APPENDIX A

DERIVATION OF CLEANUP CRITERIA

INSTALLATION RESTORATION PROGRAM
KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

DERIVATION OF CLEANUP CRITERIA
FOR
INSTALLATION RESTORATION PROGRAM SITE OT-10,
RADIATION TRAINING SITES

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Prepared for

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OMAHA DISTRICT

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CONTENTS

Section **Page**

ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE vi

DERIVATION OF CLEANUP GOALS A-1

A.1 Objective of Analysis A-1
A.2 Facility Background A-1
A.3 Exposure Assessment A-1
A.3.1 Potential Receptors A-3
A.3.2 Potential Exposure Pathways A-3
A.3.3 RESRAD Modeling A-4
A.4 Results A-4
A.4.1 Uncertainty Analysis A-7

REFERENCES A-8

ATTACHMENT 1 EXPOSURE PARAMETERS AR-1

ATTACHMENT 2 GRAPHS OF MODELING RESULTS

ATTACHMENT 3 PARAMETER CALCULATIONS

FIGURES

Figure **Page**

A.1-1 Site Location Map A-2

A.3-1 Conceptual Model A-5

A.3-2 Thorium Decay Series A-6

TABLES

Table **Page**

A.4-1 Thorium-232 Concentrations by Receptor Producing a 25 mrem/yr Dose A-9
A.4-2 Thorium-232 Effects by Pathway for Each Receptor Producing a Total 25 mrem/yr Dose A-9
A.4-3 Thorium-232 Concentrations by Receptor Producing a 25 mrem/yr Dose for OT-10, TS7 ..... A-10
A.4-4 Exposure Dose by Pathway for OT-10, TS7 ..... A-10

ACRONYMS, ABBREVIATIONS AND UNITS OF MEASURE

AFB	Air Force Base
bgs	below ground surface
CFR	*Code of Federal Regulations*
DNWS	Defense Nuclear Weapons School
ED	exposure duration
EF	exposure factor
EFH	*Exposure Factors Handbook*
EPA	U.S. Environmental Protection Agency
ft	foot and feet
IR	inhalation rate
IRP	Installation Restoration Program
mg/m^3	milligrams per cubic meter
mrem/year	millirem per year
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
PEF	particulate emission factor
PPE	personal protective equipment
RESRAD	residual radiation
TS5	Training Site 5
TS6	Training Site 6
TS7	Training Site 7
TS8	Training Site 8
USAF	U.S. Air Force

DERIVATION OF CLEANUP GOALS

A.1 OBJECTIVE OF ANALYSIS

This appendix describes the derivation of cleanup goals for four former Defense Nuclear Weapons School (DNWS) Radiation Training Sites at Kirtland Air Force Base (AFB). These inactive sites are Training Site 5 (TS5): 13.4 acres, Training Site 6 (TS6): 19 acres, Training Site 7 (TS7): 8.4 acres, and Training Site 8 (TS8): 2.4 acres, and comprise Kirtland AFB's Installation Restoration Program (IRP) Site OT-10. The sites are located in the north-central part of Kirtland AFB (see Figure A.1-1).

A.2 FACILITY BACKGROUND

From 1961 to 1990, the sites were used to train radiological response personnel in the detection of dispersed contamination resulting from simulated nuclear weapons accidents. Known quantities of Brazilian thorium oxide sludge were applied and tilled into site soils to simulate dispersed plutonium. Four other training sites (TS1 through TS4) remain active and are not addressed in this appendix.

The nature and extent of radioactive-waste-contaminated soils at the OT-10 sites were characterized during initial site surveys and two full-scale investigations. The initial site surveys were conducted at OT-10 from December 1988 to January 1990 to assess the potential for contamination to migrate off-site, and the impact of radionuclide contamination in surface and subsurface soils, vegetation, and surface water (Rademacher, 1992).

The first comprehensive investigation of OT-10, conducted between October 1994 and May 1995, included gamma-ray scan surveying and coring to delineate the general extent of radionuclide contamination. This investigation concluded that radiological contamination at OT-10 was limited to thorium-232 and its decay progeny (USAF, 1997).

A second investigation was conducted in 1996 and 1998. The horizontal extent of previously identified radiological soil contamination was confirmed, and the vertical extent of the radiological contamination in hot spots was defined. No chemical contaminants of concern were identified. The concentrations of radionuclides decreased with increasing depth, and extended in places to about 2 feet (ft) below ground surface (bgs) at TS7, 3 ft bgs at TS5, and 5 ft bgs at TS6 and TS8 (USAF, 1999).

Approximately 9 of the 43.2 acres in OT-10 had been impacted with thorium at the time of the most recent investigation (USAF, 1999). Impacted areas at each of the training sites were: TS5 – 2.7 acres of 13.4 acres; TS6 – 6.1 acres of 19 acres; TS7 – 0.03 acres of 8.4 acres; and TS8 – 0.4 acres of 2.4 acres.

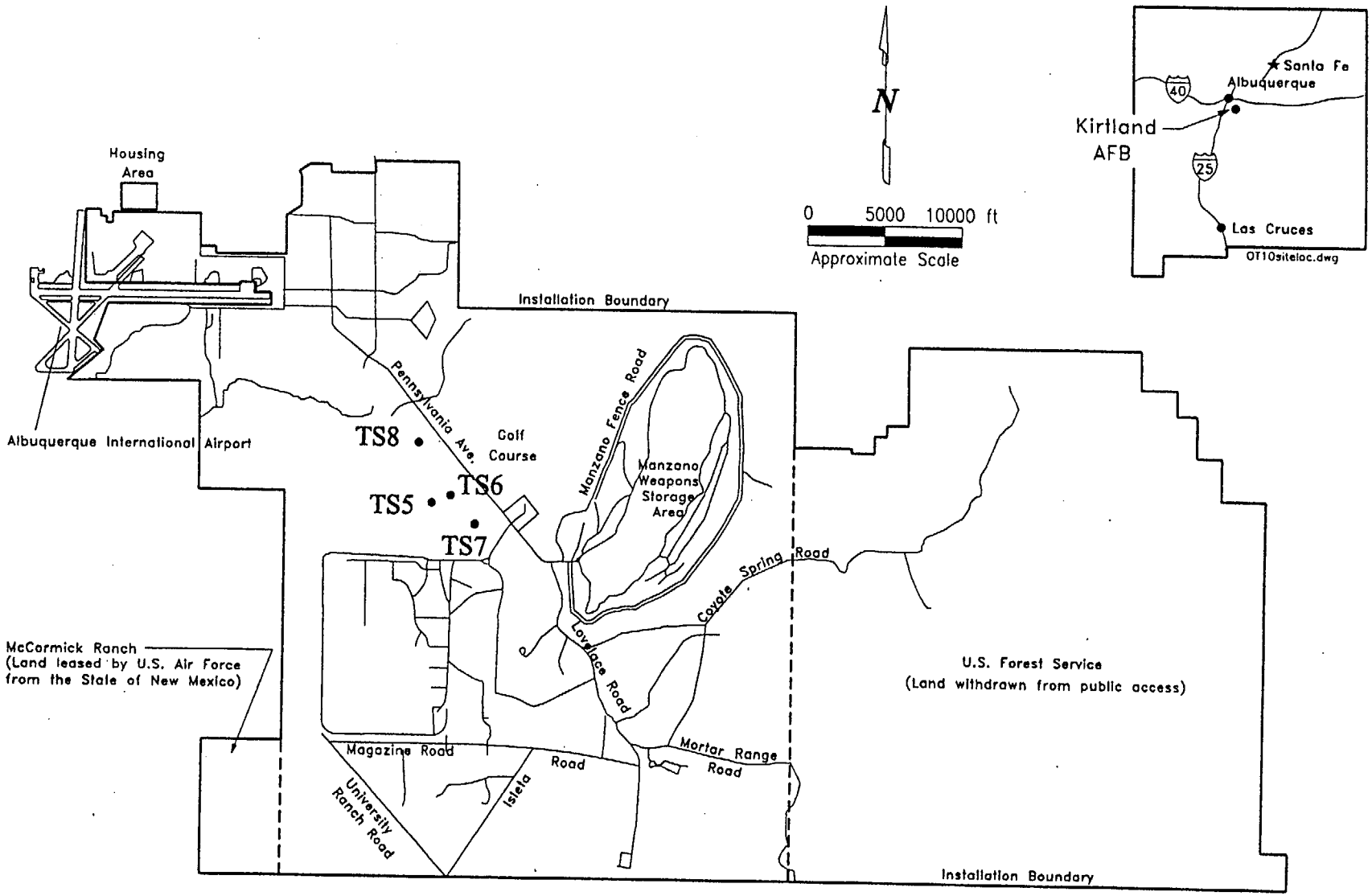

Figure A1-1. Site Location Map for IRP Site OT-10, Radiation Training Sites

Site descriptions are provided in Section 2 of the Decommissioning Plan. TS5 is located southwest of the Tijeras Arroyo Golf Course. The terrain is relatively flat. TS6 is located several hundred ft east/northeast of TS5. It slopes gently north, northeast toward Arroyo del Coyote. The arroyo runs parallel to the northeast side of TS6, at approximately 6 ft to 100 ft beyond the site boundary. TS7 is the southernmost OT-10 site, located southeast of TS6. The site is relatively flat. There are no buildings at TS5, TS6, and TS7. TS8 is the northernmost of the OT-10 sites. Site features were modified to represent a storage facility accident. It contains an igloo storage building and scattered debris, including a rocket shell. Seeding equipment and barrels containing sludge were occasionally stored in the igloo located at this site, as well as in two igloos adjacent to and southeast of the fenced area.

OT-10 soils are deep and well-drained gravelly-fine, sandy, and very fine sandy loams. Grasses (about ten species) and shrubs (about four species) are associated with these soils (USAF, 1995a). Site topography is generally flat, but slopes gently in places.

A.3 EXPOSURE ASSESSMENT

The exposure assessment is an evaluation of who may be exposed to constituents present at the sites, how they would be exposed, and how much exposure could occur. Several steps are involved. The first step is identifying populations who are (or may in the future be) potentially exposed to constituents released from the sites. The second step is the development of a conceptual model, which describes the pathways by which exposure could occur. An exposure pathway includes a source and mechanism of release, a transport medium, a point of contact with the affected medium, and an exposure route (for example, ingestion). If any one of these components is not present, the pathway is incomplete and no exposure can occur. For potentially complete exposure pathways, this section also describes how the exposure will be quantified. In this analysis, the only constituent is thorium-232.

A.3.1 POTENTIAL RECEPTORS

Currently, the sites at OT-10 are not being used, and no receptors are present. There are, however, potential future receptors because land use may change. The portion of Kirtland AFB where OT-10 is located is designated for industrial use under the Kirtland AFB Master Plan (USAF, 1995b). Potential receptors under this land use include site workers, construction workers, and site visitors. Site workers include people who primarily work indoors such as office workers, and people who primarily work outdoors such as groundskeepers. Site visitors include people regularly visiting site workers to assist in certain long-term duties or as part of an ongoing oversight. As site visitors are interacting with site workers in some capacity, there are indoor and outdoor site visitors. Construction workers are presumed to only work outdoors.

Residents are not currently present, nor are they envisioned under base land use plans. However, to provide the Air Force with a full range of options, potential future residents have been considered. There are two types of residents considered by this assessment. Both are assumed to spend all of their time at home. One resident is a full-time shut-in with no outdoor exposure, while the other resident has a garden and spends half of his/her time indoors; the other half at the house outside.

A.3.2 POTENTIAL EXPOSURE PATHWAYS

This section describes how the receptors described above could come in contact with releases from the training sites. Potential exposure pathways are summarized in the conceptual model in Figure A.3-1. Potential future workers and site visitors could be exposed to the constituent in the soil as well as the decay progeny from the thorium-232 decay series (Figure A.3-2). Routes of exposure for indoor workers and indoor visitors include incidental soil ingestion and external radiation. These routes of exposure also apply to outdoor workers and outdoor visitors. However, outdoor workers and outdoor visitors may also inhale contaminated dust. Inhalation exposure for indoor workers and indoor visitors primarily occurs through the inhalation of radon. Radon, a gas that is part of the thorium-232 decay series, can migrate into and throughout buildings. While outdoor workers and outdoor visitors can also inhale radon, the dispersion that occurs from mixing with uncontaminated air results in much lower concentrations. This exposure route is not typically quantified for these receptors.

Construction workers could be exposed to constituents in both surface and subsurface soil. Potential exposure pathways include incidental ingestion, external radiation, and inhalation of dust.

Exposure pathways for a potential future resident include external radiation, incidental soil ingestion, and inhalation of radon. For the residents that spend part of their time outdoors, exposure pathways also include dust inhalation and ingestion of contaminated garden produce. Based on conversations with personnel at several lawn and garden stores in the Albuquerque area, it was determined that soil in the greater Albuquerque area is very alkaline and produce cannot be grown in unamended soil. However, one can add acidic components to the existing soil or one can incorporate soils purchased at a home lawn and garden store to balance the soil. The net effect of this would be garden soils that are half native and half from outside sources.

A.3.3 RESRAD MODELING

Exposure was quantified using RESRAD program, version 5.95. RESRAD is a computer code developed at Argonne National Laboratory for the U.S. Department of Energy to calculate compliance with RESidual RADioactive material guidelines. RESRAD can calculate site-specific radiation doses and/or excess lifetime cancer risks to chronically exposed individuals. Such modeling can be used to determine soil concentrations that do not lead to excess radiation exposure; such concentrations are referred to as soil guidelines. For OT-10, the applicable soil guideline is a radionuclide concentration that is acceptable if the site is to be used without radiological restrictions and/or monitoring requirements. The guideline for this site is a soil concentration above background that does not result in exceeding a dose limit of 25 millirem per year (mrem/yr). This limit has been established by the U.S. Nuclear Regulatory Commission (NRC) in Code of Federal Regulations (CFR) § 20.1402.

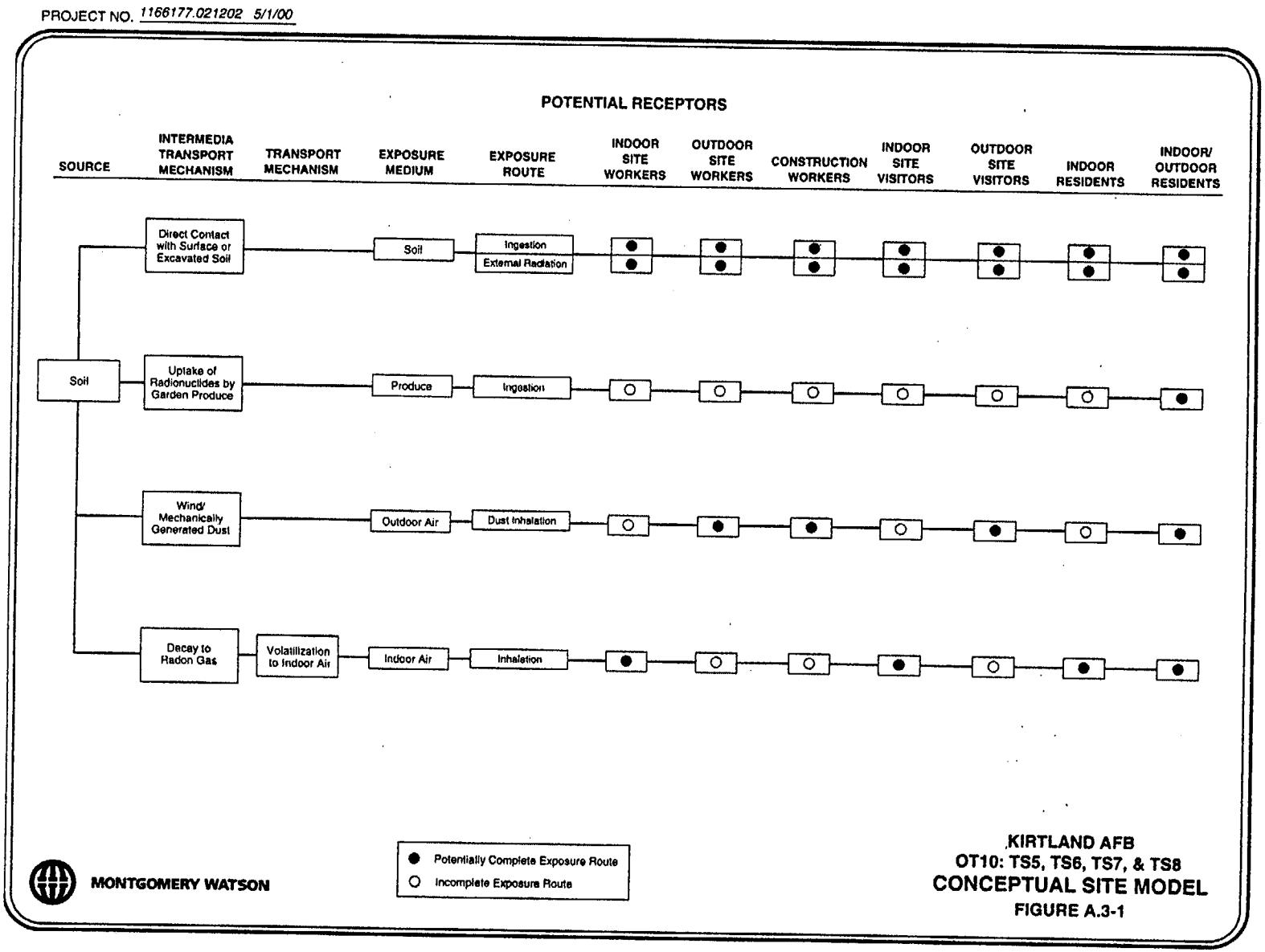

Figure A.3-1. Site Conceptual Model

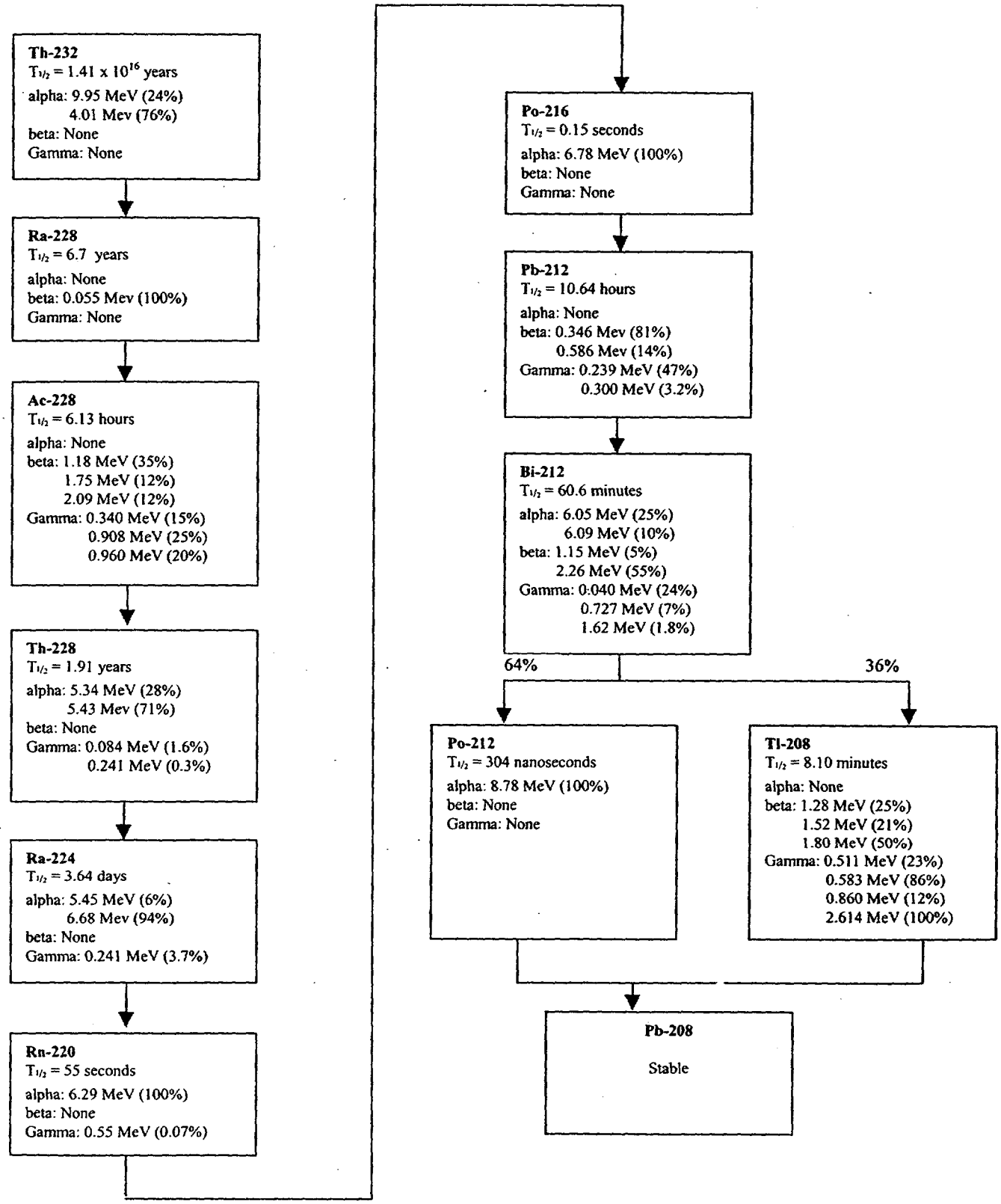

Figure A.3.2. Thorium Decay Series

RESRAD can consider nine environmental pathways: external radiation, inhalation of particulates and radon, and ingestion of soil, plant foods, meat, milk, aquatic foods, and water. Based on the site conceptual model (see Figure A.3-1), only the first five of these pathways were considered.

RESRAD uses an analytical method to relate the radionuclide concentration in soil or water to the dose a receptor is receiving. Radiation doses, health risks, soil guidelines, and media concentrations are calculated at specified time intervals. The model accounts for the movement of particles between compartments; for example, where radon forms as a result of radioactive decay and enters a house, the amount of radionuclides in outdoor soil is reduced. The source is adjusted over time to account for radioactive decay and ingrowth, leaching, erosion, and mixing. RESRAD accounts for differential transport of parent and progeny radionuclides with different distribution coefficients. As stated above, the intent of the RESRAD model runs at OT-10 was to find a concentration for thorium-232 that would create a 25 mrem/yr dose above background levels for each receptor. Site-specific and receptor-specific input parameters can be found in Attachment 1.

A.4 RESULTS

RESRAD model runs were made for each of the sites. For all the analyses, calculations were conducted at 1, 3, 10, 30, 50, 100, 300, 1,000, and 10,000 years. The results of the RESRAD modeling, presented in Tables A.4-1, A.4-2, A.4-3, and A.4-4, represent soil concentrations of thorium-232 that are predicted to result in exposures that are within NRC guidelines. Tables A.4-1 and A.4-2 apply to sites TS5, TS6, and TS8. The small, contaminated site area of TS7 led to the different results shown in Tables A.4-3 and A.4-4. The results for TS5, TS6, and TS8 are equivalent because once a contaminated area reached a certain minimum size, RESRAD produced approximately the same results. Graphs showing the results of the RESRAD model runs can be found in Attachment 2.

For industrial land use, the receptor with the greatest potential exposure is the outdoor worker. This receptor was predicted to have an exposure of 25 mrem/yr at a thorium-232 concentration of 7.4 picocuries per gram (pCi/g) at TS5, TS6, and TS8 and 8.8 pCi/g at TS7. For residential land use, an outdoor resident was predicted to be the most exposed, with a concentration of 1.9 pCi/g (at TS5, TS6, and TS8) above background leading to an exposure of 25 mrem/yr. A concentration of 2.4 pCi/g above background led to an exposure of 25 mrem/yr at TS7.

The only difference in the modeling for each training site was the contaminated site area. As has been stated above, the contaminated site areas were large enough at TS-5, TS-6, and TS-8 such that for the pathways evaluated and the range of site areas that exist, the contaminated site area of a training site did not factor into the dose received from thorium-232 or its decay progeny.

Tables A.4-1 through A.4-4 summarize the doses received from each exposure pathway for each receptor. For all receptors, external radiation contributes almost all of the exposure, accounting for a minimum of 96 percent of the radiation dose. All other pathways are essentially negligible in comparison.

Note that the receptors considered include the range of people's activities, from being outside as much as plausible, to being inside at all times. Receptors who spend time both indoors and outdoors will have exposure that is within the calculated range (for example, a worker whose responsibilities cause him/her to be inside part of the day and outside part of the day will have exposure within that calculated for an indoor and outdoor worker). Consequently, the criteria calculated for OT-10 should be protective of the full range of activities that may be applicable to these sites.

A.4.1 UNCERTAINTY ANALYSIS

Uncertainty is inherent in the risk assessment process (EPA, 1989). It can result in both over- and under-estimations of risk. The uncertainties in the estimation of dose relate to the movement of the radionuclides, and the characteristics of the receptors. The uncertainties related to these factors are described in the following paragraphs.

A.4.1.1 Uncertainties Related to Fate and Transport. The RESRAD model accounts for the decay and in-growth of radionuclides. This factor is well-defined and has very little uncertainty.

Default erosion rates were used in the modeling. The primary result of this factor was that all of the radionuclides were predicted to erode away from the site several hundred years in the future, thus apparently eliminating site exposure. This occurrence is shown in the drop-off of predicted exposure in the graphs in Attachment 2. However, as shown by these same graphs, the exposure estimates reach a maximum before being affected by such erosion. Consequently, exposure at OT-10 has not been underestimated as a result of how RESRAD models erosion.

The RESRAD modeling did not account for any exposure that would occur in adjacent areas that would receive the soil eroding from OT-10. However, the radionuclides would be more dispersed in adjacent areas than at OT-10; thus, any soil concentration that is protective of receptors at OT-10 would also be protective of receptors in adjacent areas.

The modeling also does not account for any soil that could erode from clean areas of Kirtland AFB, and cover the radionuclides. Clean cover can reduce external radiation, and, for some receptors, eliminate dust inhalation and soil ingestion. Thus, by not accounting for this pathway, exposure may be overestimated.

Note that external radiation accounts for the vast majority of potential exposure, and therefore any overestimates of potential exposure are related to this pathway. For other exposure pathways, the primary concern is whether substantial underestimates of exposure could occur.

Table A.4-1
Thorium-232 Concentrations by Receptor Producing a 25 mrem/yr Dose

	INDUSTRIAL LAND USE					RESIDENTIAL LAND USE	
	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Site Visitors	Outdoor Site Visitors	Shut-In Residents	Outdoor Residents
Concentration (pCi/g) Producing a 25 mrem/yr Dose (Above Background Levels)	10.44	7.4	11.85	26.78	18.94	2.37	1.94

Table A.4-2
Thorium-232 Effects by Pathway for Each Receptor Producing a Total 25 mrem/yr Dose
(see Table A-2 for Concentration Producing the Dose for a Given Receptor)

	INDUSTRIAL LAND USE					RESIDENTIAL LAND USE	
	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Site Visitors	Outdoor Site Visitors	Shut-In Residents	Outdoor Residents
Dose (in mrem/yr) Above Background Levels for External Radiation Pathway	24.59 (98%)	24.9 (99%)	24.27 (97%)	24.68 (99%)	24.94 (99%)	24.72 (97%)	24.09 (96%)
Dose (mrem/yr) Above Background Levels for Inhalation Pathway	0.0006452 (<0.00%)	0.00143 (<0.00%)	0.5943 (2.4%)	0.0002694 (<0.00%)	0.0004763 (<0.00%)	0.0009297 (<0.00%)	0.001331 (0.01%)
Dose (mrem/yr) Above Background Levels for Radon Inhalation Pathway	0.2581 (1%)	0.009463 (0.04%)	0.009197 (0.04%)	0.2517 (1%)	0.00945 (0.04%)	0.2475 (0.99%)	0.1065 (0.4%)
Dose (mrem/yr+A9) Above Background Levels for Plant Ingestion Pathway	0.0	0.0	0.0	0.0	0.0	0.0	0.4473 (1.8%)
Dose (mrem/yr) Above Background Levels for Soil Ingestion Pathway	0.1494 (0.6%)	0.1059 (0.4%)	0.1239 (0.5%)	.06238 (0.25%)	0.04412 (0.2%)	0.4305 (1.7%)	0.3522 (1.4%)
Total Dose (mrem/yr) Above Background Levels for All Pathways	24.9981	25.0165	24.9974	24.9943	24.994	24.9489	24.9973

Table A.4-3. Thorium-232 Concentrations by Receptor Producing a 25 mrem/yr Dose for OT-10, TS7

	INDUSTRIAL LAND USE					RESIDENTIAL LAND USE	
	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Site Visitors	Outdoor Site Visitors	Shut-In Residents	Outdoor Residents
Concentration (pCi/g) Producing a 25 mrem/yr Dose (Above Background Levels)	12.5	8.8	14.1	31.9	22.4	2.9	2.4

Table A.4-4. Exposure Dose by Pathway for OT-10, TS7

	INDUSTRIAL LAND USE					RESIDENTIAL LAND USE	
	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Site Visitors	Outdoor Site Visitors	Shut-In Residents	Outdoor Residents
Dose (mrem/yr) Above Background Levels for External Radiation Pathway	24.88 (99%)	24.97 (99%)	24.45 (98%)	24.90 (99%)	24.99 (99%)	24.81 (99%)	24.78 (99%)
Dose (mrem/yr) Above Background Levels for Inhalation Pathway+A35	0.0006 (<0.01%)	0.001 (<0.01%)	0.53 (2.1%)	0.0002 (<0.01%)	0.0004 (<0.01%)	0.0008 (<0.01%)	0.001 (0.01%)
Dose (mrem/yr) Above Background Levels for Radon Inhalation Pathway	0.083 (0.33%)	0.001 (<0.01%)	0.0009 (<0.01%)	0.082 (0.03%)	0.001 (<0.01%)	0.082 (0.33%)	0.03 (0.14%)
Dose (mrem/yr) Above Background Levels for Plant Ingestion Pathway	0.0	0.0	0.0	0.0	0.0	0.0	0.15 (0.6%)
Dose (mrem/yr) Above Background Levels for Soil Ingestion Pathway	0.022 (0.09%)	0.0.015 (0.06%)	0.018 (0.07%)	0.0089 (0.04%)	0.0063 (0.03%)	0.062 (0.25%)	0.0518 (<0.21%)
Total Dose (mrem/yr) Above Background Levels for All Pathways	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Default parameters were used to model uptake of radionuclides into vegetables. However, uptake is dependent upon such factors as soil type, pH, and organic content. Since soil amendments are required to grow vegetables in this area, these soil factors cannot be predicted for this site. The RESRAD parameters could result in an overestimate or underestimate of exposure. Furthermore, the radionuclide concentration in produce was assumed to be reduced by a factor of two due to the use of soil amendments. While this factor is likely to be accurate on average, individual gardeners may use more or less amendment. Calculations for vegetable consumption and the percentage of homegrown vegetables are presented in Attachment 3.

Dust is of greatest concern for a construction worker, where wind-blown dust is augmented by dust created by machinery. The dust level used in the RESRAD modeling corresponds to visible levels of dust. The dust level employed in the modeling is expected to be conservative. Calculations for the dust level are presented in Attachment 3.

The movement of radon into a house is expected to have been performed in a conservative manner. It was assumed that a person resides in the basement of a small house that has large cracks in the walls and a low air exchange rate. All of these factors result in a conservative prediction of the amount of exposure that could result from radon gas.

A.4.1.2. Uncertainties Related to Receptor Behavior. For site workers and visitors, there is an assumption of a high exposure frequency and duration. For example, workers are assumed to work at the same location 250 days per year for 25 years. Site visitors are assumed to visit the same location two days a week for 25 years. If exposure frequencies/durations are lower than assumed, exposures would be less and soil criteria would be higher than calculated.

As noted previously, external radiation was the dominant pathway contributing to exposure. For the indoor site worker and visitor, the building is assumed to provide shielding with respect to external radiation. The amount of shielding assumed was the model default. Since the actual amount of shielding depends on the building construction (particularly the materials and thickness of the walls and floor), exposure could be more or less than what was calculated. For the construction worker, it was assumed that heavy equipment was never utilized (or alternatively, that such equipment provided no shielding). This assumption likely leads to an overestimate of exposure for this receptor.

Other factors, such as soil ingestion and dust/air inhalation rates, are standard default parameters from the U.S. Environmental Protection Agency (EPA). These parameters are designed by the EPA to be conservative; that is, they have been established in a manner that there is only a low potential for intake to exceed these parameters.

Many of the uncertainties associated with the residents are similar to those for workers. The assumption that a resident lives at the same location for 30 years is applicable to only a small percentage of residents. The further assumption that the resident never leaves the property during this time period verges on worst case. In the case of a shut-in, the radon exposure scenario assumes that the resident is in the basement for this entire time period. For the person who is outside half of the time, it is still assumed that all of the time spent indoors is in the basement.

The amount of shielding provided by a building with respect to external radiation has the same uncertainties as a site worker and visitor. Similarly, the soil ingestion and dust/air inhalation rates are EPA default parameters.

Produce consumption was also based on EPA information; solely for those people who consume homegrown produce. The percentage of produce assumed to be homegrown is reflective of someone who relies extensively on his/her garden for vegetables.

Children have not been explicitly evaluated in establishing cleanup levels for residential land use. However, as noted above, external radiation is the primary contributor to exposure. A sensitivity analysis, utilizing higher soil ingestion rates exhibited by some young children, did not alter this conclusion. Because the analysis assumes that residents are home 365 days per year, external radiation pathways for a child and an adult would be equivalent.

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ATTACHMENT 1

EXPOSURE PARAMETERS

Table 1-1. RESRAD Site Parameters for Kirtland AFB Site OT-10

Parameter	Units	TS5	TS6	TS7	TS8
Contaminated Zone Parameters					
Area of Contaminated Zone	meters²	5382[a]	6596[a]	122[a]	1578[a]
Thickness of Contaminated Zone	meters	0.91[a]	1.52[a]	0.30[a]	1.52[a]
Length [of Contaminated Zone] Parallel to Aquifer Flow	meters	82.78[a]	91.64[a]	56.98[a]	44.82[a]
Cover and Contaminated Zone Hydrological Data					
Cover Depth	meters	0.0	0.0	0.0	0.0
Density of Contaminated Zone	grams/centimeter³	1.60[b]	1.60[b]	1.60[b]	1.60[b]
Contaminated Zone Erosion Rate	meters/year	0.001	0.001	0.001	0.001
Contaminated Zone Total Porosity	dimensionless	0.385[b]	0.385[b]	0.385[b]	0.385[b]
Contaminated Zone Field Capacity	dimensionless	0.2	0.2	0.2	0.2
Contaminated Zone Hydraulic Conductivity	meters/year	10	10	10	10
Contaminated Zone b Parameter	dimensionless	5.3	5.3	5.3	5.3
Evaporation Coefficient	dimensionless	0.95[c]	0.95[c]	0.95[c]	0.95[c]
Wind Speed	meters/second	4.52[d]	4.52[d]	4.52[d]	4.52[d]
Precipitation	meters/year	0.2212[e]	0.2212[e]	0.2212[e]	0.2212[e]
Watershed Area for Nearby Stream or Pond	meters²	5382[f]	6596[f]	122[f]	1578[f]
Uncontaminated Unsaturated Zone Parameters					
Unsaturated Zone Thickness	meters	200[g]	200[g]	200[g]	200[g]
Soil Density	grams/centimeter³	1.60[b]	1.60[b]	1.60[b]	1.60[b]
Total Soil Porosity	dimensionless	0.385[b]	0.385[b]	0.385[b]	0.385[b]
Uncontaminated Unsaturated Zone Parameters (continued)					
Effective Porosity	dimensionless	0.2	0.2	0.2	0.2
Field Capacity	dimensionless	0.2	0.2	0.2	0.2
Hydraulic Conductivity	meters/year	10	10	10	10
b Parameter	dimensionless	5.3	5.3	5.3	5.3
Occupancy, Inhalation, and External Gamma Data					
Shape of Contaminated Zone	-	Circular	Circular	Circular	Circular
Radon Data					
Cover Total Porosity	dimensionless	0.385[b]	0.385[b]	0.385[b]	0.385[b]
Cover Volumetric Water Content	dimensionless	0.05	0.05	0.05	0.05
Cover Radon Diffusion Coefficient	meters²/second	0.000002	0.000002	0.000002	0.000002
Building Foundation Thickness	meters	0.15	0.15	0.15	0.15
Building Foundation Density	grams/centimeter³	2.4	2.4	2.4	2.4
Building Foundation Total Porosity	dimensionless	0.1	0.1	0.1	0.1
Building Foundation Volumetric Water Content	dimensionless	0.03	0.03	0.03	0.03
Building Foundation Radon Diffusion Coefficient	meters²/second	0.0000003	0.0000003	0.0000003	0.0000003
Contaminated Radon Diffusion Coefficient	meters²/second	0.000002	0.000002	0.000002	0.000002
Radon Vertical Dimension of Mixing	meters	2	2	2	2
Building Air Exchange Rate	1/hour	0.5	0.5	0.5	0.5
Building Room Height	meters	2.5	2.5	2.5	2.5
Building Indoor Area Factor	dimensionless	0	0	0	0
Foundation Depth Below Ground Surface	meters	-1	-1	-1	-1
Rn-222 Emanation Coefficient	dimensionless	0.25	0.25	0.25	0.25
Rn-220 Emanation Coefficient	dimensionless	0.15	0.15	0.15	0.15

Notes:
Unless otherwise noted, parameter values are RESRAD defaults.

a Site specific value for the given training site.
b Soil Screening Guidance default value (EPA, 1996).
c Integrated Natural Resources Plan (USAF, 1995)
d Average of data for Albuquerque Airport from 1931 - 1999 (Personal communication from National Weather Service, April 20, 2000).
e From the National Weather Service - National Climatic Data Center web page.
f Site specific value for the given training site and assumed to be equal to the site area.
g Thickness of uncontaminated unsaturated zone based on local conditions.

Table 1-2. RESRAD Receptor Parameters for Kirtland AFB OT-10

Parameter	Units	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Site Visitors	Outdoor Site Visitors	Shut-In Residents	Outdoor Residents
Cover and Contaminated Zone Hydrological Data								
Irrigation	meters/year	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.635[b]
Irrigation Mode	-	-	-	-	-	-	Overhead	Overhead
Occupancy, Inhalation, and External Gamma Data								
Inhalation rate	meters³/year	3750[c]	3750[c]	3000[d]	1560[e]	1560[e]	5475[f]	5475[f]
Mass Loading for Inhalation	grams/meter³	0.0000015[g]	0.0000015[g]	0.001[h]	0.0000015[g]	0.0000015[g]	0.0000015[g]	0.0000015[g]
Exposure Duration	years	25[i]	25[i]	1[j]	25[i]	25[i]	30[f]	30[f]
Indoor Dust Filtration Factor	dimensionless	0.4	0.4	0.4	0.4	0.4	0.4	0.4
External Gamma Shielding Factor	dimensionless	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Indoor Time Fraction	dimensionless	0.23[k]	0.0[k]	0.14[l]	0.09[m]	0.0[m]	1.0[n]	0.5[o]
Outdoor Time Fraction	dimensionless	0.0[k]	0.23[k]	0.0[l]	0.0[m]	0.09[m]	0.0[n]	0.5[o]
Ingestion Pathway, Dietary Data								
Soil Ingestion	grams/year	12.5[p]	12.5[p]	15[q]	5.2[r]	5.2[r]	36.5[s]	36.5[s]
Contaminated Fraction of Household Water	dimensionless	-	-	-	-	-	0.0[t]	0.0[t]
Contaminated Fraction of Irrigation Water	dimensionless	-	-	-	-	-	0.0[t]	0.0[t]
Contaminated Fraction of Plant Food	dimensionless	-	-	-	-	-	0.0[u]	0.065[u]
Fruit, Vegetable, and Grain Consumption	kilograms/year	-	-	-	-	-	-	44[v]
Leafy Vegetable Consumption	kilograms/year	-	-	-	-	-	-	14
Ingestion Pathway, Nondietary Data								
Mass Loading for Foliar Deposition	grams/meter²	-	-	-	-	-	0.0001	0.0001
Depth of Soil Mixing Layer	meters	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Depth of Roots	meters						0.9	0.9
Groundwater Fractional Usage - Household Water	dimensionless	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]
Groundwater Fractional Usage - Irrigation Water	dimensionless	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]	0.0[t]
Plant Factors - Wet Weight Crop Yield (Non-Leafy)	kilograms/meter²	-	-	-	-	-	0.7	0.7
Plant Factors - Wet Weight Crop Yield (Leafy)	kilograms/meter²	-	-	-	-	-	0.15	0.15
Plant Factors - Length of Growing Season	years	-	-	-	-	-	0.41[w]	0.41[w]
Plant Factors - Translocation Factor	dimensionless	-	-	-	-	-	1	1
Plant Factors - Weathering Removal Constant	1/year	-	-	-	-	-	20	20
Plant Factors - Wet Foliar Inception Fraction Non-(Leafy)	dimensionless	-	-	-	-	-	0.25	0.25
Plant Factors - Dry Foliar Inception Fraction (Leafy)	dimensionless	-	-	-	-	-	0.25	0.25
Storage Times Before Use Data								
Non-Leafy Vegetables	days	-	-	-	-	-	14	14
Leafy Vegetables	days	-	-	-	-	-	1	1

Notes:
Unless otherwise noted, parameter values are RESRAD defaults.

a Irrigation was assumed to be zero for all industrial receptors and the shut-in resident.
b Irrigation was assumed to be at the maximum allowed in the Albuquerque area (Personal communication with home lawn and garden stores in the Albuquerque area).
c Based on an exposure frequency of 250 days per year and an inhalation rate of 15 meters³/day (EPA, 1991).
Based on an exposure frequency of 150 days per year and an inhalation rate of 20 meters³/day (EPA, 1991).
e Based on an exposure frequency of 104 days per year and an inhalation rate of 15 meters³/day (EPA, 1991).
f Based on an exposure frequency of 365 days per year and an inhalation rate of 15 meters³/day (EPA, 1991).
g Calculated per Attachment 3.
h Concentration is approximately at the level at which dust is readily visible, based on field observations with a MiniRAM. Based on not typically observing dust at construction sites, value is likely to be conservative.
i U. S. EPA default value (EPA, 1991).
j Construction workers are assumed to have a one year exposure duration, based on professional judgement.
k = fraction of the year the worker is indoors or outdoors at the site. A site worker is assumed to work 8 hours a day, 250 days per year (EPA, 1991): $^{8}/_{24}*^{250}/_{365}=0.23$
l = fraction of the year the construction worker is at the site. A construction worker is assumed to work 8 hours a day, 150 days per year: $^{8}/_{24}*^{150}/_{365}=0.14$
m = fraction of the year the visitor is indoors or outdoors at the site. A site visitor is assumed to visit the site two 8 hour days a week, 52 weeks per year: $^{8}/_{24}*^{104}/_{365}=0.09$
n = fraction of the year the shut-in resident is indoors or outdoors at the site. A shut-in resident is assumed to spend all his/her time indoors, 365 days per year.
o = fraction of the year the outdoor resident is indoors or outdoors at the site. An outdoor resident is assumed to spend half of his/her time indoors and the other half of the time outdoors, 365 days per year.
p Based on an exposure frequency of 250 days per year and a soil ingestion rate of 50 milligrams/day (EPA, 1991).
q Based on an exposure frequency of 150 days per year (6 days per week for 25 weeks; professional judgement) and a soil ingestion rate of 100 milligrams/day (EPA, 1991).
r Based on an exposure frequency of 104 days per year and a soil ingestion rate of 50 milligrams/day (EPA, 1991).

Table Notes for Table A1-2 (continued)

s Based on an exposure frequency of 365 days per year and a soil ingestion rate of 100 milligrams/day (EPA, 1991).

t All water is assumed to be coming from offsite sources and to be uncontaminated.

u The contaminated fraction of plant food is not applicable to the shut-in resident. For the outdoor resident the contaminated plant food fraction was assumed to be 0.13. This is based on 13 percent of produce consumed being homegrown (see Attachment 3) and soil in which the produce is grown being 50 percent native and 50 percent amended. This latter factor, which was based on discussions with personnel at multiple lawn and garden stores in the Albuquerque area, is not actually part of the fraction of plant food that is contaminated. However, it is the only appropriate place in the RESRAD model to include this factor.

v Calculated per Attachment 3.

w The length of growing season in the greater Albuquerque area (personal communication with home lawn and garden stores in the Albuquerque area).

Table 1-3. Human Health Risk Assessment Exposure Parameters at Kirtland AFB OT-10

Parameter	Units	Indoor Site Workers	Outdoor Site Workers	Construction Workers	Indoor Visitors	Outdoor Visitors	Indoor Residents	Outdoor Residents
General								
Indoor Exposure Time per Day	hours/day	8	-	-	8	-	8	-
Outdoor Exposure Time per Day	hours/day	-	8	8	-	8	-	8
Exposure Frequency (EF)	days/yr	250	250	150[a]	104[b]	104[b]	365	365
Indoor Time Fraction[c]	fraction	0.23	-	-	0.09	-	1	0.50
Outdoor Time Fraction[c]	fraction	-	0.23	0.14	-	0.09	-	0.50
Exposure Duration (ED)	yrs	25	25	1[a]	25[b]	25[b]	30	30
Inhalation of Dust								
Inhalation Rate (IR)	m^3/day	15	15	20	15	15	15	15
Mass loading for inhalation[a]	g/m^3	$1.5*10^{-6}$	$1.5*10^{-6}$	0.001	$1.5*10^{-6}$	$1.5*10^{-6}$	$1.5*10^{-6}$	$1.5*10^{-6}$
Ingestion of Soil								
Ingestion Rate (IR)	mg soil/day	50	50	100[d]	50	50	50	50
Ingestion of Garden Produce								
Total Vegetable Consumption	kg/yr	-	-	-	-	-	-	14
Fraction of Vegetables that are Contaminated	fraction	-	-	-	-	-	-	0.13

Notes:

Unless otherwise noted, parameter values are from EPA, 1991

a Construction workers are assumed to engage in contact-intensive work for 5 days per week for 26 weeks per year for one year. This corresponds to a large construction project.

b Site visitors are assumed to visit the site 2 days/week, 52 weeks per year for 25 years.

c Product of the daily duration as a fraction times the exposure frequency divided by 365 days/year.

d Value commonly used by EPA for agricultural workers and adult residents. Assumes construction workers are comparable to agricultural workers.

ATTACHMENT 2

GRAPHS OF MODELING RESULTS

Figure 2-1. Radiation Dose Due to Thorium-232 for an Indoor Site Worker at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

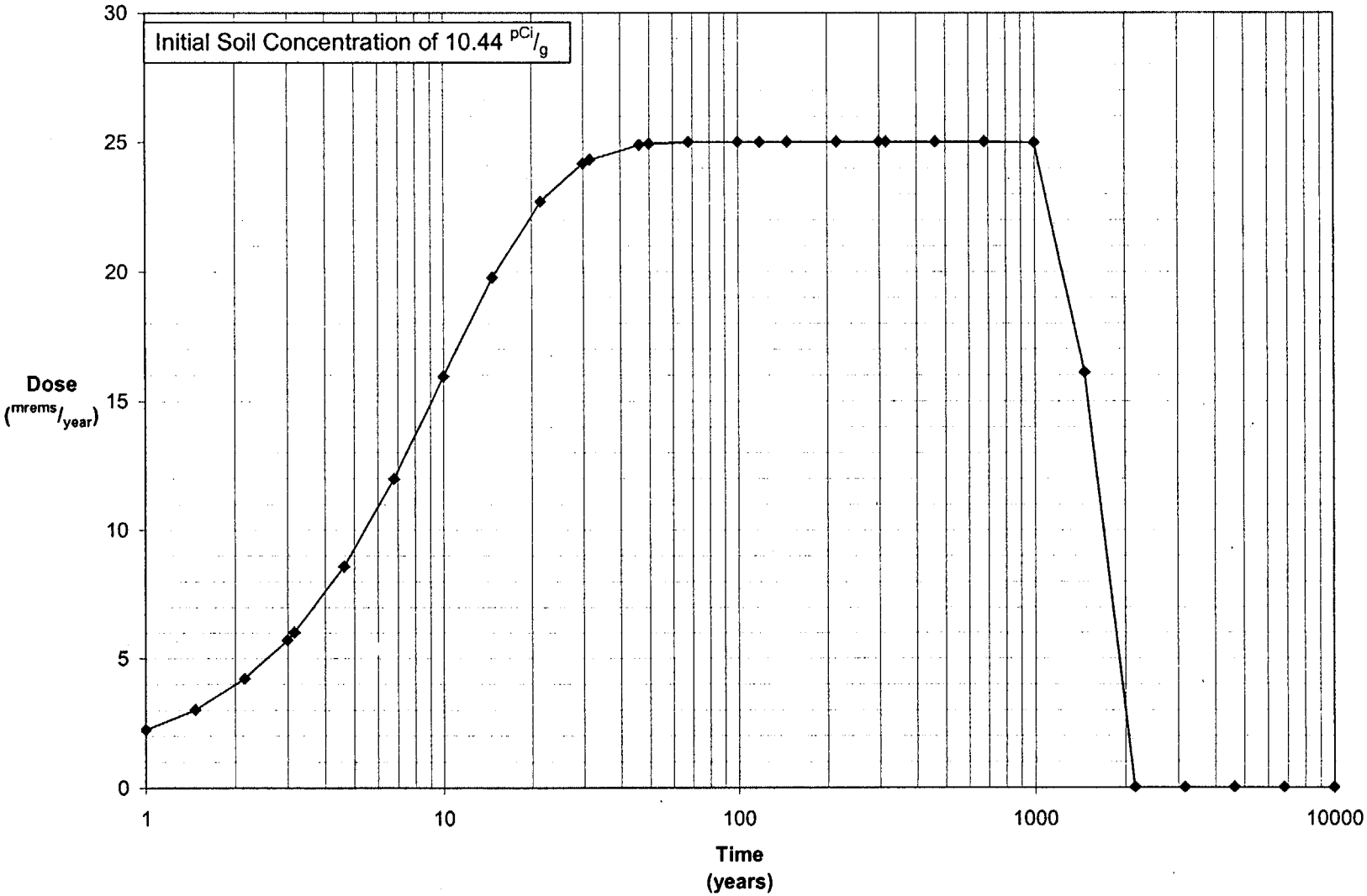


Figure 2-2. Radiation Dose Due to Thorium-232 for an Outdoor Site Worker at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

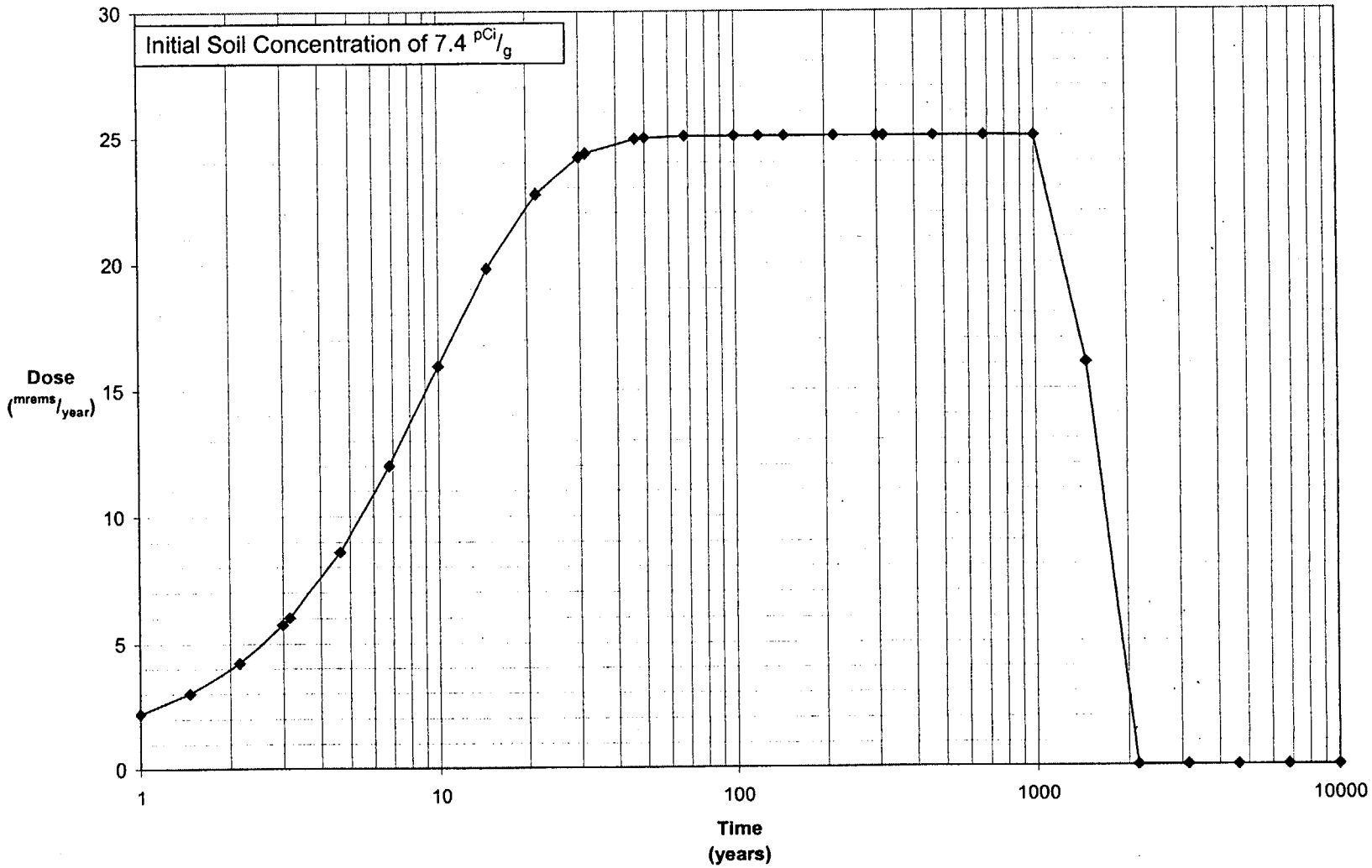


Figure 2-3. Radiation Dose Due to Thorium-232 for a Construction Worker at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

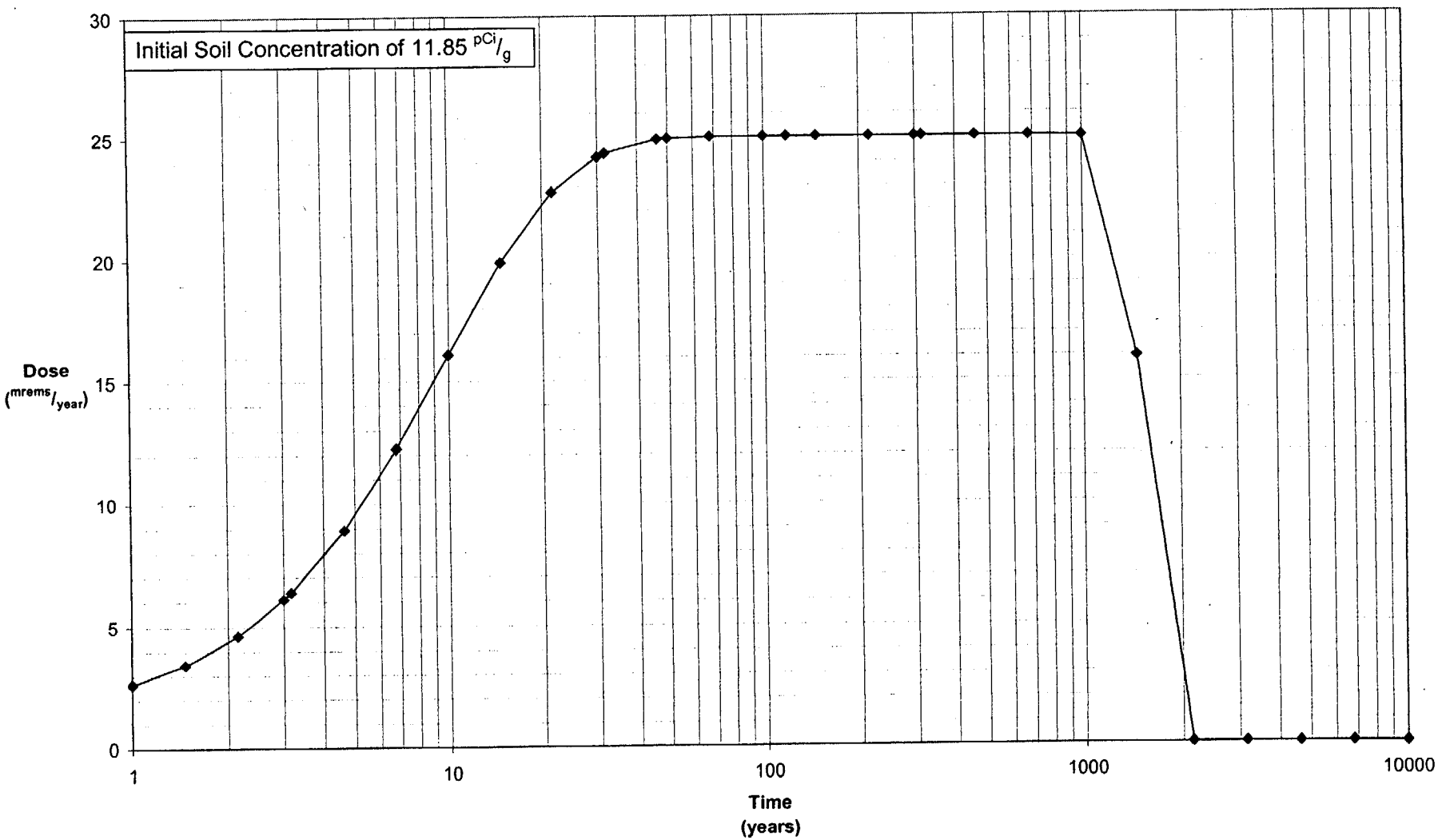


Figure 2-4. Radiation Dose Due to Thorium-232 for an Indoor Site Visitor at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

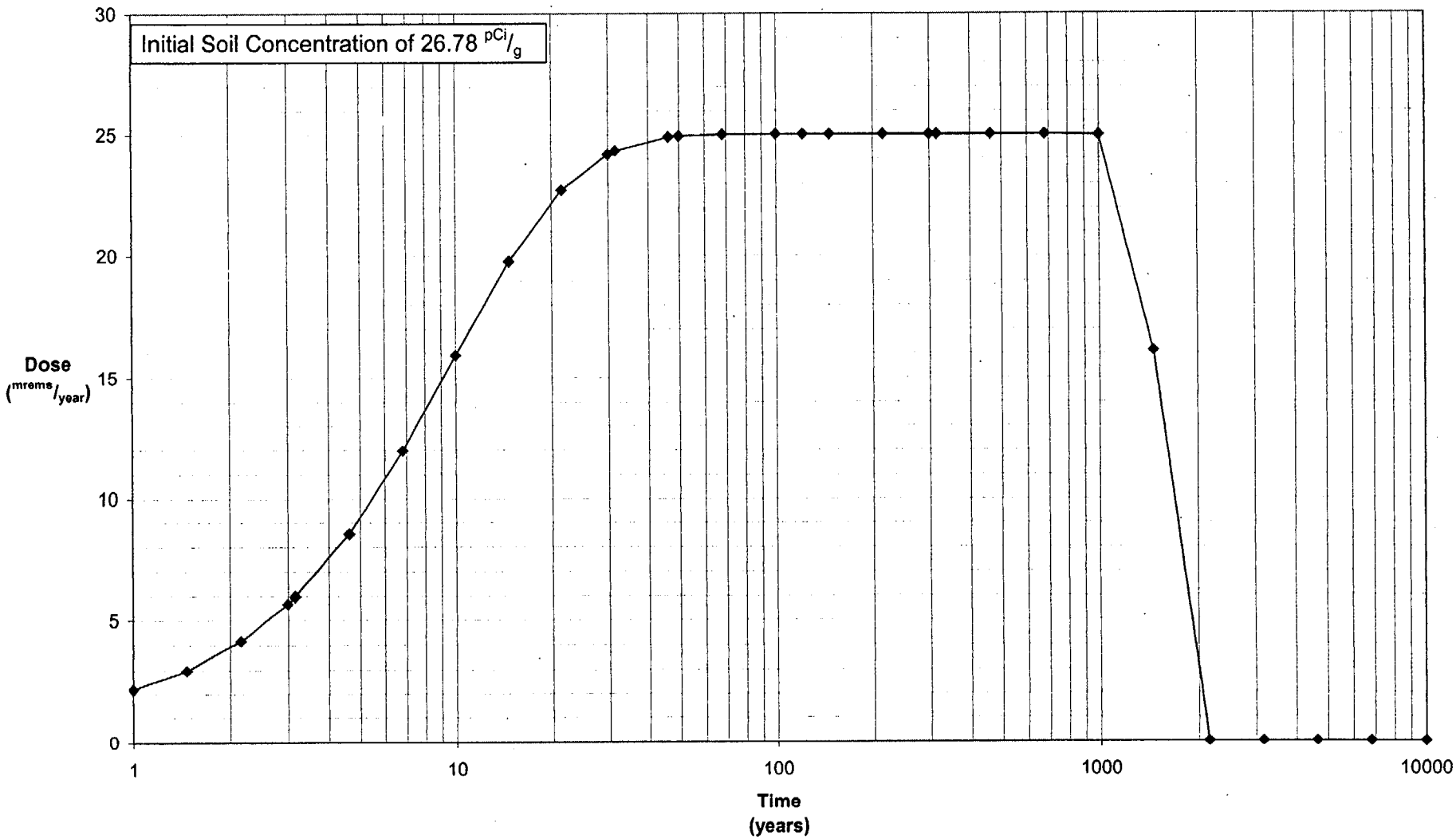


Figure 2-5. Radiation Dose Due to Thorium-232 for an Outdoor Site Visitor at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

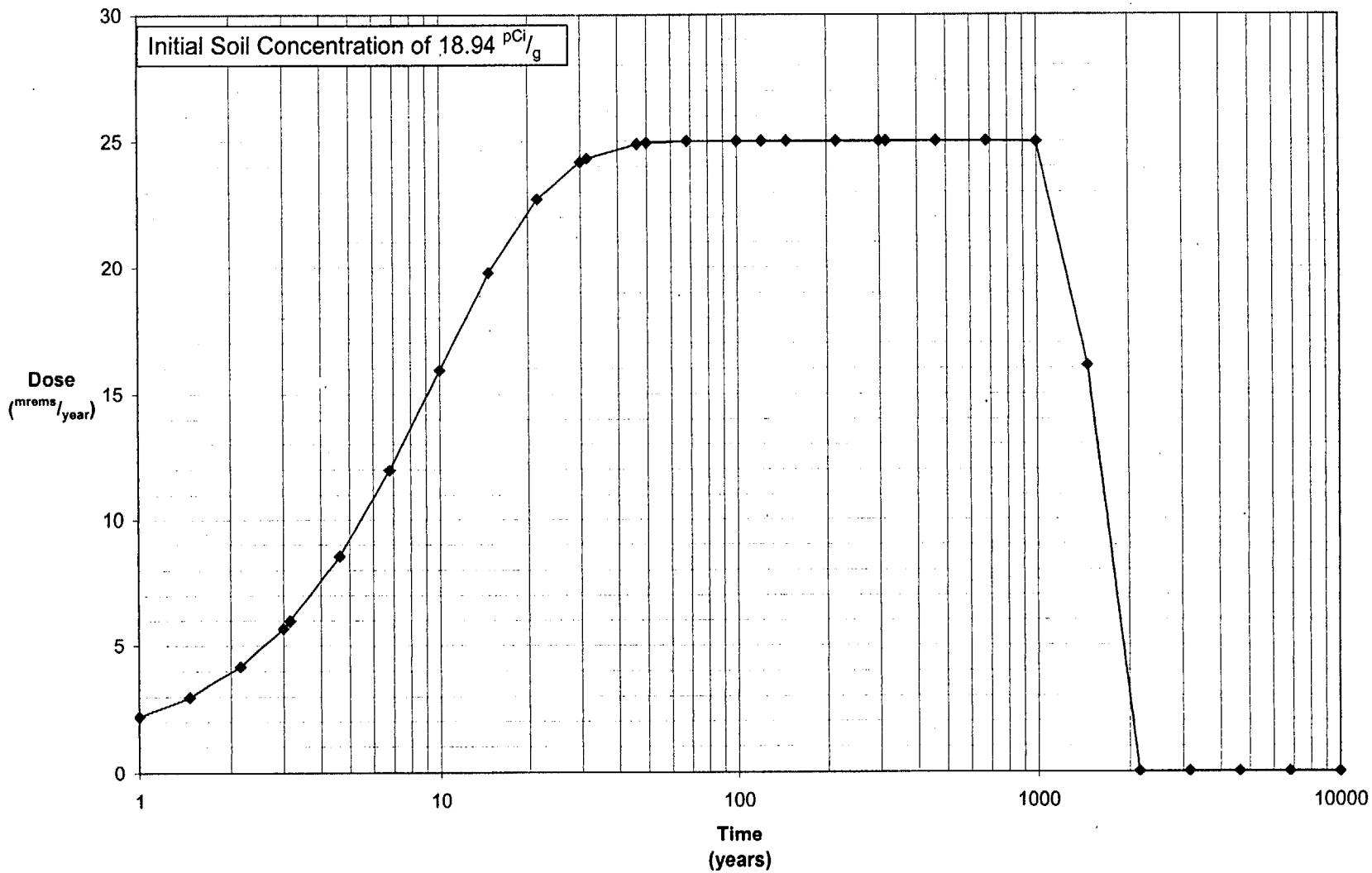


Figure 2-6. Radiation Dose Due to Thorium-232 for a Shut-In Resident at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

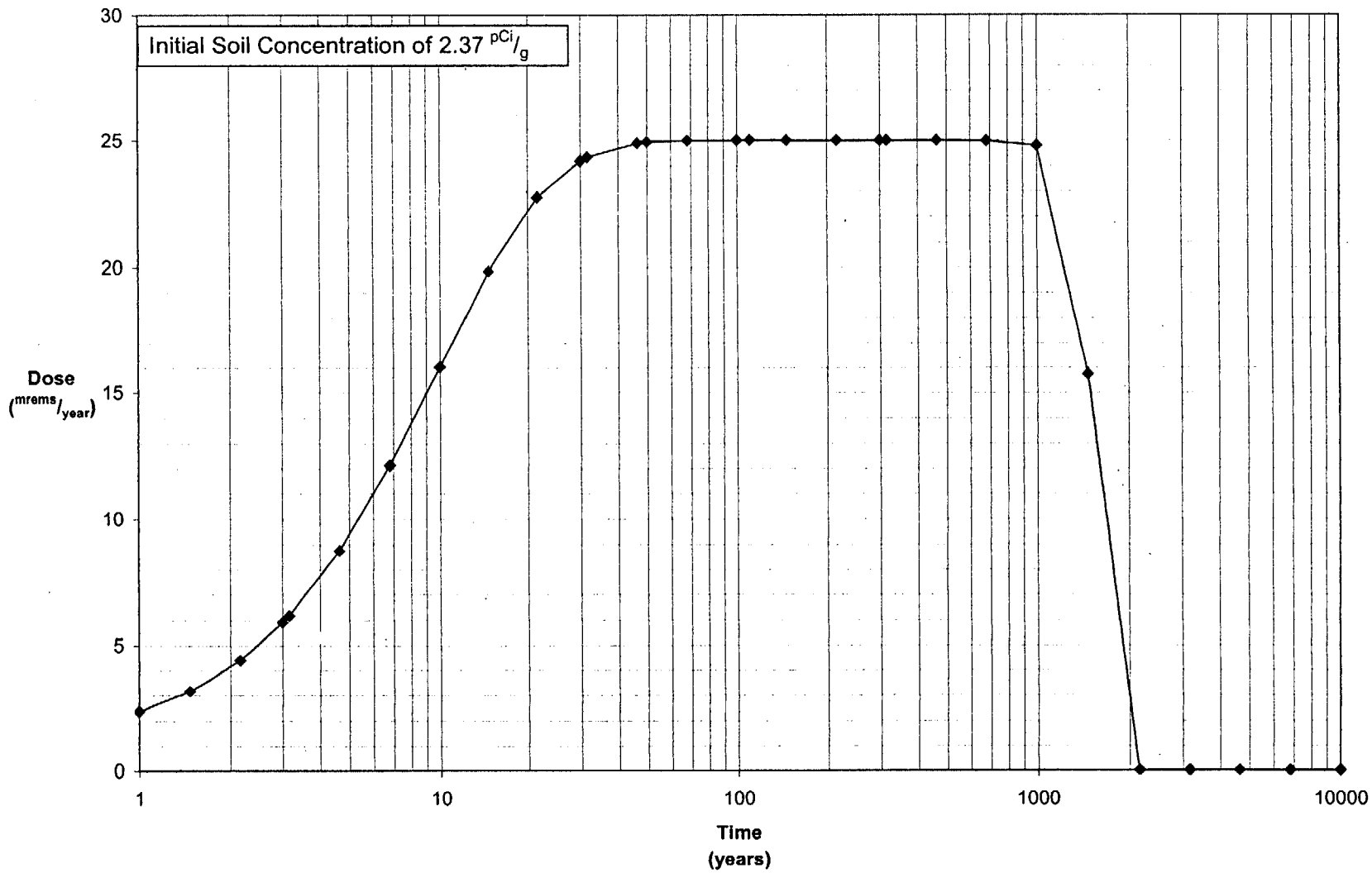


Figure 2-7. Radiation Dose Due to Thorium-232 for an Outdoor Resident at OT-10, TS5, TS6, and TS8 (Dose is Above Background Levels)

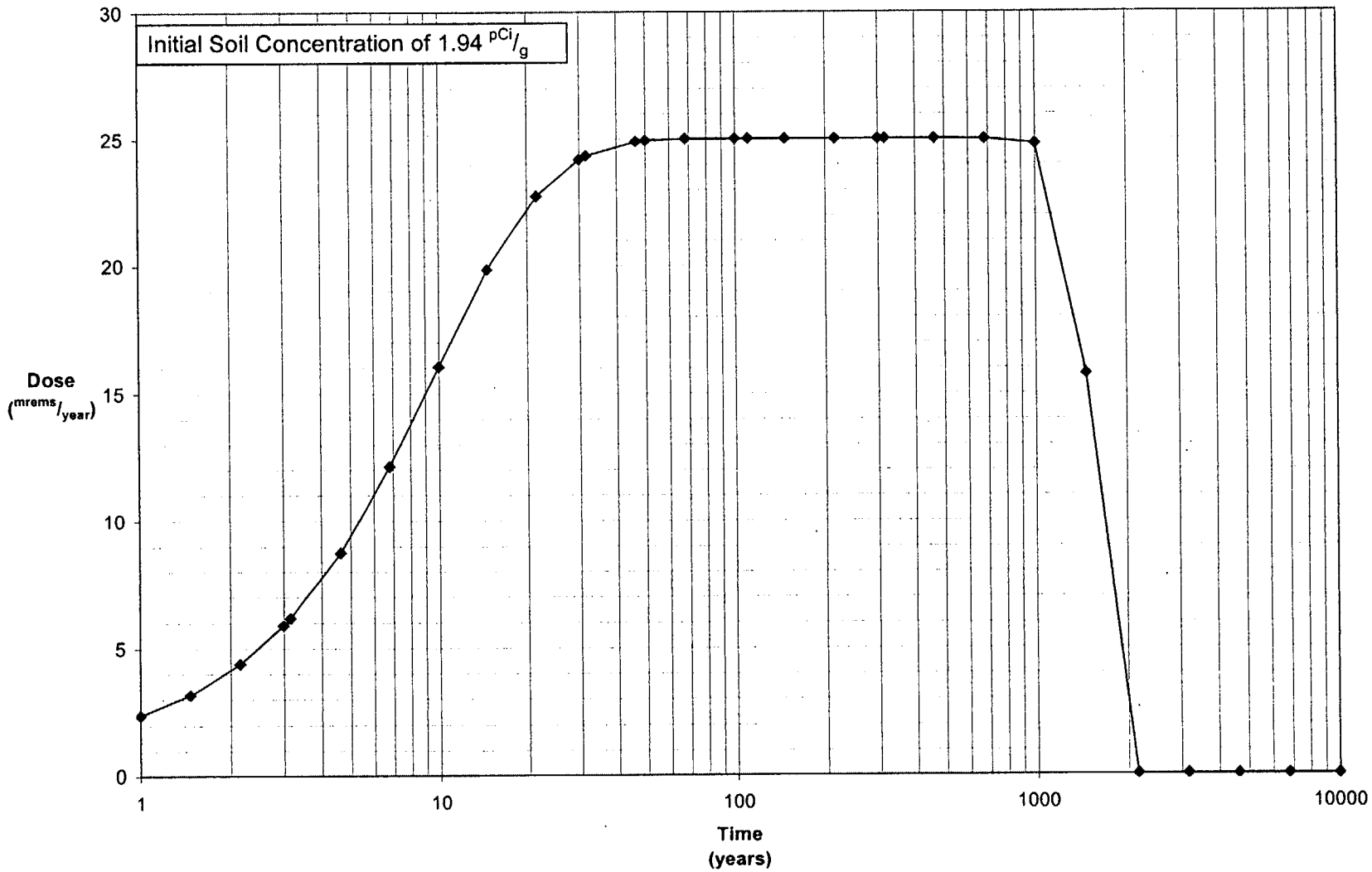


Figure 2-8. Radiation Dose Due to Thorium-232 for an Indoor Site Worker at OT-10, TS7 (Dose is Above Background Levels)

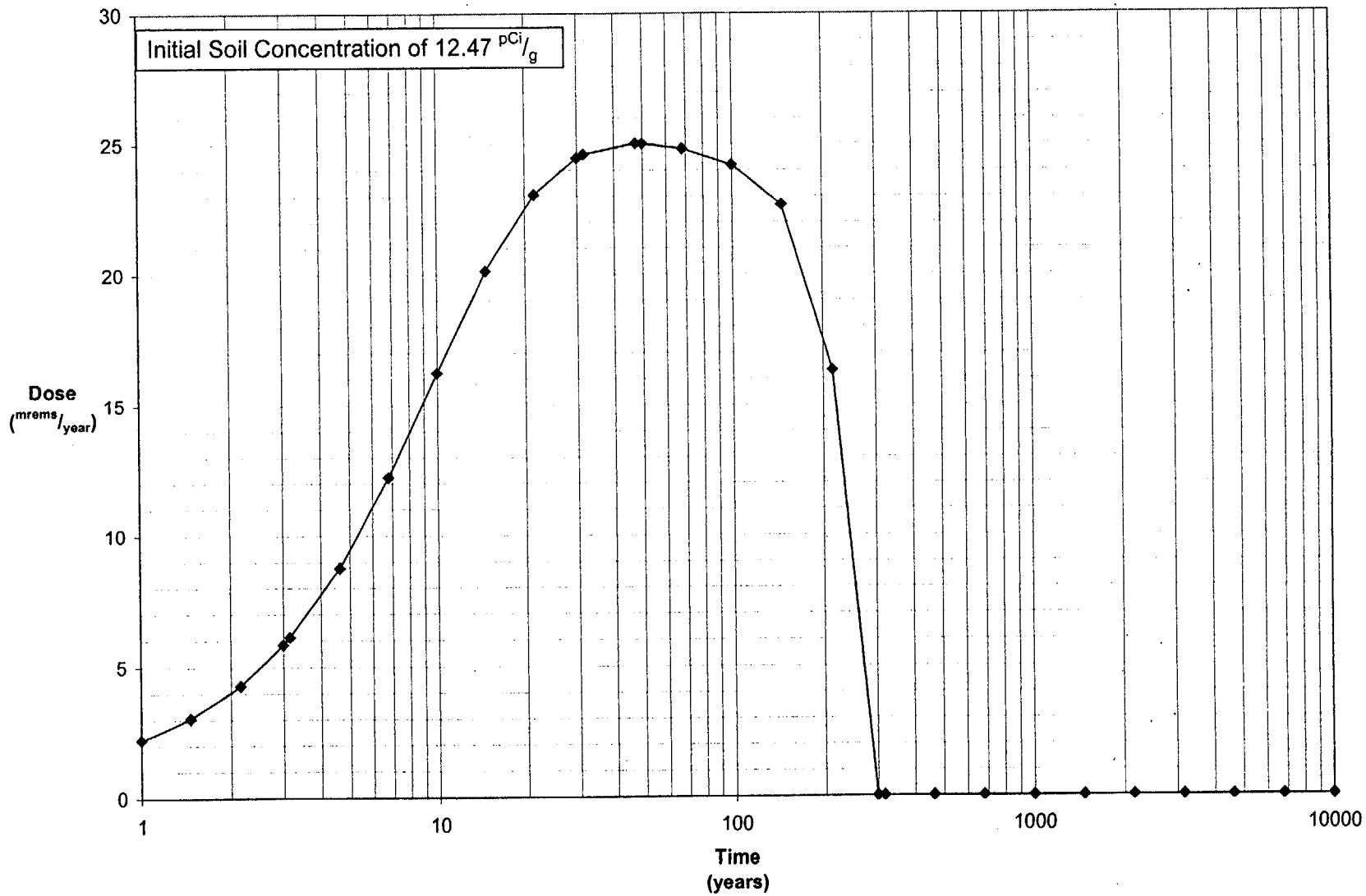


Figure 2-9. Radiation Dose Due to Thorium-232 for an Outdoor Site Worker at OT-10, TS7 (Dose is Above Background Levels)

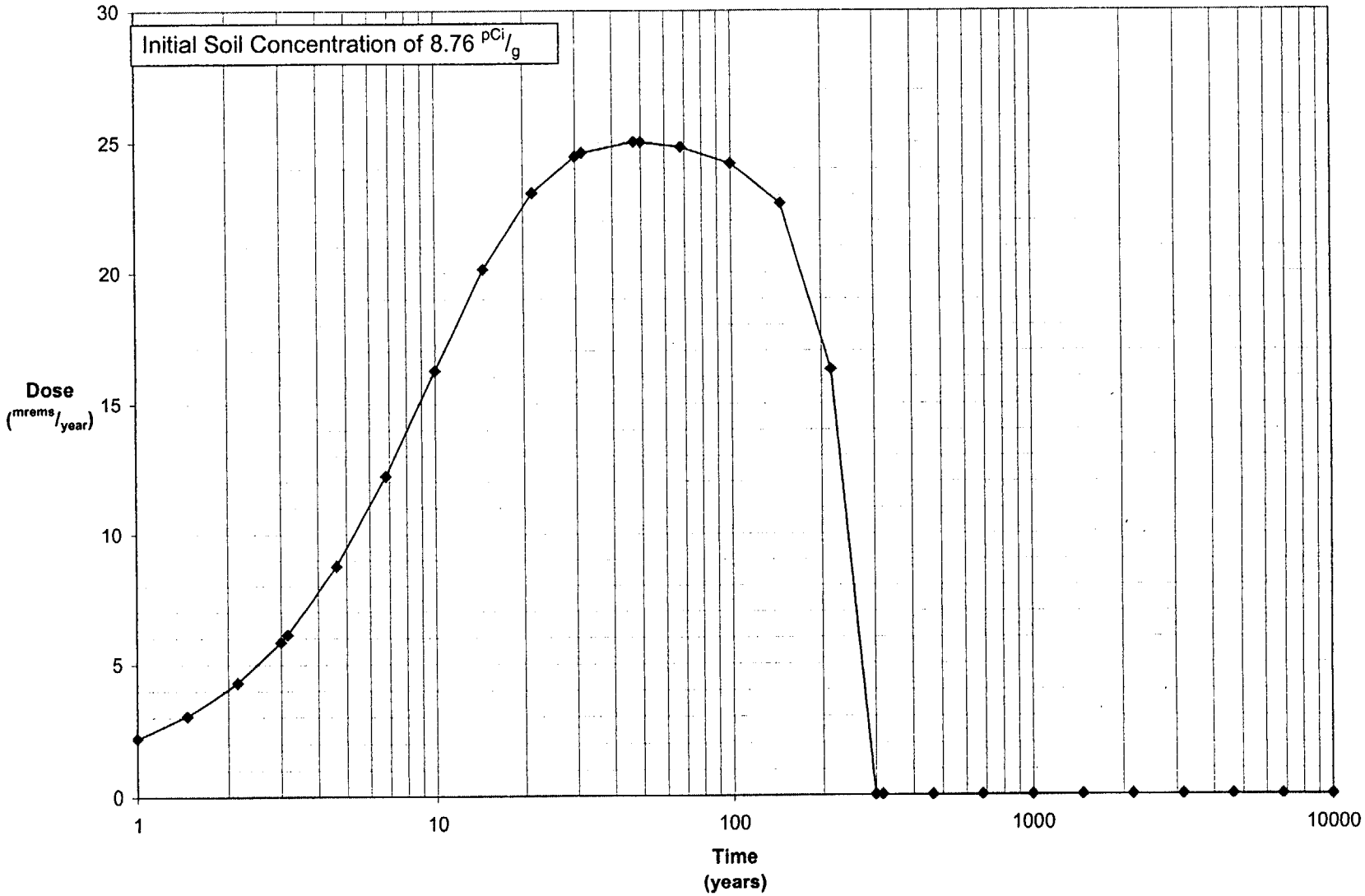


Figure 2-10. Radiation Dose Due to Thorium-232 for a Construction Worker at OT-10, TS7 (Dose is Above Background Levels)

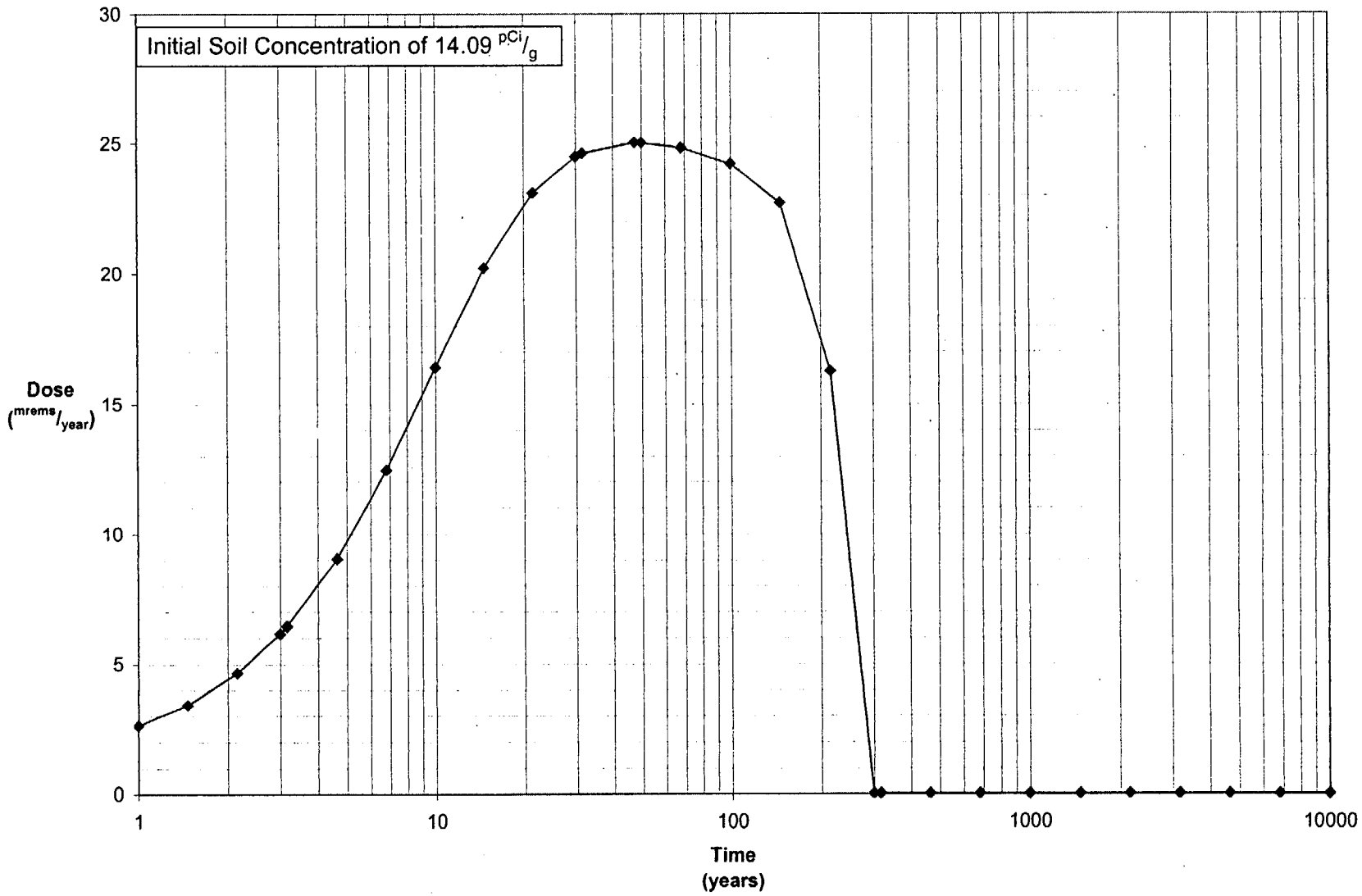


Figure 2-11. Radiation Dose Due to Thorium-232 for an Indoor Site Visitor at OT-10, TS7 (Dose is Above Background Levels)

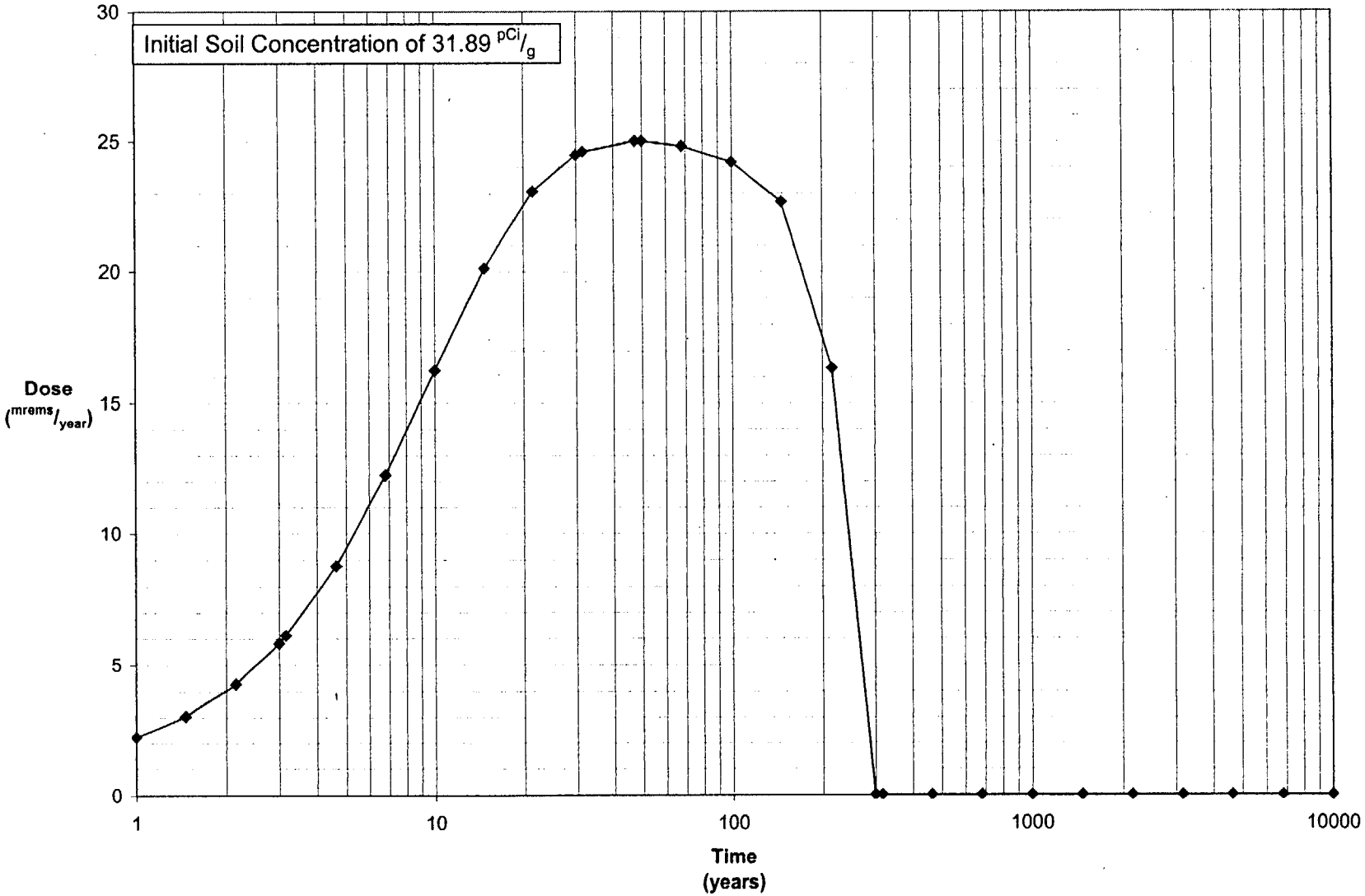


Figure 2-12. Radiation Dose Due to Thorium-232 for an Outdoor Site Visitor at OT-10, TS7 (Dose is Above Background Levels)

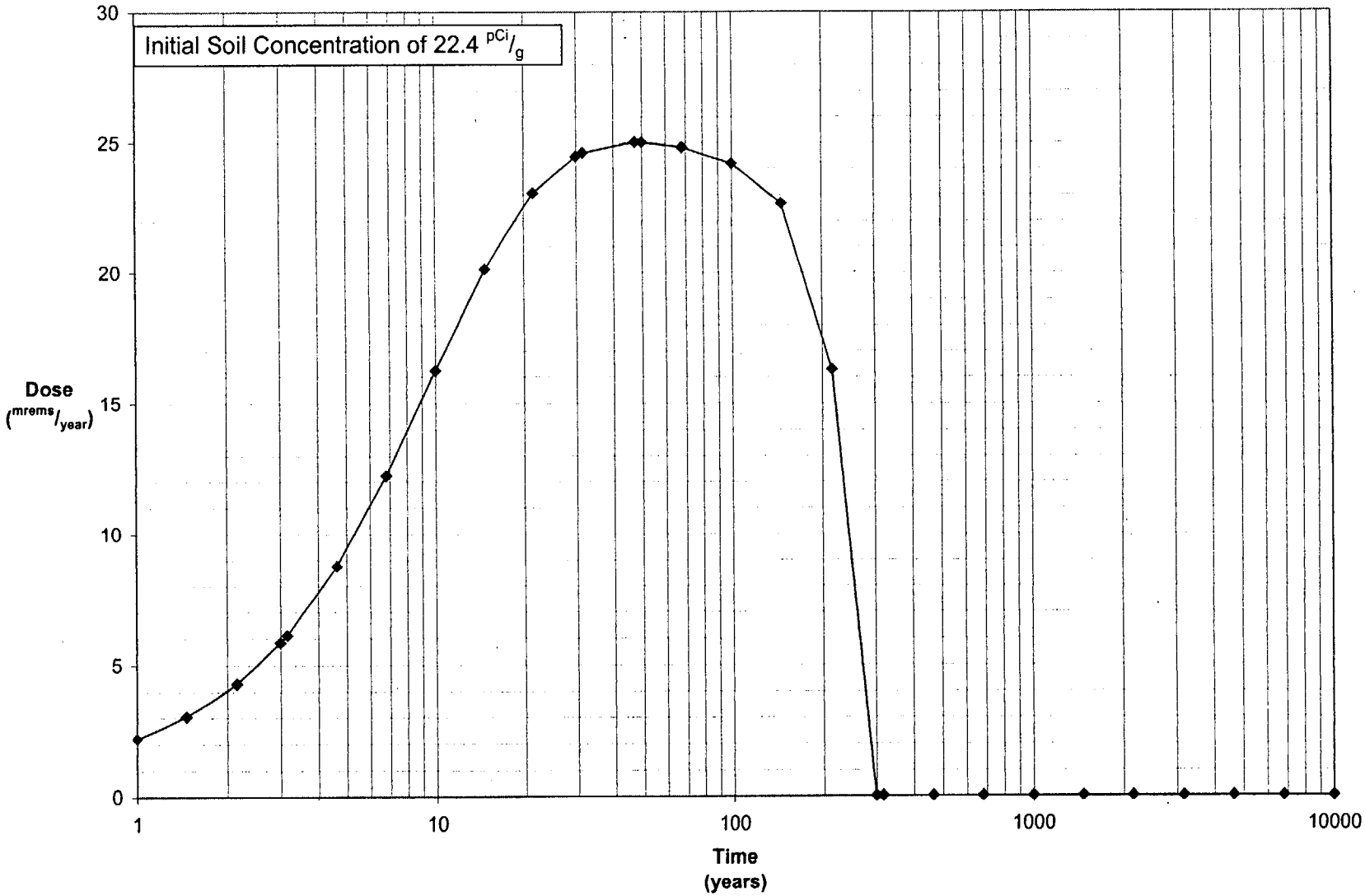


Figure 2-13. Radiation Dose Due to Thorium-232 for a Shut-In Resident at OT-10, TS7 (Dose is Above Background Levels)

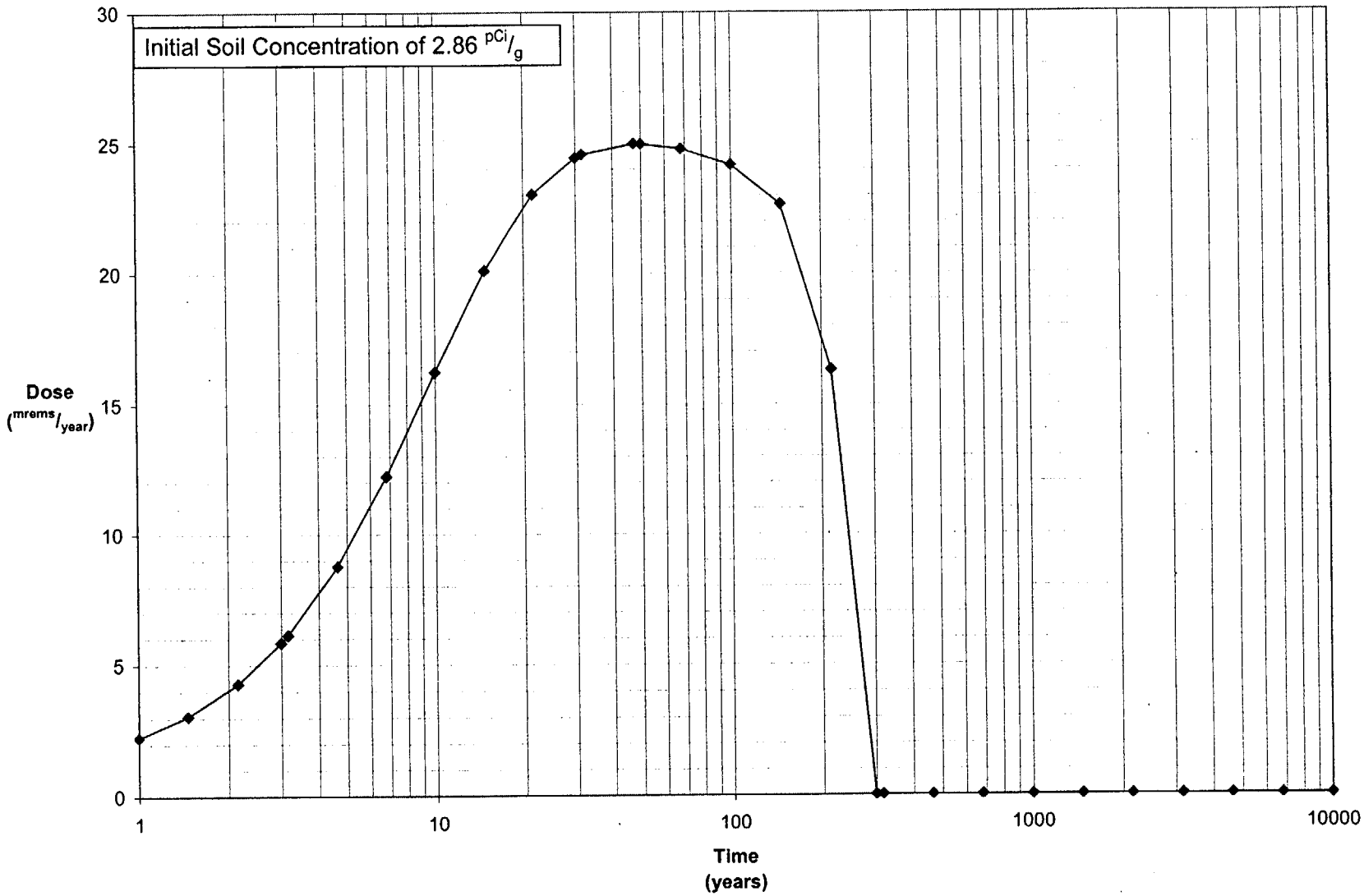
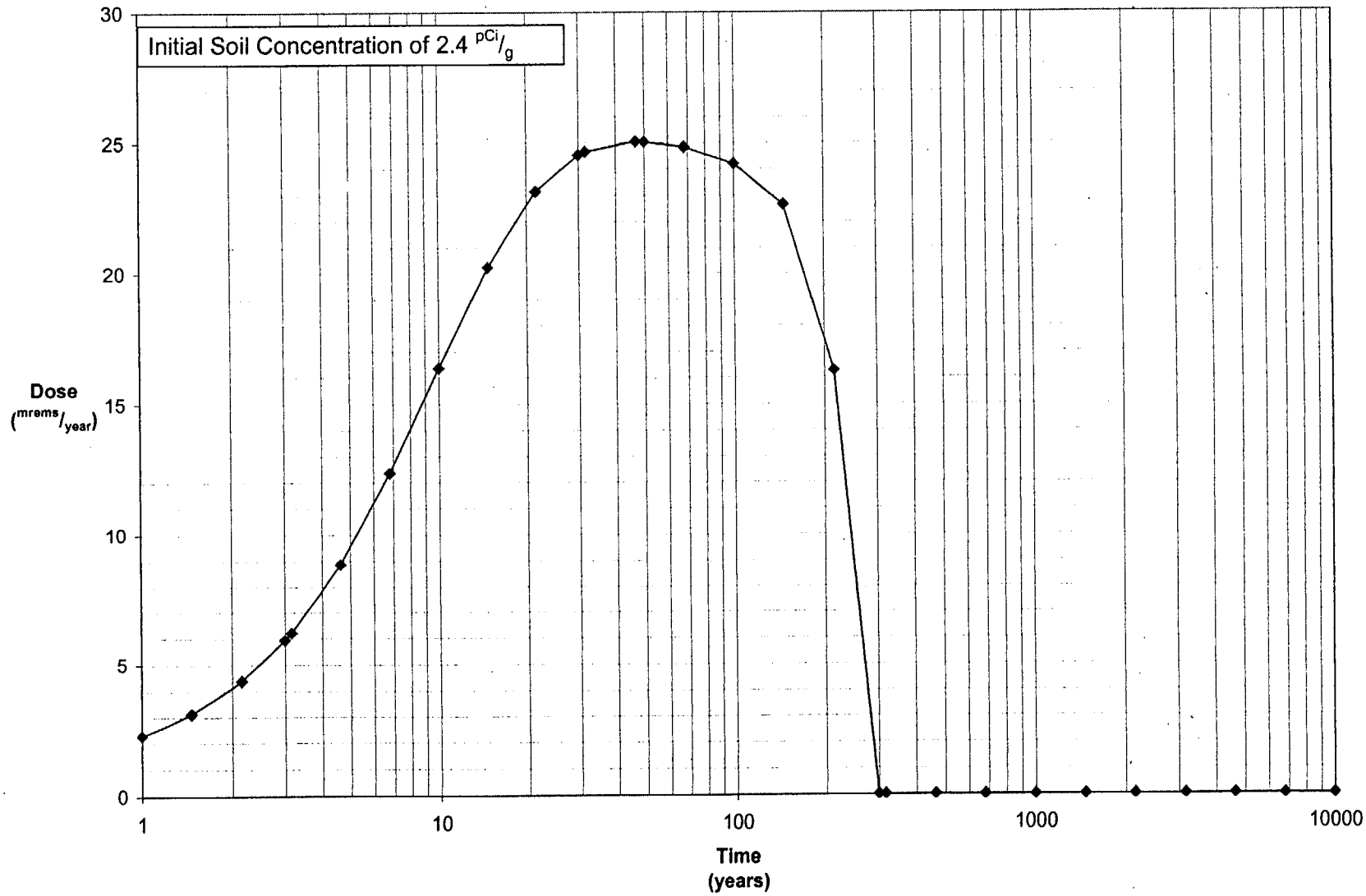


Figure 2-14. Radiation Dose Due to Thorium-232 for an Outdoor Resident at OT-10, TS7 (Dose is Above Background Levels)



ATTACHMENT 3

PARAMETER CALCULATIONS

ATTACHMENT 3 PARAMETER CALCULATIONS

This Attachment shows how the dust concentration, the total vegetable consumption, and the percentage of vegetables that were homegrown were calculated.

3.1 Dust Concentration

One of the parameters required by the RESRAD model is the dust concentration. This concentration is the amount of respirable dust that is site-related; as opposed to the total amount of dust in the air. The dust concentration was calculated based on the particulate emission factor (PEF). The PEF relates the concentration of contaminant in soil with the concentration of dust particles in air. The equations used are as follows:

$$\text{Dust Concentration (mg/m}^3\text{)} = \frac{1}{\text{PEF (m}^3\text{/kg)}} \times 10^6 \text{ mg/kg}$$

$$\text{PEF} = Q/C \times \frac{3{,}600 \text{ s/hr}}{0.036 \times (1 - V) \times (U_m/U_t)^3 \times F(x)}$$

where:

- Q/C = inverse of the mean concentration at the center of a square source (g/m^2-s per kg/m^3)
- V = fraction of vegetative cover (unitless)
- U_m = mean annual windspeed (m/s)
- U_t = equivalent threshold value of windspeed at 7 meters (m/s)
- F(x) = function dependent on U_m/U_t (unitless)

The parameter values are summarized in Table 3-1.

Table 3-1. Parameters for Dust Concentration Calculation

Parameter	Value	Source
Inverse of the mean concentration at the center of a square source (g/m^2-s per kg/m^3); Q/C	65.4	Value for a 2-acre site in Albuquerque (EPA, 1996)
Fraction of vegetative cover (unitless); V	0.0	Conservative value applicable for desert Conditions
Mean annual windspeed (m/s); U_m	4.52	Mean annual windspeed measured at the Albuquerque Airport from 1931 to 1999 (personal communication from the National Weather Service, April 20,2000)
Equivalent threshold of windspeed at 7 meters (m/s); U_t	11.32	EPA default value (EPA, 1996)
Function dependent on U_m/U_t (unitless); F(x)	0.149	Value based on U_m and U_t (EPA, 1985)

3.2 Amount of Homegrown Vegetables Consumed

The amount of homegrown vegetables consumed is related to two factors. The first is the total amount of vegetables consumed from all sources. The second factor is the percentage of vegetables consumed that are homegrown.

3.2.1 Total Amount of Vegetables Consumed

The default RESRAD model parameter for consumption of fruits, vegetables, and grains is 160 kg/year. Because the homegrown produce at OT-10 is assumed to consist of vegetables, the amount of fruits and grains consumed must be subtracted from this total. In addition, RESRAD separately accounts for the amount of leafy vegetables consumed at 14 kg/year.

The EPA *Exposure Factors Handbook* (EFH) provides information regarding the amount of fruit, vegetables, and grain consumed per year (EPA, 1997). This information is provided in units of mg/kg-day. Because body weight is incorporated into this intake and because all age groups were represented in these data, one cannot simply extract the amount of vegetables consumed. However, one can readily obtain the fraction of these three categories that is vegetables.

According to the *Exposure Factors Handbook*, the mean amount of fruit consumed per day in the western United States is 3.4 mg/kg-day; the amount of vegetables is 4.3 mg/kg-day, and the amount of grain is 4.1 mg/kg-day. The total of these three categories is 11.8 mg/kg-day. The amount of vegetables is 36.4

percent of this total. If the total amount of fruit, vegetables, and grain consumed is 160 kg/yr, the amount of vegetables consumed is 0.364 x 160 kg/yr, or 58 kg/yr.

3.2.2 Fraction of Vegetables Consumed that are Homegrown

The fraction of vegetables consumed that are homegrown was calculated based on information from the *Exposure Factors Handbook* for the western United States (EPA, 1997). The EFH contains results from food surveys that have been conducted in all seasons of the year. Two factors combine to yield the fraction of vegetables consumed that are homegrown. The first is the fraction of people that grow homegrown produce who are consuming that produce at any given time. For example, a family may only eat vegetables from their garden at certain times of the year. The second factor is the fraction of vegetables consumed that are homegrown, during the times when homegrown vegetables are being consumed. For example, a family could consume tomatoes from their garden in a salad with store-bought lettuce.

In the EFH, 53 percent of households in the Rocky Mountain region were identified as having vegetable gardens (EFH, Table 9-1), and 16.73 percent of households were identified as consuming homegrown vegetables (EFH, Table 13-17). Thus, the percentage of households with vegetable gardens consuming produce from these gardens at any point in time was 0.1673/0.53, or 31.6 percent.

The EFH identifies the mean amount of vegetables consumed per capita in the west from any source as 4.168 g/kg-day (EFH, Table 9-4). In this survey, 96.9 percent of people consumed vegetables. Thus, vegetable consumption by consumers was 4.168 g/kg-day/0.969, or 4.30 g/kg-day. The mean amount of homegrown vegetables consumed by people eating homegrown vegetables was 1.81 g/kg-day (EFH, Table 13-17). Consequently, the fraction of homegrown vegetables from people consuming these vegetables was 1.81 g/kg-day/4.30 g/kg-day, or 42.1 percent.

The total fraction of homegrown vegetables consumed by people who eat homegrown vegetables is the product of these two factors: 0.316 * 0.421 = 0.133. Thus, an estimated 13.3 percent of vegetables consumed is homegrown, considered only those people with vegetable gardens.

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EPA, 1985. Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites. EPA/600/8-85/002. U.S. Environmental Protection Agency. February 1985.

EPA, 1996. Soil Screening Guidance: Technical Background Document. EPA/540/R95/128. U.S. Environmental Protection Agency. May 1996.

EPA, 1997. Exposure Factors Handbook. EPA/600/P-95/002F. U.S. Environmental Protection Agency. August 1997.

APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY PLAN

INSTALLATION RESTORATION PROGRAM
KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR DECOMMISSIONING ACTIVITIES AT INSTALLATION RESTORATION PROGRAM SITE OT-10, RADIATION TRAINING SITES, KIRTLAND AIR FORCE BASE, NEW MEXICO

JULY 2000

Prepared for

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

CONTRACT NO. DACW 45-94-D-0003 DELIVERY ORDER NO. 23 WAD27

Prepared by

FOSTER WHEELER AND MONTGOMERY WATSON
ALBUQUERQUE, NEW MEXICO

SITE-SPECIFIC HEALTH AND SAFETY PLAN

DECOMMISSIONING ACTIVITIES AT INSTALLATION RESTORATION PROGRAM SITE OT-10, RADIATION TRAINING SITES, KIRTLAND AIR FORCE BASE, NEW MEXICO

Prepared by:

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AFCEE Program Health and Safety Manager

Reviewed by:

Jeff Johnston 7/13/00

Jeff Johnston, Montgomery Watson — Date

Delivery Order Manager

TABLE OF CONTENTS

Section **Page Number**

ACRONYMS vii

B.1.0 INTRODUCTION B-1
B.1.1 Site Location and Client Information B-1
B.1.1.1 Site Location B-1
B.1.1.2 Client Information B-1
B.1.2 Scope of Work and Schedule B-3
B.1.2.1 Scope of Work B-3
B.1.2.2 Schedule B-3
B.1.3 Purpose of the Health and Safety Plan B-4
B.1.4 Amending the Plan B-4
B.1.5 Applicable Regulations and References B-4

B.2.0 UNIQUE SITE CONDITIONS B-5
B.2.1 Radiation Protection Program B-5
B.2.2 Lift Liner™ Soft-sided Disposable Containers B-6
B.2.3 Medical Surveillance Program B-7
B.2.4 Heat Stress and Exposure to the Sun B-7
B.2.4.1 Heat Stress B-7
B.2.4.2 Exposure to Sun B-9
B.2.5 Biohazards B-9

B.3.0 MULTI-EMPLOYER WORK SITES B-10
B.3.1 OSHA Multi-Employer Work Site Rules B-10
B.3.2 Unsafe Acts or Conditions B-11
B.3.2.1 Threat of Injury or Death B-11
B.3.2.2 Differing Opinions B-11
B.3.3 Disciplinary Action B-12
B.3.4 Safety Suggestions B-12

B.4.0 ROLES AND RESPONSIBILITIES B-12
B.4.1 Montgomery Watson Management Commitment Statement B-12
B.4.2 The Project Team B-13
B.4.3 Assignment of Safety and Health Responsibilities B-14
B.4.3.1 Montgomery Watson Health and Safety Manager B-14
B.4.3.2 Delivery Order Manager B-14
B.4.3.3 Health and Safety Officer / Supervisory Personnel B-14
B.4.3.4 Radiation Safety Officer B-15
B.4.3.5. Subcontractor Safety Personnel B-15
B.4.4 Site Visitors B-16

TABLE OF CONTENTS (concluded)

Section **Page Number**

B.5.0 TRAINING, COMMUNICATIONS AND MEETINGS B-16
B.5.1 Health and Safety Training Requirements B-16
B.5.2 Methods of Communication to Employees B-17
B.5.3 Meeting Schedule B-17
B.5.4 Health and Safety Inspections / Evaluations B-18
B.5.4.1 Site Safety Inspections B-18
B.5.4.2 Health and Safety Audits B-18
B.5.5 Accident Investigation and Reporting B-18

B.6.0 DOCUMENTATION AND POSTINGS B-18

B.7.0 ACTIVITY HAZARD ANALYSIS / CODE OF SAFE PRACTICES B-19
B.7.1 Office Environment B-19
B.7.1.1 Fire Prevention Plan B-19
B.7.1.2 Electrical B-20
B.7.1.3 Ergonomic B-20
B.7.2 Common Field Issues B-21
B.7.2.1 Housekeeping and Storage of Materials B-21
B.7.2.2 Storage of Flammable Materials B-22
B.7.2.3 Hazard Communication and Material Safety Data Sheets B-22
B.7.2.4 Fire Prevention Plan B-22
B.7.2.5 First Aid and CPR B-23
B.7.2.6 Site Security B-23
B.7.2.7 Field Sanitation B-24
B.7.3 Site-Specific Field Work B-24
B.7.3.1 Welding and Cutting B-24
B.7.3.2 Electrical Work and Control of Hazardous Energy B-25
B.7.3.3 Excavation B-26
B.7.3.4 Industrial / Construction Trucks and Equipment B-27
B.7.3.5 Mobile Cranes and Overhead Hoists B-27
B.7.3.6 Hand Tools B-28
B.7.4 Personal Protective Equipment B-28

B.8.0 EMERGENCY ASSISTANCE INFORMATION B-29
B.8.1 First Aid Kit Requirements B-29
B.8.2 24-Hr Emergency Hospital B-30
B.8.3 Emergency Contact Numbers B-30
B.8.4 Key Montgomery Watson and Other Project Personnel B-32

LIST OF FIGURES

Figure B.1-1 Site Location Map B-2

Figure B.8-1 Hospital Route Map B-31

ATTACHMENTS

ATTACHMENT 1 Montgomery Watson Incident Report Form

ATTACHMENT 2 Monthly Subcontractor Safety Report

ATTACHMENT 3 Personal Acknowledgement Form

ATTACHMENT 4 Montgomery Watson Hazard Communication Program

ACRONYMS

AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AHA	activity hazard analysis
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CFR	*U.S. Code of Federal Regulations*
CPR	cardiopulmonary resuscitation
DNWS	Defense Nuclear Weapons School
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERG	Environmental Restoration Group
GFCI	ground fault circuit interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
hr	hour or hours
HSO	Health and Safety Officer
HSP	Health and Safety Plan
mrem/hr	millirem per hr
MSDS	material safety data sheet
MWCI	Montgomery Watson Constructors, Inc.
NRC	Nuclear Regulatory Commission
NRR	noise reduction rating
OSHA	Occupational Safety and Health Administration
PA/RD	preliminary assessment / remedial design
PPE	personal protective equipment
RSO	radiation safety officer
SPF	sun protection factor
SSHP	Site Safety and Health Plan (developed by Foster Wheeler)

ACRONYMS (Concluded)

TLD	thermoluminescent detectors
TS5	OT-10 Training Site 5
TS6	OT-10 Training Site 6
TS7	OT-10 Training Site 7
TS8	OT-10 Training Site 8
uCi/ml	microCuries per milliliter
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force

B.1.0 INTRODUCTION

This Site-Specific Health and Safety Plan (HSP) has been prepared for Montgomery Watson employees overseeing the decommissioning of the four inactive OT-10 training sites at Kirtland Air Force Base (AFB) in Albuquerque, New Mexico. This document, along with the others listed below, form the health and safety program documents governing this project.

- Section 4.0 of the Decommissioning Plan containing the Radiation Protection Program (USAF, 2000).
- Kirtland AFB Volume IV Site Safety and Health Plan (SSHP) developed by Foster Wheeler Environmental Corporation, March 3, 1995. Foster Wheeler Environmental Corporation developed the SSHP under a U.S. Army Corps of Engineers (USACE) Total Environmental Restoration Contract; it has been serving many contractors at Kirtland AFB since it was written. In a memorandum dated May 27, 1999, Montgomery Watson identified elements of the Foster Wheeler SSHP that did not apply or required clarification for Montgomery Watson employees.
- Contractor-specific activity hazard analyses (AHAs)

This HSP provides the safety and health procedures specific to the decommissioning activities at OT-10. The Radiation Protection Program provides specific information about the controls that will be employed to protect site workers from over-exposure to radiation.

B.1.1 SITE LOCATION AND CLIENT INFORMATION

B.1.1.1 Site Location

Kirtland AFB is located in Albuquerque, New Mexico. Installation Restoration Program (IRP) Site OT-10 is located in the north-central part of the base. It contains four former Defense Nuclear Weapons School (DNWS) Radiation Training Sites. These sites (TS5, TS6, TS7 and TS8) are being decommissioned in accordance with this plan (Figure B.1-1). The Decommissioning Plan provides a detailed discussion of the background and the nature and extent of contamination at OT-10.

B.1.1.2 Client Information

Montgomery Watson's work at OT-10 will be conducted under Air Force Center for Environmental Excellence (AFCEE) Contract No. F41624-97-D-8013, Delivery Order 37.

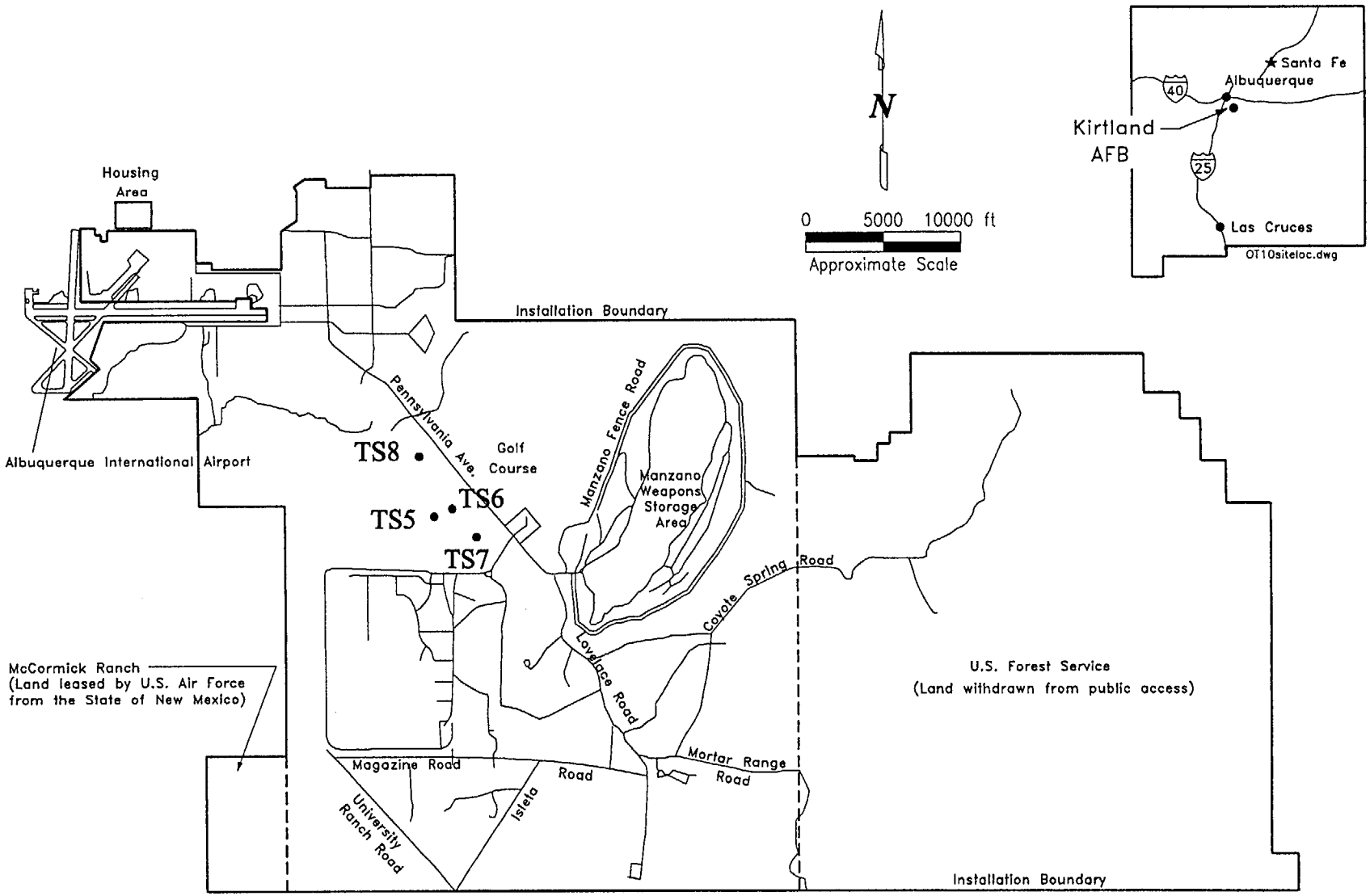

Figure B.1-1. Site Location Map for IRP Site OT-10, Radiation Training Sites

B.1.2 SCOPE OF WORK AND SCHEDULE

From 1961 to 1990, OT-10 was used to train military radiological response personnel to detect contaminants generated during simulated nuclear weapons accidents. Known quantities of Brazilian thorium oxide sludge were applied and tilled into site soils to simulate dispersed plutonium. Four other training sites (training sites 1 through 4) remain active. The training sites are owned by the U.S. Government and regulated by the U.S. Nuclear Regulatory Commission (NRC) under United States Air Force (USAF) Master Materials License No. 42-23529-01AF. Radiological contamination at OT-10 is limited to thorium-232 and its decay progeny. No chemical contaminants of concern have been identified at these sites.

B.1.2.1 Scope of Work

A detailed scope of work appears in the Decommissioning Plan. Field activities will include:

- Gamma-ray scanning surveys prior to and during decommissioning activities;
- Clearing and grubbing of vegetation and debris from excavation sites;
- Excavation of radiologically-contaminated soils;
- Sampling of vegetation, debris and soil for waste characterization;
- Packaging of vegetation, debris, and soil into Lift Liner™ Soft-sided Disposable Containers;
- Placement by crane of Lift Liner™ Soft-sided Disposable Containers onto rail cars for transport to waste disposal facility (Envirocare in Clive, Utah);
- Final status radiation surveying (includes sampling); and
- Grading and re-vegetation.

The protection of workers is a paramount decommissioning task. Health physics activities, including contamination, radiation, and air monitoring, will be overseen by onsite health physics personnel during radiological surveying, excavating, and packaging operations. Monitoring will include air-borne particulate monitoring and personal dosimetry. General air monitoring will be performed daily or whenever site work activities have the potential for releasing airborne radioactivity. Air sample filters will be measured weekly for radioactive counts to determine potential worker exposure to airborne radioactive particles. Thermoluminescent detectors (TLDs) will be used to monitor worker exposure to external radiation.

B.1.2.2 Schedule

Field activities are anticipated to take place from November 2000 through April 2002. A five day, 50-hour (hr) workweek is anticipated for this project.

B.1.3 PURPOSE OF THE HEALTH AND SAFETY PLAN

The purpose of this HSP is to address known and reasonably anticipated health and safety hazards to the Montgomery Watson employees and team conducting decommissioning activities at OT-10. In particular, this HSP is intended to provide enough information to site personnel to prevent and minimize personal injuries, illnesses, and physical damage to equipment, supplies, and property. Specifically, Section B.7.0 has been designed to serve as a code of safe practices for oversight activities on this project. Contractors performing heavy equipment operations will be required to submit an AHA covering work means and methods and the anticipated hazards and controls.

B.1.4 AMENDING THE HEALTH AND SAFETY PLAN

The evaluation of hazards, levels of protection, and procedures specified in this plan are based on the best information available at the time of this writing (July 2000). It is recognized that site conditions may change; therefore, it is imperative that safety measures be thoroughly assessed by a safety and health professional prior to any hazardous field activities.

This HSP will be modified/amended when work activities not covered by this plan are scheduled, or if the provisions specified herein are not feasible or adequate to protect the health and safety of site personnel. Modifications shall be accomplished by consultation with a Montgomery Watson safety and health professional. The Delivery Order Manager will act as liaison between the project staff and the Montgomery Watson safety and health professional. All modifications or amendments to the HSP will be written and communicated to all affected personnel.

B.1.5 APPLICABLE REGULATIONS AND REFERENCES

The Occupational Safety and Health Administration (OSHA) requires each employer involved in construction activities to comply with Title 29 of the U.S. Code of Federal Regulations (29 CFR § 1926), Safety and Health Regulations for the Construction Industry and applicable sections of 29 CFR § 1910 Safety and Health Regulations for General Industry. The Hazardous Waste Operations and Emergency Response standard (regulation) (29 CFR § 1910.120 and 29 CFR § 1926.65) applies to the decommissioning of the radioactive training sites.

OT-10 decommissioning activities will receive added precautions because of the radioactive nature of the contamination at OT-10. The USAF and the NRC will review the Decommissioning Plan and oversee decommissioning activities. Title 10 CFR Parts 20, 30, and 49, the *U.S. Nuclear Regulatory Commission Draft Regulatory Guide DG-4006*, and the *Multi-Agency Radiation Survey and Site Investigation Manual* guided the writing of this Decommissioning Plan.

All employees and contractors will implement and enforce the requirements of the safety plan(s) of the company he/she is working for; and comply with the requirements of 29 CFR

§ 1926 and relevant sections of 29 CFR § 1910, as well as the relevant Title 10, 20, 30, 40, and 49 CFR requirements.

B.2.0 SITE-SPECIFIC CONDITIONS

B.2.1 Radiation Hazard

The radiation aspects of OT-10 make it an interesting and unique project. A Radiation Protection Plan, required for such a project, has been developed by a contracted health physicist. The Radiation Protection Plan provides detailed information about the contamination hazards and exposure monitoring program at the site. The Radiation Protection Plan is included in Section 4.0 of the Decommissioning Plan. The Radiation Protection Plan can be summarized as follows:

- The primary hazards are thorium-232 and its decay progeny. This element decays to ten different isotopes before it stabilizes. Its decay process liberates radon-220 gas that is an alpha emitter. Its decay process also liberates alpha, beta, and gamma radiation. Several of its decay progeny emit gamma radiation.
- Uranium 238 and its decay progeny are also present at OT-10; it liberates radon-222 gas. Its decay process also liberates alpha, beta, and gamma radiation.
- Radon gas is a significant health concern due to the alpha particle's ability to damage the lung tissue, including the potential to cause lung cancer. However, radon-220 is a less important source of exposure to humans than radon-222 due to its short half life and limited ability to migrate. Radon-222 control actions will also reduce exposure to radon-220.
- Daily air monitoring will be performed to quantify the amount of alpha radiation being generated by invasive (clearing, grubbing, excavation and loading) decommissioning activities. The monitoring will be accomplished by collecting particulate samples on a filter cassette attached to a personal air sampling pump, as well as area samples on intermediate volume air sampling pumps. The samples will be analyzed daily and again a week later by a scintillation counter providing gross alpha radiation data. This monitoring will be considered as a surrogate to direct monitoring for thorium-232.
- A portable Ludlum 44-10 sodium iodide scintillometer equipped with a Ludlum 2221 ratemeter/scaler will be used to measure direct radiation (gamma) dose rates at the surface of soil piles, Lift Liner™ Soft-sided Disposable Containers, and any other surface in question.
- Onsite workers will be issued individual TLDs to monitor their external exposure. The TLDs will be worn under protective clothing to prevent possible contamination of the TLD from dirt or airborne dust. All TLDs, as well as controls, will be placed in the support zone when not in use. TLDs will be provided and read quarterly by a third-party vendor certified by the National Voluntary Laboratory Accreditation Program.
- 2 millirem per hr (mrem/hr) will be the maximum acceptable dose rate for workers. At this level the onsite health physicist will work with the crew to ensure that unnecessary exposure does not occur. Two mrem/hr equates to an overall gross alpha concentration of 6.8×10^{-12} microCuries per milliliter (μCi/ml) of airborne particulates.

- The principles of time, distance, and shielding for the protection of workers from radiation will be employed. The amount of time each worker is exposed to radiation above background by having them record times in and out on a sign-in/sign-out sheet. The time a worker spends onsite will be limited by the acceptable exposure dose rate (2 mrem/hr). To the extent feasible, work will be coordinated such that a minimum amount of time is spent within the 2 mrem/hr dose rate work zone.
- Invasive work tasks will start in Level C personal protective equipment (PPE). If at least one week of air monitoring indicates that airborne thorium-232 levels are acceptable and planned activities are not anticipated to generate any more dust than those conducted during the one week evaluation period, downgrading out of respirators may be permitted.
- Level C PPE for this project requires:
  - ✓ Standard Tyvek® suite with feet and hood
  - ✓ Steel-toed safety boots
  - ✓ Galosh overboots with tread to prevent slipping hazards
  - ✓ Latex or nitrile inner gloves
  - ✓ Cotton or other cloth overgloves
  - ✓ Full-face air purifying respirator with P100 (high efficiency particulate air) filters. With permission from the Site Radiation Safety Officer (RSO), half-face respirators may be used.
  - ✓ Hard hat
  - ✓ Safety glasses with side shields
- A pre-project medical radiation whole body count may be provided to all project personnel. This will be coordinated by the Site RSO.
- The amount and type of radiation at Site OT-10 is not strong enough to result in an acute onsite radiation injury or illness to site workers. Any injury or illness occurring at the site would be the result of other factors. It is possible for an injured or ill worker to have contaminated soil adhere to his/her PPE or exposed body. For this reason medical emergencies will require decontamination and planning. Section 8.0 of this HSP provides information about the medical assistance network established for this project. The emergency medical service (local 24-hr hospital) has been informed of this project and the potential for radioactive soil contamination on an injured/ill worker's clothing or body.
- Decontamination will include the removal of outer clothing and washing affected body parts with soap and water. Note: do not use a hard-bristled brush when washing skin or equipment as it could lead to tiny abrasions which would allow the injection of contaminated material. Decontamination solutions and spent PPE will be containerized and disposed of in accordance with the Decommissioning Plan.

B.2.2 Lift Liner™ Soft-sided Disposable Containers

Lift Liner™ Soft-sided Disposable Containers each measuring approximately 96 inches x 86 inches x 54 inches (about 1,937 gallons) and can contain a maximum load of 11 tons (10,000 kilograms). The Lift Liner™ waste packaging system includes a 25-mil woven outer

polyethylene fabric shell with a 2-mil water resistant coating and a 45-mil double-layer polypropylene inner liner. The outer shell is equipped with 18 lifting straps made of 2-inch polyester seat belt webbing materials. The system also includes a loading frame used to support the shell and inner liner during loading and a lifting/spreader bar. The lifting frame is constructed of steel, meets American Society for Testing and Materials (ASTM) standard A-500, and its hooks are 3 ton carbon steel design capacity of 40,000 pounds. The lifting weight capacity is 24,000 pounds @ 125% certified (per DOE Standard-1090 Hoisting and Rigging Devices). The lifting/spreader bar attaches to the lifting straps to hoist the container from the loading frame onto a transport vehicle.

The Lift Liner™ Soft-sided Disposable Containers will be loaded with OT-10 soil and debris. They will then be lifted by crane onto trucks, transported to the railcar siding, and placed on a rail car for transport to the disposal facility.

B.2.3 MEDICAL SURVEILLANCE

In addition to the annual medical evaluation required by the Hazardous Waste Operations and Emergency Response standard (described in the SSHP), project personnel may be required to obtain pre and post whole body radiation counts to assess radiation exposure. The Sandia National Laboratory has the facilities to conduct this test and the testing will be coordinated by Dr. Kenneth Baker, the Site RSO. Montgomery Watson employees will need to bring a copy of the Authorization to Release Previous Medical Records form to Sandia so that the results can be forwarded directly to Dr. Greaney for inclusion in the employee's permanent medical surveillance file. Since the form does not have Dr. Greaney's address, it is being included here for reference: WorkCare, 333 S. Anita Dr., Suite 630, Orange, CA 92868. Phone 800-455-6155 ext. 113 with any questions. Mr. Jeffrey Johnston, the Delivery Order Manager will have copies of this form to provide to all Montgomery Watson personnel participating in the radiation testing program.

B.2.4 HEAT STRESS AND EXPOSURE TO THE SUN

B.2.4.1 Heat Stress

The stress of working in a hot environment can cause a variety of illnesses including heat exhaustion or heat stroke; the latter can be fatal. Personal protective equipment (i.e., EPA Level C protection) can significantly increase heat stress. While the field work associated with the decommissioning of OT-10 is scheduled to take place during the fall and winter months, heat stress is still a potential concern in the desert portions of the country, particularly in New Mexico. To reduce or prevent heat stress, frequent rest periods and controlled beverage consumption to replace body fluids and salts may be required. It should be noted that heat stress can occur in people wearing regular, permeable, work clothing.

Additionally, quantitative physiological monitoring for heat stress may be conducted. Physiological monitoring for heat stress includes heart rate as a primary indicator and oral temperature as a secondary indicator. The frequency of monitoring depends on the ambient

temperature and the level of protection used on-site. To determine the initial monitoring frequency, after a work period of moderate exertion, use the following information:

Adjusted Temperature*	Level D	Level C
90 F or above	after 45 minutes	after 15 minutes
87.5 to 90 F	after 60 minutes	after 30 minutes
82.5 to 87.5 F	after 90 minutes	after 60 minutes
77.5 to 82.5 F	after 120 minutes	after 90 minutes
72.5 to 77.5 F	after 150 minutes	after 120 minutes

* Adjusted air temperature (F) = observed temp + (13 x percent sunshine)

Air temperature measured with bulb shielded from radiant heat, percent sunshine is the time sun is not covered by clouds thick enough to produce a shadow (100 percent = no cloud cover and a sharp, distinct shadow; 0 percent = no shadows). The Industrial Environment, its Evaluation and Control; U.S. Department of Health and Human Services, 1973.

The following procedures and action levels are to be used for the physiological monitoring of heat stress:

Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle one-third and keep the rest period the same. If the heart rate exceeds the 110 beats per minute at the next rest period, shorten the following work cycle by another one-third and also monitor oral temperature.

Oral temperature: Use a clinical thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6 F, shorten the next work cycle by one-third without changing the rest period. If oral temperature exceeds 99.6 F at the beginning of the next rest period, shorten the following work cycle by one-third. ***DO NOT*** allow a field team member to wear EPA Level C protection when oral temperature exceeds 100.6 F.

Personnel will be trained to recognize the symptoms of heat stress and the appropriate action to take upon recognition. Even though physiological monitoring is not always necessary, it is essential that personnel understand the significance of heat stress and its recognition.

Some of the symptoms, which indicate heat exhaustion, are:

- Clammy skin
- Lightheadedness
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Confusion
- Fainting
- Nausea (vomiting)

If these conditions are noted, the following steps should be performed:

- Remove the victim to a cool and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.

Symptoms that indicate heat stroke include:

- Staggering gait
- Hot skin, temperature rise (yet may feel chilled)
- Incoherent, delirious
- Mental confusion
- Convulsions
- Unconsciousness

If heat stroke conditions are noted, immediately perform the following steps:

- Remove victim to a cool, uncontaminated area.
- Cool the victim, whole body, with water, compresses and/or rapid Fanning.
- Give water to drink, if conscious.
- Transport the victim to the designated medical facility for further cooling and monitoring of body functions. ***HEAT STROKE IS A MEDICAL EMERGENCY!***

B.2.4.2 Exposure to the Sun

When working outdoors, even on seemingly cloudy days, exposure to the sun can result in sun burn. Workers wearing the minimum level of personal protective equipment at OT-10 will be fairly well protected against sun burn, except for their face. It is possible that workers will be wearing respirators that will cover their faces for a good portion of the work, but exposure may still be an issue. For this reason, it is recommended that workers use a sun screen to protect the exposed skin against sun burn. The higher the sun protection factor (SPF), the better. Exposed skin will likely include the back of the neck, top of the ears, nose, cheeks and forehead as well as forearms and hands. Should a worker experience a sun burn, first aid treatment should be administered in accordance with the booklet in the first aid kit on the site.

B.2.5 BIOHAZARDS

Potential biological hazards at Site OT-10 include snakes, scorpions, spiders, ticks and fleas, poisonous plants such as poison oak and poison ivy, and the newly identified hantavirus.

Spiders, scorpions, snakes, and fleas exist in cool, dark, moist areas. The potential for encounters exist when reaching into dark, covered places. Such places include storage of site supplies. Suggestions for control include using a long stick to break apart webs or loosen soil from certain areas. A flashlight should also be used when reaching into a dark area. Field personnel shall be aware of their surroundings and avoid contact with all insects.

Rattlesnakes and scorpions are indigenous to many parts of the United States, particularly New Mexico. The daily tailgate safety meetings should include a reminder to be on the lookout for rattlesnakes and scorpions. It should be noted that the American Red Cross does not advocate the use of snake bite kits for snake bite injuries. Rather, experience has shown that the victim has a better chance of recovery without permanent damage when the site of the wound is immobilized and the victim rushed to the closest emergency medical facility (preferably within 30 minutes). Most snakes and scorpions are not generally aggressive, however, if the temperature is very warm, they may already be irritated and encountering you may put them over the edge. Do not attempt to handle a snake. Rather, see if the snake will leave on its own, if not contact the local animal control at: 505-768-1975.

Poisonous plants such as poison ivy and poison oak grow wild in dark, moist areas, and at the base or surrounding seedling or adult trees. Some individuals are prone to break out in dermal (skin) rashes upon contact with the plant oil. A visual site inspection and identification of the plants should be completed prior to each work shift so that all individuals are aware of the potential exposure.

A recently identified disease, hantavirus, has resulted in several deaths in the southwestern part of the United States. While there may not have been any outbreaks or notices of the virus at a particular project site, field team members should be aware of the cause and potential control methods. The hantavirus has been shown to be transmitted through the aerosolization of dried rodent excreta. The newly recognized hantavirus-associated disease begins with one or more symptoms including fever, muscle aches, headache, and cough and progresses rapidly to severe lung disease, often requiring intensive care treatment. To control potential contact with dust that may be carrying the rodent excreta, the field team will conduct a visual survey of the area around each site to note whether rodents are thriving in the area. If it is determined that non-domesticated rodents may be living near the work area, or the area is affected by wind blowing dust into the work area, dust suppression techniques and/or respiratory protection (dust mask or dual cartridge air purifying respirator with dust filters) will be required. The Center for Disease Control, in Atlanta Georgia, has established a hotline for inquiries regarding the hantavirus: (800) 532-9929.

New Mexico has reported 9 cases of Plague in 1998. Plague is contracted from a bite of an infected rodent flea, primarily in the months between May and September. Again, try to identify areas where there are rodents and keep clear of them. Do not attempt to kill them as that would encourage the flea to jump from the now dead rodent to the live person standing near by.

B.3.0 MULTI EMPLOYER WORK SITES

B.3.1 OSHA MULTI-EMPLOYER WORK SITE RULES

Under the Occupational Safety and Health Act, each employer is required to provide a safe and healthy working environment for employees. When several contractors are working simultaneously on the project, the activities of one contractor could expose employees of another company to a hazard. OSHA categorizes four types of employers (note, one

employer may fit more than one category): the creating employer (activities that create a hazard), the exposing employer (employees exposed to a hazardous condition), the controlling employer (the contractor with authority to correct unsafe conditions) and the general contractor (responsible for the safety of the project regardless of which contractor is creating a hazardous condition).

Based on OSHA's categorization of employers, it is clear that the general contractor and the exposing employers must take action to ensure the safety of site workers. This in no way relieves other contractors/employers of their obligations to work in a safe manner, thus all contractors must engage in a cooperative effort to create a safe job-site.

Montgomery Watson is the general contractor for this project and is thus responsible for ensuring that Montgomery Watson employees and other subcontractors are appraised of hazards, provided the necessary safety tools and are made to follow site safety requirements.

B.3.2 UNSAFE ACTS OR CONDITIONS

Any direct subcontractor to Montgomery Watson shall immediately correct any and all unsafe acts or conditions that are brought to its attention. Any failure to correct unsafe acts and/or unsafe conditions will result in stoppage of the subcontractor's work until the unsafe acts and/or conditions are corrected to the satisfaction of Montgomery Watson.

In the role of general contractor, Montgomery Watson employees will follow the guidance below in addressing potentially unsafe acts or conditions:

B.3.2.1 Threat of Injury or Death

- Have the contractor remove people from the immediate danger or hazard zone.
- Notify the contractor's superintendent or foreman.
- Issue a written notice to the contractor indicating that immediate corrective action is needed.
- Record in the daily report the time and to whom any verbal or written notices were given.
- If you think it is necessary, take photographs.
- If the contractor does not take action stop work.
- The Construction Manager on site or the Delivery Order Manager will write a full report in the daily construction report form on the condition found to be unsafe and the actions and correspondence taken, including names and times.

B.3.2.2 Differing Opinions

When a dispute or difference of opinion occurs between Montgomery Watson and a subcontractor concerning any interpretation of the safety practices or procedures required for the subcontractor's scope of work, Montgomery Watson or its designee's interpretation shall control. The subcontractor shall not start or continue with work until the safety practices and procedures in dispute are resolved to the satisfaction of Montgomery Watson.

B.3.2.3 Reporting Unsafe Conditions

If any site worker or visitor observes conditions that exposes themselves or other workers to hazards that are likely to cause harm, they must immediately report the hazard to their supervisor so that prompt corrective action can be taken to correct the hazard. In cases of imminent danger, any person on site may stop an activity if s/he is aware that by not doing so it would cause serious harm to a person, property, or equipment.

B.3.3 DISCIPLINARY ACTION

Subcontractor employees refusing or repeatedly failing to comply with job safety requirements, or supervisors failing to enforce compliance with these and referenced safety and health standards shall be promptly disciplined, which at Montgomery Watson's discretion, may include removal from the job site.

B.3.4 SAFETY SUGGESTIONS

The project has an "open door policy" for site personnel to make suggestions to improve safety. Suggestions are welcome and may be made by any person conducting or observing work, or affected by work on site. Suggestions may be communicated verbally to a Montgomery Watson manager or in written form.

B.4.0 ROLES AND RESPONSIBILITIES

B.4.1 MANAGEMENT COMMITTMENT

It is the policy of Montgomery Watson and the management organization assigned to field projects to provide a safe and healthful work environment for all assigned employees. Montgomery Watson recognizes that injury, illness, or property/equipment loss impacts each of our lives through suffering and potential disability, as well as through lost wages and productivity.

A fundamental principle of occupational safety and loss prevention is that most all accidents causing injuries or illnesses and property damage are ***preventable***. Examinations of the causes of accidents and industrial illnesses demonstrate that most injuries or illnesses are the result of an unsafe act or condition. Montgomery Watson recognizes that it is both a moral obligation and a sound business practice to prevent workplace injuries and illnesses. This can be accomplished by recognizing, evaluating, and controlling unsafe acts and conditions.

The health a safety program embodied in each Montgomery Watson health and safety plan (HSP) has been developed in accordance with relevant occupational safety and health regulations and requirements, and applies to all field sites and workplaces associated with the referenced Contract.

Safety and loss prevention are a direct responsibility of all levels of management on all projects. Each level of onsite management has the responsibility to provide a safe and

healthful work environment. This shall be achieved through strict adherence to the requirements of this site health and safety program and associated addenda.

Management personnel at all levels shall, through personal example, create a work climate in which all assigned employees develop a concern not only for their own safety and health, but also for the safety and health of their fellow workers and the environment. While it is important to instill a sense of empowerment for innovation and efficiency, the knowledge of boundary conditions concerning the health and safety program by all personnel is vital. Common sense and good judgment always need to be applied to site work; however, it is not intended that the health and safety guidelines contained in this HSP or subsequent addenda be open to innovative interpretation.

B.4.2 THE PROJECT TEAM

The efforts of multiple organizations will be needed to complete this project. Each individual assigned to the project is responsible for conducting his/her job in a safe and healthful manner. However, in order to facilitate the implementation of this HSP and the site safety and health program, it is necessary to assign key responsibilities to specified individuals. The Decommissioning Plan for the OT-10 project details the team and their responsibilities. In summary the following firms have the following roles at OT-10 on this project:

Montgomery Watson
- Prime contractor
- Reporting
- Confirmation soil sampling

Montgomery Watson Constructors, Inc.
- Construction oversight

Environmental Restoration Group (ERG) (contracted Senior Health Physicist and Health Physicist Technician)
- Preparation of the Radiation Protection Program
- Serve as the Site RSO
- Conduct radiation surveys prior to, during, and after decommissioning activities
- Conduct personal radiation safety monitoring (air, wipe, badge, etc.)

Keers Environmental
- Mobilization and site preparation
- Development of temporary facilities
- Clear and grub vegetation
- Excavation of radiation-contaminated soils
- Packaging of soil and debris into Lift Liner™ Soft-sided Disposable Containers
- Transportation of Lift Liner™ Soft-sided Disposable Containers
- Re-vegetation
- Demobilization

MHF Logistics
- Rail transportation of radioactive waste

Envirocare of Utah
- Disposal of radioactive waste

B.4.3 ASSIGNMENT OF SAFETY AND HEALTH RESPONSIBILITIES

B.4.3.1 Montgomery Watson Health and Safety Manager:

Beth Darnell, CIH, is the Montgomery Watson safety manager for this project. She is responsible for preparing this HSP and ensuring that the Delivery Order Manager and Construction Manager have the tools necessary to implement the safety plan on site. She will see that the site is audited for compliance with the HSP periodically throughout the life of the project.

B.4.3.2 Delivery Order Manager

Mr. Jeffrey Johnston is the Delivery Order Manager for this project. He is responsible for the budgeting and coordination of the project health and safety program. He will act as the liaison between the field health and safety staff and the Montgomery Watson safety manager, as needed.

B.4.3.3 Health and Safety Officer/Supervisory Personnel:

Mr. Reid Olson is the Construction Manager and, thus, the Montgomery Watson Health and Safety Officer (HSO) onsite, responsible for implementing this HSP for Montgomery Watson and Montgomery Watson Constructors, Inc.

The Health and Safety Officer has the authority to stop work and to remove personnel (or subcontractors) from the site when their actions are considered dangerous or when attitude jeopardizes the safe performance of the project. His duties include, but are not limited to:

- Serve as the lead in all issues related to health and safety.
- Coordinate site safety issues with the Site RSO.
- Conduct / participate in daily Tailgate Safety Meetings. Participate in project meetings.
- Conduct periodic site safety inspections and document them.
- Maintain necessary health and safety documentation and records.
- Ensure that personnel wear the prescribed level of personal protective clothing and perform correct decontamination procedures in accordance with the Radiation Protection Program.
- Ensure that the bulletin board contains the necessary health and safety postings and that the information is current.

- Use authority, if needed, to suspend work that could adversely affect workers or the environment.
- Prepare incident reports for near miss accidents and actual work-related injuries, illnesses or losses involving the environment or property.
- Maintain current cardiopulmonary resuscitation (CPR) and first aid training, and be able to provide such care in the event that it is needed.
- Maintain first aid supplies and rescue equipment.
- Assure maintenance of fire extinguishers.

B.4.3.4 Radiation Safety Officer

Dr. Kenneth Baker of ERG, is the Site RSO for this project. He may designate someone to assist or perform onsite duties in his absence, but maintains overall responsibility for the site radiation safety program. Specifically, he will

- Conduct initial radiation surveys and communicate results to site personnel.
- Conduct on-going radiation monitoring to document personnel exposure to radiation.
- Make recommendations to adjust PPE ensembles to balance the risk of radiation exposure with the risks of wearing protective gear such as heat stress, decreased visibility and communication.
- Monitor decontamination activities to make sure that employees are not spreading contamination outside of the approved work zones.
- Provide external monitoring for the waste containers prior to shipment.
- Conduct monitoring and make recommendations for the protection of the community outside of the regulated work zones.

B.4.3.5 Subcontractor Safety Personnel

Each Montgomery Watson subcontractor shall designate a **competent person** (capable of recognizing hazards, with the authority to immediately correct) in a supervisory position, to administer its safety program. This person, or a formal designee, shall be onsite at all times the subcontractor is performing work. However, should the subcontractor's safety effort be considered inadequate, Montgomery Watson has the option to request the replacement of the designated safety person. These designated safety personnel shall attend all applicable safety meetings and communicate relevant site safety information to all of its company employees at the site. The following personnel will serve as Safety Personnel for the subcontractors listed below:

- Montgomery Watson Constructors, Inc. – Jeff Biggars
- ERG – Ken Baker
- Keers Environmental - Ray Jaramillo

B.4.4 SITE VISITORS

Visitors will be permitted to enter the project site with prior approval by the site Delivery Order Manager and Site RSO. Visitors who have obtained approval to enter the training sites must read the documents that make up the site safety and health program for this project, attend the daily tailgate safety meeting conducted in the morning before each day of work, or be given a briefing by the site HSO as well as by the Site RSO. Site visitors must have the necessary training and medical clearance to access areas that are restricted due to specific training, medical surveillance, and personal protective equipment requirements.

B.5.0 TRAINING, COMMUNICATIONS AND MEETINGS

B.5.1 SAFETY TRAINING REQUIREMENTS

Health and safety training is an integral part of the total project health and safety program. The objectives of such training are to educate workers about the potential health and safety hazards associated with working at the project site. Montgomery Watson's Deliver Order and Construction Managers and subcontractor site supervisors are expected to instruct their employees about the hazards of the project and site before allowing them to work. An orientation should include an overview of this HSP, the Foster Wheeler SSHP, the Radiation Protection Plan, emergency information, and other relevant information that would assist the safety and health of the person(s) entering the project site.

The following specific training requirements apply:

- 40-hr initial Hazardous Waste Operations and Emergency Response (HAZWOPER) training
- 8-hr HAZWOPER refresher training, annually
- 8-hr HAZWOPER supervisor training required of the Construction Manager
- 10-hr Construction Safety Awareness (all field crew)
- Four to 8-hr Radiation Safety Program Orientation
- CPR and First Aid (required for at least two people at the site with one being the Construction Manager, though it is recommended for all site personnel)
- Fire Extinguisher Use (required for the Construction Manager, recommended for all)
- Function-specific training for heavy equipment operators such as backhoe/loader, dump truck and crane.

Each subcontractor is required to verify that their employees have received any necessary training and that certificates for training are available on the project site for inspection by Montgomery Watson.

B.5.2 METHODS OF COMMUNICATION TO EMPLOYEES

Project safety information will be communicated to site employees in the following manner:

- Off-site training described above will provide general health and safety information, prior to coming to the site.
- Project briefing on the first day of site work.
- Each site worker is required to read this HSP, the Radiation Protection Plan, and any contractor-specific AHAs.
- Each day prior to starting work there will be a tailgate safety meeting conducted to inform people of the day's activities, the expected hazards, and to remind them of the control program.
- The project trailer/office will contain postings of a safety and health nature that employees may read.
- Other communications in the form of verbal, written or audio-visual information will be provided as needed or desired.

B.5.3 MEETING SCHEDULE

Montgomery Watson and subcontractor supervisors will conduct "tailgate" safety meetings with their crews at least once daily to emphasize safety.

Meeting topics discussed will be documented, accompanied with an attendance signature sheet. The meetings are to be conducted as follows:

Meeting Type	Purpose	Length	Frequency
Site Orientation	To acquaint personnel with the project and the contractors at the site.	Likely up to four hrs	At time of first assignment to the project.
Supervisory Meeting	To ensure that all site supervisory personnel maintain coordination and focus on the site safety program. It allows for coordination between organizations conducting work at the same time at the site.	Likely two hrs – depending on topics and nature of the work.	Monthly
Tailgate	To orient personnel to the tasks for the day or time period; go over any unusual occurrence from the previous day; discuss any particular safety considerations for the new or routine tasks ahead.	Approximately 20 minutes.	Daily

B.5.4 SAFETY INSPECTIONS / EVALUATIONS

B.5.4.1 Site Safety Inspections

It is the responsibility of the site HSO to ensure safety inspections are carried out periodically. This includes conducting on-going visual inspections of the work looking for problems in the safety and health program. When problems are identified, actions shall be taken to correct or address the problem as soon as possible. A written record of such issues shall be kept and reported on the daily progress documents.

B.5.4.2 Health and Safety Audits

Montgomery Watson audits projects on a random and periodic basis. Based on the duration of this project and the unique radiation hazard it poses, this project will be subject to a formal health and safety audit. The audit will be conducted by a Montgomery Watson safety and health professional early enough in the project to be effective. Coordination of the audit will be conducted with the Delivery Order Manager.

B.5.5 ACCIDENT INVESTIGATION AND REPORTING

Accidents and incidents (including near misses) will be investigated. The Delivery Order Manager along with the Construction Manager should take the lead in conducting the investigation. If assistance is needed, contact the Health and Safety Manager. The investigation shall be documented either using a Montgomery Watson incident report form (see Attachment 1 to this HSP) or a subcontractor form, as deemed appropriate. A copy of the report shall be provided to the Montgomery Watson Safety and Health Manager. A copy is to be kept in a project file on site as well.

Each and every month in which a subcontractor performs any work on the project, a monthly summary of hrs worked as well as accidents and injuries will be provided to Montgomery Watson. This information is required no later than the 7th calendar day of the month. This summary will be completed in a manner prescribed by Montgomery Watson and/or by the submission of a properly completed monthly summary of accident form or forms supplied by Montgomery Watson (see Attachment 2 to this HSP).

B.6.0 DOCUMENTATION AND POSTINGS

The following documents are required to be accessible, either at the project site, or from an employee's home office:

- Employee safety training for work tasks performed (e.g., HAZWOPER, Excavation/Trench, Competent Person, Crane Operation, Hazard Communication, etc.).
- Equipment certifications, licenses and permits (e.g., Crane Inspection, Excavations, Trenches, Underground Utility Clearance, etc.).
- Medical surveillance documentation.

The following documents are to be kept on site:

- Project documentation in a log book or other approved record keeping format. This will include daily safety observations, any deviations from the safety program, and any corrective actions initiated.
- Personal acknowledgement form indicating that each project employee has read and will abide by the project safety program (see Attachment 3 to this HSP)
- Daily, weekly and monthly safety meetings documentation.
- Accident/Incident investigations
- Hazard Communication Program and Material Safety Data Sheets (MSDS) for hazardous materials used at the site.

The following health and safety postings are to be displayed in a location where workers are likely to see them (i.e., a lunchroom, entry/exit trailer, administration office):

- The Federal OSHA Job Safety and Health Protection Poster.
- NRC Radiation Protection Program Poster
- A copy of the "Route to Hospital" map and emergency medical contact information in this plan. Refer to section 8.0 of this HSP.

B.7.0 ACTIVITY HAZARD ANALYSIS / CODE OF SAFE PRACTICES

As part of Montgomery Watson's AFCEE contract documents, contractors are required to submit to Montgomery Watson AHAs for each task they will be performing. Montgomery Watson will review the AHAs and no work is permitted to begin until an AHA satisfactory to Montgomery Watson has been developed. The AHAs shall be routed through the Contract Manager/Buyer or Delivery Order Manager.

B.7.1 OFFICE ENVIRONMENT

B.7.1.1 Fire Protection Plan

Mr. Reid Olson, the HSO/Construction Manager will, at a minimum, maintain training for the use of portable fire extinguishers. Other employees are encouraged to be trained. Two ten-pound ABC fire extinguisher shall be available in the office trailer. It is the HSO's responsibility to ensure that the extinguishers are inspected monthly (note that it is charged, pin is in place and it is in its proper location) and serviced annually.

In the event of a fire, those who have been trained to use the extinguisher may attempt to put the fire out if it is safe to do so. If access to a telephone permits, dial 911 to call the fire department. If it is not deemed to be safe to try and fight the fire or call for help, Montgomery Watson employees must evacuate the office trailer by means of the nearest marked exit, or other portion of the construction site immediately. All employees shall meet to be counted at the job site trailer. The HSO will collect the head count.

Employees will be alerted to an emergency evacuation. When out in the field, notification will either be by direct visual or verbal contact, or by means of a horn. The horn may be on a piece of equipment or a portable air horn, as deemed necessary by the HSO.

Note that contractors may have flammable materials, fuels and welding supplies that present a fire hazard. Each contractor using such material must have MSDSs and a fire prevention plan for the materials. In the event of a fire involving contractor materials, Montgomery Watson personnel should immediately evacuate the area and report the incident according to this HSP.

B.7.1.2 Electrical Hazards

The electric circuit breaker for the trailer must be located. A 6 foot clearance shall be maintained in front of the electrical panel and a clear path to the panel must be maintained.

Avoid using extension cords for fixed electrical devices. When using a surge protector, only use one per outlet – that is do not string them together like extension cords. Keep electrical cords away from heat and water. Do not run cords under rugs. Do not remove the third prong (ground) on grounded plugs. Do not use damaged electrical equipment or cords. Be sure that all appliances are turned off when they are no longer needed and at the end of the shift.

B.7.1.3 Ergonomic Hazards

Ergonomic hazards in the office typically result from repeated use of computer keyboards, resulting in aches, pain, or disease to the wrists and forearms, and from prolonged static postures, resulting in back and leg pain. To avoid these hazards and their end results, try implementing the following tips:

- Work in a neutral body position – that is with your neck straight, your arms hanging from your shoulders, your back positioned with the natural curve in the lower back supported and all other joints at right angles.
- Try to work with your muscles relaxed.
- Avoid slumped sitting positions, rounded shoulders, sway back or an overly straight, stiff posture.
- Adjust your work-station or chair so that your hands work within two inches above or below your elbow.
- Keep commonly used items (e.g., phone, planner) within arm's reach.
- Sit close to your work so that you do not bend over it.
- Place the top of your video monitor at eye level
- Try to type with your wrists in a neutral position – let your fingers dangle over the keys.
- If your desk has sharp edges, purchase a wrist rest to create a comfortable position for your forearms.

- Reduce glare on the monitor by positioning it perpendicular to a window, or facing it away from a window. Try to place it under an indirect light source.
- Take a work break at a rate of about ten minutes every hr.
- Take mini-breaks to stretch your neck and body by circling, shrugging and arching – this will increase circulation and relieve tension.

Back injuries are common in office environments due to improper lifting. Follow the guidelines below for proper lifting:

- Size up the load, can you get someone to help you lift it? If so, do.
- Use any sort of mechanical lifting mechanisms that are available.
- If you can, try to place heavy items on a surface that is waist high so that you do not have to bend down or lift up to reach it.
- Push rather than pull
- Keep the load close to your body
- Bend at the knees and hips to avoid pressure on the lower back
- Do not twist when lifting
- Lift with the muscles in your legs instead of your back.

B.7.2 COMMON FIELD SAFETY ISSUES

This section provides safety information common to all field projects regardless of size, hazardous environment, or client.

B.7.2.1 Housekeeping and Storage of Materials

Housekeeping and clean-up acceptable to Montgomery Watson shall be maintained by subcontractors in all areas within and related to the subcontractor's scope of operation. Supervisors are to inspect their work areas frequently and at the end of each day to ensure housekeeping is maintained. At a minimum, the following must be ensured:

- Trip and impalement hazards are eliminated.
- Incoming materials are secured to prevent tipping or rolling.
- Trash is secured in covered containers.
- Scrap lumber with protruding nails, pipe, sawdust, snow, and all other debris are cleared from work areas, passageways, stairs, and in and around buildings or other structures.
- Drinking water is provided in tightly closed containers with disposable cups. Mark water containers to identify their contents.
- Test job site water supply if the water is derived from a private well.
- Mark outlets carrying non-potable water.
- Provide workers with restroom facilities.
- Provide adequate washing facilities for employees using paints, coatings, chemicals, or for other operations where contaminants may be harmful to the employees.
- Provide employees with a clean and safe area to take breaks.
- Use fencing/barricades as necessary after each shift to secure the area.

B.7.2.2 Storage of Flammable Materials

If the subcontractors need to store fuel onsite, this section provides some basic guidelines that should be observed in the field. Flammable liquids should be kept in safety cans, except for bulk shipments. All safety cans should be equipped with a dispensing funnel or hose. Each container should be clearly labeled and closed when not in use. Drums containing flammable liquids should be grounded when in use, have a self-closing faucet, and a bung vent.

Flammable and combustible materials should be stored away from sources of ignition and areas where hot work is performed. Flammable material storage areas should be clearly marked with signs denoting "FLAMMABLE - No Smoking or Open Flames within 50 feet". Flammable and combustible materials shall be stored a minimum of 20 feet from a building or structure. The storage area shall be graded in a manner to direct possible spills away from buildings or other exposures or shall be surrounded by a curb at least 6 inches high. One portable dry chemical fire extinguisher (10A-60 B:C) shall be located within 10 feet of the storage area.

Oxygen cylinders in storage should be separated from flammable liquids or gases or combustible materials (e.g. oil, grease) by a minimum distance of 20 feet or a non-combustible barrier at least 5 feet high having a fire-resistance rating of at least one half hr. Cylinders should always be secured in an upright position with valves capped.

B.7.2.3 Hazard Communication and Material Safety Data Sheets

Montgomery Watson will have available on the project site a written Hazard Communications program that complies with the requirements of 29 CFR 1926.59 and 29 CFR 1910.1200 (see Attachment 4). MSDSs for products that are used on the site (e.g. surveyor paint, fuel gases, welding rods, petroleum products etc.) will also be available on the job site for review by workers. The HSO will collect MSDSs from subcontractors. All containers of hazardous materials are required to have a written warning that includes its contents, a health hazard warning, and a physical hazard warning. If this is not the case, field personnel should inform the HSO.

B.7.2.4 Fire Prevention Plan

In the field it is important to plan ahead for potential fires. This includes identification of a safe place of refuge, ability to contact fire department personnel and ability to try to extinguish fires on site, before they get out of control. Each day during the tailgate safety meetings a safe place of refuge shall be identified. Use of cellular phones will be permitted in the work zone and will allow for direct contact with fire department personnel (make sure this is true). In accordance with the paragraph below, fire extinguishers shall be available for use by trained personnel.

Clear access to all available fire fighting equipment should be maintained at all times. Fire prevention equipment should be inspected monthly. Fire lanes providing access to all areas should be established and maintained free from obstruction. Fire extinguishers should be a

multipurpose dry chemical fire extinguisher not rated less than 2A-40 B:C. Specific areas where fire extinguishers are required are identified below

- Where flammable materials are stored, handled, and used
- On cranes and heavy equipment
- Where welding or open flame cutting is being done.
- In shops and offices near exit doors
- Near gasoline powered generators and pumps
- Job site vehicles.

B.7.2.5 First Aid and CPR

At least two people trained and willing to provide first aid and CPR will be required in the work or exclusion zone at all times. Such training shall be equivalent to or exceed the elements covered in the Standard First Aid course provided by the American Red Cross. If the training course does not cover the use of "universal precautions" as defined in the Bloodborne Pathogens standard under OSHA (29 CFR 1910.1030), supplemental training will be needed. The HSO will be provided with information needed to give this supplemental training by the Montgomery Watson Health and Safety Manager, if necessary.

Each employer working on the project is responsible to provide a clean and hazard-free area with adequate supplies to administer first-aid to their employees. The location of first-aid kit will be communicated to site employees. First-aid supplies shall be individually sealed and stored in a weatherproof container. The contents of first-aid kits are to be checked by the employer before being sent out to the project and at least weekly to ensure that expended items are replaced. Contents of the Montgomery Watson first aid are provided in Section 8.1. At a minimum, supervisors are to:

- Maintain a record of inspection of first-aid kits.
- Provide bloodborne pathogen kits.
- Establish a shaded heat-stress rehabilitation area.
- Ensure employees are aware of posted telephone emergency response numbers, such as physician, hospital, ambulance, and have means to get help (such as a cell phone or two-way radio).
- Provide a means for persons exposed to injurious corrosive materials to flush their eyes or body.

B.7.2.6 Site Security

Site personnel are required to sign a tailgate safety meeting form each day. This will assist controlling who is on site and accounting for personnel in case there is an emergency.

A security fence will be shut and locked at the end of each day after personnel have left the site. This is the responsibility of the HSO.

B.7.2.7 Field Sanitation

Employers must provide an adequate supply of potable drinking water for their workers on site, at least two liters per person, per day. Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a drain faucet. Water must not be dipped from containers. Containers are to be clearly marked as to the nature of their contents and not used for any other purpose. A common drinking cup is prohibited. Where disposable cups are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups will be provided.

Toilet facilities shall be provided for site workers. If the field office or existing toilet facilities at Kirtland AFB are not close enough to provide reasonable access to site personnel, a portable toilet facility will be brought to the worksite. If a portable toilet is provided, there must be at least one for every 20 workers with a door capable of being locked from the inside (this will avoid the need to supply separate facilities for men and women).

B.7.3 SITE SPECIFIC FIELD WORK

Montgomery Watson field workers may be subject to the hazards posed by the various construction activities being conducted by Keers Environmental. This section of the HSP is meant to provide a brief description of the controls that should be taken to prevent injury to personnel observing such tasks. This section therefore serves as a Code of Safe Practices of the physical hazards associated with oversight, surveying and confirmation sampling activities on this project. The following tasks are anticipated to be performed by Keers Environmental. Company specific information about the safety procedures for these tasks is included in the AHA to be submitted by this contractor:

- Mobilization and demobilization of equipment and supplies (may require use of welding or cutting materials, electrical connections and industrial trucks)
- Clearing and grubbing using heavy equipment and hand tools
- Excavation of soils including the use of excavators and dump trucks
- Mobile crane lifting Lift Liner™ Soft-sided Disposable Containers

B.7.3.1 Welding and Cutting

If the object to be welded or cut cannot be moved and if all fire hazards cannot be removed, then guards / shields shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards. Prior to welding or cutting, contractor personnel shall inspect the area for the presence of flammable and combustible materials including vapors and gases. A Hot Work Permit may be required by Kirtland AFB and issued for all cutting, and welding activities in locations where flammables and combustibles are present. The contractor should identify any Hot Work Permit requirements and follow them.

A fire watch shall be required whenever welding or cutting is performed in locations where combustible materials are

- closer than 35 feet away from the point of operations,

- more than 35 feet away but are easily ignited by sparks,
- adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation

To protect workers and others in the vicinity from sparks or welding arcs, noncombustible or flameproof screens shall be used to shield welding and cutting operations. All cylinders must be labeled with the contents and whether it is full/in-use/empty and secured by chain or dolly. Workers shall be provided with protective clothing and equipment including eye/face protection, gloves, aprons, and welding jackets/leathers. Observers should stand far enough away to negate the need personal protective gear.

B.7.3.2 Electrical Work and Control of Hazardous Energy

It is each contractor's responsibility to see that only qualified personnel conduct electrical operations. Montgomery Watson personnel are not authorized to conduct electrical work on this project. All electrical work should be done according to local codes and regulations as well as contract documents.

All electrical tools used on the project must be properly grounded (containing a ground plug and tested for shorts) or double insulated. Power cords shall be of the three-wire type and rated for heavy-duty use (for example type S ST, and SO). Additionally, the use of ground fault circuit interrupters (GFCI) are required for all portable electrical tools and fixed electrical equipment to be used at the site. All portable generators shall be equipped with only GFCI receptacles.

Work on energized mechanical, electrical, or other equipment in which workers could be injured as a result of accidental start-up or release of stored energy (e.g. electricity, fluids under pressure, etc.) shall be locked out. A competent person will coordinate lockout procedures among the contractors and shall conduct periodic inspections to ensure that lockout procedures are followed.

Lockout Guidelines

1. Notify affected employees.
2. Shut down equipment by normal stopping procedure.
3. Isolate from energy sources.
4. Apply locks. Each authorized person working on equipment applies his/her own.
5. Bleed off or otherwise release any stored energy.
6. Verify isolation.
7. Remove guards or covers as necessary and perform work.
8. When work is complete, reinstall guards and inspect equipment to ensure it is operational. Notify affected employees.
9. Remove locks. Each authorized employee removes his/her own.
10. Return the equipment to service and notify affected employees.

B.7.3.3 Excavations

All excavations and trenches required for this project shall comply with the requirements of 29 CFR subpart P. The contractor digging the excavation or trench is required to have a competent person available to classify soils and ensure that proper protective systems are installed. The excavations at OT-10 are anticipated to be between one and five feet in depth. If the excavation reaches four feet, a protective system must be employed if workers will be required to enter the excavation for the collection of confirmation soil samples. If the confirmation samples can be collected from the backhoe bucket and protective systems are not employed – PERSONNEL ARE PROHIBITED FROM ENTERING ANY EXCAVATION. The following are guidelines to follow while observing activities around excavations and trenches:

- Before excavation begins, the responsible supervisor should have identified overhead hazards and called the local utility companies to locate and mark all underground installations (i.e., sewer, telephone, water, natural gas, electric). All underground installations should have been identified, located, protected, supported, and removed as necessary. For instance, electrical lines should be de-energized; water and gas lines should be blocked and locked out.
- A stairway, ladder, ramp or safe means of egress should be located inside excavations more than 4 feet deep, if personnel are required to enter. The means of egress shall not be more than 25 feet from any worker in the excavation. If a ladder is used, it shall be properly secured and extend at least 3 feet beyond the surface or top of the excavation.
- Observations of work inside an excavation should be made from at least two feet away from the excavation edge. Significant communication between ground personnel and the operator of heavy equipment is necessary to ensure that observations can be made in a safe location.
- It is also important for the ground personnel to know the traffic patterns of the excavation equipment, staging areas and dump trucks. Do not stand or walk within the swing radius of the excavation equipment.
- The contractor should be placing stop logs when equipment is operated near the edge of an excavation.
- A competent worker should be completing daily inspections of the excavation before work begins each day or shift to verify the absence of water accumulation, water seepage soil cracks, sloughing, cave-ins, hazardous atmospheres, or failure of protective systems (i.e., shoring and bracing). If any of these items are noted, work shall be stopped immediately and the excavation evacuated until the appropriate control measures are taken and installed.
- Excavations should be shored and braced when the stability of adjoining structures is endangered.
- Construction material, excavated soil, rock, and equipment should be kept at least 2 feet from the edge of any excavation.

B.7.3.4 Industrial / Construction Trucks and Equipment

There will be many types of heavy equipment being operated as part of the decommissioning activities at this site. Montgomery Watson will coordinate work with operators so that observers can stay out of the way of operating vehicles. Do not approach a vehicle unless you have made eye contact with the operator and it is known that you plan to approach. Wear a highly visible traffic safety vest while on site. Truck tires should be choked when stationary or loading and unloading. When standing within about ten feet of operating equipment, the noise level usually approaches 85 decibels, which is the action level for requiring hearing protection. If planning to be on site near (within ten feet) heavy equipment for more than four hrs a day – Montgomery Watson personnel shall wear hearing protection. The contractor should have a program for conducting safe operating inspections on heavy trucks and equipment, these inspections should occur daily. Equipment that is unsafe should not be operated. Any repairs should be made with the equipment protected from movement (see control of hazardous energy). Employees riding on equipment must be in a seat meant for transporting people. Heavy equipment and trucks should have audible back-up alarms. Dust should be controlled such that it does not limit visibility and release requirements of the Radiation Protection Program.

B.7.3.5 Mobile Cranes and Overhead Hoists

Montgomery Watson and other ground personnel should be vigilant about standing clear of crane operations. At no time is it permitted to stand or walk underneath a suspended load. Personnel must stand outside of the swing radius of the crane arm and pay attention to the signals of the other ground personnel assisting the crane operator. This section provides information about the safety issues associated with the use of a mobile crane.

The contractor employing cranes shall be responsible for ensuring that:

- safe, suitable equipment is provided to meet the requirements of the job,
- a pre-job site inspection is conducted to ensure that the area is adequately prepared for the operation of the crane.
- overhead utility clearance of 20 feet is maintained

The contractor is responsible for supplying an operator that is trained in the safe operation of the crane(s). The contractor should be able to provide written proof that the operator has been trained. The contractor should also be able to provide documentation of current inspections, tests, repairs, modifications to, and maintenance of the crane. The crane should be inspected daily by a competent person.

No machine shall be selected to do any lifting on a specific job until its size and characteristics of the crane are considered against:

- the weights, dimension, and lifting radii of the heaviest and largest loads,
- the maximum lift height, the maximum lift radius, and the weight of the loads that must be handled,
- the number and frequency of lifts to be made,
- how long the crane will be required on site,

- the type of lifting to be done (for example, is precision placement of loads important?)
- the type of carrier required (this depends on ground conditions and machine capacity in its various operating quadrants),
- whether the load will have to be walked or carried,
- whether loads will have to be suspended for lengthy periods,
- site condition, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impeded access or operations.

The contractor is responsible for verifying the weight of the object to be lifted.

B.7.3.6 Hand Tools

The contractor should be inspecting tools to be sure they are clean and in good repair. Any defective tool must be taken out of service such that no one can accidentally use it. Personnel operating hand tools should have been trained in their safe operation. Electrical cords are not to be used for hauling or hoisting tools. Power tools should be double insulated or grounded and kept out of wet locations. Guards should be in place to protect chains drives, sprockets, gears, belt-pulleys, reciprocating parts, screw conveyors, exposed shafts, blades, and other nip points.

B.7.4 PERSONAL PROTECTIVE EQUIPMENT

All site personnel will be required to wear the following equipment on site, regardless of task:

Item	Specifications
Exterior garments	Long pants, shirt with sleeves (no tank tops or shorts)
Foot protection	Safety toed footwear/boots (ANSI Z41).
Gloves	Cloth or heavy leather gloves for clearing/grubbing. Latex or nitrile gloves if handling soil.
Eye and face protection	Safety glasses with side shields. (ANSI Z87.1).
Head protection	Hard hats (ANSI Z89.1). Hard hats shall be worn with the brim pointed forward.
Hearing protection	Earplugs or muffs with a noise reduction rating (NRR) of 25 db. When working on or near operating equipment or machinery.
Safety Vest	Workers will wear a high-visibility traffic safety vest, when working near heavy equipment and traffic.

When performing invasive work in the radiation contaminated work zone, personnel will incorporate the following into a Level C PPE ensemble:

Item	Specifications
Level D PPE	As listed above.
Body protection	Tyvek® suit with feet and hood.
Outer foot protection.	Galoshes with tread to cover safety shoes.
Respiratory protection	Full-face air purifying respirator with P100 filters. Filters shall be changed as directed by the RSO. If the RSO determines that more frequent changes are required, this shall be communicated to site personnel.

B.8.0 EMERGENCY ASSISTANCE INFORMATION

ALWAYS PROVIDE YOUR EXACT LOCATION TO THE 911 OPERATOR

Kirtland Air Force Base
Site OT-10 (see Figure 1-1)
Albuquerque, New Mexico

The Deliver Order Manager will be responsible for taking necessary action and contacting the appropriate emergency contacts and Montgomery Watson personnel in case of an emergency.

B.8.1 FIRST AID and CPR

An adequate number of employees (at least two) from each employer must have a valid certificate in first aid and CPR training from the American Red Cross or equivalent training that can be verified by documentary evidence. Along with the training requirement, a first aid kit must be available at the site suitable for the number of employees expected to be under Montgomery Watson's control. The contents of the kit should include the following:

• Container that will ensure that all supplies are kept clean and sanitary. • Aspirin or non-aspirin substitute • Eye drops • Burn spray or ointment • Antiseptic spray, cream or ointment • Hydrogen peroxide 3% solution • Bandaids: knuckle bandaid, elastic strips (3"x7/8"), adhesive bandage (3"x3/4"), • finger tip bandage (2"x13/4") • Triangle bandage and safety pins • Gauze bandages: 2 and 4 inch square pads and 1, 2, and 4 inch rolls or compresses	• Instant ice packs • Scissors and tweezers • Latex gloves • CPR barricade, to prevent mouth to mouth contact • Ammonia inhalant • First aid guidebook • Blankets (mylar) • Ace bandage • Antiseptic hand cleaner • Sterile water • Pressure dressings • First aid tape • Eye dressing packet

A kit with these contents (with the exception of the CPR barricade and latex gloves, purchase these separately and add to the kit for the control of bloodborne pathogens) can be purchased through safety supply catalogs such as Masune (800/831-0894).

B.8.2 24- HR EMERGENCY HOSPITAL

Lovelace, Gibson (switchboard)	(505) 262-7000
Lovelace, Gibson Emergency Room	**(505) 262-7222**
(contact: Marti Miller)	(505) 262-7341
5400 Gibson Blvd. S. E.	
Albuquerque, New Mexico 87108	

Note: This facility is equipped to handle emergency situations with radiation contamination. Figure B.8-1 indicates the location of this clinic along with driving instructions.

B.8.3 EMERGENCY CONTACT NUMBERS

Ambulance	911
Fire Department	911
Police Department	911
NM Poison Control Center (UNM, north campus)	(505) 843-2551
National Response Center	(800) 424-8802
Utilities Underground Service Alert	(505) 260-1990
Bioengineering, Radiation Protection (Kirtland AFB RSO)	(505) 846-4259
Safety (Kirtland AFB) (contact: Dennis Hine, Peter Moss)	(505) 846-4226
Industrial Hygiene (Sandia National Labs - CSE, Patrick Harring)	(505) 845-7412
Kirtland AFB Command Post	(505) 846-6432

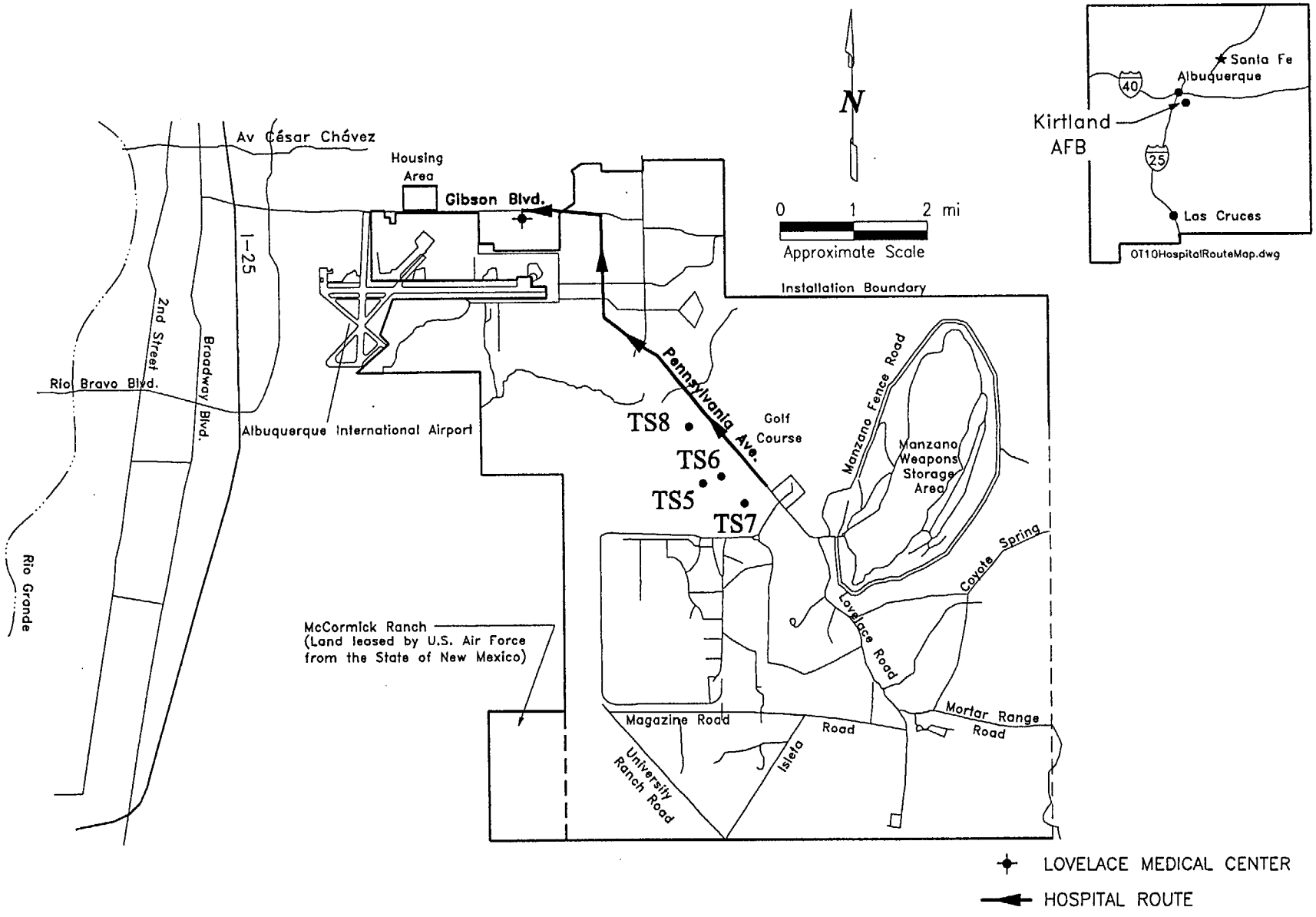

Figure B.8-1. Hospital Route Map

Montgomery Watson Workers' Compensation Insurance Information:

AON (Janice Johnson)	(213) 630-3200
The Hartford (Steve Tribucher)	(800) 826-7365
Teleclaim account number 78397	(800) 327-3636

LARS or Location Code = Cost Center Number

B.8.4 KEY MONTGOMERY WATSON AND OTHER PROJECT PERSONNEL

Contact Person	Work Number	Home Number	Mobile
Jeff Johnston Delivery Order Manager	(505) 878-1430	N/A	N/A
Reid Olson Onsite Health and Safety Officer/Construction Manager	(505) 878-1430	N/A	(505) 247-2711
Beth Darnell Health and Safety Manager	(949) 222-1844	(949) 454-0636	(818) 547-8479
Mike Grasso MWCI Construction Safety Manager	(607) 648-6935	N/A	(630) 258-3283
Ken Baker ERG Health Physicist	(505) 298-4224	N/A	N/A
Ray Jaramillo Keers Environmental	(505) 823-9006	N/A	N/A

ATTACHMENT 1

INCIDENT REPORT FORM

OCCUPATIONAL INJURY/ILLNESS/INCIDENT REPORT FORM

This report is for (check all that apply):

__ Montgomery Watson
__ Equipment Damage
__ Theft
__ Injury
__ Non-Montgomery Watson
__ Spill/Leak
__ Property Damage
__ Illness
__ Near Miss
__ Fire
__ Vehicle Damage
__ Other (Describe):_____
_____

In the event of a fatality or the hospitalization of an individual, contact the company Health & Safety Manager immediately.

Section 1 - Employee Information

Name:_____ Title:_____ Sex:_____

Business Unit:_____ Employee Number:_____ Date Hired:_____

Birth Date:_____ Social Security Number:_____ Phone Number:_____

Address:_____

Section 2 - Incident Information

Date of Incident:_____ Day of Week: S M T W TH F S Time:_____

Weather Conditions: SUN CLEAR OVERCAST RAIN SNOW

Temperature: TO 32°F 32-50°F 50-70°F 70-85°F 85°F & UP

Wind: STILL MODERATE HIGH

Location of Incident:_____

Project Name:_____

Contractor or Subcontractor involved?_____

Did employee leave work site?_____ If so, time employee left:_____

Section 3 - Injury/Illness Information (if applicable)

Date/Time injury reported:_____ Reported to whom?_____

Type of injury sustained (check all that apply):

__ Bruise, Contusion
__ Chemical Exposure
__ Concussion
__ Dismemberment
__ Electrical Burn
__ Loss of Senses (hearing, sight, smell, etc.)
__ Electrical Shock
__ Fatality
__ Foreign Object in Eye
__ Fracture
__ Hernia
__ Unconsciousness
__ Joint Sprain
__ Laceration, Puncture
__ Muscle Strain
__ Suffocation
__ Thermal Burn
__ Other (Specify):_____
_____

Specific parts of body affected (e.g., head, left leg, right ear, index finger, etc.):____
_____

Type of illness resulted (check all that apply):

__ Cardiovascular (heart/circulatory system)
__ Eye
__ Respiratory
__ Effect of Hazardous Substance/Material (Specify):_____
__ Central Nervous System (brain/spine)
__ Skin
__ Heat/Cold Stress
__ Cumulative Trauma Disorder (i.e., carpal tunnel syndrome)
__ Systemic (Liver, Kidney, Heart, etc.)
__ Hearing Loss
__ Other (Specify):_____
_____

What caused the injury of illness? (check all that apply)

__ Caught In, Under, Between
__ Contact w/ Electrical Current
__ Contact w/ Material
__ Contact w/ Plant, Animal, Insect
__ Contact w/ Temperature Extremes
__ Fall from Higher Elevation
__ Fall on Same Level
__ Inhalation of Material
__ Ingestion of Material
__ Involuntary Body Reaction
__ Over Exertion
__ Rubbed or Abraded
__ Slip
__ Struck Against
__ Struck By
__ Trip
__ Other (Specify):
_____

Method of Treatment

__ Onsite First Aid
__ Doctor's Care
__ Clinic/Doctor First Aid
__ Hospitalization

Name of service, physician, location:_____

Phone number:_____

Address:_____

Will injury-illness result in restricted activity?
__ No __ Yes __ Do Not Know

Will injury-illness result in lost workday(s)?
__ No __ Yes, How Many?____ __ Do Not Know

Section 4 - Incident Description

Description of incident:_____

_____

What was person doing at time of incident?_____

_____

Why did incident occur?_____

Was use or lack of safety equipment a factor in this incident?_____

If so, explain:_____

Were any safety regulations violated?_____ Explain:_____

_____

Were any regulatory agencies notified?_____ Explain:_____

_____

Action taken by regulatory agency:_____

Property damage?_____ Extent of damage:_____

Property owner:_____ Phone Number:_____

Address:_____

Space for Sketch or Additional Narrative

Section 5 - Incident Witnesses/Documentation

Incident Witness:_____ Phone Number:_____

Address:_____

Employer:_____

Statements Attached? __ No __ Yes

Were any photographs taken of the site after the incident? __ No __ Yes

Photographs taken by whom?_____

Photographs stored at:_____

Section 6 - Corrective Action/Recommendations

Recommended Corrective Action(s):_____

_____

Assigned to:_____ Targeted Completion Date:_____

Was this corrective action shared with all affected employees? __ No __ Yes, Date?_____

Section 7 - Acknowledgment/Distribution

Printed Name	Signature	Date
Employee Reporting Incident:		
Direct Supervisor:		
Business Unit Manager/Program Director:		
Program Health and Safety Coordinator:		
Health and Safety Manager:		

Section 8 - Follow-Up

Follow-up necessary? __ No __ Yes

Recommendation:_____

Completed by:_____ Date:_____

Note: For each Montgomery Watson incident or work-related injury/illness, this form must be completed, and faxed/mailed to the distribution list above within 24 hrs. In addition, for injuries and illnesses, an Employer's First Report of Injury Form, and an Employee's Claim for Workers' Compensation Benefits form must be completed within 24 hrs and sent to Human Resources.

If a fatality occurs or 3 or more employees require in-patient hospitalization, the local OSHA office must be notified of the incident within 8 hrs. If the Company Health and Safety Manager can not be contacted with a reasonable time, the most senior Montgomery Watson person at the scene shall make the notification.

ATTACHMENT 2

MONTHLY PROJECT SAFETY REPORT

MONTHLY PROJECT SAFETY REPORT

PURPOSE

The purpose of the Monthly Project Safety Report is to collect data on the effectiveness of MWCI Safety Program. The intent of the report is to capture successes and failures. The data collected in the report is tabulated and a Corporate Safety report are prepared for the quarterly management meeting, for OSHA and insurance purposes, and to meet the client's request for information on the number of man-hrs worked.

DISCUSSION

The Monthly Project Safety Report will be used to analyze injury, illness, and near miss incident trends over time so those patterns with common causes can be identified and preventive measures implemented. As required for statistical comparison with other companies the total man–hr worked is important to measure the total hrs it took to complete a project. Historically, this data can be used to estimate the cost of future projects.

PROCEDURE

On the 15th of every month following the reporting month, The Construction Manager or their designated representative must submit the Monthly Project Safety Report to the MWCI Health and Safety Manager.

Each month in which a subcontractor performs any work on the project, a monthly summary of hrs worked, accidents, and injuries will be provided to Montgomery Watson no later than the 7th calendar day of the month. This summary will be completed in a manner prescribed by Montgomery Watson and/or by the submission of a properly completed monthly summary of accident form or forms supplied by Montgomery Watson.

Upon completion of the contract the Subcontractor must submit the Monthly Subcontractors Safety Report to the Construction Manager. The report will cover the portion of the reporting month in which the subcontractor worked.

RECORDING

Information on the man-hrs worked by Montgomery Watson and each subcontractor and information on the number of incidents that resulted in a first aid case, or OSHA recordable case shall be recorded on the attached forms.

MONTHLY SUBCONTRACTORS SAFETY REPORT

INSTRUCTION: This report must include sub's subcontractors. The report must be submitted to the MWCI representative by the 7th of every month following the reporting month.

SUBCONTRACTOR:

MWCI PROJECT NAME:

NAME OF SUPERINTENDENT: _____

FIRST AID CASES	
OSHA RECORDABLE INJURIES	
LOST WORKDAY CASES	
TOTAL HRS WORKED	

BRIEF DESCRIPTION OF RECORDABLE INJURIES

THIS REPORT WAS PREPARED AND SUBMITTED BY:

DATE:

MONTHLY CONSTRUCTION SAFETY REPORT

INSTRUCTION: The Monthly Project Safety Report must be filled out and submitted to the MWCI Health and Safety Manager by the 15th of every month following the reporting month. Indicate the total hrs all site personnel worked. Record the number of OSHA and lost workday cases (LWDC).

PROJECT NAME: _____ DATE: _____

PROJECT No: _____ REPORTING MONTH: _____

PROJECT MANAGER: _____ PREPARED BY: _____

MONTGOMERY WATSON	TOTAL HRS	FIRST AID	OSHA	LWDC
Construction Management				
MWCI Labor				
SUBCONTRACTORS				
A.				
B.				
C.				
D.				
E.				
F.				
TOTAL				
LAST MONTHS PROJECT TOTAL				
TOTAL TO DATE				

BRIEF DESCRIPTION OF WORK OR UNIQUE SAFETY SITUATIONS

DESCRIPTION OF MONTHLY SAFETY ACTIVITIES

UPCOMING CRITICAL ACTIVITIES (include start dates)

ATTACHMENT 3

PERSONAL ACKNOWLEDGEMENT FORM

PERSONAL ACKNOWLEDGEMENT FORM

HEALTH AND SAFETY PROGRAM

Kirtland Air Force Base, Site OT-10

As a component of the Montgomery Watson Health and Safety Program (which includes Site Specific Health and Safety Plans) designed to provide personnel safety during construction operations, you are required to read and understand the Site-Specific Health and Safety Program for this project. This project's safety and health program includes the following documents:

1. Foster Wheeler Site Safety and Health Plan (SSHP) for Kirtland Air Force Base
2. This Health and Safety Plan (HSP) which is attached to the Decommissioning Plan for Site OT-10
3. The Radiation Protection Program that is included in the Decommissioning Plan

Upon completion of reading and understanding these documents, please sign and date this personal acknowledgment form and return it to the Health and Safety Officer or Delivery Order Manager, Jeff Johnston.

_____ _____

Signature Name (Printed)

_____

Date

ATTACHMENT 4

HAZARDOUS COMMUNICATION PROGRAM
AND
EMPLOYEE GUIDE TO HAZARDOUS MATERIALS

1000 HAZARD COMMUNICATION PROGRAM

I. PURPOSE

The purpose of the OSHA Hazard Communication Standard is to establish uniform requirements to make sure that:

1. The hazards of all chemicals produced, imported or used within the United States are evaluated, and

2. This hazard information is transmitted to affected employers and employees.

At Montgomery Watson, our first consideration in the performance of work is the protection of the safety and health of all employees. Montgomery Watson has developed this Hazard Communication Program to ensure that employees receive adequate information about the possible hazards of hazardous substances used in the workplace.

II. DISCUSSION

A. APPLICABILITY

This program applies to chemicals known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency. The hazardous materials that are exempt include:

- Foods, drugs, and cosmetics intended for personal consumption by employees while in the workplace.

- Consumer products packaged for distribution to, and use by, the general public. These materials must be used in the workplace in the same manner as normal consumer use, and cannot result in a duration and frequency of exposure greater than exposures experienced by consumers.

B. MONTGOMERY WATSON FACILITIES

At Montgomery Watson the majority of our facilities are "office" areas and would not be bound by the specific requirements of this program. However, many office products contain hazardous substances and are potential sources of employee chemical exposure. Care should always be exercised when using any hazardous material, even within an office setting.

Montgomery Watson operations other than office areas may not be exempt from the provisions of the Hazard Communication Standard and therefore must strictly abide by the procedures set forth in this program. These include chemical use operations, such as the print shops, laboratories, graphics areas, research and development shops, hazardous waste sites, construction sites, water and wastewater treatment plants as well as work at industrial facilities.

Montgomery Watson laboratories utilize numerous chemicals and hazardous materials that have been interpreted as falling under the provisions of the "Occupational Exposure to Hazardous Chemicals in Laboratories" regulation, which supersedes this program. For details, see the Laboratory Chemical Hygiene Plan (Montgomery Watson Safety and Health Policies and Procedures No. 1001).

C. NON-MONTGOMERY WATSON FACILITIES

Montgomery Watson employees may be faced with greater potential exposure to hazardous materials while working on non-Montgomery Watson regulated facilities. All Montgomery Watson employees should understand that it is a Federal and State OSHA requirement that every employer using hazardous materials in the workplace have an effective Hazard Communication Program or equivalent. A specific component of these programs is the responsibility of employers to provide information regarding their hazardous substances to contractors and guests.

When visiting a client's facility, Montgomery Watson employees should abide by the onsite health and safety procedures, become familiar with the site emergency procedures and utilize Material Safety Data Sheets (MSDSs) to gain information on the hazardous materials present.

III. DEFINITIONS

Appendix B of Montgomery Watson's Health and Safety Policies and Procedures Manual contains the Montgomery Watson Employee Guide to Hazardous Materials. At the end of this guide is a glossary of terms used frequently in the Hazard Communication Standard and on MSDSs. A few of the more commonly used terms are repeated here.

Carcinogen: A substance or agent capable of causing or producing cancer in humans or animals.

Designated representative: Any individual or organization to whom an employee gives written authorization to exercise a right of access to exposure and/or medical records.

Hazard warning: Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the health hazards and physical hazards of the substance(s) in the containers(s).

Hazardous Substances: A hazardous substance is one for which scientifically valid evidence exists that it is a combustible liquid, compressed gas, explosive, flammable, organic peroxide, radioactive, oxidizer, pyrophoric, unstable (reactive), or water reactive.

Health Hazards: A health hazard is a substance which is an irritant, skin hazard, toxic agent, highly toxic agent, corrosive material, eye hazard, agent that acts on the blood system, is a sensitizer, cancer-causing agent, reproductive toxin, liver toxin, kidney toxin, nervous system toxin, or agent that damages the skin, eyes, or mucous membranes.

Health hazard effects can generally be classified as either acute (an immediate response to a short-term exposure) or chronic (from repeated exposure over a long period of time).

Material Safety Data Sheet (MSDS): A fact sheet summarizing information about material identification, hazardous ingredients, heath, physical, and fire hazards; first-aid; chemical reactivities and incompatibilities; spill, leak, and disposal procedures; and protective measures required for safe handling and storage. OSHA has established guidelines for descriptive data that should be concisely provided on a data sheet to serve as the basis for written hazard communication programs. The Chemical Manufacturer's Association developed a set of guidelines for a consistent MSDS format. This format has been accepted by the American National Standards Institute.

Physical hazard: A substance for which there is evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an oxidizer, unstable (reactive), or water-reactive.

IV. PROCEDURE

A. HAZARD DETERMINATION

The Hazard Communication Standard requires that either chemical manufacturers, importers or employers evaluate chemicals and determine if they are hazardous. At Montgomery Watson, we purchase materials from importers, distributors, or manufacturers for use "as-is", and do not produce our own chemical products. We meet the hazard determination requirement by relying on the analysis already performed by the manufacturers of the substances and do not reevaluate their hazards. Where necessary, we may perform independent analysis of mixtures of materials to determine if additional hazards exist.

The following are sources for lists of hazardous substances:

1. The Director's List of Hazardous Substances prepared by the Director of Industrial Relations for the State of California and similar lists produced by the Governor's office in States with OSHA-approved State Plans.

2. 29 Code of Federal Regulations 1910, Subpart Z "Toxic and Hazardous Substances" (Occupational Safety and Health Administration).

3. "Threshold Limit Values for Chemical Substances in the Work Environment" by the American Conference of Governmental Industrial Hygienists (ACGIH).

B. CONTAINER LABELING

1. Original Manufacturer's Containers

Manufacturers, importers, and distributors of materials which Montgomery Watson purchases must label, tag, or mark each container of hazardous substance(s) with the following information:

- Identity of the hazardous substance(s).
- Appropriate hazard warnings.
- Name and address of the manufacturer, importer or other responsible party.

No container of hazardous substances shall be released for use in the workplace unless the container is correctly labeled and the label is legible.

Receiving departments, or person(s), must check all chemical containers (such as bags, drums, pails, etc.) to ensure that the label is intact, legible, written in English and has not been damaged in any way during shipment. Any containers with damaged labels must be kept separate and not used until they are re-labeled. A supply of new labels should be obtained from the manufacturer, importer, or distributor for this purpose.

2. Secondary Containers

Appropriate hazard warning labels must also be placed on secondary containers (i.e., containers used to store material dispensed from the manufacturer's original container). The secondary container must be labeled with either a copy of the manufacturer's label or a produced label that includes:

- Product identity
- Fire, physical and health hazards
- First Aid procedures
- Manufacturer's name

This label information can be obtained from the manufacturer's original container or the applicable MSDS. Business Units must ensure that all labels on secondary containers are clearly visible, legible, and include the required information. Whenever practical, Montgomery Watson Business Units are encouraged to order/purchase hazardous materials in sizes that reduce/eliminate secondary container use.

3. Stationary Process Containers

A stationary process container is a fixed vessel or tank used to hold process chemicals. For example, a closed tank used to hold chemicals which are metered into continuous treatment processes, such as water treatment systems, is considered a stationary process container.

Appropriate hazard warning labels, signs, placards, process sheets, batch tickets, or operating procedures must be placed on or in the immediate area of all stationary process containers which contain hazardous materials. These must specify:

- Hazardous substance identity
- Hazard warnings (fire, physical, health)
- Emergency and first aid procedures
- Manufacturer's name (if applicable)

C. PROPOSITION 65 WARNINGS

Proposition 65, The Safe Drinking Water and Toxic Enforcement Act, has been incorporated into the Hazard Communication Standard for the State of California. In addition to the other requirements of the Hazard Communication Standard, Proposition 65 requires businesses in California to give a clear and reasonable warning if they expose any individual, including workers and consumers, to a listed chemical (those considered to cause cancer or reproductive harm) within twelve months after a chemical first appears on the list. The list includes tobacco smoke, aspirin, and may include other chemicals found in the Montgomery Watson workplace. Because the Proposition 65 list is updated frequently, a current listing is maintained by the Health and Safety Manager. To comply with the Hazard Communication Proposition 65 requirements, the following procedures should be followed in California:

1. Contact the Health and Safety Manager for a current listing of Proposition 65 chemicals.

2. Conduct a Chemical Inventory, listing all chemical components of mixed materials (i.e., there may be lead or chromium pigment in paint; and there may be benzene in gasoline).

3. Identify if any chemicals from the inventory match the Proposition 65 list.

   If no chemicals match - document the efforts and place in Proposition 65 Compliance File.

If you recognize any listed chemical in your work area, whether office, print shop, laboratory, hazardous waste site, etc.:

a. Check to see if that chemical/product is already labeled with some type of warning, which refers to that chemical's carcinogenic or reproductive hazards.

b. If so labeled, ensure employee awareness, including appropriate hazard communication.

   If not so labeled, place the following worded sign near/on the chemical:

   1. "WARNING: This area contains a chemical known to the State of California to cause cancer."

   2. "WARNING: This area contains a chemical known to the State of California to cause birth defects or other reproductive harm."

c. If the chemical is part of a building/structure with no obvious label, i.e., asbestos insulation, a "warning" sign, as noted above, needs to be affixed.

   Note: Avoid creating exposure hazards when affixing signs, i.e., drilling though asbestos wallboard.

For more information on Proposition 65, see Montgomery Watson Safety and Health Policies and Procedures No. 302 or contact the Health and Safety Manager.

D. MATERIAL SAFETY DATA SHEETS

1. General

An MSDS explains the hazards associated with the use of a product and is a key source of hazard information for employees. Other than specifically exempt products, Montgomery Watson is required to have available for employee and contractor/guest review the MSDSs for the hazardous materials utilized by employees. Business Units are responsible for surveying their areas for all hazardous materials used and stored there and establishing a list of hazardous substances. Based on this inventory of hazardous substances, Business Units must maintain a current MSDS for each product.

To assist Business Units, Montgomery Watson's current practice is to require vendors to send MSDSs with each shipment of hazardous

materials. When an MSDS does not accompany the shipment and no copy of the MSDS is available within the company, the shipment should be set aside in a controlled area until the MSDS is received.

2. Material Safety Data Sheet Binders

Copies of MSDSs are to be kept in an MSDS Binder that must be readily available to all department employees. The Business Unit Supervisor will be responsible for maintaining this binder and ensuring that it is properly maintained. The binder should be kept in a location that is readily accessible to employees during all shifts; if necessary, copies may also be placed in other locations to facilitate availability.

The MSDSs in the binder should generally be organized alphabetically by manufacturer and then product name. For example, methyl ethyl ketone (MEK) from Shell Oil Company would be found under "S" for Shell and then "M" within the Shell products.

The Business Unit's list of hazardous substances should serve as the table of contents for the MSDS binder. All items listed on the inventory should have a MSDS and every MSDS should correspond to an inventory item.

3. Material Safety Data Sheet Review

New materials will not be introduced into the workplace until an MSDS has been received. Employees are required to receive information regarding the hazards of the materials they work with prior to actual usage.

PHSCs will work with chemical users to review incoming MSDSs for completeness and any new and significant health and safety information. They will ensure that MSDSs are available to employees for every applicable product used and any new information is passed on to appropriate employees.

If an MSDS is not provided by the manufacturer, importer or distributor, or if any of the required MSDS information is missing, the using Business Units will contact the appropriate party and request a complete MSDS. This request must be in writing, directed to the product manufacturer, importer or distributor and be made within 7 working days of missing MSDS/information discovery. If a response to the inquiry is not received within 25 working days, the Business Unit Supervisor should send a copy of the written request to the Montgomery Watson Health and Safety Manager and the State agency responsible for Industrial Relations.

4. New Information

Whenever new and significant health information is made known to Montgomery Watson concerning a hazardous substance being used in the workplace, an updated MSDS must be requested from the manufacturer, importer, or distributor. This new information will be discussed with all affected employees (within 30 days of receipt) and the new MSDS placed into the Business Unit MSDS binder. Similarly, if Montgomery Watson receives a new or revised MSDS the new information must be provided to employees within 30 days.

E. LIST OF HAZARDOUS SUBSTANCES

A list of all the hazardous substances used by a Business Unit is required to be placed or posted in an area that is readily accessible to affected employees. This list provides employees with their workplace hazardous substance inventory and shows which MSDSs are contained in the Business Unit's MSDS binder (it should also serve as the binder's table of contents). It is the Business Unit Supervisor's responsibility (with assistance from the PHSC) to keep the list current.

One purpose of the Hazardous Substance List is to assist employees in finding the MSDS for hazardous substances used in the Business Unit. The list must identify the manufacturer and product identity. It should be organized alphabetically by manufacturer and then by product name. Catalog numbers, order numbers, or reference numbers can also be included on the list to facilitate product identification.

F. EMPLOYEE INFORMATION AND TRAINING

1. General

All employees included in this program who are exposed or potentially exposed to hazardous substances in their work must be provided Hazard Communication information and training. Information and training will be given prior to initial work assignment and whenever a new hazard is introduced into their work area. In addition, those already trained must be periodically checked, retrained, and their compliance with applicable requirements enforced.

At a minimum, employees should receive Hazard Communication training/retraining to demonstrate knowledge of the following topics:

- An overview of the Hazard Communication Standard requirements, including employee rights.
- Information on any operation in their work areas where hazardous substances are present.

- The location and availability of the Montgomery Watson Written Hazard Communication Program, i.e., this policy/procedure and the Montgomery Watson Employee Guide to Hazardous Materials, Appendix B to the Montgomery Watson Safety and Health Policies and Procedures Manual.
- The physical and health hazards of the hazardous substances in the work area.
- Methods and observation techniques for determining the presence or release of hazardous substances in the workplace.
- How to lessen or prevent exposure to hazardous substances through controlled work practices, proper handling, and personal protective equipment.
- The steps Montgomery Watson has taken to lessen or prevent exposure to these substances.
- Emergency and first aid procedures to follow if employees are exposed.
- How to read labels and review MSDSs to obtain appropriate hazard information.

2. Employee Rights

OSHA and the Hazard Communication Standard provides the following rights to every Montgomery Watson employee. All employees must be informed of these rights.

- Employees or their designated representative can receive all information regarding any hazardous substances they work with or are exposed to. This includes occupational monitoring results, exposure records, MSDSs, and medical records (medical records can be released to other individuals only when written permission is granted by the employee). Access must be provided within 15 days of a written request.
- Employees are protected from discharge or other discrimination for exercising any of their employee rights.
- Employees can refuse to work with a hazardous substance if the company cannot find out and communicate the hazards.

3. Documentation

All employee health and safety training (group, "tailgate", classroom, individual) must be thoroughly documented. Proper documentation includes the type of training conducted, date, attendees, instructor, and copies of handouts/material covered. Business Unit Supervisors may utilize the health and safety training attendance sheet included as Attachment A of the Montgomery Watson Safety Meeting Policy

(Montgomery Watson Safety and Health Policies and Procedures No. 700) as the backbone for documenting training efforts.

G. HAZARDOUS NON-ROUTINE TASKS

Employees may be required to perform non-routine tasks involving hazardous materials as part of their work. Prior to the start of such non-routine work, Business Unit Supervisors must provide each affected employee with information about hazards to which they may be exposed. This information will include:

- Specific hazard information
- Protective or safety measures which must be utilized.

H. HAZARDOUS SUBSTANCES IN UNLABELED PIPES

Unlabeled pipes containing hazardous substances represent a serious safety concern for any employee working on these pipes. Prior to initiating any work on unlabeled pipes employees must be informed of the hazards of the materials contained within the pipes. Pipe diagrams and schematics are excellent sources of information and should be made readily available to employees.

Prior to starting work on unlabeled pipes, supervision must provide the following information to employees:

- The identity of the hazardous substance(s) within the pipes.
- The potential hazards of those substances.
- Safety precautions which must be taken.

I. CONTRACTOR WORK

The Hazard Communication Standard requires that contractors be informed of the nature of hazardous substances to which their employees may be exposed while performing their work. In situations where contractor exposure to hazardous materials may occur, Business Unit Supervisors shall provide the following information prior to the beginning of the work:

- The identities of hazardous substances used by Montgomery Watson that the contractor's employees may be significantly exposed to while on the job site.
- Location and access to applicable MSDSs.

- Recommended precautions, protective measures and emergency procedures.

In addition, Montgomery Watson employees must be protected from the hazardous materials used by contractors. Montgomery Watson Business Unit Supervisors, with assistance from PHSCs, should review with contractors the hazardous materials that they are intending to utilize in performing their work. If necessary, Montgomery Watson Business Unit Supervisors should request MSDSs from the contractors.

J. PLAN ADMINISTRATION

This Hazard Communication Program will be monitored by the Health and Safety Manager who will be responsible for ensuring that all facets of the program are carried out and that the program is functioning effectively.

V. REFERENCES

A. Title 29 Code of Federal Regulations 1910.1200, Hazard Communication.

B. Title 8 California Code of Regulations Section 5194.

C. Genium Publishing Corporation. The MSDS Pocket Dictionary 2nd Ed. Schenectady, NY. 1994.

EMPLOYEE GUIDE TO HAZARDOUS MATERIALS

I. INTRODUCTION

As a Montgomery Watson employee, your duties may require you to work with substances which are potentially hazardous to your health. Training you to work safely with these hazardous substances is a critical step in providing a workplace that protects your health and safety. This guide was developed as part of the Montgomery Watson Hazard Communication Program and together with training will provide you with information on current regulations, health hazards, safety procedures, and emergency procedures associated with the hazardous substances you work with.

Specifically, this guide will introduce and explain the requirements of two regulations which have been established by the Occupational Safety and Health Administration (OSHA). These regulations are known as "Access to Employee Exposure and Medical Records" (29 CFR 1910.1020) and the "Hazard Communication Standard" (29 CFR 1910.1200). (Note: Approved State OSHA plans have their own regulation corresponding to these Federal OSHA standards.)

II. ACCESS TO EMPLOYEE EXPOSURE AND MEDICAL RECORDS

This regulation requires that Montgomery Watson provide employees or their designated representative access to their own Exposure and Medical Records.

Employee Exposure Record includes any environmental and biological monitoring that has been taken to estimate your exposure to toxic substances or harmful physical agents.

Employee Medical Record contains information concerning the health status of an employee. Maintained by a physician or nurse, this record includes any medical history questionnaires, medical opinions, and diagnoses. It also contains descriptions of treatments, prescriptions and employee complaints.

Written requests for these records should be directed to the Health & Safety Manager.

III. INTRODUCTION TO TOXICOLOGY AND CHEMICAL HAZARDS

A. WHAT ARE HAZARDOUS SUBSTANCES?

Hazardous substances are chemicals which due to their toxic effects; physical properties like flammability, explosivity and reactivity; or potential to adversely affect the environment have been identified as requiring special precautions during their use. Very simply, they are materials that can cause you harm.

The Hazard Communication Standard is specifically concerned with potential harm that these materials can cause to workers. The types and forms of hazardous substances you might find in your workplace are: acids, bases, solvents, dusts, fumes, mists, gases, fuels, smokes, and oils.

B. WHAT DOES THE TERM "TOXIC" MEAN?

While you may easily understand the hazard that a flammable liquid poses to you, the effects of a "toxic" exposure may be more complex. Simply stated, "toxic" means poisonous. However, you must understand that all chemicals, including common table salt and sugar, are toxic if consumed in large enough quantities. Therefore, you should look at the term "toxic" from the standpoint of how toxic is the substance, and how much has been absorbed by the body.

For example, very little exposure to a highly toxic substance will cause you harm. For a less toxic substance, a much larger exposure would be necessary to cause harm.

C. WHAT ARE "EXPOSURE LIMITS"?

OSHA (the Occupational Safety and Health Administration) has reviewed medical and toxicological data on many hazardous substances. It has established airborne levels for many hazardous substances below which an average worker can safely work with the substance. These levels are called **"Permissible Exposure Limits (PELs)."** An employer must reduce worker exposure below the PEL by using control measures.

There is another source of exposure limits which are not set by the government, but by a private organization called the ACGIH (American Conference of Governmental Industrial Hygienists). These levels are called **Threshold Limit Values (TLVs)**. They are not legal limits, but are guidelines for worker exposures to hazardous substances.

Other factors discussed below are also important in understanding how hazardous substances may result in a toxic effect.

D. HOW DO HAZARDOUS SUBSTANCES ENTER THE BODY?

There are three common routes of entry for hazardous substances to enter your body: by inhalation, by absorption, and by ingestion.

Inhalation: Gases, vapors, mists, dusts, and fumes, when breathed, in, can either harm the lungs directly or can be absorbed into the bloodstream and affect other organs, like the liver and kidneys. Because inhalation is the most common and potentially the most harmful type of exposure, nearly all PELs and TLVs refer to airborne levels of toxic substances.

Absorption: Some substances that come into contact with your skin or eyes can be absorbed into your bloodstream through your skin or if splashed in your eyes. The MSDS will indicate if skin absorption or direct skin injury may occur with a hazardous material.

Ingestion: Ingestion is not a common way that a hazardous substance enters your body. However, even small amounts of some highly toxic materials can be ingested and cause harm to you from bad personal hygiene practices (such as eating or smoking without first washing your hands).

E. WHAT ARE THE TYPES OF TOXIC EFFECTS?

In general, there are two major types of toxic effects: acute and chronic.

Acute effects can occur when your exposure to a chemical is large enough so that it affects you right away. Examples of acute toxicity are chemical skin burns, asphyxiation and sudden poisoning.

Chronic effects can occur with repeated exposures after a long period of time. These effects may occur with fairly low-level exposures, so that the damage may not be obvious at first, but can eventually result in harm to you. The resulting injury may be slight (for example, skin irritation), or it may involve severe damage to organs and systems of your body (such as lung disease, cancer, or impaired reproductive function).

Some hazardous chemicals have only acute or chronic effects, but some have both.

F. HAZARD GROUPS

It is important for you to understand the potential hazards of the substance with which you work so that you can help maintain a safe environment for yourself and your fellow workers. ***Most hazardous substances can be used safely if you combine a basic understanding of the potential hazards with care, common sense, and appropriate control measures.***

Commonly used groups of these substances and their potential hazards are reviewed on the following pages.

1. Flammables

Substances that are easily ignited and which burn rapidly are called flammables. There are three factors that must exist to have a fire: fuel, oxidizer (supplies oxygen in a chemical reaction), and ignition source. These three components make up the fire triangle.

Flammable liquids are a common cause of fire in industry. A flammable liquid can form an ignitable mixture with air at room temperatures. The flammable liquid is the fuel, the air is the oxidizer, and the flame or spark, the ignition source.

2. Corrosives

Substances that can cause destruction or irreversible damage to human tissues are called corrosives. They may be liquid, solid, or gas, although they most commonly occur in the liquid state as acids or bases.

Corrosives are also defined in terms of pH. Strong acids, such as sulfuric acid and hydrochloric acid, usually have a pH less than 2. Strong bases, also referred to as caustics, such as ammonium hydroxide and potassium hydroxide, usually have a pH greater than 12. Pure water has a neutral pH of 7.

Corrosives are mainly damaging to the skin and eyes. Strong bases have a more corrosive effect on tissue than most strong acids. Bases are capable of dissolving skin fat, softening the skin layers, and sensitizing the skin to chemicals. Acids cause symptoms that resemble severe burns, such as redness, blistering, cracking, and rashes.

3. Irritants

Irritants are substances that may cause an inflammation when in contact with human tissue. Epoxy resin systems and organic solvents are two common examples. The areas most commonly affected by irritants are the skin, eyes, and respiratory tract.

4. Sensitizers

Sensitizers do not always cause noticeable skin effects on first contact. They may cause unseen changes in the body's immune system, making the person allergic to future exposures to the same substance. Examples of sensitizers are epoxy resins and hardeners, and phenolic plastics.

Photosensitizers are chemicals which sensitize the skin to sunlight so that the skin becomes sunburned unusually quickly. Coal tar pitch and crude petroleum are examples.

5. Asphyxiants

Asphyxiants are substances that deprive the body of oxygen, which must be transported from the lungs via the bloodstream to the cells. With complete deprivation of oxygen, brain cells perish in 4 to 6 minutes. If allowed to continue, oxygen deprivation may result in death. Asphyxiants are classified as either simple or chemical.

Simple asphyxiants are inert gases which displace the oxygen in the atmosphere to levels below that required for sufficient oxygen supply to body cells. Some common examples include carbon dioxide, ethane, helium, hydrogen, methane, and nitrogen.

Chemical asphyxiants are gasses that prevent the uptake of oxygen by the blood or interfere with oxygen transportation from the lungs to the tissues. Common examples include carbon monoxide, hydrogen cyanide, and hydrogen sulfide.

6. Cryogens

Cryogens are very cold liquids usually contained within pressurized cylinders. Among the most common are oxygen, nitrogen, natural gas, argon, helium, and hydrogen. Hazards associated with these materials include explosive atmospheres (where liquid natural gas or hydrogen is used), asphyxiation (where the cryogenic vapors have displaced the breathable air), and skin and eye hazards due to the extremely low temperatures of these materials.

7. Carcinogens

Carcinogens are defined as substances which are capable of causing or producing cancer in humans or animals. The substances that induce cancer do so in a way that is still not understood. No one really knows why some substances are carcinogenic and others are not. We can be exposed to carcinogens not only through the air we breathe and the water we drink, but also by our diet. Certain elements of our lifestyle, both on and off the job, may contribute to cancer.

OSHA lists carcinogens with which employers must use special precautions to prevent harmful exposure to workers. Exposures to these carcinogens is reduced by limiting their amount in solid or liquid mixtures, using localized ventilation, providing employee training, using protective clothing, and prohibiting eating, drinking, and smoking in regulated areas.

8. Incompatibles

Certain materials will react violently when combined with each other. They are called incompatibles. Their reactions may produce fire, explosion, toxic gases, or tremendous heat. Some examples are:

Acids and Cyanides — the reaction between acids and cyanide salts gives off poisonous hydrogen cyanide gas. Many electroplating operations use both cyanide solutions and acid solutions. The two should never be mixed.

Acids and Bases — the reaction between strong acids and strong bases will give off large amounts of heat, often violently. Care must be taken not to mix the two.

Water Plus Strong Acids or Bases — strong acids and bases will also react by giving off large amounts of heat when mixed with water. When diluting strong solutions, always add the acid or base slowly to a large amount of water.

Oxidizers and Flammables — an oxidizer is an efficient source of oxygen which can keep a fire burning. It may be reactive enough to start a fire. Oxidizers sometimes supply enough heat to make fire extinguishers ineffective. Examples of oxidizers are nitric acid and potassium permanganate. (Flammables were discussed earlier.)

REMEMBER, incompatible materials must be stored separately at all times to avoid hazardous reactions that can occur during spills, container leakages, fire, or earthquakes.

IV. THE HAZARD COMMUNICATION STANDARD — 29 CFR 1910.1200

A. PURPOSE OF THE HAZARD COMMUNICATION LAW

The purpose of this standard is to communicate to you and all employees the hazards of the materials that you work with. It is sometimes also called the "Employee Right-to-Know" law. This information is provided through the Montgomery Watson **Hazard Communication Program** which includes the following:

- Written Hazard Communication Program
- Hazardous Substances Listing and Inventory
- Material Safety Data Sheet Inventory
- Labeling and Hazard Warning System
- Employee Information and Training Program

B. SCOPE AND APPLICATION OF THE LAW

This law requires manufacturers or importers to find out the hazards of materials which they produce or import, then provide this information to employers by way of MSDSs (Material Safety Data Sheets). The employer is then required to supply the MSDS and other hazardous material information to employees. This law applies to any hazardous material which is in the workplace and used in a way that could cause exposure to employees under normal conditions of use or in an emergency.

V. MAJOR COMPONENTS OF HAZARD COMMUNICATION:

A. THE WRITTEN PROGRAM

1. Details how the company is fulfilling all the requirements of the Hazard Communication Law.

2. Is part of the Montgomery Watson Safety and Health Policies Manual (No. 1000 Hazard Communication Program).

3. Is available, upon request, to you and your designated representatives.

B. LIST OF HAZARDOUS SUBSTANCES

1. The list must be posted in every work area.

2. The list must also be in every department MSDS binder.

3. The list itemizes the hazardous substances used in the Business Unit or specific work area.

4. The list can be utilized as a reference to the MSDSs in the binder and for hazardous substances used.

C. HAZARDOUS SUBSTANCES TRAINING

1. Is required for all employees exposed to hazardous substances.

2. Informs you of the physical and health hazards of the substances which you work with, how you can protect yourself, and the requirements of the standard.

3. Training will cover:

a. The general requirements, the details of the Hazard Communication Program, the location and availability of MSDSs, the list of hazardous substances, the written program and other general hazardous substances information.

b. Additional training will be given as needed on the specific health and physical hazards of substances which you work with.

D. CONTAINER LABELING

1. Original Manufacturer's Containers

a. Manufacturers, importers and distributors of substances which Montgomery Watson purchases must label, tag or mark each container of hazardous substance(s) with the following information:

- Identity of the hazardous substance(s).
- Appropriate hazard warnings.
- Name and address of the manufacturer, importer or other responsible party.

b. No container of hazardous substances shall be released for use in the workplace unless the container is correctly labeled and the label is legible.

c. Any containers with damaged labels must be kept separate and not used until they are relabeled. A supply of new labels must be obtained from the manufacturer, importer or distributor for this purpose.

2. Secondary Containers

a. Appropriate hazard warning labels must also be placed on secondary containers (i.e., containers used to store material dispensed from the manufacturer's original container).

b. The secondary container must be labeled with either a copy of the manufacturer's label or a department produced label that includes:

- Product identity
- Fire, physical and health hazards
- First Aid procedures
- Manufacturer's name

c. This label information can be obtained from the manufacturer's original container or the applicable Material Safety Data Sheet (MSDS).

d. Business Unit Supervisors must ensure that all labels on secondary containers are clearly visible, legible and include the required information.

E. MATERIAL SAFETY DATA SHEETS (MSDS)

1. MSDSs for every hazardous substance used in your work area should be in the plainly marked MSDS binder which is located in your Business Unit Supervisor's office. In some cases, there will be an MSDS binder in other work areas as well.

2. Each MSDS should contain the following information:

   a. Source of the MSDS (manufacturer)

      1. The name, address and emergency phone number of the preparer of the MSDS and the date of MSDS preparation.

   b. Identity of the substance

      1. Common name.

      2. Scientific or chemical name.

      3. Trade name or abbreviation.

      4. Chemical formula.

      5. Chemical Abstract Service (CAS) number.

   c. List of hazardous ingredients

      1. Exception: trade secrets don't need to be listed, but the information must be made available to safety and health professionals.

   d. Physical and chemical characteristics

      1. Boiling point, specific gravity, vapor pressure, appearance and odor, etc.

   e. Fire and explosion information

      1. Conditions which could result in a fire or explosion.

      2. Appropriate fire extinguisher.

      3. Approved fire fighting methods.

   f. Physical hazards

      1. Materials which are incompatible with the substance.

      2. Any conditions to be avoided.

g. Health hazards

1. Signs and symptoms of overexposure.

2. Acute and chronic effects.

3. Routes of entry.

4. Medical conditions aggravated by exposure.

5. Listing as carcinogen or potential carcinogen.

6. Occupational exposure limits:

a) OSHA PELs.
b) ACGIH TLVs.

h. Special protection information

1. Personal protective equipment to be used.

2. Safe handling requirements.

3. Engineering and administrative controls.

i. Emergency and first aid procedures

j. Special precautions

1. Special handling and storage requirements.

2. Spill and leak procedures.

F. EMPLOYEE RIGHTS

OSHA, through the Hazard Communication standard, gives you the following rights:

1. You can personally receive all information regarding any hazardous substances you work with or are exposed to.

2. Your doctor or collective bargaining agent can receive information regarding any hazardous substances you work with or are exposed to.

3. The company cannot discharge you or discriminate against you for exercising any of your rights under this law.

4. You can refuse to work with a hazardous substance if the company cannot find out the hazards and communicate them to you.

VI. PREVENTING EMPLOYEE EXPOSURE

A. EMPLOYER MEASURES

Ways the company limits or prevents your exposure:

1. Engineering Controls

Ventilation systems and physical isolation of the chemical from the worker are examples of engineering controls. Engineering controls are the surest means of controlling your exposure to hazardous substances. They are also the most expensive and are sometimes not practical to install. Proper design and maintenance are important to keep them operating at maximum efficiency.

2. Administrative Controls

Substitution of less hazardous materials, providing rest periods, and rotating employees (where appropriate), are examples of reducing exposure through administrative controls. Business Unit Supervisors should use information provided in MSDSs to determine whether administrative controls can be used to further protect you from hazardous substances.

3. Personal Protective Equipment

Respirators and impervious gloves are examples of personal protective equipment (PPE). PPE reduces a worker's exposure to hazardous substances, but does not improve the overall workplace environment. Some PPE, like respirators, require special training and fitting to ensure proper protection, as well as a medical examination.

B. EMPLOYEE RESPONSIBILITIES

1. Use safe work practices

Certain practices over which you have personal control (for example how fast a machine operates or how ingredients are added to a mixing vessel) can significantly affect your exposure. You should be carefully trained to recognize this fact and always work according to prescribed procedures.

2. Personal hygiene

Measures as simple as washing your hands before eating, or smoking, or showering at the end of a work shift can significantly reduce your exposure to hazardous substances. Personal hygiene is particularly important when handling highly toxic substances. OSHA regulations for certain substances (like lead) require specific personal hygiene practices.

3. Read and follow label warnings

Labeling (as required by the Hazard Communication Law) can be an important control measure if workers read, understand, and follow label instructions. If you see the words:

"danger," "warning," or "caution," make sure you read the label carefully and refer to the MSDS for more information.

C. DETECTING HAZARDOUS SUBSTANCES

The following methods or reactions can be used to help you detect the presence of, release of or exposure to hazardous substances.

1. Air Sampling

Industrial hygienists are trained to use a variety of sampling equipment which is designed to detect mists, vapors, dust or fumes in the air.

2. Visual Appearance

Some hazardous substances will form colored "clouds" or stain surfaces which they contact.

3. Odor

In some cases a hazardous substance will have a particular odor and be easily detected, e.g. ammonia. Although many hazardous substances will not have any odor at all, e.g. carbon monoxide.

4. Dizziness/Headache

Some hazardous substances will cause headache and dizziness when you are exposed.

5. Skin/Eye/Throat Irritation

Many hazardous substances will cause irritation of the eyes, skin and/or throat if you are exposed.

It is very important that you understand the health hazards and other properties of the hazardous substances you work with in an effort to predict, prevent or detect potentially hazardous releases or exposures.

Many hazardous substances will cause irritation of the eyes, skin and/or throat if you are exposed.

Glossary

Acute effect — an adverse effect, usually as a result of a short-term but high-level exposure.

ACGIH — American Conference of Governmental Industrial Hygienists. ACGIH publishes recommended occupational exposure limits for hundreds of chemical substances and physical agents.

Carcinogen — a substance or agent capable of causing or producing cancer in humans or animals.

Chronic effect — an adverse effect with symptoms that develop over a long period of time or which recur frequently. This effect is usually a result of a long-term exposure.

Combustible substance — any substance which after ignition will continue to burn in air.

Designated representative — any individual or organization to whom an employee gives written authorization to exercise a right of access to exposure and/or medical records.

DOT — Department of Transportation.

Emergency — Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which may or does result in a release of a hazardous substance into the workplace.

Exposure or Exposed — Any situation arising from work operation where an employee may ingest, inhale, absorb through the skin or eyes, or otherwise come into contact with a hazardous substance.

Flammable liquids — liquids with a flash point below 100 F.

Flash point — the minimum temperature at which a liquid gives off vapor at sufficient concentrations to form an ignitable mixture with air.

Fumes — small, solid particles usually created by heating metals above their melting point.

General exhaust ventilation — provides air circulation throughout a room or building by natural infiltration of air or with an air moving device.

Hazard — possibility that exposure to a material will cause injury or harm when used under certain conditions.

Hazard warning — Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the health hazards and physical hazards of the substance(s) in the containers(s).

Hazardous substance — Any substance which is a physical hazard or a health hazard. In a broad sense, any substance with properties capable of producing adverse effects on the safety or health of a human being.

Health Hazard — A substance for which there is evidence that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes substances which are carcinogens, toxic agents, irritants, corrosives, sensitizers, and agents which damage the lungs, skin, eyes, or mucous membranes.

Ingestion — the swallowing of substances.

Inhalation — the breathing in of a gas, mist, fume, vapor, or dust.

Label — Any written, printed, or graphic material displayed on or affixed to containers of hazardous substances.

LC — lethal concentration; a concentration of a substance that is fatal for a test animal.

LD — lethal dose; a dose, usually in grams or milligrams, that is fatal for a test animal.

LD50 — Lethal dose–50; a dose at which 50 percent of a population of the same species will die within a specified time.

LEL — lower explosive limit; the lowest concentration of a substance that will produce an explosion when an ignition source is present.

Local exhaust ventilation — captures and removes the contaminant being controlled at or near the place where it is created or dispersed.

Local health effect — damage which occurs where the chemical makes initial contact with the body.

Material Safety Data Sheet (MSDS) — A fact sheet summarizing information about material identification; hazardous ingredients; heath, physical, and fire hazards; first aid; chemical reactivities and incompatibilities; spill, leak, and disposal procedures; and protective measures required for safe handling and storage. OSHA has established guidelines for descriptive data that should be concisely provided on a data sheet to serve as the basis for written hazard communication programs. The Chemical Manufacturer's Association developed a set of guidelines for a consistent MSDS format. This format has been accepted by the American National Standards Institute.

Organic — chemicals that contain carbon.

OSHA — Occupational Safety and Health Administration. Part of the U.S. Department of Labor.

Oxygen deficiency — an atmosphere with less than the percentage of oxygen found in normal air. OSHA defines an oxygen deficient atmosphere as having less than 19.5 percent oxygen.

Particulate — solid substance which may be suspended in air.

PEL — permissible exposure limit; an exposure level set by OSHA which may either be a time-weighted average (TWA) or a short term exposure limit (STEL).

pH — a scale from 0 to 14 which is used to measure the strength of acids and bases, with neutrality indicated at 7. Acids have a pH less than 7 and bases have a pH greater than 7.

Physical hazard — A substance for which there is evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an oxidizer, unstable (reactive) or water-reactive.

ppm — parts per million; a unit for measuring the concentration of a gas, vapor, or other contaminant in the air. It is a measure of the parts of gas, vapor, or other contaminant per million parts of air.

Polymerization — a chemical reaction in which small molecules combine to form larger molecules. This becomes a hazard when a large amount of energy is released during the process.

Sensitizer — a substance that may cause some individuals to develop an allergic reaction after extended or repeated exposure.

Stability — the ability of a material to remain unchanged.

Systemic health effect — damage which occurs when a chemical is absorbed and travels through the body to a specific organ.

TLV — threshold limit value; an estimate of the chemical levels, in parts per million or milligrams per cubic meter of air, that most people can be exposed to without adverse effects. TLVs are recommendations established by the American Conference of Governmental Industrial Hygienists and are used only as guidelines.

TLV-ceiling — the concentration which should not be exceeded, even for an instant.

TLV-STEL — short-term exposure level; the maximum concentration to which workers can be exposed for a period of up to 15 minutes.

TLV-TWA — the allowable time-weighted average concentration for a normal 8 hr workday or 40 hr workweek.

Toxic material — a substance which produces injury or illness if it is ingested, inhaled, or absorbed.

Toxicity — The capacity of a substance to produce an unwanted effect.

UEL — upper explosive limit; the highest concentration of a substance that will produce an explosion when an ignition source is present.

Unstable — the tendency of a material to decompose or change chemically during normal handling or storage.

Vapors — the gaseous form of substances, which are normally in the solid or liquid state at room temperature and pressure.

APPENDIX C

QUALIFICATIONS OF SITE RADIATION SAFETY OFFICER

KENNETH R. BAKER, PH.D.

EDUCATION:

Ph.D., Experimental Nuclear Physics -- Vanderbilt University (1972)
M.S., Physics -- Indiana State University (1966)
B.S., Mathematics -- Indiana State University (1964)

PROFESSIONAL TRAINING:

- AEC Health Physics Fellow (three-year program)
- Hazardous Materials Workers 40-hour Training (current)

CAPABILITY SUMMARY:

Twenty years experience in environmental, health, and safety-related activities. Experience includes: principal consultant for very large site remediations for industrial clients, managed RI/FS activities for DOE sites, established and managed a radiological services department to support the cleanup of 24 uranium mill tailings sites. Currently principal of company specializing in planning and supporting the decommissioning of radiologically contaminated property. Fields of competence include remediation of radiological sites, regulatory analysis, radiation dose and risk assessment, site characterization, decontamination and decommissioning, hazardous waste management, remediation planning, radiation measurement techniques, health physics practices and procedures, environmental sampling and analysis.

FUNCTIONAL SUMMARY:

- **Principal Consultant and Radiation Safety Officer for the decommissioning of two Michigan Sites owned by Dow Chemical Company.** Prepared all radiation protection and operating procedures. Established two on-site laboratories for sample analyses. Responsible for all environmental health and safety activities and the 15 radiation technicians working on site. This $25 million dollar project was completed in 1997.
- **Principal Consultant for Pathfinder Mines Corporation.** Conducted site characterization studies and prepared verification plans and other reclamation planning documents for submittal to the Nuclear Regulatory Commission for two uranium mill sites currently being decommissioned. ERG is supporting the cleanup by conducting GPS-based radiological surveys, excavation control surveys, and soil sampling and analyses for these sites. ERG established and is operating an on-site laboratory. This large program was completed in 1999.

- **Principal Consultant and Radiation Safety Officer for the remediation of a large industrial radioactive waste storage facility owned by Dow Chemical Co and Consolidated Aluminum Corporation where 90,000 cubic yards of slag and soil contaminated with Th-230/Th-232 and PCBs were removed.** Tasks include conducted a groundwater study for organic, radiological, and chemical contaminants; conducted a chemical/radiological site characterization of the 40-acre site; developed remediation alternatives and associated risks; represented client interests at meetings with the Illinois Department of Nuclear Safety, developed remedial concept designs; prepared the remediation management plan, remedial action operations plan, and the health and safety plan; served as Corporate Radiation Safety Officer for client; established an on-site laboratory, and managed

various remedial action activities including removal of radiological and PCB contaminated materials.
Prepared site verification reports for submittal to the regulatory agencies. This work was completed in the fall of 1992 and the radioactive materials license was terminated in January 1993. Regulatory approval of the PCB cleanup was also received in January 1993.

- **Principal Consultant for Remediation of the Bluewater Uranium Mill** owned by Atlantic Richfield Company. Developed and implemented a site characterization plan for the facility with emphasis on disposal alternatives for buildings and process system components. Samples from process tanks and residual materials, were taken and analyzed for use in the disposal alternatives assessment. Several risk assessments were performed to support the unrestricted release of material and to obtain exemptions from regulations and the reclamation plan. Assisted the client in preparing remedial designs and in presenting the reclamation plans to the Nuclear Regulatory Commission (NRC). Prepared a Supplemental Environmental Report for submission to the NRC and a Petition for Redesign of the Main Tailings Pile Cover System. Innovative changes to the design have resulted in savings to the client of approximately $6 million. Currently serves as Principal Consultant and Quality Assurance Specialist for all Environmental Health and Safety Functions for this $75 million project. This work was completed in 1996.

- **Principal Consultant and Environmental Contractor for Remediation of the Homestake Mining Company Mill Site.** Characterized mill tailings pile and cover material for parameters necessary to model the radon flux from the pile. Developed tailings pile cover design for this NRC regulated site. Developed soil verification procedures for the site. Serves as principal technical liaison between client and the NRC regarding cover design. Made radon flux measurements on pile and old mill site.

- ERG provided radiological survey services and verification measurements associated with the decontamination of the large windblown tailings contamination around the mill tailings pile. A global positioning system coupled to radiological survey equipment was used to support the cleanup of approximately 1000 acres of windblown tailings contaminated property. Prepared the Completion Report. This work was completed in 1996.

- **Project Manager for the DOE Environmental Restoration Program Activities.** Managed RI/FS work assigned to WESTON for the Mound Plant and LANL facility. Prepared scoping documents, sampling and analysis plans, standard operating procedures for sampling and handling of radioactive samples, and a baseline risk assessment. Conducted audits of laboratory radioactive analytical and sample handling procedures. Worked closely with EPA Region V in developing the Mound Plant Documents.

- **Manager of Radiological Services for DOE's UMTRA project, which involves the cleanup of 24 abandoned uranium facilities.** Responsible for supervising a staff of nine health physicists for five years, defining the data necessary for determination of source term and extent of contamination, managing over $2

million annually for four years of subcontractor radiological data acquisition, developing measurement procedures and requirements for use by all subcontractors, developing and implementing a QA program to ensure data quality, managing and participating in the radiological design efforts, establishing the environmental monitoring program around the 24 processing sites, developing the project health and safety program, and performing the risk assessments for the NEPA documents.

- **Under contract to the Office of Radiation Programs, U.S. EPA, performed several studies to support EPA rulemaking.** Designed and managed a large site characterization and radiological risk assessment associated with exposure of the public to open-pit uranium mines. Also participated in a literature review of radiological impacts associated with diffuse naturally occurring radioactive wastes. This work was used in developing the National Emissions Standards for Hazardous Air Pollutants. Other work included collecting soil-gas permeability, soil Ra-226 concentration, and soil-gas radon concentration data near homes with elevated indoor radon concentrations. Correlations were done in order to develop and test models to predict the indoor radon concentration. Other work included conducting a literature search and review of treatment technologies for mixed radioactive wastes.

- **Responsible for preparing portions of the RI/FSs for the Montclair/West Orange and Glenridge radioactively contaminated sites in New Jersey under the EPA REM II SARA contract.** Specific areas of responsibility included preparing the project operations plan, health and safety plan, QA plan, laboratory data evaluation, conducting property screening surveys, interpreting design data, and assessing health risks associated with the various alternatives. Similar tasks were performed for the New Jersey U.S. Radium site.

- **Managed and participated in the radiological site characterization of six radium-contaminated properties in Denver, Colorado.** Interim mitigative design alternatives were developed for each of the properties as part of the overall feasibility study.

- **Served as Principal Technical Advisor to WESTON at Rockwell International, Rocky Flats RCRA permitting on radiation-related issues, and supervised additional radiological specialists as needed.** Developed and implemented radiological screening procedures for the removal of mixed-waste samples from the production area.

- **Radiological Engineering Group Leader.** Responsible for serving the nuclear power industry while employed by INPO by identifying radiation protection, waste management, or environmental problems, and proposing or developing solutions to the problems. Notable accomplishments include developing a new method for estimating doses from beta radiation, developing a method for evaluating portal monitors, and publishing the Radiological Experience Notebook, a new periodical for member utilities containing articles on safe radiological practices or other items of interest to radiological protection personnel.

- **While employed by DOE, initiated programs leading to the development of environmental and occupational safety standards and policies applicable to DOE waste management, decontamination and decommissioning, and radiation protection programs.** Appraised the performance of DOE field offices and contractors in health protection and environmental matters. Developed cleanup criteria for sites to be decommissioned and released to the public. Reviewed decommissioning plans and reports for technical accuracy and adequacy. Provided technical assistance and reviews for the DOE remedial activities in the South Pacific and Formerly Utilized Sites Remedial Action Programs. Participated in selecting the best decommissioning options. Special interest work was done in the areas of transuranics in the environment and natural radioactivity.

- Research and faculty assignments, Georgia Institute of Technology and Bradley University. Performed research in the areas of atomic and nuclear physics employing gamma ray, x-ray, and electron spectrometers using radioactive sources and particle accelerators.

- Special short-term assignments at Los Alamos National Laboratory, Argonne National Laboratory, and the National Council on Radiation Protection and Measurements.

PROFESSIONAL EXPERIENCE:

Environmental Restoration Group, Inc., Principal, Albuquerque, NM - 1992 - Present

Roy F. Weston, Inc., Vice President, Project Director, Project Manager, Albuquerque Office - 1982 - 1992

Institute of Nuclear Power of Operations, Radiological Protection and Emergency Preparedness Division - 1980 - 1982

U.S. Department of Energy, Division of Operational and Environmental Safety - 1974 - 1980

Georgia Institute of Technology, School of Chemistry - 1972 - 1974

Bradley University, School of Applied Sciences and Engineering - 1966 - 1968

PROFESSIONAL REGISTRATIONS/ AFFILIATIONS:

- Member, Health Physics Society
- Member, American Nuclear Society

PUBLICATIONS: Published more than 30 publications in professional journals in the areas of waste management, health physics, nuclear physics, and atomic physics.

CLEARANCES: DOE Q, inactive