	1.24e-02	1.31e-02	1.45e-02	1.52e-02	2.54e-02	3.09e-02
Collective mortality	0	1.20e-06	4.04e-06	6.18e-06	6.53e-06	7.24e-06	7.60e-06	1.27e-05	1.55e-05

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure 8.00e-06 person-rem per shipment

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Table B.38.3 Impact and Cost Calculations - Reference Rare Metal Extraction Plant Case 1 & 1A									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	0.16	0.52	0.80	0.84	0.93	0.98	1.64	2.00
Soil volume (m ³)	0	15	50	76	81	89	94	157	191
Soil shipments	0	2	5	8	8	9	9	15	18
Soil person-rem	0	1.60e-05	4.00e-05	6.40e-05	6.40e-05	7.20e-05	7.20e-05	1.20e-04	1.44e-04
Collective mortality	0	8.00e-09	2.00e-08	3.20e-08	3.20e-08	3.60e-08	3.60e-08	6.00e-08	7.20e-08
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	24	81	124	131	145	152	254	309
Collective mortality	0	1.01e-06	3.40e-06	5.19e-06	5.49e-06	6.08e-06	6.38e-06	1.07e-05	1.30e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	2	5	8	8	9	9	15	18
Total distance (km)	0	3,200	8,000	12,800	12,800	14,400	14,400	24,000	28,800
Collective mortality	0	1.22e-04	3.04e-04	4.86e-04	4.86e-04	5.47e-04	5.47e-04	9.12e-04	1.09e-03

Table B.38.4.1

**Summary Costs for Rare Metal Extraction Facility
Case 1 & 1A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$35,627	\$71,000	\$106,627
60	\$117,502	\$73,000	\$190,502
25	\$189,639	\$272,000	\$461,639
15	\$210,439	\$1,130,000	\$1,340,439
3	\$367,995	\$6,844,000	\$7,211,995

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Table B.38.4.2			
Summary Costs for Rare Metal Extraction Facility Case 1 & 1A Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$192,952	\$71,000	\$263,952
60	\$646,459	\$73,000	\$719,459
25	\$1,043,775	\$272,000	\$1,315,775
15	\$1,157,483	\$1,130,000	\$2,287,483
3	\$2,028,763	\$6,844,000	\$8,872,763

Table B.38.4.3

**Summary Costs for Rare Metal Extraction Facility
Case 1 & 1A
Disposal Cost - \$10/ft³**

Residual Dose Limit	Soil Removal	Survey	TOTAL
100	\$12,834	\$71,000	\$83,834
60	\$33,465	\$73,000	\$106,465
25	\$55,617	\$272,000	\$327,617
15	\$60,775	\$1,130,000	\$1,190,775
3	\$104,497	\$6,844,000	\$6,948,497

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Table B.39.1

Incremental Impacts - Rare Metal Case 1B1

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$22,631	\$83,874	\$455,507	1.24e-01	1.88e-04	1.23e-01	\$183,443	\$679,865	\$3,692,225
60 < 25	\$221,152	\$271,137	\$596,316	1.08e-01	1.87e-04	1.08e-01	\$2,049,122	\$2,512,264	\$5,525,260
25 < 15	\$863,158	\$878,800	\$971,708	3.09e-02	6.21e-05	3.08e-02	\$27,999,932	\$28,507,345	\$31,521,190
15 < 3	\$5,757,722	\$5,871,556	\$6,585,279	3.71e-02	3.75e-04	3.67e-02	\$156,919,365	\$160,021,768	\$179,473,373

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Table B.39.2

Statistical Mortality - Reference Rare Metal Extraction Plant Case 1B1

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	3.09e-01	1.20e-06	8.00e-09	1.01e-06	1.22e-04	3.09e-01	1.24e-04
60	1.85e-01	4.04e-06	2.00e-08	3.40e-06	3.04e-04	1.86e-01	3.11e-04
30	9.27e-02	6.18e-06	3.20e-08	5.19e-06	4.86e-04	9.32e-02	4.98e-04
25	7.72e-02	6.53e-06	3.20e-08	5.49e-06	4.86e-04	7.77e-02	4.98e-04
15	4.63e-02	7.24e-06	3.60e-08	6.08e-06	5.47e-04	4.69e-02	5.61e-04
10	3.09e-02	7.60e-06	3.60e-08	6.38e-06	5.47e-04	3.15e-02	5.61e-04
3	9.27e-03	1.27e-05	6.00e-08	1.07e-05	9.12e-04	1.02e-02	9.35e-04
0.3	3.09e-03	1.55e-05	7.20e-08	1.30e-05	1.09e-03	4.21e-03	1.12e-03

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Table B.39.3 Impact and Cost Calculations - Reference Rare Metal Extraction Plant Case 1B1									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	10	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use		6.65e-02			
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Alternative Land Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.89e-03	3.33e-03	2.00e-03	9.98e-04	8.31e-04	4.99e-04	3.33e-04	9.98e-05	3.33e-05
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft		# persons exposed		93	[10,000		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.61e-01	3.09e-01	1.85e-01	9.27e-02	7.72e-02	4.63e-02	3.09e-02	9.27e-03	3.09e-03

Table B.39.4.1

Summary Costs for Rare Metal Extraction Facility (SM) Case 1B1 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$35,627	\$71,000	\$106,627
60	\$117,502	\$73,000	\$190,502
25	\$189,639	\$272,000	\$461,639
15	\$210,439	\$1,130,000	\$1,340,439
3	\$367,995	\$6,844,000	\$7,211,995

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Table B.39.4.2			
Summary Costs for Rare Metal Extraction Facility (\$M)			
Case 1B1			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$192,952	\$71,000	\$263,952
60	\$646,459	\$73,000	\$719,459
25	\$1,043,775	\$272,000	\$1,315,775
15	\$1,157,483	\$1,130,000	\$2,287,483
3	\$2,028,763	\$6,844,000	\$8,872,763

Table B.39.4.3

**Summary Costs for Rare Metal Extraction Facility (\$M)
Case 1B1
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$12,834	\$71,000	\$83,834
60	\$33,465	\$73,000	\$106,465
30	\$53,038	\$0	*
25	\$55,617	\$272,000	\$327,617
15	\$60,775	\$1,130,000	\$1,190,775
10	\$63,354	\$0	*
3	\$104,497	\$6,844,000	\$6,948,497
1	\$124,613	\$0	*

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Table B.40.1									
Incremental Impacts - Rare Metal Case 1B2									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$10/ft3	Disposal @ \$50/ft3	Disposal @ \$350/ft3
100 < 60	\$22,631	\$83,874	\$455,507	6.18e-01	1.88e-04	6.18e-01	\$36,644	\$135,808	\$737,547
60 < 25	\$221,152	\$271,137	\$596,316	5.41e-01	1.87e-04	5.40e-01	\$409,257	\$501,757	\$1,103,522
25 < 15	\$863,158	\$878,800	\$971,708	1.54e-01	6.21e-05	1.54e-01	\$5,590,975	\$5,692,294	\$6,294,093
15 < 3	\$5,757,722	\$5,871,55	\$6,585,279	1.85e-01	3.75e-04	1.85e-01	\$31,129,447	\$31,744,897	\$35,603,680

Table B.40.2

Statistical Mortality - Reference Rare Metal Extraction Plant Case 1B2

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.54e+00	1.20e-06	8.00e-09	1.01e-06	1.22e-04	1.54e+00	1.24e-04
60	9.27e-01	4.04e-06	2.00e-08	3.40e-06	3.04e-04	9.27e-01	3.11e-04
30	4.63e-01	6.18e-06	3.20e-08	5.19e-06	4.86e-04	4.64e-01	4.98e-04
25	3.86e-01	6.53e-06	3.20e-08	5.49e-06	4.86e-04	3.87e-01	4.98e-04
15	2.32e-01	7.24e-06	3.60e-08	6.08e-06	5.47e-04	2.32e-01	5.61e-04
10	1.54e-01	7.60e-06	3.60e-08	6.38e-06	5.47e-04	1.55e-01	5.61e-04
3	4.63e-02	1.27e-05	6.00e-08	1.07e-05	9.12e-04	4.73e-02	9.35e-04
0.3	1.54e-02	1.55e-05	7.20e-08	1.30e-05	1.09e-03	1.66e-02	1.12e-03

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Table B.40.3 Impact and Cost Calculations - Reference Rare Metal Extraction Plant Case 1B2									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	10	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use		6.65e-02			
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Alternative Land Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.89e-03	3.33e-03	2.00e-03	9.98e-04	8.31e-04	4.99e-04	3.33e-04	9.98e-05	3.33e-05
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft	# persons exposed		465	[50,000 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.81e+00	1.54e+00	9.27e-01	4.63e-01	3.86e-01	2.32e-01	1.54e-01	4.63e-02	1.54e-02

Table B.40.4.1

Summary Costs for Rare Metal Extraction Facility (\$M)

Case 1B2

Disposal Cost - \$50/ft³

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$35,627	\$71,000	\$106,627
60	\$117,502	\$73,000	\$190,502
25	\$189,639	\$272,000	\$461,639
15	\$210,439	\$1,130,000	\$1,340,439
3	\$367,995	\$6,844,000	\$7,211,995

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Table B.40.4.2			
Summary Costs for Rare Metal Extraction Facility (\$M)			
Case 1B2			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$192,952	\$71,000	\$263,952
60	\$646,459	\$73,000	\$719,459
25	\$1,043,775	\$272,000	\$1,315,775
15	\$1,157,483	\$1,130,000	\$2,287,483
3	\$2,028,763	\$6,844,000	\$8,872,763

Table B.40.4.3

**Summary Costs for Rare Metal Extraction Facility (SM)
Case 1B2
Disposal Cost - \$10/Ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$12,834	\$71,000	\$83,834
60	\$33,465	\$73,000	\$106,465
25	\$55,617	\$272,000	\$327,617
15	\$60,775	\$1,130,000	\$1,190,775
3	\$104,497	\$6,844,000	\$6,948,497

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Table B.41.1									
Incremental Impacts - Rare Metal Case 1C									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/ft ³	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$10/ft ³	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
100 < 60	\$20,631	\$81,874	\$453,507	7.43e-02	1.88e-04	7.41e-02	\$278,302	\$1,104,437	\$6,117,536
60 < 25	\$66,152	\$116,137	\$441,316	6.50e-02	1.87e-04	6.48e-02	\$1,020,191	\$1,791,050	\$6,805,912
25 < 15	\$8,158	\$23,800	\$116,708	1.86e-02	6.21e-05	1.85e-02	\$440,536	\$1,285,237	\$6,302,451
15 < 3	\$243,722	\$357,556	\$1,071,279	2.23e-02	3.75e-04	2.19e-02	\$11,118,14	\$16,311,03	\$48,869,697

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Table B.41.2

Statistical Mortality - Reference Rare Metal Extraction Plant Case 1C

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.86e-01	1.20e-06	8.00e-09	1.01e-06	1.22e-04	1.86e-01	1.24e-04
60	1.11e-01	4.04e-06	2.00e-08	3.40e-06	3.04e-04	1.12e-01	3.11e-04
30	5.57e-02	6.18e-06	3.20e-08	5.19e-06	4.86e-04	5.62e-02	4.98e-04
25	4.65e-02	6.53e-06	3.20e-08	5.49e-06	4.86e-04	4.69e-02	4.98e-04
15	2.79e-02	7.24e-06	3.60e-08	6.08e-06	5.47e-04	2.84e-02	5.61e-04
10	1.86e-02	7.60e-06	3.60e-08	6.38e-06	5.47e-04	1.91e-02	5.61e-04
3	5.57e-03	1.27e-05	6.00e-08	1.07e-05	9.12e-04	6.51e-03	9.35e-04
0.3	1.86e-03	1.55e-05	7.20e-08	1.30e-05	1.09e-03	2.98e-03	1.12e-03

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Table B.41.3 Impact and Cost Calculations - Reference Rare Metal Extraction Plant									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	5.85e-02	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft	# persons on land		3.72	[400 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.17e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	2.41e-03	8.09e-03	1.24e-02	1.31e-02	1.45e-02	1.52e-02	2.54e-02	3.09e-02
Collective mortality	0	1.20e-06	4.04e-06	6.18e-06	6.53e-06	7.24e-06	7.60e-06	1.27e-05	1.55e-05
III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure	8.00e-06	person-rem per shipment							

**Table B.41.3 Impact and Cost Calculations - Reference Rare Metal
Extraction Plant**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	0.16	0.52	0.80	0.84	0.93	0.98	1.64	2.00
Soil volume (m ³)	0	15	50	76	81	89	94	157	191
Soil shipments	0	2	5	8	8	9	9	15	18
Soil person-rem	0	1.60e-05	4.00e-05	6.40e-05	6.40e-05	7.20e-05	7.20e-05	1.20e-04	1.44e-04
Collective mortality	0	8.00e-09	2.00e-08	3.20e-08	3.20e-08	3.60e-08	3.60e-08	6.00e-08	7.20e-08
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	24	81	124	131	145	152	254	309
Collective mortality	0	1.01e-06	3.40e-06	5.19e-06	5.49e-06	6.08e-06	6.38e-06	1.07e-05	1.30e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	2	5	8	8	9	9	15	18
Total distance (km)	0	3,200	8,000	12,800	12,800	14,400	14,400	24,000	28,800
Collective mortality	0	1.22e-04	3.04e-04	4.86e-04	4.86e-04	5.47e-04	5.47e-04	9.12e-04	1.09e-03

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Table B.41.4.1			
Summary Costs for Rare Metal Extraction Facility			
Case 1C			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$35,627	\$85,000	\$120,627
60	\$117,502	\$85,000	\$202,502
25	\$189,639	\$129,000	\$318,639
15	\$210,439	\$132,000	\$342,439
3	\$367,995	\$332,000	\$699,995

Table B.41.4.2

**Summary Costs for Rare Metal Extraction Facility
Case 1C
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$192,952	\$85,000	\$277,952
60	\$646,459	\$85,000	\$731,459
25	\$1,043,775	\$129,000	\$1,172,775
15	\$1,157,483	\$132,000	\$1,289,483
3	\$2,028,763	\$332,000	\$2,360,763

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Table B.41.4.3			
Summary Costs for Rare Metal Extraction Facility Case 1C Disposal Cost - \$10/ft3			
Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$12,834	\$85,000	\$97,834
60	\$33,465	\$85,000	\$118,465
25	\$55,617	\$129,000	\$184,617
15	\$60,775	\$132,000	\$192,775
3	\$104,497	\$332,000	\$436,497

Table B.42.1

Incremental Impacts - Rare Metal Case 2 & 2A									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$263,307	\$944,787	\$5,208,632	7.43e-02	2.31e-03	7.20e-02	\$3,656,523	\$13,120,169	\$72,331,789
60 < 25	\$641,072	\$1,812,329	\$9,110,758	6.50e-02	3.93e-03	6.11e-02	\$10,492,749	\$29,663,292	\$149,120,350
25 < 15	\$1,118,857	\$1,799,085	\$6,054,812	1.86e-02	2.31e-03	1.63e-02	\$68,766,453	\$110,574,239	\$372,137,010
15 < 3	\$6,532,845	\$8,682,174	\$22,102,784	2.23e-02	7.30e-03	1.50e-02	\$435,722,469	\$579,076,710	\$1,474,193,837

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Table B.42.2							
Statistical Mortality - Reference Rare Metals Extraction Plant Case 2 & 2A							
Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	1.86e-01	8.85e-05	4.04e-07	7.44e-05	6.14e-03	1.92e-01	6.30e-03
60	1.11e-01	1.21e-04	5.52e-07	1.02e-04	8.39e-03	1.20e-01	8.61e-03
30	5.57e-02	1.65e-04	7.52e-07	1.39e-04	1.14e-02	6.75e-02	1.17e-02
25	4.65e-02	1.77e-04	8.04e-07	1.49e-04	1.22e-02	5.90e-02	1.25e-02
15	2.79e-02	2.09e-04	9.52e-07	1.76e-04	1.45e-02	4.27e-02	1.49e-02
10	1.86e-02	2.35e-04	1.07e-06	1.98e-04	1.63e-02	3.53e-02	1.67e-02
3	5.57e-03	3.12e-04	1.42e-06	2.62e-04	2.16e-02	2.77e-02	2.22e-02
0.3	1.86e-03	4.59e-04	2.08e-06	3.85e-04	3.17e-02	3.44e-02	3.25e-02

**Table B.42.3 Impact and Cost Calculations - Reference Rare Metals Extraction
Plant Case 2 & 2A**

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	5.85e-02	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04
I. Living Onsite - Mortality for Radiation Exposure									
Contaminated land area	100,000	sq ft	# persons on land		3.72	[400 persons per km ²]			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.17e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.177	0.242	0.331	0.354	0.419	0.471	0.624	0.917
Collective mortality	0	8.85e-05	1.21e-04	1.65e-04	1.77e-04	2.09e-04	2.35e-04	3.12e-04	4.59e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Soil shipment exposure	8.00e-06	person-re							

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Table B.42.3 Impact and Cost Calculations - Reference Rare Metals Extraction Plant Case 2 & 2A									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	11.76	16.08	21.95	23.49	27.81	31.24	41.42	60.90
Soil volume (m ³)	0	1093	1495	2041	2184	2586	2905	3853	5663
Soil shipments	0	101	138	188	201	238	268	355	521
Soil person-rem	0	8.08e-04	1.10e-03	1.50e-03	1.61e-03	1.90e-03	2.14e-03	2.84e-03	4.17e-03
Collective mortality	0	4.04e-07	5.52e-07	7.52e-07	8.04e-07	9.52e-07	1.07e-06	1.42e-06	2.08e-06
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-h	0	1771	2423	3306	3539	4189	4706	6242	9175
Collective mortality	0	7.44e-05	1.02e-04	1.39e-04	1.49e-04	1.76e-04	1.98e-04	2.62e-04	3.85e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil shipments	0	101	138	188	201	238	268	355	521
Total distance (km)	0	161,600	220,800	300,800	321,600	380,800	428,800	568,000	833,600
Collective mortality	0	6.14e-03	8.39e-03	1.14e-02	1.22e-02	1.45e-02	1.63e-02	2.16e-02	3.17e-02

Table B.42.4.1

**Summary Costs for Rare Metal Extraction Facility
Case 2 & 2A
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,561,114	\$71,000	\$2,632,114
60	\$3,503,900	\$73,000	\$3,576,900
25	\$5,117,229	\$272,000	\$5,389,229
15	\$6,058,314	\$1,130,000	\$7,188,314
3	\$9,026,488	\$6,844,000	\$15,870,488

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Table B.42.4.2			
Summary Costs for Rare Metal Extraction Facility Case 2 & 2A Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$14,140,911	\$71,000	\$14,211,911
60	\$19,347,542	\$73,000	\$19,420,542
25	\$28,259,300	\$272,000	\$28,531,300
15	\$33,456,111	\$1,130,000	\$34,586,111
3	\$49,844,895	\$6,844,000	\$56,688,895

Table B.42.4.3

**Summary Costs for Rare Metal Extraction Facility
Case 2 & 2A
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$708,452	\$71,000	\$779,452
60	\$969,759	\$73,000	\$1,042,759
25	\$1,411,831	\$272,000	\$1,683,831
15	\$1,672,688	\$1,130,000	\$2,802,688
3	\$2,491,533	\$6,844,000	\$9,335,533

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Table B.43.1									
Incremental Impacts - Rare Metal Case 2B1									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$263,307	\$944,787	\$5,208,632	1.24e-01	2.31e-03	1.21e-01	\$2,171,655	\$7,792,232	\$42,958,754
60 < 25	\$641,072	\$1,812,329	\$9,110,758	1.08e-01	3.93e-03	1.04e-01	\$6,153,560	\$17,396,286	\$87,452,876
25 < 15	\$1,118,857	\$1,799,085	\$6,054,812	3.09e-02	2.31e-03	2.86e-02	\$39,148,736	\$62,949,906	\$211,857,573
15 < 3	\$6,532,845	\$8,682,174	\$22,102,784	3.71e-02	7.30e-03	2.98e-02	\$219,486,416	\$291,698,227	\$742,595,447

Table B.43.2

Statistical Mortality - Reference Rare Metals Extraction Plant Case 2B1

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	3.09e-01	8.85e-05	4.04e-07	7.44e-05	6.14e-03	3.15e-01	6.30e-03
60	1.85e-01	1.21e-04	5.52e-07	1.02e-04	8.39e-03	1.94e-01	8.61e-03
30	9.27e-02	1.65e-04	7.52e-07	1.39e-04	1.14e-02	1.04e-01	1.17e-02
25	7.72e-02	1.77e-04	8.04e-07	1.49e-04	1.22e-02	8.98e-02	1.25e-02
15	4.63e-02	2.09e-04	9.52e-07	1.76e-04	1.45e-02	6.12e-02	1.49e-02
10	3.09e-02	2.35e-04	1.07e-06	1.98e-04	1.63e-02	4.76e-02	1.67e-02
3	9.27e-03	3.12e-04	1.42e-06	2.62e-04	2.16e-02	3.14e-02	2.22e-02
0.3	3.09e-03	4.59e-04	2.08e-06	3.85e-04	3.17e-02	3.56e-02	3.25e-02

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Table B.43.3 Impact and Cost Calculations - Reference Rare Metals Extraction Plant Case 2B1

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	10	m ² per		Fatal transport		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use dose		6.65e-02			
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Alternative Land Use									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.89e-03	3.33e-03	2.00e-03	9.98e-04	8.31e-04	4.99e-04	3.33e-04	9.98e-05	3.33e-05
I. Alternative Land Use - Mortality for Radiation Exposure									
Contaminated land area	100,000 sq ft		# persons exposed 93			[10,000 persons per km ²]			
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	3.61e-01	3.09e-01	1.85e-01	9.27e-02	7.72e-02	4.63e-02	3.09e-02	9.27e-03	3.09e-03

Table B.43.4.1

**Summary Costs for Rare Metal Extraction Facility (\$M)
Case 2B1
Disposal Cost - \$50/ft3**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,561,114	\$71,000	\$2,632,114
60	\$3,503,900	\$73,000	\$3,576,900
25	\$5,117,229	\$272,000	\$5,389,229
15	\$6,058,314	\$1,130,000	\$7,188,314
3	\$9,026,488	\$6,844,000	\$15,870,488

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Table B.43.4.2			
Summary Costs for Rare Metal Extraction Facility (SM)			
Case 2B1			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$14,140,911	\$71,000	\$14,211,911
60	\$19,347,542	\$73,000	\$19,420,542
25	\$28,259,300	\$272,000	\$28,531,300
15	\$33,456,111	\$1,130,000	\$34,586,111
3	\$49,844,895	\$6,844,000	\$56,688,895

Table B.43.4.3

**Summary Costs for Rare Metal Extraction Facility (\$M)
Case 2B1
Disposal Cost - \$10/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$708,452	\$71,000	\$779,452
60	\$969,759	\$73,000	\$1,042,759
25	\$1,411,831	\$272,000	\$1,683,831
15	\$1,672,688	\$1,130,000	\$2,802,688
3	\$2,491,533	\$6,844,000	\$9,335,533

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Table B.44.1									
Incremental Impacts - Rare Metal Case 2B2									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$263,307	\$944,787	\$5,208,632	6.18e-01	2.31e-03	6.15e-01	\$427,811	\$1,535,053	\$8,462,780
60 < 25	\$641,072	\$1,812,32	\$9,110,758	5.41e-01	3.93e-03	5.37e-01	\$1,194,629	\$3,377,250	\$16,977,773
25 < 15	\$1,118,857	\$1,799,08	\$6,054,812	1.54e-01	2.31e-03	1.52e-01	\$7,354,287	\$11,825,457	\$39,798,512
15 < 3	\$6,532,845	\$8,682,17	\$22,102,78	1.85e-01	7.30e-03	1.78e-01	\$36,694,648	\$48,767,317	\$124,150,181

Table B.44.2

Statistical Mortality - Reference Rare Metals Extraction Plant Case 2B2

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	1.54e+00	8.85e-05	4.04e-07	7.44e-05	6.14e-03	1.55e+00	6.30e-03
60	9.27e-01	1.21e-04	5.52e-07	1.02e-04	8.39e-03	9.35e-01	8.61e-03
30	4.63e-01	1.65e-04	7.52e-07	1.39e-04	1.14e-02	4.75e-01	1.17e-02
25	3.86e-01	1.77e-04	8.04e-07	1.49e-04	1.22e-02	3.99e-01	1.25e-02
15	2.32e-01	2.09e-04	9.52e-07	1.76e-04	1.45e-02	2.47e-01	1.49e-02
10	1.54e-01	2.35e-04	1.07e-06	1.98e-04	1.63e-02	1.71e-01	1.67e-02
3	4.63e-02	3.12e-04	1.42e-06	2.62e-04	2.16e-02	6.85e-02	2.22e-02
0.3	1.54e-02	4.59e-04	2.08e-06	3.85e-04	3.17e-02	4.80e-02	3.25e-02

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**Table B.44.3 Impact and Cost Calculations - Reference Rare Metals Extraction Plant
Case 2B2**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Soil exposure rate	10	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per		Alt. use dose		6.65e-02			

REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Alternative Land Use

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.89e-03	3.33e-03	2.00e-03	9.98e-04	8.31e-04	4.99e-04	3.33e-04	9.98e-05	3.33e-05

I. Alternative Land Use - Mortality for Radiation Exposure

Contaminated land area	100,000 sq ft	# persons exposed 465 [50,000 persons per km2]							
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	1.81e+00	1.54e+00	9.27e-01	4.63e-01	3.86e-01	2.32e-01	1.54e-01	4.63e-02	1.54e-02

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Table B.44.4.1

**Summary Costs for Rare Metal Extraction Facility (\$M)
Case 2B2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$2,561,114	\$71,000	\$2,632,114
60	\$3,503,900	\$73,000	\$3,576,900
25	\$5,117,229	\$272,000	\$5,389,229
15	\$6,058,314	\$1,130,000	\$7,188,314
3	\$9,026,488	\$6,844,000	\$15,870,488

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Table B.44.4.2			
Summary Costs for Rare Metal Extraction Facility (\$M) Case 2B2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$14,140,911	\$71,000	\$14,211,911
60	\$19,347,542	\$73,000	\$19,420,542
25	\$28,259,300	\$272,000	\$28,531,300
15	\$33,456,111	\$1,130,000	\$34,586,111
3	\$49,844,895	\$6,844,000	\$56,688,895

Table B.44.4.3

**Summary Costs for Rare Metal Extraction Facility (SM)
Case 2B2
Disposal Cost - \$10/t3**

Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$708,452	\$71,000	\$779,452
60	\$969,759	\$73,000	\$1,042,759
25	\$1,411,831	\$272,000	\$1,683,831
15	\$1,672,688	\$1,130,000	\$2,802,688
3	\$2,491,533	\$6,844,000	\$9,335,533

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Table B.45.1									
Incremental Impacts - Rare Metal Case 2C									
Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$10/r3	Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$261,307	\$942,787	\$5,206,632	7.43e-02	2.31e-03	7.20e-02	\$3,628,749	\$13,092,395	\$72,304,015
60 < 25	\$486,072	\$1,657,329	\$8,955,758	6.50e-02	3.93e-03	6.11e-02	\$7,955,786	\$27,126,330	\$146,583,387
25 < 15	\$263,857	\$944,085	\$5,199,812	1.86e-02	2.31e-03	1.63e-02	\$16,216,983	\$58,024,769	\$319,587,540
15 < 3	\$1,018,845	\$3,168,174	\$16,588,784	2.23e-02	7.30e-03	1.50e-02	\$67,954,093	\$211,308,334	\$1,106,425,461

Table B.45.2

Statistical Mortality - Reference Rare Metals Extraction Plant Case 2C

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	1.86e-01	8.85e-05	4.04e-07	7.44e-05	6.14e-03	1.92e-01	6.30e-03
60	1.11e-01	1.21e-04	5.52e-07	1.02e-04	8.39e-03	1.20e-01	8.61e-03
30	5.57e-02	1.65e-04	7.52e-07	1.39e-04	1.14e-02	6.75e-02	1.17e-02
25	4.65e-02	1.77e-04	8.04e-07	1.49e-04	1.22e-02	5.90e-02	1.25e-02
15	2.79e-02	2.09e-04	9.52e-07	1.76e-04	1.45e-02	4.27e-02	1.49e-02
10	1.86e-02	2.35e-04	1.07e-06	1.98e-04	1.63e-02	3.53e-02	1.67e-02
3	5.57e-03	3.12e-04	1.42e-06	2.62e-04	2.16e-02	2.77e-02	2.22e-02
0.3	1.86e-03	4.59e-04	2.08e-06	3.85e-04	3.17e-02	3.44e-02	3.25e-02

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Table B.45.3 Impact and Cost Calculations - Reference Rare Metals Extraction Plant Case 2C

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per person		Fatal transport		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	5.85e-02	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	100,000 sq ft	# persons on land	3.72	[400 persons per km ²]					
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	2.17e-01	1.86e-01	1.11e-01	5.57e-02	4.65e-02	2.79e-02	1.86e-02	5.57e-03	1.86e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.177	0.242	0.331	0.354	0.419	0.471	0.624	0.917
Collective mortality	0	8.85e-05	1.21e-04	1.65e-04	1.77e-04	2.09e-04	2.35e-04	3.12e-04	4.59e-04

III. Transporting Waste - Mortality for Radiation Exposure

Soil shipment exposure 8.00e-06 person-rem per shipment

**Table B.45.3 Impact and Cost Calculations - Reference Rare Metals Extraction
Plant Case 2C**

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil depth removed (cm)	0	11.76	16.08	21.95	23.49	27.81	31.24	41.42	60.90
Soil volume (m ³)	0	1093	1495	2041	2184	2586	2905	3853	5663
Soil shipments	0	101	138	188	201	238	268	355	521
Soil person-rem	0	8.08e-04	1.10e-03	1.50e-03	1.61e-03	1.90e-03	2.14e-03	2.84e-03	4.17e-03
Collective mortality	0	4.04e-07	5.52e-07	7.52e-07	8.04e-07	9.52e-07	1.07e-06	1.42e-06	2.08e-06
REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil person-h	0	1771	2423	3306	3539	4189	4706	6242	9175
Collective mortality	0	7.44e-05	1.02e-04	1.39e-04	1.49e-04	1.76e-04	1.98e-04	2.62e-04	3.85e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Soil shipments	0	101	138	188	201	238	268	355	521
Total distance (km)	0	161,600	220,800	300,800	321,600	380,800	428,800	568,000	833,600
Collective mortality	0	6.14e-03	8.39e-03	1.14e-02	1.22e-02	1.45e-02	1.63e-02	2.16e-02	3.17e-02

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Table B.45.4.1			
Summary Costs for Rare Metal Extraction Facility Case 2C Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$2,561,114	\$85,000	\$2,646,114
60	\$3,503,900	\$85,000	\$3,588,900
25	\$5,117,229	\$129,000	\$5,246,229
15	\$6,058,314	\$132,000	\$6,190,314
3	\$9,026,488	\$332,000	\$9,358,488

Table B.45.4.2

**Summary Costs for Rare Metal Extraction Facility
Case 2C
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$14,140,911	\$85,000	\$14,225,911
60	\$19,347,542	\$85,000	\$19,432,542
25	\$28,259,300	\$129,000	\$28,388,300
15	\$33,456,111	\$132,000	\$33,588,111
3	\$49,844,895	\$332,000	\$50,176,895

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Table B.45.4.3			
Summary Costs for Rare Metal Extraction Facility Case 2C Disposal Cost - \$10/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey (In-situ)	TOTAL
100	\$708,452	\$85,000	\$793,452
60	\$969,759	\$85,000	\$1,054,759
25	\$1,411,831	\$129,000	\$1,540,831
15	\$1,672,688	\$132,000	\$1,804,688
3	\$2,491,533	\$332,000	\$2,823,533

Table B.46.1

Incremental Impacts - Rare Metal Case 3

Residual Dose Rate Reduction (mrem/yr)	Incremental Cost (\$M)			Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit		
	Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3				Disposal @ \$10/f3	Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$0	\$0	\$0	1.86e+00	0.00e+00	1.86e+00	\$0	\$0	\$0
60 < 25	\$0	\$0	\$0	1.63e+00	0.00e+00	1.63e+00	\$0	\$0	\$0
25 < 15	\$0	\$3,598	\$0	4.65e-01	1.81e-05	4.64e-01	\$0	\$7,746	\$0
15 < 3	\$0	\$424,757	\$0	5.57e-01	1.96e-04	5.57e-01	\$0	\$762,301	\$0

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Table B.46.2

Statistical Mortality - Reference Rare Metal Extration Plant Case 3

Residual Dose Limit (mrem/y)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Living Onsite	Perform Decon	Transport Waste (Truck)	Perform Decon	Transport Waste (Truck)	TOTAL	
100	4.65e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.65e+00	0.00e+00
60	2.79e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.79e+00	0.00e+00
30	1.39e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.39e+00	0.00e+00
25	1.16e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.16e+00	0.00e+00
15	6.97e-01	9.83e-06	0.00e+00	8.26e-06	0.00e+00	6.97e-01	1.81e-05
10	4.65e-01	3.67e-05	0.00e+00	3.08e-05	0.00e+00	4.65e-01	6.75e-05
3	1.39e-01	1.17e-04	0.00e+00	9.79e-05	0.00e+00	1.40e-01	2.14e-04
0.3	4.65e-02	2.69e-04	0.00e+00	2.26e-04	0.00e+00	4.69e-02	4.95e-04

Table B.46.3 Impact and Cost Calculations - Reference Rare Metal Extration Plant Case 3

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per person-h		
Exposure duration	1000	y		Burial site		1600	km per		
Agricultural usage rate	2500	m ² per		Fatal		3.8e-08	per km		
Disposal volume	10.87	m ³ per							

REFERENCE FACILITY Rare Metal Extraction Facility - High Soil Contamination - Unrestricted Use

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.17e+02	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	5.85e-02	5.00e-02	3.00e-02	1.50e-02	1.25e-02	7.50e-03	5.00e-03	1.50e-03	5.00e-04

I. Living Onsite - Mortality for Radiation Exposure

Contaminated land area	100,000 sq ft	# persons on land	93	[10,000 persons per km ²]					
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	5.43e+00	4.65e+00	2.79e+00	1.39e+00	1.16e+00	6.97e-01	4.65e-01	1.39e-01	4.65e-02

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Soil person-rem	0	0.023	0.023	0.023	0.023	0.043	0.096	0.256	0.561
Collective mortality	0	1.14e-05	1.14e-05	1.14e-05	1.14e-05	2.13e-05	4.81e-05	1.28e-04	2.81e-04

III. Transporting Waste - Mortality for Radiation Exposure

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Table B.46.4			
Summary Costs for Rare Metal Extraction Facility			
Case 3			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Soil Removal	Survey	TOTAL
100	\$0	\$71,000	\$71,000
60	\$0	\$71,000	\$71,000
25	\$0	\$71,000	\$71,000
15	\$3,598	\$71,000	\$74,598
3	\$426,355	\$73,000	\$499,355

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Table B.47.1							
Incremental Impacts - Power Reactor - Structures Case 1							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
100 < 60	\$0.143	\$0.317	4.10e-02	2.83e-04	4.07e-02	\$3.516	\$7.79
60 < 25	\$0.076	\$0.422	3.58e-02	3.96e-04	3.54e-02	\$2.144	\$11.91
25 < 15	\$0.027	\$0.141	1.02e-02	1.45e-04	1.01e-02	\$2.675	\$13.97
15 < 3	\$0.239	\$0.862	1.22e-02	6.64e-04	1.16e-02	\$20.6	\$74.4

Table B.47.2

**Statistical Mortality - Power Reactor
Structures Case 1**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.02e-01	1.05e-02	1.26e-03	1.13e-04	1.76e-03	1.16e-01	1.36e-02
60	6.14e-02	1.05e-02	1.35e-03	1.41e-04	1.88e-03	7.53e-02	1.39e-02
30	3.07e-02	1.06e-02	1.44e-03	1.41e-04	2.01e-03	4.49e-02	1.42e-02
25	2.56e-02	1.06e-02	1.48e-03	1.42e-04	2.07e-03	3.99e-02	1.43e-02
15	1.54e-02	1.07e-02	1.52e-03	1.43e-04	2.13e-03	2.98e-02	1.45e-02
10	1.02e-02	1.07e-02	1.57e-03	1.43e-04	2.19e-03	2.48e-02	1.46e-02
3	3.12e-03	1.08e-02	1.74e-03	1.73e-04	2.43e-03	1.82e-02	1.51e-02
1	1.04e-03	1.09e-02	1.91e-03	1.74e-04	2.68e-03	1.67e-02	1.57e-02

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Table B.47.3 Impact and Cost Calculations - Power Reactor Structures Case 1									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		
REFERENCE FACILITY Power Reactor - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-04	5.19e-05	1.73e-05
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy	# persons 50	Facility area				250,000 ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.58e+01	8.53e-02	5.12e-02	2.56e-02	2.13e-02	1.28e-02	8.53e-03	2.60e-03	8.65e-04
b. Building renovation	# persons 10								
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.16e+00	1.71e-02	1.02e-02	5.12e-03	4.27e-03	2.56e-03	1.71e-03	5.19e-04	1.73e-04
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.90e+01	1.02e-01	6.14e-02	3.07e-02	2.56e-02	1.54e-02	1.02e-02	3.12e-03	1.04e-03
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.47.3 Impact and Cost Calculations - Power Reactor
Structures Case 1**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	20.979	21.071	21.195	21.235	21.315	21.315	21.541	21.773
Surfaces person-rem	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Collective mortality	0	1.05e-02	1.05e-02	1.06e-02	1.06e-02	1.07e-02	1.07e-02	1.08e-02	1.09e-02
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	11,136	11,712	12,480	12,736	13,248	13,824	15,264	16,704
Surfaces volume (ft ³)	0	0	0	0	0	0	0	0	0
Building waste shipments	0	29	31	33	34	35	36	40	44
Building waste person-rem	0	2.523	2.697	2.871	2.958	3.045	3.132	3.480	3.828
Collective mortality	0	1.26e-03	1.35e-03	1.44e-03	1.48e-03	1.52e-03	1.57e-03	1.74e-03	1.91e-03
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	2679	3351	3365	3375	3394	3394	4108	4151
Surfaces person-h	0	0	0	0	0	0	0	0	0
Collective mortality	0	1.13e-04	1.41e-04	1.41e-04	1.42e-04	1.43e-04	1.43e-04	1.73e-04	1.74e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	29	31	33	34	35	36	40	44
Total distance (km)	0	46,400	49,600	52,800	54,400	56,000	57,600	64,000	70,400
Collective mortality	0	1.76e-03	1.88e-03	2.01e-03	2.07e-03	2.13e-03	2.19e-03	2.43e-03	2.68e-03

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Table B.47.4.1			
Summary Costs for Power Reactor (\$M)			
Structures Case 1			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.115	\$0.269	\$1.384
60	\$1.258	\$0.269	\$1.527
30	\$1.308	\$0.269	\$1.577
25	\$1.334	\$0.269	\$1.603
15	\$1.361	\$0.269	\$1.630
10	\$1.395	\$0.269	\$1.664
3	\$1.600	\$0.269	\$1.869
1	\$1.697	\$0.403	\$2.100

Table B.47.4.2

**Summary Costs for Power Reactor (\$M)
Structures Case 1
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$4.455	\$0.100	\$4.555
60	\$4.772	\$0.100	\$4.872
30	\$5.052	\$0.100	\$5.152
25	\$5.194	\$0.100	\$5.294
15	\$5.335	\$0.100	\$5.435
10	\$5.542	\$0.100	\$5.642
3	\$6.197	\$0.100	\$6.297
1	\$6.709	\$0.100	\$6.809

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Table B.48.1							
Incremental Impacts - Power Reactor - Structures Case 1A							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/f3	Disposal @				Disposal @ \$50/f3	Disposal @ \$350/f3
100 < 60	\$0.143	\$0.317	2.05e-02	2.83e-04	2.02e-02	\$7.081	\$15.70
60 < 25	\$0.076	\$0.422	1.79e-02	3.96e-04	1.75e-02	\$4.337	\$24.08
25 < 15	\$0.027	\$0.141	5.12e-03	1.45e-04	4.97e-03	\$5.428	\$28.34
15 < 3	\$0.239	\$0.862	6.12e-03	6.64e-04	5.46e-03	\$43.8	\$158.0

Table B.48.2

**Statistical Mortality - Power Reactor
Structures Case 1A**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	5.12e-02	1.05e-02	1.26e-03	1.13e-04	1.76e-03	6.48e-02	1.36e-02
60	3.07e-02	1.05e-02	1.35e-03	1.41e-04	1.88e-03	4.46e-02	1.39e-02
30	1.54e-02	1.06e-02	1.44e-03	1.41e-04	2.01e-03	2.95e-02	1.42e-02
25	1.28e-02	1.06e-02	1.48e-03	1.42e-04	2.07e-03	2.71e-02	1.43e-02
15	7.68e-03	1.07e-02	1.52e-03	1.43e-04	2.13e-03	2.21e-02	1.45e-02
10	5.12e-03	1.07e-02	1.57e-03	1.43e-04	2.19e-03	1.97e-02	1.46e-02
3	1.56e-03	1.08e-02	1.74e-03	1.73e-04	2.43e-03	1.67e-02	1.51e-02
1	5.19e-04	1.09e-02	1.91e-03	1.74e-04	2.68e-03	1.62e-02	1.57e-02

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Table B.48.3 Impact and Cost Calculations - Power Reactor Structures Case 1A									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		
REFERENCE FACILITY Power Reactor - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+01	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-04	5.19e-05	1.73e-05
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy		# persons 20	Facility area			250,000 ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-02	8.53e-03	5.12e-03	3.41e-03	1.04e-03	3.46e-04
b. Building renovation		# persons 10							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.16e+00	1.71e-02	1.02e-02	5.12e-03	4.27e-03	2.56e-03	1.71e-03	5.19e-04	1.73e-04
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.49e+00	5.12e-02	3.07e-02	1.54e-02	1.28e-02	7.68e-03	5.12e-03	1.56e-03	5.19e-04
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.48.3 Impact and Cost Calculations - Power Reactor
Structures Case 1A**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	20.979	21.071	21.195	21.235	21.315	21.315	21.541	21.773
Surfaces person-rem	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Collective mortality	0	1.05e-02	1.05e-02	1.06e-02	1.06e-02	1.07e-02	1.07e-02	1.08e-02	1.09e-02
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	11,136	11,712	12,480	12,736	13,248	13,824	15,264	16,704
Surfaces volume (ft ³)	0	0	0	0	0	0	0	0	0
Building waste shipments	0	29	31	33	34	35	36	40	44
Building waste person-rem	0	2.523	2.697	2.871	2.958	3.045	3.132	3.480	3.828
Collective mortality	0	1.26e-03	1.35e-03	1.44e-03	1.48e-03	1.52e-03	1.57e-03	1.74e-03	1.91e-03
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	2679	3351	3365	3375	3394	3394	4108	4151
Surfaces person-h	0	0	0	0	0	0	0	0	0
Collective mortality	0	1.13e-04	1.41e-04	1.41e-04	1.42e-04	1.43e-04	1.43e-04	1.73e-04	1.74e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	29	31	33	34	35	36	40	44
Total distance (km)	0	46,400	49,600	52,800	54,400	56,000	57,600	64,000	70,400
Collective mortality	0	1.76e-03	1.88e-03	2.01e-03	2.07e-03	2.13e-03	2.19e-03	2.43e-03	2.68e-03

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Table B.48.4.1			
Summary Costs for Power Reactor (\$M) Structures Case 1A Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.115	\$0.269	\$1.384
60	\$1.258	\$0.269	\$1.527
30	\$1.308	\$0.269	\$1.577
25	\$1.334	\$0.269	\$1.603
15	\$1.361	\$0.269	\$1.630
10	\$1.395	\$0.269	\$1.664
3	\$1.600	\$0.269	\$1.869
1	\$1.697	\$0.403	\$2.100

Table B.48.4.2

**Summary Costs for Power Reactor (\$M)
Structures Case 1A
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$4.455	\$0.100	\$4.555
60	\$4.772	\$0.100	\$4.872
30	\$5.052	\$0.100	\$5.152
25	\$5.194	\$0.100	\$5.294
15	\$5.335	\$0.100	\$5.435
10	\$5.542	\$0.100	\$5.642
3	\$6.197	\$0.100	\$6.297
1	\$6.709	\$0.100	\$6.809

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Table B.49.1

Incremental Impacts - Power Reactor - Structures Case 2

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
60 < 25	\$0.366	\$0.504	2.24e-01	9.10e-04	2.23e-01	\$1.643	\$2.26
25 < 15	\$0.366	\$0.504	9.42e-02	9.10e-04	9.33e-02	\$3.923	\$5.40
15 < 3	\$0.366	\$0.504	5.49e-02	9.10e-04	5.40e-02	\$6.1	\$9.3

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Table B.49.2

**Statistical Mortality - Power Reactor
Structures Case 2**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.93e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	3.97e-01	4.12e-03
60	2.36e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	2.40e-01	4.12e-03
30	1.18e-02	3.30e-03	5.22e-04	4.81e-04	7.30e-04	1.68e-02	5.03e-03
25	1.18e-02	3.30e-03	5.22e-04	4.81e-04	7.30e-04	1.68e-02	5.03e-03
15	1.18e-02	3.30e-03	5.22e-04	4.81e-04	7.30e-04	1.68e-02	5.03e-03
10	1.18e-02	3.30e-03	5.22e-04	4.81e-04	7.30e-04	1.68e-02	5.03e-03
3	1.19e-02	4.00e-03	6.09e-04	5.84e-04	8.51e-04	1.80e-02	6.05e-03
1	3.98e-03	4.00e-03	6.09e-04	5.84e-04	8.51e-04	1.00e-02	6.05e-03

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Table B.49.3 Impact and Cost Calculations - Power Reactor Structures Case 2									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		
REFERENCE FACILITY Power Reactor - Structures									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+00	3.00e+00	3.00e+00	3.00e+00	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-05	5.12e-05	5.12e-05	5.12e-05	5.19e-05	1.73e-05
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy	# persons	210			Facility area	250,000 ft2			
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	6.64e+01	3.58e-01	2.15e-01	1.08e-02	1.08e-02	1.08e-02	1.08e-02	1.09e-02	3.64e-03
b. Building renovation	# persons	20							
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-03	1.02e-03	1.02e-03	1.02e-03	1.04e-03	3.46e-04
c. Total for working onsite									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	7.27e+01	3.93e-01	2.36e-01	1.18e-02	1.18e-02	1.18e-02	1.18e-02	1.19e-02	3.98e-03
II. Performing Decon - Mortality for Radiation Exposure									

Table B.49.3 Impact and Cost Calculations - Power Reactor Structures Case 2

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	5.191	5.191	6.598	6.598	6.598	6.598	8.004	8.004
Collective mortality	0	2.60e-03	2.60e-03	3.30e-03	3.30e-03	3.30e-03	3.30e-03	4.00e-03	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment	8.70e-02	person-re							
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4554	4554	4554	4554	5014	5014
Building waste shipments	0	11	11	12	12	12	12	14	14
Building waste	0	0.957	0.957	1.044	1.044	1.044	1.044	1.218	1.218
Collective mortality	0	4.79e-04	4.79e-04	5.22e-04	5.22e-04	5.22e-04	5.22e-04	6.09e-04	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	11,454	11,454	11,454	11,454	13,895	13,895
Collective mortality	0	3.79e-04	3.79e-04	4.81e-04	4.81e-04	4.81e-04	4.81e-04	5.84e-04	5.84e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Total shipments (no)	0	11	11	12	12	12	12	14	14
Total distance (km)	0	17,600	17,600	19,200	19,200	19,200	19,200	22,400	22,400
Collective mortality	0	6.69e-04	6.69e-04	7.30e-04	7.30e-04	7.30e-04	7.30e-04	8.51e-04	8.51e-04

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Table B.49.4.1			
Summary Costs for Power Reactor (\$M)			
Structures Case 2			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.690	\$0.315	\$2.005
25	\$1.690	\$0.315	\$2.005
15	\$1.690	\$0.315	\$2.005
10	\$1.690	\$0.315	\$2.005
3	\$2.057	\$0.315	\$2.372
1	\$2.027	\$0.403	\$2.430

Table B.49.4.2

**Summary Costs for Power Reactor (\$M)
Structures Case 2
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$3.056	\$0.315	\$3.371
25	\$3.056	\$0.315	\$3.371
15	\$3.056	\$0.315	\$3.371
10	\$3.056	\$0.315	\$3.371
3	\$3.560	\$0.315	\$3.875
1	\$3.560	\$0.403	\$3.963

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Table B.49.5							
Statistical Mortality - Power Reactor Structures Case 2							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.93e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	3.97e-01	4.12e-03
60	2.36e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	2.40e-01	4.12e-03
30	1.18e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	1.22e-01	4.12e-03
25	9.81e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	1.02e-01	4.12e-03
15	3.93e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	8.96e-03	5.03e-03
10	3.93e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	8.96e-03	5.03e-03
3	3.98e-03	4.00e-03	6.09e-04	5.84e-04	8.51e-04	1.00e-02	6.05e-03
1	3.98e-03	4.00e-03	6.09e-04	5.84e-04	8.51e-04	1.00e-02	6.05e-03

Table B.49.6 Impact and Cost Calculations - Power Reactor Structures Case 2

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal transport rate		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - Structures

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.00e+00	1.00e+00	1.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	1.71e-05	1.71e-05	1.73e-05	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy		# persons 210			Facility area 250,000 ft2				
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	6.64e+01	3.58e-01	2.15e-01	1.08e-01	8.96e-02	3.58e-03	3.58e-03	3.64e-03	3.64e-03
b. Building renovation		# persons 20							
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-02	8.53e-03	3.41e-04	3.41e-04	3.46e-04	3.46e-04
c. Total for working onsite									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Collective mortality	7.27e+01	3.93e-01	2.36e-01	1.18e-01	9.81e-02	3.93e-03	3.93e-03	3.98e-03	3.98e-03

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Table B.49.6 Impact and Cost Calculations - Power Reactor Structures Case 2

II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	5.191	5.191	5.191	5.191	6.598	6.598	8.004	8.004
Collective mortality	0	2.60e-03	2.60e-03	2.60e-03	2.60e-03	3.30e-03	3.30e-03	4.00e-03	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure	8.70e-02 person-rem per shipment								
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4093	4093	4554	4554	5014	5014
Building waste shipments	0	11	11	11	11	12	12	14	14
Building waste person-rem	0	0.957	0.957	0.957	0.957	1.044	1.044	1.218	1.218
Collective mortality	0	4.79e-04	4.79e-04	4.79e-04	4.79e-04	5.22e-04	5.22e-04	6.09e-04	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	9,013	9,013	11,454	11,454	13,895	13,895
Collective mortality	0	3.79e-04	3.79e-04	3.79e-04	3.79e-04	4.81e-04	4.81e-04	5.84e-04	5.84e-04

**Table B.49.6 Impact and Cost Calculations - Power Reactor
Structures Case 2**

V. Transporting Waste - Mortality for Accidents

Residual Dose Limit	None	100	60	30	25	15	10	3	1
Total shipments (no	0	11	11	11	11	12	12	14	14
Total distance (km)	0	17,600	17,600	17,600	17,600	19,200	19,200	22,400	22,400
Collective mortality	0	6.69e-04	6.69e-04	6.69e-04	6.69e-04	7.30e-04	7.30e-04	8.51e-04	8.51e-04

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Table B.49.7.1			
Summary Costs for Power Reactor (\$M)			
Structures Case 2			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.324	\$0.315	\$1.639
25	\$1.324	\$0.315	\$1.639
15	\$1.690	\$0.315	\$2.005
10	\$1.690	\$0.315	\$2.005
3	\$2.057	\$0.315	\$2.372
1	\$2.027	\$0.403	\$2.430

Table B.49.7.2

**Summary Costs for Power Reactor (\$M)
Structures Case 2
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$2.552	\$0.315	\$2.867
25	\$2.552	\$0.315	\$2.867
15	\$3.056	\$0.315	\$3.371
10	\$3.056	\$0.315	\$3.371
3	\$3.560	\$0.315	\$3.875
1	\$3.560	\$0.403	\$3.963

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Table B.49.8							
Statistical Mortality - Power Reactor Structures Case 2							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	3.93e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	3.97e-01	4.12e-03
60	2.36e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	2.40e-01	4.12e-03
30	1.18e-01	2.60e-03	4.79e-04	3.79e-04	6.69e-04	1.22e-01	4.12e-03
25	9.81e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	1.02e-01	4.12e-03
15	5.89e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	6.30e-02	4.12e-03
10	3.93e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	8.96e-03	5.03e-03
3	3.98e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	9.01e-03	5.03e-03
1	3.98e-03	4.00e-03	6.09e-04	5.84e-04	8.51e-04	1.00e-02	6.05e-03

Table B.49.9 Impact and Cost Calculations - Power Reactor

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per person-h		
Exposure duration	70	y		Burial		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+0	1.00e+0	6.00e+0	3.00e+0	2.50e+0	1.50e+0	1.00e+00	1.00e+	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-05	1.73e-	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy	#	210		Facility	250,000	ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.64e+0	3.58e-01	2.15e-01	1.08e-01	8.96e-02	5.38e-02	3.58e-03	3.64e-	3.64e-03
b. Building renovation	#	20							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+0	3.41e-02	2.05e-02	1.02e-02	8.53e-03	5.12e-03	3.41e-04	3.46e-	3.46e-04
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	7.27e+0	3.93e-01	2.36e-01	1.18e-01	9.81e-02	5.89e-02	3.93e-03	3.98e-	3.98e-03

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0

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Table B.49.9 Impact and Cost Calculations - Power Reactor									
Surfaces person-rem	0	5.191	5.191	5.191	5.191	5.191	6.598	6.598	8.004
Collective mortality	0	2.60e-03	2.60e-03	2.60e-03	2.60e-03	2.60e-03	3.30e-03	3.30e-	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure	8.70e-02	person-r							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4093	4093	4093	4554	4554	5014
Building waste shipments	0	11	11	11	11	11	12	12	14
Building waste person-rem	0	0.957	0.957	0.957	0.957	0.957	1.044	1.044	1.218
Collective mortality	0	4.79e-04	4.79e-04	4.79e-04	4.79e-04	4.79e-04	5.22e-04	5.22e-	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	9,013	9,013	9,013	11,454	11,454	13,895
Collective mortality	0	3.79e-04	3.79e-04	3.79e-04	3.79e-04	3.79e-04	4.81e-04	4.81e-	5.84e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	11	11	11	11	11	12	12	14
Total distance (km)	0	17,600	17,600	17,600	17,600	17,600	19,200	19,200	22,400
Collective mortality	0	6.69e-04	6.69e-04	6.69e-04	6.69e-04	6.69e-04	7.30e-04	7.30e-	8.51e-04

Table B.49.10.1

**Summary Costs for Power Reactor (\$M)
Structures Case 2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.324	\$0.315	\$1.639
25	\$1.324	\$0.315	\$1.639
15	\$1.324	\$0.315	\$1.639
10	\$1.690	\$0.315	\$2.005
3	\$1.690	\$0.315	\$2.005
1	\$1.690	\$0.403	\$2.093

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Table B.49.10.2			
Summary Costs for Power Reactor (SM) Structures Case 2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$2.552	\$0.315	\$2.867
25	\$2.552	\$0.315	\$2.867
15	\$2.552	\$0.315	\$2.867
10	\$3.056	\$0.315	\$3.371
3	\$3.056	\$0.315	\$3.371
1	\$3.056	\$0.403	\$3.459

Table B.50.1

Incremental Impacts - Power Reactor - Structures Case 3

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
60 < 25	\$0.366	\$0.504	4.38e-02	9.10e-04	4.29e-02	\$8.539	\$11.76
25 < 15	\$0.366	\$0.504	1.84e-02	9.10e-04	1.75e-02	\$20.890	\$28.77
15 < 3	\$0.366	\$0.504	1.07e-02	9.10e-04	9.83e-03	\$37.2	\$51.3

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Table B.50.2							
Statistical Mortality - Power Reactor Structures Case 3							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	7.68e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	8.09e-02	4.12e-03
60	4.61e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	5.02e-02	4.12e-03
30	2.30e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	7.34e-03	5.03e-03
25	2.30e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	7.34e-03	5.03e-03
15	2.30e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	7.34e-03	5.03e-03
10	2.30e-03	3.30e-03	5.22e-04	4.81e-04	7.30e-04	7.34e-03	5.03e-03
3	2.34e-03	4.00e-03	6.09e-04	5.84e-04	8.51e-04	8.38e-03	6.05e-03
1	7.79e-04	4.00e-03	6.09e-04	5.84e-04	8.51e-04	6.82e-03	6.05e-03

**Table B.50.3 Impact and Cost Calculations - Power Reactor
Structures Case 3**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal transport		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+00	3.00e+00	3.00e+00	3.00e+00	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-05	5.12e-05	5.12e-05	5.12e-05	5.19e-05	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 25 Facility area 250,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	7.91e+00	4.27e-02	2.56e-02	1.28e-03	1.28e-03	1.28e-03	1.28e-03	1.30e-03	4.33e-04

b. Building renovation # persons 20

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-03	1.02e-03	1.02e-03	1.02e-03	1.04e-03	3.46e-04

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.42e+01	7.68e-02	4.61e-02	2.30e-03	2.30e-03	2.30e-03	2.30e-03	2.34e-03	7.79e-04

II. Performing Decon - Mortality for Radiation Exposure

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Table B.50.3 Impact and Cost Calculations - Power Reactor Structures Case 3									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	5.191	5.191	6.598	6.598	6.598	6.598	8.004	8.004
Collective mortality	0	2.60e-03	2.60e-03	3.30e-03	3.30e-03	3.30e-03	3.30e-03	4.00e-03	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4554	4554	4554	4554	5014	5014
Building waste shipments	0	11	11	12	12	12	12	14	14
Building waste person-rem	0	0.957	0.957	1.044	1.044	1.044	1.044	1.218	1.218
Collective mortality	0	4.79e-04	4.79e-04	5.22e-04	5.22e-04	5.22e-04	5.22e-04	6.09e-04	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	11,454	11,454	11,454	11,454	13,895	13,895
Collective mortality	0	3.79e-04	3.79e-04	4.81e-04	4.81e-04	4.81e-04	4.81e-04	5.84e-04	5.84e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	11	11	12	12	12	12	14	14
Total distance (km)	0	17,600	17,600	19,200	19,200	19,200	19,200	22,400	22,400
Collective mortality	0	6.69e-04	6.69e-04	7.30e-04	7.30e-04	7.30e-04	7.30e-04	8.51e-04	8.51e-04

Table B.50.4.1

**Summary Costs for Power Reactor (\$M)
Structures Case 3
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.690	\$0.315	\$2.005
25	\$1.690	\$0.315	\$2.005
15	\$1.690	\$0.315	\$2.005
10	\$1.690	\$0.315	\$2.005
3	\$2.057	\$0.315	\$2.372
1	\$2.027	\$0.403	\$2.430

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Table B.50.4.2			
Summary Costs for Power Reactor (\$M)			
Structures Case 3			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$3.056	\$0.315	\$3.371
25	\$3.056	\$0.315	\$3.371
15	\$3.056	\$0.315	\$3.371
10	\$3.056	\$0.315	\$3.371
3	\$3.560	\$0.315	\$3.875
1	\$3.560	\$0.403	\$3.963

Table B.50.5

**Statistical Mortality - Power Reactor
Structures Case 3**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	7.68e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	8.09e-0	4.12e-03
60	4.61e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	5.02e-0	4.12e-03
30	2.30e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	2.72e-0	4.12e-03
25	1.92e-02	2.60e-03	4.79e-04	3.79e-04	6.69e-04	2.33e-0	4.12e-03
15	7.68e-04	3.30e-03	5.22e-04	4.81e-04	7.30e-04	5.80e-0	5.03e-03
10	7.68e-04	3.30e-03	5.22e-04	4.81e-04	7.30e-04	5.80e-0	5.03e-03
3	7.79e-04	4.00e-03	6.09e-04	5.84e-04	8.51e-04	6.82e-0	6.05e-03
1	7.79e-04	4.00e-03	6.09e-04	5.84e-04	8.51e-04	6.82e-0	6.05e-03

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**Table B.50.6 Impact and Cost Calculations - Power Reactor
Structures Case 3**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per person-h		
Exposure duration	70	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.00e+00	1.00e+00	1.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	1.71e-05	1.71e-05	1.73e-0	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy	# persons 25	Facility area					250,000	ft2		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Collective mortality	7.91e+00	4.27e-02	2.56e-02	1.28e-02	1.07e-02	4.27e-04	4.27e-04	4.33e-0	4.33e-04	

b. Building renovation	# persons 20	Facility area					250,000	ft2		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-02	8.53e-03	3.41e-04	3.41e-04	3.46e-0	3.46e-04	

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.42e+01	7.68e-02	4.61e-02	2.30e-02	1.92e-02	7.68e-04	7.68e-04	7.79e-0	7.79e-04

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
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**Table B.50.6 Impact and Cost Calculations - Power Reactor
Structures Case 3**

Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	5.191	5.191	5.191	5.191	6.598	6.598	8.004	8.004
Collective mortality	0	2.60e-03	2.60e-03	2.60e-03	2.60e-03	3.30e-03	3.30e-03	4.00e-0	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4093	4093	4554	4554	5014	5014
Building waste shipments	0	11	11	11	11	12	12	14	14
Building waste person-rem	0	0.957	0.957	0.957	0.957	1.044	1.044	1.218	1.218
Collective mortality	0	4.79e-04	4.79e-04	4.79e-04	4.79e-04	5.22e-04	5.22e-04	6.09e-0	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	9,013	9,013	11,454	11,454	13,895	13,895
Collective mortality	0	3.79e-04	3.79e-04	3.79e-04	3.79e-04	4.81e-04	4.81e-04	5.84e-0	5.84e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	11	11	11	11	12	12	14	14
Total distance (km)	0	17,600	17,600	17,600	17,600	19,200	19,200	22,400	22,400
Collective mortality	0	6.69e-04	6.69e-04	6.69e-04	6.69e-04	7.30e-04	7.30e-04	8.51e-0	8.51e-04

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Table B.50.7.1			
Summary Costs for Power Reactor (\$M) Structures Case 3 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.324	\$0.315	\$1.639
25	\$1.324	\$0.315	\$1.639
15	\$1.690	\$0.315	\$2.005
10	\$1.690	\$0.315	\$2.005
3	\$2.057	\$0.315	\$2.372
1	\$2.027	\$0.403	\$2.430

Table B.50.7.2

**Summary Costs for Power Reactor (SM)
Structures Case 3
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$2.552	\$0.315	\$2.867
25	\$2.552	\$0.315	\$2.867
15	\$3.056	\$0.315	\$3.371
10	\$3.056	\$0.315	\$3.371
3	\$3.560	\$0.315	\$3.875
1	\$3.560	\$0.403	\$3.963

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Table B.50.8

**Statistical Mortality - Power Reactor
Structures Case 3**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	7.68e-02	2.60e-03	4.79e-04	3.79e-0	6.69e-04	8.09e-02	4.12e-03
60	4.61e-02	2.60e-03	4.79e-04	3.79e-0	6.69e-04	5.02e-02	4.12e-03
30	2.30e-02	2.60e-03	4.79e-04	3.79e-0	6.69e-04	2.72e-02	4.12e-03
25	1.92e-02	2.60e-03	4.79e-04	3.79e-0	6.69e-04	2.33e-02	4.12e-03
15	1.15e-02	2.60e-03	4.79e-04	3.79e-0	6.69e-04	1.56e-02	4.12e-03
10	7.68e-04	3.30e-03	5.22e-04	4.81e-0	7.30e-04	5.80e-03	5.03e-03
3	7.79e-04	3.30e-03	5.22e-04	4.81e-0	7.30e-04	5.81e-03	5.03e-03
1	7.79e-04	4.00e-03	6.09e-04	5.84e-0	8.51e-04	6.82e-03	6.05e-03

Table B.50.9 Impact and Cost Calculations - Power Reactor Structures Case 3

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal		4.2e-08	per person-h		
Exposure duration	70	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Power Reactor - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+00	1.00e+	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-05	1.73e-0	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy		# persons 25		Facility area		250,000 ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	7.91e+00	4.27e-02	2.56e-02	1.28e-02	1.07e-02	6.40e-03	4.27e-04	4.33e-0	4.33e-04
b. Building renovation		# persons 20							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e+00	3.41e-02	2.05e-02	1.02e-02	8.53e-03	5.12e-03	3.41e-04	3.46e-0	3.46e-04
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.42e+01	7.68e-02	4.61e-02	2.30e-02	1.92e-02	1.15e-02	7.68e-04	7.79e-0	7.79e-04

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
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Table B.50.9 Impact and Cost Calculations - Power Reactor Structures Case 3									
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	5.191	5.191	5.191	5.191	5.191	6.598	6.598	8.004
Collective mortality	0	2.60e-03	2.60e-03	2.60e-03	2.60e-03	2.60e-03	3.30e-03	3.30e-0	4.00e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure	8.70e-02 person-rem per shipment								
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	4093	4093	4093	4093	4093	4554	4554	5014
Building waste shipments	0	11	11	11	11	11	12	12	14
Building waste person-rem	0	0.957	0.957	0.957	0.957	0.957	1.044	1.044	1.218
Collective mortality	0	4.79e-04	4.79e-04	4.79e-04	4.79e-04	4.79e-04	5.22e-04	5.22e-0	6.09e-04
REFERENCE FACILITY Power Reactor - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	9,013	9,013	9,013	9,013	9,013	11,454	11,454	13,895
Collective mortality	0	3.79e-04	3.79e-04	3.79e-04	3.79e-04	3.79e-04	4.81e-04	4.81e-0	5.84e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	11	11	11	11	11	12	12	14
Total distance (km)	0	17,600	17,600	17,600	17,600	17,600	19,200	19,200	22,400
Collective mortality	0	6.69e-04	6.69e-04	6.69e-04	6.69e-04	6.69e-04	7.30e-04	7.30e-0	8.51e-04

Table B.50.10.1

**Summary Costs for Power Reactor (\$M)
Structures Case 3
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.324	\$0.315	\$1.639
60	\$1.324	\$0.315	\$1.639
30	\$1.324	\$0.315	\$1.639
25	\$1.324	\$0.315	\$1.639
15	\$1.324	\$0.315	\$1.639
10	\$1.690	\$0.315	\$2.005
3	\$1.690	\$0.315	\$2.005
1	\$1.690	\$0.403	\$2.093

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Table B.50.10.2			
Summary Costs for Power Reactor (\$M)			
Structures Case 3			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.552	\$0.315	\$2.867
60	\$2.552	\$0.315	\$2.867
30	\$2.552	\$0.315	\$2.867
25	\$2.552	\$0.315	\$2.867
15	\$2.552	\$0.315	\$2.867
10	\$3.056	\$0.315	\$3.371
3	\$3.056	\$0.315	\$3.371
1	\$3.056	\$0.403	\$3.459

Table B.51.1

Incremental Impacts - Uranium Fuel Fabrication Facility - Structures Case 1

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
60 < 25	\$1.015	\$1.606	2.14e+00	3.19e-03	2.14e+00	\$0.475	\$0.751
25 < 15	\$1.022	\$1.613	8.92e+01	3.19e-03	8.89e-01	\$1.149	\$1.814
15 < 3	\$1.048	\$1.639	5.35e-01	3.19e-03	5.32e-01	\$1.969	\$3.079

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Table B.51.2							
Statistical Mortality - Uranium Fuel Fabrication Facility Structures Case 1							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	2.14e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.14e+00	0.00e+00
60	2.14e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.14e+00	0.00e+00
30	3.57e-05	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.57e-05	0.00e+00
25	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
15	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
10	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
3	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
1	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03

**Table B.51.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 1**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance	1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal transport rate	3.8e-08	per km		

REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.15e+07	6.00e+01	6.00e+01	1.00e-03	1.00e-03	1.00e-03	1.00e-03	1.00e-03	1.00e-03
Cumulative risk	1.10e+03	2.10e-03	2.10e-03	3.50e-08	3.50e-08	3.50e-08	3.50e-08	3.50e-08	3.50e-08

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 1000 Facility area 240,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.10e+06	2.10e+00	2.10e+00	3.50e-05	3.50e-05	3.50e-05	3.50e-05	3.50e-05	3.50e-05

b. Building renovation # persons 20

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+04	4.20e-02	4.20e-02	7.00e-07	7.00e-07	7.00e-07	7.00e-07	7.00e-07	7.00e-07

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.13e+06	2.14e+00	2.14e+00	3.57e-05	3.57e-05	3.57e-05	3.57e-05	3.57e-05	3.57e-05

II. Performing Decon - Mortality for Radiation Exposure

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Table B.51.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 1									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	4.778	4.778	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	2.39e-03	2.39e-03	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	1,970	1,970	1,970	1,970	1,970
Building waste shipments	0	0	0	0	6	6	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.174	0.174	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	8.70e-05	8.70e-05	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	8,295	8,295	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	3.48e-04	3.48e-04	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	6	6	6	6	6
Total distance (km)	0	0	0	0	9,600	9,600	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	3.65e-04	3.65e-04	3.65e-04	3.65e-04	3.65e-04

Table B.51.4.1

**Summary Costs for Uranium Fuel Fabrication Facility (SM)
Structures Case 1
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$1.013	\$0.154	\$1.167
15	\$1.013	\$0.163	\$1.176
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

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Table B.51.4.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M)			
Structures Case 1			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$1.604	\$0.154	\$1.758
15	\$1.604	\$0.163	\$1.767
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

Table B.51.5

**Statistical Mortality - Uranium Fuel Fabrication Facility
Structures Case 1**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	8.93e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.93e-01	0.00e+00
60	8.93e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.93e-01	0.00e+00
30	8.93e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.93e-01	0.00e+00
25	8.93e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.93e-01	0.00e+00
15	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
10	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
3	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
1	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03

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Table B.51.6 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 1									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h			
Exposure duration	70	y		Burial site distance	1600	km per shipment			
Agricultural usage rate	2500	m2 per		Fatal transport rate	3.8e-08	per km			
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.15e+07	2.50e+01	2.50e+01	2.50e+01	2.50e+01	1.00e-03	1.00e-03	1.00e-03	1.00e-03
Cumulative risk	1.10e+03	8.75e-04	8.75e-04	8.75e-04	8.75e-04	3.50e-08	3.50e-08	3.50e-08	3.50e-08
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy		# persons 1000		Facility area		240,000 ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.10e+06	8.75e-01	8.75e-01	8.75e-01	8.75e-01	3.50e-05	3.50e-05	3.50e-05	3.50e-05
b. Building renovation		# persons 20							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+04	1.75e-02	1.75e-02	1.75e-02	1.75e-02	7.00e-07	7.00e-07	7.00e-07	7.00e-07
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.13e+06	8.93e-01	8.93e-01	8.93e-01	8.93e-01	3.57e-05	3.57e-05	3.57e-05	3.57e-05
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.51.6 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 1**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	0.000	4.778	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.39e-03	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	10,185	10,185	10,185	10,185	1,970	1,970	1,970	1,970
Building waste shipments	0	0	0	0	0	6	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.000	0.174	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.70e-05	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	0	8,295	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.48e-04	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	0	6	6	6	6
Total distance (km)	0	0	0	0	0	9,600	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.65e-04	3.65e-04	3.65e-04	3.65e-04

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Table B.51.7.1			
Summary Costs for Uranium Fuel Fabrication Facility (\$M) Structures Case 1 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$1.013	\$0.163	\$1.176
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

Table B.51.7.2

**Summary Costs for Uranium Fuel Fabrication Facility (\$M)
Structures Case 1
Disposal Cost - \$350/t3**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$1.604	\$0.163	\$1.767
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

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Table B.51.8							
Statistical Mortality - Uranium Fuel Fabrication Facility Structures Case 1							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	3.57e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.57e+00	0.00e+00
60	2.14e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.14e+00	0.00e+00
30	1.07e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.07e+00	0.00e+00
25	5.36e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.36e-01	0.00e+00
15	5.36e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.36e-01	0.00e+00
10	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
3	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03
1	3.57e-05	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.22e-03	3.19e-03

Table B.51.9 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 1

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance	1600	km per		
Agricultural usage rate	2500	m2 per		Fatal transport rate	3.8e-08	per km		

REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.15e+07	1.00e+02	6.00e+0	3.00e+01	5.25e-04	5.25e-04	1.00e-03	1.00e-03	1.00e-03
Cumulative risk	1.10e+03	3.50e-03	2.10e-0	1.05e-03			3.50e-08	3.50e-08	3.50e-08

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy		# persons 1000		Facility area		240,000 ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.10e+06	3.50e+00	2.10e+0	1.05e+00	5.25e-01	5.25e-01	3.50e-05	3.50e-05	3.50e-05
b. Building renovation		# persons 20							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+04	7.00e-02	4.20e-0	2.10e-02	1.05e-02	1.05e-02	7.00e-07	7.00e-07	7.00e-07
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.13e+06	3.57e+00	2.14e+0	1.07e+00	5.36e-01	5.36e-01	3.57e-05	3.57e-05	3.57e-05

II. Performing Decon - Mortality for Radiation Exposure

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Table B.51.9 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 1									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	0.000	0.000	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	0.00e+00	0.00e+00	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	0	1,970	1,970	1,970
Building waste shipments	0	0	0	0	0	0	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.000	0.000	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	0.00e+00	0.00e+00	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	0	0	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	0.00e+00	0.00e+00	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	0	0	6	6	6
Total distance (km)	0	0	0	0	0	0	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	0.00e+00	0.00e+00	3.65e-04	3.65e-04	3.65e-04

Table B.51.10.1

**Summary Costs for Uranium Fuel Fabrication Facility (\$M)
Structures Case 1
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$0.000	\$0.163	\$0.163
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

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Table B.51.10.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M) Structures Case 1 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$0.000	\$0.163	\$0.163
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

Table B.52.1

Incremental Impacts - Uranium Fuel Fabrication Facility - Structures Case 2

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
60 < 25	\$1.015	\$1.606	2.10e-01	3.19e-03	2.07e-01	\$4.908	\$7.766
25 < 15	\$1.022	\$1.613	8.75e-02	3.19e-03	8.43e-02	\$12.122	\$19.132
15 < 3	\$1.048	\$1.639	5.25e-02	3.19e-03	4.93e-02	\$21/254	\$33.240

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Table B.52.2							
Statistical Mortality - Uranium Fuel Fabrication Facility Structures Case 2							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	2.10e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.10e-01	0.00e+00
60	2.10e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.10e-01	0.00e+00
30	3.50e-06	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.50e-06	0.00e+00
25	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
15	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
10	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
3	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
1	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03

**Table B.52.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 2**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h			
Exposure duration	70	y		Burial site distance	1600	km per			
Agricultural usage rate	2500	m2 per		Fatal transport rate	3.8e-08	per km			

REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.15e+07	6.00e+01	6.00e+0	1.00e-03	1.00e-03	1.00e-03	1.00e-03	1.00e-03	1.00e-03
Cumulative risk	1.10e+03	2.10e-03	2.10e-0	3.50e-08	3.50e-08	3.50e-08	3.50e-08	3.50e-08	3.50e-08

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy		# persons 80			Facility area 240,000 ft ²				
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	8.83e+04	1.68e-01	1.68e-0	2.80e-06	2.80e-06	2.80e-06	2.80e-06	2.80e-06	2.80e-06
b. Building renovation		# persons 20							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+04	4.20e-02	4.20e-0	7.00e-07	7.00e-07	7.00e-07	7.00e-07	7.00e-07	7.00e-07
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.10e+05	2.10e-01	2.10e-0	3.50e-06	3.50e-06	3.50e-06	3.50e-06	3.50e-06	3.50e-06

II. Performing Decon - Mortality for Radiation Exposure

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Table B.52.3 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 2									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	4.778	4.778	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	2.39e-03	2.39e-03	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	1,970	1,970	1,970	1,970	1,970
Building waste shipments	0	0	0	0	6	6	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.174	0.174	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	8.70e-05	8.70e-05	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	8,295	8,295	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	3.48e-04	3.48e-04	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	6	6	6	6	6
Total distance (km)	0	0	0	0	9,600	9,600	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+0	0.00e+00	3.65e-04	3.65e-04	3.65e-04	3.65e-04	3.65e-04

Table B.52.4.1

**Summary Costs for Uranium Fuel Fabrication Facility (SM)
Structures Case 2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$1.013	\$0.154	\$1.167
15	\$1.013	\$0.163	\$1.176
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

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Table B.52.4.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M) Structures Case 2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$1.604	\$0.154	\$1.758
15	\$1.604	\$0.163	\$1.767
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

Table B.52.5

**Statistical Mortality - Uranium Fuel Fabrication Facility
Structures Case 2**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	8.75e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.75e-02	0.00e+00
60	8.75e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.75e-02	0.00e+00
30	8.75e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.75e-02	0.00e+00
25	8.75e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.75e-02	0.00e+00
15	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
10	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
3	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
1	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03

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Table B.52.6 Impact and Cost Calculations - Uranium Fuel Fabrication Facility Structures Case 2										
GENERIC ASSUMPTIONS:										
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h				
Exposure duration	70	y		Burial site distance	1600	km per				
Agricultural usage rate	2500	m2 per		Fatal transport rate	3.8e-08	per km				
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures										
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Initial Dose Rate (mrem/y)	3.15e+0	2.50e+01	2.50e+01	2.50e+01	2.50e+01	1.00e-03	1.00e-03	1.00e-03	1.00e-03	
Cumulative risk	1.10e+0	8.75e-04	8.75e-04	8.75e-04	8.75e-04	3.50e-08	3.50e-08	3.50e-08	3.50e-08	
I. Working Onsite - Mortality for Radiation Exposure										
a. Building occupancy	# persons	80	Facility area				240,000	ft2		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Collective mortality	8.83e+0	7.00e-02	7.00e-02	7.00e-02	7.00e-02	2.80e-06	2.80e-06	2.80e-06	2.80e-06	
b. Building renovation	# persons	20								
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Collective mortality	2.21e+0	1.75e-02	1.75e-02	1.75e-02	1.75e-02	7.00e-07	7.00e-07	7.00e-07	7.00e-07	
c. Total for working onsite										
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1	
Collective mortality	1.10e+0	8.75e-02	8.75e-02	8.75e-02	8.75e-02	3.50e-06	3.50e-06	3.50e-06	3.50e-06	
II. Performing Decon - Mortality for Radiation Exposure										

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**Table B.52.6 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 2**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	0.000	4.778	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.39e-03	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	10,185	10,185	10,185	10,185	1,970	1,970	1,970	1,970
Building waste shipments	0	0	0	0	0	6	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.000	0.174	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.70e-05	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	0	8,295	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.48e-04	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	0	6	6	6	6
Total distance (km)	0	0	0	0	0	9,600	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.65e-04	3.65e-04	3.65e-04	3.65e-04

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Table B.52.7.1			
Summary Costs for Uranium Fuel Fabrication Facility (\$M) Structures Case 2 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$1.013	\$0.163	\$1.176
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

Table B.52.7.2

**Summary Costs for Uranium Fuel Fabrication Facility (SM)
Structures Case 2
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$1.604	\$0.163	\$1.767
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

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Table B.52.8							
Statistical Mortality - Uranium Fuel Fabrication Facility Structures Case 2							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	3.50e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.50e-01	0.00e+00
60	2.10e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.10e-01	0.00e+00
30	1.05e-01	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.05e-01	0.00e+00
25	5.25e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.25e-02	0.00e+00
15	5.25e-02	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.25e-02	0.00e+00
10	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
3	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03
1	3.50e-06	2.39e-03	8.70e-05	3.48e-04	3.65e-04	3.19e-03	3.19e-03

**Table B.52.9 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 2**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate	4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance	1600	km per shipment		
Agricultural usage rate	2500	m2 per person		Fatal transport rate	3.8e-08	per km		

REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	3.15e+07	1.00e+02	6.00e+01	3.00e+01	1.50e+01	1.50e+01	1.00e-03	1.00e-03	1.00e-03
Cumulative risk	1.10e+03	3.50e-03	2.10e-03	1.05e-03	5.25e-04	5.25e-04	3.50e-08	3.50e-08	3.50e-08

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 80 Facility area 240,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	8.83e+04	2.80e-01	1.68e-01	8.40e-02	4.20e-02	4.20e-02	2.80e-06	2.80e-06	2.80e-06

b. Building renovation # persons 20

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+04	7.00e-02	4.20e-02	2.10e-02	1.05e-02	1.05e-02	7.00e-07	7.00e-07	7.00e-07

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.10e+05	3.50e-01	2.10e-01	1.05e-01	5.25e-02	5.25e-02	3.50e-06	3.50e-06	3.50e-06

II. Performing Decon - Mortality for Radiation Exposure

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**Table B.52.9 Impact and Cost Calculations - Uranium Fuel Fabrication Facility
Structures Case 2**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	0.000	0.000	0.000	0.000	0.000	4.778	4.778	4.778
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.39e-03	2.39e-03	2.39e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	0	1,970	1,970	1,970
Building waste shipments	0	0	0	0	0	0	6	6	6
Building waste person-rem	0	0.000	0.000	0.000	0.000	0.000	0.174	0.174	0.174
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.70e-05	8.70e-05	8.70e-05
REFERENCE FACILITY Uranium Fuel Fabrication Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	0	0	0	0	0	8,295	8,295	8,295
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.48e-04	3.48e-04	3.48e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	0	0	0	0	0	6	6	6
Total distance (km)	0	0	0	0	0	0	9,600	9,600	9,600
Collective mortality	0	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.65e-04	3.65e-04	3.65e-04

Table B.52.10.1

**Summary Costs for Uranium Fuel Fabrication Facility (\$M)
Structures Case 2
Disposal Cost - \$50/M³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$0.000	\$0.163	\$0.163
10	\$1.013	\$0.163	\$1.176
3	\$1.013	\$0.198	\$1.211
1	\$1.013	\$0.198	\$1.211

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Table B.52.10.2			
Summary Costs for Uranium Fuel Fabrication Facility (\$M)			
Structures Case 2			
Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.000	\$0.129	\$0.129
60	\$0.000	\$0.152	\$0.152
30	\$0.000	\$0.154	\$0.154
25	\$0.000	\$0.154	\$0.154
15	\$0.000	\$0.163	\$0.163
10	\$1.604	\$0.163	\$1.767
3	\$1.604	\$0.198	\$1.802
1	\$1.604	\$0.198	\$1.802

Table B.53.1

Incremental Impacts - Sealed Source Manuf - Structures Case 1

Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft3	Disposal @ \$350/ft3				Disposal @ \$50/ft3	Disposal @ \$350/ft3
60 < 25	\$0.011	\$0.014	6.81e-03	2.40e-05	6.79e-03	\$1.606	\$2.03
25 < 15	\$0.011	\$0.014	2.81e-03	2.40e-05	2.78e-03	\$3.844	\$5.07
15 < 3	\$0.011	\$0.014	1.67e-03	2.40e-05	1.65e-03	\$6..5	\$8.6

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Table B.53.2							
Statistical Mortality - SS Manufacturer Structures Case 1							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.19e-02	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.21e-02	1.74e-04
60	7.17e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	7.34e-03	1.74e-04
30	3.58e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	5.57e-04	1.98e-04
25	3.58e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	5.57e-04	1.98e-04
15	3.58e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	5.57e-04	1.98e-04
10	3.58e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	5.57e-04	1.98e-04
3	3.64e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	5.62e-04	1.98e-04
1	1.21e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.19e-04	1.98e-04

**Table B.53.3 Impact and Cost Calculations - SS Manufacturer
Structures Case 1**

GENERIC ASSUMPTIONS:

Fatal cancer risk	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site		1600	km per shipment		
Agricultural usage	2500	m2 per person		Fatal transport		3.8e-08	per km		

REFERENCE FACILITY SS Manuf - Structures

Residual Dose	None	100	60	30	25	15	10	3	1
Initial Dose Rate	6.53e+04	1.00e+02	6.00e+01	3.00e+00	3.00e+00	3.00e+00	3.00e+00	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-05	5.12e-05	5.12e-05	5.12e-05	5.19e-05	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 5 Facility area 6,000 ft2

Residual Dose	None	100	60	30	25	15	10	3	1
Collective	1.58e+00	8.53e-03	5.12e-03	2.56e-04	2.56e-04	2.56e-04	2.56e-04	2.60e-04	8.65e-05

b. Building renovation # persons 2

Residual Dose	None	100	60	30	25	15	10	3	1
Collective	6.33e-01	3.41e-03	2.05e-03	1.02e-04	1.02e-04	1.02e-04	1.02e-04	1.04e-04	3.46e-05

c. Total for working onsite

Residual Dose	None	100	60	30	25	15	10	3	1
Collective	2.21e+00	1.19e-02	7.17e-03	3.58e-04	3.58e-04	3.58e-04	3.58e-04	3.64e-04	1.21e-04

II. Performing Decon - Mortality for Radiation Exposure

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Table B.53.4.1

**Summary Costs for SS Manuf (SM)
Structures Case 1
Disposal Cost - \$50/m³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.040	\$0.027	\$0.067
25	\$0.040	\$0.027	\$0.067
15	\$0.040	\$0.027	\$0.067
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.040	\$0.027	\$0.067

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Table B.53.4.2			
Summary Costs for SS Manuf (\$M) Structures Case 1 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.075	\$0.027	\$0.102
25	\$0.075	\$0.027	\$0.102
15	\$0.075	\$0.027	\$0.102
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.075	\$0.027	\$0.102

Table B.53.5

**Statistical Mortality - SS Manufacturer
Structures Case 1**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	1.19e-02	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.21e-02	1.74e-04
60	7.17e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	7.34e-03	1.74e-04
30	3.58e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.76e-03	1.74e-04
25	2.99e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.16e-03	1.74e-04
15	1.79e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.77e-04	1.98e-04
10	1.79e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.77e-04	1.98e-04
3	1.82e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.80e-04	1.98e-04
1	1.21e-04	1.00e-04	4.35e-05	1.50e-05	6.08e-05	3.40e-04	2.19e-04

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Table B.53.6 Impact and Cost Calculations - SS Manufacturer Structures Case 1

GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance		1600	km per shipment		
Agricultural usage rate	2500	m2 per person		Fatal transport rate		3.8e-08	per km		
REFERENCE FACILITY SS Manuf - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+00	1.50e+00	1.50e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-05	2.56e-05	2.60e-05	1.73e-05
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy		# persons 5	Facility area		6,000	ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.58e+00	8.53e-03	5.12e-03	2.56e-03	2.13e-03	1.28e-04	1.28e-04	1.30e-04	8.65e-05
b. Building renovation		# persons 2							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e-01	3.41e-03	2.05e-03	1.02e-03	8.53e-04	5.12e-05	5.12e-05	5.19e-05	3.46e-05
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+00	1.19e-02	7.17e-03	3.58e-03	2.99e-03	1.79e-04	1.79e-04	1.82e-04	1.21e-04
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.53.6 Impact and Cost Calculations - SS Manufacturer
Structures Case 1**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	0.122	0.122	0.122	0.122	0.164	0.164	0.164	0.200
Collective mortality	0	6.10e-05	6.10e-05	6.10e-05	6.10e-05	8.20e-05	8.20e-05	8.20e-05	1.00e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	107	107	107	107	118	118	118	129
Building waste shipments	0	1	1	1	1	1	1	1	1
Building waste person-rem	0	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087
Collective mortality	0	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05
REFERENCE FACILITY SS Manuf - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	212	212	212	212	284	284	284	356
Collective mortality	0	8.90e-06	8.90e-06	8.90e-06	8.90e-06	1.19e-05	1.19e-05	1.19e-05	1.50e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	1	1	1	1	1	1	1	1
Total distance (km)	0	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600

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Table B.53.7.1			
Summary Costs for SS Manuf (SM) Structures Case 1 Disposal Cost - \$50/ft3			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.029	\$0.027	\$0.056
25	\$0.029	\$0.027	\$0.056
15	\$0.040	\$0.027	\$0.067
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.050	\$0.027	\$0.077

Table B.53.7.2

**Summary Costs for SS Manuf (\$M)
Structures Case 1
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.061	\$0.027	\$0.088
25	\$0.061	\$0.027	\$0.088
15	\$0.075	\$0.027	\$0.102
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.089	\$0.027	\$0.116

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Table B.53.8							
Statistical Mortality - SS Manufacturer Structures Case 1							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon &)
100	1.19e-02	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.21e-02	1.74e-04
60	7.17e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	7.34e-03	1.74e-04
30	3.58e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.76e-03	1.74e-04
25	2.99e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.16e-03	1.74e-04
15	1.79e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.97e-03	1.74e-04
10	1.19e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.18e-04	1.98e-04
3	1.21e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.19e-04	1.98e-04
1	1.21e-04	1.00e-04	4.35e-05	1.50e-05	6.08e-05	3.40e-04	2.19e-04

Table B.53.9 Impact and Cost Calculations - SS Manufacturer Structures Case 1

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance		1600	km per shipment		
Agricultural usage rate	2500	m2 per person		Fatal transport rate		3.8e-08	per km		

REFERENCE FACILITY SS Manuf - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+00	1.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-05	1.73e-05	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 5 Facility area 6,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	1.58e+00	8.53e-03	5.12e-03	2.56e-03	2.13e-03	1.28e-03	8.53e-05	8.65e-05	8.65e-05

b. Building renovation # persons 2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e-01	3.41e-03	2.05e-03	1.02e-03	8.53e-04	5.12e-04	3.41e-05	3.46e-05	3.46e-05

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.21e+00	1.19e-02	7.17e-03	3.58e-03	2.99e-03	1.79e-03	1.19e-04	1.21e-04	1.21e-04

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
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Table B.53.10.1

**Summary Costs for SS Manuf (\$M)
Structures Case 1
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.029	\$0.027	\$0.056
25	\$0.029	\$0.027	\$0.056
15	\$0.029	\$0.027	\$0.056
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.050	\$0.027	\$0.077

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Table B.53.10.2			
Summary Costs for SS Manuf (\$M) Structures Case 1 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.061	\$0.027	\$0.088
25	\$0.061	\$0.027	\$0.088
15	\$0.061	\$0.027	\$0.088
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.089	\$0.027	\$0.116

Table B.54.1

Incremental Impacts - Sealed Source Manuf - Structures Case 3							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/r3	Disposal @ \$350/r3				Disposal @ \$50/r3	Disposal @ \$350/r3
60 < 25	\$0.011	\$0.014	2.92e-03	2.40e-05	2.89e-03	\$3.766	\$4.77
25 < 15	\$0.011	\$0.014	1.20e-03	2.40e-05	1.18e-03	\$9.075	\$11.96
15 < 3	\$0.011	\$0.014	7.16e-04	2.40e-05	6.92e-04	\$15.5	\$20.4

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Table B.54.2

Statistical Mortality - SS Manufacturer Structures Case 3

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	5.12e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	5.29e-03	1.74e-04
60	3.07e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.25e-03	1.74e-04
30	1.54e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.52e-04	1.98e-04
25	1.54e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.52e-04	1.98e-04
15	1.54e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.52e-04	1.98e-04
10	1.54e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.52e-04	1.98e-04
3	1.56e-04	8.20e-05	4.35e-05	1.19e-05	6.08e-05	3.54e-04	1.98e-04
1	5.19e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.50e-04	1.98e-04

**Table B.54.3 Impact and Cost Calculations - SS Manufacturer
Structures Case 3**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY SS Manuf - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+00	3.00e+00	3.00e+00	3.00e+00	3.00e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-05	5.12e-05	5.12e-05	5.12e-05	5.19e-05	1.73e-05

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 1 Facility area 6,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.16e-01	1.71e-03	1.02e-03	5.12e-05	5.12e-05	5.12e-05	5.12e-05	5.19e-05	1.73e-05

b. Building renovation # persons 2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e-01	3.41e-03	2.05e-03	1.02e-04	1.02e-04	1.02e-04	1.02e-04	1.04e-04	3.46e-05

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.49e-01	5.12e-03	3.07e-03	1.54e-04	1.54e-04	1.54e-04	1.54e-04	1.56e-04	5.19e-05

II. Performing Decon - Mortality for Radiation Exposure

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Table B.54.4.1

**Summary Costs for SS Manuf (\$M)
Structures Case 3
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.040	\$0.027	\$0.067
25	\$0.040	\$0.027	\$0.067
15	\$0.040	\$0.027	\$0.067
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.040	\$0.027	\$0.067

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Table B.54.4.2			
Summary Costs for SS Manuf (\$M) Structures Case 3 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.075	\$0.027	\$0.102
25	\$0.075	\$0.027	\$0.102
15	\$0.075	\$0.027	\$0.102
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.075	\$0.027	\$0.102

Table B.54.5

**Statistical Mortality - SS Manufacturer
Structures Case 3**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	5.12e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	5.29e-03	1.74e-04
60	3.07e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.25e-03	1.74e-04
30	1.54e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.71e-03	1.74e-04
25	1.28e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.45e-03	1.74e-04
15	7.68e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.75e-04	1.98e-04
10	7.68e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.75e-04	1.98e-04
3	7.79e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.76e-04	1.98e-04
1	5.19e-05	1.00e-04	4.35e-05	1.50e-05	6.08e-05	2.71e-04	2.19e-04

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Table B.54.6 Impact and Cost Calculations - SS Manufacturer Structures Case 3									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site		1600	km per shipment		
Agricultural usage rate	2500	m2 per		Fatal transport		3.8e-08	per km		
REFERENCE FACILITY SS Manuf - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+00	1.50e+00	1.50e+00	1.00e+00
Cumulative risk	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-05	2.56e-05	2.60e-05	1.73e-05
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy		# persons 1	Facility area			6,000	ft2		
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-05	2.56e-05	2.60e-05	1.73e-05
b. Building renovation		# persons 2							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e-01	3.41e-03	2.05e-03	1.02e-03	8.53e-04	5.12e-05	5.12e-05	5.19e-05	3.46e-05
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.49e-01	5.12e-03	3.07e-03	1.54e-03	1.28e-03	7.68e-05	7.68e-05	7.79e-05	5.19e-05
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.54.6 Impact and Cost Calculations - SS Manufacturer
Structures Case 3**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	0.122	0.122	0.122	0.122	0.164	0.164	0.164	0.200
Collective mortality	0	6.10e-05	6.10e-05	6.10e-05	6.10e-05	8.20e-05	8.20e-05	8.20e-05	1.00e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 8.70e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	107	107	107	107	118	118	118	129
Building waste shipments	0	1	1	1	1	1	1	1	1
Building waste person-rem	0	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087
Collective mortality	0	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05
REFERENCE FACILITY SS Manuf - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	212	212	212	212	284	284	284	356
Collective mortality	0	8.90e-06	8.90e-06	8.90e-06	8.90e-06	1.19e-05	1.19e-05	1.19e-05	1.50e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1

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**Table B.54.6 Impact and Cost Calculations - SS Manufacturer
Structures Case 3**

Total shipments (no washing)	0	1	1	1	1	1	1	1	1
Total distance (km)	0	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Collective mortality	0	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05

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Table B.54.7.1

**Summary Costs for SS Manuf (\$M)
Structures Case 3
Disposal Cost - \$50/t3**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.029	\$0.027	\$0.056
25	\$0.029	\$0.027	\$0.056
15	\$0.040	\$0.027	\$0.067
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.050	\$0.027	\$0.077

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Table B.54.7.2			
Summary Costs for SS Manuf (\$M) Structures Case 3 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.061	\$0.027	\$0.088
25	\$0.061	\$0.027	\$0.088
15	\$0.075	\$0.027	\$0.102
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.089	\$0.027	\$0.116

Table B.54.8

**Statistical Mortality - SS Manufacturer
Structures Case 3**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			Short Term Fatalities (Decon & Transportation)
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	
100	5.12e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	5.29e-03	1.74e-04
60	3.07e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	3.25e-03	1.74e-04
30	1.54e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.71e-03	1.74e-04
25	1.28e-03	6.10e-05	4.35e-05	8.90e-06	6.08e-05	1.45e-03	1.74e-04
15	7.68e-04	6.10e-05	4.35e-05	8.90e-06	6.08e-05	9.42e-04	1.74e-04
10	5.12e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.49e-04	1.98e-04
3	5.19e-05	8.20e-05	4.35e-05	1.19e-05	6.08e-05	2.50e-04	1.98e-04
1	5.19e-05	1.00e-04	4.35e-05	1.50e-05	6.08e-05	2.71e-04	2.19e-04

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Table B.54.9 Impact and Cost Calculations - SS Manufacturer Structures Case 3									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per person		Fatal		3.8e-08	per km		
REFERENCE FACILITY SS Manuf - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
	6.53e+04	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	1.00e+00	1.00e+00	1.00e+00
Initial Dose Rate (mrem/y)	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-05	1.73e-05	1.73e-05
Cumulative risk									
a. Building occupancy	# persons	1		Facility area	6,000	ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.16e-01	1.71e-03	1.02e-03	5.12e-04	4.27e-04	2.56e-04	1.71e-05	1.73e-05	1.73e-05
b. Building renovation	# persons	2							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.33e-01	3.41e-03	2.05e-03	1.02e-03	8.53e-04	5.12e-04	3.41e-05	3.46e-05	3.46e-05
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	9.49e-01	5.12e-03	3.07e-03	1.54e-03	1.28e-03	7.68e-04	5.12e-05	5.19e-05	5.19e-05
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1

**Table B.54.9 Impact and Cost Calculations - SS Manufacturer
Structures Case 3**

Bioshield person-rem	0	0	0	0.000	0.000	0.000	0.000	0.000	0
Surfaces person-rem	0	0.122	0.122	0.122	0.122	0.122	0.164	0.164	0.200
Collective mortality	0	6.10e-05	6.10e-05	6.10e-05	6.10e-05	6.10e-05	8.20e-05	8.20e-05	1.00e-04
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure	8.70e-02	person-rem							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield volume (ft ³)	0	0	0	0	0	0	0	0	0
Surfaces volume (ft ³)	0	107	107	107	107	107	118	118	129
Building waste shipments	0	1	1	1	1	1	1	1	1
Building waste person-rem	0	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087
Collective mortality	0	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05	4.35e-05
REFERENCE FACILITY SS Manuf - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Bioshield person-h	0	0	0	0	0	0	0	0	0
Surfaces person-h	0	212	212	212	212	212	284	284	356
Collective mortality	0	8.90e-06	8.90e-06	8.90e-06	8.90e-06	8.90e-06	1.19e-05	1.19e-05	1.50e-05
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	1	1	1	1	1	1	1	1
Total distance (km)	0	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Collective mortality	0	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05	6.08e-05

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Table B.54.10.1			
Summary Costs for SS Manuf (\$M)			
Structures Case 3			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.029	\$0.027	\$0.056
60	\$0.029	\$0.027	\$0.056
30	\$0.029	\$0.027	\$0.056
25	\$0.029	\$0.027	\$0.056
15	\$0.029	\$0.027	\$0.056
10	\$0.040	\$0.027	\$0.067
3	\$0.040	\$0.027	\$0.067
1	\$0.050	\$0.027	\$0.077

Table B.54.10.2

**Summary Costs for SS Manuf (SM)
Structures Case 3
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$0.061	\$0.027	\$0.088
60	\$0.061	\$0.027	\$0.088
30	\$0.061	\$0.027	\$0.088
25	\$0.061	\$0.027	\$0.088
15	\$0.061	\$0.027	\$0.088
10	\$0.075	\$0.027	\$0.102
3	\$0.075	\$0.027	\$0.102
1	\$0.089	\$0.027	\$0.116

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Table B.55.1							
Incremental Impacts - Rare Metal Extraction Facility - Structures Case 1							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
60 < 25	\$1.019	\$1.372	1.07e+00	2.43e-03	1.07e+00	\$0.954	\$1.284
25 < 15	\$1.000	\$1.353	4.46e-01	2.43e-03	4.43e-01	\$2.255	\$3.051
15 < 3	\$1.070	\$1.423	2.67e-01	2.43e-03	2.65e-01	\$4.039	\$5.371

Table B.55.2

**Statistical Mortality - Rare Metal Extraction Facility
Structures Case 1**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.79e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e+00	3.79e-03
60	1.07e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.07e+00	3.79e-03
30	5.36e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.39e-01	3.79e-03
25	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
15	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
10	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
3	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
1	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03

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**Table B.55.3 Impact and Cost Calculations - Rare Metal Extraction Facility
Structures Case 1**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Rare Metal Extraction Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.25e-02	2.25e-02	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	7.88e-07	7.88e-07	7.88e-07	7.88e-07	7.88e-07

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 500 Facility area 150,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+03	1.75e+00	1.05e+00	5.25e-01	3.94e-04	3.94e-04	3.94e-04	3.94e-04	3.94e-04

b. Building renovation # persons 10

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	7.88e-06	7.88e-06	7.88e-06	7.88e-06	7.88e-06

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.51e+03	1.79e+00	1.07e+00	5.36e-01	4.02e-04	4.02e-04	4.02e-04	4.02e-04	4.02e-04

II. Performing Decon - Mortality for Radiation Exposure

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**Table B.55.3 Impact and Cost Calculations - Rare Metal Extraction Facility
Structures Case 1**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	4.783	4.783	4.783	8.623	8.623	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	6232	6232	6232	6232	6232
Building waste shipments	0	14	14	14	17	17	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.493	0.493	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	14,971	14,971	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	17	17	17	17	17
Total distance (km)	0	22,400	22,400	22,400	27,200	27,200	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03	1.03e-03	1.03e-03

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Table B.55.4.1			
Summary Costs for Rare Metal Extraction Facility (\$M)			
Structures Case 1			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$2.277	\$0.119	\$2.396
15	\$2.277	\$0.123	\$2.400
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

Table B.55.4.2

**Summary Costs for Rare Metal Extraction Facility (\$M)
Structures Case 1
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$4.146	\$0.119	\$4.265
15	\$4.146	\$0.123	\$4.269
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

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Table B.55.5							
Statistical Mortality - Rare Metal Extraction Facility Structures Case 1							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.79e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e+00	3.79e-03
60	1.07e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.07e+00	3.79e-03
30	5.36e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.39e-01	3.79e-03
25	4.46e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	4.50e-01	3.79e-03
15	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
10	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
3	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
1	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03

Table B.55.6 Impact and Cost Calculations - Rare Metal Extraction Facility

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Rare Metal Extraction Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.50e+01	2.25e-02	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	8.75e-04	7.88e-07	7.88e-07	7.88e-07	7.88e-07

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 500 Facility area 150,000 ft²

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+03	1.75e+00	1.05e+00	5.25e-01	4.38e-01	3.94e-04	3.94e-04	3.94e-04	3.94e-04

b. Building renovation # persons 10

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	8.75e-03	7.88e-06	7.88e-06	7.88e-06	7.88e-06

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.51e+03	1.79e+00	1.07e+00	5.36e-01	4.46e-01	4.02e-04	4.02e-04	4.02e-04	4.02e-04

II. Performing Decon - Mortality for Radiation Exposure

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
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Table B.55.6 Impact and Cost Calculations - Rare Metal Extraction Facility									
Surfaces person-rem	0	4.783	4.783	4.783	4.783	8.623	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	6232	6232	6232	6232
Building waste shipments	0	14	14	14	14	17	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.406	0.493	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	8,304	14,971	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	14	17	17	17	17
Total distance (km)	0	22,400	22,400	22,400	22,400	27,200	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03	1.03e-03

Table B.55.7.1

**Summary Costs for Rare Metal Extraction Facility (SM)
Structures Case 1
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$1.281	\$0.119	\$1.400
15	\$2.277	\$0.123	\$2.400
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

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Table B.55.7.2			
Summary Costs for Rare Metal Extraction Facility (SM) Structures Case 1 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$2.797	\$0.119	\$2.916
15	\$4.146	\$0.123	\$4.269
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

Table B.55.8

**Statistical Mortality - Rare Metal Extraction Facility
Structures Case 1**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.79e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e+00	3.79e-03
60	1.07e+00	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.07e+00	3.79e-03
30	5.36e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.39e-01	3.79e-03
25	4.46e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	4.50e-01	3.79e-03
15	2.68e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	2.72e-01	3.79e-03
10	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
3	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03
1	4.02e-04	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.62e-03	6.22e-03

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Table B.55.9 Impact and Cost Calculations - Rare Metal Extraction Facility Structures Case 1									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		
REFERENCE FACILITY Rare									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	8.75e-04	5.25e-04	7.88e-07	7.88e-07	7.88e-07
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy	# persons	500		Facility area	150,000	ft2			
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+03	1.75e+00	1.05e+00	5.25e-01	4.38e-01	2.63e-01	3.94e-04	3.94e-04	3.94e-04
b. Building renovation	# persons	10							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	8.75e-03	5.25e-03	7.88e-06	7.88e-06	7.88e-06
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.51e+03	1.79e+00	1.07e+00	5.36e-01	4.46e-01	2.68e-01	4.02e-04	4.02e-04	4.02e-04
II. Performing Decon - Mortality for Radiation Exposure									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1

**Table B.55.9 Impact and Cost Calculations - Rare Metal Extraction Facility
Structures Case 1**

Surfaces person-rem	0	4.783	4.783	4.783	4.783	4.783	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure	2.90e-02	person-re							
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	0	6232	6232	6232
Building waste shipments	0	14	14	14	14	14	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.406	0.406	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	8,304	8,304	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	14	14	17	17	17
Total distance (km)	0	22,400	22,400	22,400	22,400	22,400	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03

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Table B.55.10.1			
Summary Costs for Rare Metal Extraction Facility (\$M) Structures Case 1 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$1.281	\$0.119	\$1.400
15	\$1.281	\$0.123	\$1.404
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

Table B.55.10.2

**Summary Costs for Rare Metal Extraction Facility (\$M)
Structures Case 1
Disposal Cost - \$350/t3**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$2.797	\$0.119	\$2.916
15	\$2.797	\$0.123	\$2.920
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

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Table B.56.1							
Incremental Impacts - Rare Metal Extraction Facility - Structures Case 2							
Residual Dose Rate Reduction (mrem/yr)	Present Value Cost (\$M)		Long-Term Fatalities Averted	Short-Term Fatalities Incurred	Net Health Benefit	Cost (\$M) per Net Health Benefit	
	Disposal @ \$50/ft ³	Disposal @ \$350/ft ³				Disposal @ \$50/ft ³	Disposal @ \$350/ft ³
60 < 25	\$1.019	\$1.372	1.05e-01	2.43e-03	1.03e-01	\$9.938	\$13.381
25 < 15	\$1.000	\$1.353	4.37e+02	2.43e+03	4.13e+02	\$24.222	\$32.772
15 < 3	\$1.070	\$1.423	2.62e+02	2.43e+03	2.38e+02	\$44.987	\$59.829

Table B.56.2

**Statistical Mortality - Rare Metal Extraction Facility
Structures Case 2**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.75e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e-01	3.79e-03
60	1.05e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.09e-01	3.79e-03
30	5.25e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.63e-02	3.79e-03
25	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
15	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
10	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
3	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
1	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03

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Table B.56.3 Impact and Cost Calculations - Rare Metal Extraction Facility

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Rare Metal Extraction Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.25e-02	2.25e-02	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	7.88e-07	7.88e-07	7.88e-07	7.88e-07	7.88e-07

I. Working Onsite - Mortality for Radiation Exposurea. Building occupancy # persons 40 Facility area 150,000 ft²

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.76e+02	1.40e-01	8.40e-02	4.20e-02	3.15e-05	3.15e-05	3.15e-05	3.15e-05	3.15e-05

b. Building renovation # persons 10

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	7.88e-06	7.88e-06	7.88e-06	7.88e-06	7.88e-06

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+02	1.75e-01	1.05e-01	5.25e-02	3.94e-05	3.94e-05	3.94e-05	3.94e-05	3.94e-05

II. Performing Decon - Mortality for Radiation Exposure

Table B.56.3 Impact and Cost Calculations - Rare Metal Extraction Facility

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	4.783	4.783	4.783	8.623	8.623	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	6232	6232	6232	6232	6232
Building waste shipments	0	14	14	14	17	17	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.493	0.493	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	14,971	14,971	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	17	17	17	17	17
Total distance (km)	0	22,400	22,400	22,400	27,200	27,200	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03	1.03e-03	1.03e-03

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Table B.56.4.1			
Summary Costs for Rare Metal Extraction Facility (\$M)			
Structures Case 2			
Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$2.277	\$0.119	\$2.396
15	\$2.277	\$0.123	\$2.400
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

Table B.56.4.2

**Summary Costs for Rare Metal Extraction Facility (\$M)
Structures Case 2
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$4.146	\$0.119	\$4.265
15	\$4.146	\$0.123	\$4.269
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

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Table B.56.5							
Statistical Mortality - Rare Metal Extraction Facility Structures Case 2							
Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.75e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e-01	3.79e-03
60	1.05e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.09e-01	3.79e-03
30	5.25e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.63e-02	3.79e-03
25	4.38e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	4.75e-02	3.79e-03
15	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
10	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
3	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
1	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03

**Table B.56.6 Impact and Cost Calculations - Rare Metal Extraction Facility
Structures Case 2**

GENERIC ASSUMPTIONS:

Fatal cancer risk rate	5.00e-04	per rem		Fatal work		4.2e-08	per		
Exposure duration	70	y		Burial site		1600	km per		
Agricultural usage rate	2500	m2 per		Fatal		3.8e-08	per km		

REFERENCE FACILITY Rare Metal Extraction Facility - Structures

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.50e+01	2.25e-02	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	8.75e-04	7.88e-07	7.88e-07	7.88e-07	7.88e-07

I. Working Onsite - Mortality for Radiation Exposure

a. Building occupancy # persons 40 Facility area 150,000 ft2

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.76e+02	1.40e-01	8.40e-02	4.20e-02	3.50e-02	3.15e-05	3.15e-05	3.15e-05	3.15e-05

b. Building renovation # persons 10

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	8.75e-03	7.88e-06	7.88e-06	7.88e-06	7.88e-06

c. Total for working onsite

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+02	1.75e-01	1.05e-01	5.25e-02	4.38e-02	3.94e-05	3.94e-05	3.94e-05	3.94e-05

II. Performing Decon - Mortality for Radiation Exposure

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Table B.56.6 Impact and Cost Calculations - Rare Metal Extraction Facility Structures Case 2									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	4.783	4.783	4.783	4.783	8.623	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	6232	6232	6232	6232
Building waste shipments	0	14	14	14	14	17	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.406	0.493	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	8,304	14,971	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	14	17	17	17	17
Total distance (km)	0	22,400	22,400	22,400	22,400	27,200	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03	1.03e-03

Table B.56.7.1

**Summary Costs for Rare Metal Extraction Facility (\$M)
Structures Case 2
Disposal Cost - \$50/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$1.281	\$0.119	\$1.400
15	\$2.277	\$0.123	\$2.400
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

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Table B.56.7.2			
Summary Costs for Rare Metal Extraction Facility (SM) Structures Case 2 Disposal Cost - \$350/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$2.797	\$0.119	\$2.916
15	\$4.146	\$0.123	\$4.269
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

Table B.56.8

**Statistical Mortality - Rare Metal Extraction Facility
Structures Case 2**

Residual Dose Limit (mrem/yr)	Mortality from Radiation Exposure			Mortality from Accidents			
	Working Onsite	Perform Decon	Transport Waste	Perform Decon	Transport Waste	TOTAL	Short Term Fatalities (Decon & Transportation)
100	1.75e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.79e-01	3.79e-03
60	1.05e-01	2.39e-03	2.03e-04	3.49e-04	8.51e-04	1.09e-01	3.79e-03
30	5.25e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	5.63e-02	3.79e-03
25	4.38e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	4.75e-02	3.79e-03
15	2.63e-02	2.39e-03	2.03e-04	3.49e-04	8.51e-04	3.00e-02	3.79e-03
10	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
3	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03
1	3.94e-05	4.31e-03	2.47e-04	6.29e-04	1.03e-03	6.26e-03	6.22e-03

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Table B.56.9 Impact and Cost Calculations - Rare Metal Extraction Facility Structures Case 2									
GENERIC ASSUMPTIONS:									
Fatal cancer risk rate	5.00e-04	per rem		Fatal work rate		4.2e-08	per person-h		
Exposure duration	70	y		Burial site distance		1600	km per shipment		
Agricultural usage rate	2500	m2 per person		Fatal transport rate		3.8e-08	per km		
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Initial Dose Rate (mrem/y)	1.97e+05	1.00e+02	6.00e+01	3.00e+01	2.50e+01	1.50e+01	2.25e-02	2.25e-02	2.25e-02
Cumulative risk	6.89e+00	3.50e-03	2.10e-03	1.05e-03	8.75e-04	5.25e-04	7.88e-07	7.88e-07	7.88e-07
I. Working Onsite - Mortality for Radiation Exposure									
a. Building occupancy	# persons 40	Facility area			150,000 ft2				
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	2.76e+02	1.40e-01	8.40e-02	4.20e-02	3.50e-02	2.10e-02	3.15e-05	3.15e-05	3.15e-05
b. Building renovation	# persons 10								
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	6.89e+01	3.50e-02	2.10e-02	1.05e-02	8.75e-03	5.25e-03	7.88e-06	7.88e-06	7.88e-06
c. Total for working onsite									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Collective mortality	3.44e+02	1.75e-01	1.05e-01	5.25e-02	4.38e-02	2.63e-02	3.94e-05	3.94e-05	3.94e-05
II. Performing Decon - Mortality for Radiation Exposure									

**Table B.56.9 Impact and Cost Calculations - Rare Metal Extraction Facility
Structures Case 2**

Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-rem	0	4.783	4.783	4.783	4.783	4.783	8.623	8.623	8.623
Collective mortality	0	2.39e-03	2.39e-03	2.39e-03	2.39e-03	2.39e-03	4.31e-03	4.31e-03	4.31e-03
III. Transporting Waste - Mortality for Radiation Exposure									
Waste shipment exposure 2.90e-02 person-rem per shipment									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces volume (ft ³)	0	0	0	0	0	0	6232	6232	6232
Building waste shipments	0	14	14	14	14	14	17	17	17
Building waste person-rem	0	0.406	0.406	0.406	0.406	0.406	0.493	0.493	0.493
Collective mortality	0	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.03e-04	2.47e-04	2.47e-04	2.47e-04
REFERENCE FACILITY Rare Metal Extraction Facility - Structures									
IV. Performing Decon - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Surfaces person-h	0	8,304	8,304	8,304	8,304	8,304	14,971	14,971	14,971
Collective mortality	0	3.49e-04	3.49e-04	3.49e-04	3.49e-04	3.49e-04	6.29e-04	6.29e-04	6.29e-04
V. Transporting Waste - Mortality for Accidents									
Residual Dose Limit (mrem/y)	None	100	60	30	25	15	10	3	1
Total shipments (no washing)	0	14	14	14	14	14	17	17	17
Total distance (km)	0	22,400	22,400	22,400	22,400	22,400	27,200	27,200	27,200
Collective mortality	0	8.51e-04	8.51e-04	8.51e-04	8.51e-04	8.51e-04	1.03e-03	1.03e-03	1.03e-03

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Table B.56.10.1			
Summary Costs for Rare Metal Extraction Facility (SM) Structures Case 2 Disposal Cost - \$50/ft³			
Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$1.281	\$0.096	\$1.377
60	\$1.281	\$0.096	\$1.377
30	\$1.281	\$0.096	\$1.377
25	\$1.281	\$0.119	\$1.400
15	\$1.281	\$0.123	\$1.404
10	\$2.277	\$0.123	\$2.400
3	\$2.277	\$0.197	\$2.474
1	\$2.277	\$0.197	\$2.474

Table B.56.10.2

**Summary Costs for Rare Metal Extraction Facility (SM)
Structures Case 2
Disposal Cost - \$350/ft³**

Residual Dose Limit (mrem/y)	Facility Decon	Survey	TOTAL
100	\$2.797	\$0.096	\$2.893
60	\$2.797	\$0.096	\$2.893
30	\$2.797	\$0.096	\$2.893
25	\$2.797	\$0.119	\$2.916
15	\$2.797	\$0.123	\$2.920
10	\$4.146	\$0.123	\$4.269
3	\$4.146	\$0.197	\$4.343
1	\$4.146	\$0.197	\$4.343

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ATTACHMENT C

REPRODUCED SECTIONS OF CHAPTER 5.3 OF DRAFT GEIS

ATTACHMENT C

REPRODUCED SECTIONS OF CHAPTER 5.3 OF DRAFT GEIS

In this final GEIS, reference is made to analysis and results from Chapter 5.3 of the draft GEIS. To assist the user of this report and to provide completeness, those Sections of Chapter 5.3 of the draft GEIS are reproduced here as Attachment C. The section numbering system indicating that this was Chapter 5.3 has been retained.

5.3 Other Environmental Consequences

Environmental consequences other than those directly affecting human health are evaluated in this section. These include impacts on the biological, socioeconomic, and physical environments both from the decontamination activities and from residual radiation levels. Specifically addressed are the physical and radiological impacts on plant and animal populations; land use changes; social, economic, and cultural resource impacts; noise; aesthetics; and impacts on planned low-level waste disposal capacity.

Impacts were previously evaluated for the entire decommissioning process and are described in NUREG-0586 (NRC, 1988) and supporting documents. Since the decontamination of building structures and areas of contaminated soils is a component of decommissioning, some of the same activities and impacts were discussed in that document. This GEIS focuses on both the costs and environmental effects attributable to activities required to achieve the residual dose criteria indicated in Section 5.2.1.

5.3.1 Biological Environment

During the decommissioning process, biological components of the environment may be affected by the physical removal of contaminated soils from site areas outside of structures and by exposure to any residual radiation. Estimated area and depth of soil contamination for each category of reference facility are given in Table 4-1.

Decontamination activities would include physical removal of the contaminated soils to depths of a few inches to a foot or more, followed by conditioning and revegetating of the disturbed area. Where warranted, site surveys for State or Federally listed or candidate threatened or endangered species would be made prior to any land disturbance outside of the facility structures.

Analysis of the effects on these environmental components is qualitative because radionuclide impact analysis on human health will usually bound the impact on biota, and because the range of residual dose criteria being considered in this GEIS is well below the exposures where effects were observed on biota (SC&A, 1993a). Also, issues related to biota may be very site-specific and will need to be addressed in an EIS prepared for a specific facility.

5.3.1.1 Plants.

Decontamination.

Soils and vegetation would be removed to depths of a few inches to a foot or more at a few hundred sites. Areas affected range from a few hundred square feet to 300 acres of land surface. After excavation to acceptable levels of residual radiation, the disturbed areas would be revegetated. These effects would be local and temporary. It is expected that most

vegetation involved would be grasses, forbs, and shrubs, and successful reestablishment would occur within a few growing seasons.

The IAEA (1992) concluded after a review of the major studies on effects of radiation on plants that "it appears that in the natural environment, the most sensitive plants display acute radiation sensitivities which are similar in magnitude to those found for mammals, but that the majority of data relate to radiation exposures which are not acute for the plant species investigated but are more correctly described as short term or chronic."

Based on a review of the scientific literature, no discernible effects to individual plants or plant communities are expected at residual dose levels of 100 mrem/yr or less. Reduction in shoot growth for the radiosensitive pines occurred at an exposure of 1 R/day, several thousand times the 100 mrem/yr residual dose level.

5.3.1.2 Mammals.

Decontamination.

Earth removal activities would result in loss or displacement of any mammals living or foraging on a few hundred square feet to 300 acres of land surface at several hundred sites. These effects would be local and temporary. Habitat would soon re-establish to former levels. It is expected that the smaller field mammals would be most affected, and these would quickly repopulate the area once revegetation was completed.

Post-decommissioning.

Mammals could be exposed to radionuclides at decommissioned sites both from external irradiation from being on the land surface or living in burrows on the site and by ingestion of any onsite vegetation having increased radionuclide content through uptake from contaminated soil. While the effects of external irradiation have received extensive study, the scientific literature contains little information concerning the effects on animals from ingestion of radionuclides through the food chain.

A summary by Rice and Baptist (1974) indicated that several species of mammals have LD50s slightly lower than man's. It appears that several large domestic animals are at least as radiosensitive as humans to the effects of acute radiation exposure. The LD50s for cattle, dogs, burros, and goats are on the order of 240 to 255 rads, compared with an LD50 of 300 rads for humans. One can speculate that the larger wild animals, such as bear and moose, are comparable to the large domestic animals in radiosensitivity (SC&A, 1993a).

Even the more radiosensitive mammals for which data are available appear to be only slightly more susceptible than humans to radiation effects. Thus, even with the possibility of an added exposure to some mammals from ingestion of vegetation with an added uptake of

radionuclides, no discernible effects to individual mammals or populations are expected at residual dose levels of 100 mrem/yr or less.

5.3.1.3 Birds.

Decontamination.

Earth removal activities would displace any birds living or foraging on a few hundred square feet to 300 acres of land surface at several hundred sites. Soil removal during the nesting season could result in loss of eggs or nestlings. These effects would be local and temporary. It is expected that the ground nesting field birds would be most affected. Habitat and populations would soon re-establish to former levels.

Post-decommissioning.

The radiosensitivity of wild birds appears to range from about 400 to > 1000 R for acute LD50s. Few data are available for assessing the effects of protracted (rather than acute) radiation exposures and the effects of low intensities (IAEA, 1992). Several factors enter into evaluating avian exposure at a decommissioned site. The exposure for each species will differ, based on feeding habits, time spent on site, and nesting habits. Considering the short natural life spans of most wild bird species (typically a few years) and the migratory nature of many species as well as the fact that wild birds appear to be less radiosensitive than humans, no discernible effects on individual wild birds or populations are expected at residual dose levels of 100 mrem/yr or less.

5.3.1.4 Reptiles and Amphibians.

Decontamination.

Earth removal activities would result in loss or displacement of any reptiles and amphibians living or foraging on a few hundred square feet to 300 acres of land surface at several hundred sites. These effects would be local and temporary. Habitat and populations would soon re-establish to former levels.

Post-decommissioning.

While there are few studies of the radiosensitivity of reptiles and amphibians, available data suggest that they may be somewhat less sensitive than birds and mammals, though there appears to be some overlap. At chronic radiation exposure of ~2 R/day over a period of 1 to 2 years, females of two long-lived species of lizards became sterile and populations drifted toward extinction. Another species showed no effects on life spans, age distributions, and sex ratios after 5 years of exposure. Results from another experiment suggest impaired reproduction in several species of lizards after exposures of 1 to 5 rad/day over a 5-year period; many survivors lacked ovaries and many males were sterile

(IAEA, 1992). However, the exposures in these studies are several thousand times the maximum residual levels contemplated in the proposed standards; no discernible effects on individual reptiles and amphibians or populations are expected at residual dose levels of 100 mrem/yr or less.

5.3.1.5 Invertebrates.

Decontamination.

Earth removal activities would displace any invertebrates living or foraging on a few hundred square feet to 300 acres of land surface at several hundred sites. These effects would be local and temporary. Habitat and populations would soon re-establish to former levels.

Post-decommissioning.

A review by O'Brian and Wolfe (1964) indicated that lethal doses for insects were generally in excess of 10,000 R. The exposures discussed in the review are many orders of magnitude higher than the maximum residual levels contemplated in the proposed standards; no discernible effects on individual invertebrates or populations are expected at residual dose levels of 100 mrem/yr or less.

5.3.2 Socioeconomic Environments

Human social, cultural, and economic institutions exist in the vicinity of the nuclear facility during the time that the facility is operating. These institutions could be affected by specific decommissioning actions and the alternative regulatory approaches being considered, and new social, cultural, and economic institutions may come to exist following license termination. The analysis of the impacts on these environments is qualitative because, for the range of doses being considered, the differential impact on these institutions is not significant. Also, the socioeconomic impacts will be very site-specific and do not lend themselves to generic analysis. The GEIS does not specifically include the impacts on Native American tribal land use. This GEIS evaluation is based on reference facilities, which means that the average or most typical case is characterized. Tribal use is very specific, and impacts can most properly be assessed on a case-by-case basis. Impacts on Native American tribal use of site lands would be better addressed in an Environmental Impact Statement or Environmental Assessment for a specific facility at the time of decommissioning of that facility.

Decontamination.

Decontamination activities at major facilities will require teams of nuclear professionals and construction workers for periods of several months to several years; this work will be carried out by the existing workforce and/or through contracting. At some sites, there may be a temporary influx of construction crews for major demolition and earthmoving work. This may result in temporary increases in local populations, traffic, and demands on community

services. The incremental impact in the person-hours spent working on site attributable to the alternate residual dose criteria being considered is generally small compared to the total amount of labor involved in a decommissioning.

Post-decommissioning.

Socioeconomic effects could occur locally if land use restrictions precluded future industrial or commercial development of the site and no alternate lands were available locally. Certain land uses such as housing, schools, etc., may be precluded at the higher proposed levels of residual radiation. This could result in the site being dedicated to non-occupancy uses such as parking lots, green belts, or open space. These effects will depend on the specific location and local land availability. Site-specific environmental analyses will be prepared for sites where post-decommissioning land uses are restricted.

5.3.3 Physical Environment

The physical environment (water, noise levels, air quality, aesthetics, and low-level waste capacity) could be affected by specific decommissioning actions and the alternative regulatory approaches being considered as part of license termination. Except for low-level waste capacity, analysis of the impacts on these components is qualitative because, for the range of doses being considered, the differential impact on these physical environments is not significant. Also, most of these impacts will be very site-specific and do not lend themselves to generic analysis. However, quantitative analysis of the adequacy and utilization of low-level waste capacity is provided.

5.3.3.1 Noise and Aesthetics.

Decontamination.

Levels of noise attributable to decontamination work will generally be comparable to the normal industrial activities previously carried out at the sites.

Post-decommissioning.

No incremental noise or aesthetic effects will be attributable to the alternative residual dose criteria being considered. Such effects could result from any subsequent uses of the sites but cannot be predicted at this time.

5.3.3.2 Water Resources.

The specific environmental review of impacts on the water resources at a site would be considered in detail in a site-specific environmental statement or assessment. The following is a generic discussion of water resources as it relates to possible incremental impacts from alternate dose criteria.

Surface Water.

At some sites, small areas of ponded surface waters will require decontamination, usually by evaporation. These contaminated waters may not be considered suitable for domestic, agricultural, or wildlife use. Treatment of these contaminated waters will eliminate the risk of release or discharge and contamination of local streams and drainages. Conceivably, during precipitation, there could be some contamination of runoff through leaching or suspension of radionuclide-contaminated soils. The effects of this are not expected to be discernible at the decontamination criteria or residual levels under review.

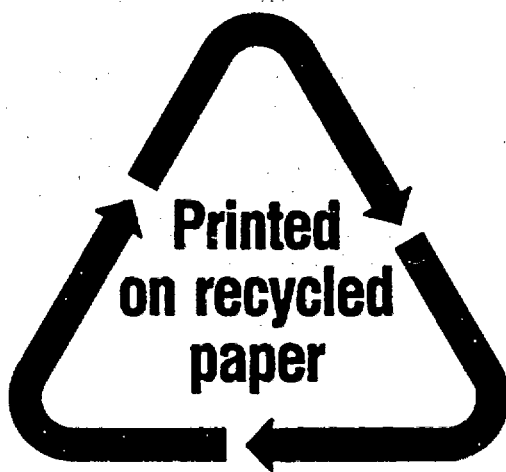
Groundwater.

Removal of contaminated soils and treatment of contaminated surface waters will remove potential sources of groundwater contamination. Conceivably, during precipitation, contaminated soils could be leached by downward percolating water thereby contaminating local groundwater resources. The effects of this contamination are not expected to be discernible at the decontamination criteria or residual levels under review.

5.3.3.3 Air Quality.

As at any demolition or earthmoving project, during removal of structures and soils, there will be some local degradation of air quality from increased particulates and emissions from diesel or gasoline engines. Workers will be required to follow standard dust suppression practices, maintain appropriate emission controls on diesel and gasoline motors, and follow approved practices for any blasting. Applicable air quality standards should not be exceeded. The incremental impact on air quality attributable to the alternate residual dose criteria being considered should be small based on the type of activities to be carried out and the methods used for controlling emissions.

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202	U.S. NUCLEAR REGULATORY COMMISSION BIBLIOGRAPHIC DATA SHEET (See instructions on the reverse)	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1496 Vol. 2			
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11. ABSTRACT (200 words or less) <p>The action being considered in this Final Generic Environmental Impact Statement (GEIS) is an amendment to the Nuclear Regulatory Commission's (NRC) regulations in 10 CFR Part 20 to include radiological criteria for decommissioning of lands and structures at nuclear facilities. Under the National Environmental Policy Act (NEPA), all Federal agencies must consider the effect of their actions on the environment. To fulfill NRC's responsibilities under NEPA, the Commission is preparing this GEIS which analyzes alternative courses of action and the costs and impacts associated with those alternatives.</p> <p>In preparing the final GEIS, the following approach was taken: (1) a listing was developed of regulatory alternatives for establishing radiological criteria for decommissioning; (2) for each alternative, a detailed analysis and comparison of incremental impacts, both radiological and nonradiological, to workers, members of the public, and the environment, and costs were performed; and (3) based on the analysis of impacts and costs, conclusions on radiological criteria for decommissioning were provided. Contained in the GEIS are results and conclusions related to achieving, as an objective of decommissioning ALARA, reduction to preexisting background, the radiological criterion for unrestricted use, decommissioning ALARA analysis for soils and structures containing contamination, restricted use and alternative analysis for special site-specific situations and groundwater cleanup.</p>					
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