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FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDICES (U)

19 SEPTEMBER 1991

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APPENDIX A

METHODS FOR CALCULATING RADIATION DOSES, HEALTH EFFECTS, AND IMPACTS OF TRANSPORATION (U)

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APPENDIX A

METHODS FOR CALCULATING RADIATION DOSES, HEALTH EFFECTS, AND IMPACTS OF TRANSPORTATION (U)

([redacted]) This appendix discusses the methods for calculating both normal and accidental radiation doses and health effects and the methods for calculating the impacts of the normal operations, accident scenarios, and transportation scenarios presented in Chapter 4 of this Environmental Impact Statement (EIS).

Nature of Radiation and Its Biological Effects (U)

(U) All matter is composed of submicroscopic atoms. An atom, in turn, contains a relatively small nucleus enriched by a number of electrons. The nucleus contains protons, which carry positive charge, and neutrons, which carry no charge. Electrons carry a negative charge. The number of protons determine the chemical element. For example, a carbon nucleus has 6 protons, a uranium nucleus 92 protons. The number of protons and the number of neutrons determine the nuclide. Nuclides of an element (same number of protons) are called isotopes, e.g., uranium-235 and uranium-238. Some nuclides are stable but most are not. Of the approximately 1,700 known nuclides, about 280 are stable.

(U) Over a length of time that varies by nuclide, the structure of unstable nuclides changes, or decays. Unstable nuclides are termed radionuclides because they emit radiation when they decay. They transform spontaneously into either another nuclide or a more stable form of the same nuclide. The decay rate of a radionuclide is its activity. In this document, the unit of activity is the curie (Ci), 3.7×10^{10} disintegrations per second, or approximately the activity of one gram of the radionuclide radium-226.

(U) Radiation is a particle or electromagnetic wave from the decay of a radionuclide that causes ionization when traveling through matter. Matter is said to be ionized when the negatively charged electrons are separated from the positively charged nucleus. When the matter is living tissue, the ionization can damage the cells composing the tissue. The energy imparted by radiation per unit mass of irradiated matter is called the absorbed dose. The unit of absorbed dose used in this EIS is the rad; 1 rad is equal to the deposition of 0.01 joule of energy per 1 kilogram (2.2 lbs) of the absorbing material.

(U) Some forms of radiation are more effective than others in causing biological harm. Dose equivalent is the term used for dose that takes into account both the absorbed dose and the ability, or effectiveness, of different forms of radiation to cause biological harm. Dose equivalent is equal to absorbed dose multiplied by a factor, the quality factor, that takes into account the "biological effectiveness" (degree of harm) of a particular radiation. For electromagnetic radiation (gamma rays and X rays) and beta particles, the quality factor is set at unity (1); for alpha particles, the quality factor is 20. (A beta particle is the electron formed when a neutron decays into a proton; an alpha particle is a doubly charged helium-4 nucleus.) The physical measure (average energy loss per unit track length) associated with the quality

[redacted]

factor is called the linear energy transfer (LET). Electromagnetic radiation and beta particles are low LET radiation. Alpha particles, as well as protons and neutrons, are high LET radiation.

(U) Excluding chemically inert noble gases, radionuclides that are inhaled or ingested can interact chemically with body tissues or organs so that the radionuclides may reside in the body for years. While these radionuclides reside in the body, they continue to decay and emit radiation so that internal tissues and organs are exposed over an extended period of time. The quantity that takes this effect into account for an organ or tissue is called the committed dose equivalent (CDE), the time-integrated dose. In the calculations made for this EIS, dose equivalent is accumulated over 50 years (i.e., a 50-year dose commitment).

(U) The various organs of the body have different suspectibilities to harm from radiation. The quantity that takes these different suspectibilities into account to provide a broad indicator of the risk to the health of an individual from radiation is called the committed effective dose equivalent. It is obtained by multiplying the CDE in each major organ or tissue by a weighting factor associated with the risk susceptibility of the tissue or organ and then summing. It is possible that the CDE to an organ is larger than the committed effective dose equivalent if that organ has a small weighting factor. The concept of committed dose applies only for internal pathways. For other pathways (external pathways), there is no long-term residence of radionuclides in the body and the appropriate measure of dose is called the effective dose equivalent (EDE). For convenience, the sum of the committed effective dose equivalent from internal pathways and the effective dose equivalent from external pathways is called the committed effective dose equivalent (CEDE) in this EIS (note that in DOE Order 5400.5, this quantity is called the effective dose equivalent).

(U) The unit used in this EIS for CDE, EDE, and CEDE to an individual is the rem. The corresponding unit for the collective dose to a population (the sum of the doses to members of the population, or the product of the number of exposed individuals and their average dose) is the person-rem. The rem is defined as the dose of a particular type of radiation required to produce the same biological effects as absorption of 0.01 joules of energy from X rays or gamma rays in 1 kilogram (2.2 lbs) of tissue. Thus, 1 rem of one type of radiation is presumed to have the same biological effects as 1 rem of any other kind of radiation. This standard allows comparison of the biological effects of radionuclides that emit different types of radiation.

Health Effects (U)

([redacted]) If the whole body is exposed to a very high dose of radiation, death may occur immediately or within a matter of weeks. The dose that is lethal to about 50% of the exposed population within 60 days of exposure is about 500 rem (Abrahamson et al., 1989). If a limited area of the body is exposed briefly to a very high dose, death may not occur but there may be other early (sometimes called "acute") effects; for example, doses to the gonads (i.e., testes or ovaries) might cause sterility. Short-term health effects are usually not observed below an acute dose of about 25 rem. However, changes in blood cells have been detected at doses as low as 5 rem (NCRP, 1971). Estimated doses to the general population from normal operations of reactors and support facilities are in the range of fractions of millirem (1 millirem = 1/1000 rem) per year of operations and fall well below the level that would produce acute effects.

(U) Doses of radiation that are too weak to cause early effects may have consequences later in life. These are known as long-term health effects. Long-term health effects can be broken down into latent somatic effects and latent genetic effects. The somatic effect of greatest importance is the possible development of cancer 5 to 30 years after exposure. Although the basic processes by which radiation induces cancer may not be fully understood, studies of the survivors of the atomic bombings in Japan, of patients who have been exposed to radiation, of uranium workers, and of workers in the radium-luminizing industry in the 1930s have established that the incidence of cancer is greater in groups who were exposed to high doses of radiation in earlier years than in groups who were not exposed. Latent genetic effects include mutations in the genetic material of exposed persons that affect later generations.

(U) The data that established a link between cancer and radiation were data for persons who received high doses, and no equivalent statistical link has been established between cancer and low doses of radiation. However, a conservative assumption is that the probability of a late effect is proportional to dose (linear dose-risk relationship); then, half the dose would result in half the number of persons developing the effect, a tenth the dose in a tenth the number of persons developing the effect, and so on. Also, a linear dose-risk relationship would enhance the meaningfulness of the collective CEDE as a measure of the effect of radiation on a population because it would not matter how the exposure was distributed among the individuals.

(U) Radiation from releases to the environment can reach individuals via five major pathways that cause radiological exposure (external and internal) and thus health risks: 1) internal doses from breathing contaminated air (inhalation); 2) internal doses from eating contaminated food or drinking contaminated water (ingestion); 3) external doses from surrounding contaminated air (air immersion); 4) external doses from radionuclides deposited on ground surfaces (ground surface or ground shine); and 5) external doses from a radioactive cloud overhead (cloud shine).

(U) These environmental pathways for the contamination and exposure of individuals and the public in general are mutually dependent and interconnected by an array of subpathways. For instance, radionuclides deposited on ground surfaces can be sources of external dose through ground shine and sources of internal dose through the ingestion pathway. Internal dose through ingestion can occur directly as a result of ingestion of contaminated vegetation (through uptake of radionuclides from the ground) or indirectly as a result of ingestion of animal products from animals that grazed on contaminated vegetation. Also, water bodies contaminated by liquid releases can be sources of internal dose, either directly through ingestion of contaminated water or indirectly through ingestion of contaminated aquatic foods or ingestion of food crops that have become contaminated as a result of uptake of radionuclides in contaminated water used for irrigation.

A.1 NORMAL OPERATION (U)

([redacted]) The normal operation of the [redacted] ([redacted]) Project would result in the release of small amounts of radioactive material to the environment. Essentially, all this release would be to the atmosphere and would consist of noble gases, halogens, volatile elements and other mixed fission products in the form of particulates. This section describes the methods and assumptions used to calculate the doses and the resulting health effects to the individual at the location of maximum dose and to the population 80 kilometers (50 miles) downwind of the release point. Analysis is performed for two different DOE sites. These sites are 1) the Nevada Test Site (NTS); and 2) the Idaho National Engineering Laboratory (INEL). Within the INEL are 2 potential locations: the QUEST site and the LOFT site.

([redacted]) Routinely, doses and health effects are calculated to the population residing out to a distance of 80 kilometers (50 miles) from nuclear facilities as required by 40 CFR 61, Subpart H. This has been done for the [redacted] Project. Deposition of particulates and atmospheric dispersion of radioactivity results in much smaller doses beyond 80 kilometers (50 miles) than at close-in distances.

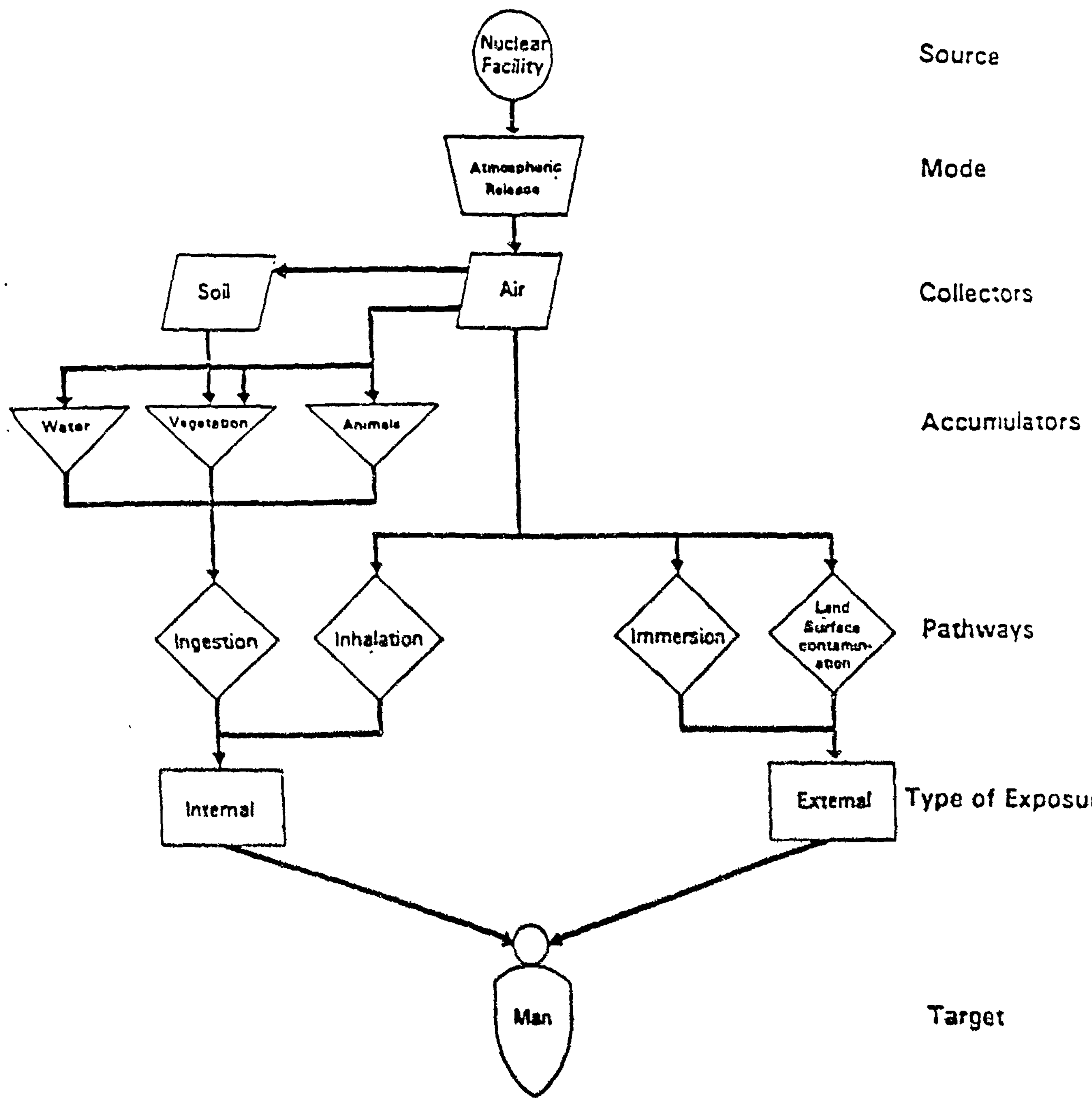
([redacted]) Radioactive materials released to the environment become involved in a complex series of physical, chemical, and biological processes. The principal pathways by which radioactivity released from the [redacted] Project could reach people are 1) external exposure to nuclides in the air; 2) external exposure to nuclides deposited or on the ground; 3) inhalation of radioactivity; and 4) ingestion of radioactivity in food or liquids. Figure A.1-1 shows these pathways. Only atmospheric pathways are shown; since all liquid discharges from the [redacted] Project would be treated and solidified on site, there is no viable release mechanism to ground water [redacted], which could be used for internal consumption. The inhalation pathway can be further broken down into inhalation during the cloud passage and inhalation of resuspended particles. (U) The calculations of radiological doses to members of the public from these various pathways are based on methods developed for the U.S. Nuclear Regulatory Commission (NRC). Estimates of doses are based on analyses of the sources and rates of radioactive releases and the pathways by which people can be exposed to dispersed radioactive materials. The analysis considered 473 radioisotopes in estimating doses to the public.

A.1.1 Computer Code Application to the Calculation of Doses Resulting From Atmospheric Releases to the Environment (U)

([redacted]) The computer code MACCS (Chanin, 1990) was used to calculate the doses that would result from airborne releases of radioactivity during normal operation and postulated accidents of the [redacted] Project. The MACCS code was developed by Sandia National Laboratories as a severe accident risk assessment code for the U.S. Nuclear Regulatory Commission. MACCS, the MELCOR Accident Consequence Code System, calculates the off-site consequences of an atmospheric release of radionuclides using a straight line Gaussian plume dispersion and transport model. MACCS models the off-site consequences of a nuclear reactor accident that releases a plume of radioactive materials to the atmosphere. Should such an accidental release

[redacted]

FIGURE A.1-1 (U)
(U) Exposure Pathways Considered in Radiological Impact Assessments



[redacted]

occur, the radioactive gases and aerosols in the plume, while dispersing in the atmosphere, would be transported by the prevailing wind. The environment would be contaminated by radioactive materials deposited from the plume and the population would be exposed to radiation. Estimation of the range and probability of the health effects induced by the radiation exposures that would result from the contamination of the environment is the object of a MACCS calculation.

([redacted]) As discussed in Chapter 4, MACCS was chosen to model releases from normal operations instead of another code such as AIRDOS-EPA because of the relatively short duration and periodic nature of [redacted] operations. AIRDOS-EPA is most representative for operational releases of a year or more (chronic exposure). The reactors operate for only a short duration (1000 seconds or less) during the year which can be approximated by an accidental release (acute exposure) scenario.

([redacted]) The time scale after the accident (release) is divided into three phases: emergency phase, intermediate phase, and long-term phase. For normal operations, the time scale begins with the routine operational releases instead of the accident releases.

([redacted]) The emergency phase begins immediately after the accident. Within the code, this period is modeled by the EARLY module of MACCS. In this period, the exposure of the population to both radioactive clouds and contaminated ground is modeled.

([redacted]) The intermediate phase can be used to represent a period in which evaluations are performed and decisions are made regarding the type of protective actions which need to be taken. This phase was not used for the [redacted] analyses.

([redacted]) The long-term phase represents all time subsequent to the intermediate phase. Within the code, this period is modeled by the CHRONC module of MACCS. As with the intermediate phase, the only exposure pathways considered here are those resulting from the contaminated ground.

(U) Humans can receive doses externally from direct exposure to radioactive materials outside the body or internally from the intake of radioactive material by inhalation or ingestion. Radionuclides that enter the body are distributed to various organs and are removed by normal biological processes and radioactive decay. The rate at which each radionuclide is removed from the body depends on its chemical, physical, and radiological properties. Historically, dose calculations have included an accounting of doses resulting from the fraction of radionuclides that are retained and decay in the body for 50 years following the year of intake. This 50-year "integrating period" was used as the basis of the dose commitment conversion factors used in these dose calculations. The total dose to an organ is the sum of the internal 50-year committed dose equivalent from intake and the external dose equivalent received.

([redacted]) Several changes were made to the MACCS consequence code to enable it to better simulate the particulars of the [redacted] system. MACCS was developed to model terrestrial nuclear power plant releases. The isotope list, containing 60 isotopes was determined to best represent power

[redacted]

plant releases out to very long distances [(1,600 kilometers (1000 miles)]. These isotopes are the bad actors from a terrestrial nuclear power plant and are relatively long lived. However, MACCS neglects moderate lived isotopes to a large degree, and completely ignores short lived isotopes. It was felt that the addition of several hundred other isotopes was necessary, especially moderate lived half-lives, to better represent the inventory from the test systems.

([redacted]) To accomplish this MACCS was modified to handle more isotopes than it was originally designed for. The changes were simple array dimension changes that increased the storage of the isotope and isotope related arrays. When these changes were implemented, the three MACCS sample problems (received with the MACCS distribution files) and some previous calculations were run to ensure that MACCS was operating properly. In all cases the original results were achieved.

([redacted]) Once MACCS was fitted to handle the increased isotope volume, changes were implemented to the MACCS dose conversion factor (DCF) file. Several sources of DCF data were utilized that were felt to be reliable. These included the original 60 isotopes included in the MACCS distribution files, 825 isotopes provided by Keith Eckerman of Oak Ridge National Laboratory (Eckerman, 1988), and 396 isotopes provided by Steve Fetter of the University of Maryland (Fetter, 1988).

([redacted]) The original 60 isotopes accompanying the MACCS distribution source are Eckerman DCFs. In addition, 38 other isotopes added later (EDE only) are also of Eckerman origin. Fetter's DCFs were developed by Idaho National Engineering Laboratory to be used in fusion reactor safety studies. They incorporate many fission isotopes for comparison with Eckerman data, as well as many bad actors that are unique to fusion reactions. Fetter's data matches Eckerman's data within 30% for almost all isotopes that are common between the two files. In some cases (approximately 10 isotopes) the data are off by more than a factor of two. Usually the differences can be accounted for because of differences in how the two codes (Eckerman and Fetter) calculate the DCFs. Eckerman's code treats all decay daughter isotopes with biological behavior according to their own atomic number. Fetter, on the other hand, assumes that daughter products behave biologically as prescribed by their parents atomic number. ICRP follows Fetter's prescription except for the case of parents that decay to iodine, in which case the biological behavior is like iodine. These disparities in solution methodology lead to differences in the DCFs between the two sources of a factor of two or more for isotopes of tellurium and iodine.

([redacted]) In order to select DCFs that maintained as much similarity as with those in MACCS that were used previously, the three data sources were prioritized. The priority was given in the order of MACCS, followed by Eckerman, followed by Fetter. That is, given that a DCF for a particular isotope was supplied by MACCS, it was chosen over the other two sources in every case. If the isotope was not supplied in the MACCS DCF file, then Eckerman data were given priority, followed lastly by Fetter.

([redacted]) Once the priority scheme was developed, it was necessary to select only isotopes that were included in the ORIGEN2 (Croff, 1983) output inventory so it could ensure that an inventory

[redacted]

value could be supplied for input into the MACCS code. ORIGEN2 contains 1,040 different radioactive isotopes. By taking the union of the DCF data from MACCS, Eckerman, and Fetter, and subsequently intersecting that data set with the ORIGEN2 set, 473 isotopes that could both provide DCFs and inventory values for input into MACCS were selected. Of these isotopes, 60 DCFs (the original) come from MACCS, 371 from Eckerman and 42 from Fetter.

([redacted]) MACCS determines dose estimates for four major pathways including cloudshine, groundshine, inhalation (acute and chronic) and chronic ingestion. DCFs were supplied for all 473 isotopes and all organs, utilized by MACCS, for the cloudshine, chronic ingestion, and chronic inhalation pathways. DCFs, for the acute inhalation and groundshine pathways are only defined for the original 60 MACCS isotopes.

([redacted]) Determining groundshine doses with MACCS requires the user to input two time integrated DCFs (integrated over 8 hours and 1 week) for each isotope (accounting for daughters) which it uses to approximate the dose as a function of time (this is because MACCS lacks the capability to properly model multiple parent-daughter decay chains internally). This approach approximates the time integrated DCFs required by MACCS for estimating groundshine doses for additional isotopes.

([redacted]) Acute inhalation, also, is only defined for the original 60 MACCS isotopes. Acute inhalation DCFs are used to assess emergency phase exposures based on a protracted dose. A protracted dose is the dose that delivered over 1 day, would have the same effect as the actual dose accumulated over some longer time period during which the dose contributes to early health effects. Emergency phase protracted doses are typically much smaller than the unprotracted dose estimated by health physicists for emergency phase exposures. Acute inhalation doses are calculated based on a scheme that sums a weighted inhalation dose, evaluated at several different times for several organs of interest (stomach, small intestine, lungs, red marrow, lower large intestine, and thyroid). It was not possible to provide appropriate acute inhalation DCFs for these EIS results. Unlike the groundshine doses, however, the acute inhalation DCFs do not contribute to the total life time chronic dose.

(U) These limitations are recognized, but are not felt to contribute significantly to inaccuracies in the results or conclusions. Program upgrades are in progress.

A.1.2 Radiation Consequence Calculations (U)

([redacted]) The calculations of radiation doses in MACCS is divided into two domains: early exposure during and shortly after plume passage (emergency phase) and long-term or chronic exposure (intermediate and long-term phases) after early exposure.

([redacted]) In general, the dose equation for an early exposure pathway in MACCS in a given spatial element is the product of the following quantities: radionuclide concentration, dose conversion factor, duration of exposure, and shielding factor. The quantities used in the dose equations depend on the exposure pathway. For example, for the cloud inhalation exposure pathway, these quantities are the ground level air concentration at a spatial element, inhalation dose conversion factor, duration of exposure, breathing rate, and inhalation shielding factor. The total organ dose is then determined by summing the component doses received from each pathway and each radionuclide.

([redacted]) Four long-term exposure pathways are modeled in MACCS to predict the long-term radiation exposures from the radiological releases: groundshine, resuspension inhalation, ingestion of contaminated food, and ingestion of contaminated drinking water. The dose from each of the long-term pathways is evaluated for each spatial element surrounding the reactor site. For the intermediate phase, only the groundshine and resuspension inhalation exposure pathways are considered.

(U) The long-term ingestion models are based on the simple principle that the long-term dose produced by any radionuclide to an organ via a pathway is the product of 1) the ground concentration of the nuclide, 2) the integrated transfer factor for the nuclide to human intake for the pathway, and 3) the ingestion dose conversion factor.

A.1.3 Input Data (U)

([redacted]) The meteorological data used for MACCS assumed a wind speed of 5.5 meters per second (10 ft/s) and a atmospheric stability class D. Because the tests will each be for a short duration (1000 seconds or less), the tests will be controlled such that they will only be performed when the wind is blowing in a favorable direction in order to minimize exposures to large population centers. The tests will be controlled in a method similar to underground weapons testing (DOE, 1989) such that the tests will only be conducted when conditions are favorable. The mixing height was assumed to be 2,000 meters, and the release height was assumed to be 6 meters (20 ft) [the building height was 5 meters (16.5 ft) and the stack was 1 meter (3.3 ft) above the building). These conditions represent standard modeling conditions for other test programs at DOE nuclear sites, and are conservative when compared to anticipated conditions.

([redacted]) The source term was generated by the ORIGEN2 computer code, and consists of mixed fission and activation products for normal operational releases. The fission products generated were based on operational runs of 550 MW for 500 seconds for the PIPET and mini-GTA tests and 2,000 MW for 1,000 seconds for the GTA and QTA tests. Example fission product inventories are given in Tables A.1-1 and A.1-2 of this Appendix. Similar inventories have been generated for other normal operations and accident scenarios. The releases were assumed to be released from the flare stack with the energy added by the burning hydrogen flare. Plume powers of 605 MW and 3,025 MW were used for plume rise calculations.

([redacted]) Fission product release fractions were estimated from data taken from an SNL memo (Powers, 1988) and an SNL report (Wright, 1991) describing chemical classifications which are implemented within the MACCS code. The release fractions were determined only for diffusion processes through the coatings surrounding the fuel kernel. Other phenomena, including thermal gradient driven diffusion, stress gradient controlled diffusion, grain size, porosity distribution, stoichiometry, and chemistry effects were ignored. Release fractions were calculated for a volatile group (Xe, Kr, I, Cs and Ce) and for a refractory metal group (Mo, Ba, Nb, Zr, and Sr).

TABLE A.1-1
PIPET AND MINI-GTA FISSION PRODUCT INVENTORY
(550 MW FOR 500 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
H-3	6.429E-02	Kr-85	2.156E-02
Be-10	5.759E-06	Kr-85m	6.619E+04
C-14	1.147E-08	Kr-87	7.465E+05
Na-24	1.054E+02	Kr-88	5.405E+05
Mg-27	3.598E+04	Kr-89	1.773E+07
Mg-28	7.541E-06	Rb-86	6.876E-02
Al-28	1.745E+06	Rb-86m	2.531E+02
Al-29	2.376E-10	Rb-87	8.196E-11
Cu-66	1.587E-03	Rb-88	1.202E+05
Cu-67	2.205E-10	Rb-89	4.023E+06
Zn-72	6.538E-01	Sr-87m	1.523E-01
Ga-72	3.550E-03	Sr-89	1.291E+02
Ga-73	2.078E+01	Sr-90	5.307E+00
Ge-75	3.256E+02	Sr-91	2.247E+05
Ge-77	1.240E+02	Sr-92	9.517E+05
Ge-78	5.980E+03	Sr-93	1.559E+07
As-76	2.793E-03	Y-90	1.980E+01
As-77	6.214E+01	Y-90m	1.745E+00
As-78	2.504E+02	Y-91	3.157E+00
Se-79	3.583E-06	Y-91m	6.524E+03
Se-81	2.270E+05	Y-92	1.412E+04
Se-81m	3.022E+03	Y-93	8.773E+04
Se-83	2.027E+05	Y-94	6.085E+06
Br-80	4.969E-01	Y-95	1.164E+07
Br-80m	2.836E-02	Zr-93	2.351E-07
Br-82	1.060E+00	Zr-95	4.066E+02
Br-83	5.197E+04	Zr-97	1.528E+05
Br-84	4.218E+05	Nb-92	3.911E-23
Kr-81	4.124E-13	Nb-93m	3.481E-08
Kr-83m	1.132E+03	Nb-94	1.459E-09

[redacted]

TABLE A.1-1 (con't)
PIPET AND MINI-GTA FISSION PRODUCT INVENTORY
(550 MW FOR 500 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
Nb-94m	1.214E+00	Ag-108	2.404E-05
Nb-95	2.525E-02	Ag-108m	2.228E-12
Nb-95m	6.605E-01	Ag-109m	6.014E+02
Nb-96	1.117E+01	Ag-110	1.189E-01
Nb-97	1.234E+04	Ag-110m	3.180E-07
Nb-97m	1.512E+05	Ag-111	2.591E+00
Nb-98	2.679E+07	Ag-112	2.994E+01
Nb-98m	1.328E+04	Ag-115	1.186E+04
Mo-99	3.791E+04	Cd-109	1.930E-16
Mo-101	7.435E+06	Cd-113m	4.213E-04
Tc-98	1.983E-17	Cd-115	3.436E+01
Tc-99	1.357E-07	Cd-115m	4.334E-01
Tc-99m	2.632E+02	Cd-117	1.532E+03
Tc-101	1.408E+06	Cd-117m	6.799E+02
Tc-104	1.793E+06	In-113m	9.162E-07
Ru-103	1.174E+03	In-114	8.215E-05
Ru-105	2.310E+04	In-114m	6.561E-09
Ru-106	1.824E+01	In-115	8.243E-21
Rh-102	4.925E-14	In-115m	3.551E-01
Rh-103m	5.060E+01	In-116	9.657E-02
Rh-104	3.067E-01	In-116m	9.741E-03
Rh-104m	1.291E-01	In-117	3.021E+01
Rh-105	8.359E+01	In-117m	3.896E+01
Rh-105m	6.473E+03	In-119m	5.880E+03
Rh-106m	4.049E+00	Sn-117m	8.946E-06
Rh-107	8.891E+04	Sn-119m	3.797E-02
Pd-107	5.677E-08	Sn-121	2.494E+02
Pd-109	6.017E+02	Sn-121m	8.076E-06
Pd-111	2.242E+04	Sn-123	7.373E-01
Pd-111m	1.659E+01	Sn-123m	1.038E+04

[redacted]

TABLE A.1-1 (con't)
PIPET AND MINI-GTA FISSION PRODUCT INVENTORY
(550 MW FOR 500 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
Sn-125	2.957E+01	I-130	6.466E+00
Sn-126	3.643E-05	I-131	7.985E+01
Sn-127	2.092E+04	I-132	4.193E+03
Sn-128	1.588E+05	I-133	1.919E+04
Sb-122	4.626E-04	I-134	5.406E+05
Sb-124	3.353E-03	I-135	4.056E+05
Sb-124m	3.008E+01	Xe-133	3.105E+00
Sb-125	1.107E-01	Xe-133m	3.580E+01
Sb-126	1.433E+00	Xe-135	2.727E+03
Sb-126m	6.056E+02	Xe-135m	2.566E+05
Sb-127	1.583E+02	Xe-137	2.068E+07
Sb-128	7.827E+02	Xe-138	9.581E+06
Sb-129	4.022E+04	Cs-132	5.382E-09
Sb-130	1.349E+05	Cs-134	3.492E-04
Sb-131	2.461E+06	Cs-134m	4.087E+00
Te-123	5.517E-22	Cs-135	2.153E-08
Te-123m	2.283E-08	Cs-135m	2.970E+02
Te-125m	4.454E-05	Cs-136	1.023E+01
Te-127	3.123E+00	Cs-137	4.914E+00
Te-127m	1.544E-02	Cs-138	1.172E+06
Te-129	6.599E+03	Cs-139	1.227E+07
Te-129m	6.852E+00	Ba-135m	4.639E-03
Te-131	3.564E+05	Ba-139	4.817E+05
Te-131m	3.067E+03	Ba-140	7.273E+03
Te-132	1.673E+04	Ba-141	6.933E+06
Te-133	4.746E+06	Ba-142	1.107E+07
Te-133m	1.326E+06	La-138	2.759E-14
Te-134	3.984E+06	La-140	7.400E+01
I-128	1.121E+01	La-141	9.079E+04
I-129	2.749E-09	La-142	3.956E+05

TABLE A.1-1 (con't)
PIPET AND MINI-GTA FISSION PRODUCT INVENTORY
(550 MW FOR 500 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
La-143	8.827E+06	Eu-152m	4.949E-03
Ce-141	3.895E+00	Eu-154	1.037E-05
Ce-143	1.413E+04	Eu-155	3.819E-02
Ce-144	3.029E+02	Eu-156	1.476E-01
Pr-142	8.272E-04	Eu-157	5.731E+01
Pr-142m	4.586E-02	Eu-158	2.691E+02
Pr-143	1.461E+00	Gd-152	3.818E-15
Pr-144	1.680E+02	Gd-153	7.512E-10
Pr-145	1.461E+05	Gd-159	2.837E+00
Pr-147	3.006E+06	Gd-161	4.622E+02
Nd-144	2.148E-17	Tb-160	2.463E-05
Nd-147	4.912E+02	Tb-161	1.695E-01
Nd-149	1.742E+05	Dy-165	5.476E-01
Nd-151	7.130E+05	Dy-166	1.184E-02
Pm-146	2.875E-12	Ho-166	7.423E-05
Pm-147	6.232E-04	Ho-166m	1.253E-10
Pm-148	1.740E-02	Er-169	1.763E-11
Pm-148m	3.265E-04	Th-228	8.005E-19
Pm-149	1.251E+02	Th-229	6.042E-19
Pm-150	8.308E+01	Th-230	8.679E-17
Pm-151	1.328E+03	Th-231	4.297E-05
Sm-146	2.472E-20	Th-232	1.892E-20
Sm-147	4.769E-16	Th-233	8.292E-11
Sm-148	1.564E-23	Th-234	2.225E-08
Sm-151	5.861E-05	Pa-231	7.205E-15
Sm-153	4.521E+02	Pa-232	2.029E-11
Sm-155	3.300E+04	Pa-233	3.873E-15
Sm-156	6.584E+02	Pa-234	1.587E-10
Eu-150	1.392E-08	U-231	1.477E-13
Eu-152	9.507E-07	U-232	4.181E-13

TABLE A.1-1 (con't)
PIPET AND MINI-GTA FISSION PRODUCT INVENTORY
(550 MW FOR 500 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
U-233	8.074E-10	Np-239	1.279E+02
U-234	1.217E-06	Np-240	3.459E-01
U-235	1.141E-02	Pu-236	1.337E-17
U-236	4.841E-05	Pu-237	1.137E-14
U-237	5.693E+00	Pu-238	3.790E-14
U-238	1.337E-04	Pu-239	1.984E-08
U-239	1.444E+05	Pu-240	4.604E-10
U-240	1.067E-01	Pu-241	1.115E-10
Np-235	2.750E-16	Pu-242	3.915E-19
Np-236	1.815E-19	Pu-243	1.699E-14
Np-237	1.184E-11	Am-241	4.828E-19
Np-238	5.801E-07	Am-242	2.823E-17

TABLE A.1-2
GTA FISSION PRODUCT INVENTORY
(2000 MW FOR 1000 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
H-3	5.204E-01	Kr-83m	2.194E+04
Be-10	4.189E-05	Kr-85	2.497E-01
Na-24	7.640E+02	Kr-85m	6.555E+05
Mg-27	2.019E+05	Kr-87	5.628E+06
Mg-28	6.328E-05	Kr-88	3.930E+06
Al-28	6.827E+06	Kr-89	7.506E+07
Al-29	3.982E-09	Rb-86	5.349E-01
Si-31	3.955E-16	Rb-86m	9.233E+02
Cu-66	7.632E-03	Rb-87	1.371E-09
Cu-67	1.660E-09	Rb-88	1.305E+06
Zn-69	7.849E-16	Rb-89	3.359E+07
Zn-72	4.795E+00	Sr-87m	1.089E+00
Ga-72	4.220E-02	Sr-89	2.414E+03
Ga-73	1.554E+02	Sr-90	5.281E+01
Ge-75	2.827E+03	Sr-91	1.792E+06
Ge-77	9.492E+02	Sr-92	6.841E+06
Ge-78	4.240E+04	Sr-93	8.331E+07
As-76	2.036E-02	Y-90	1.439E+02
As-77	5.028E+02	Y-90m	1.249E+01
As-78	3.082E+03	Y-91	5.852E+01
Se-79	7.153E-05	Y-91m	1.132E+05
Se-81	1.522E+06	Y-92	1.936E+05
Se-81m	2.093E+04	Y-93	1.015E+06
Se-83	1.328E+06	Y-94	4.245E+07
Br-80	3.132E+00	Y-95	6.901E+07
Br-80m	2.040E-01	Zr-93	5.534E-06
Br-82	9.024E+00	Zr-95	5.167E+03
Br-83	4.433E+05	Zr-97	1.110E+06
Br-84	3.869E+06	Nb-92	3.915E-22
Kr-81	3.032E-12	Nb-93m	2.532E-07

[redacted]

TABLE A.1-2 (con't)
GTA FISSION PRODUCT INVENTORY
(2000 MW FOR 1000 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
Nb-94	1.217E-08	Pd-111m	1.257E+02
Nb-94m	6.170E+00	Ag-108	1.099E-04
Nb-95	4.915E-01	Ag-108m	1.620E-11
Nb-95m	4.822E+00	Ag-109m	6.435E+03
Nb-96	8.107E+01	Ag-110	2.108E+00
Nb-97	1.348E+05	Ag-110m	3.254E-06
Nb-97m	1.165E+06	Ag-111	8.655E+01
Nb-98	9.739E+07	Ag-112	2.602E+02
Nb-98m	9.145E+04	Ag-115	8.016E+04
Mo-99	2.838E+05	Cd-109	2.746E-15
Mo-101	4.586E+07	Cd-113m	3.591E-03
Tc-98	3.964E-16	Cd-115	3.400E+02
Tc-99	2.023E-06	Cd-115m	3.513E+00
Tc-99m	3.921E+03	Cd-117	1.185E+04
Tc-101	1.611E+07	Cd-117m	5.095E+03
Tc-104	1.286E+07	In-113m	6.476E-06
Ru-103	8.895E+03	In-114	3.013E-04
Ru-105	3.241E+05	In-114m	4.772E-08
Ru-106	1.425E+02	In-115	1.830E-19
Rh-102	2.447E-12	In-115m	6.401E+00
Rh-103m	8.560E+02	In-116	3.562E-01
Rh-104	1.421E+00	In-116m	6.749E-02
Rh-104m	5.996E-01	In-117	4.753E+02
Rh-105	1.104E+03	In-117m	6.445E+02
Rh-105m	9.076E+04	In-119m	5.764E+04
Rh-106m	5.996E+01	Sn-117m	2.942E-04
Rh-107	8.847E+05	Sn-119m	7.514E-01
Pd-107	1.252E-06	Sn-121	2.013E+03
Pd-109	6.438E+03	Sn-121m	5.873E-05
Pd-111	1.597E+05	Sn-123	5.637E+00

[redacted]

TABLE A.1-2 (con't)
GTA FISSION PRODUCT INVENTORY
(2000 MW FOR 1000 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
Sn-123m	7.256E+04	I-129	4.057E-08
Sn-125	2.155E+02	I-130	4.981E+01
Sn-126	2.655E-04	I-131	1.655E+03
Sn-127	1.490E+05	I-132	3.296E+04
Sn-128	1.102E+06	I-133	2.379E+05
Sb-122	3.917E-03	I-134	5.441E+06
Sb-124	2.598E-02	I-135	2.973E+06
Sb-124m	1.121E+02	Xe-133	2.274E+01
Sb-125	1.355E+00	Xe-133m	4.802E+02
Sb-126	1.051E+01	Xe-135	2.258E+04
Sb-126m	3.827E+03	Xe-135m	1.645E+06
Sb-127	1.585E+03	Xe-137	9.362E+07
Sb-128	5.662E+03	Xe-138	5.816E+07
Sb-129	3.655E+05	Cs-132	5.413E-08
Sb-130	9.151E+05	Cs-134	2.618E-03
Sb-131	1.640E+07	Cs-134m	2.924E+01
Te-123	4.011E-21	Cs-135	2.101E-07
Te-123m	1.660E-07	Cs-135m	2.048E+03
Te-125m	3.351E-04	Cs-136	7.438E+01
Te-127	2.995E+01	Cs-137	5.090E+01
Te-127m	1.166E-01	Cs-138	1.271E+07
Te-129	5.948E+04	Cs-139	7.220E+07
Te-129m	5.284E+01	Ba-135m	3.368E-02
Te-131	4.018E+06	Ba-139	5.902E+06
Te-131m	2.421E+04	Ba-140	5.889E+04
Te-132	1.438E+05	Ba-141	4.486E+07
Te-133	3.264E+07	Ba-142	6.380E+07
Te-133m	9.196E+06	La-138	2.007E-13
Te-134	2.714E+07	La-140	6.235E+02
I-128	7.310E+01	La-141	1.209E+06

[redacted]

TABLE A.1-2 (con't)
GTA FISSION PRODUCT INVENTORY
(2000 MW FOR 1000 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
La-142	4.671E+06	Eu-150	1.387E-07
La-143	5.435E+07	Eu-152	9.462E-06
Ce-141	1.056E+02	Eu-152m	4.885E-02
Ce-143	1.826E+05	Eu-154	7.782E-05
Ce-144	2.381E+03	Eu-155	5.509E-01
Pr-142	6.694E-03	Eu-156	1.855E+00
Pr-142m	2.790E-01	Eu-157	7.431E+02
Pr-143	3.861E+01	Eu-158	2.686E+03
Pr-144	1.471E+03	Gd-152	7.502E-14
Pr-145	1.483E+06	Gd-153	5.688E-09
Pr-147	1.973E+07	Gd-159	4.507E+01
Nd-144	1.601E-16	Gd-161	2.157E+03
Nd-147	8.173E+03	Tb-160	1.792E-04
Nd-149	1.556E+06	Tb-161	1.831E+00
Nd-151	4.239E+06	Dy-165	4.522E+00
Pm-146	1.757E-10	Dy-166	8.655E-02
Pm-147	2.439E-02	Ho-166	6.969E-04
Pm-148	1.273E-01	Ho-166m	9.116E-10
Pm-148m	2.435E-03	Er-169	2.427E-10
Pm-149	2.436E+03	Tm-170	7.262E-19
Pm-150	6.196E+02	Ac-227	5.132E-20
Pm-151	1.673E+04	Th-228	1.602E-17
Sm-146	2.475E-19	Th-229	8.788E-18
Sm-147	3.469E-15	Th-230	1.262E-15
Sm-148	2.187E-22	Th-231	4.533E-04
Sm-151	1.478E-03	Th-232	2.753E-19
Sm-153	6.143E+03	Th-233	1.560E-09
Sm-155	2.291E+05	Th-234	2.352E-07
Sm-156	4.894E+03	Pa-231	1.521E-13

[redacted]

TABLE A.1-2 (con't)
GTA FISSION PRODUCT INVENTORY
(2000 MW FOR 1000 SECONDS) ([redacted])

Isotope	Curies	Isotope	Curies
Pa-232	5.893E-10	Np-238	1.334E-05
Pa-233	1.456E-13	Np-239	1.722E+03
Pa-234	3.337E-09	Np-240	6.385E+00
U-231	1.477E-12	Pu-236	6.042E-16
U-232	4.184E-12	Pu-237	4.340E-13
U-233	5.871E-09	Pu-238	1.565E-12
U-234	8.850E-06	Pu-239	5.442E-07
U-235	6.028E-02	Pu-240	1.603E-08
U-236	3.521E-04	Pu-241	5.396E-09
U-237	5.026E+01	Pu-242	2.642E-17
U-238	7.064E-04	Pu-243	1.588E-12
U-239	9.359E+05	Am-241	4.736E-17
U-240	9.866E-01	Am-242	3.606E-15
Np-235	6.327E-15	Am-242m	5.071E-21
Np-236	4.176E-18	Am-243	6.069E-22
Np-237	2.025E-10		

[redacted]

([redacted]) Ideally, a consequence modeler would like to have the capability to input a release fraction for each isotope produced from the fission reactions which number approximately 1,700. This task can be considerably reduced by assuming that all isotopes of a common element interact chemically in the same manner. However, this still leaves some 100 elements to which release fractions must be assigned. The MACCS consequence code further reduces this task by combining the elements into nine chemically similar groups. The ten elements specified in the release fraction data provide representatives for six of the nine chemical groups prescribed within MACCS.

([redacted]) This release fraction data have different values for elements than MACCS groups into the same chemical category. For example, Ce is estimated to have a release fraction of approximately 5% while Zr was estimated at approximately 0.04%. The dilemma is which element does one chose to represent the MACCS chemical group (group 8) when their release fractions differ by more than two orders of magnitude. The group classification of Ce was changed from tetravalent-lanthanide (group 8) to a halogen (group 2). Other cases of double release fractions for similar groups showed less than an order of magnitude of difference.

([redacted]) Given the sparsity and conflicts present within the available data, the following release fractions were assumed for the operational calculations:

a)	Nobles (group 1)	8.0%
b)	Halogens and Volatiles (groups 2 and 3)	5.0%
c)	All Others (groups 4 thru 9)	0.4%

Group 1 and 2 were assigned the highest release fraction of representative elements within their respective groups. Groups 4 thru 9 are typically thought of as non-volatile and were assigned the highest release inventory of the refractory elements (Mo).

([redacted]) In addition to fuel particle releases, ETS retention fractions of 99.9% for particulates and 99.5% for volatiles were used to estimate operational releases. The volatile retention fraction was applied to groups 1 and 2 while the particulate retention fraction was applied to groups 3 thru 9. Operational results were determined for four different hold up times including no hold-up (no cryo-bed), finite hold-up for 1 hour and 1 day and infinite hold-up, where the volatiles trapped within the cryo-bed are assumed to be recovered and treated as waste. The finite hold-up times were treated as two plumes consisting of the infinite hold-up release followed later by a second plume containing the decayed volatiles. The operational release fractions for each group and hold-up class are given below.

(U)	No Hold-up		Finite Hold-up (2nd Plume, Volatiles only)		Infinite Hold-up	
(U)	Group	Fraction	Group	Fraction	Group	Fraction
	1	8.0×10^{-2}	1	7.96×10^{-2}	1	4.0×10^{-4}
	2	5.0×10^{-2}	2	4.975×10^{-2}	2	2.5×10^{-4}
	3	5.0×10^{-5}			3	5.0×10^{-5}
	4-9	4.0×10^{-6}			4-9	4.0×10^{-6}

[redacted]

(U) The population within an 80 kilometer (50 mile) radius of each site was taken from 1990 sources. Population data for NTS were taken from an EPA census (Thome, 1991a) describing all population centers (including individuals at ranch sites) out to 150 km (90 mi) from the site. The population data were given in terms of longitude, latitude and the number of people at that coordinate. These data were converted to place each population center in a specific sector. Summing all entries for each sector gives the total population for that sector.

(U) Crop fractional breakdown data were gathered from Thome (1991b) for NTS and is used directly in this analysis.

(U) INEL population data (1990 census) were taken from (DOE, 1991c). The data specified a total population for an 80 km (50 mi) radius, and the population of each major city within that distance. A sector map was provided with the cities in the appropriate sectors. This map was used directly to place city populations within the appropriate sectors. The difference between the total population and the sum of all city populations was attributed to a rural population and was added to each sector by weighing the rural population with the ratio of each sector area to the total area within the 80 km radius.

(U) The two different test locations within INEL were considered independently. However, since the largest cities within 80 km of either location were included in the site data, population doses do not differ significantly between the locations. A single population dose analysis was used for both locations.

(U) Crop breakdown data for INEL were taken from Hardinger (1990). The data specified total acreage devoted to farming and specific acreages devoted to each crop category. The fractions of each category were determined by dividing the individual crop category acreages by the total acreage devoted to farming.

(U) The common input parameters used in all analyses are summarized in Table A.1-3.

(U) The following exposure pathways were considered for the atmospheric dose assessment:

1. (U) Cloudshine--External dose from radioactive materials transported through the atmosphere during the cloud passage.

2. (U) Groundshine--External dose from radioactive materials deposited on the ground.

3. (U) Inhalation--Internal dose from inhalation of radioactive materials transported through the atmosphere during the cloud passage

4. (U) Resuspension--Internal dose from inhalation of radioactive materials resuspended in the air after initial deposition on the ground.

5. (U) Food Ingestion--Internal dose from ingestion of contaminated foodstuffs.

6. (U) Water Ingestion--Internal dose from ingestion of contaminated water.

([redacted]) The doses to the individual and collective doses to the population 80 km (50 mi) downwind of the release points that would result from normal operation of the [redacted] facility at NTS and INEL are presented in Figures A.1-2 - A.1-22 (legend for multiline graph corresponds to order of lines along right side). Total program dose is based on an assumed experimental level of 40 PIPET/Mini-GTA runs, 20 GTA runs, and 1 QTA run (as indicated in Chapter 2).

(U) All radiological consequence analyses presented in Figures A.1-2 - A.1-22 incorporate the following assumptions:

([redacted]) • PIPET & Mini-GTA - 550 MW for 500 seconds, 1 day cryo-bed holdup,

([redacted]) • GTA - 2,000 MW for 1,000 seconds, 1 day cryo-bed holdup, and

([redacted]) • QTA - 2,000 MW for 1,000 seconds, no ETS utilized.

([redacted]) The ETS was assumed operational for all test system operations. Use of the ETS was not assumed for the QTA test nor postulated for accident releases.

(U) All radiological impact assessments assume a one day holdup of those radionuclides captured on the ETS cryo-bed. Release of these radionuclides is assumed following the holdup (decay) period.

A.1.4 Radiation-Induced Health Effects (U)

([redacted]) Radiation can affect human health by causing cancer, genetic disorders, and other health problems. The Committee on Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences has published a detailed review of available data on radiation-induced health effects (BEIR, 1990).

(U) Health effects estimators for low linear energy transfer (low-LET) radiation were derived for use in estimating health effects based on an evaluation of the data presented in the BEIR V report. The resulting health effects estimators used in this EIS total 795 cancer fatalities per million person-rem for low-LET radiation. The health effects estimate for genetic effects used in this EIS is 260 genetic effects per million person-rem of radiation for low-LET radiation (range of 100-200 genetic effects per 1 million person-rem). The health effects estimators used could vary widely, depending on the models used. The values used in this analysis are 7.9 x 10^{-4} cancer fatalities/person-rem (CEDE) and 2.6 x 10^{-4} genetic effect/person-rem (CEDE).

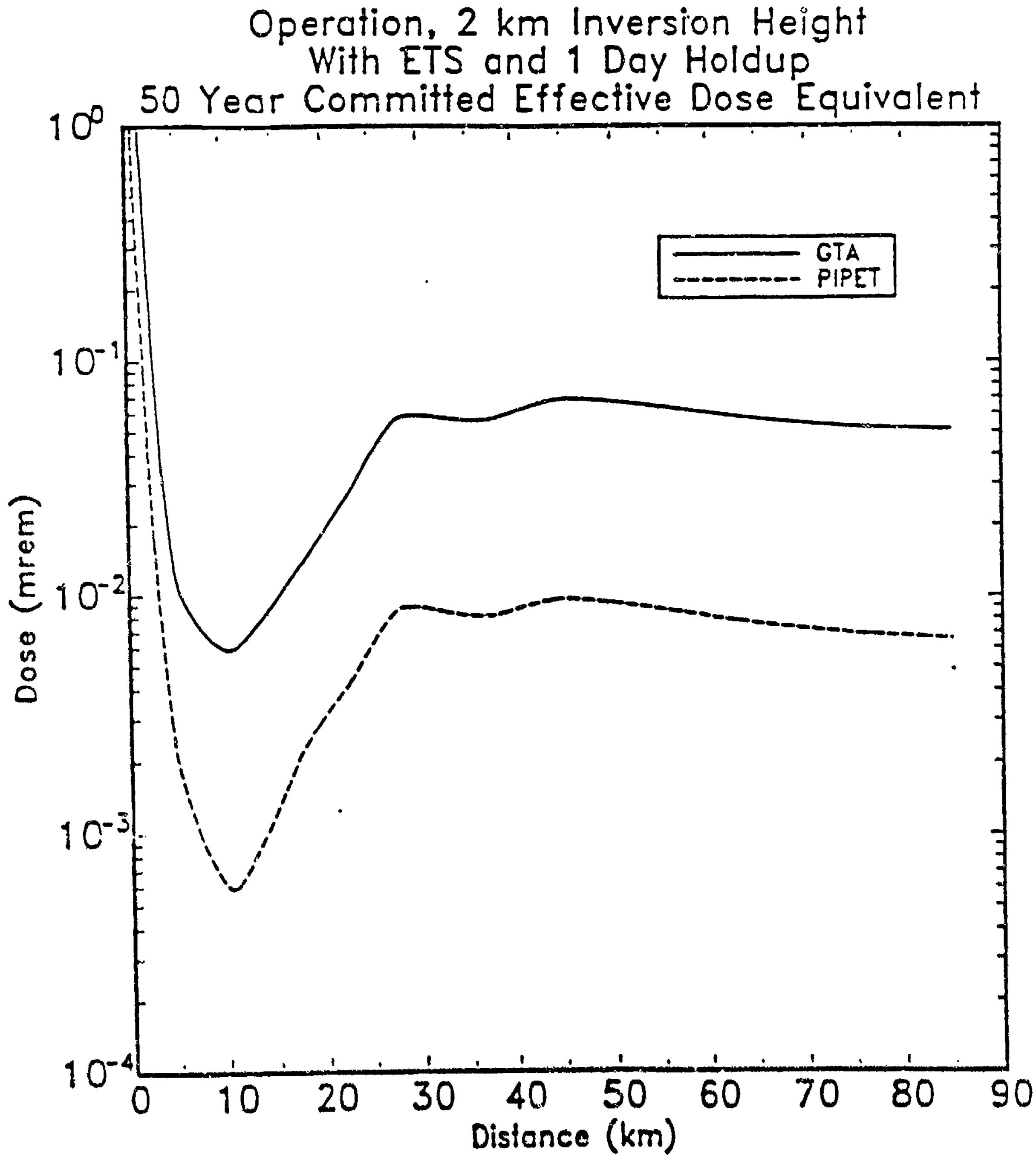
TABLE A.1-3 ([redacted])
COMMON PARAMETERS USED TO CALCULATE DOSES IMPARTED TO THE MAXIMALLY EXPOSED INDIVIDUAL AND POPULATION FROM ROUTINE RELEASES

PARAMETER	VALUE
GENERAL DATA	
Number of sectors	[illegible]
Number of radial spatial elements	[illegible]
OPERATIONAL RELEASE DATA	
Number of plume segments	[illegible]
Height of plume at release	6 meters
Building width	[illegible] meters
Building height	5 meters
Particle size	1 micrometer AMAD*
DEPOSITION DATA	
Washout coefficient-linear factor	1.5 x 10[illegible]
Washout coefficient - exponential factor	0.5
Particle deposition velocity	[illegible] meters/second
Surface roughness	1.27
METEOROLOGICAL DATA	
Boundary mixing layer height	[illegible] meters
Boundary weather stability class	D
Boundary rain rate	0 mm/hour
Boundary wind speed	[illegible] meters/second
RADIOLOGICAL DATA	
Number of isotopes released	[illegible]
Number of isotope groups	[illegible]

PARAMETER	VALUE
[illegible]	
Population distribution	specified
Population density	N/A
Spatial interval at which population begins	20 km
Number of organs defined for health effects	9
Names of organs	[illegible]
Breathing rate	[illegible]
Resuspension factor	1×10^{-6}/m

[redacted]

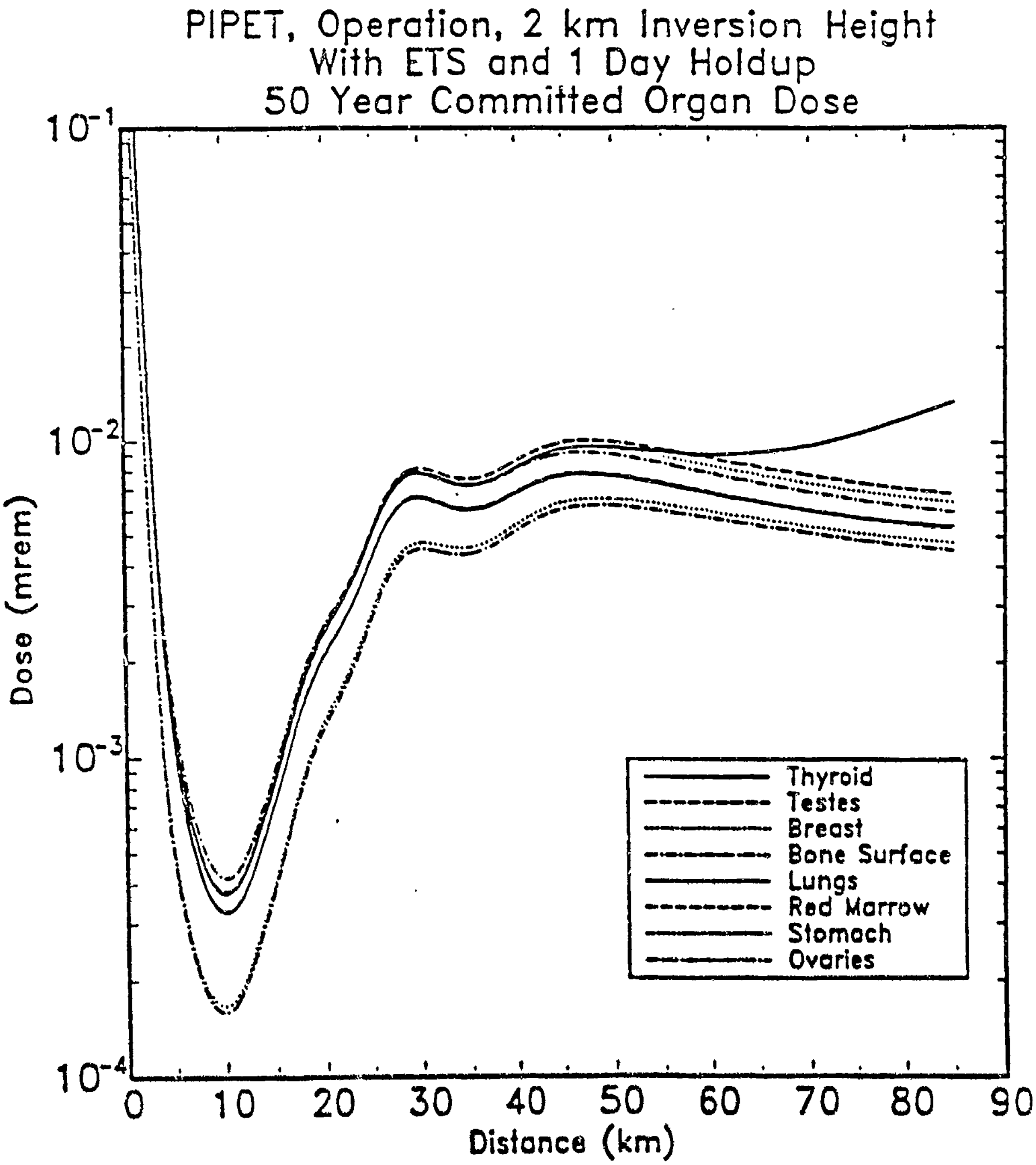
Figure A.1-2 (U)



[redacted]

[redacted]

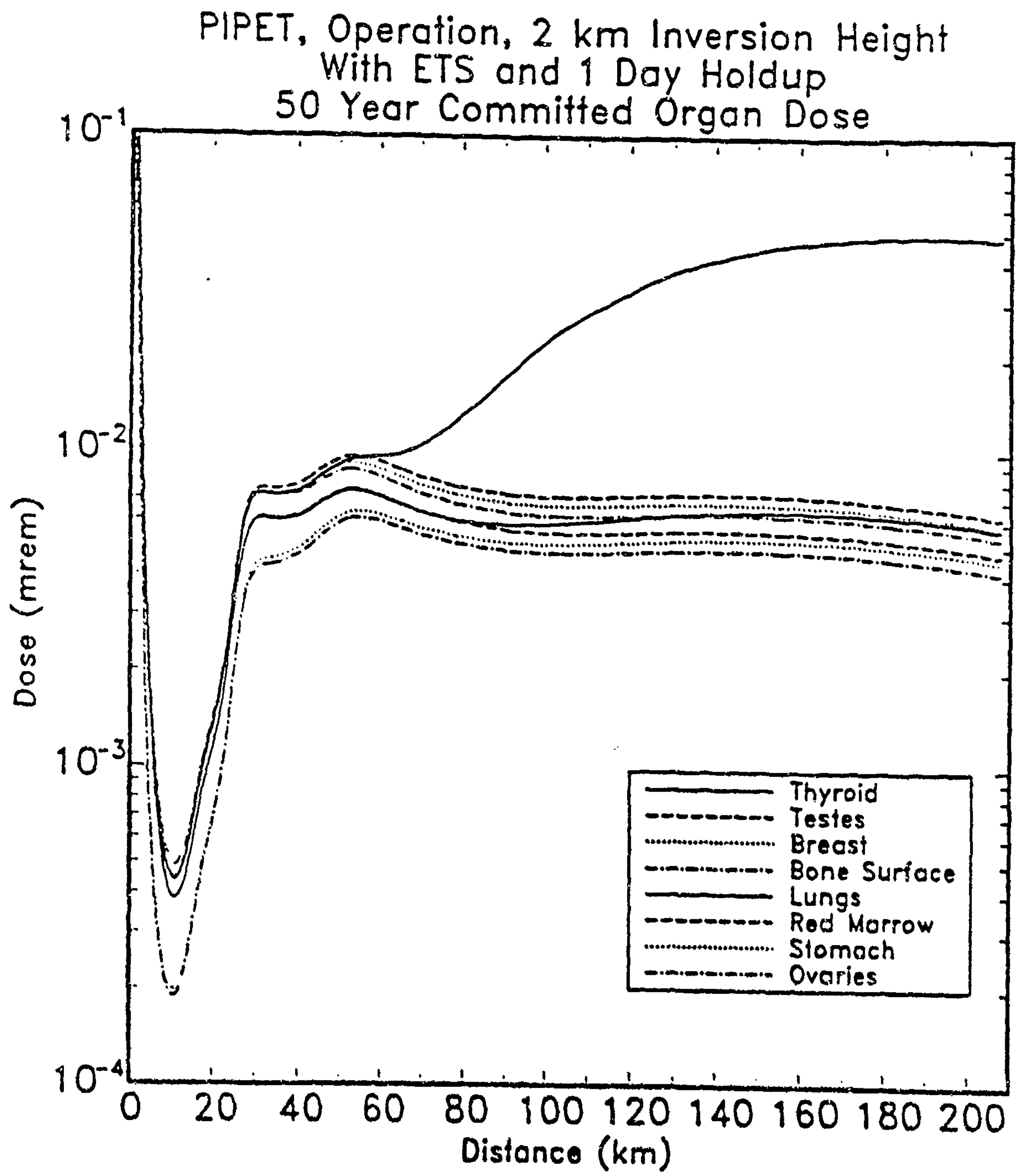
Figure A.1-3 (U)



[redacted]

[redacted]

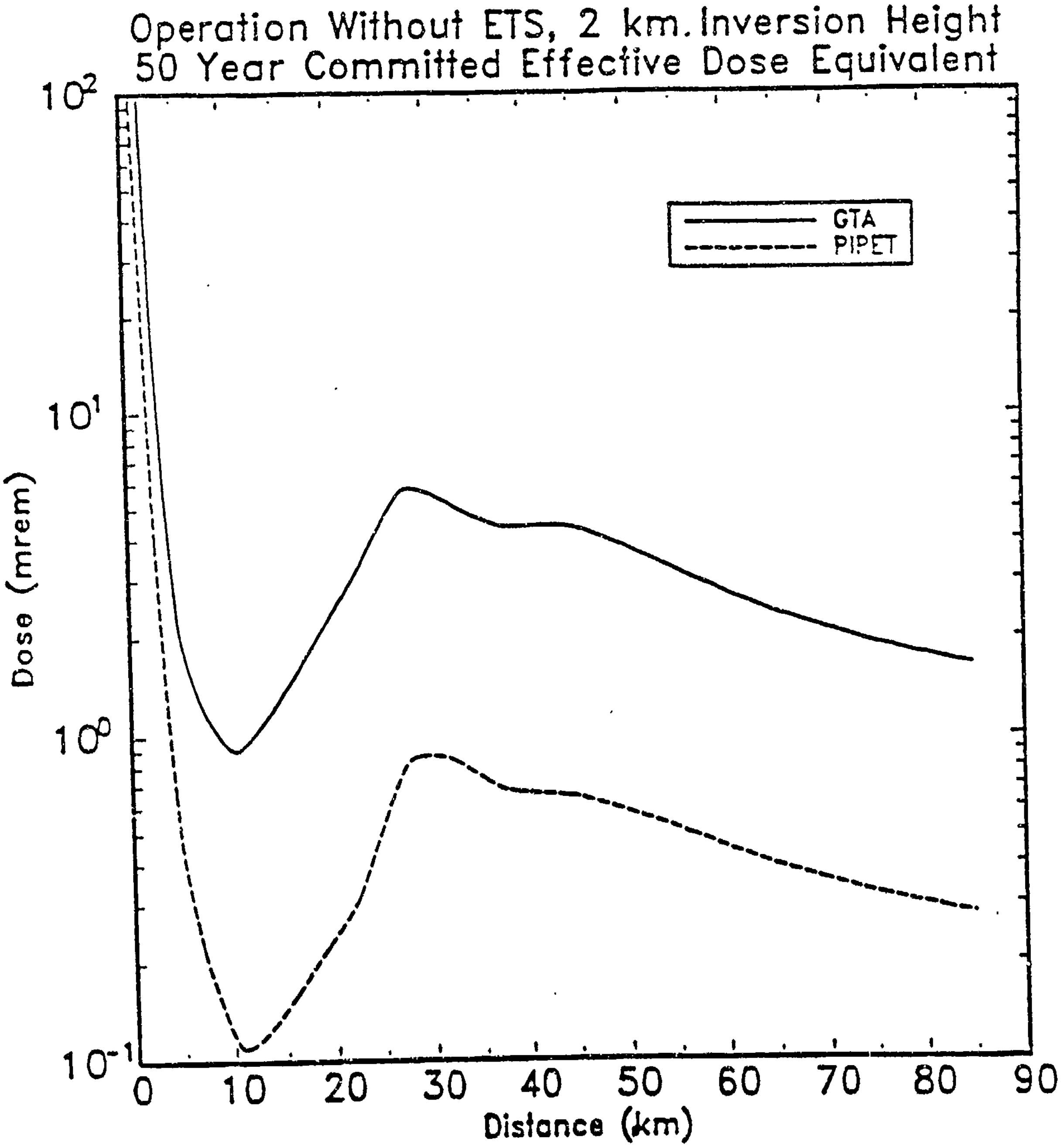
Figure A.1-4 (U)



[redacted]

[redacted]

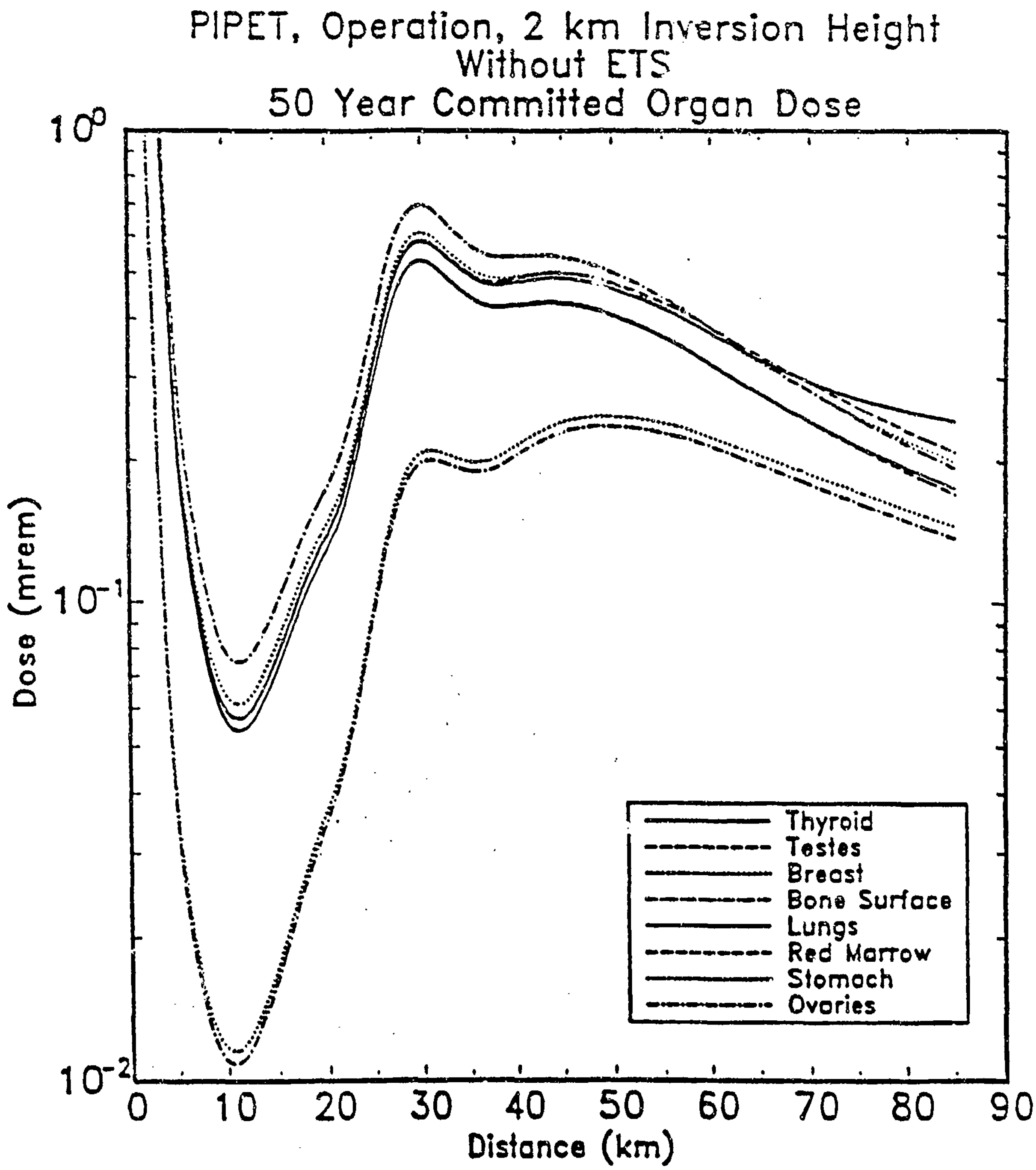
Figure A.1-5 (U)



[redacted]

[redacted]

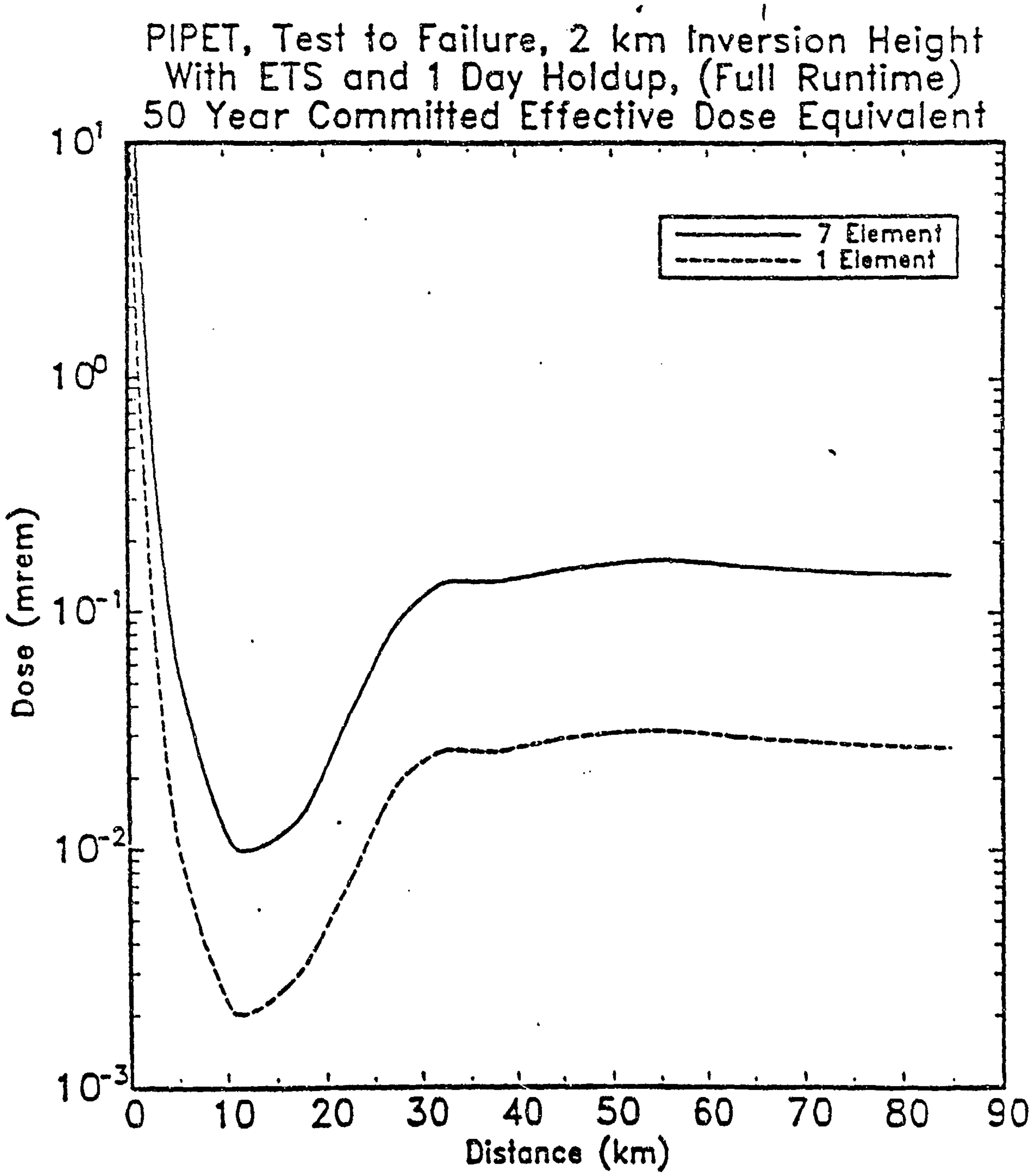
Figure A.1-6 (U)



[redacted]

[redacted]

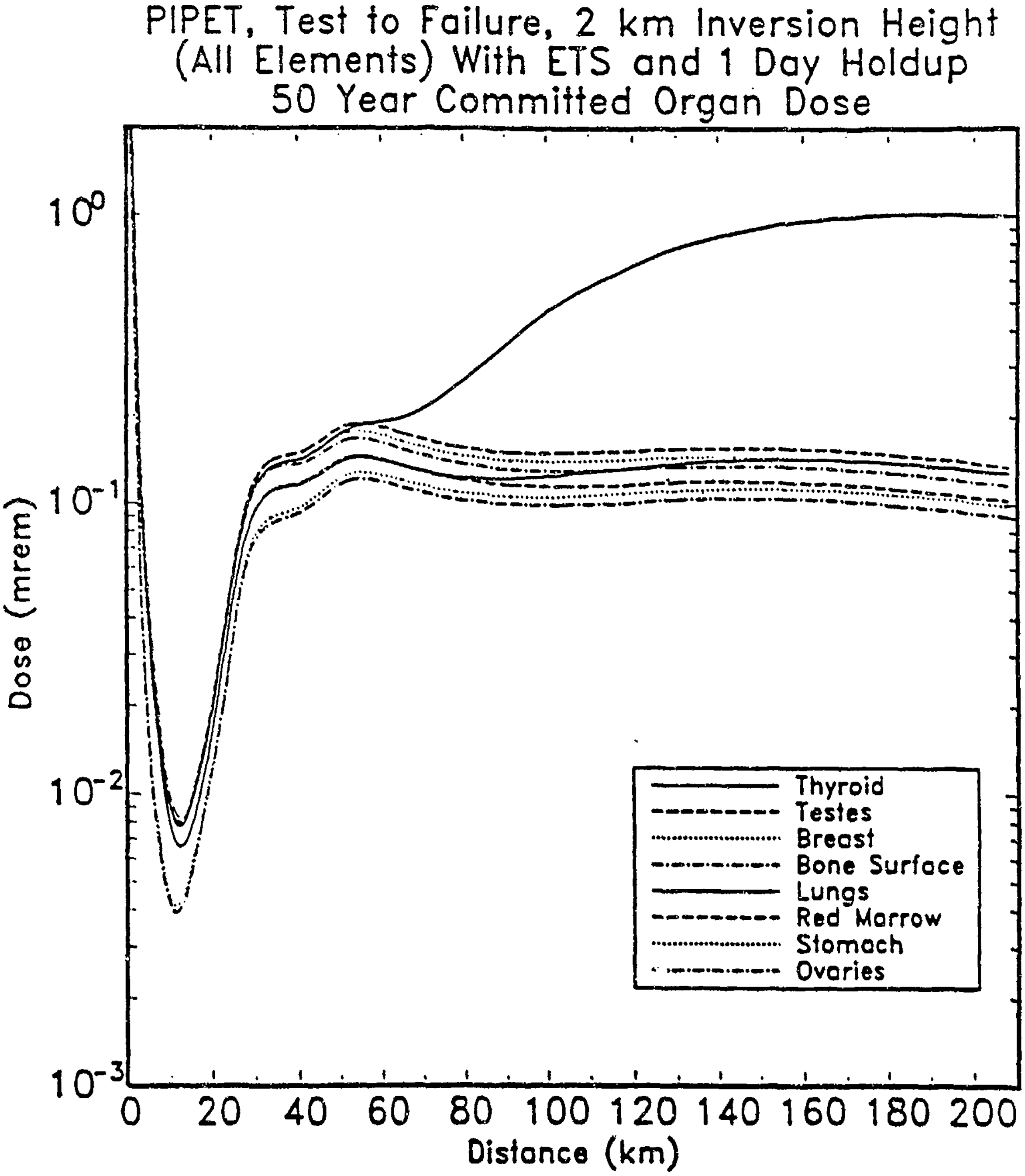
Figure A.1-7 [redacted]



[redacted]

[redacted]

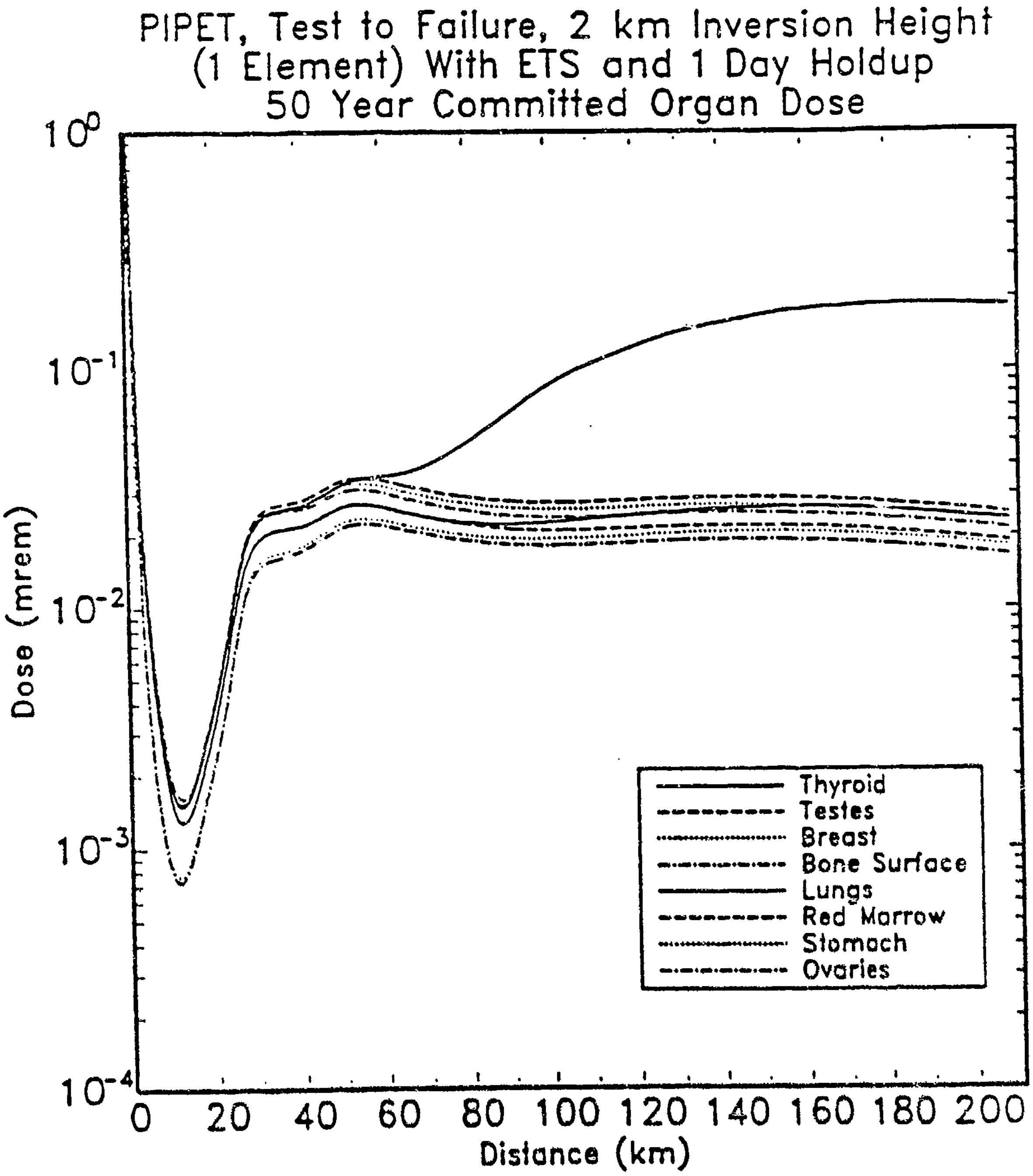
Figure A.1-8 (U)



[redacted]

[redacted]

Figure A.1-9 (U)

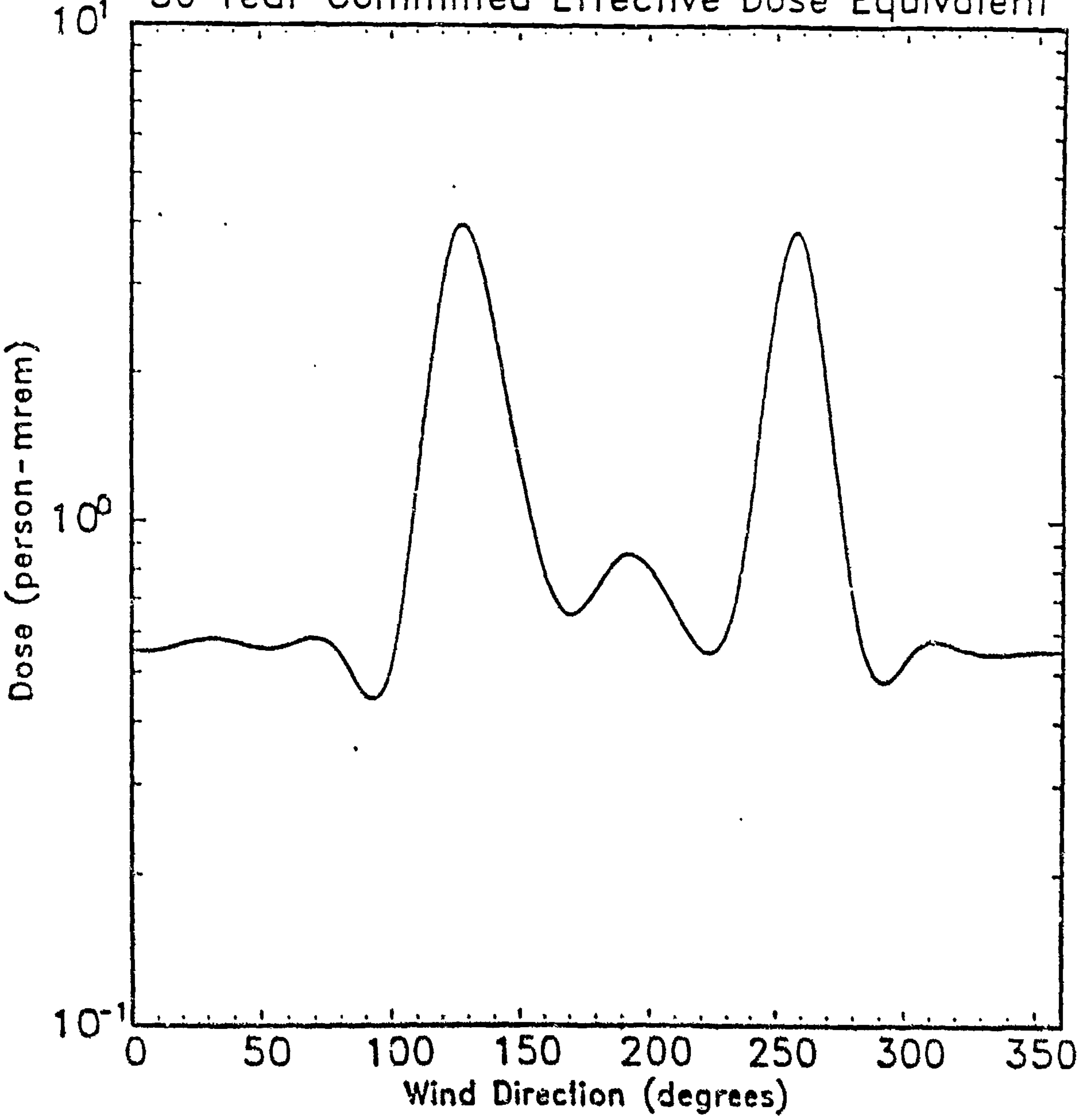


[redacted]

[redacted]

Figure A.1-10 (U)

PIPET, Operation, 2 km Inversion Height
With ETS and 1 Day Holdup
Total Population Dose at NTS
50 Year Committed Effective Dose Equivalent



Measured Clockwise from North = 0

[redacted]

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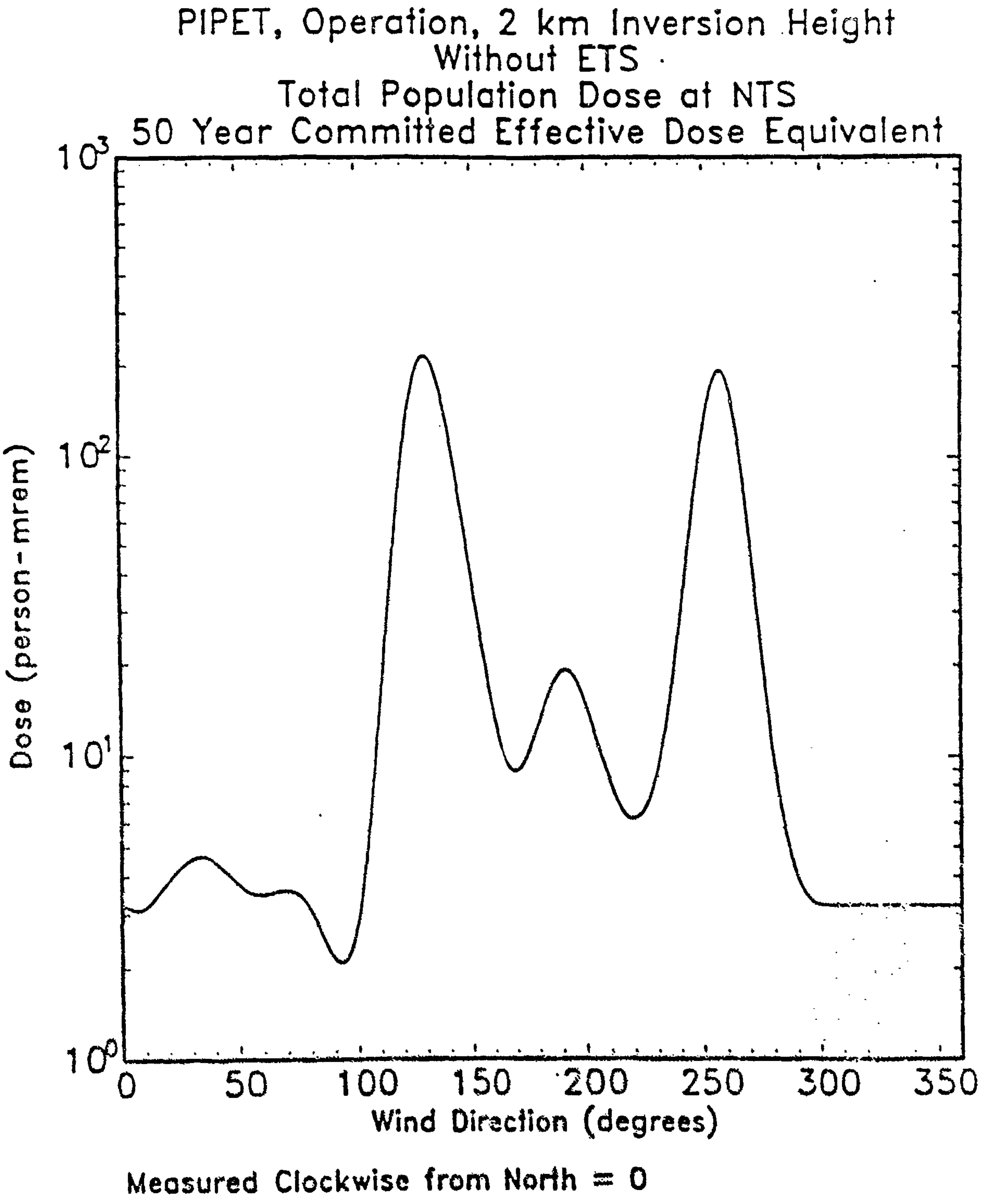
Figure A.1-11 (U)

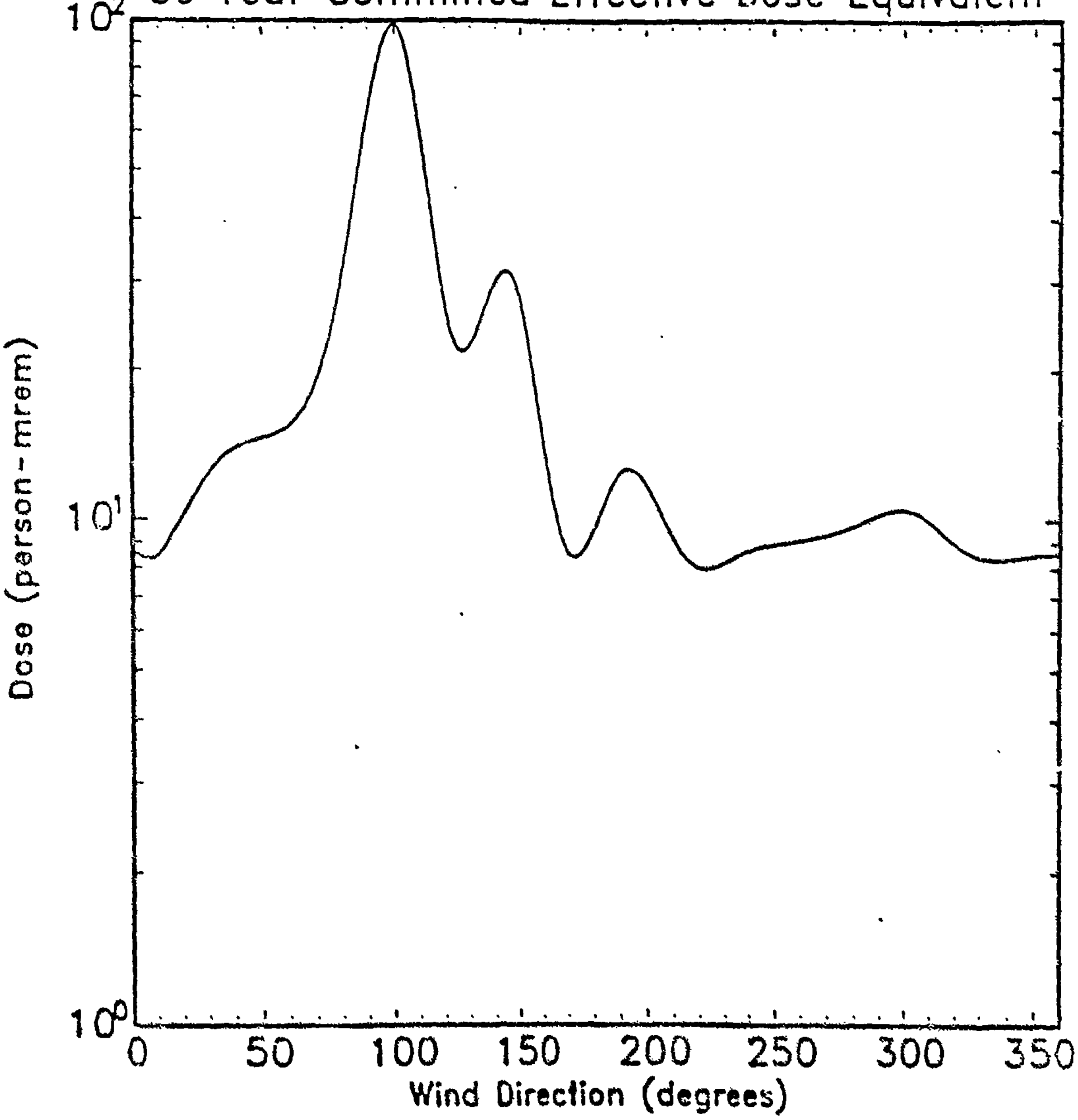


[redacted]

[redacted]

Figure A.1-12 (U)

PIPET, Operation, 2 km Inversion Height
With ETS and 1 Day Holdup
Total Population Dose at INEL
50 Year Committed Effective Dose Equivalent



Measured Clockwise from North = 0

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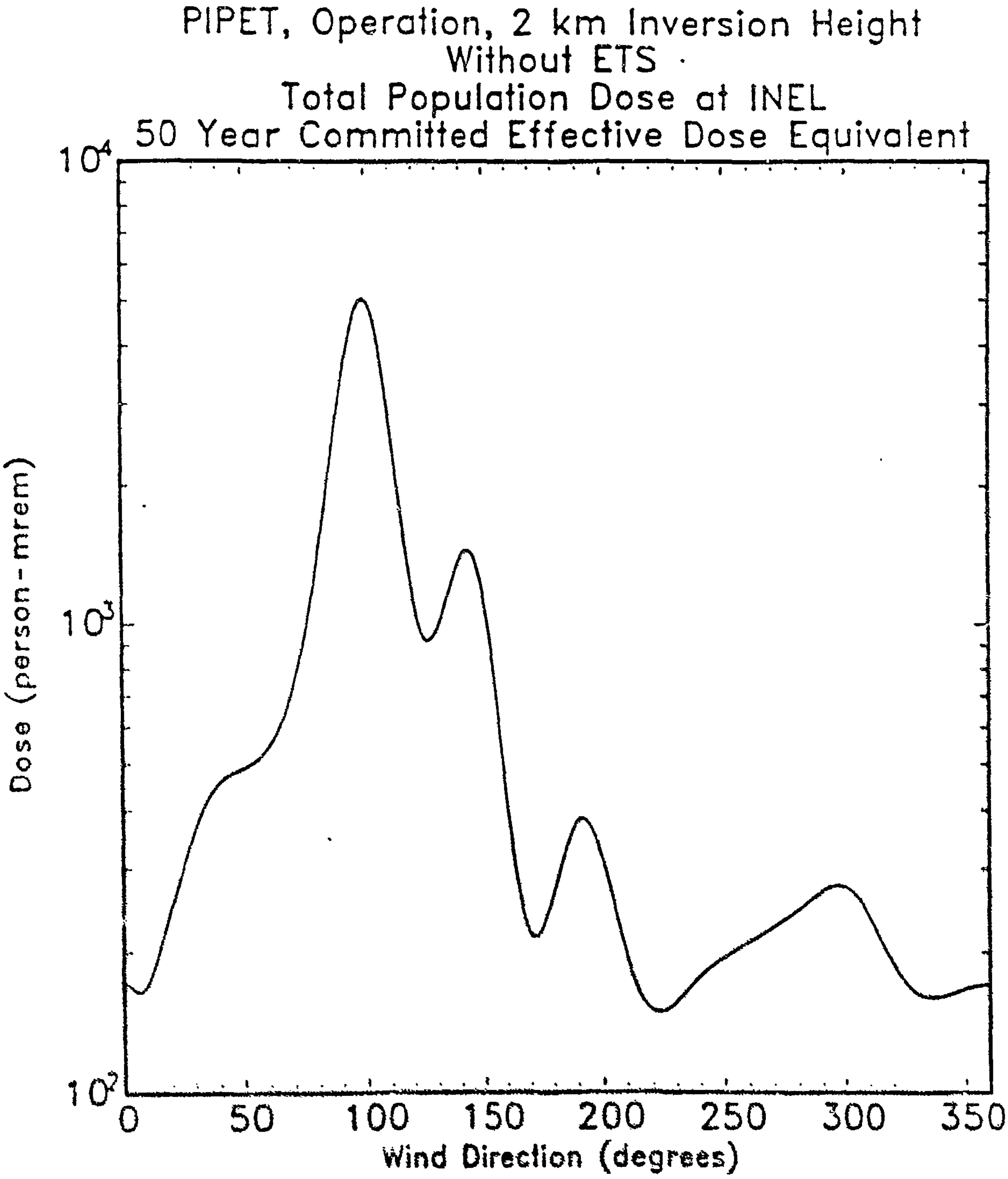
[redacted]

Figure A.1-13 (U)



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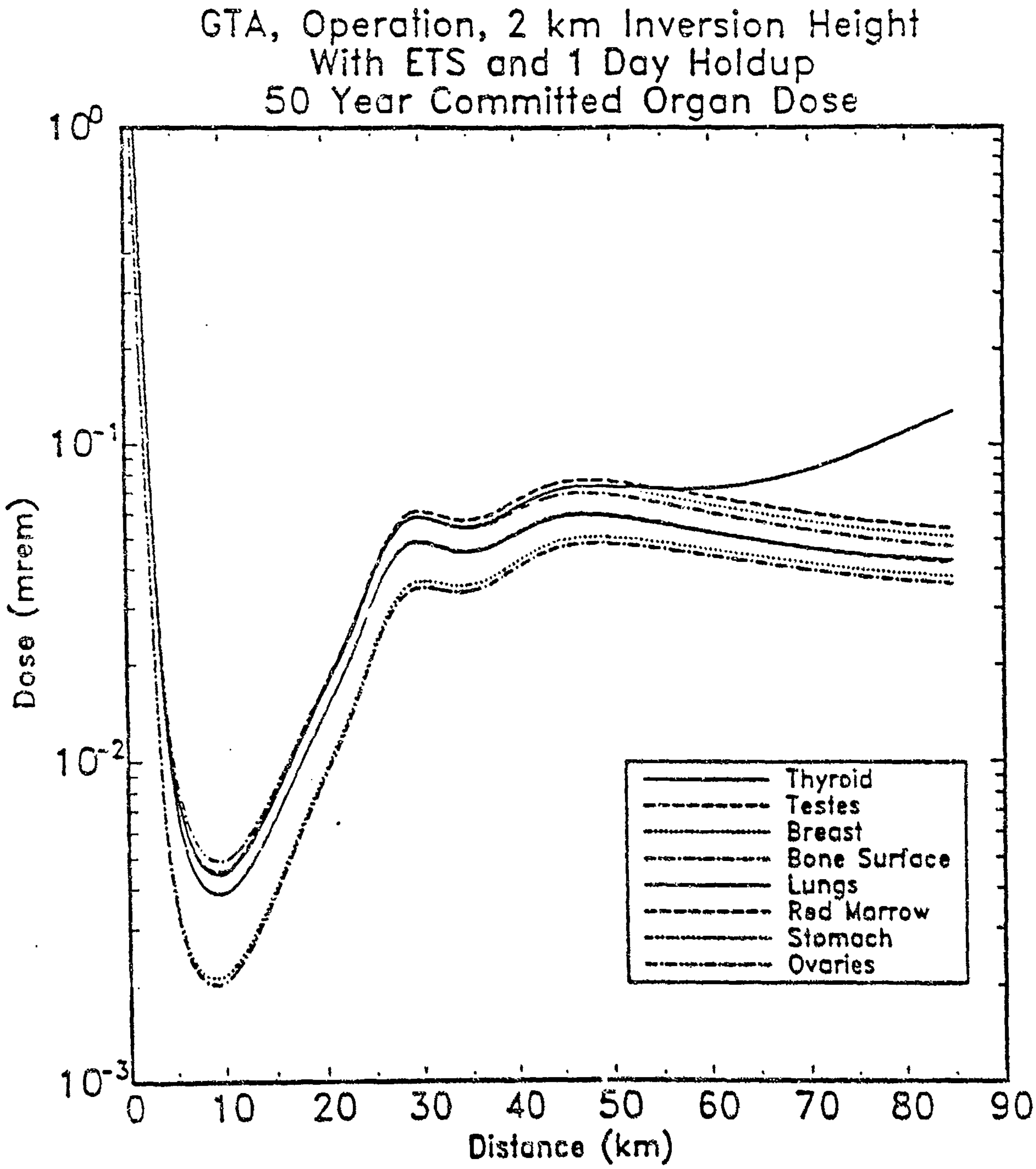
[redacted]

[redacted]

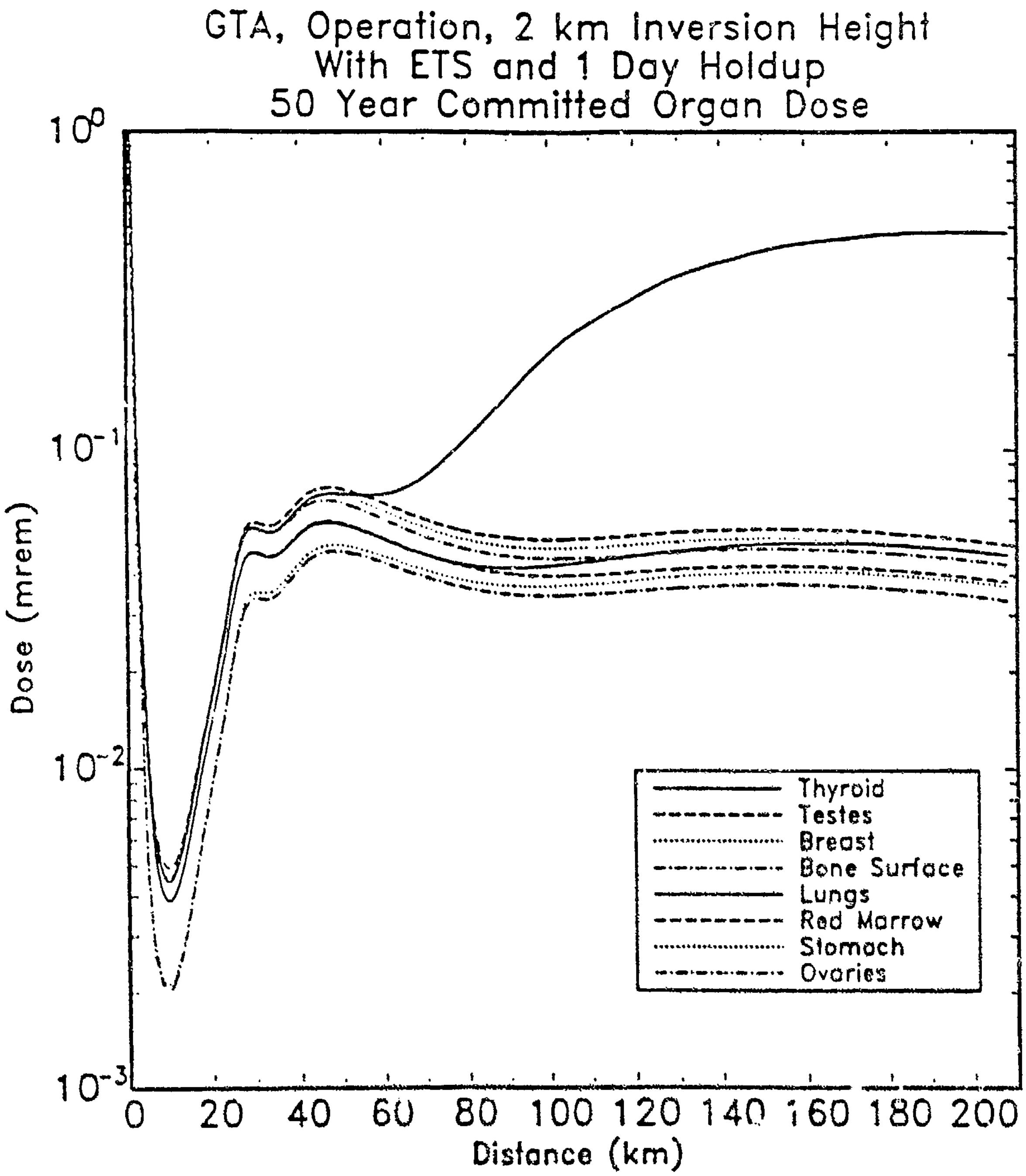
Figure A.1-14 (U)



[redacted]

[redacted]

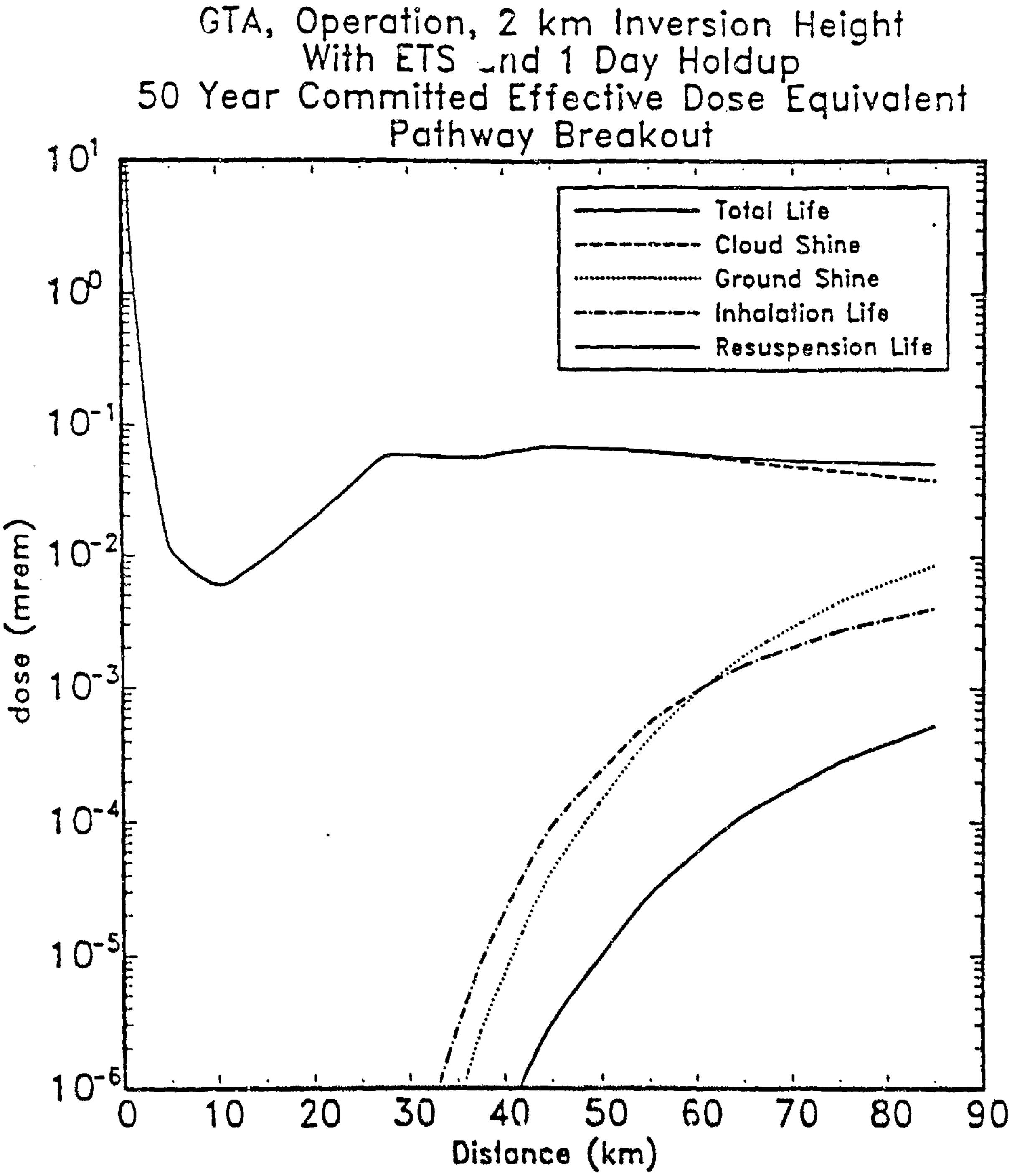
Figure A.1-15 (U)



[redacted]

[redacted]

Figure A.1-16 (U)

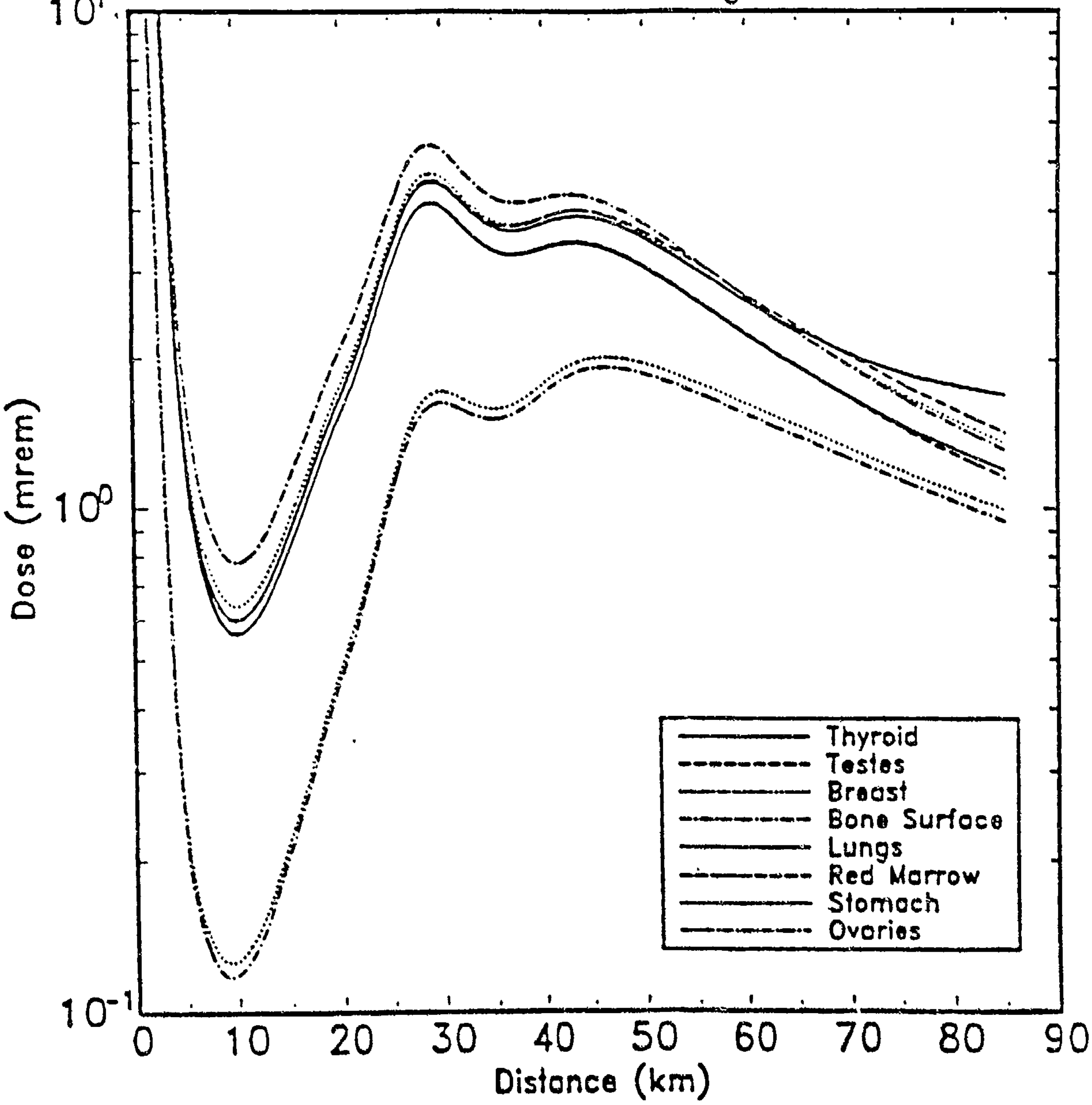


[redacted]

[redacted]

Figure A.1-17 (U)

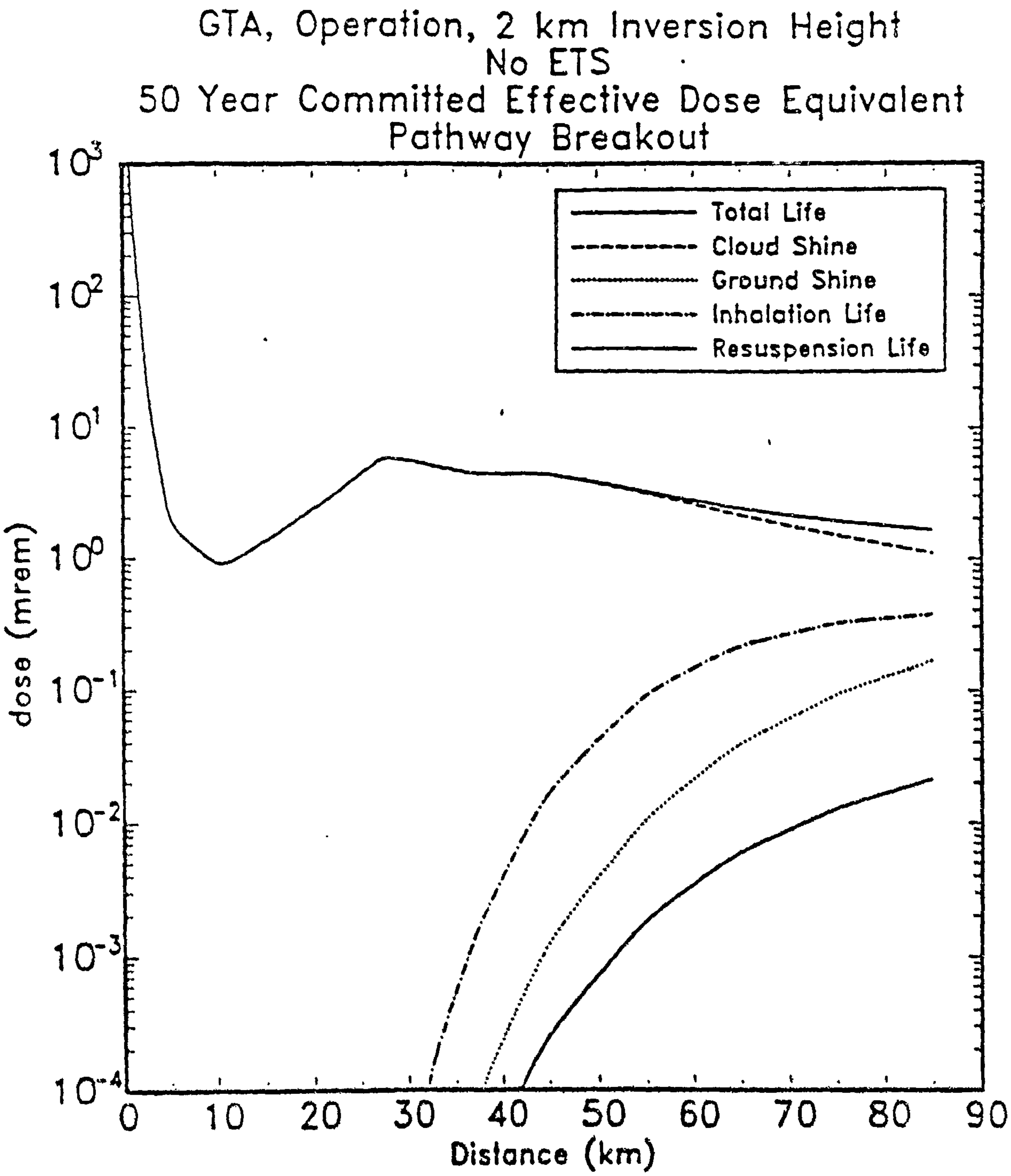
GTA, Operation, 2 km Inversion Height
Without ETS
50 Year Committed Organ Dose



[redacted]

[redacted]

Figure A.1-18 (U)

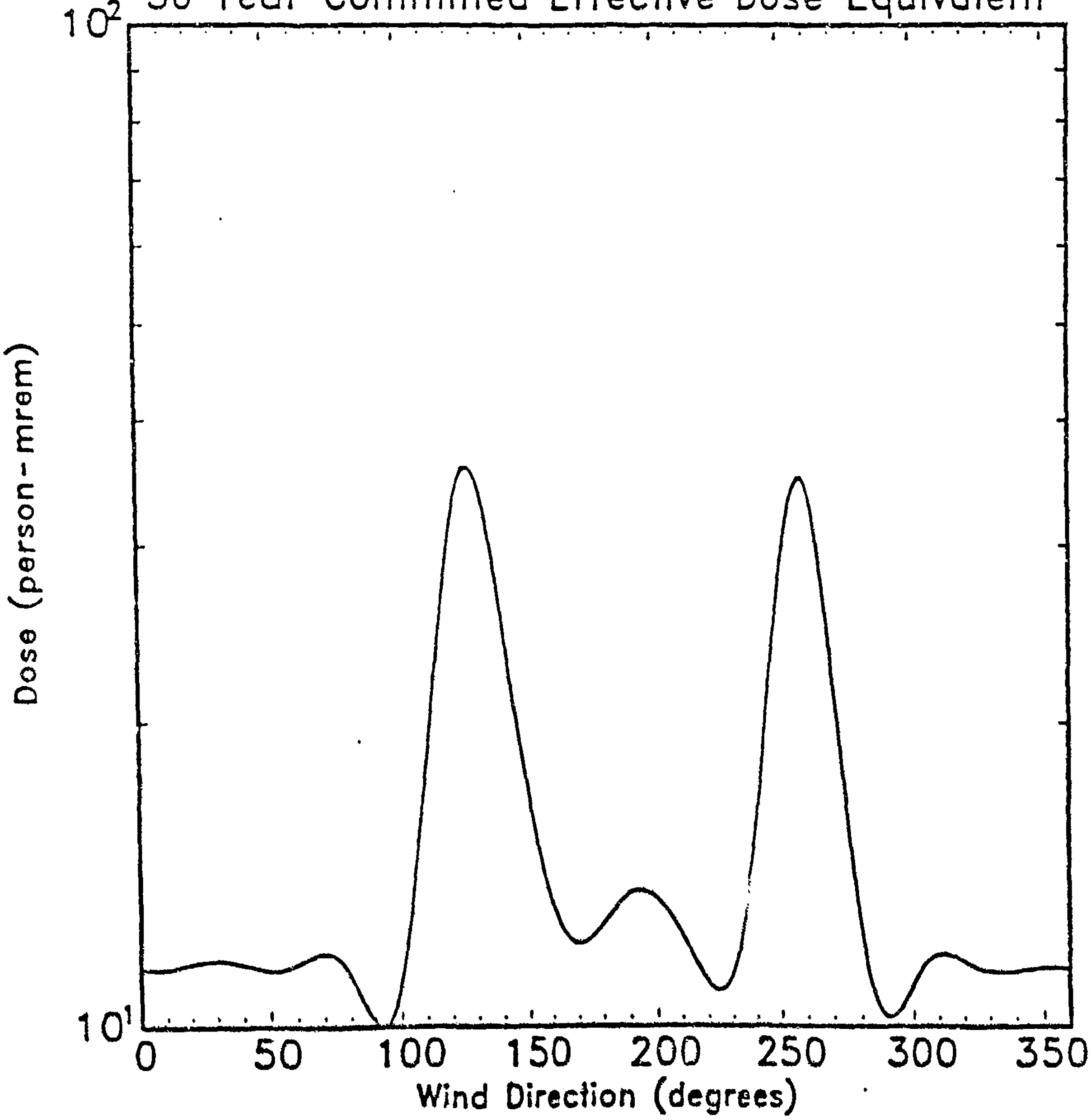


[redacted]

[redacted]

Figure A.1-19 (U)

GTA, Operation, 2 km Inversion Height
With ETS and 1 Day Holdup
Total Population Dose at NTS
50 Year Committed Effective Dose Equivalent

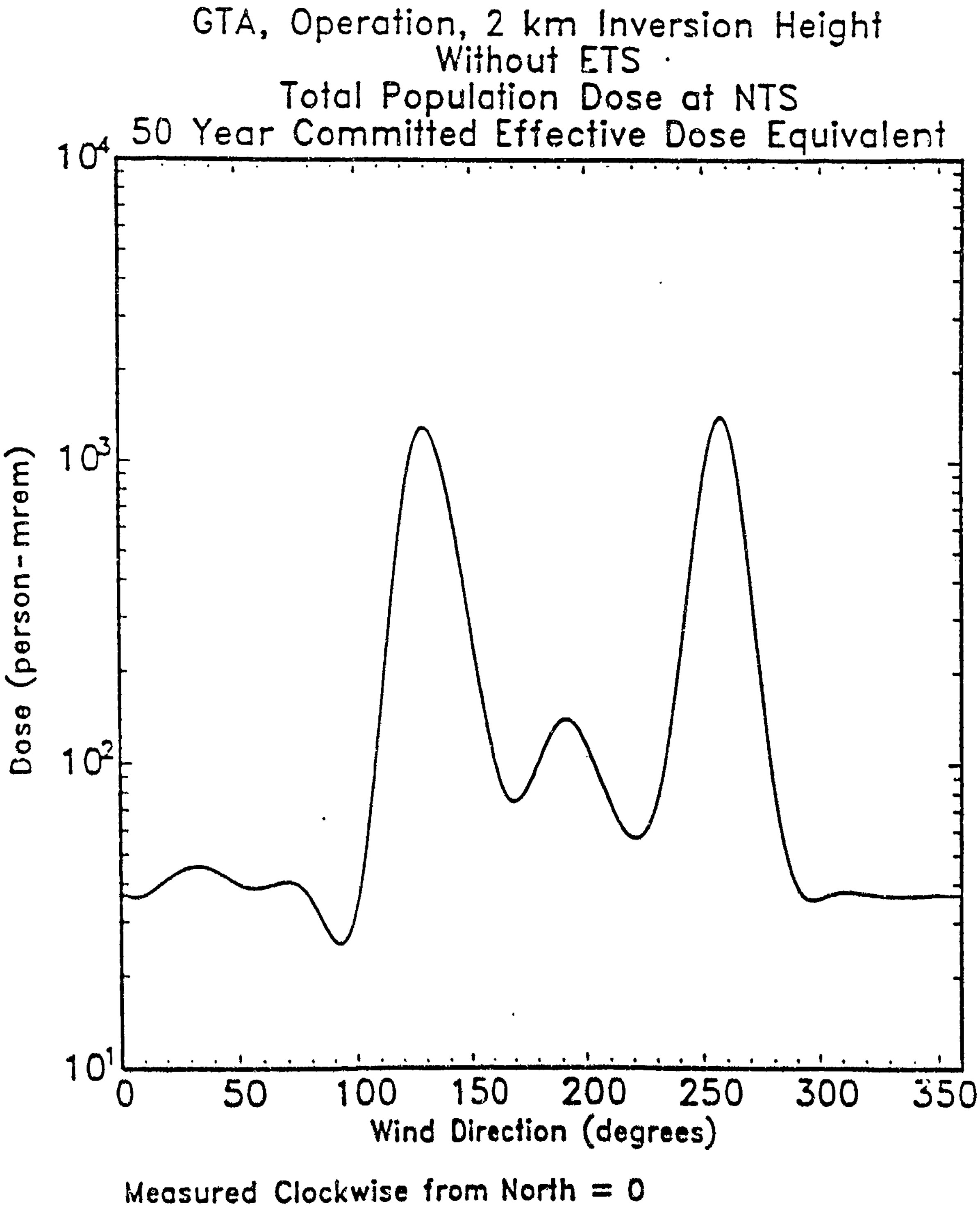


Measured Clockwise from North = 0

[redacted]

[redacted]

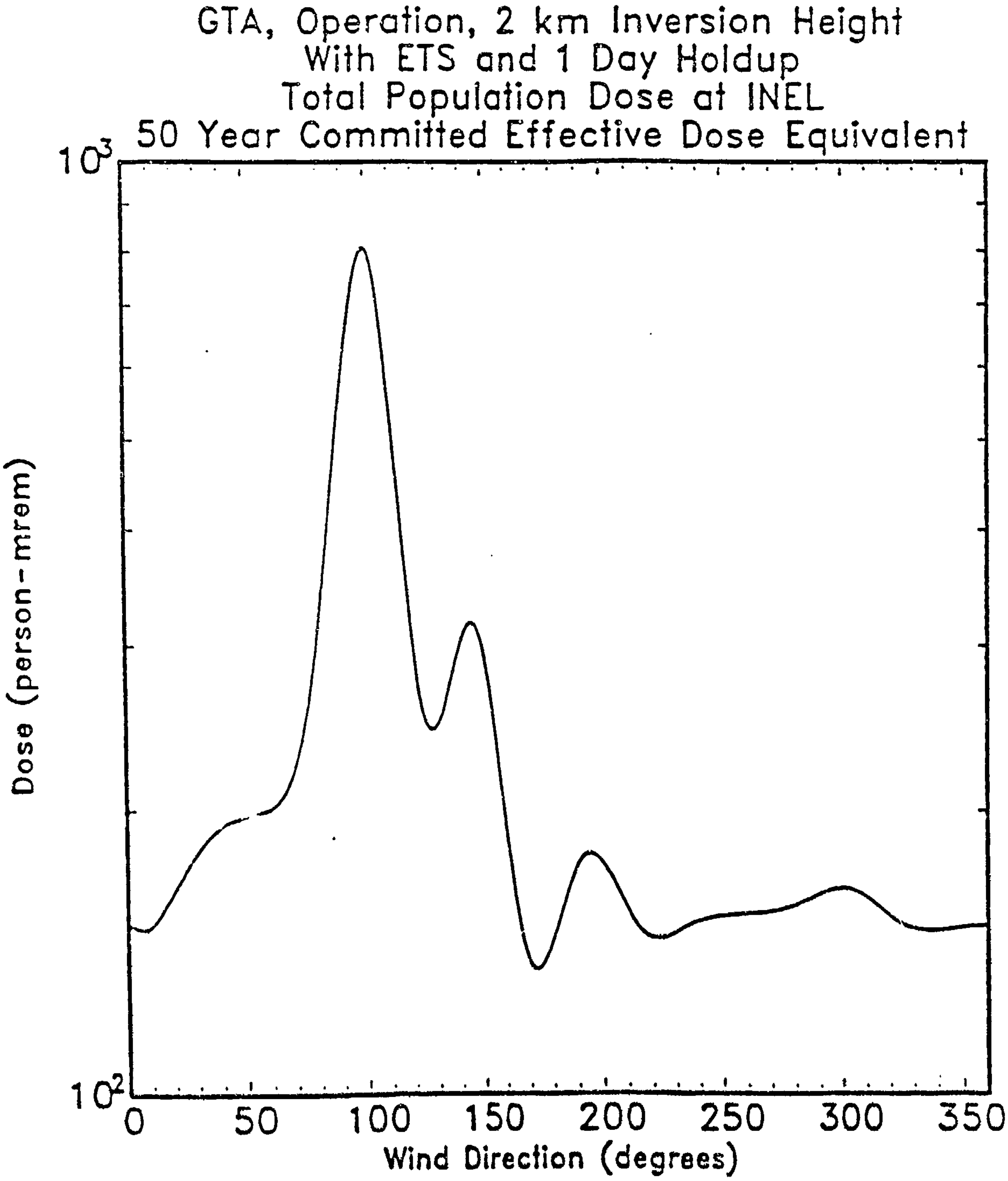
Figure A.1-20 (U)



[redacted]

[redacted]

Figure A.1-21 (U)



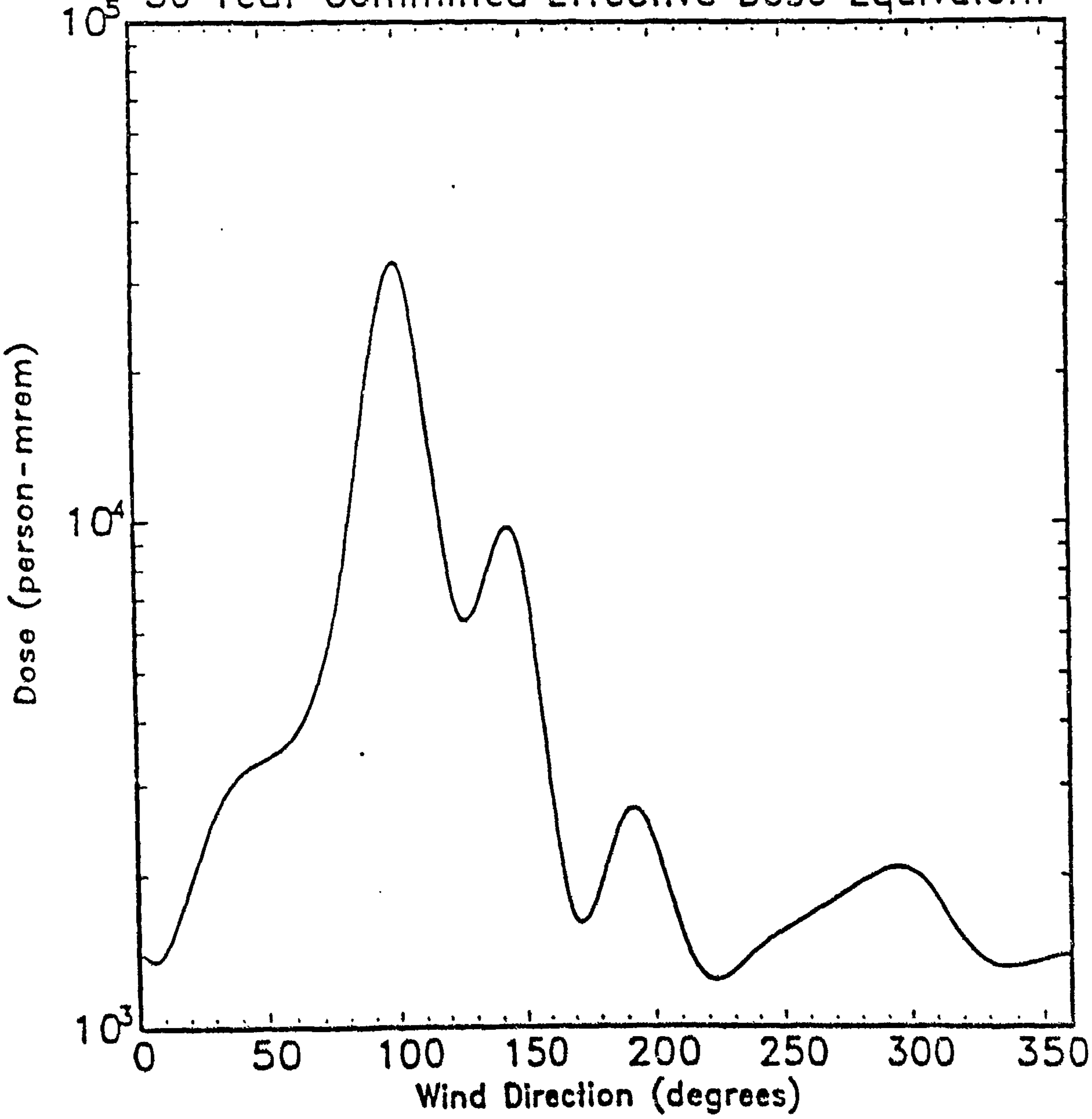
Measured Clockwise from North = 0

[redacted]

[redacted]

Figure A.1-22 (U)

GTA, Operation, 2 km Inversion Height
Without ETS
Total Population Dose at INEL
50 Year Committed Effective Dose Equivalent



Measured Clockwise from North = 0

[redacted]

A.2 CALCULATIONS OF CONSEQUENCES FROM ACCIDENTAL RELEASES (U)

([redacted]) The consequence analysis for the accidental release of radioactivity was conducted using the MACCS code described in Section A.1. All of the input parameters, including: meteorological conditions and exposure pathways were the same as those assumed in Section A.1. The difference between the consequences from the accidental releases and operational releases are a result of the different source terms due to core release fractions and ETS efficiency. The results are presented in Figures A.2-1 to A.2-8 (legend on multiline graphs corresponds to order of lines along right side of graph).

A.2.1 Source Terms (U)

([redacted]) The same fission product inventory assumed for normal operations was used for accidents. The quantities of fission products released are given in Tables A.1-1 and A.1-2. The accident scenario assumed that the full operating power (550 MW for PIPET and Mini-GTA or 2,000 MW for GTA and QTA) was released over a 60 second time period as a plume. The release fractions were assumed to be 1.0 for all radionuclides. The scenario assumed that the ETS was either not present or non-functional and that there was no chemical recombination or precipitation, such that there is no source term mitigation assumed in the calculations.

A.2.2 Deposition Processes (U)

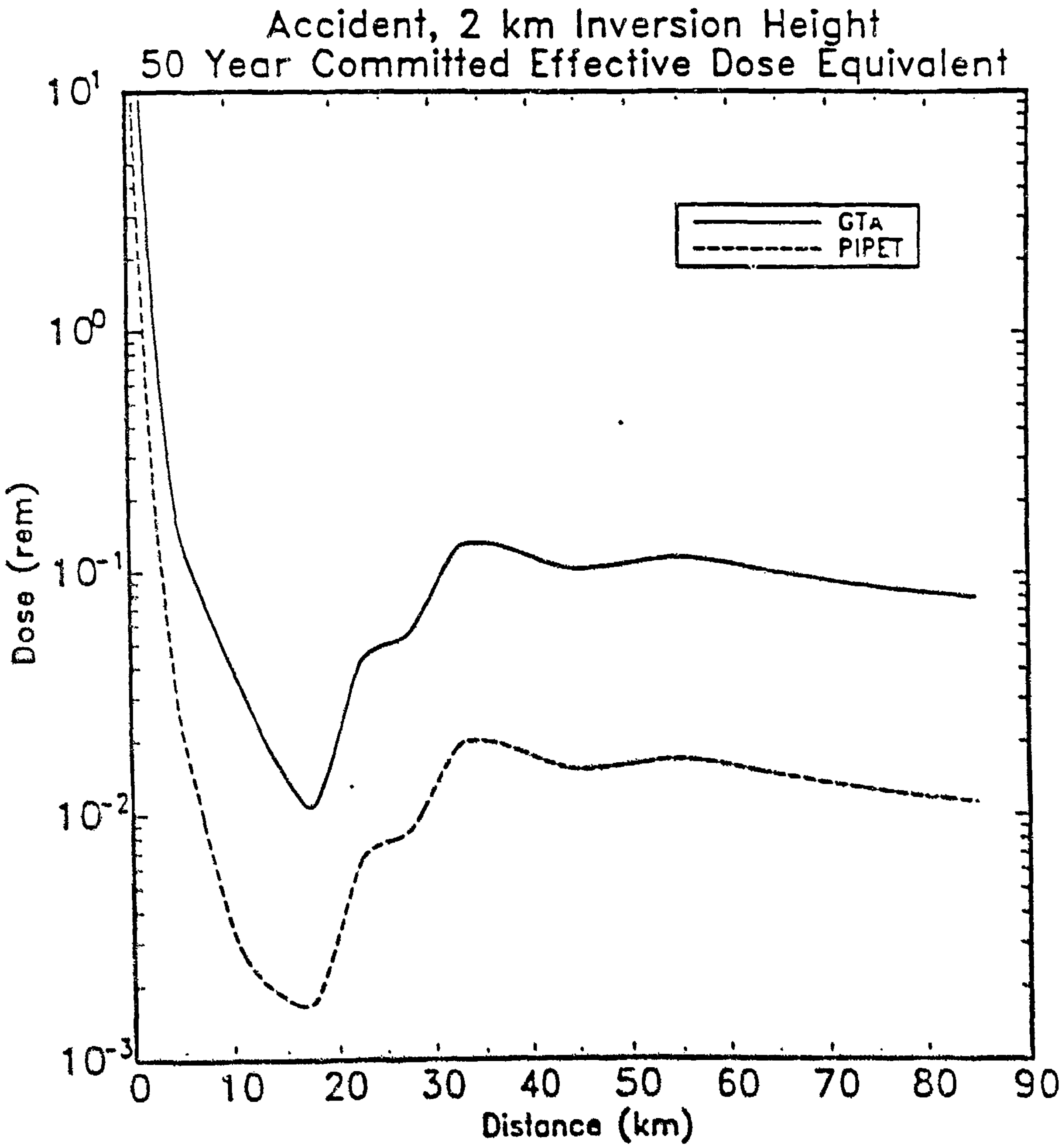
([redacted]) The processes that affect deposition are the same for accidental releases as normal operations. As the plume of radioactive material travels outward from the facility, various mechanisms remove the airborne material. In addition to radioactive decay, the radioactive material is removed by such depositional processes as impaction on obstacles (dry deposition) and precipitation scavenging (wet deposition).

([redacted]) Removal rates depend significantly on such factors as the type and rate of precipitation, particle density and size distribution, the surface characteristics of the ground, and weather conditions. For simplicity, the dry-deposition velocity (i.e., ratio of the deposition flux to the air concentration at a particular distance from the surface) is assumed to be constant for particulate matter. When it rains or snows, wet deposition occurs simultaneously with dry deposition. Wet deposition is modeled by a simple exponential removal rate, which should be dependent on the rate of rainfall. The removal rate is a function of the thermal stability. Noble gases are assumed to be insoluble and non-reactive, and therefore are not removed by either dry or wet deposition. For these scenarios, no precipitation was assumed to fall during accidental releases or the subsequent plume dispersion.

(U) The concentration of radionuclides on the ground is calculated from the airborne concentration and from the depositional rate. The material deposited on the ground is subtracted from the airborne material.

[redacted]

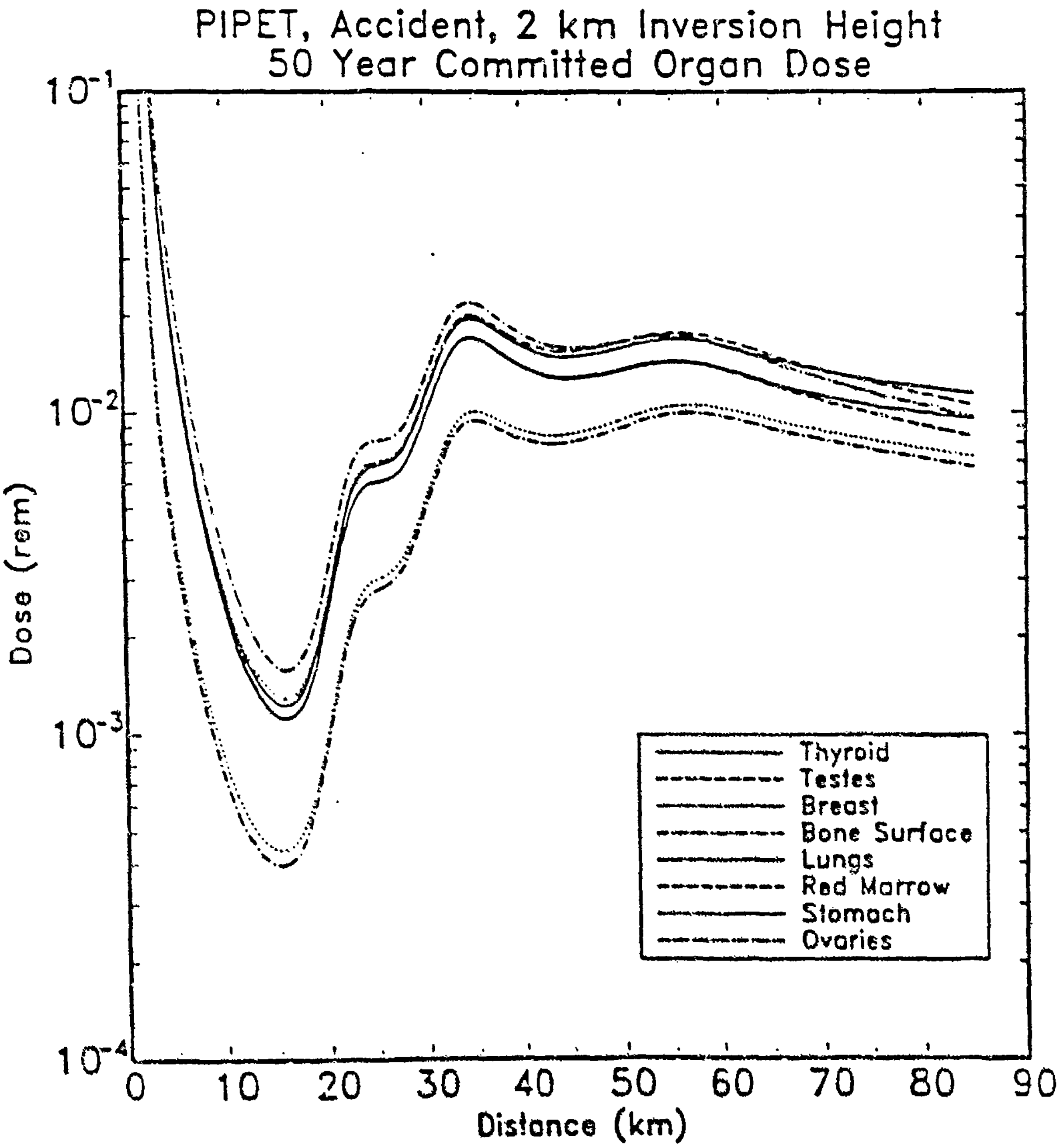
Figure A.2-1 (U)



[redacted]

[redacted]

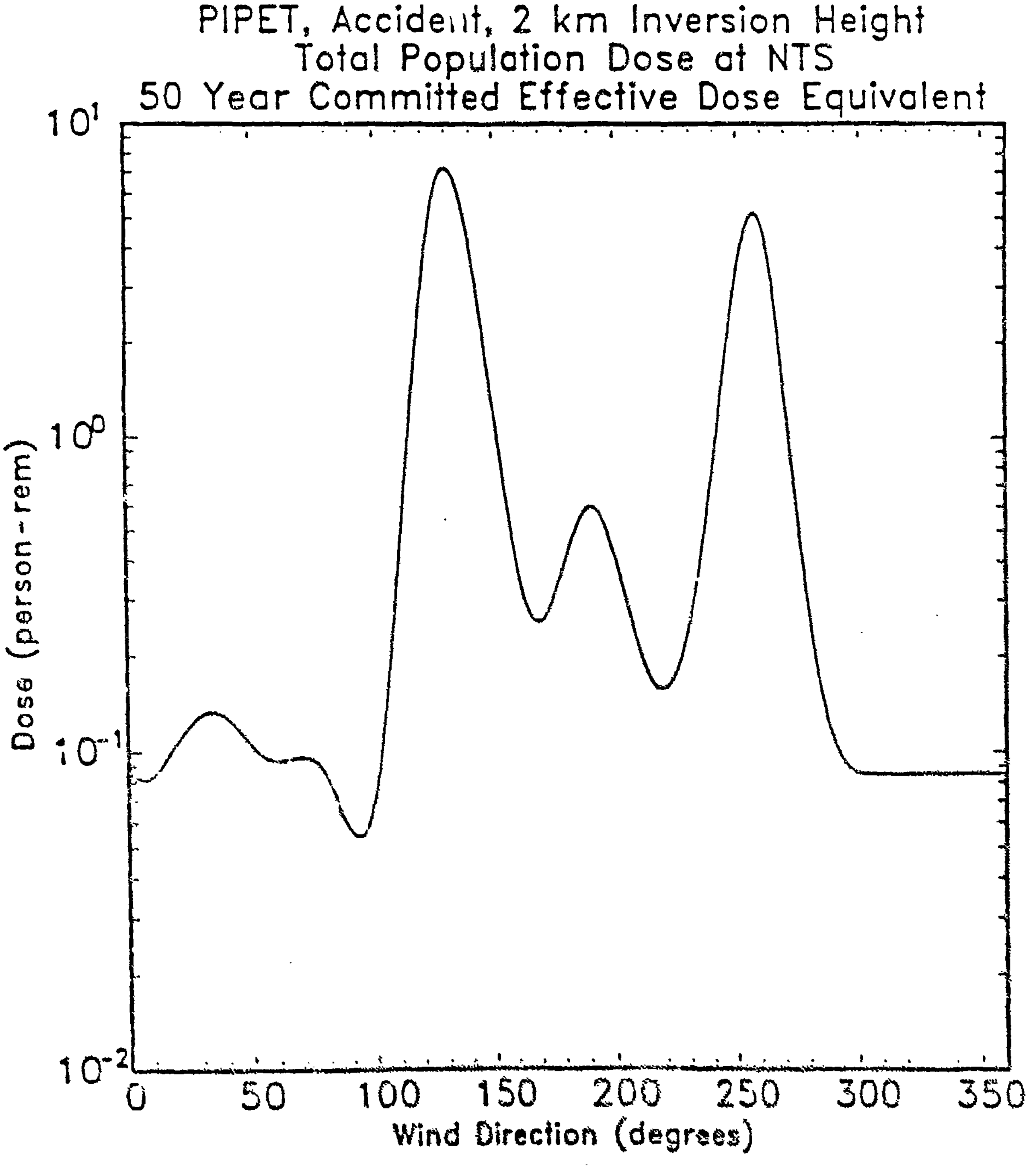
Figure A.2-2 (U)



[redacted]

[redacted]

Figure A.2-3 (U)

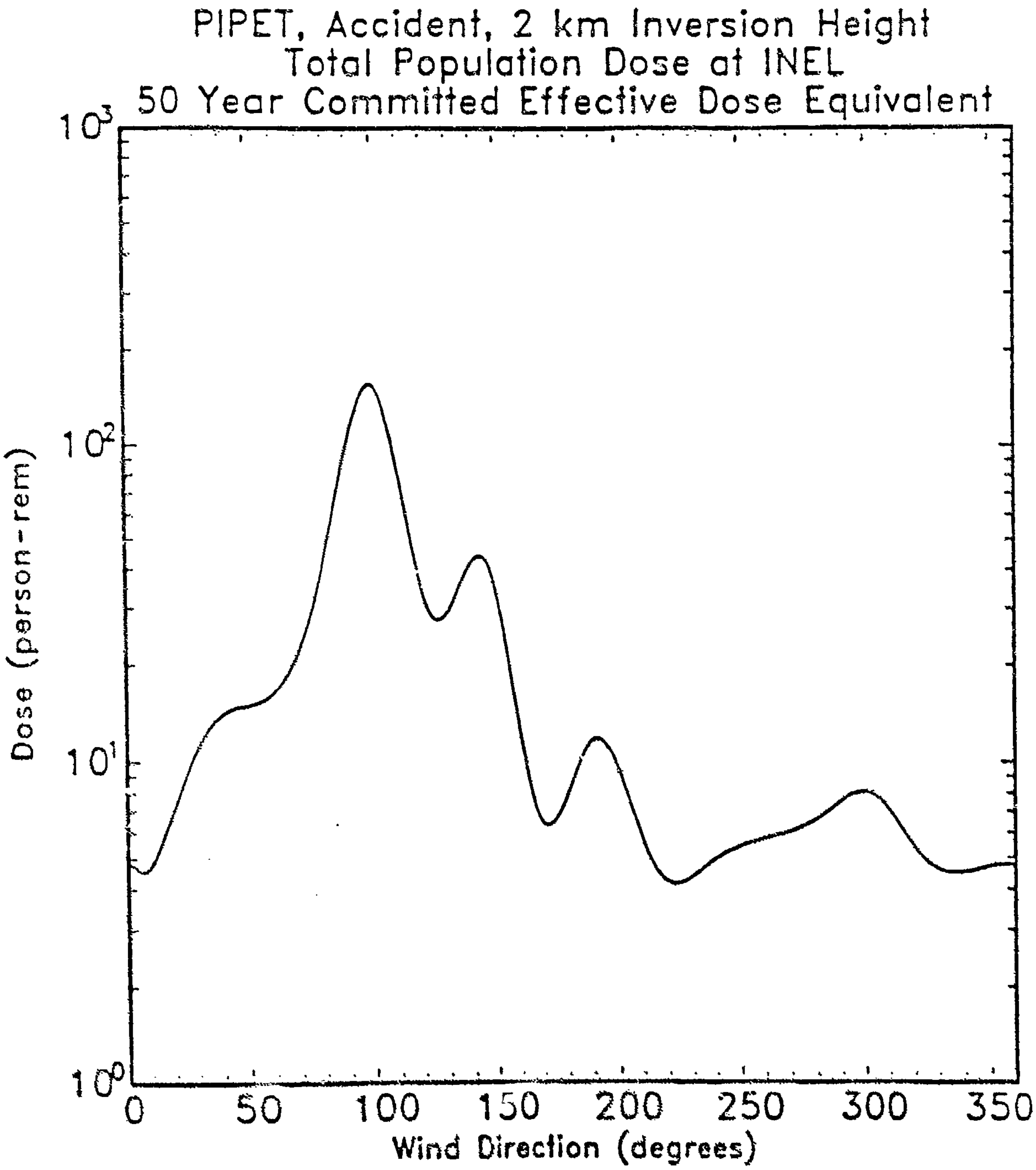


Measured Clockwise from North = 0

[redacted]

[redacted]

Figure A.2-4 (U)

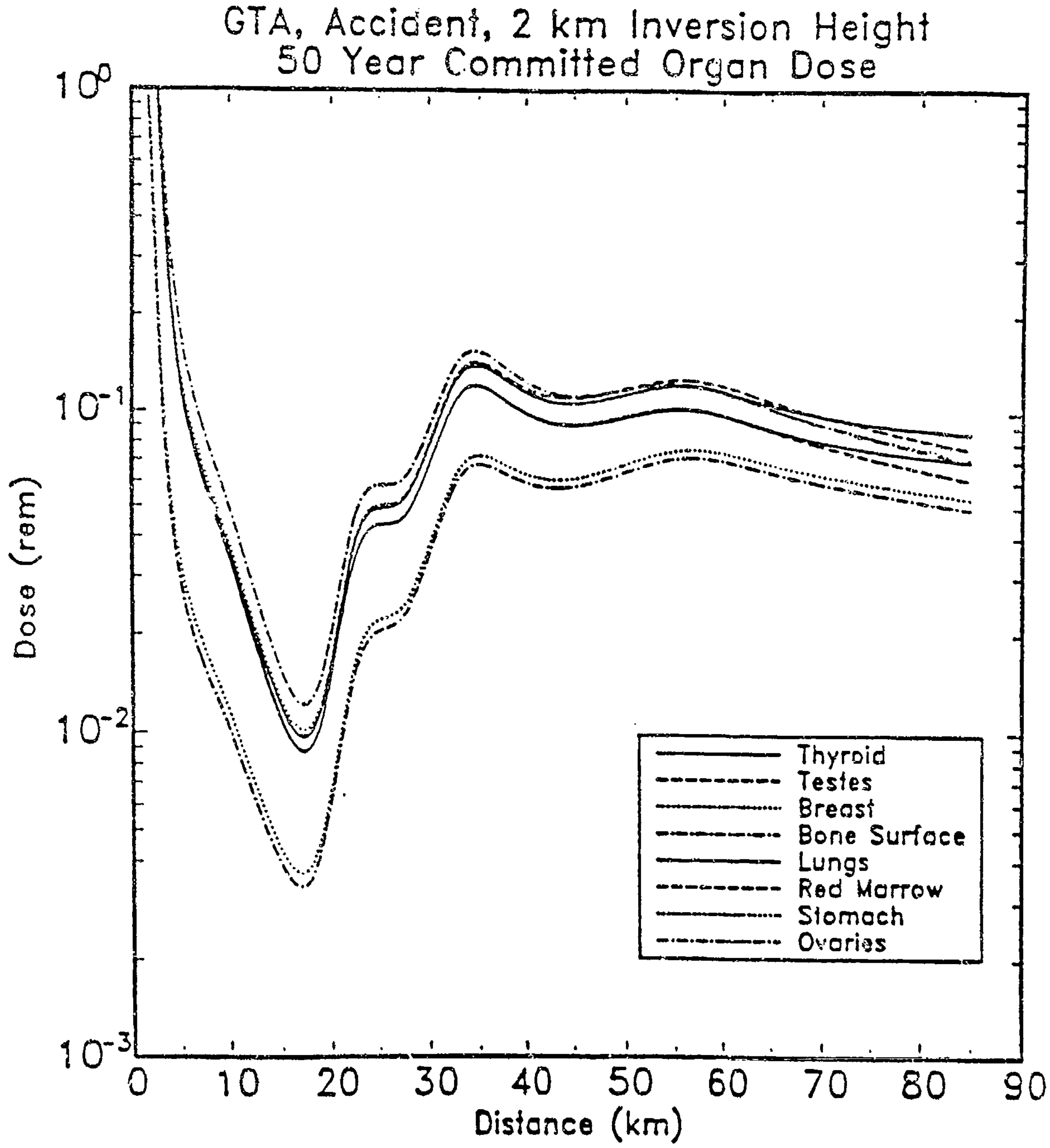


Measured Clockwise from North = 0

[redacted]

[redacted]

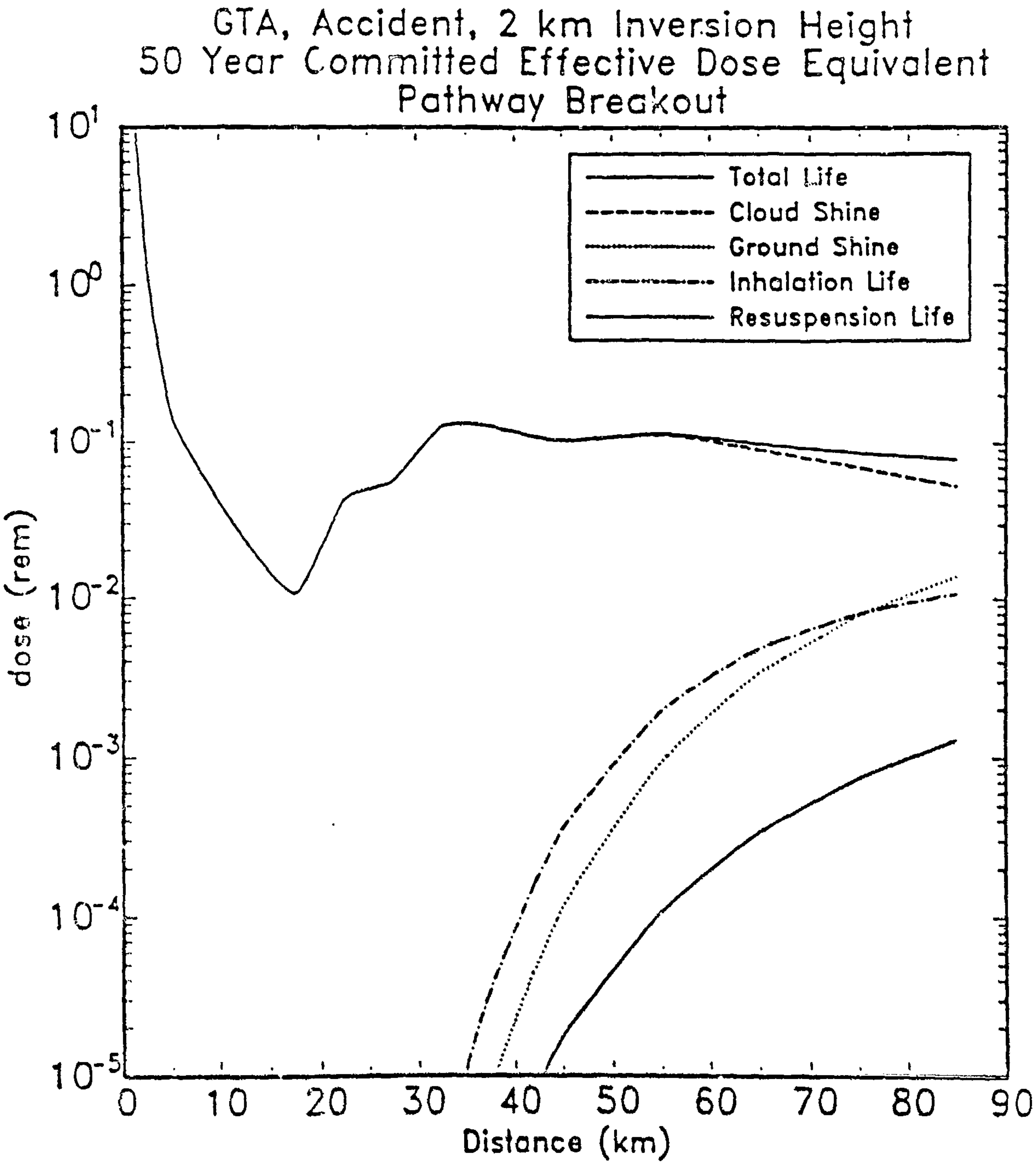
Figure A.2-5 (U)



[redacted]

[redacted]

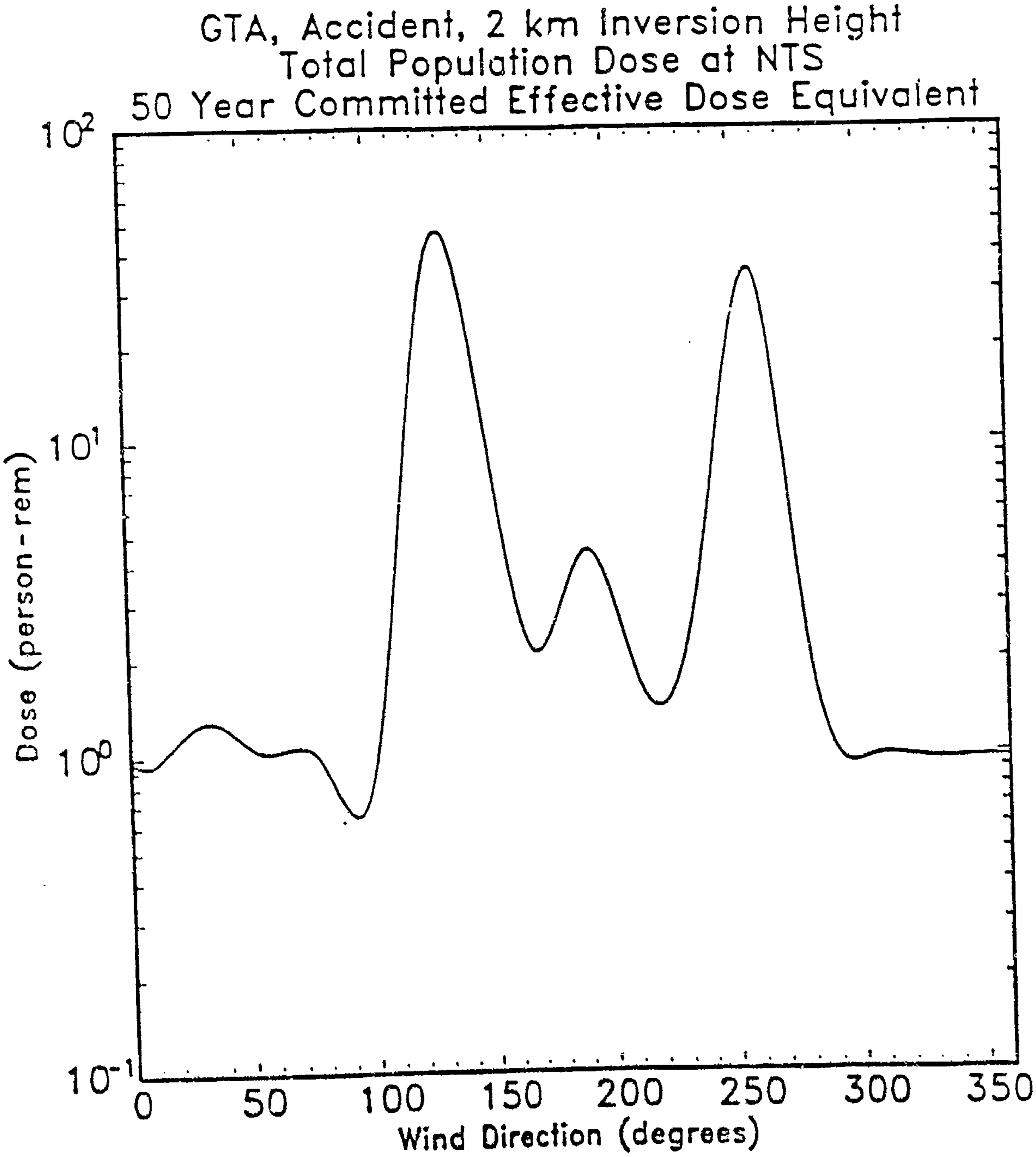
Figure A.2-6 (U)



[redacted]

[redacted]

Figure A.2-7 (U)

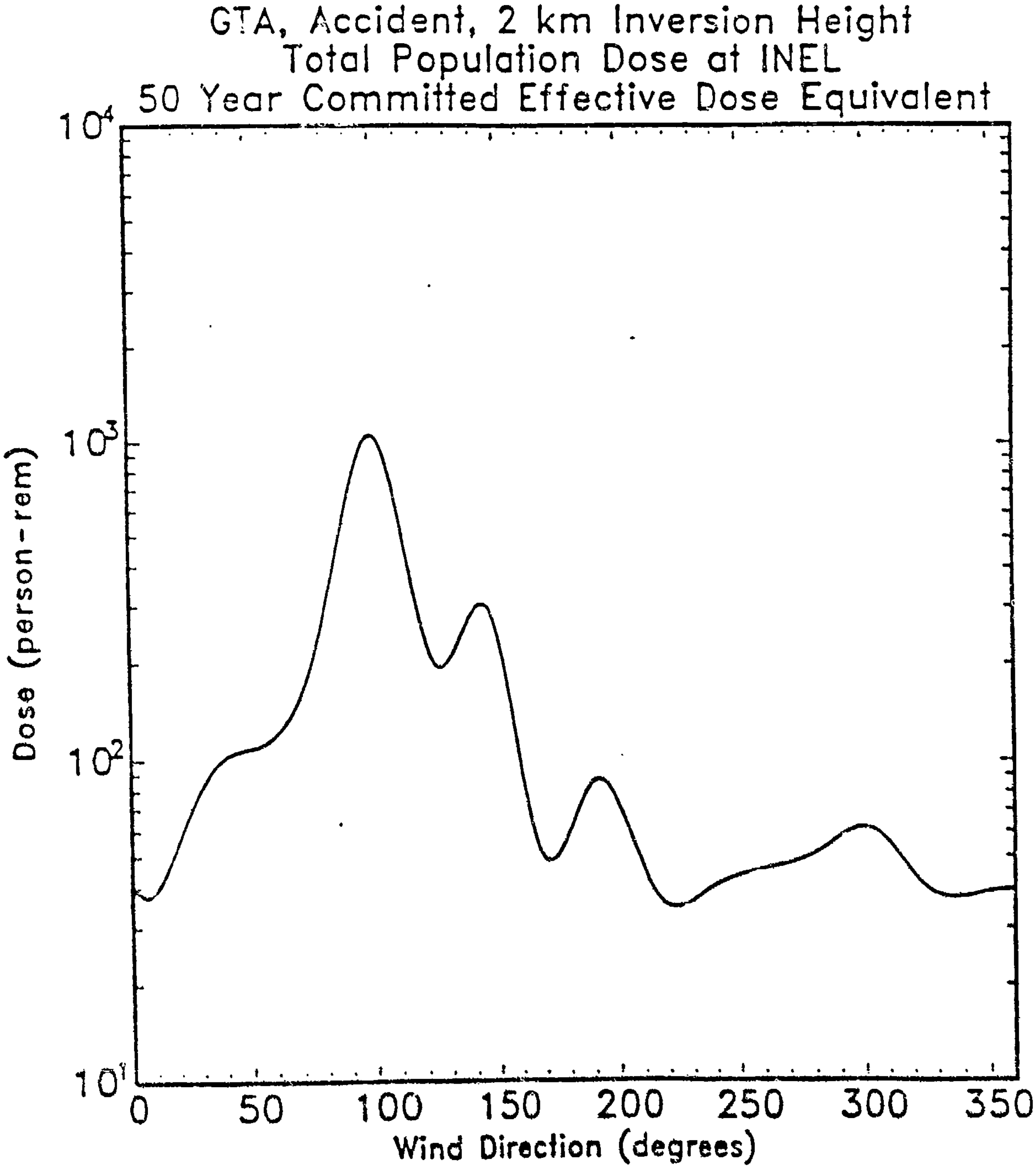


Measured Clockwise from North = 0

[redacted]

[redacted]

Figure A.2-8 (U)



Measured Clockwise from North = 0

[redacted]

A.3 RADIOLOGICAL IMPACTS OF TRANSPORTATION (U)

(U) The impacts of transporting feed, fresh product, irradiated product, TRU waste, and low-level waste (LLW) for the program were analyzed using the RADTRAN computer code developed by Sandia National Laboratories. This section describes this computational method and the analysis performed.

([redacted]) The purpose of this analysis is to provide a technical assessment of radiological and nonradiological risk associated with transportation of radioactive materials used for system development work at ground test facilities. [redacted]. This analysis does not assess "social amplification of risk," which may be affected by public perceptions (Kasperson et al., 1988). No generally accepted method has yet been developed for the formal analysis of these factors. However, awareness of these concerns is responsible, at least in part, for the recognition of "secondary factors" in the U.S. Department of Transportation (DOT) routing guidelines and for the strong tendency toward conservatism (i.e., toward overestimation of risk) in the risk analysis.

RADTRAN Model (U)

(U) The RADTRAN 4 risk analysis model was developed by Sandia National Laboratories to calculate radiological risks associated with the transport of radioactive materials by a variety of modes, including truck, rail, air, ship, and barge (Neuhauser and Kanipe 1991, in preparation). The RADTRAN 4 computer code consists of two major modules for each transport mode: the incident-free transport module, in which doses resulting from normal transport are modeled; and the accident module, in which consequences and probabilities of accidents are evaluated and used to generate a risk estimate. RADTRAN 4 is the central code of the set of codes and databases developed by Sandia National Laboratories to support transportation risk analysis. With these codes and databases, radiological and nonradiological transport risks can be estimated, and they are well suited to complex problems involving multiple package types, transport mode options, and potential destinations. RADTRAN 4 permits the user to describe route segments in detail. This capability is used in the present analysis to generate shipment-level risk values (Neuhauser and Kanipe, 1991 in preparation).

(U) The single greatest "limitation" facing users of RADTRAN or any code of this type is a scarcity of statistical data for certain input parameters. This difficulty often can be overcome by using conservative estimates of these parameters (i.e., values that tend to maximize the risk). The resulting risks tend to be overestimates (Neuhauser and Reardon, 1986), but are appropriate for use as bounding estimates in environmental documents. In this context, use of confidence limits as a measure of uncertainty would be inappropriate. See the references for a discussion of the limitations of parameter uncertainty analysis.

[redacted]

(U) An extensive analysis of the sensitivity of RADTRAN risk calculations to variations in parameters was performed by Neuhauser and Reardon (1986) for a sample truck transport case. The parameters that had the greatest effect on the incident-free risk calculation for truck transport were found to be, in decreasing order of importance: exposure distance while stopped; package dose rate; packages per shipment; shipments per year; K_0 (a factor that accounts for the shape of the package); distance traveled; stop time; number of persons exposed while stopped; shipments per year; distance from source to crew; and number of crew members. All of these are either deterministic (i.e., have known, fixed values for the problem being analyzed) or can be appropriately bounded by a conservative assumption. The accident risk calculation was sensitive to values for release fraction and for probability of occurrence of accident-severity categories; it was relatively insensitive to changes in accident rate or fractions of travel in urban, suburban and rural population-density zones. Consequently, where data are not available, conservative assumptions regarding package release fractions and accident-severity-category probabilities are used.

Incident-Free Radiological Risk (U)

(U) Included in the incident-free module for highway and rail transport are models describing:

- (U) Dose to persons within 800 meters (2,600 ft) of the transport link,
- (U) Dose to persons sharing the transport link,
- (U) Dose to persons at stops (e.g., refueling stops, rail classification yards).

(U) The magnitude of this risk depends mainly on the package or shipment dose rate and the surrounding population densities. The package dose rate is defined as the dose rate in millirem per hour at 1 meter (3 ft) from the package surface. The shipment dose rate is defined as the corresponding dose rate at 1 meter from the conveyance. The latter is often used to model multiple-package shipments. Three population density zones (rural, suburban, and urban) are used for Interstate highway routes. These correspond to mean population densities at 6; 719; and 3,861 persons per square kilometer (250 acres), respectively.

Radiological Accident Risk (U)

(U) Accident risk may be generically defined as the consequences of an accident multiplied by the probability of that accident. In practice, any number of different accident sequences exist, each of which has an associated probability. These various types of accident sequences may be grouped according to their severities; in RADTRAN, each of these groupings is considered an Accident Severity Category. Severity is a function of the magnitudes of the impact, puncture, and thermal forces to which a package may be subjected during an accident. Because all accidents may be described in terms of these basic physical forces, severity is scenario-independent. That is, any sequence of events that results in an accident in which a package is subjected to forces within a certain range is assigned to the Accident Severity Category associated with that range of values. Each value in the severity category matrix represents a conditional probability. This is, each value is the probability, given that an accident occurs, that it will be of that particular severity. To determine the expected frequency of each severity category, each value must be multiplied by the baseline accident rate for the mode and

[redacted]

population zone. Each population density zone has a distinct baseline accident rate and distribution of accident severities because of differences in average velocity, traffic density, and other factors in rural, suburban, and urban areas.

(U) Radiological consequences were calculated by assigning release fractions to each category for each chemically and physically distinct type of radioisotope. The release fraction is defined as that fraction of the radioisotope group in the package that could be released in a given severity of accident. Release fractions vary by package type. Most solid materials are relatively nondispersible and would be difficult to release in particulate form. Therefore, RADTRAN allows the user to assign values for aerosolized and respirable aerosol fractions of the released radioactive material for each Accident Severity Category. Distinct aerosol and respirable aerosol fractions are assigned by material dispersibility category; these categories describe the physical form of the material (e.g., gas, liquid, solid in power form, monolithic or nondispersible solid).

(U) RADTRAN contains a meteorological model that allows the user to define the behavior of a plume of particulates, if one is produced by the type of accident considered. Material released in aerosol form is assumed to travel away from the immediate vicinity of an accident in a particulate plume.

(U) To calculate health effects, five exposure pathways are considered:

- (U) Inhalation of respirable aerosols in the passing plume.
- (U) Cloudshine, defined as exposure to penetrating radiation (e.g., gamma radiation) from the passing plume.
- (U) Groundshine, defined as exposure to penetrating radiation from radioactive material that is deposited on the ground from the plume.
- (U) Resuspension, defined as inhalation dose from respirable aerosols that are deposited on the ground by the passing plume and subsequently resuspended.
- (U) Ingestion, defined as exposure from ingestion of agriculture products from areas contaminated by particulates from the plume (rural zones only).

(U) Cloudshine and inhalation of respirable aerosols occur only while persons are exposed to the plume. Since persons outdoors would be most directly affected, RADTRAN allows the user to account for pedestrian densities in urban areas. Groundshine, resuspension, and ingestion doses would be incurred at later times, and their magnitudes would depend in part on how rapidly a contaminated area is evacuated and whether the area is cleaned up or restricted from use. RADTRAN allows the user to estimate evacuation times, and it includes contamination thresholds for determining whether interdiction or cleanup will occur. The cleanup level is in accordance with proposed EPA guidelines.

<u>Total Radiological Risk of Transport</u> (U)

(U) A unit-shipment approach was used to calculate transportation risk. The risk per shipment is calculated and multiplied by the number of shipments of each material type. These products may then be summed to give total risk values.

Nonradiological Risk of Transport (U)

(U) The RADTRAN postprocessor performs calculations for nonradiological unit-risk factors (e.g., risk of fatality from mechanical injury) to determine total nonradiological risks. Note that for these risks the two-way travel distance is used because, while radiological risks may be incurred only for a shipment containing radioactive material, nonradiological risks are equally likely when the transport vehicle is traveling empty.

Representative Routes (U)

(U) For truck transport, to estimate the fraction of travel in each population density zone, representative Interstate highway routes are generated for each origin-destination combination, and population densities along these routes are determined from 1980 census data. These data and one-way mileage estimates are generated by a highway routing code.

Analysis (U)

Input Data and Modeling of Packages/Shipments (U)

(U) RADTRAN requires substantial amounts of input data to adequately model the packaging, the packaging contents, the vehicle and transport link, and potential radiological consequences. In addition, a conditional probability must be assigned to each Accident Severity Category for each population-density zone, and accident rates for each vehicle type and transport mode must be determined. Many of these values do not change for a specific application. For example, Interstate highway lane dimensions do not change regardless of what vehicle type or payload is being analyzed. Since predetermined default values are used for these parameters, the user needs to consider only the values of those parameters that may change as a result of program-specific conditions. In this section, program-specific conditions and related input values are discussed and documented.

([redacted]) The program would receive shipments of high-enriched uranium feed material from Oak Ridge, TN. All uranium feed material shipments, for analysis purposes, were considered to be in oxide form. The uranium feed material would be converted to "fresh product" at Lynchburg, VA. From Lynchburg, the fresh product would be transported to Albuquerque, NM, where small quantities could be irradiated in existing facilities at SNL or transported to one of the potential sites of the new ground test facility. At either the SNL or new ground test facility locations, the fresh product material would be irradiated in a reactor environment for cumulative time periods ranging from a few seconds to a few thousand seconds. Following this irradiation and subsequent on-site examination, the irradiated product material would be subject to one of the following options:

(U) Option 1: Shipment to an off-site hot cell facility for further examination.

(U) Option 2: Shipment to a processing facility for recovery and recycle of high-enriched uranium (also for unused fresh product).

(U) Option 3: Treatment as waste for either on-site or off-site disposal depending on the given site's waste acceptance criteria.

(U) If the irradiated product material is shipped to an off-site hot cell for further examination, the final disposition would be through either Option 2 or 3 above.

([redacted]) Transuranic (TRU) wastes could also be generated in very small quantities during nuclear testing operations. And low level wastes (LLW) would be generated during testing operations. These LLW waste forms would potentially include filter media, particulates, activated hardware, and contaminated structural materials. Depending on the capabilities of the selected ground testing location, the LLW would be either disposed of on-site or shipped to an adequate disposal site. Any TRU waste would be shipped to the Waste Isolation Pilot Plant (WIPP). Waste meeting the TRU waste acceptance criteria could not be demonstrated to be produced during operations, but for conservatism testing operations were modeled as generating sufficient TRU waste to account for a single shipment to the WIPP site.

(U) A set of conservative baseline conditions was defined for analysis to provide a point of comparison for relative risk assessments. Briefly, each material would be shipped by truck; shipments of feed, fresh product, and irradiated product materials going for further examination or recovery and recycle processing would be carried in safe secure transports (SSTs). The TRU waste would be grouted and shipped off-site by commercial carriers in Type A packages (55-gallon drums) in TRUPACT-II Type B overpacks, and the LLW would be packaged according to all applicable regulations and hauled to an on-site LLW disposal facility. The structural materials that might be LLW were all modeled as being broken down into units small enough to fit into 55-gallon drums with a 50% void volume factor accounted for. In actuality, it is probable that at least some of these structural materials would be shipped as low-specific-activity material in bulk form, which would greatly reduce the number of such shipments. Therefore, the risk values given for LLW transportation in this analysis are conservative. A summary of the packaging assumptions used in the analysis is given in Table A.3-1.

(U) In prior analyses of similar materials (DOE/EIS-0136), two shipment sizes--full and half-full loads--were analyzed. This was considered because it was possible that a reduced payload might decrease the consequences of a severe accident and thus reduce the overall risk. The results of this earlier analysis indicate that, although there was some reduction in high-severity accident consequences, this was more than offset by the increase in risk resulting from the fact that twice as many shipments must be made to transport the same amount of material. Therefore, only full loads are considered in this present analysis.

(U) All low-level waste generated during operations of the proposed new test facility is modeled as being disposed of on-site. This waste will consist primarily of fission-product-contaminated material and activated structural materials. The former was modeled as containing the maximum amount of the given material that can be carried in a Type A package (one A_2 equivalent of a radioisotope mixture resembling the irradiated product). For all materials modeled (filter media, etc.) this amount still contains less than 100 nanocuries per gram of alpha-contaminated material, which is the maximum concentration of alpha-emitting isotopes permitted in LLW, thus the analysis is conservative.

(U) The total output of LLW from operations is expected to be about 1.7E+05 metric ton with a volume of 46,000 cubic meters (1.6 million ft^3) (includes 50% packing volume allowance), which is equivalent to about 219,250 55-gallon drums. The radionuclide inventory of a package varies from 2 to almost 40 curies; the latter applies only to special form material. Although the transport distance could vary at the two alternative sites for the new test facility, a maximum distance of 50 kilometers (approximately 30 miles) was used for both sites. The average velocity on-site was assumed to be 50 kilometers per hour (about 30 miles per hour).

(U) Stop times associated with transport by SST differ from those for commercial truck transport. Stop time was set at 0.0021 hour per kilometer in accordance with safe operating procedures for the SST (Mulryan, 1987). The value for commercial truck transport is 0.011 hour per kilometer which was used for all other off-site shipments. The operating procedures for the SST are classified.

(U) Representative Interstate highway routes from each potential origin to each potential destination were generated by the INTERSTAT routing highway code, which also gives fractions by travel in rural, suburban, and urban population density zones (Cashwell, 1987) and total one-way distance. These are listed in Tables A.3-2 and A.3-3.

(U) The INTERSTAT routing network includes the Interstate highway system, state-designated alternate routes, and access routes into various DOE facilities. Because of their high and uniform levels of engineering and safety, the Interstate highways have been identified by the DOT as the preferred routes for transport of highway-route-controlled quantities of radioactive materials (formerly called large-quantity shipments); where available, urban beltways and bypasses must be used. States and tribes may designate alternative routes when the designation is accompanied by a safety analysis demonstrating equal or greater levels of safety.

(U) The accident rates used in the analysis are from DOT data for the entire commercial shipping industry (i.e., accidents on Interstate highways involving at least one commercial tractor-trailer regardless of payload), and are based on millions of total vehicle-kilometers of travel. Available unclassified accident/incident data for radioactive materials shipments indicate, for example, that for the eleven-year period from 1971 to 1982, fewer than thirty Type B packages were involved in truck or rail accidents (Wolf, 1984). There was no release of radioactive material in any of these accidents. An accident rate derived from this information should not be used; the statistical significance would be questionable because the total truck-kilometers involved are relatively small and because few accidents occurred. Therefore, the accident rates in this analysis are conservatively set equal to the national average accident rates for commercial tractor-trailers. The national average rates are derived from DOT data and are appropriate for relatively long-distance routes that traverse several states. Sandia National Laboratories has conducted a number of tests to demonstrate the validity of this conclusion. The average for the entire United States is 3.1×10^{-7} accidents per kilometer (4.0×10^{-7} accidents per mile). The limited variability in accident rates supports the use of national average data for the program shipments. These accident rates were also used for on-site shipments. This is a conservative approach because lower speeds and institutional controls are expected to lower actual on-site accident rates.

(U) These rates are for all reported combination truck accidents on interstate highways. The possibility of the very severe accidents which would be required to result in a release of radioactive material is much lower. The overall frequency of under-reporting of accidents is about 40 percent for property-damage-only accidents; the reporting of serious and fatal accidents is virtually 100 percent (Smith and Wilmot, 1982). Thus, the base accident rate is not adjusted for under-reporting, since doing so would serve only to raise the relative frequency of occurrence of low-severity accidents and lower the relative frequency of occurrence of high-severity accidents, which would remove a certain level of conservatism in the accident-risk calculation. The eight-category Accident Severity Category matrix for commercial truck transport from NUREG-0170 (NRC, 1977b) is used.

(U) Additional conservatism is attributed to the fact that SSTs do not operate in poor weather conditions. Restricting truck transport to good weather conditions reduces the overall truck accident rate by about 10 percent (NUREG-0170, Section 6.3.3). Since accidents associated with travel in poor weather conditions are included in the DOT accident-rate data that were used in the risk analysis, the risk estimate is slightly conservative with respect to this parameter. In the unlikely event of an unforeseen road closure, radiological impacts would be associated mainly with an increase in stop time and perhaps an increase/decrease in distance traveled (e.g., if a vehicle were able to use an alternate route). Since only one or a few shipments would be affected on an annual basis, the overall annual incident-free risk estimate would not change significantly.

(U) The SST would be used to transport program-related shipments of feed, fresh or irradiated product material. The SST acts as a significant secondary barrier; it provides additional shielding that reduces the external dose rate of the shipments, and it provides additional levels of accident resistance. For shipments of TRU waste to the WIPP, the TRUPACT-II would be used. Release fractions for a typical Type B package were used (NRC, 1977b) to represent the TRUPACT-II, and no credit was taken for any protection that might be afforded by the inner Type A packages (drum). The LLW low-specific activity and Type A packages were modeled as typical Type A packages.

(U) The 6M is one of the few packagings for which a large amount of data exists on response to the higher severity category accidents, and the release fraction values used here and in earlier studies are based on these data (McWhirter et al., 1975; Bonzon, 1977; Fisher et al., 1987). It is expected that the 6M will be replaced by a newer packaging of the same type with an improved closure mechanism. However, other basic features of the packaging would remain the same, and the new Type B inner packaging is modelled in this analysis as having the same properties as a 6M. The accident resistance provided by the SST is significant. The high integrity of the trailer acts as an impact-force-reducing barrier and provides thermal protection. The release fractions assigned to the Type B packaging in Accident Severity Categories VI, VII, and VIII for the 6M inner packaging must be modified to reflect the protection afforded a shipment by the SST. Lesser accident categories (I through V) result in no release of material to the environment (NRC, 1977b).

(U) The SST also provides enhanced thermal protection, being capable of withstanding temperatures in excess of the regulatory test-fire temperature [1,475° F (800° C)] for periods exceeding the test duration of 30 minutes without significant elevation of internal temperature (SNL, 1976). The SST provides additional thermal protection such that the Type B packagings, which are themselves highly fire-resistant, would not directly experience thermal loads characteristic of a Category VI fire. Note that both fire and impact forces of the magnitudes defined above are required for an accident to be classified as Accident Severity Category VI; this is also true of the definitions of Categories VII and VIII. The SST so effectively prevents either of these conditions from affecting the payload that a Category VI accident would not result in any release of contents. Therefore, the release fraction for this severity category is equal to zero for shipments of the Type B/SST configuration. For shipments of the Type A/SST configuration, the release fraction for Category VI was set equal to 0.01. Since Type A packages subject to severe impact loadings encountered in Categories VII and VIII must be assumed to fail completely, the SST was conservatively modeled as providing no additional protection in these two highest categories.

(U) The forces a shipment may experience in Category VII accidents [140,000-230,000 kilograms (300,000-500,000 pounds)], if applied uniformly to the SST, would not result in crush forces in the interior of the trailer that exceeded the Type B failure threshold. However, concentrated application of such forces could cause local deformation of the SST. Crush forces on packagings in the immediate vicinity of the impact point could exceed the Type B threshold. Forces of that magnitude are seldom encountered in actual accidents. A grade-crossing accident involving a train moving at high velocity could conceivably provide the requisite force at a 90-degree impact angle, and the force would be concentrated in a relatively small area rather than being uniformly distributed. Therefore, for the purposes of this study, all accidents of this severity are modeled conservatively as being of the local-deformation type. For a close-packed array of Type B packages, four packages in the immediate vicinity of the local deformation would be affected. The four packages damaged by crush forces generated as a result of impact could be subjected to a Category VII fire [800° C (1475°F) for up to 2 hours] and could release some fraction of their contents. The release fraction for each shipment was then conservatively set equal to the product of the fraction of affected Type Bs and the release fraction for a Type B in a Category VII accident (as defined in NUREG-0170 using Model II). For SSTs carrying Type A packages, all Type A packages were modeled as failing completely in a hypothetical Category VII.

(U) Accident Severity Category VIII, as defined in NUREG-0170 (NRC, 1977b) for highway transport, includes accidents involving both forces greater than 230,000 kilograms (500,000 lbs) and fires over 2 hours in duration at 800° C (1475°F) (or equivalent thermal load). No highway accident this severe has ever been recorded, so for the purposes of this study the local-deformation scenario used in Category VII was extended. Six Type Bs would be damaged as a result and subjected to fire. The shipment release fraction is again conservatively set equal to the product of the fraction of affected Type Bs and the release fraction for a Type B package in a Category VIII accident (as defined in NUREG-0170). For SSTs carrying Type A packages, all Type A packages were modeled as failing completely in a hypothetical Category VIII accident.

(U) Aerosol and respirable aerosol fraction values for dispersibility category 5 (loose, small powder) are used for feed material (NRC, 1977b). They determine the amounts of material that may be dispersed and eventually inhaled in each severity category in which a release may occur. The fraction of airborne material that is less than 10 microns in size (mean aerodynamic diameter) and that could therefore enter the human respiratory system (ICRP, 1979) was set at 50 percent for feed. Ninety percent (mass percentage) of all inhaled airborne particles between 10 and 20 microns (mean aerodynamic diameter) and 100 percent of all particles over 20 microns (mean aerodynamic diameter) are deposited in the nasopharyngeal region. Respirable aerosols may be generated by impact forces and, more importantly, by fire. The uranium oxide, although it will not burn, is more dispersible when in powder form, and this was accounted for in the analysis by the dispersability category assignment. The respirable aerosols potentially generated in severe accidents are, therefore, estimated in a conservative, material-specific manner. The deposition velocity of all released particulates was set at the default value of 0.03 feet per second (0.01 meters per second), which is representative of aerosols. The fraction of all radionuclides that would be deposited on agricultural land and then transferred to food products was set equal to 2.8×10^{-6} (Ostmeyer, 1986).

([redacted]) The fresh product is a very high integrity material. Even under very severe mechanical and thermal loadings to the fresh product package, more than 99% of the material would be in [redacted]. Therefore, aerosol and respirable aerosol fraction values for a similar high-integrity material--Fort St. Vrain power reactor fuel--are used for fresh product.

([redacted]) The irradiated product and material for recycle also are assigned aerosol and respirable aerosol fraction values like those used for Fort St Vrain power reactor spent fuel. These are also expected to be high integrity materials with the vast majority of [redacted]

(U) Aerosol and respirable aerosol fractions similar to those used for ordinary commercial shipments of Type A packages are used for low-level waste, and TRU waste is modeled as described in the WIPP SEIS. These values are typically used in RADTRAN evaluations of the shipment of these materials for environmental evaluations.

(U) For this analysis, RADTRAN results are given in terms of population dose (i.e., person-rem) per shipment. To obtain risk in terms of health effects, these values are multiplied by the total number of shipments of the appropriate material type and by health effect estimators discussed in a BEIR model. The effective whole-body doses calculated by RADTRAN were reduced by a factor of 2 to yield gonadal dose for genetic risks as suggested by the ICRP (ICRP, 1977).

Results (U)

(U) Radiological unit-risk factors from the RADTRAN System are expressed in units of expected dose (person-rem) and health effects (cancer deaths and genetic effects) per shipment for each type of shipment. Risk factors are calculated separately for the public under incident-free and accident conditions. The representation of each of the three population zones (rural, suburban, and urban) is indicated in the route data given in Tables A.3-2 and A.3-3.

(U) Nonradiological risks are deaths arising from traffic accidents (mechanical injuries) and deaths from respiratory ailments resulting from vehicular air pollution (Rao, Wilmot, and Luna, 1981). Nonradiological unit-risk factors based on national statistics were obtained from DOT data.

(U) In this analysis, the entire package dose rate was modeled as gamma radiation, which tends to overestimate total integrated dose because neutrons are rapidly attenuated in air whereas gamma radiation is not.

(U) The per shipment risk values are multiplied by the expected number of shipments of each material type to give total risks for each. The per shipment and total radiological risks for transporting feed, fresh product, irradiated product, material for recycle, and TRU waste are given in Tables A.3-4 and A.3-5, respectively. The number of genetic effects is 40 percent of the number of cancer deaths shown in these tables. The risk to the public from transportation of low-level and hazardous wastes that are to be treated and disposed of on-site is negligible. The total radiological risks of LLW transport on-site are 7.07 person-rem (3.51×10^{3} latent cancer fatality and 1.40×10^{3} genetic effect) for incident-free transport and 7.87×10^{4} person-rem (3.92×10^{-11} latent cancer fatality and 1.57×10^{-11} genetic effect) for accidents. Total radiological risks for the NTS and INEL alternatives are given in Tables A.3-6 and A.3-7. The total nonradiological risk of an accident-related fatality is 2.12×10^{1} for NTS and 2.38×10^{1} for INEL. Total nonradiological transportation risks are given in Table A.3-8.

(U) Table A.3-9 is a summary of total radiological and non-radiological risks for all materials that includes both the risks for incident-free conditions and the risks for accident conditions. The radiological risks of transportation result mainly from the transport of fresh product. Most of the radiological risk is attributable to incident-free transport. That is, potential accidents contribute little to the total radiological risks. Nonradiological risks are about 2.5 times higher than radiological risks and would result from mechanical injuries from traffic accidents. The predicted number of traffic accident fatalities of *2.06×10^{1} to 2.32×10^{1}* is trivial in comparison with the thousands of traffic deaths on American highways each year.

[redacted]

TABLE A.3-1: PACKAGING ASSUMPTIONS USED IN ANALYSES (U)

Material	Package Type	Estimated Percent of Material	Radioactive Material Form and Content	Radiation Dose Transport Index (TI) per Package	Estimated Packages Per Shipment	Transport Carrier
Feed	6M	100	UO_2 powder	10.0*	3 or 13	SST
Fresh Product	Type A-fissile	100	encapsulated	10.0	2 or 37	SST
Irradiated Product	Type A-fissile	50	encapsulated	10.0	1	SST
	Type B-fissile	50	encapsulated	10.0	2 or 37	SST
Material for Recycle	6M	100	encapsulated	10.0	3 or 25	SST
LLW	Low-Specific Activity	0**	bulk; special form	10.0		
	Type A	95	various	10.0	72 drums	On-site or Commercial Truck
	Type B	5	various	10.0	1	Commercial Truck
TRU	Type A Drum in Type B TRUPACT-II	100		10.0	42	Commercial Truck
MIXED LLW	Type A Drums	100	various	10.0	50	On-Site Truck

* Maximum regulatory value used as default.
** No LSA used in analysis, but some Type A LLW could be shipped as LSA.

[redacted]

[redacted]

TABLE A.3-2:
TRANSPORTATION QUANTITIES AND DISTANCES FOR PROPOSED SHIPMENTS THAT ARE INDEPENDENT OF SITE ALTERNATIVES ([redacted])

Origin	Destination	Material	Estimated Number of Shipments	Kilometers Per Shipment	Percent of Travel		
					Rural	Suburban	Urban
Oak Ridge, TN	Lynchburg, VA	Feed	50	526	67.7%	31.2%	1.1%
Lynchburg, VA	Albuquerque, NM	Fresh Product	1	2731	76%	23%	1.1%
Albuquerque, NM	Lynchburg, VA	Irradiated Product	1	2731	76%	23%	1.1%
Albuquerque, NM	Beatty, NV*	Low-Level Waste	0	1043	86.7%	12.4%	0.9%
Albuquerque, NM	Oak Ridge, TN	Material for Recycle	1	2205	78%	21%	1.0%
Lynchburg, VA	Oak Ridge, TN	Material for Recycle	1	526	68%	31%	1.0%
Test Location	Disposal Location	Low Level	3523	50	100%	0%	0%

[redacted]

[redacted]

TABLE A.3-3:
TRANSPORTATION QUANTITIES AND DISTANCES FOR SITE ALTERNATIVES ([redacted])

Alternative	Site	Origin	Destination	Material	Estimated Number of Shipments	Kilometers Per Shipment	Percent of Travel Rural	Percent of Travel Suburban	Percent of Travel Urban
1	NTS	Lynchburg, VA	Albuquerque, NM	Fresh Product	83	2731	76%	23%	1%
		Albuquerque, NM	Mercury, NV	Fresh Product	83	1043	87%	12%	1%
		Mercury, NV	Mercury, NV	LLW*	3523**	50	100%	0%	0%
		Mercury, NV	Albuquerque, NM	Irradiated Product	83	1043	87%	12%	1%
		Albuquerque, NM	Lynchburg, VA	Irradiated Product	83	2731	76%	23%	1%
		Mercury, NV	Carlsbad, NM	TRU Waste	1	1492	87%	12%	1%
2	INEL	Lynchburg, VA	Albuquerque, NM	Fresh Product	83	2731	76%	23%	1%
		Albuquerque, NM	Idaho Falls, ID	Fresh Product	83	1801	87%	12%	1%
		Idaho Falls, ID	Idaho Falls, ID	LLW*	3523**	50	100%	0%	0%
		Idaho Falls, ID	Albuquerque, NM	Irradiated Product	83	1801	87%	12%	1%
		Albuquerque, NM	Lynchburg, VA	Irradiated Product	83	2731	76%	23%	1%
		Idaho Falls, ID	Carlsbad, NM	Tru Waste	1	2250	87%	12%	1%

* On-site transportation of LLW is assumed to be 50 kilometers (30 miles) for all sites.
** Includes 11 shipments of mixed waste to on-site mixed-waste-processing facility.

[redacted]

TABLE A.3-4:
RADIOLOGICAL TRANSPORTATION RISK ([redacted])
(person-rem per shipment)

Shipment Type	Route	Person-rem/shipment Incident-Free*	Person-rem/shipment Accident
Fresh Prod 2-element	Lynchburg-NTS	7.91E-01	1.68E-12
	Lynchburg-INEL	9.44E-01	1.90E-12
Fresh Prod 32-element	Lynchburg-NTS	7.91E-01	3.12E-11
	Lynchburg-INEL	9.44E-01	3.53E-11
Feed	ORNL-Lynchburg	1.16E-01	2.94E-08
Irradiated Product 2-element	NTS-Lynchburg	4.01E-01	5.21E-06
	INEL-Lynchburg	4.78E-01	5.88E-06
Irradiated Product 37-element	NTS-Lynchburg	4.01E-01	9.61E-05
	INEL-Lynchburg	4.78E-01	1.09E-04
Experimental Product 4 kg	ALBQ-Lynchburg	2.09E-01	4.78E-12
Material for Recycle	ALBQ-ORNL	4.65E-01	1.95E-05
	Lynchburg-ORNL	1.16E-01	5.69E-05
	ALBQ-Lynchburg	5.81E-01	2.04E-05

* Based on TI = 10 for all shipments.

TABLE A.3-4 (cont'd): RADIOLOGICAL TRANSPORTATION RISK (U) (person-rem per shipment)

Shipment Type	Route	Person-rem/shipment Incident-Free*	Person-rem/shipment Accident
Low-Level Wastes:			
<u>Concrete & Steel</u>	NTS-NTS	2.00E-03	2.16E-12
	INEL-INEL	2.00E-03	2.16E-12
<u>Aluminum</u>	NTS-NTS	2.00E-03	7.87E-14
	INEL-INEL	2.00E-03	7.87E-14
<u>ETS-filters</u>	NTS-NTS	2.00E-03	3.53E-12
	INEL-INEL	2.00E-03	3.53E-12
<u>ETS-gravel</u>	NTS-NTS	2.00E-03	4.71E-13
	INEL-INEL	2.00E-03	4.71E-13
<u>ETS-silica</u>	NTS-NTS	2.00E-03	4.71E-13
	INEL-INEL	2.00E-03	4.71E-13
<u>ETS-struct</u>	NTS-NTS	2.00E-03	2.72E-11
	INEL-INEL	2.00E-03	2.72E-11
<u>Copper</u>	NTS-NTS	2.00E-03	1.33E-08
	INEL-INEL	2.00E-03	1.33E-08
<u>Beryllium</u>	NTS-NTS	2.00E-03	2.75E-15
	INEL-INEL	2.00E-03	2.75E-15
<u>Graphite</u>	NTS-NTS	2.00E-03	5.95E-19
	INEL-INEL	2.00E-03	5.95E-19
High-Activity ETS Waste:			
<u>ZiC-Graph</u>	NTS-NTS	2.00E-03	1.60E-13
	INEL-INEL	2.00E-03	1.60E-13
<u>Aluminum</u>	NTS-NTS	2.00E-03	5.05E-10
	INEL-INEL	2.00E-03	5.05E-10
<u>Structural</u>	NTS-NTS	2.00E-03	5.06E-10
	INEL-INEL	2.00E-03	5.06E-10
TRU Waste:			
<u>TRU</u>	NTS-WIPP	8.49E-03	1.74E-10
	INEL-WIPP	1.28E-02	2.62E-10
Mixed Waste:			
<u>Mixed</u>	NTS-NTS	9.82E-03	1.24E-05
	INEL-INEL	9.82E-03	1.24E-05

* Based on TI = 10 for all shipments.

TABLE A.3-5: TOTAL RADIOLOGICAL TRANSPORTATION RISKS (person-rem) ([redacted])

Shipment Type	Route	Shipment Number	Incident-Free*	Accident
Fresh Prod	Lynchburg-NTS	80	6.31E+01	1.35E-10
(2-element)	Lynchburg-INEL	80	7.55E+01	1.52E-10
Fresh Prod	Lynchburg-NTS	3	2.37E+00	9.36E-11
(37-element	Lynchburg-INEL	3	2.83E+00	1.06E-10
Feed	ORNL-Lynchburg	50	5.80E+00	1.47E-06
Irradiated	NTS-Lynchburg	80	3.21E+01	4.17E-04
Product	INEL-Lynchburg	80	3.82E+01	4.70E-04
(2-element)				
Irradiated	NTS-Lynchburg	3	1.20E+00	2.89E-04
Product	INEL-Lynchburg	3	1.43E+00	3.27E-04
(37-element)				
Experimental Product 4 kg	ALBQ-Lynchburg	1	2.09E-01	4.78E-12
Material for	ALBQ-ORNL	1	4.65E-01	1.95E-05
Recycle	Lynchburg-ORNL	1	1.16E-01	5.69E-05
	ALBQ-Lynchburg	1	5.81E-01	2.04E-05
Low-Level Wastes:				
Concrete &	NTS-NTS	612	1.22E+00	1.32E-09
Steel	INEL-INEL	612	1.22E+00	1.32E-09
Aluminum	NTS-NTS	148	2.96E-01	1.17E-11
	INEL-INEL	148	2.96E-01	1.17E-11
ETS-filters	NTS-NTS	143	2.86E-01	5.05E-10
	INEL-INEL	143	2.86E-01	5.05E-10
ETS-gravel	NTS-NTS	143	2.86E-01	6.74E-11
	INEL-INEL	143	2.86E-01	6.74E-11

* Based on 71 = 10 for all shipments.

TABLE A.3-5 (cont'd): TOTAL RADIOLOGICAL TRANSPORTATION RISKS (person-rem) ([redacted])

Shipment Type	Route	Shipment Number	Incident-Free*	Accident
ETS-silica	NTS-NTS	143	2.86E-01	6.74E-11
	INEL-INEL	143	2.86E-01	6.74E-11
ETS-struct	NTS-NTS	2319	4.64E+00	6.31E-08
	INEL-INEL	2319	4.64E+00	6.31E-08
Copper	NTS-NTS	1	2.00E-03	1.33E-08
	INEL-INEL	1	2.00E-03	1.33E-08
Graphite	NTS-NTS	1	2.00E-03	5.95E-19
	INEL-INEL	1	2.00E-03	5.95E-19
High-Activity ETS Waste:				
ZiC-Graph	NTS-NTS	1	1.98E-03	1.60E-13
	INEL-INEL	1	1.98E-03	1.60E-13
Aluminum	NTS-NTS	1	1.98E-03	5.05E-10
	INEL-INEL	1	1.98E-03	5.05E-10
Structural	NTS-NTS	1	1.98E-03	5.06E-10
	INEL-INEL	1	1.98E-03	5.06E-10
Beryllium	NTS-NTS	1	2.00E-03	2.75E-15
	INEL-INEL	1	2.00E-03	2.75E-15
TRU Waste:				
TRU	NTS-WIPP	1	8.49E-03	1.74E-10
	INEL-WIPP	1	1.28E-02	2.62E-10
Mixed Waste:				
Mixed	NTS-NTS	11	1.08E-01	1.36E-04
	INEL-INEL	11	1.08E-01	1.36E-04

* Based on TI = 10 for all shipments.

TABLE A.3-6: RADIOLOGICAL TRANSPORTATION RISKS FOR NTS ALTERNATIVE ([redacted])

	Dose in Person-rem		LCFs*	
Alternative	Incident-Free**	Accident	Incident-Free	Accident
Fresh Prod (2)	6.31E+01	1.35E-10	3.15E-02	6.75E-14
Fresh Prod (37)	2.37E+00	9.36E-11	1.19E-03	4.68E-14
Fresh Prod Total			3.27E-02	1.14E-13
Feed:ORNL-Lynch	5.80E+00	1.47E-06	2.90E-03	7.35E-10
Irrad Prod (2)	3.21E+01	4.17E-04	1.61E-02	2.09E-07
Irrad Prod (37)	1.20E+00	2.89E-04	6.00E-04	1.45E-07
Irrad Prod Total			1.61E-02	3.54E-07
Experimental Product	2.09E-01	4.78E-12	1.05E-04	2.39E-15
Recycle Route 1	4.65E-01	1.95E-05	2.33E-04	9.75E-09
Recycle Route 2	1.16E-01	5.69E-05	5.80E-05	2.85E-08
Recycle Route 3	5.81E-01	2.04E-05	2.91E-04	1.02E-08
Recycle Total			5.82E-04	4.85E-08
LLW:				
Concrete & Steel	1.22E+00	1.32E-09	6.10E-04	6.60E-13
Aluminum	2.96E-01	1.17E-11	1.48E-04	5.85E-15
ETS-filters	2.86E-01	5.05E-10	1.43E-04	2.53E-14
ETS-gravel	2.86E-01	6.74E-11	1.43E-04	3.37E-14
ETS-silica	2.86E-01	6.74E-11	1.43E-04	3.37E-14
ETS-struct-1	4.64E-00	6.31E-08	2.32E-03	3.16E-11
Copper	2.00E-03	1.33E-08	1.00E-06	6.65E-12
Graphite	2.00E-03	5.95E-19	1.00E-06	2.98E-22
ETS-struct-2***	1.98E-03	5.06E-10	9.90E-06	2.53E-13
Beryllium***	2.00E-03	2.75E-15	1.00E-06	1.38E-18
LLW Total			3.51E-03	3.92E-11

* Conversion factor = 5.0E-4 LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

TABLE A.3-6 (cont'd): RADIOLOGICAL TRANSPORTATION RISKS FOR NTS ALTERNATIVE (U)

	Dose in Person-rem		LCFs*	
Alternative	Incident-Free**	Accident	Incident-Free	Accident
High Activity ETS Waste:				
ZiC-Graphite	1.98E-03	1.60E-13	9.90E-06	8.00E-17
Aluminum	1.98E-03	5.05E-10	9.90E-06	2.53E-14
High-Activity Total			1.98E-05	2.53E-14
TRU Waste:	8.49E-03	1.74E-10	4.25E-06	8.70E-14
Mixed Waste:	1.08E-01	1.36E-04	5.40E-05	6.80E-08
TOTAL			5.86E-02	4.24E-07

* Conversion factor = 5.0E-4 LCF/person-rem (BEIR V).

** Based on package dose rate (TI) = 10 as default.

*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

TABLE A.3-7:
RADIOLOGICAL TRANSPORTATION RISKS FOR INEL ALTERNATIVE ([redacted])

	Dose in Person-rem		LCFs*	
Alternative	Incident-Free**	Accident	Incident-Free	Accident
Fresh Prod (2)	7.55E+01	1.52E-10	3.78E-02	7.60E-14
Fresh Prod (37)	2.83E+00	1.06E-10	1.42E-03	5.30E-14
Fresh Prod Total			3.92E-02	1.29E-13
Feed:ORNL-Lynch	5.80E+00	1.47E-06	2.90E-03	7.35E-10
Irrad Prod (2)	3.82E+01	4.70E-04	1.91E-02	2.35E-07
Irrad Prod (37)	1.43E+00	3.27E-04	7.15E-04	1.64E-07
Irrad Prod Total			1.98E-02	3.99E-07
Experimental Product	2.90E-01	4.78E-12	1.05E-04	2.39E-15
Recycle Route 1	4.65E-01	1.95E-05	2.33E-04	9.75E-09
Recycle Route 2	1.16E-01	5.69E-05	5.80E-05	2.85E-08
Recycle Route 3	5.81E-01	2.04E-05	2.91E-04	1.02E-08
Recycle Total		5.82E-04	4.85E-08	
LLW:				
Concrete & Steel	1.22E+00	1.32E-09	6.10E-04	6.60E-13
Aluminum	2.96E-01	1.17E-11	5.85E-04	5.85E-15
ETS-filters	2.86E-01	5.05E-10	1.43E-04	2.53E-14
ETS-gravel	2.86E-01	6.74E-11	1.43E-04	3.37E-14
ETS-silica	2.86E-01	6.74E-11	1.43E-04	3.37E-14
ETS-struct-1	4.64E+00	6.31E-08	2.32E-03	3.16E-11
Copper	2.00E-03	1.33E-08	1.00E-06	6.65E-12
Graphite	2.00E-03	5.95E-19	1.00E-06	2.98E-22
ETS-struct-2***	1.98E-03	5.06E-10	9.90E-06	2.53E-13
Beryllium***	2.00E-03	2.75E-15	1.00E-06	1.38E-18
LLW Total			3.51E-03	3.92E-11

* Conversion factor = 5.0E-4 LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

[redacted]

TABLE A.3-7 (cont'd): RADIOLOGICAL TRANSPORTATION RISKS FOR INEL ALTERNATIVE (U)

	Dose in Person-rem		LCFs*	
Alternative	Incident-Free**	Accident	Incident-Free	Accident
High Activity ETS Waste:				
ZiC-Graphite	1.98E-03	1.60E-13	9.90E-06	8.00E-17
Aluminum	1.98E-03	5.05E-10	9.90E-06	2.53E-14
High-Activity Total			1.98E-05	2.53E-14
TRU Waste:	1.28E-02	2.62E-10	6.40E-06	1.31E-13
Mixed Waste:	1.08E-01	1.36E-04	5.40E-05	6 80E-08
TOTAL			6.88E-02	5.18E-07

* Conversion factor = 5.0E-4 LCF/person-rem (BEIR V).

** Based on package dose rate (TI) = 10 as default.

*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

[redacted]

TABLE A.3-8: NONRADIOLOGICAL TRANSPORTATION RISKS (fatalities) ([redacted])

Type	Route	Shipment Number	Fatalities/ One-way trip	Total
Fresh Prod (2) via ALBQ	Lynchburg-NTS	80	4.39E-04	7.02E-02
	Lynchburg-INEL	80	5.33E-04	8.52E-02
Fresh Prod (37) via ALBQ	Lynchburg-NTS	3	4.39E-04	2.64E-03
	Lynchburg-INEL	3	5.33E-04	3.20E-03
Feed	ORNL-Lynchburg	50	5.52E-05	5.52E-03
Irradiated Product (2) via ALBQ	NTS-Lynchburg	80	4.39E-04	7.02E-02
	INEL-Lynchburg	80	5.33E-04	8.52E-02
Irradiated Product (37) via ALBQ	NTS-Lynchburg	3	4.39E-04	2.64E-03
	INEL-Lynchburg	3	5.33E-04	3.20E-03
Experimental Product 4 kg	ALBQ-Lynchburg	1	3.10E-04	6.20E-04
Material for Recycle	ALBQ-ORNL	1	2.53E-04	5.06E-04
	Lynchburg-ORNL	1	5.52E-05	1.10E-04
	ALBQ-Lynchburg	1	3.10E-04	6.20E-04
Low Level Wastes:				
Concrete & Steel	NTS-NTS	612	6.80E-06	8.22E-03
	INEL-INEL	612	6.80E-06	8.32E-03
Aluminum	NTS-NTS	148	6.80E-06	2.02E-03
	INEL-INEL	148	6.80E-06	2.02E-03
ETS-filters	NTS-NTS	143	6.80E-06	1.94E-03
	INEL-INEL	143	6.80E-06	1.94E-03
ETS-gravel	NTS-NTS	143	6.80E-06	1.94E-03
	INEL-INEL	143	6.80E-06	1.94E-03

[redacted]

TABLE A.3-8 (cont'd): NONRADIOLOGICAL TRANSPORTATION RISKS (fatalities) (U)

Type	Route	Shipment Number	Fatalities/ One-way trip	Total
Low-Level Wastes (cont'd):				
ETS-silica	NTS-NTS	143	6.80E-06	1.94E-03
	INEL-INEL	143	6.80E-06	1.94E-03
ETS-struct	NTS-NTS	2319	6.80E-06	3.16E-02
	INEL-INEL	2319	6.80E-06	3.16E-02
Copper	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-06	1.36E-05
Graphite	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-06	1.36E-05
High-Activity ETS Waste:				
ZiC-Graph	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-05	1.36E-05
Aluminum	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-06	1.36E-05
Structural	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-06	1.36E-05
Beryllium	NTS-NTS	1	6.80E-06	1.36E-05
	INEL-INEL	1	6.80E-06	1.36E-05
TRU Waste:				
TRU	NTS-WIPP	1	1.85E-04	3.70E-04
	INEL-WIPP	1	2.79E-04	5.58E-04
Mixed Waste:				
Mixed	NTS-NTS	11	6.80E-06	1.50E-04
	INEL-INEL	11	6.80E-06	1.50E-04

[redacted]

TABLE A.3-9:
TOTAL TRANSPORTATION RISKS (U)

Alternative	Estimated Nonradiological Fatalities
NTS	2.06E-01
INEL	2.32E-01

Alternative	Estimated Radiological Risk			
	Person-rem	LCFs	Genetic Effects*	Total
NTS				
Incident-free	1.2×10^{2}	5.9E-02	2.4E-02	8.3E-02
Accident	8.5×10^{-4}	4.2E-07	1.7E-07	5.1E-07
INEL				
Incident-free	1.4×10^{2}	6.9E-02	2.8E-02	9.7E-02
Accident	1.0×10^{-3}	5.2E-07	2.1E-07	7.3E-07

* Based on 2.0E-04 genetic effects/person-rem.

[redacted]

APPENDIX A.4: COMPARISON OF DIFFERENT TIME INTERVALS BETWEEN EXPERIMENTAL RUNS (U)

(U) Analyses were performed to determine the impact to both normal operations dose and accident dose (Committed Effective Dose Equivalent) from increased "cooldown time" between multiple tests of a single test reactor or using separate reactor cores for each test. This latter analysis also indicates the difference in radiological impact between assuming one run fission product buildup and assuming multiple run buildup. Three scenarios were investigated:

1) Five runs on one core with one week between each run plus five runs on a second core with the same one week interval between each run. All ten runs were within a one year period.

2) Five runs on one core with one month between each run plus five runs on a second core with the same one month interval between each run. All ten runs were within a one year period.

3) Ten fresh cores, each run one time, but all within a one year period.

(U) The normal operations analyses was performed by running ORIGEN2 for the normal operation scenarios followed by a MACCS run to determine the dose to the offsite individual. Following the MACCS run, another ORIGEN2 run was performed that included the first run, the decay interval, and a second run. MACCS was again run to determine the dose from the second operational test. The dose from this second run was summed with the dose from the previous (single) run. This process was repeated, until the dose from five consecutive runs was determined. This process was then repeated for a second core, summing that dose with that of the first core.

(U) Next, the entire process described in the above paragraph was repeated using an increased decay interval of one month between each run. Following this, the dose from ten separate single run cores was summed. The results were compared and are shown in Figures A.4-1 and A.4-2.

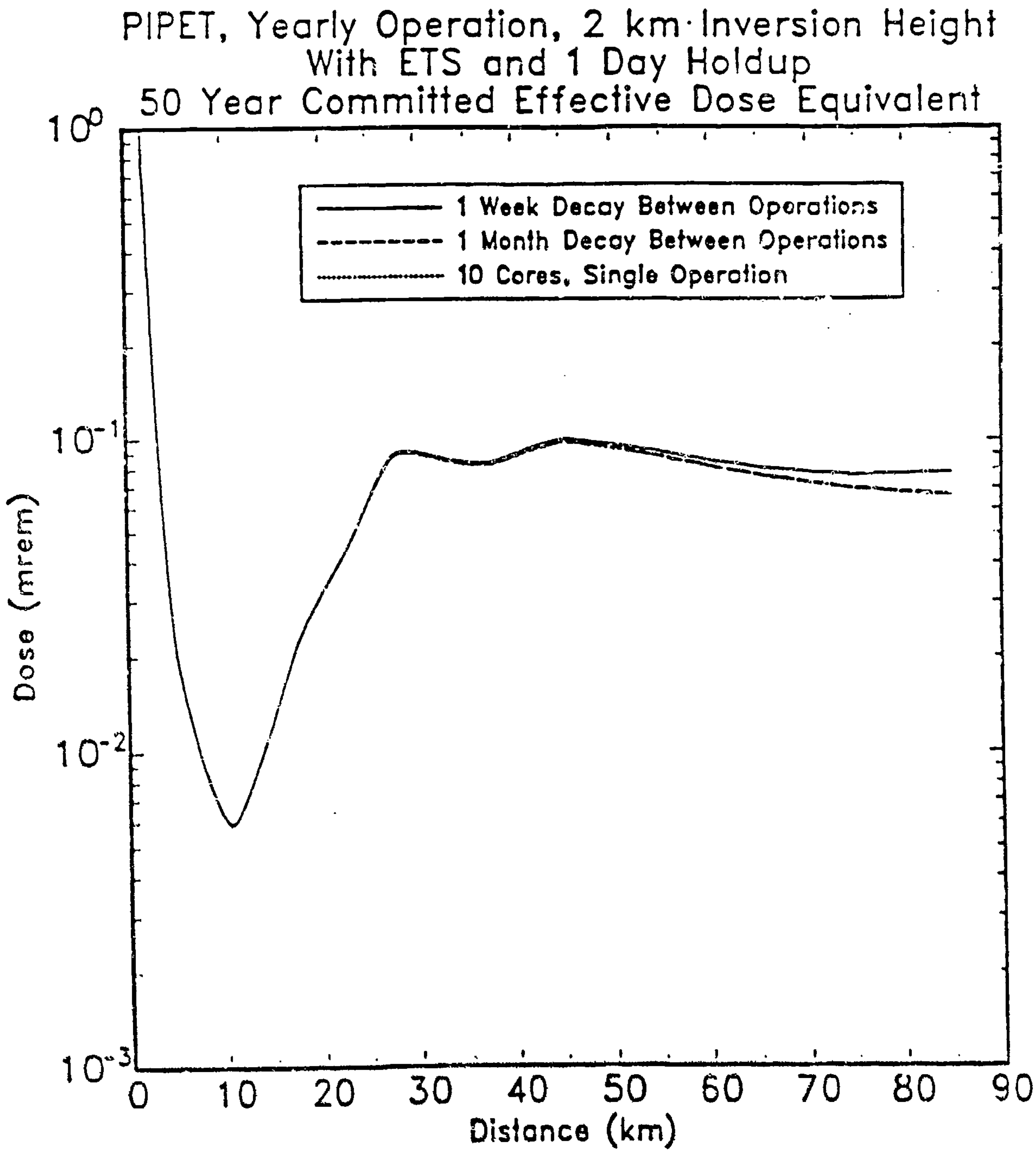
(U) The accident analyses were performed by running ORIGEN2, specifying a five run sequence with the two different decay intervals between the runs (i.e., one week and one month). MACCS was run using the fission product inventory following the fifth run in each case. Also, the dose from an accident to a single run of fresh core was determined. The results of the three scenarios are shown in Figures A.4-3 and A.4-4. This analysis demonstrates the difference in impact between a single run core and multi-run core accident.

(U) This analysis is discussed in Section 4.7.

[redacted]

[redacted]

Figure A.4-1 [redacted]

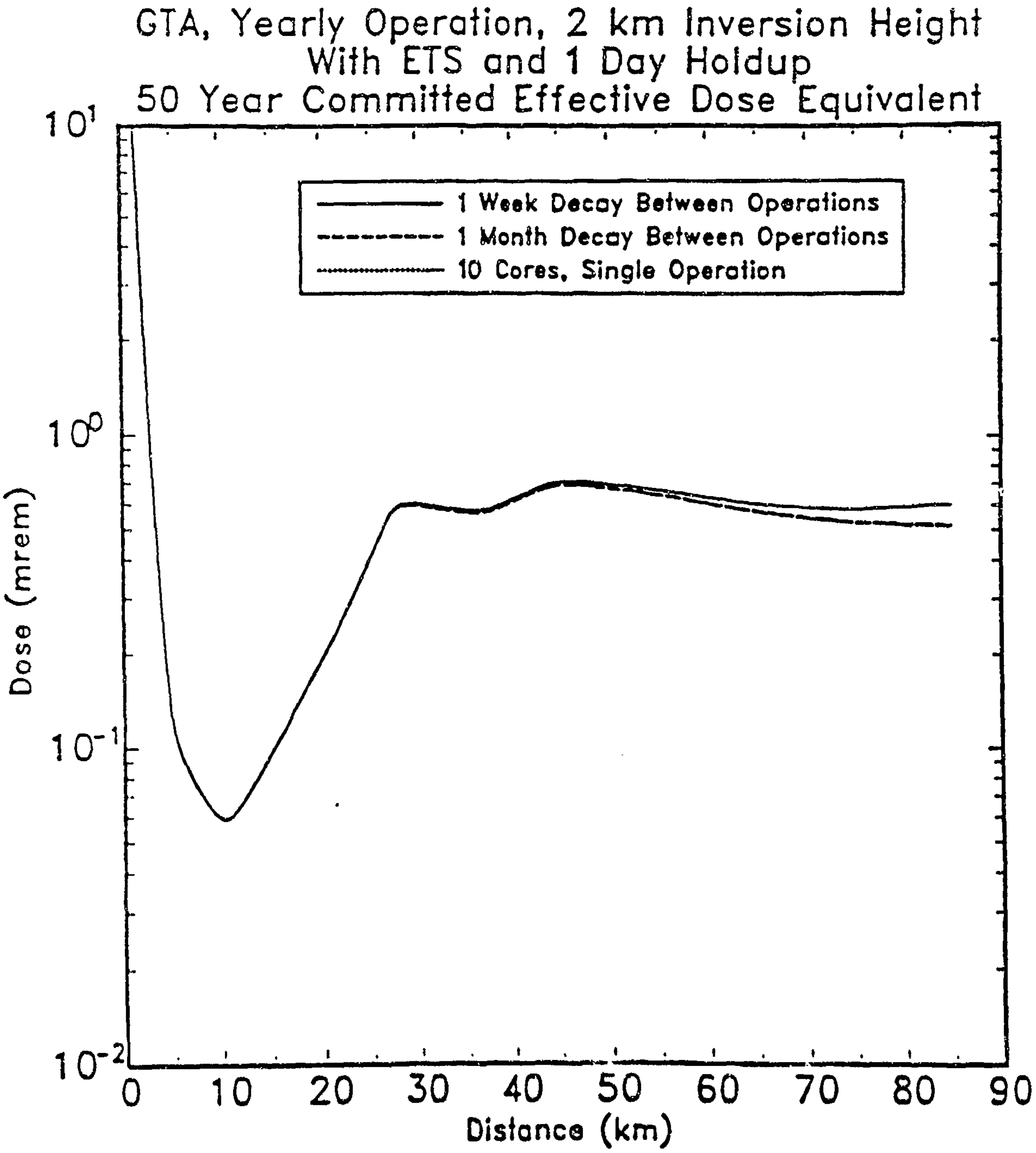


2 Cores at 5 Operations Each

[redacted]

[redacted]

Figure A.4-2 [redacted]

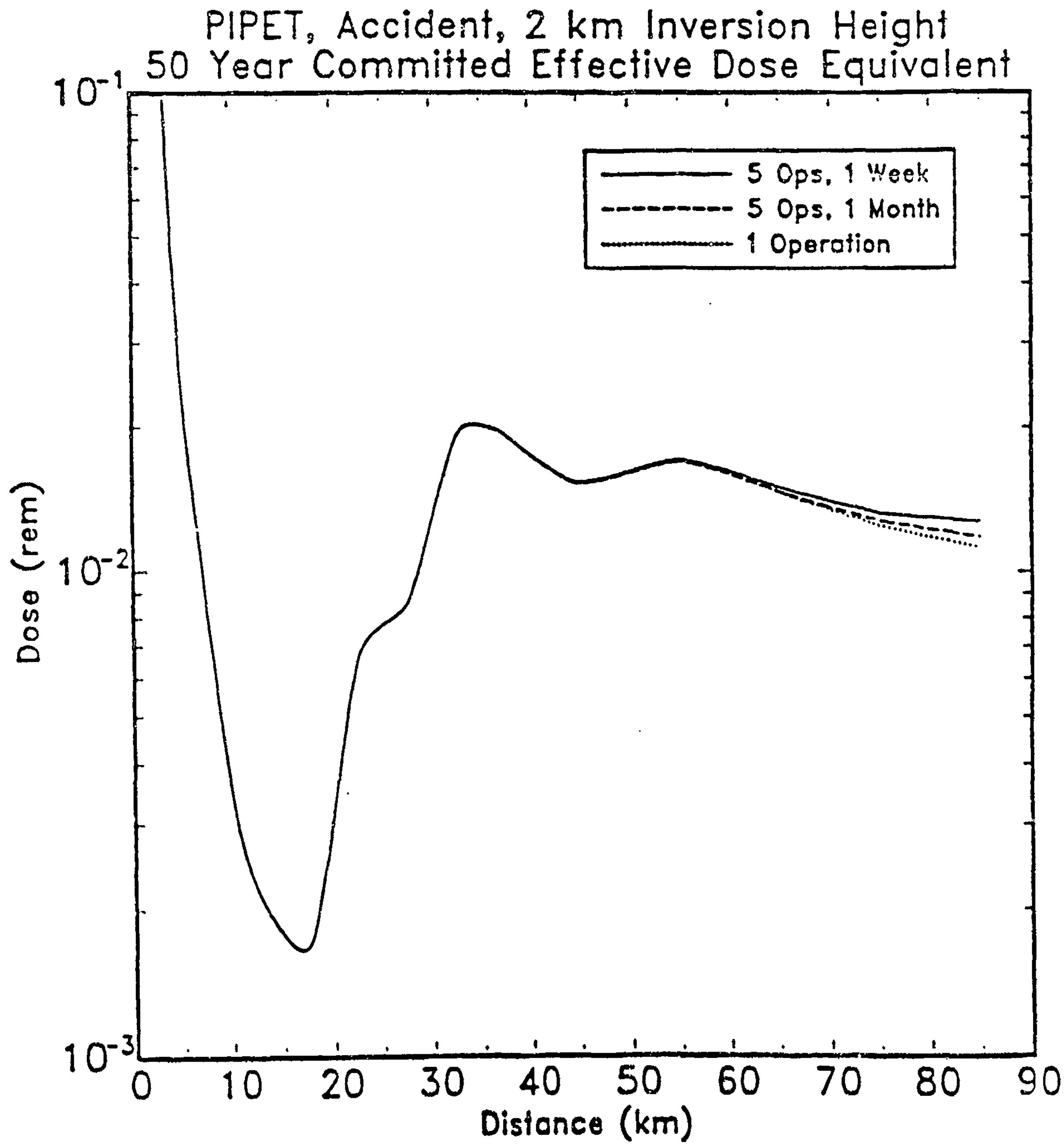


2 Cores at 5 Operations Each

[redacted]

[redacted]

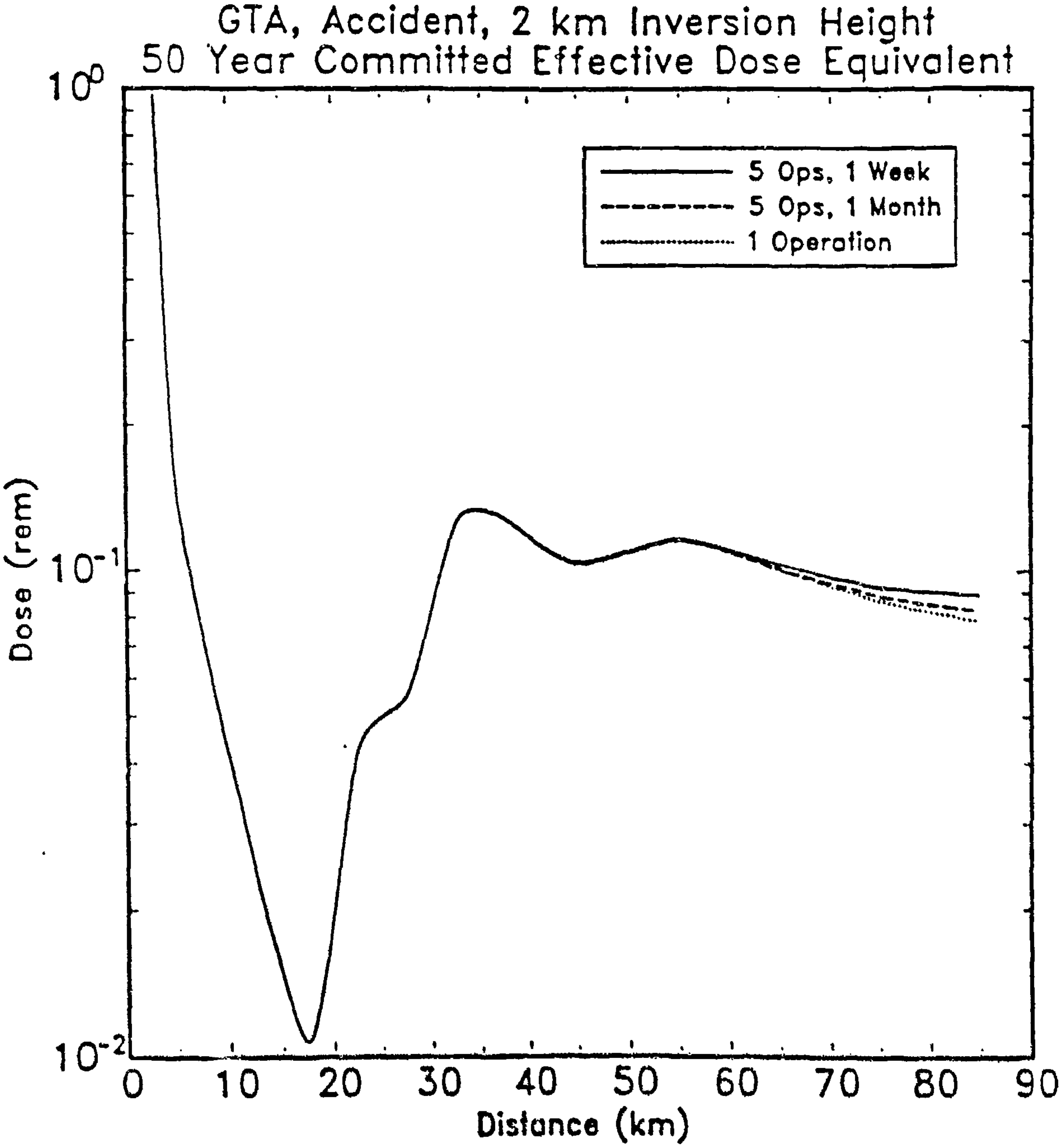
Figure A.4-3 [redacted]



[redacted]

[redacted]

Figure A.4-4 [redacted].



[redacted]

[redacted]

APPENDIX B

SAFETY ANALYSIS REPORT OUTLINE (U)

(U) NOTICE: ALL INDIVIDUAL PORTIONS OF THIS OUTLINE ARE UNCLASSIFIED, BUT COMPILATION WILL REVEAL CLASSIFIED INFORMATION WHICH IS SECRET/SPECIAL ACCESS REQUIRED.

[redacted]

[redacted]

APPENDIX B
SAFETY ANALYSIS REPORT OUTLINE (U)

Appendix B includes a

CHAPTER 1
INTRODUCTION AND GENERAL DESCRIPTION OF FACILITY.

1.1 INTRODUCTION
- 1.1.1 Program Overview
- 1.1.2 Special Design Considerations
- 1.1.3 Purpose of Report
- 1.1.4 Document Requirements and Guidelines
- 1.1.5 Compliance
- 1.1.6 Preparation and Format

1.2 GENERAL FACILITY DESCRIPTION
- 1.2.1 SMTS Site
  - 1.2.1.1 Location
  - 1.2.1.2 Site Preparation
- 1.2.2 Facility Physical Plant
  - 1.2.2.1 Facility Overview
  - 1.2.2.2 Systems Overview
  - 1.2.2.2.1 Reactor
  - 1.2.2.2.2 Reactor Coolant System
  - 1.2.2.2.3 Decay Heat Removal
  - 1.2.2.2.4 Instrumentation and Control
  - 1.2.2.2.5 Effluent Treatment System
  - 1.2.2.2.6 Emergency Systems/Safety Provisions
  - 1.2.2.3 Auxiliary Systems
  - 1.2.2.3.1 Fuel Handling and Storage
  - 1.2.2.3.2 Waste Management
  - 1.2.2.4 Support System
  - 1.2.2.4.1 Electrical Power
  - 1.2.2.4.2 Communications
  - 1.2.2.4.3 Water and Sewer Systems
  - 1.2.2.4.4 Security, Safeguards, and Access Control

1.3 COMPARISONS WITH SIMILAR FACILITIES

1.4 IDENTIFICATION OF AGENTS AND CONTRACTORS

1.5 FURTHER ANALYSIS SUPPORT OF THE FINAL SAFETY ANALYSIS REPORT

1.6 CONFORMANCE TO DOE ORDERS

1.7 ACCIDENT ANALYSIS SUMMARY

[redacted]

(cont)

CHAPTER 2 SITE CHARACTERISTICS

2.1 GEOGRAPHY AND DEMOGRAPHY,
- 2.1.1 Site Location and Description
- 2.1.2 Access Control
- 2.1.3 Population Distribution

2.2 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES
- 2.2.1 Facilities Susceptible to Effects from the SMTS
- 2.2.2 Hazards From Nearby Facilities
- 2.2.3 Evaluation of Potential Accidents

2.3 METEOROLOGY,
- 2.3.1 Regional Climatology
- 2.3.2 Local Meteorology
  - 2.3.2.1 Temperatures
  - 2.3.2.2 Precipitation
  - 2.3.2.3 Humidity
  - 2.3.2.4 Winds
  - 2.3.2.5 Severe Weather
- 2.3.3 On-Site Meteorological

2.4 HYDROLOGY,
- 2.4.1 Hydrologic Description
- 2.4.2 Floods

2.5 GEOLOGY AND SEISMOLOGY, → and design criteria.
- 2.5.1 Geology
- 2.5.2 Seismology

→ Appendix C discusses the site selection process. Appendix D includes methodology and its effect on archeology, land use, safety, waste management, air quality etc. Appendix E lists environmental compliance requirements.

CHAPTER 3
DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.1 CONFORMANCE WITH DOE ORDERS AND NRC GENERAL DESIGN CRITERIA
- 3.1.1 Introduction
- 3.1.2 Overall Requirements (Criteria 1-5)
- 3.1.3 Protection by Multiple Fission Product Barriers (Criteria 10-19)
- 3.1.4 Protection and Reactivity Control Systems (Criteria 20-29)
- 3.1.5 Fluid Systems (Criteria 30-46)
- 3.1.6 Reactor Containment (Criteria 50-57)
- 3.1.7 Fuel Radioactivity Control (Criteria 60-64)

3.2 SEISMIC CLASSIFICATION OF STRUCTURES AND SYSTEMS
- 3.2.1 Seismic Classification
  - 3.2.1.1 Category I
  - 3.2.1.2 Category II

3.3 WIND AND TORNADO CONSIDERATIONS

3.4 FLOOD CONSIDERATIONS

CHAPTER 4 REACTOR

CHAPTER 5
REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

CHAPTER 6
ENGINEERED SAFETY FEATURES

CHAPTER 7
INSTRUMENTATION AND CONTROL

7.1 INTRODUCTION
- 7.1.1 Identification of Reactor Safety-Related Systems
  - 7.1.1.1 Neutron Flux Monitoring Systems
  - 7.1.1.2 Coolant Flow Monitoring System
  - 7.1.1.3 Coolant Exit Temperature Monitoring System
  - 7.1.1.4 Reactor Safety System (RSS)
  - 7.1.1.5 Reactor Control Console
  - 7.1.1.6 Alarm and Communication Systems
- 7.1.2 Identification of Safety Criteria
  - 7.1.2.1 Safety Criteria
  - 7.1.2.2 Reactor Trip Conditions
  - 7.1.2.3 System Interlocks

7.2 REACTOR TRIP SYSTEM
- 7.2.1 Description
  - 7.2.1.1 System Description
  - 7.2.1.2 Design Basis Information
  - 7.2.1.3 Final System Drawings
- 7.2.2 Analysis
  - 7.2.2.1 Loss of Signal from Neutron Monitoring System
  - 7.2.2.2 Loss of Coolant Flow
  - 7.2.2.3 Coolant Inlet Pressure Drop
  - 7.2.2.4 Loss of Temperature Signal from Any Fuel Element
  - 7.2.2.5 Coolant Exit Temperature Exceeding Set Point
  - 7.2.2.6 Coolant Exit Temperature Time Rate of Increase Exceeding Set Point
  - 7.2.2.7 Safety Rod Actuator By-Pass Solenoid Valve Power Supply

7.3 ENGINEERED-SAFETY FEATURE SYSTEMS
- 7.3.1 Description
  - 7.3.3.1 System Description
- 7.3.2 Third Confinement Barrier in Reactor
- 7.3.3 Emergency Core Cooling
- 7.3.4 Control Room Habitability System
- 7.3.5 Effluent Treatment System
- 7.3.6 Radiation Monitoring System

7.4 SYSTEMS REQUIRED FOR SAFE SHUTDOWN
- 7.4.1 Description
  - 7.4.1.1 Normal Shutdown
  - 7.4.1.2 System Shutdown Caused by Reactor Trip

7.5 SAFETY-RELATED DISPLAY INSTRUMENTATION
- 7.5.1 Description

7.6 ALL OTHER INSTRUMENTATION SYSTEMS REQUIRED FOR SAFETY
- 7.6.1 Description

CHAPTER 8 ELECTRICAL POWER

CHAPTER 9 AUXILIARY SYSTEMS

9.6.2 Communication Systems
9.6.3 Lighting System
9.6.4 Remote Inspection/Maintenance Systems (RIMS)
9.6.5 Real-Time Weather Data Systems
9.6.6 Physical Security and Safeguards
9.6.7 Data Acquisition and Logging System (SANDUS)

CHAPTER 10

Chapter 10 does not apply, and is intentionally omitted from this outline.

CHAPTER 11 RADIOACTIVE WASTE

11.1 INTRODUCTION
11.2 SOURCE TERMS
11.2.1 Generation and Distribution of Fission Products
11.2.2 Activation Products - Nonstationary
11.2.2.1 Tritium Production
11.2.2.2 Nitrogen-16 Production
11.2.2.3 Argon-41 Production
11.3 SOLID WASTE
11.4 LIQUID WASTE
11.5 GASEOUS EFFLUENTS
11.6 WASTE MANAGEMENT
11.6.1 Radioactive and Mixed Waste Generation
11.6.2 Radioactive and Mixed Waste Sampling and Analysis
11.6.3 Radioactive and Mixed Waste Storage
11.6.4 Monitoring of Waste and Waste Storage Areas

CHAPTER 12 RADIATION PROTECTION

12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)
12.1.1 Policy Considerations
12.1.2 Design Considerations
12.1.3 Operational Considerations
12.2 RADIATION SOURCES
12.2.1 Contained Sources
12.2.2 Airborne Radioactive Material Sources

12.3 RADIATION PROTECTION DESIGN FEATURES

12.3.1 Facility Design Features
12.3.2 Shielding
12.3.3 Ventilation
12.3.4 Radiation Monitoring Implementation

12.4 HEALTH PHYSICS PROGRAM

12.4.1 Health Physics Staff
12.4.2 Exposure Limits
12.4.3 Personnel Monitoring Devices
12.4.4 Radiation Surveys
12.4.5 Monitoring Procedures

CHAPTER 13 CONDUCT OF OPERATIONS

13.1 ORGANIZATIONAL STRUCTURE

13.1.1 Management and Technical Support Organization
- 13.1.1 General Organization
- 13.1.2 Safety Responsibility
- 13.1.3 Management Responsibility and Authority
- 13.1.4 Safety Committees
- 13.1.4.1 Sandia Reactor Safety Committee
- 13.1.4.2 TCS Reactor Committee

13.1.2 Operating Organization
- 13.1.2.1 Division Supervisor
- 13.1.2.2 Reactor Supervisor
- 13.1.2.3 Reactor Operator
- 13.1.2.4 Supervisor-in-Training
- 13.1.2 5 Operator-in-Training

13.2 TRAINING

13.2.1 Training Program
- 13.2.1.1 Division Supervisor
- 13.2.1.2 Reactor Supervisor
- 13.2.1.3 Outside Representatives

13.2.2 Certification Program
- 13.2.2.1 Formal Training
- 12.2.2.2 On-the-Job Training

13.2.3 Continuing Training

13.3 EMERGENCY PLANNING

13.3.1 Emergency Plans
- 13.3.1.1 General NTS Emergency Plan
- 13.3.1.2 Site Emergency Plan
- 13.3.1.2.1 Emergency Checklist
- 13.3.1.2.2 Release of Radioactive Materials

CHAPTER 14 INITIAL TEST PROGRAM

CHAPTER 16 TECHNICAL SPECIFICATIONS

CHAPTER 17 QUALITY ASSURANCE

[redacted]

APPENDIX C

SITE NARROWING REPORT (U)

[redacted]

[redacted]

APPENDIX C
SITE NARROWING REPORT (U)

Summary (U)

(U) The site narrowing report documents the process, rationale, and results of the siting methodology used to narrow the location of the Test Program from multiple sites throughout the Continental United States (CONUS) to the three now being considered in this EIS. The ultimate site selection decision will be based on the siting report, the EIS, and other program documents.

(U) A systematic, multidisciplinary approach was implemented to incorporate all technical, operational, policy, and legal factors into the siting process and to achieve four basic goals: 1) maximize project effectiveness by maximizing project security, optimizing site operations, and maximizing mission compatibility; 2) minimize cost through maximizing constructability and minimizing construction requirements; 3) minimize public impacts by minimizing economic impacts and maximizing public safety, and 4) minimize environmental impacts through minimizing impacts to the natural and cultural resources and to special status lands.

(U) The site selection process established to achieve these goals was based on the application of exclusionary and evaluative criteria. Exclusionary criteria define the minimum level of acceptability of alternative sites. Evaluation criteria did not exclude sites, but were developed to measure preferences for specific site characteristics. All of these criteria are presented in the [redacted] Final Site Narrowing Report (THG, 1991).

Exclusionary Criteria (U)

(U) Initial screening began with the application of the exclusionary criteria which required that the site be a federally owned facility and be located within the Continental United States (CONUS). In addition, sites were screened for similarity of operations. Specifically, sites were excluded if they did not currently host similar nuclear research operations and have the infrastructure to support defense-related nuclear research activities. It was at this point that several Department of Defense (DOD) sites were dropped from the list, leaving thirteen Department of Energy (DOE) sites for further consideration.

(U) The second step in the narrowing process involved the application of the "stand-off" requirement that required that the site be at least 15 KM (9.3 miles) form the nearest urban area as measured on a U.S. Geologic Survey (USGS) 1:100,000 scale map. This eliminated all but the four sites of Hanford, Idaho National Engineering Laboratory (INEL), Nevada Test Site (NTS), and the Savannah River Site (SRS).

(U) DOE determined that the proposed [redacted] test program created a significant conflict with the Hanford and Savannah River operations (THG, 1991). Savannah River is currently the primary source for tritium production in the United States. In order to maintain ample separation between [redacted] and tritium production activities, siting the [redacted] test facility at Savannah River would conflict with wetlands and special status lands on the installation as well as the use of

[redacted]

public roads that cross SRS. Hanford was excluded because it is currently undergoing environmental restoration as a requirement of a memorandum of agreement with the State of Washington. The [redacted] ground testing program is not compatible with this agreement or the restoration activities. Also the public attention that Hanford has received recently regarding the environmental restoration program is inconsistent with the [redacted] program security requirements.

(U) Following the application of the exclusionary criteria and the discussions with DOE regarding Hanford and Savannah River conflict issues, the process of applying the evaluative criteria to the two remaining installations, NTS and INEL, began.

Evaluative Criteria (U)

(U) A team consisting of government and contractor experts in safety, security, program technology, and civil and environmental engineering was formed to apply the evaluative criteria to identify specific alternative sites at NTS and INEL. This team met with installation representatives who were familiar with operations, land use, and other concerns at the installations. Discussions with these representatives placed particular emphasis on ongoing and planned land use in the immediate area of any potential alternative site which might be considered.

(U) Based on the requirements of the program and the knowledge of the installation representatives, three specific sites were identified for further evaluation. These included the Saddle Mountain Test Station (SMTS) at NTS and the QUEST and LOFT sites at INEL. Tours of the installations were conducted and specific site visits were made to SMTS and LOFT. Sufficient characterization of the QUEST site was possible with a reconnaissance of the areas surrounding the site and published information.

([redacted]) All three sites were determined to be reasonable alternatives as a result of the discussions between the team and installation representatives and the subsequent application of the evaluative criteria. SMTS, however, emerged as the preferred site because of several factors. SMTS is a remote and secluded site which provides superior conditions for security and public safety. In addition, existing testing activities, security systems, and worker safety procedures and practices are in place at NTS. Another factor which makes SMTS preferable is that activities associated with "event" related tests and procedures required for these tests are common at NTS and do not draw public attention to test related procedures.

(U) The LOFT site already has power, communications, water, and waste water facilities from previous test activities and physical security meets anticipated requirements. The site, however, is not separated from other installation activities and is visible from off-site locations. An existing containment facility could be used for the test cell, but would require significant and potentially costly modifications. Although the QUEST site is in a relatively secluded area of INEL, it is visible from off-site locations.

[redacted]

(U) INEL has infrastructure and worker safety and emergency procedures for testing of reactors, but has no recent experience with event related testing requiring down range evacuation. This, combined with the fact that public roads cross the installation, would require temporary stand-off procedures that would result in deviations from normal operating conditions and attract public and non-program personnel attention.

(U) The ultimate site selection decision will be based on the siting report, the EIS, and other program documents.

[redacted]

[redacted]

APPENDIX D

METHODOLOGY (U)

[redacted]

APPENDIX D
METHODOLOGY (U)

Socioeconomics (U)

(U) Population and Economy

(U) Public services consist of those services provided by governmental jurisdiction, e.g. police, fire, education hospital, etc.

(U) Negligible Impact - Would result when an increase in population occurs but in numbers small enough that place little or no additional demand on services and facilities, of an affected government jurisdiction.

(U) Low Impact - Would result when an increase in potential population places additional measurable usage on public services and facilities but would not result in an increase in either staff or equipment.

(U) Moderate Impact - Would result when additional staff or equipment for public services and facilities are required to support the increased demand of the population associated with the project. This may include an increased burden on the jurisdictional government budget, which is at least partially offset by increased income from the increased population.

(U) High Impact - Would result when potential population increases in a governmental jurisdiction exceeds 5 percent over baseline growth in any given year. This may include an undue burden on the jurisdictional government budget, which is not offset by increased income from the increased population.

Land Use and Infrastructure (U)

Land Use (U)

(U) The levels of impact for land use and planning consider two factors: absorption of developable vacant land during the growth cycle and the potential for under utilization of developed land during the decline cycle. While infill is generally desirable, total depletion of vacant developable land could result in a need for annexation or encourage scattered development in unincorporated areas where costs for utilities and services would be high. An under utilization of developed land could result in reduced maintenance of properties and inefficient use of utilities and services, thereby creating a financial burden on local government and/or local taxpayers. The land use analysis assumes that future development will be located where it will be compatible with existing uses and conform to adopted plans and policies.

(U) Negligible Impact - Would result in no change in land use beyond current usage or would cause only minor reductions in the supply of vacant developable or usable land.

(U) Low Impact - Would cause changes in land use that either deplete the supply of vacant developable or usable land or create an under utilization of developed or usable land that exceeds the highest recent average annual residential vacancy rate.

(U) High Impact - Would cause a permanent change in the land use or character of the area.

<u>Infrastructure</u> (U)

(U) Negligible Impact - Would have no noticeable effect on operating practices and will not require additional equipment or facilities. No degradation of existing performance parameters or service levels will be noted.

(U) Low Impact - Would require changes in operating practices and cause temporary operating deficiencies and degradation of existing performance or service to occur. Minor additions of equipment might be required.

(U) Moderate Impact - Would overload existing facilities for protracted periods, causing isolated failures and corresponding reductions in service. New equipment or facilities or expansions of existing facilities will be needed.

(U) High Impact - Would cause major disruptions of service and serious degradation of existing performance characteristics. Major new facilities and equipment will be required.

Noise (U)

(U) Negligible Impact -	Predicted noise impacts will not exceed ambient noise levels by more than 2.9 decibels weighted on the A-scale (dBA). The increase is perceived as barely noticeable.
(U) Low Impact -	Predicted noise impacts will exceed ambient noise levels by 3 to 34.9 dBA. The increase is perceived as noticeable.
(U) Moderate Impact -	Predicted noise impacts will exceed ambient noise levels by 35 dBA or more but will not exceed OSHA limits in the workplace; < 90 dBA over an 8 hour period for long-term exposure and < 115 dBA over a 15 minute period for short-term exposure.
(U) High Impact -	Predicted noise impacts will exceed ambient noise levels by 35 dBA or more and will exceed OSHA limits in the workplace; > 90 dBA over an 8 hour period for long-term exposure and > 115 dBA over a 15 minute period for short-term exposure.

Historic and Archaeological Resources (U)

(U) Negligible Impact -	Those instances in which the project affects resources not possessing scientific cultural importance.
(U) Low Impact -	Those instances in which the project will result in finite but minimal loss of resources possessing scientific cultural importance.
(U) Moderate Impact -	Those instances in which the project will result in limited loss of resources possessing important scientific or cultural values.
(U) High Impact -	Those instances in which the project will result in extensive loss of resources possessing important scientific or cultural values.

Safety (U)

(U) Negligible Impact - Would result when the general public or project-related workers are exposed at any one time to construction or operating conditions that don't exist under normal conditions but are too slight to require safety precautions.

(U) Low Impact - Would result when the general public or project-related workers are continuously exposed to construction or operating conditions that don't exist under normal conditions and would require the implementation of minimal safety precautions.

(U) Moderate Impact - Would result when the project-related action threatens the physical well-being of the general public or project-related workers.

(U) High Impact - Would result when the project-related action is life threatening to the general public or project-related workers.

Waste (U)

(U) Negligible Impact - Would result when the project generates waste in quantities sufficient to be handled under existing operational arrangements.

(U) Low Impact - Would result when the project generates waste in quantities that require developing special procedures in order to handle the waste.

(U) Moderate Impact - Would result when special handling procedures require shipment of waste to an offsite facility.

(U) High Impact - Would result when new handling procedures are required to treat waste on-site.

Physical Environment (U)

(U) <u>Topography</u>

(U) Negligible Impact - Would result in little change to the character of the area.

(U) Low Impact - Would occur when project related activities create a generally noticeable change to the project site's topographical features, but will not result in a change to the character of the area.

(U) Moderate Impact - Would result in an interruption of the topographical features of the project site that will change the character of the area on a temporary basis.

(U) High Impact - Would result in a permanent change to the character of the area.

(U) Geology and Soils

(U) Negligible Impact - Would result when project related activities cause no loss or irretrievable commitment of any geologic/soils resources within project area.

(U) Low Impact - Would result when project related activities cause loss or irretrievable commitment of less than 50 percent of any geologic/soils resource within project area.

(U) Moderate Impact - Would result when project related activities cause loss or irretrievable commitment of more than 50 percent but less than 100 percent of any geologic/soils resource within project area.

(U) High Impact - Would result when project related activities cause irretrievable loss of one or more geologic/soils resources within project area.

(U) Seismic Activity

(U) Negligible Impact - Would result when project related activities cause micro-seismic activity that would be noticeable to neither instrumentation nor human observations.

(U) Low Impact - Would result when project related activities causes micro-seismic activity that would be noticeable to instrumentation but not noticeable to human observations.

(U) Moderate Impact - Would result when project related activities causes seismic activity noticeable to human observation but not strong enough to damage man-made structures or causes physical harm to humans.

(U) High Impact - Would result when project related activities causes seismic activity that threatens the safety of humans or causes damage to man-made structures.

(U) Water Resources

(U) Negligible Impact - Would result in no easily measurable change in the current water resource system.

(U) Low Impact - Would result in a measurable change in the current water resource system that could require minor modification in operations.

(U) Moderate Impact - Would result in a measurable change in the current water resource system that will require minor modification in operations or facilities.

(U) High Impact - Would result in a measurable change in the current water resource system that will require major changes in operations or facilities.

Meteorology and Air Quality (U)

(U) Negligible Impact - Would result when predicted incremental concentrations of emissions do not equal or exceed EPA minimum threshold levels.

(U) Low Impact - Would result when predicted incremental concentration of emissions equal EPA minimum threshold levels.

(U) Moderate Impact - Would result when predicted incremental concentrations of emissions exceed EPA minimum threshold levels.

(U) High Impact - Would result when predicted incremental concentration of emissions causes general health effects, which would include mild aggravation of symptoms in susceptible people and initial symptoms occurring in the healthy population.

[redacted]

Biological Resources (U)

(U) Negligible Impact - Would result if impacts occurred and the susceptibility, quantity, duration and habitat quality characteristics are all low.

(U) Low Impact - Would generally affect widespread habitats with low diversity or areas that are highly modified or degraded (usually by human activities).

(U) Moderate Impact - Would generally affect diverse habitats, habitats supporting species of state concern, special wildlife use areas, or vegetation/habitat types of regionally limited areal extent.

(U) High Impact - Would generally result in disruption or loss of highly unique vegetation/habitat types, habitats that are relatively unmodified, or habitats of federally listed threatened or endangered species.

Radiological Environment ([redacted])

(U) Negligible Impact - Would result if radiological dose to maximally exposed public individual from normal operations or design basis accident is less than 10 percent of applicable standards and no resultant health effects are anticipated in the exposed population.

(U) Low Impact - Would result if radiological dose to maximally exposed public individual from normal operations or during design basis accident is greater than 10 percent of applicable standards but does not exceed those standards and no resultant health effects are anticipated in the exposed population.

(U) Moderate Impact - Would result if radiological dose to maximally exposed public individual from normal operations or during design basis accident exceed applicable standards and no resultant health effects are anticipated in the exposed population.

(U) High Impact - Would result if radiological dose to maximally exposed public individual from normal operations or during design basis accident exceeds applicable standards and health effects are anticipated in the exposed population.

[redacted]

[redacted]

APPENDIX E

ENVIRONMENTAL COMPLIANCE REQUIREMENTS (U)

[redacted]

APPENDIX E
ENVIRONMENTAL COMPLIANCE REQUIREMENTS (U)

(U) This chapter provides a summary of the major laws, regulations, Executive Orders, U.S. Department of Energy (DOE) Orders, DOD Directives, and guidelines applicable to the [redacted] project that are provided for the protection of public health and the environment.

(U) Discussed are the National Environmental Policy Act (NEPA), as amended, Executive Orders, as amended, DOE Orders, as amended, and Federal and state requirements, as amended.

(U) Environmentally related Presidential Executive Orders that clarify issues of national policy and set guidelines under which Federal agencies, including DOE, must act, are addressed. DOE exercises its responsibilities for protection of public health, safety, and the environment through a series of Departmental Orders that are mandatory for operating contractors of DOE-owned facilities and DOE Orders related to environmental, health, and safety protection. In addition to complying with DOE Orders, DOE facilities must comply with various Federal and state requirements, which are also discussed.

(U) Finally, DOE has established a general environmental protection policy. DOE has stated its commitment to national environmental protection goals and sound environmental management in all of its programs and at all of its facilities in a policy statement, DOE N.5400.1, issued on January 8, 1986, and extended on January 7, 1987. This policy statement indicates that "it is DOE's policy that efforts to meet environmental obligations be carried out consistently across all operations and among all field organizations programs."

National Environmental Policy Act of 1969, as Amended (42 USC 4321 et seq.) (U)

(U) The National Environmental Policy Act (NEPA) establishes a national policy promoting awareness of the environmental consequences of the activity of humans on the environment and promoting consideration of environmental impacts during the planning and decision-making stages of a project. The NEPA requires all agencies of the Federal Government to prepare a detailed statement on the environmental effects of proposed major Federal actions that may significantly effect the quality of the human environment.

(U) The EIS has been prepared in response to these NEPA requirements. It discusses potential environmental impacts of the [redacted] Project and has been prepared in accordance with the Council on Environmental Quality (CEQ) Regulations on Implementing the National Environmental Policy Act (40 CFR 1500-1508) and DOE Guidelines for Compliance with the NEPA (52 FR-47662, December 13, 1987), as amended.

EXECUTIVE ORDERS (U)

[redacted]

(U) Executive Order 12088 [Federal Compliance with Pollution Control Standards, (October 13, 1978), as amended by Executive Order 12580 (January 23, 1987)],requires Federal agencies to comply with applicable administrative and procedural pollution control standards established by the following Federal laws:

1) Toxic Substances Control Act (15 USC 2061 et seq.)
2) Federal Water Pollution Control Act, as amended (33 USC 1251 et seq.)
3) Public Health Service Act, as amended by the Drinking Water Act (42 USC 300F et seq.)
4) Clean Air Act, as amended (42 USC 7401 et seq.)
5) Noise Control Act of 1972 (42 USC 4901 et seq.)
6) Solid Waste Disposal Act, as amended (42 USC 6901 et seq.)

<u>Executive Order 11593 (May 13, 1971)</u> (U)

(U) Requires Federal agencies, including DOE to locate, inventory, and nominate properties under their jurisdiction or control to the <u>National Register of Historic Places</u> if those properties qualify. This process requires DOE to provide the Advisory Council on Historic Preservation the opportunity to comment on the possible impacts of the proposed activity on any potential eligible or listed resources.

<u>Executive Order 11988; Floodplain Management (1977; as amended by EO 12148 (10CFR Part 1022)</u>

(U) Executive Order 11988 requires that each Federal agency take action to reduce the risk of flood damage, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by floodplains.

(U) Compliance with Executive order 11988 is required for all Federal and Federally-supported activities and projects. Specific compliance actions are required if activities are planned within a defined 100-year floodplains.

<u>Executive Order 11990, Protection of Wetlands (1977) (10 CFR part 1022)</u>

(U) The intent of Executive order 11990 is to avoid, to the extent practicable, the long- and short-term adverse impacts of destroying or modifying wetlands, and to avoid direct or indirect support of new construction in wetlands if there is a practicable alternative.

(U) Compliance with Executive Order 11990 is required for all Federal and Federally-supported activities and projects.

<u>Executive Order 11514</u> (U)

(U) Requires Federal agencies to monitor and control on a continuing basis their activities so as to protect and enhance the quality of the environment, and to develop procedures to ensure the fullest practicable provision of timely public information and understanding Federal plans and

[redacted]

programs with regards to environmental impact in order to obtain the views of interested parties. DOE has issued guidelines at 52 FR 46662, December 15, 1987, as amended, and DOE Order 5440.1c for compliance with this Executive Order.

Executive Order 12580 (Superfund Implementation) (U)

(U) Delegates to the heads of Executive departments and agencies the responsibility for undertaking remedial actions for releases, or threatened releases, that are not on the National Priorities List (NPL) and removal actions other than emergencies, where the release is from any facility under the jurisdiction or control or Executive departments and agencies.

DEPARTMENT OF ENERGY ORDERS (U)

(U) Through authority of the AEA, DOE is responsible for establishing a comprehensive health, safety, and environmental program for its facilities. The regulatory mechanism through which DOE manages its facilities is the issuance of DOE Orders. These Orders generally set forth policy and the programs and procedures for implementing that policy. The major DOE Orders pertaining to the construction and operation pertaining to this project include:

DOE Order 5440.1d, National Environmental Policy Act (U)

(U) This Order establishes responsibilities and sets forth procedures necessary for implementing the NEPA of 1969, as amended, in order to operate each of its facilities in full compliance with the letter and spirit of the Act.

DOE Order 5480.1B, Environmental Protection, Safety, and Health Protection Program for DOE Operations (U)

(U) This Order provides the organization, assigns responsibilities, and establishes the components of an environmental protection, safety, and health protection program applicable to all DOE operations. It is currently being revised and, as part of the revisions, each of its 14 chapters are being issued as separate DOE Orders in the 5480 series.

([redacted]) Chapter XI provides, among other things, radiation-protection standards for occupational and nonoccupational exposures and guidance for keeping exposures to radionuclides as low as reasonably achievable (ALARA). It also provides concentration guides for airborne emissions and liquid effluents, and it establishes exposure standards aimed at achieving ALARA dosage rates. Chapter XI additionally sets forth monitoring requirements to ensure that these standards are met. Chapter XII establishes requirements for DOE operations to ensure control of sources of environmental pollution and compliance with environmental protection laws and with Executive Order 12088.

(U) The current DOE Order 5480.11 Chapter XI revises public exposure requirements and adds a new section on environmental protection. The previous radiation dose equivalent of 500 millirem per year has been changed to 100 millirem per year. Additionally, the derived concentration guides (DCGs) for members of the public who are not "occupational workers" have been revised based on input from various national and international organizations [primarily the International Commission on Radiological Protection (ICRP)]. These DCGs establish allowable upper limits of radioisotope concentrations in air and water above natural background levels that would result in ingestion or inhalation.

(U) The requirements of the order also implements regulations concerning the protection of soils, aquifers, natural waterways, and aquatic organisms against avoidable contamination by radioactive materials. Definitive radiological monitoring requirements have been established, and additional guidance on recommended procedures and activities has been developed. General requirements also are included concerning capabilities to detect and assess unplanned releases of radioactive material and radiological consequences.

<u>DOE Order 5480.3, Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Waste</u> (U)

(U) This Order establishes requirements for packaging hazardous materials similar to the regulations for packaging hazardous materials in 10 CFR 71 and 49 CFR 109-199 for non-DOE facilities. Radioactive materials are segregated into categories based on control of nuclear criticality during shipping. Specifications are based on both amount and type of radioactive material.

<u>DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards</u> (U)

(U) Order 5480.4 specifies and provides "requirements for the application of the mandatory environmental protection, safety and health standards applicable to al DOE operations." In essence, this Order sets the standards required by the environmental protection, safety, and health program established by DOE Order 5480.1B.

(U) Order 5480.4 classifies all or parts of the following statutes and regulations as mandatory:

- National Historic Preservation Act of 1966
- Clean Air Act
- Clean Water Act
- Endangered Species Act of 1973
- Federal Insecticide, Fungicide, and Rodenticide Act
- Resource Conservation and Recovery Act
- Comprehensive Environmental Response, Compensation, and Liability Act.

DOE Order 5480.12, General Environmental Protection Program Requirements (Draft) (U)

(U) DOE Order 5480.12 is a draft order, issued on May 12, 1987, for internal DOE review. When it is issued, this Order will be an "umbrella" directive for the oversight of environmental programs that are the responsibility of the assistant Secretary for Environment, Safety and Health. It will also restructure several DOE Orders.

DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements (U)

(U) DOE Order 5484.1 establishes the requirements and procedures for reporting information having environmental-protection, and health-protection significance for DOE operations.

DOE Order 5820.2, Radioactive Waste Management (U)

(U) DOE Order 5820.2 establishes policies and guidelines for the management of radioactive waste, waste by-products, and radioactively contaminated surplus facilities. The objective of this Order is to ensure that DOE operations involving the management of radioactive waste, waste by-products, and surplus facilities adequately protect public health and safety in accordance with radiation-protection standards. This Order defines key terms and specifies lines of authority. Chapter III establishes the policies and guidelines for managing low-level waste and specified criteria for site selection, design, and disposal-site operations. In addition, it details requirements for disposal, and for site closure and postclosure. Chapter IV deals with the management of wastes contaminated with naturally occurring radionuclides. Chapter V discusses the decontamination and decommissioning of surplus facilities.

Federal Statutes and Regulations (U)

AIR QUALITY (U)

(U) The Clean Air Act (CAA), as amended, is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the CAA, as amended, requires that each Federal agency, such as DOE, with jurisdiction over any property or facility that might result in, the discharge of air pollutants, comply with "all Federal, State, interstate, and local requirements" with regard to the control and abatement of air pollution.

(U) As appropriate, all federal state, and/or local permits will be obtained in a timely manner.

40 CFR 50, National Primary and Secondary Ambient Air Quality Standards (U)

(U) This regulation contains the national primary and secondary ambient air quality standards. National primary ambient air quality standards define levels of air quality judged by the EPA to be necessary to protect public health. Standards are promulgated for sulfur oxides, particulates, carbon monoxide, photochemical oxidants, hydrocarbons and nitrogen oxides (NO_x).

40 CFR 52, Prevention of Significant Deterioration of Air Quality (U)

(U) This regulation requires in part that any operation with the potential to emit more than 250 tons per year of regulated pollutants, including NO_x, is subject to review for these pollutants. This policy was incorporated in clean air areas to specific increments even though the ambient air standards are being met. The Prevention of Significant Deterioration (PSD) permit ensures that air quality will be protected and that the best available control technology is being applied.

40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP) (U)

(U) This regulation establishes air emission Standards for beryllium, mercury, asbestos, vinyl chloride, and other hazardous materials. 40 CFR 61.92 establishes equivalents to members of the general public resulting from air emissions from DOE activities at DOE facility. These annual limits are 25 millirem to the whole body and 75 millirem to the critical organ of any individual. The regulations also require DOE to notify and obtain approval from the Administrator of the EPA prior to the start of construction on a new source of emissions or modification of an existing source of emissions.

40 CFR 82, Stratospheric Ozone Protection (U)

(U) Pursuant to the Montreal Protocol, EPA issued on August 1, 1988, a final rule limiting the production and importation of chlorofluorocarbons (CFCs) and Halone. Issuance of the rule fulfilled the U.S. commitment to protect the ozone layer by requiring a 50-percent reduction of production and consumption of these substances, based on 1986 levels, by 1988. The rule would take effect in July 1989 if the protocol is ratified by nations representing two-thirds of the 1986 global consumption of CFC's and Halone.

WATER QUALITY (U)

The Clean Water Act, as Amended (33 USC 1251 et seq.) (U)

(U) The Clean Water Act (CWA), which amended the Federal Water Pollution Control Act, was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA prohibits the discharge of toxic pollutants into the surface waters of the United States. Section 313 of the CWA, as amended, requires all branches of the Federal Government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, state, interstate, and local requirements.

(U) In addition to setting water quality standards for the nation's waterways, the CWA supplies guidelines and limitations for effluent discharges from point sources, sets standard of performance for new point source discharges, and provides authority for the EPA to implement the national Pollutant Discharge Elimination System (NPDES) permitting program.

(U) As appropriate, all federal state, and/or local permits will be obtained in a timely manner.

Safe Drinking Water Act, as Amended (42 USC 300(f) et seq.) (U)

(U) The primary objective of the Safe Drinking Water Act (SDWA), as amended, is to protect the quality of public water supplies and all sources of drinking water. The implementing regulations are found in 40 CFR 141, National Interim Primary Drinking Water Regulations. These regulations, administered by the EPA, establish standards applicable to public water systems. They promulgate maximum contaminant levels, including those for systems that serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. For radioactive material, the regulations specify that the average annual concentration of man-made radionuclides in drinking water not produce a dose equivalent to the total body or an internal organ greater than 4 millirem per year beta activity.

(U) As appropriate, all federal state, and/or local permits will be obtained in a timely manner.

River and Harbors Act of 1989 (U)

(U) The Act prohibits the discharge of "any refuse matter of any kind or description" into any navigable water.

National Primary Drinking Water Regulation 40 CFR 141 (U)

(U) Defines maximum contaminant levels in public water systems. The EPA may adopt a regulation that requires the use of a treatment technique in lieu of a maximum contaminant level. The EPA may delegate primary enforcement responsibility for public water systems to a state.

Marine protection, Research, and Sanctuaries Act 1972, as Amended 1974, 33 USC Section 1401 et seq. PL 93-254, 86 Stat 1052 (U)

(U) More commonly referred to as the "Ocean Dumping Act" this law regulates the dumping of dredging wastes, industrial chemicals, and sewage sludge into the ocean environment. Any ocean dumping requires an Ocean Dumping permit. This act also designates and protect "areas of the marine environment of special national significance due to their resource as human use values."

Federal Water Pollution Control Act (U)

(U) Enacted to restore and maintain the chemical, physical, and biological integrity of the Nation's waters and provide that: discharge of toxic pollutants be prohibited; area wide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each state; and major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

[redacted]

NOISE (U)

Noise Control Act of 1972, as Amended (42 USC 4901 et seq.) (U)

(U) Section 4 of the Noise Control Act of 1972, as amended, directs all Federal agencies to carry out "to the fullest extent within their authority" programs within their jurisdictions in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health or welfare.

BIOLOGICAL RESOURCES (U)

Endangered Species Act, as Amended (16 USC 703 et seq.) (U)

(U) The Endangered Species Act, as amended, is intended to prevent the further decline of endangered and threatened species and to bring about the restoration of these species and their habitats. The Act is jointly administered by the Departments of Commerce and the Interior. Section 7 requires consultation to determine whether endangered and threatened species are known to have critical habitats on or in the vicinity of the proposed action. No such species are expected to be impacted by the project's proposed action.

Migratory Bird Treaty Act, as Amended (16 USC 703 et seq.) (U)

(U) The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. It regulates the harvest of migratory birds by specifying the mode of harvest, hunting seasons, bag limits, etc. The Act stipulates that it is unlawful at any time, by any means, or in any manner to "kill...any migratory bird." Although no permit for this project is required under the Act, DOE is required to consult with the U.S. Fish and Wildlife Service (DELEGATE) regarding impacts to migratory birds and to evaluate ways to avoid or minimize these effects in accordance with the DELEGATE Mitigation Policy (DOI, 1981). Protected species for NTS are listed in Table E-1. Protected species for INEL are listed at Table E-2.

Bald and Golden Eagle Protection Act, as Amended (16 USC 668-668d) (U)

(U) The Bald and Golden Eagle Protection Act makes it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States (Section 668, 668c). A permit must be obtained from the Department of the Interior to relocate a nest that interferes with resource development on recovery operations (Section 668a).

(U) There are no permit or approval procedure requirements unless a nest is found; in that case, DOE can attempt to obtain permission from the Secretary of the Interior to move the nest pursuant to Section 668a, claiming interference with resource development.

[redacted]

TABLE E-1
SPECIES PROTECTED
UNDER MIGRATORY BIRD ACT
AT NTS (U)
(As Revised April 5, 1985)

Common Name	Scientific Name
Western Grebe	Aechmophorus occidentalis
Eared Grebe	Podiceps nigricollis
Cpied Billed Grebe	Podilymbus podiceps
American White Pelican	Pelecanus erythrorhynchos
American Bittern	Botaurus lentiginosers
Black Crowned Night-Heron	
Sage Sparrow	Amphispita belli
Black Throated Sparrow	Amphispita bilineata
House Finch	Capodacus mexicanus
Horned Lark	Erimophila alpestris
Pinyum Jay	Acymnorhinus cyanocephala
Oregon Junco	Junco hyemalis
Mourning Dove	Zenaida macroura
Greenbacked Heron	Butorides striatus
Snowy Egret	Egretta thulla
Great Blue Heron	Ardea herodias
White Faced Ibis	Plegadis chihi
Canadian Goose	Branta canadensis
Mallard	Anas platyrhynchos
Caduall	Anas strepera
Green-Winged Teal	Anas crecca
American Wigeon	Anas americana
Northern Pintail Duck	Anas acuta
Northern Shoveler	Anas clypeata
Innamon Teal	Anas cyanoptera
Redhead	Aythya americana
Lesser Scaup	Aythya athnis

TABLE E-1 (con't)

Common Name	Scientific Name
Bufflehead	Bucephala albeola
Common Merganser	Mergus merganser
Virginia Rail	Rallus limicola
American Coot	Fulica americana
American Avocet	Recurirostra americana
Black-Necked Stilt	Himantopus mexicanus
Snowy Plover	Charadinus alexandrinus
Killdeer	Charadrius vociferus
Spotted Sandpiper	Actitus macularia
Wilson's Phalarope	Phalaropus tricolor
Common Snipe	Gallinago gallinago
Turkey Vulture	Cathartes aura
Golden Eagle	Aquila chrysaetos
Northern Harrier-Raptor	Circus cyaneus
Sharp-Shinned Hawk	Accipiter striatus
Cooper's Hawk	Accipiter cooperii
Red-Tailed Hawk	Buteo jamaicensis
Swainson's Hawk	Buteo swainsoni
Rough-Legged Hawk	Buteo lagopus
Fariginous Hawk	Buteo regalis
American Kestral	Falco sparverius
Prairie Falcon	Falco mexicanus
Yellow Billed Cuckoo	Coccyzus americanum
Greater Roadrunner	Geococcyx californianus
Common Barn Owl	Tyto alba
Short Eared Owl	Asio flammeus
Long Eared Owl	Asio otus
Great Horned Owl	Bubo virginiamus

TABLE E-1 (con't)

Common Name	Scientific Name
Western Schreech Owl	Otus kennicottii
Flammulated Owl	Otus flammeolus
Northern Pygmy Owl	Glaucidium gnoma
Northern Saw-Whet Owl	Aegolius acadius
Burrowing Owl	Athene cunicularia
Common Poorwill	Phalaenoptilus nuttallii
Common Nighthawk	Chordeiles minor
Lesser Nighthawk	Chordeiles acutipennis
White Throated Swift	Aeronautes saxatalis
Black-Chinned Hummingbird	Archilochus alexandri
Calliope Hummingbird	Stellula calliope
Broad Tailed Hummingbird	Selasphorus platycercus
Belted Kingfisher	Ceryle alcyon
Northern Flicker	Colaptes auratus
Lewis' Woodpecker	Melanerpes lewis
Williamson's Sapsucker	Sphyrapicus thyroideus
Red Breasted Sapsucker	Sphyrapicus ruber
Yellow Bellied Sapsucker	Sphyrapicus varius
Hairy Woodpecker	Picoides villosus
Ladder Backed Woodpecker	Picoides scalaris
Western Kingbird	Tyrannus verticalis
Cassin's Kingbird	Tyrannus vociferans
Ash-Throated Flycatcher	Myiarchus cinerascens
Western Wood Pewee	Contopus sordidulus
Say's Phoebe	Sayornis saya
Willow Flycatcher	Empidonax traillii
Tree Swallow	Tachycineta bicolor
Violet-Green Swallow	Tachycineta thalassina
Cliff Swallow	Hirundo pyffhonota
Northern Rough-Winged Swallow	Stelgidoptery gernpennis
Scrub Jay	Aphelocoma coerulescens

TABLE E-1 (con't)

Common Name	Scientific Name
Clark's Nutcracker	Nucifraga columbiana
American Crow	Corrus brachyfhynchos
Common Raven	Corrus corax
Plain Titmouse	Parus inornatus
Mountain Chickadee	Parus gambeli
Bushtit	Pgaltriparus minimum
Brown Creeper	Certhia americana
White Breasted Nuthatch	Sitta carolineusis
Red Breasted Nuthatch	Sitta canadensis
House Wren	Troglodytes aedon
Bewick's Wren	Thryomanes bewicki
Marsh Wren	Cistothorus palustris
Canyon Wren	Catherpes mexicanus
Rock Wren	Salpinctes obsoletus
Cactus Wren	Campylorhynchus brunneicapillus
Golden-Crowned Kinglet	Regulus satrapa
Ruby Crowned Kinglet	Regulus calendula
Blue Gray Gnatcatcher	Polioptila caerulea
Black Tailed Gnatcatcher	Polioptila melanusa
Western Bluebird	Sialia mexicana
Mountain Bluebird	Sialia currocoides
Townsend's Soltaire	Myadestes townsendi
Swainson's Thrush	Catharus ustulatus
Hermit Thrush	Catharus guttatus
American Robin	Turdus migratorius
Loggerhead Shrike	Lanius ludoricianus
Northern Shrike	Lanis excubitur
Mockingbird	Mimus polyglottos
Sage Thrasher	Oreoscoptes montanus
Bendire's Thrasher	Toxostoma bendirei

TABLE E-1 (con't)

Common Name	Scientific Name
LeContes' Thrasher	Toxostoma lecontei
Water Pipit	Anthus spinoletta
American Dipper	Cinclus mexicanus
Bohemian Waxuring	Bombycilla garrulus
Cedar Waxuring	Bombycilla cedrorum
Pharinopepla	Phainopepla nitens
Solitary Vireo	Vireo solitarius
Virginia's Warbler	Vermima virginiae
Yellow-Rumped Warbler	Dendroica coronata
Black Throated Gray Warbler	Dendroica nigrescens
Yellow Warbler	Dendroica petechia
Common Yellowthroat	Geothlypis trichas
Yellow Breasted Chat	Icteria vinens
Black Headed Orosbeak	Pheniticus melanocephalens
Blue Grosbeak	Guiraca caerulea
Lazuli Bunting	Passerina amoena
Greentailed Towhee	Pipilo chlorusrus
Rufous Sided Towhee	Pipilo erythropithalamus
Grasshopper Sparrow	Ammodramus saramnarum
Vesper Sparrow	Proecetes gramineus
Savannah Sparrow	Passerculus sandurchensis
Song Sparrow	Melospiza melodia
Lark Sparrow	Chondestes grammacus
American Tree Sparrow	Spizella arborea
Chipping Sparrow	Spizella passerina
Brewer's Sparrow	Spizella breweri
Blackchinned Sparrow	Spizella atrogularis
White Crowned Sparrow	Zonotrichia leucophqrys
Fox Sparrow	Passerella iliaca
Lincoln's Sparrow	Melospiza lincolnii
Western Meadowlark	Stunella neglecta

TABLE E-1 (con't)

Common Name	Scientific Name
Yellowheaded Blackbird	Xantho cephalus
Redwinged Blackbird	Agelaius phoeniceus
Brewer's Blackbird	Euphagus cyanocephalus
Scott's Oriole	Icterus parisorum
Northern Oriole	Icterus galbula
Hooded Oriole	Icterus cucullatus
Western Tanager	Firanga ludoriciana
Pine Siskin	Carduelis pinus
American Goldfinch	Carduelis tristis
Lesser Goldfinch	Cardeulis psaltria
Red Grossbill	Loxia curvirostra
Rosy Finch	Lencosticle arcota
Purple Finch	Carpodacus purpureus
Cassin's Finch	Carpodacus cassinii

TABLE E-2
SPECIES PROTECTED
UNDER MIGRATORY BIRD ACT
AT INEL (U)
(As Revised April 5, 1985)

Common Name	Scientific Name
Western Grebe	Aechmophorus occidentalis
Horned Grebe	Podiceps auritus
Eared Grebe	Podiceps nigricollis
Pied-Billed Grebe	Podilymbus podiceps
American White Pelican	Pelecanus erythrorhynchos
Double-Crested Cormorant	Phalacrocorax auritus
American Bittern	Botaurus lentiginosous
Black Crowned Night Heron	Nycticorax nycticorax
Green Backed Heron	Buturides striatus
Snowy Egret	Egretta thula
Great Blue Heron	Ardea herodias
Sandhill Crane	Grus canadensis
Trumpeter Swan	Lygnus buccinator
Greater White Fronted Goose	Anser albifrons
Canada Goose	Branta canadensis
Mallard Duck	Anas platyrhynchos
Gadwall Duck	Anas strepera
Green Winged Teal	Anas crecca
American Wigeon	Anas americana
Northern Pintail	Anas acuta
Northern Shoveler	Anas clypeata
Blue Winged Teal	Anas discors
Cinnamon Teal	Anas cyanoptera
Ruddy Duck	Oxyura jamaicensis
Canvasback	Aythya valisineria

TABLE E-2 (con't)

Common Name	Scientific Name
Redhead	Aythya americana
Lesser Scaup	Aythya affinis
Harlequin Duck	Histrionicus histrionicus
Common Goldenage	Bucephala
Bufflehead	Bucephala albeoloa
Common Merganser	Mergus merganser
Virginia Rail	Rallus limicola
Sora	Porzana carolina
American Avocet	Recurvirostra americana
Black-Necked Stilt	Himantopus mexicanus
Killdeer	Charadrius vociferus
Willet	Catoptrophorus semipalmatus
Spotted Sandpiper	Actitis macularia
Wilson's Phalarope	Phalaropus tricolor
Franklin's Gull	Larus pipixcan
Ring-Billed Gull	Larus californicus
Forster's Tern	Sterna Forsteri
Black Tern	Chlidonias niger
Turkey Vulture	Cathartes aura
Northern Harrier	Circus cyaneus
Sharp-Shinned Hawk	Accipiter striatus
Cooper's Hawk	Accipiter cooperii
Northern Goshawk	Accipiter gentilis
Red-Tailed Hawk	Buteo jamaicensis
Osprey	Pandion heliaetus
Merlin	Falco columbaris
Bald Eagle	Heliaeetus leucocephalus
Peregrine Falcon	Falco Peregrinus
Ruffed Grouse	Bonasa umbellus

TABLE E-2 (con't)

Common Name	Scientific Name
Spruce Grouse	Dendragapus canadensis
White-Tailed Ptarmigan	Lagopus leucumis
Sharp-Tailed Grouse	Tympanuchus pallidicinctus
Rock Dove	Columba livia
Short-Eared Owl	Asio flammeus
Great Horned Owl	Bubo virginianus
Great Gray Owl	Strix nebulosa
Western Screech Owl	Otus kennicottii
Flammulated Owl	Otus flammerlus
Northern Pygmy Owl	Glaicidium gnoma
Northern Saw-Whet Owl	Aegolius acadicus
Common Poorwill	Phalaenoptilus nuttallii
Common Nighthawk	Chordeiles minor
White Throated Swift	Aeronautes saxatalis
Black Chinned Hummingbird	Archilochus alexandri
Calliope Hummingbird	Stellula calliope
Broadtailed Hummingbird	Selasphorus Platycercus
Rufons Hummingbird	Selasphorus rufus
Belted Kingfisher	Ceryle alujon
Northern Flicker	Colaptes auratus
Lewis' Woodpecker	Melanerpes leuris
Williamson's Sapsucker	Sphyrapicus thyroideus
Yellowbellied Sapsucker	Sphyrapicus varius
Downy Woodpecker	Picordes pubescens
Hairy Woodpecker	Picordes villosus
Three-Toed Woodpecker	Picordes tridactylus
Eastern Kingbird	Tyrannus tyrannus
Western Kingbird	Tyrannus verticalis
Olive-Sided Flycatcher	Contopus borealis
Western Wood-Pewee	Contopus sordidulus
Say's Phoebe	Sayomis saya

TABLE E-2 (con't)

Common Name	Scientific Name
Dusky Flycatcher	Empidonax oberholseri
Hammond's Flycatcher	Empidonax hammondii
Willow Flycatcher	Empidonax traillii
Tree Swallow	Tachycineta bicolor
Violet Green Swallow	Tachycineta thalassina
Bank Swallow	Riparia riparia
Northern Rough-Winged Swallow	Stelgidopteryx serripennis
Cliff Swallow	Hirundo pyrrhonota
Scrubjay	Aphelocoma coerulescens
Stellar's Jay	Cyanocitta stelleri
Gray Jay	Perisoreus canadensis
Clark's Nutcatcher	Nucifraga columbiana
American Crow	Corvus brachyrhynchos
Common Raven	Corvus corax
Black-Capped Chickadee	Parus atricapillus
Mountain Chickadee	Parus gambeli
Brown Creeper	Certhia americana
Whitebreated Nuthatch	Sitta carolinensis
Red-Breasted Nuthatch	Sitta canadensis
House Wren	Troglodytes aedon
Marsh Wren	Cistothorus palustris
Canyon Wren	Catherpes mexicanus
Rock Wren	Salpinctes obsoletus
Golden-Crowned Kinglet	Regulus satrapa
Ruby Crowned Kinglet	Regulus calendula
Mountain Bluebird	Sialia currucoides
Townsend's Solitaire	Myadestes townsendi
Veery	Catherus fuscesiens
Swainson's Thrush	Catharus ustulatus
Hermit Thrush	Catharus guttaltus

TABLE E-2 (con't)

Common Name	Scientific Name
Loggerhead Shrike	Lanius ludoricianus
Gray Cat Bird	Dumetella carolinensis
American Dipper	Cirelus mexicanus
Bohemian Waxwing	Bombycilla garrulus
Cedar Waxwing	Bombycilla cedrorum
Solitary Vireo	Vireo solitarius
Red Eyed Vireo	Vireo olivaceus
Warbling Vireo	Vireo gilvus
Orange-Crowned Warbler	Vermivora celata
Nashville Warbler	Vermivora ruficapilla
Yellow Rumped Warbler	Dendroica coronata
Yellow Warbler	Dendroica petechia
MacGillivray's Warbler	Oporornis tolmiei
Common Yellowthroat	Geothlypis trichas
Yellowbreasted Chat	Icteria virens
Black-Headed Grosbeak	Pheucticus melanocephalus
Lazuli Bunting	Passerina amoena
Green-Tailed Towhee	Pipilo chlorurus
Rufus-Sided Towhee	Pipilo erthrophthalmus
Vesper Sparrow	Pooecetes gramineus
Savannah Sparrow	Passerculus sandwichensis
Song Sparrow	Melospiza melodia
Lark Sparrow	Chondestes grammacus
American Tree Sparrow	Spizella arborea
Chipping Sparrow	Spizella passerina
Dark-Eyed Junco	Junco hyemalis
Fox Sparrow	Passerella iliaca
Lincoln's Sparrow	Melospiza lincolnii
Lapland Longspur	Calcurius lapponicus
Snow Bunting	Plectrophenax Nivalis
Bobolink	Dolichonyx oryzivorus

TABLE E-2 (con't)

Common Name	Scientific Name
Yellowheaded Blackbird	Xanthocephalus xanthocephalus
Redwinged Blackbird	Agelaibls phoeniceus
Brewer's Blackbird	Euphagus cyanocephalus
Brownheaded Crowbird	Molothrus ater
Northern Oriole	Icterus Galbula
Western Tanager	Piranga ludoviciana
House Sparrow	Passer domesticus
Pine Siskin	Carduelis pinus
American Goldfish	Carduelis tristis
Red Crossbill	Loxia curvivostra
Pine Grosbeak	Pinicola enucleator
White Winged Crossbill	Loxia leucoptera
Rosy Finch	Leucosticte arcota
Cassin's Finch	Carpodacus cassinii
House Finch	Carpodacus mexicanus
Evening Grosbeak	Coocothraustes vespertinus
Ferruginous Hawk	Buteo regalis
Rough-Legged Hawk	Buteo lagopus
Swainson's Hawk	Buteo swainsoni
Golden Eagle	Aquila chrysaetos
Prairie Falcon	Falco mexicanus
American Kestrel	Falco sparverius
Gray Partridge	Perdix perdix
Chukar	Alextoris chukar
Ring-Necked Pheasant	Phasianus colchicus
Blue Grouse	Dendragapus obscurus
Sage Grouse	Centrocercus urophasianus
American Coot	Fulica americana
Long-Billed Curlew	Numenius americanus
Common Snipe	Gallinago gallinago

TABLE E-2 (con't)

Common Name	Scientific Name
Mourning Dove	Zenaida macroura
Burrowing Owl	Athene cunicularia
Long-Eared Owl	Asio otus
Horned Lark	Eremophila alpestris
Barn Swallow	Hirundo rustica
Black-Billed Magpie	Pica pica
Robin	Turdus migratorius
Sage Thrasher	Oreoscoptes montanus
Western Meadowlark	Sturnella neglecta
Brewer's Sparrow	Spizella breweri
Sage Sparrow	Amphispiza belli

Fish and Wildlife Coordination Act 1965, 16USC 662 PL 89.72 (U)

(U) This law requires that the U.S. Fish and Wildlife Service be consulted when water bodies, including wetlands, greater than 10 acres in the area are to be modified, controlled, or impounded. Further action may be required to be taken to prevent loss and damage to these resources and provision for their development and improvement.

Fish and Wildlife Conservation Act (U)

(U) Congress encourages "all Federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and to promote conservation of nongame fish and wildlife and their habitats." The act also encourages each state to develop a conservation plan.

(U) Whenever a Federal department or agency proposes or authorizes the modification, control, or impoundment of the waters of any streams or body of water (greater than 10 acres), including wetlands, that agency must first consult with the USFWS under the Fish and Wildlife Conservation Act. Any such project must make adequate provision "for the conservation, maintenance , and management of wildlife resources." The Act requires a Federal agency to give full consideration to the recommendation of the USFWS and to any recommendations of a state agency on wildlife aspects of a project.

Marine Mammal Protection Act of 1972 (U)

(U) Marine mammal species should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and, consistent with this major objective, they should not be permitted to diminish below their optimum sustainable population.

National Wildlife Refuge System 16:668dd (U)

(U) Established for the purpose of consolidating the authorities relating to the various categories of the areas that are administered by the Secretary of the Interior for the conservation of fish and wildlife designated as the NWRS, including species that are threatened with extinction, all lands, waters, and interest therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges wildlife management areas, or waterfowl production areas.

CULTURAL RESOURCES (U)

Antiquities Act 1906, PL 59-209, 34 Stat. 225, 16 USC 431-433 (U)

(U) Provides for protection of all historic and prehistoric ruins or monuments on Federal lands.

American Indian Religious Freedom Act (AIRFA) of 1978. (P.L. 95-341, 42 USC 1966; 36 CFR 296; 43 CFR Part 7)

(U) The purpose of the Act is to require Federal agencies to consider religious values in undertaking land use projects.

(U) AIRFA is applicable to all site characterization activities that could directly or indirectly affect sacred or religious site of Native Americans.

(U) Indian religious valves should be considered and unnecessary interference with Indian religious practices

Archaeological Resources Protection Act (ARPA) of 1979 (16 USC Sections 470aa-47011; 36296; 43 CFR 7)

(U) The purpose of this Act is to secure the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster the exchange of information between involved individuals and entities. Prohibitions against vandalism are addressed in the ARPA and in the programmatic Agreement develop between the DOE and the Advisory council on Historic Preservation, particularly in the section dealing with worker education. The Act applies to all site characterized on activities that affect Federal land.

Historic site Act 1935 PL 74-292, 49 Stat. 666, 16 USC 461-467 (U)

(U) Declares as national policy the preservation for public use of historic sites, buildings, and objects. Established the national Historic Landmarks program (the beginning of the national register program).

National Historic Preservation Act, as Amended (16 USC 470 et seq.) (U)

(U) The National Historic Preservation Act, as amended, provides that places with significant national historic value be placed on the National Register of Historic Places.

(U) There are no permits or certifications required under the Act. However, if an undertaking may impact a historic property resource, consultation with the Advisory Council of Historic Preservation will generally result in the generation of a memorandum of Agreement, including stipulations that must be followed to minimize adverse impacts.

Archeological and Historic Preservation Act, as Amended (16 USC 469a et seq.) (U)

(U) This Act is directed at the preservation of historic and archeological data that would otherwise be lost as a result of Federal construction or other federally licensed or assisted activities. It authorizes the Department of the Interior to undertake recovery, protection, and preservation of archeological and historic data. When Federal agencies find that their undertakings may cause irreparable damage to archeological resources, the agency is required to notify the Department of the Interior in writing. The agencies involved may then undertake recovery and preservation, or they may request the Department of the Interior to undertake preservation measures.

Archeological Resource Protection Act, as Amended (16 USC 470aa et seq.) (U)

(U) This Act requires a permit for any excavation or removal of archeological resources from public Indian lands. Excavations must be undertaken for the purpose of furthering archeological knowledge in the public interest, and resources removed are to remain the property of the United States. Consent must be obtained from the Indian tribe owning lands on which a resource is located prior to issuance of a permit, and the permit must contain terms or conditions requested by the tribe.

National and International Monuments Acts (U)

(U) The President may declare historic landmarks and structures on Federal government controlled land to be national monuments. As part of the designation, the President may reserve a further area "compatible with the proper care and management of the objects to be protected."

LAND USE (U)

Coastal Zone Management Act (U)

(U) Used to stimulate land use planning in coastal areas. The statute provides Federal grants as a voluntary inducement to the development and adoption of state management programs. Under the Act, the Secretary of Commerce through the Office of Coastal Zone Management in the national Oceanic and Atmospheric Administration exercises Federal administrative responsibility for the program.

(U) The Act specifies that any Federal agency conducting activities, supporting activities, or undertaking any development project within the coastal zone must ensure that those activities or projects are "to maximum extent practicable, consistent with approved state management programs."

Farmland Protection Policy Act (FPPA) of 1981

(U) The farmland Protection Policy Act seeks to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmlands to non-agricultural uses.

Federal Land Policy and Management Act (FLPMA) of 1976 (P.L. 94-579; 43 USC 1701-1784; 43 CFR 2800)

(U) FLPM establishes U.S. policy with regards to government-owned lands administered by the Bureau of Land Management (BLM). Among other provisions FLPMA makes it the policy of the U.S. Government that will (1) protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological values; (2) preserve and protect, (3) provide food and habitat for fish and domestic animals; and (4) provide for outdoor recreation and human occupancy and use. Federal activities requiring access to, and activity on, such public lands require compliance with FLPMA.

Materials Act of 1947

(U) The materials Act of 1947 authorizes the land-management agencies, such as the Bureau of Land Management (BLM) and the U.S. Forest Service, to make available to Federal and state agencies common varieties of sand, stone, and gravel from public lands. Use of these materials is authorized by the issuance of a Free-use Permit to the Federal agency.

Mineral Lands Leasing Act 30:22 (U)

(U) Except as otherwise provided, all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are free and open to exploration and purchase and the lands in which they are found to occupation and purchase, by citizens of the U.S. and those who have declared their intention to become such, under prescribed by law, and according to local custom rules of miners in the several mining districts, so far as the same are applicable and not inconsistent with the Laws, of the U.S.

Multiple Use and Sustained Yield Act 16:528 (U)

(U) This act is directed towards the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and fish & wildlife purposes. It can control anything affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish in the national forest; it also controls anything affecting the use or administration of the mineral resources of national forest lands or to affect the use or administration of Federal lands not within national forests.

(U) The Secretary of Agriculture is authorized to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therefrom.

National Forest Management Act 16:1601 (U)

(U) This Act refers to the renewable resources of the forest and requires: (1) an analysis of present and anticipated uses, demands, and supplies of renewable resources, with consideration of the international resource situation and an emphasis on pertinent supply and demand; (2) an inventory, based on information developed by the Forest Service and other Federal agencies, of present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services, together with estimates of investments costs and direct & indirect returns to Federal Government; (3) a description of Forest Service programs and responsibilities in research, cooperative programs and management of the National Forest System, their interrelationship, and relationship of the programs and responsibilities to public and private activities; and (4) a discussion of important policy, considerations, laws, regulations, and other factors expected to influence and affect significantly the use, ownership, and management of forest, range and other associated lands.

National Parks and Recreation Act 16:1 (U)

(U) This Act promotes and regulates the use of Federal areas known as national parks; monuments and reservations specified, except those under the jurisdiction of the Army, to conserve the scenery and the material and historic objects and the wildlife and provide unimpaired enjoyment of future generations.

Outer Continental Shelf Lands Act P.L. 212 (U)

(U) This Act refers to all submerged lands lying seaward and outside of the area of lands beneath navigable waters and subsoil and seabed appertain to the U.S. and are subject to its jurisdiction and control. The Act requires the subsoil and seabed of the outer Continental Shelf appertain to the United States and are subject to its jurisdiction, control, and power of disposition as provided in this Act. This Act shall be constructed in a way that the character of the waters above the Outer Continental Shelf as seas and the right to navigation and fishing therein is not the be affected.

Soil Conservation and Domestic Allotment Act 16:590a (U)

(U) This Act recognizes that it is the policy of Congress to provide permanent control and prevention of soil erosion, and preserve natural resources, control floods, prevent impairment of reservoirs, maintain navigability of rivers and harbors and to protect public health and land.

Taylor Grazing Act (U)

(U) The Secretary of Interior is authorized to establish grazing districts these do not include national forests, national parks and monuments, Indian reservation and lands which are, in his opinion valuable for raising crops.

Wild and Scenic Rivers Act P.L. 90-542 16 USC 1271 (U)

(U) This Act declares by policy of the United States that certain selected rivers of the Nation which pass remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or similar values, should be preserved in free flowing conditions, and protected for the benefit of enjoyment of present and future generations.

Wilderness Act 16:1131 (U)

(U) This Act is used to assure that increasing population, accompanied by expanding settlement and growing mechanization, does not overtake areas within the U.S. and its possessions, leaving no land designated for its preservation and protection in their natural condition.

HAZARDOUS MATERIALS AND WASTES (U)

Resource Conservation and Recovery Act, as Amended, (42 USC 6901 et seq.) (U)

(U) The Resource Conservation and Recovery Act (RCRA), as amended, governs the use, handling, treatment, and disposal of solid and hazardous materials and wastes. The use of underground storage tanks is also regulated. The EPA regulations implementing RCRA are found at 40 CFR 260-280. These regulations define and identify various types of hazardous wastes and specify how the various types must be transported, handled, and disposed of.

(U) The regulations imposed on a generator or a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored and/or disposed of. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.

(U) Generally, all generators must provide documentation (a "manifest") of the creation of the waste, and the waste must be tracked from generation through treatment, storage, and/or final disposition. The RCRA regulations also require that Department of Transportation (DOT) regulations for packaging, labeling, and transporting hazardous materials and wastes be followed. These are found at 49 CFR 100-199.

Toxic Substances Control Act, as Amended 1981, [PL 94-469, 15 USC 260] [Enacted September 28, 1976; (reauthorization only)] (U)

(U) This statute specifies that all agencies of the Federal government must fully comply with its requirements. Section 22, national Defense Waiver, however, states that EPA, upon request of the President, may grant a wavier to a facility if it is in the interest of national defense.

Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA) as Amended 1975, 1978, 1980 [PL 92-516, 7 USC 136] [Enacted October 21, 1972; (reauthorization only)] (U)

(U) In reference to Federal facilities, all Federal government agencies are required to meet the requirements specified in FIFRA. Section 18, Exemption of Federal Agencies, states that the Administrator may exempt any Federal or State agency from any provision of FIFRA if EPA determines that existing emergency conditions warrant such an exemption. In addition, under Section 4, the Federal agency, with EPA approval, may establish its own certification program for applicators or restricted use pesticides to enable Federal employees to apply restricted use pesticides.

Hazardous Material Transportation Act (U)

(U) This Act refers to the authority of the Secretary of Transportation to control for establishment of facilities and technical staff for evaluation of hazards, for establishment of central reporting system for accidents, and for conducting a review and making recommendations regarding transportation of hazardous material. These materials include explosives, flammable liquids and solids, combustible and corrosive materials, and compressed gases, etc. It is declared the policy of Congress to protect the nation as adequately as possible against the risk to life and property which are inherent in the transportation of hazardous material in commerce.

Radiation Control for Health and Safety Act 42:2636 (U)

(U) The Congress declares that the public health and safety must be protected from the dangers of electronic product radiation. Therefore, this Act provides an electronic product radiation control program which includes the development and administration of performance standards to control the emission of electronic product radiation from the electronic products and the undertaking by private and public organizations of research and investigations into the effects and control of such radiation emissions.

Superfund Amendments and Reauthorization Act (SARA) (U)

(U) SARA is a freestanding legislative program known as the Emergency Planning and Community Right-To-Know Act of 1986. The Act requires (1) immediate notice for accidental releases of hazardous substance and extremely hazardous substances; (2) provision information to local emergency planning committees for the development of emergency plans, and (3) maintenance of Material Safety Data Sheets, emergency and hazardous chemical inventory forms, and toxic release forms.

(U) The law requires each state to designate a state emergency commission. In turn, the state must designate emergency planning districts and local emergency planning commissions. The primary responsibility for emergency planning is at the local level.

Comprehensive Environmental Response Compensation, and Liability Act, as Amended, (42 USC 9601 et seq.) (U)

(U) The Comprehensive Environmental Response Compensation, and Liability Act (CERCLA), as amended provides a regulatory mechanism for the cleanup of previously active waste sites that are now unused or closed and--as amended by the Superfund Amendments and Reauthorization Act (SARA)--provides an emergency response program in the event of a release of a hazardous substance from any site, whether active or inactive. CERCLA requires remediation as necessary. Using the Hazard Ranking System, sites are ranked and may be included on the NPL. The Act also includes requirements for reporting releases of certain materials in specified amounts to identified agencies.

Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001 et seq.) (U)

(U) Under this Act, Federal facilities, including those of DOE, are required to provide information, such as inventories of specific chemicals used or stored, to the State Emergency Response commission and to the Local Emergency Planning committee to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. Implementation of the provisions of this Act began in 1987, and inventory and annual emission reporting is to have begun in 1988, based on 1987 activities and information.

HEALTH AND SAFETY (U)

Occupational Safety and Health Act's (OSHA) (U)

(U) Purpose is to "assure so far as possible every working man and women in the nation, safe and healthful working conditions and to preserve our human resources." The Act provides each Federal agency the responsibility to "establish and maintain" an effective and comprehensive occupational safety and health program that is consistent with national standards. Each agency must:

- Provide safe & healthful conditions and places of employment.
- Acquire, maintain, and require use of safety equipment.
- Keep records of occupational accidents and illness.
- Report annually to the Secretary of Labor.

(U) The Superfund Amendments and Reauthorization Act requires the OSHA to issue regulations specifically designed to protect workers engaged in hazardous waste operation. The OSHA hazardous waste rules include requirements for hazard communication, medical surveillance health and safety programs, air monitoring, decontamination, and training.

RADIOLOGICAL ENVIRONMENT (U)

Atomic Energy Act (U)

(U) Pursuant to the Atomic Energy Act (AEA) of 1954, as amended, and the Energy Reorganization Act of 1974, most DOE defense related operations are not subject to regulation by the Nuclear Regulatory Commission. DOE has issued extensive standards and requirements to ensure safe operation of its facilities that are exempt from NRC licensing.

MISC. (U)

Federal Power Act 16:791 P.L. 100-473 October 6, 1988 (U)

(U) Regulatory fairness

Regulations for Radioactivity (U)

1) DOE Order 5480.11, Radiation Protection for Occupational Workers. (U)

(U) This order defines the exposure limits for occupational radiation workers, an unborn child, and members of the public entering a controlled area. The limits are:

Stochastic Effects - 5 rem annual effective dose equivalent

Non-Stochastic Effects -
Lens of Eye - 15 rem annual effective dose equivalent

Extremity - 50 rem annual effective dose equivalent
Skin - 50 rem annual effective dose equivalent
Organ or Tissue - 50 rem annual effective dose equivalent
Unborn Child - 0.5 rem entire gestation period
Planned Special Exposure - 10 rem per year

Public Entering a Controlled Area -
Whole Body - 0.1 rem annual effective dose equivalent
Organ or Tissue - 5 rem annual effective dose equivalent

(U) In all cases, annual effective dose equivalent includes contributions from internal and external exposures.

2) DOE Order 5400.1, General Environmental Protection Program (U)

(U) This order sets the general requirements for protection of the environment. The order follows the standards set forth in 40 CFR Part 61 and states that these standards are mandatory for DOE sites.

3) DOE Order 5400.5, Radiation Protection of the Public and the Environment (U)

(U) This order sets the standards for exposure limits to the public from offsite releases from DOE facilities. The limits are:

All exposure modes	- 100 millirem per year
Airborne	- 10 millirem per year
Drinking Water	- 4 millirem per year

(U) In addition to the specified limits, the order also requires an ALARA program to maintain exposures As Low As Reasonably Achievable. The order specifies general methodology to be used to model off-site doses to the public. Doses should be calculated using AIRDOS/RADRISK (CAPSS) or when available and approved, AIRDOS-PC, or other codes listed in 40 CFR Part 61. The doses should be modeled within a radius of 80 kilometer from the site and documented at least annually.

4) DOE Order 5480.6, Safety of DOE Owned Nuclear Reactors ([redacted])

([redacted]) This order requires that DOE owned reactors meet the requirements set forth in 10 CFR Part 50. The majority of the document is directed at technical design criteria and site criteria.

5) ANSI/ANS-15.7, American National Standard Research Reactor Site Evaluation ([redacted])

([redacted]) This is a recommendation developed by the American Nuclear Society (ANS 1977) to prescribe limits for a research reactor for accidental releases. The recommendations include developing 4 zones surrounding the reactor with the following dose limits from an accidental release:

Operations boundary
- 25 rem whole body, 75 rem any organ.

Site boundary
- 5 rem whole body, 15 rem any organ for 2 hour exposure.

Rural zone
- 0.5 rem whole body, 15 rem any organ for 2 hour exposure.

Urban boundary
- 0.5 rem whole body, 1.5 rem any organ for 24 hour exposure.

([redacted]) While this standard is advisory in nature, its recommendations are the most restrictive for accidental releases from a reactor.

6) 10 CFR Part 20, Standards for Protection Against Radiation ([redacted])

([redacted]) This standard describes the regulations for protection against radiation hazards arising out of activities under licenses issued by the Nuclear Regulatory Commission. The occupational limits are:

Restricted areas (per quarter)

- Whole body, head and trunk, active blood forming organs, lens of eye, gonads: 1.25 rem

- Hands and forearms, feet and ankles: 18.75 rem

- Quarterly limits are given for inhalation per isotope in Curies.

Unrestricted areas

- Whole body: 0.5 rem per year

- Whole body in any one hour: 0.002 rem

- Whole body in any 7 consecutive days: 0.1 rem

([redacted]) The standard also describes proper monitoring, posting, and reporting procedures.

7) 10 CFR Part 100, Reactor Site Criteria ([redacted])

([redacted]) This standard provides guidance for the evaluation of the suitability of proposed sites for stationary power and testing reactors subject to 10 CFR Part 50 (Domestic Licensing of Production and Utilization facilities). The standard establishes three zones around a reactor based on an accidental release. The zones are:

[redacted]

- Exclusion Area, dose on outer boundary: 25 rem whole body, 300 rem to thyroid from iodine for 2 hours following release.

- Low population zone, dose on outer boundary: 25 rem whole body or 300 rem to thyroid from iodine during cloud passage.

- Population center at least 1-1/3 times the distance from the reactor to the outer boundary of the low population zone.

8) 40 CFR Part 61, Environmental Protection Agency Regulations on National Emission Standards for Hazardous Air Pollutants (NESHAP) (U)

(U) This standard describes the exposure limits for members of the public from routine airborne release of hazardous materials. Subpart H applies to all facilities that are owned or operated by the Department of Energy. The limits are:

- Members of the public (non-DOE, NRC facilities)

  - Effective dose equivalent: 10 mrem per year
  - Effective dose equivalent from iodine: 3 mrem per year

- Members of the public (DOE facilities)

  - Effective dose equivalent: 10 mrem per year

(U) In addition to these dose limits, the NESHAPs state that an application for construction or modification of a facility does not need to be filed if the effective dose equivalent from all emissions caused by the construction or modification is less than 1% of the standard (0.1 mrem).

9) 40 CFR Part 141, Environmental Protection Agency National Primary Drinking Water Regulations (U)

(U) This standard describes the maximum contaminant levels allowed in drinking water for beta particles, photon emitting radionuclides, radium-226 and radium-228.

10) ICRP 26, Recommendations of the International Commission on Radiological Protection, Publication 26 (U)

(U) This report describes the methodology recommended by the international scientific community for calculating doses from radiation exposures based on internal and external exposures.

(U) The philosophies of the ICRP have been incorporated in DOE Order 5480.11 and in 40 CFR Part 61, and include the use of weighing factors for various body organs and tissues to determine an effective dose equivalent.

[redacted]

11) NCRP Report 91, Recommendations on Limits for Exposure to Ionizing Radiation (U)

(U) This report is from the National Council on Radiation Protection and Measurements, and recommends limits on radiation exposures based on the recommendations of the ICRP. The recommended limits are:

Occupational (annual)

- Stochastic: 5 rem
- Non-stochastic (tissues and organs):
    - Lens of the eye: 15 rem
    - All others: 50 rem

Public (annual)

- Continuous or frequent exposure: 0.1 rem
- Infrequent exposure: 0.5 rem

DOD DIRECTIVES

(U) 1000.3(D)	03/29/79 Safety and Occupational Health Policy for the Department of Defense
(U) 1000.18	06/29/76 Federal and State Occupational Safety and Health Inspections and Investigations at Contractor Workplaces on Department of Defense Installations
(U) 3020.4(D)	09/11/85 Order of Succession to Act as Secretary of Defense and Secretaries of the Army, Navy, and Air Force
(U) 3020.36(D)	11/02/88 Assignment of National Security Emergency Preparedness (NSEP)
(U) 3030.2	05/24/83 Community Planning and Impact Assistance
(U) 3145.2(D)	07/23/87 Chemical Weapons Policy
(U) 3150.1(D)	12/27/83 Joint Nuclear Weapons Development Studies and Engineering Projects
(U) 3150.2(D)	Safety Studies and Reviews of Nuclear Weapon Systems
(U) 3150.3(D)	01/23/91 Survivability and Security (S2) of Nonstrategic Nuclear Forces (NSNF)
(U) 3150.5(D)	03/24/87 DoD Response to Improvised Nuclear Device (ND Incidents)
(U) 3150.6(D)	02/03/88 United States Nuclear Command and Control System Support Staff
(U) 3200.12(D)	02/15/83 DoD Scientific and Technical Information Program
(U) 3200.12-R-2	01/17/85 Centers for Analysis of Scientific and Technical Information Regulation
(U) 3201.3	03/31/81 DoD Research and Development Laboratories
(U) 3204.1	12/01/83 Independent Research and Development
(U) 3216.2(D)	01/07/83 Protection of Human Subjects in DoD Supported Research
(U) 3222.3(D)	08/20/90 Department of Defense Electromagnetic Compatibility Program (EMCP)

(U) 3222.5(D)	10/14/86 DoD Support for Commercial Space Launch Activities
(U) 4105.68(D)	09/30/85 Defense Acquisition Research
(U) 4120.13	07/09/87 Safety Program for Chemical Agents and Weapon Systems
(U) 4120.14	08/30/77 Environmental Pollution Prevention Control and Attainment
(U) 4145.26	07/19/85 DoD Contractors Safety Requirements for Ammunition and Explosives
(U) 4145.26-M	03/01/86 DoD Contractors' Safety manual for Ammunition and Explosives
(U) 4165.60(D)	10/04/78 Solid Waste Management - Collection, Disposal, Resource Recovery, and Recycling Program
(U) 4210.14(D)	07/27/89 Hazardous Material Pollution Prevention
(U) 4215.4(D)	07/25/88 Acquisition of Nuclear Survivable Systems
(U) 4245.13	08/15/87 Design and Acquisition of Nuclear, Biological, and Chemical (NBC) Contamination-survivable Systems
(U) 4540.5(D)	06/14/78 Movement of Nuclear Weapons by Noncombat Delivery Vehicles
(U) 5000.46(D)	09/11/89 Defense Acquisition Board
(U) 5013.3	04/27/87 U.S. Nuclear Test Data Preservation
(U) 5030.15(D)	08/08/74 Safety Studies and Reviews of Nuclear Weapons Systems
(U) 5030.41(D)	06/01/77 Oil and Hazardous Substances Pollution Prevention and Contingency Program
(U) 5030.45(D)	11/29/83 DOD Representation on Federal Emergency Management Agency (FEMA) Regional Preparedness Committees and Regional Field Boards
(U) 5030.55	01/21/74 Joint AEC-DOD Nuclear Weapons Development Procedures
(U) 5100.9(D)	09/22/55 Delegation of Authority Pursuant to Executive Order 10621
(U) 5100.50(D)	05/24/73 Protection and Enhancement of Environmental Quality

(U) 5100.52	03/10/81 Radiological Assistance in the Event of an Accident Involving Radioactive Materials
(U) 5100.52-m	09/01/90 Nuclear Weapon Accident Response Procedures (NARP)
(U) 5105.31(D)	01/24/91 Defense Nuclear Agency
(U) 5126.47	12/02/85 Department of Defense Energy Policy Council
(U) 5210.63	Security of Nuclear Reactor and Special Nuclear Materials
(U) 6050.1(D)	07/30/79 Environmental Effects in the United States of DoD Actions
(U) 6055.5	01/10/89 Industrial Hygiene and Occupational Health

(U) The following permits and approvals are administered only by the state of Nevada in that there are no Federal laws that mandate compliance with these state laws by Federal agencies (DOE, 1988e).

Approval of Plans to Construct Sanitary and Sewage Collection System and Permit to Operate System (Nevada Administrative Code 445.179 through 445.182; 445.750 through 445.840; NRS 444.650) (U)

(U) The purpose of this permit system is to regulate the design, construction, and operation of sanitary and sewage collection systems and grant operating permits for such facilities in an effort to prevent and/or limit discharges of pollutants into waters of the state. The Nevada Department of Conservation and Natural Resources (NDCNR) requires that complete engineering plans and specifications for disposal of sanitary wastes and sewage be submitted to the agency for review and approval (Nevada Administrative Code 445.180). The materials must be prepared by an engineer authorized under state law to prepare such plans and specifications. The system should, to the extent possible, be located outside the 100 year floodplain. Before issuing the permit, the proposed location of the system must be approved by local government (Nevada Administrative Code 445.179). The design of the system must ensure compliance with Nevada Administrative Code 445.140 through 445.174 [National Pollutant Discharge Elimination System (NPDES) discharge permits].

Permit to Appropriate Public Waters of Nevada (NRS 533.325 to 533.540; NRS 534.010 to 534.90). (U)

(U) The purpose of a Water Appropriation permit is to prevent possible interference with prior water rights and/or improper use of non-available waters.

(U) The contents of the application form for a Water Appropriation Permit (NRS 533.335) includes among other things:

1. The source from which the appropriation is to be made.
2. The amount of water to be appropriated.
3. The purpose for which the water will be used.
4. A description of the water.
5. A description of the proposed works.
6. The estimated cost of the works.
7. The estimated time required to construct the works.
8. The estimated time required to put the water to beneficial use.

(U) The Nevada State Engineer, under authority of Nevada Revised Statues (NRS) 533.350 and 533.375, can ask for additional information to accompany the permit.

Nevada Water Pollution control Law (Nevada Revised Statutes 445.131 through 445.354) (U)

(U) The Nevada Water Pollution Control Laws as enacted to maintain the quality of the waters of the state of Nevada for public health and enjoyment, protection of animal life, operation of existing industries, the pursuit of agriculture, and the economic development of the state.

(U) The Nevada Division of Environmental Protection (NDEP) within the Department of Conservation and Natural Resources defines "Waters of the State" to include water courses, waterways, and drainage systems, as well as all underground waters (NRS 445.191). Dry washes are considered by the state to fall within this definition permit if the sewage system will discharge more than 5,000 gallons of sewage per day.

(U) NDEP requires that discharges of pollutants into the subsurface be controlled if there is the potential for contamination of groundwater supplies.

(U) The Nevada Water Pollution Control Law (NRS 445.2533) also empowers the State Environmental Commission to prescribe controls on diffuse sources of pollutants if these sources could seriously degrade the quality of waters of the State. Although runoff from site characterization is a "diffuse" source of pollutants, such runoffs will not seriously degrade any waters of the State.

Nevada State Wildlife Statues (NRS 501.105 to 501.110 NAC 503.010 to 503.080).

(U) Nevada law (NRS 501.105 to 501.110) provides for management and protection of various types of wildlife including game animals, birds, fish, and amphibians; fur-bearing animals; and protected, rare, or endangered species.

(U) The State of Nevada via the Nevada Department of Wildlife (NDOW) manages game on BLM lands through cooperative agreements with the BLM. If protected animals are to be captured, removed, or destroyed, a permit must first be obtained from the NDOW.

Nevada State Vegetation Statutes (NRS 501.105; 504.520; 527.050; 527.100; 527.105; 527.270; NAC 527.010 to 527.020). (U)

(U) Nevada law provides for broad protection of the indigenous flora of the State as well as for selected species classified as Critically Endangered.

(U) It is unlawful, without written permission from the Nevada State Forester Firewarden to destroy any plant declared endangered by the State on Federal or State lands (NRS 527.050). The destruction, mutilation, or possession of any cactus or yucca from state and Federal lands is also prohibited without written permission (NRS 527.100).

(U) Plant species whose existence is considered endangered by the State of Nevada are provided protection under NRS 527.270. Nineteen plant species are currently listed as Endangered by the State.

(U) The following permits and approvals are administered only by the state of Idaho (DOE 1988a).

(U) The Idaho Environmental Protection and Health Act (Idaho Code, Title 39, Chapter 1) establishes general provisions for protection of the environment and public health. The Department of Health and Welfare has been created by this Act to implement these environmental, health, and social services requirements. The Act authorizes the Department to promulgate standards, rules, and regulations relating to water and air quality, noise reduction, and solid waste disposal. The Department is granted authority to issue required permits, collect fees, establish compliance schedules, and review plans for the construction of sewage and public water treatment and disposal facilities.

(U) Authorization is also granted to the Department of Health and Welfare by the Idaho Water Pollution Control Act (Idaho Code, Title 39, Chapter 36) for the protection of the waters of Idaho. General language concerning the prevention of water pollution and the provision of financial assistance to municipalities is contained in this law.

(U) The Department of Health and Welfare is also responsible for enforcement and implementation of the Hazardous Waste Management Act of 1983, as amended (Idaho Code, Title 39, Chapter 44), which provides for the protection of health and the environment from the effects of improper or unsafe management of hazardous wastes and for the establishment of tracking or manifesting system for these wastes. The Idaho Act sets forth requirements for the development of plans that address identification of hazardous wastes, unauthorized treatment, storage, release, use, or disposal of these wastes, and permit requirements for hazardous waste facilities. Rules and regulations concerning the transportation, monitoring, reporting, and record keeping of hazardous wastes are to be promulgated under authority of this Act.

<u>Idaho Air Pollution Control Regulations</u> (U)

(U) Title 1, Chapter 1, of the Rules and Regulations for the Control of Air Pollution in Idaho is intended to provide authority and standards in compliance with the CAA. The Department of Health and Welfare has been granted authority to implement the requirements of the CAA and to adopt rules and regulations for that purpose. These rules and regulations include provisions for establishing compliance schedules and emission limits, reporting and correction of emissions that exceed established limits, and permitting requirements for construction and operation of facilities or activities that may generate emissions in excess of the prescribed standards. The control of open burning and fugitive dust is addressed by these rules, as are specified types of facilities that may exceed emission limits. Also required by the Idaho Air pollution control Regulations is the formulation of a plan for the prevention and alleviation of air pollution emergencies. The plan includes definitions of the severity of the emergency, requirements for public notification, and recommended actions to be taken in reducing an air pollution emergency.

Idaho Water Quality Standards and Wastewater treatment Requirements (U)

(U) Provisions are set forth by these regulations (Title 1, Chapter 2) for protection of designated water uses and the establishment of water quality standards that will protect those uses. The Department of Health and Welfare has been authorized to develop and enforce these regulations by Section 39-105 of the Idaho Code. Restrictions are outlined by these regulations for control of point-source and nonpoint -source discharges and including surface and ground waters. These regulations identify water-use classifications, specifically prohibited discharges, water quality criteria, and requirements for treatment of waste water prior to discharge in the waters of Idaho.

Idaho Regulations for Public Drinking Water Systems (U)

(U) Maximum contaminant levels for public drinking water systems are provided by these regulations. The Water Quality Bureau, as a subdivision of the Department of Health and Welfare, sets forth monitoring and reporting requirements for inorganic and organic chemicals and radiochemicals. Other water quality and locational standards are also included in these regulations. The Department reserves the authority to determine whether the contamination is caused by nuclear facilities and/or require further monitoring.

Idaho Hazardous Waste Management Regulations (U)

(U) Pursuant to the Hazardous Waste Management Act, the Department of Health and Welfare (Title 1, Chapter 5) has adopted, by reference the Federal regulations regarding hazardous waste rule making, hazardous waste delisting, and identification of wastes. Included in these regulations are requirements for hazardous waste generators, transporters, and management facilities as well as detailed procedures for permitting these activities. The general requirements for generators, transporters, and management facilities have been incorporated by reference; however, some sections have been revised to reflect Idaho's permitting program. Section 39-4403 (14) of the Act identifies "restricted hazardous waste" that includes liquid hazardous wastes containing specified concentrations of constituents as well as hazardous wastes containing concentrations of halogenated compounds.

Idaho Solid Waste Management Regulations (U)

(U) These regulations, as developed by the Idaho Department of Health and Welfare in Title 1, Chapter 6, of the Solid Waste Management Regulations and Standards Manual, provide standards for the management of solid wastes to minimize the detrimental effects of disposal. These standards include requirements for the review of plans and the approval of procedures and operational and post-operational standards for landfills, incinerators, and processing facilities and for transportation and storage of solid waste.

Idaho Rules and Regulations for Construction and Use of Injection Wells (U)

(U) Requirements for the construction, location, and usage of injection wells within the State of Idaho are set forth in these regulations. The Department of Water Resources has been granted administrative authority over injection wells. Injection of radioactive or hazardous materials through an existing well or above a drinking water source is prohibited. Parameters for quality of fluids discharged and allowable uses of injection wells are included in these regulations as are classifications of well types and permitting requirements for injection wells.

APPENDIX F

CONSULTATION (U)

This appendix includes all written comments received from the State of Nevada during the agency review and comment process for the Environmental Impact Statement. The comments are presented in numerical order printed in bold type followed by a formal comment response.

RESPONSE TO COMMENTS:
PAUL LIEBENDORFER (STATE OF NEVADA)
August 15, 1991

1. Where does DOE differentiate between HLW and LLW. If the project, however unlikely, does generate HLW, how is DOE going to manage the HLW?

It is anticipated that no HLW will be generated by the program. If high level waste is generated, it would be in the form of spent reactor fuel. Such HLW would be handled as defense HLW and temporarily stored until a permanent storage facility is made available. This will be so stated in Sections 2.4.1, 4.3.1.6, and 4.4.1.6 of the FEIS.

2. NTS has no permitted (or interim status) MW storage facility (p.89).

The wording "storage" area will be changed to "disposal" area in Section 4.3.1.6 of the FEIS.

3a. Re: Liquid LLW or MW. Liquid waste cannot be disposed of at NTS, therefore, the solidification process must be discussed and analyzed in the document.

Sections 2.4.1, 4.3.1.6, and 4.4.1.6 of the FEIS will state that, if water injection is used to cool the effluent in the ETS, that water would be solidified and disposed of as a solid waste. A few options are available to accomplish this. These methods include incorporating the liquid into concrete or using an evaporative process.

3b. Also, solidification of MW will require DOE/NV to possess a RCRA treatment permit (which DOE does not have).

If liquid mixed wastes are generated, a permitted treatment process would have to be developed.

4. Management of HW offsite needs to be discussed in a manner that the management of HW is done by the current permittee, REECo.

Concur. Statement will be incorporated into Section 3.2.1.1.6 of the FEIS.

5. Diesel generators require a permit if they are greater than 250 hp and if used for more than 100 hours per year.

This will be so stated in Section 4.3.2.5 of the FEIS.

6. Reiterate that Yucca Mountain is not approved for HLW disposal.

Concur. The present status of the Yucca Mountain site will be clearly stated in Section 3.2.1.1.2 of the FEIS as designated for site characterization to determine suitability for development of a repository.

7. Waste generated from other support sites should be discussed in a manner that identifies that their waste is entered into their normal disposal stream. It is not clear that waste from other sites is not coming to NTS for disposal.

Paragraph on facility waste will be included into Sections 2.4.1 and 4.2 that states that each individual facility is responsible for its own respective waste.

8. Septic system under 5,000 gallons effluent per day with no industrial waste will be reviewed by Consumer Health; greater than 5,000 gal per day or if any contains industrial waste will be reviewed by Nevada Division of Environmental Protection.

It is anticipated that the septic system will handle less than 5,000 gal/day with no industrial waste as part of this waste stream. Only review by the Nevada Department of Consumer Health is required. This will be described in Section 4.3.1.6.

9. Remember that the Area 5 MW EA is not done yet. This preliminary draft EIS assumes approval for the EA for disposal of MW.

Concur. Section 4.3.1.6 will be modified to delete the word "permitted" in describing the mixed waste (RCRA) disposal area at the Area 5 RWMS.

10. The State of Nevada requests a 30 day review of the DEIS.

The Draft EIS was completed and distributed on August 5, 1991. The Final EIS is in preparation and responds to comments received on the DEIS. Your comments will be incorporated to the maximum extent feasible.

EG&G
ENERGY MEASUREMENTS

INTER-OFFICE MEMORANDUM

FOR OFFICIAL USE ONLY 9 September 1988
LV88-601

TO: Thomas P. O'Farrell

FROM: Kent Ostler

SUBJECT: Preactivity survey of [redacted] facility

On July 21, Bob Bivona of NTSO requested a work statement providing costs for a preactivity survey for threatened and endangered candidate species at the [redacted] facility in Area 14. Since Sandia was requesting the work, no survey work was commenced until approval by Sandia was received. This occurred on August 22. We were supplied with an overall site plan as shown in reduced form in Figure 1. Cathy Wills and I conducted the survey on August 24 and 25. Cathy called Steve Mellington on August 26 to inform him the survey was completed.

The [redacted] facility is located in Mid Valley east of Shoshone Mountain. Access to the facility is off of Mid Valley road approximately 2 miles south from the Mine Mountain Junction with Mid Valley Road. The areas proposed for disturbance had been marked and flagged. These included approximately 2 miles of powerline from the Mine Mountain Junction to the facility, two access roads that were each approximately .8 miles long, a .5 mile long water supply line, a 250' square water tank area and an approximately 4 acre main facility area (Fig. 1).

The facility is situated on an east-facing bahada at an elevation of 4840 ft. The access roads extend from the 4840 ft elevation to Mid Valley road at roughly 4600 ft. The dominate vegetation at the facility and along the access roads is Coleogyne ramosissima, Ephedra nevadensis, Yucca brevifolia, Chrysothamnus teretifolius and Cowania mexicana. Yucca schidigera was also found although it was much less common than Y. brevifolia. The water supply line and much of the powerline routes were in old burn areas. The composition of the vegetation in the burned areas was similar to unburned areas except there were considerably more annual species, particularly Bromus rubens.

Since yuccas are protected species under Nevada State law, we estimated the number that would be displaced by this facility. Direct counts of individuals on a 50' wide strip along the exit road "B", the southern-most road, yielded 110 individuals. Since the road was 4100 ft long, it represents an area of 4.7 acres. Estimates of yuccas disturbed on the 4 acre facility based on the same density as was found on the exit road would yield approximately 94 individuals. The water line and tank area are estimated to displace 68 individuals and the main access road another 44 individuals. Only 3 individuals of Y. schidigera were found on the road "B" right-of-way, thus fewer than 10 individuals would probably be affected by the entire facility.

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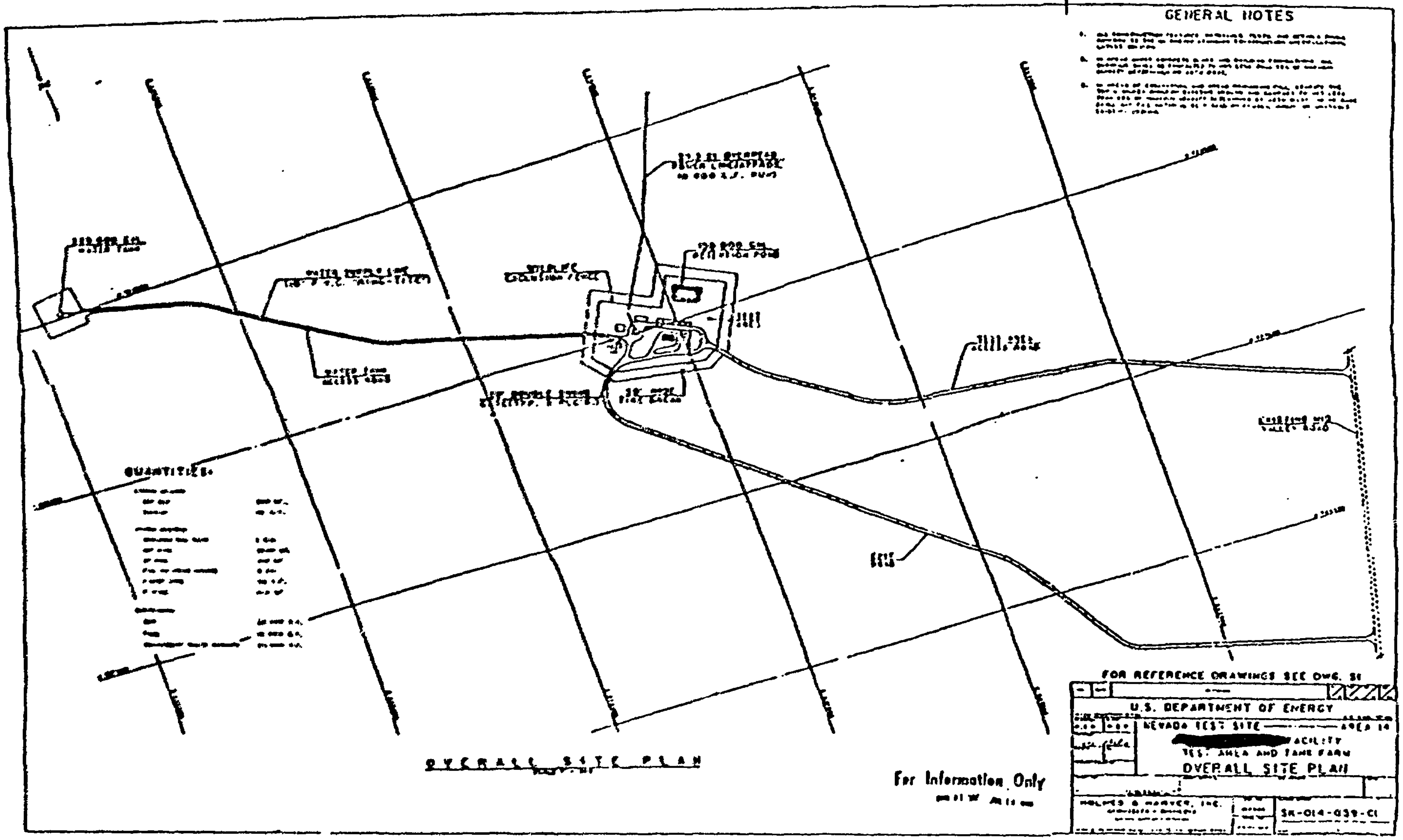
Eight individual plants of Coryphantha vivipara were found at two proposed disturbance locations. Both sitings were approximately .25 mile from the Mid Valley Road at approximately 4700 ft. Five plants were found on the northern access road and three individuals were found on the southern exit road. Since flowers are required to make a positive identification, it was not possible to determine whether the plants found were C. vivipara variety rosea which is listed in the Federal Register (1985) as a 3C candidate species or C. vivipara variety deserti which is not listed. Variety rosea generally occurs at higher elevations, 6100-6800 ft. in the NTS although it has been collected from the C.P. hills. Variety deserti has been collected from the southeastern slopes of Shoshone Mountain and generally occurs at lower elevations, 4400 - 4800 ft., on the NTS (Beatley, 1976).

RECOMMENDATIONS

Since there is considerable doubt that the cacti found were C. vivipara rosea and there were only eight plants impacted, it should not be necessary to modify or reroute the access roads.

The yuccas on the proposed disturbance represent a valuable resource that DOE should not destroy. The joshua tree (Y. brevifolia) is a very popular plant for residential and commercial landscaping. Although there are no federal laws protecting yuccas, Nevada State law 527.300 specifically protects yuccas from destruction or collection. Both California and Arizona have recognized the value of yuccas and have passed similar laws to protect this species. A mature yucca may cost $1,500 retail depending on shape and size. They are also relatively easy to transplant from one area to other. EG&G/EM recommends that one of the following alternatives be implemented to protect this valuable resource: 1) allow a commercial nursery to come in and remove the yuccas for a fee; 2) remove the yuccas and donate them to counties or municipalities for landscaping of public facilities such as schools; 3) allow NTS personnel to remove them for personal use; 4) remove them and use them for landscaping or on NTS, (there will be revegetation studies for the Yucca Mountain Nuclear Waste Repository that will require yuccas); 5) remove them and provide them for revegetation of federal lands outside NTS.

Figure 1. Overall site plan for [redacted] Facility



TO: Dr. Thomas P. O'Farrell DATE: 5 July 1983

FROM: Mary Sauls *Mary*

SUBJECT: Preconstruction surveys, locations U19ar, U19r, U19ao, and Ue14, NTS.

On 15 June Elizabeth Collins, Bill Dunn, Valerie Sheppe, Paul Peterson and I conducted a preconstruction biological survey of the proposed drilling location U19ar in Area 19, in response to Bob Bivona's request of 14 June. On 20 and 21 June I surveyed three more locations, U19r, U19ao, and Ue14, in areas 19 and 14, in response to Bivona's request of 16 June.

No evidence of sensitive species was observed at the Area 19 sites. One potential desert tortoise burrow was found near the northern perimeter of the 1500' radius of the Ue14 site. The construction projects, as proposed, will not negatively impact any populations of sensitive species, nor will they disturb any important ecological sites. The locations and results of the surveys are described in detail below.

Site U19ar was located at coordinates N918,300, E589,295 approximately 800 m southeast of Pahute Mesa Road, about 500 m southeast of U19ys, at an elevation of 6680' (Figure 1). Holmes and Narver personnel were in the process of flagging the 1500' radius when we conducted our survey. Vegetation was primarily a mixture of Artemisia tridentata and Artemisia nova, with Stipa comata and Hilaria rigida. Soils over most of the site were deep residual, tuffaceous sands with some rhyolite rocks. Some flatrock habitat was present in a drainage along the northwestern edge of the site, adjacent to the existing pad for U19ys, but no Astragalus beatleyae was observed. Prior to our survey we had checked the condition of A. beatleyae plants at the species' nearest known locality, 1500 m to the southwest (Figure 1), and found many plants both in fruit and in a green, growing state.

Site U19r was located at coordinates N922,700, E618,200 in a remote area of eastern Area 19 at the end of the existing but impassable Road 19-04 at an elevation of 6750' (Figure 2). A pad and center hole had already been constructed at the site at least three years ago, judging from the extent of revegetation on the pad. The existing pad will be enlarged and Road 19-04 will be reopened in the proposed construction project. The pad site is situated at the base of a steep-sided rhyolite butte in deep, residual, tuffaceous soils with Artemisia and Stipa vegetation. The eastern portion of the 1500 m radius zone had dense pinyon-juniper vegetation growing in tuffaceous gravels. Although two rare plant species, Trifolium andersonii ssp. beatleyae and Frasera pahutensis, could be expected to occur in such gravelly habitats in this area, neither species was observed.

Site U19ao was located at coordinates N897,600, E585,550 in a drainage at the at the end of 19-02 Road at an elevation of 6600′ (Figure 3). Access will be not from 19-02 Road, but will be provided by enlarging an existing jeep trail which runs south from Pahute Mesa Road through a canyon to the west of the proposed site. The pad site is located in deep residual soils with Artemisia-pinyon-juniper vegetation. Extensive flatrock was present along the edges of a small drainage along the western perimeter of the 1500′ radius zone. No Astragalus beatleyae was observed on these outcrops during this preconstruction survey, nor was the species observed when the same outcrops were surveyed in 1982.

Site Ue14 was located at coordinates N794,100, E652,300 near Barren Wash in southern Mid-Valley, 1.5 miles east of the new Mid-Valley road, at elevation 4340′ (Figure 4). There was existing access up to within 400 m of the pad site along a road which runs from Mid-Valley road to a large tower. The site had habitat typical of lower bajadas in the Mid-Valley area: gentle topography with flat areas of well-developed desert pavement dissected by small drainages in the southwestern portions of the site, and stony alluvial deposits where Barren Wash cut through the northeastern corner of the 1500′ radius zone. Vegetation consisted of Lycium, Grayia, Coleogyne, Ephedra, Yucca, Atriplex, Stipa speciosa, and Chrysothamnus teretifolius. Animal burrows were uncommon over most of the southwestern portion of the site. However, in and along the banks of Barren Wash and some of the other large drainages on the site there were many large burrows, most of which could be identified as badger dens or foraging holes or coyote dens. One shallow burrow was found along the north bank of Barren Wash that had entrance characteristics typical of desert tortoise burrows. This burrow was flagged with light green flagging. No other desert tortoise sign was observed in the project area. No sensitive plant species were observed, and none would be expected in this area and habitat.

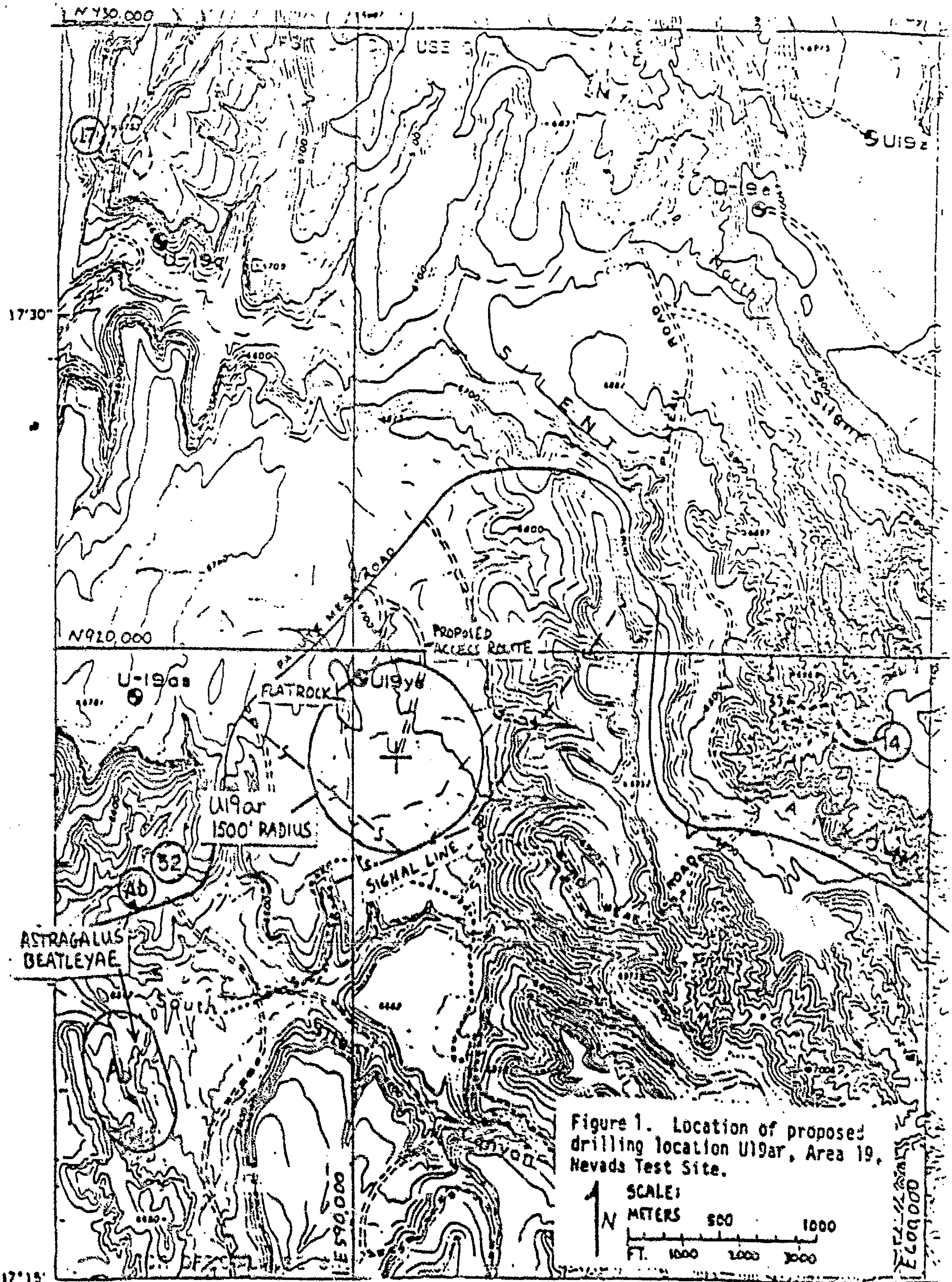


Figure 1. Location of proposed drilling location U19ar, Area 19, Nevada Test Site.

Figure 2. Location of proposed drilling location U19r, Area 19, Nevada Test Site.

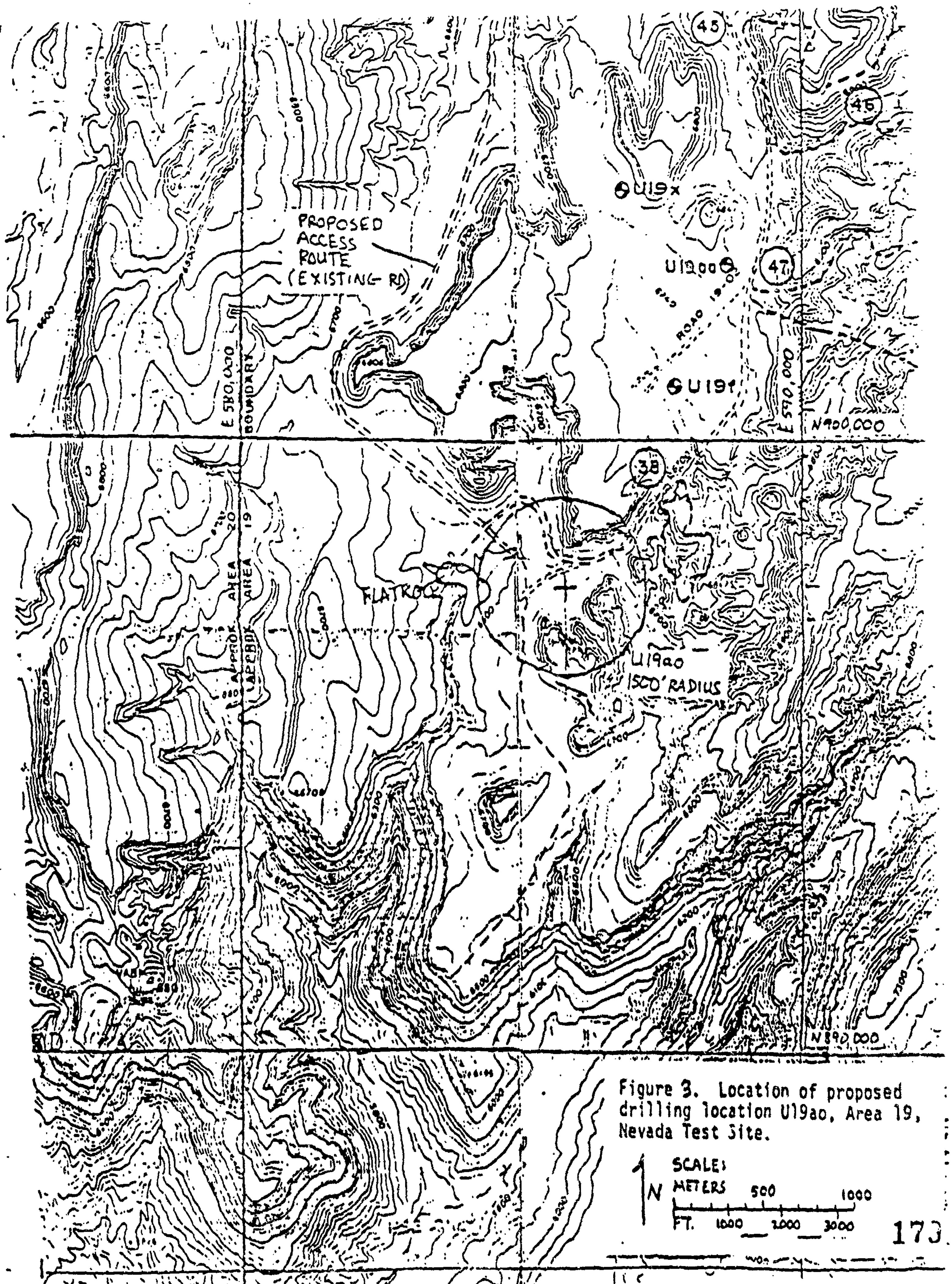


Figure 3. Location of proposed drilling location U19ao, Area 19, Nevada Test Site.

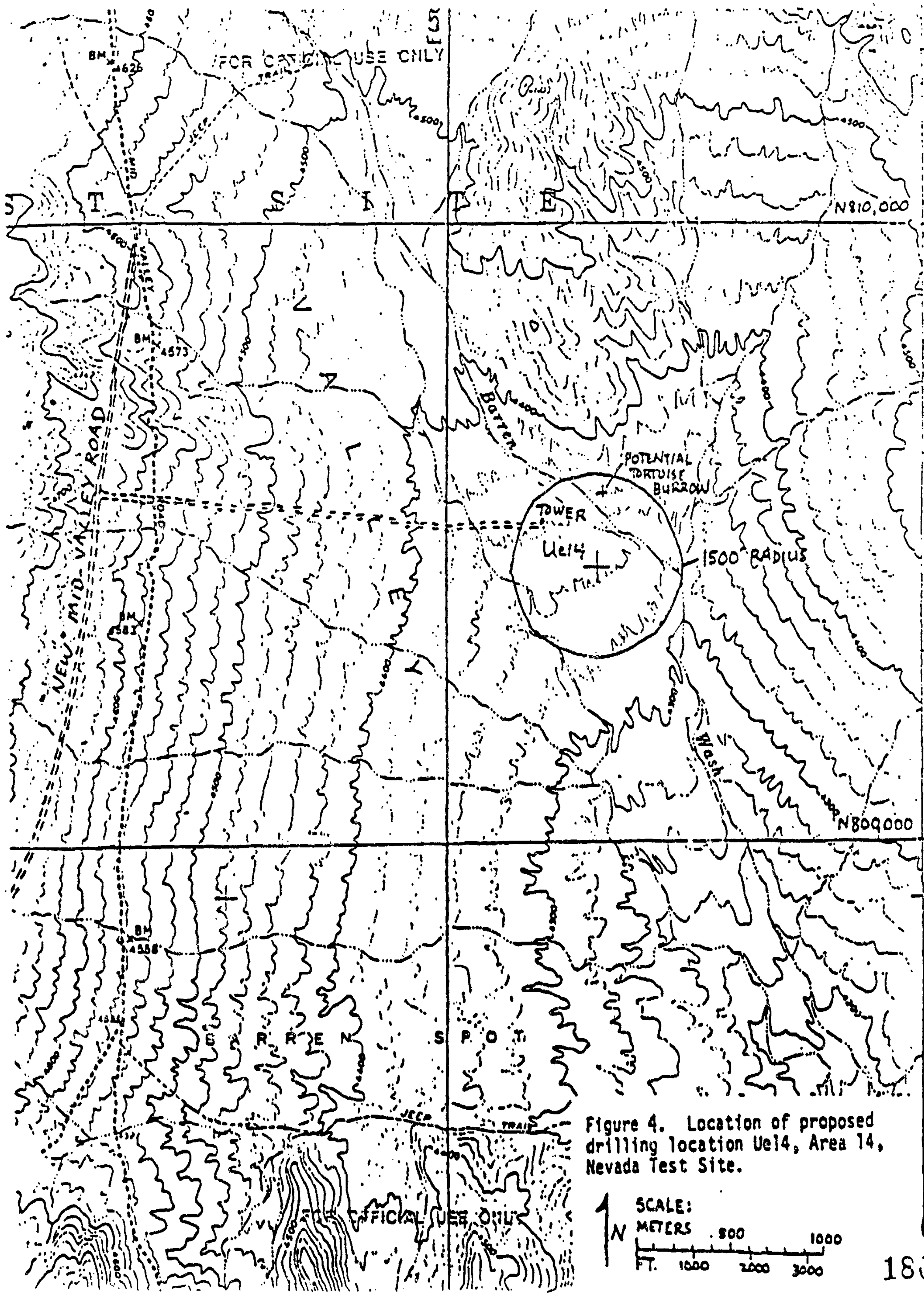


Figure 4. Location of proposed drilling location Ue14, Area 14, Nevada Test Site.

DESERT RESEARCH INSTITUTE
CULTURAL RESOURCES RECONNAISSANCE
SHORT REPORT

NTS REPORT NO. SR103183-1

PROJECT: Archaeological Reconnaissance of Drill Hole Pad UE14b (Nevada Coordinates N794100.57/E650100.55) and Access Road from Mine Mountain Junction to 16-02 Road.

GEOGRAPHIC AREA: Mid Valley

MAP REFERENCE: U.S.G.S. Mine Mountain 7.5 Quadrangle (1961) and U.S.G.S. Tippipah Spring 7.5 Quadrangle (1960).

DATES OF FIELD RECONNAISSANCE: October 31, November 1 and November 7, 1983.

PERSONNEL: J. Brantley Jackson, Greg Henton, Steve James, and Vera Morgan

PREVIOUS CULTURAL RESOURCES STUDIES IN AREA:

Cultural resources studies in the Mid Valley area have been conducted systematically since 1980. In August, 1980, personnel from Desert Research Institute surveyed three proposed drill hole pads (DH 1, SH 1, T-23) and support facility locations in the northwestern portion of Mid Valley (Zerga 1980). Two archaeological sites were recorded during this time, one of which was considered to be a "base camp" containing raw lithic materials. Both sites are in the larger vicinity encompassesd by the access road. However, neither site is in close proximity to the present project and will not be disturbed. Further studies in Mid Valley include seismic area surveys in Barren Spot located in the southern portion of the valley, again conducted by Desert Research Institute personnel (Reno 1983). Eighteen areas containing cultural resources were identified. These resources ranged from isolated artifacts to lithic scatters including a knapping station comprised of white chert flakes. As pointed out in that report, isolated artifacts "gain their scientific value from their nature and distribution on the landscape....", but however, may "belong to a larger, discrete association of artifacts" found away from project locales.

Further cultural resources surveys were conducted in Mid Valley during the summer of 1983. The report on the results of a survey of a drill hole pad (UE14a) and three associated seismic line routes located in the east central portion of Mid Valley is in preparation and is expected to contain data synthesized for the Mid Valley region (Reno, personal communication). Data relevant to the present project is obtained from the seismic line and drill hole pad (UE14a) surveys. Thirty-eight sites were recorded for that project which include isolated artifacts as well as dense lithic scatters and one historic camp. The area along Barren Wash appears to be a locality of some appeal not only to prehistoric peoples but to historic prospectors as well. A camp containing food cans, bottles, cooking implements, assorted wire and other debris occurs along the terrace above the wash. As part of the prehistoric components of many sites, raw materials of "chert" nodules were observed along the terrace and in the streambed alluvium of Barren Wash. This in part accounts for the presence of chipping stations in the vicinity. One site (SO62283RR23) was revisited as part of the current project. This large lithic scatter had been corded off to be avoided during construction of drill hole pad UE14a. Further discussion of this site will occur under Identified Cultural Resources.

Mid Valley is a small valley measuring 5.3 miles N/S and 2.7 miles E/W bordered by Shoshone Mountain to the west and northwest, Mine Mountain to the east, and Lookout Peak to the south. The bajadas of Mid Valley are covered by a well-developed desert pavement with recent alluvial fill occurring in the numerous ephemeral washes which dissect the bajadas.

This alluvium displays less well-developed pavement. These ephemeral drainages enter Barren Wash which drains Mid Valley to the south. Vegetation of Mid Valley is dominated by blackbrush (*Coleogyne ramosissima*) (Beatley 1976, Fig. 4). The project area also supports an abundance of mormon tea (*Ephedra nevadensis*), desert thorn (*Lycium andersonii*), bud sagebrush (*Artemisia spinescens*), spiny hop sage (*Grayia spinosa*) and rabbitbrush (*Chrysothamnus teretifolius*). Joshua tree (*Yucca brevifolia*) is present but scattered, and increases as one moves upslope. Cottonthorn (*Tetradymia axillaris*), spiny menodora (*Menodora spinescens*) and cholla (*Opuntia echinocarpa*) dot the landscape. Dense stands of *Bromus rubens*, *Bromus trinii*, and *Bromus tectorum* mark disturbed areas

Faunal resources observed during the current survey include coyote (*Canis latrans*) scats, cottontail rabbits (*Sylvilagus* sp.), jackrabbits (*Lepus californicus*), and badger (*Taxidea taxus*) holes. Ravens (*Corvus corax*) flew overhead.

RECONNAISSANCE METHODS AND PROCEDURES:

The area of drill hole pad UE14b had been flagged by Holmes and Narver surveyors. The area to be surveyed covered 1200 m^2 around a centrally located stake marking the planned drill hole. Survey of this area was conducted by a four-person team walking twelve 30-meter wide parallel transects in a zig-zag fashion throughout the flagged project area. The access road area was flagged to indicate proposed areas of realignment to the existing roadbed. Again, the four-person team conducted the survey. This team was split into two groups of two persons each. Survey was conducted by "leap-frogging" in one-half kilometer units. Each two person team walked transects along the existing road and the proposed center line spaced at approximately 30 meter intervals in order to cover both areas.

When cultural materials were observed the teams would haphazardly walk around the vicinity of observed materials in order to discern the extent of surficial deposits. In this manner boundaries of site locales could be located and adequately recorded.

IDENTIFIED CULTURAL RESOURCES:

Thirty-six areas of cultural resources were recorded for both survey areas; fourteen sites at the drill pad location and 22 sites along the access road. Six isolated flakes comprise the majority (43%) of cultural remains recorded within the vicinity of drill hole UE14b. These flakes found at sites S103183MV1, S103183MV3, S103183MV5, S103183MV10, S103183MV11, and S103183MV13 were all located on desert pavement of older bajada surfaces, as were isolated tools (S103183MV2 (an obsidian biface) and S103183MV7 (an obsidian Pinto point). Lithic scatters S103183MV8, S103183MV9, S103183MV12, and S103183MV14 were also located on the older bajada surfaces. Isolate S103183 MV4 (an obsidian biface) and lithic scatter S103183MV6 were located in or near ephemeral wash bottoms on recent alluvial fill.

All isolated sites were collected at the time of their discovery, as were two lithic scatters (S103183MV8 and S103183MV9). Site S103183MV12 occurs outside the project area and was not collected. Site S103183MV6, another lithic scatter, was located in the bottom of an ephemeral wash and also was not collected. Lithic scatter S103183MV14 is a lateral extension of S062283RR23, a site recorded during the survey of drill hole pad UE14a. As part of that project S062283RR23 was flagged to prevent disturbance during the construction of drill hole UE14a. That site consisted of a diffuse lithic scatter of varied raw materials (rhyolite, white chert and obsidian). No diagnostic tools were recorded at that time. Three Great Basin Stemmed point fragments, in addition to several rhyolite, chert and obsidian flakes were recorded during the present survey. Data gathered during the present survey will be used to augment information on site S062283RR23.

Of the twenty-two sites recorded along the Mid Valley Access Road extending from Mine Mountain Junction to 16-02 road, seven were isolated cultural resources. These sites S110183GH1, S110183GH2, S110183GH9, S110183GH10, S110183GH12, S110183MVR7, and S110783MVR1 were all collected upon discovery. Nine lithic scatters S110183MVR1, S110183MVR2, S110183MVR3, S110183MVR4, S110183MVR5, S110183GH3, S110183GH6, S110783GH13, and S110783MVR2 were flagged for future reference. Site S110183GH3 contained a diagnostic artifact (an Elko Series point) which was collected at the time of its discovery.

Six temporary camp localities were identified. S110183GH4, S110183GH5 and S110183GH7 consisted of sparse lithic scatters with one metate at each site. S110183GH8 contained 2 lightly used metate fragments, fire-cracked rock and burned bone fragments. S110183GH11 contained 5 metate fragments; two with light use and three with heavy use indicated on the grinding surfaces. In addition to the prehistoric materials, an historic component conwisting of 7 hole-in-top cans and green bottle glass fragments as well as window glass fragments was identified at this locality. S110183MVR6 consisted of a lithic scatter (approximately 150 flakes) with a knapping station (5 x 5 m^2) and two slab metates.

SITE EVALUATIONS AND STATEMENTS OF SIGNIFICANCE:

As indicated earlier, isolated artifacts gain their scientific value from their nature and distribution on the landscape. Without a knowledge of the areal distribution of cultural materials throughtout Mid Valley, it is difficult to evaluate the significance of isolates

Further data may be obtained on subsistence patterns of early prehistoric peoples in Mid Valley by studies of this and other similar sites. These factors, coupled with a potential for buried, in situ, cultural materials qualifies S103183MV14 for consideration for nomination to the National Register of Historic Places. For this reason, S103183MV14 should be avoided. If this is not possible, a mitigation program should be considered.

Lithic scatters S110183MVR1, S110183MVR2, S110183MVR3, S110183MVR4, S110183MVR5, S110183GH3, S110183GH6, S1107GH13, and S110783MVR2, and temporary camps, S110183GH4, S110183GH5, S1101GH7, S110183GH8, S110183GH11, and S110183MVR6 are all located in the planned access road rehabilitation area. The existing road which formerly ended at Tippipah Spring is mapped as an historic route (Ball 1907). It connects with Mid Valley Road which has also been mapped as a historic route from Cane Springs in the south (Mendenhall 1909). As Mid Valley drains south into Frenchman Flat via Barren Wash, it is apparent that Barren Wash and Mid Valley served as major transportation routes from Cane Springs to White Rock Springs (in the north) via Tippipah Springs. This region is likely to have served such a purpose not only in historic times, but throughout the prehistoric past. As such the sites listed above may contain valuable information, especially when combined with data recorded and previously recovered from the White Rock Springs locale, Tippipah Springs, and Cane Springs (Worman 1969), on settlement and subsistence patterns in the region. Given the nature and location of the above mention sites and their potential for providing subsurface cultural materials, these sites should be considered as eligible for nomination to the National Register of Historic Places.

ASSESSMENT OF POTENTIAL IMPACTS:

Activities at drill hole pad UE14b may impact Site S103183MV14.

Given the scientific value of this site as discussed above, it should be avoided. This could be accomplished by extending the cord around it from its companion and extension S062283RR23. If this cannot be accomplished then a more complete mitigation plan needs to be considered.

. As the proposed access road realignment as well as the existing roadbed are along an historic and probable prehistoric route of major importance in the region, sites located in this area hold promise of providing valuable information about cultural activities in the Valley and its surrounding environs. Construction activities in this area will disturb and possibly destroy these sites. Choice of an alternate route originating elsewhere may be more feasible, as the potential of more sites occurs in the vicinity east and west of the existing roadbed.

RECOMMENDATIONS:

It is recommended that site S103183MV14, an extension of site S062283RR23, be avoided by cording the site area with yellow rope. As S062283RR23 is already roped off, extending this rope around S103183MV14 should not be difficult or time consuming. An alternate rout was suggested to avoid historic and prehistoric sites along the existing roadbed and proposed realignment of the access road from 16-02 Road into Mid Valley. However, this proved impractical. Therefore a field examination by Lonnie Pippin, Vera Morgan (DRI personnel), Frank Bingham, Lloyd Krivanec (DOE personnel), Vic Hunter (H&N personnel) and Charles "Bud" Witmer (ReeCo personnel) was undertaken to develop a plan for avoidance of cultural resources or mitigation of potential adverse effects to sites located along the proposed route. This plan allows for expansion and rehabilitation of the existing roadbed with avoidance of a few sites, minor disturbance to a few sites, and major disturbance to only three sites. These recommendations include flagging of sites using lath and green tape so the sites (or portions thereof) thusly marked may be avoided during consturction, a systematic collection and mapping of artifacts at some sites and the placement of one test unit measuring 1 x 2 meters at one site that may contain subsurface deposits. Figure 1 indicates the sites located along the access road. Recommendations developed during the field examination for avoidance or mitigation of potential adverse effects to sites along the access road are outlined for each site in the following paragraphs.

Sites S110183GH1, S110183GH2, S110183MVR7, S110183GH9, S110183GH10, S110783GH12, and S110783MVR1 are all isolates which were collected at the time of their discovery and no further action need be taken. S110183MVR3, S110783GH12 and S119783MVR2 are all small, sparse lithic scatters which should be collected as they may be destroyed by road construction vehicles.

S110183MVR1 is an aboriginal toolstone quarry and lithic scatter which contains an historic component. This site spans the existing road-bed. It is recommended that the portion of the site extending east of the road be flagged while the few flakes west of the road be collected for analysis. S110183MVR2, a lithic scatter, should be flagged and avoided. S110183MVR4, a lithic scatter should be mapped and collected. S110183GH3, a large lithic scatter extending across the roadway should be mapped and collected. S110183GH4, a lithic scatter, should be flagged and avoided. S110183GH5, a temporary camp, should be flagged and avoided. Two flakes at the roadbed edge of this site should be collected.

S110183GH6, a lithic scatter, should be mapped and collected. S110183MVR5, a temporary camp, should be mapped and collected. S110183MVR6, a temporary camp extending across the existing roadway, should be flagged west of the road. The portion east of the road should be collected. A 1 x 2 meter test pit is also recommended as this large site has the potential of containing subsurface cultural deposits. The site should be mapped. S110183GH7, a temporary camp, should be mapped and collected. S110183 GH8, a small campsite should be flagged and avoided. S110183GH11, a temporary camp containing an historic component, extends across the existing roadbed. This site should be mapped and the historic portion extending east of the road should be collected. The portion of the site extending west of the road contains both historic and prehistoric materials. This area should be flagged to insure avoidance during construction activities.

In summary, seven sites need no further consideration. Three small, sparse lithic scatters need to be collected. Four sites should be flagged and avoided. Four large lithic scatters (or portions of these sites) need to be mapped and collected. Four temporary camps or portions of these camps should be mapped and collected. One test pits should be placed at S110183MVR6. Given the amount of mapping collecting of artifacts and the time involved in excavating a test pit, it is expected that the proposed mitigation plan should take three or four people five or six days to complete, barring any unforseen weather conditions.

Vera Morgan
prepared by

REFERENCES

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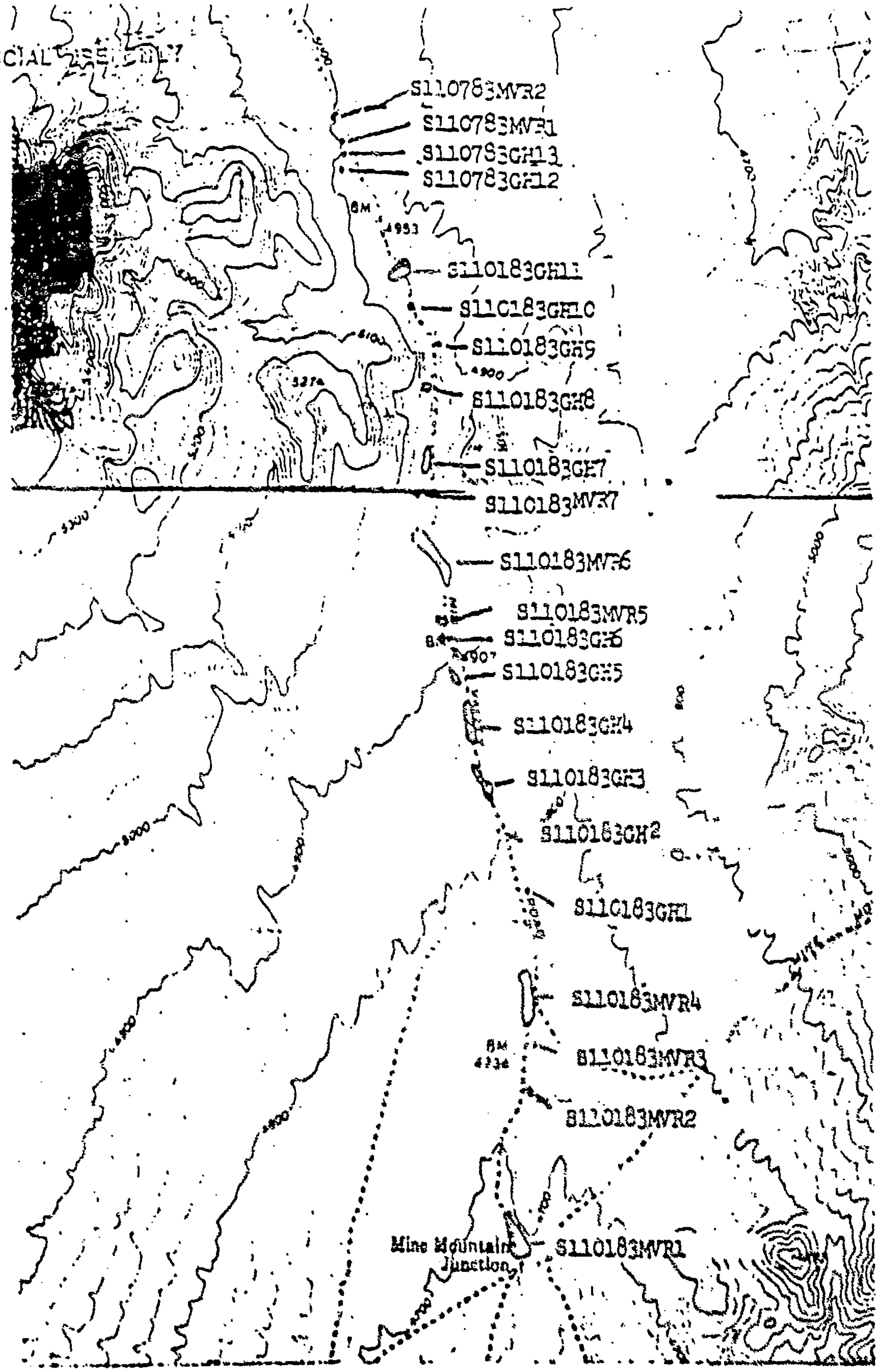

Figure 1. Sites located along the acces road realignment in Mid Valley to 16-02 Road. (Mine Mountain, 7.5 Quad 1961) (Tippipah Spring, 7.5 Quad 1960)

recorded during the present survey. However, as these isolated artifacts were collected, and their context and provenience recorded during the cultural resources reconnaissance, their scientific value has been preserved. The information garnered about context and provenience will be added to the growing data obtained on sites in the Mid Valley region and will be utilized in a later report to formulate a predictive model for future site assessments (Reno, personal communication).

Lithic scatters S103183MV6, S103183MV8, S103183MV9 and S103183MV12 do not individually meet requirements for nomination to the National Register of Historic Places, however, these sites may yield valuable information when considered in an area wide survey of resource utilization. The significance of these sites' locations can only be discerned against the patterning of other archaeological sites in the region. Site S103183MV6 occurs in the bottom of an ephemeral wash at the north end of the project area and will not be disturbed by activities at UE14b. S103183MV12 occurs outside the project area and will not be disturbed by construction activities. Sites S103183VM8 and S103183MV9 occur in close proximity to the planned drill hole on well-developed, stable desert pavement with no discernible depth. These two sites were collected according to BLM standards for small sites.

Lithic scatter S103183MV14 is a significant site not only due to its location on the edge of Barren Wash and its inclusion as an extension of site S062283RR23, but due to its variety of utilized raw materials. The assemblage may include the primary sequence of tool production, and has potential for revealing information on how different materials were shapped into usable tools. Additional information may be gleaned from the inclusion of Great Basin Stemmed projectile points in the assemblage.

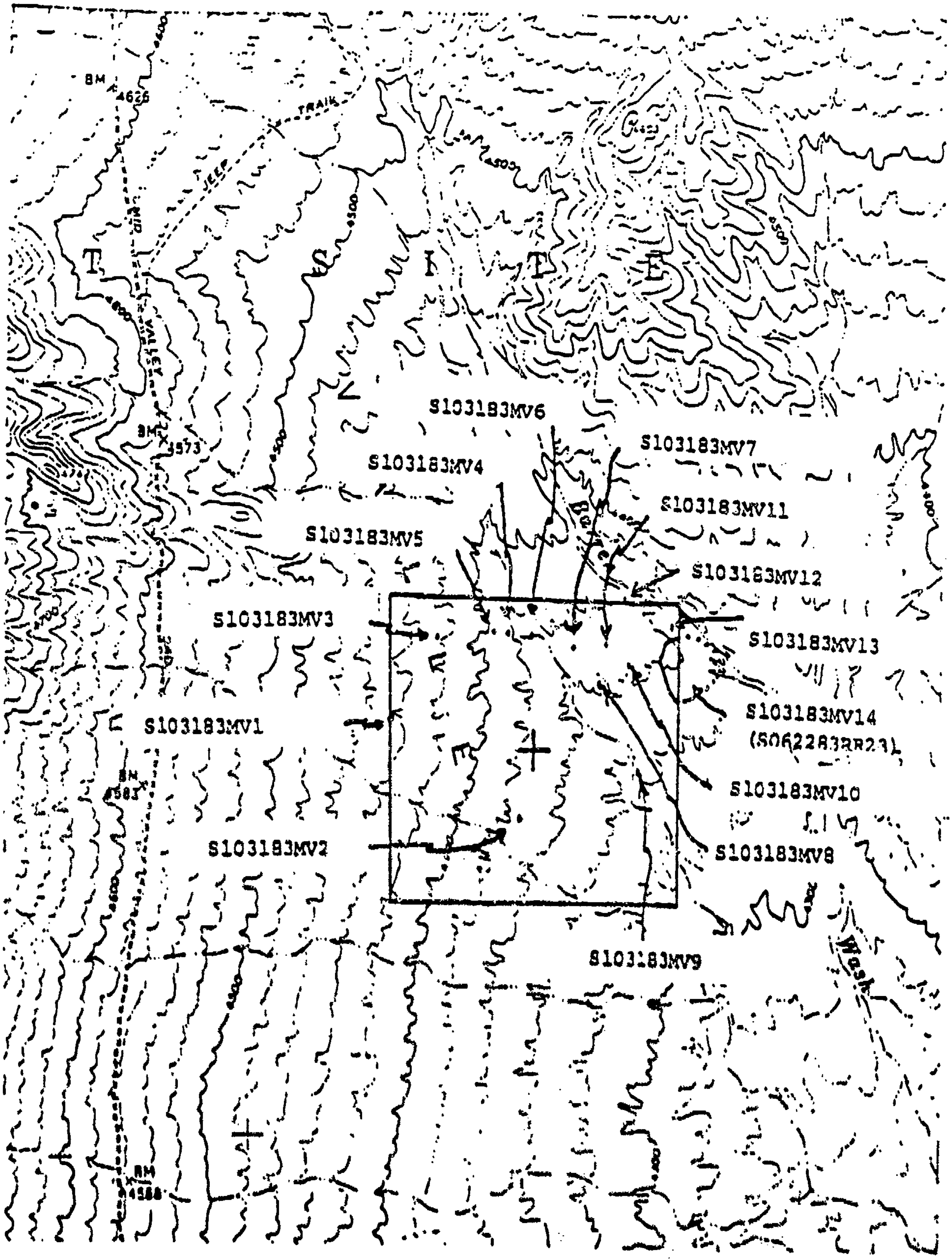

Figure 2. Site locations at drill hole pad UE14b.
USGS Mine Mountain 7.5 Quad 1961

UC - 11-5-89

To: Lloyd Krivanec

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From: Vera Morgan

Subject: Mitigation of Adverse Effects to Cultural Resources along the Mid Valley Access Road between Mine Mountain Junction and 16-02 Road.

Date: 28 November 1983

Twelve sites along the Mid Valley Access Road were flagged or mapped and collected as part of the mitigation program for this project. Four sites, S110183MVR2, S110183MVR3, S110183GH4, S110183GH8, were completely flagged off to be avoided during construction activities. Nine sites, S110183MVR1, S110183MVR4, S110183GH3, S110183GH5, S110183GH6, S110183MVR5, S110183MVR6, S110183GH7, and S110183GH11, were either partially flagged off where they could be avoided and collected (and mapped) where they could not be avoided, or completely collected. A test pit was also excavated east of the road at S110183MVR6. The attached map indicates the sites involved in the mitigation program.

In addition to the above outlined information, two other sites S111983JJ1 and S111983JJ2 were located and collected during the mitigation program. Also, a restaked line was surveyed at the north end of the project area.

Thus, the Mid Valley Access Road has been cleared for construction activities. Should you have any questions about this project, please call me or Lonnie Pippin in Reno. I will be at the Tonopah Test Range for the remainder of this week but can be reached there through Ed Ravell's office.

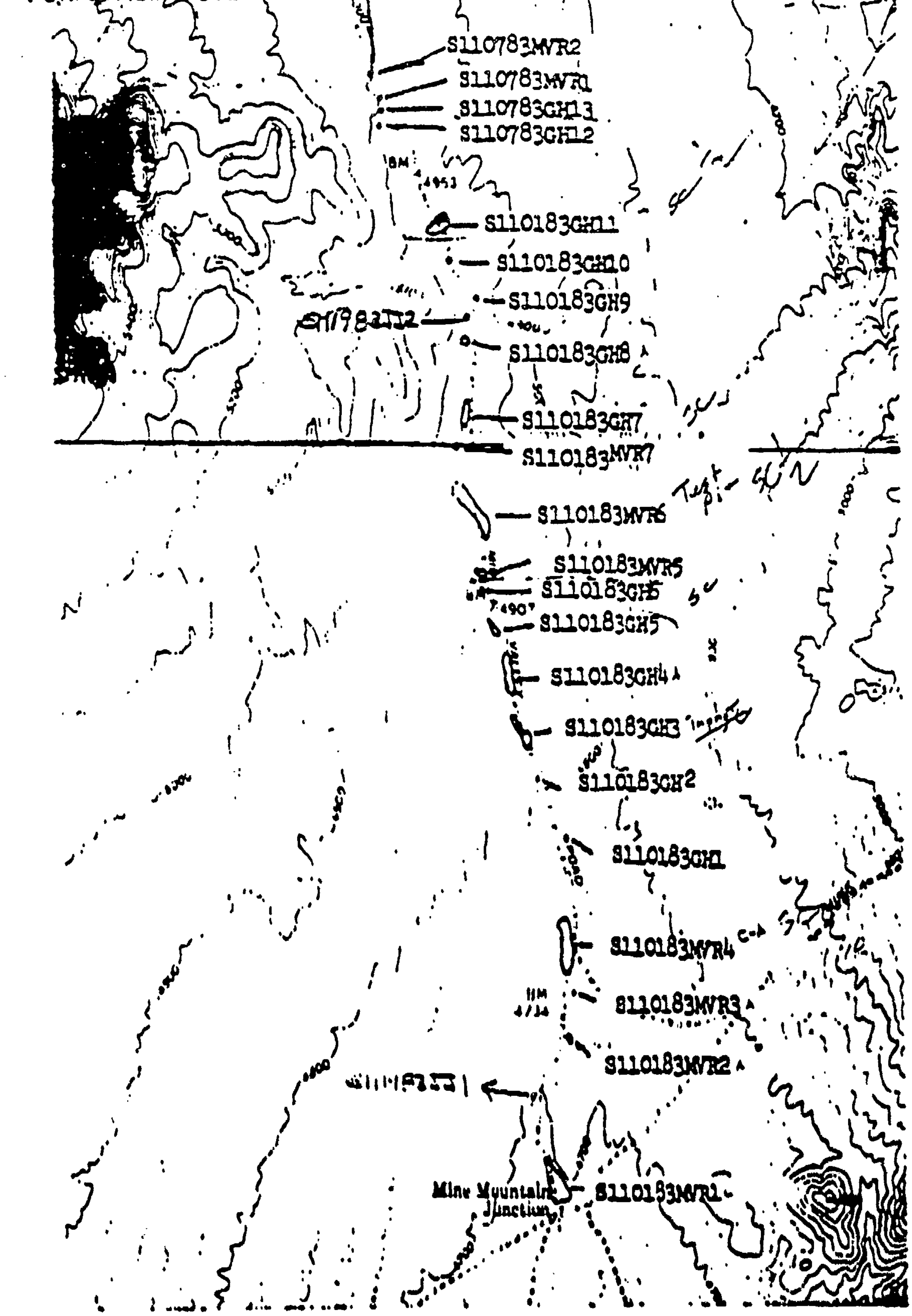

Figure 1. Sites located along the acces road realignment in Mid Valley to 16-02 Road. (Mine Mountain, 7.5 Quad 1961) (Tippipah Spring, 7.5 Quad 1960)

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DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF HISTORIC PRESERVATION AND ARCHEOLOGY

201 S. Fall Street

Capitol Complex

Carson City, Nevada 89710

(702) 885-5133

ACTION EPD-

INFO

December 28, 1988

Frank E. Bingham, Chief
Environmental Compliance Branch
Health Physics & Environmental Division
Department of Energy
Nevada Operations Office
P.O. Box 98518
Las Vegas, Nevada 89193-8518

Dear Mr. Bingham:

This letter is in response to your request for comments on SRO92288-1, A Class III Cultural Resources Reconnaissance of [redacted] in Area 14, Nevada Test Site, Nye County. The report indicates that significant historic or archeological site were not discovered. The construction of the proposed test area and tank farm will have no effect on properties of National Register quality.

The Division concurs with your findings. Your agency has satisfied its obligations under the National Historic Preservation Act of 1966. We have no further comments on the proposed action.

Sincerely,

for Alice M. Becker
Staff Archeologist

AMB:emt

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DESERT RESEARCH INSTITUTE
CULTURAL RESOURCES RECONNAISSANCE
SHORT REPORT

SR092288
NTS

PROJECT:

A Class III Cultural Resources Reconnaissance of [redacted] in Area 14.

GEOGRAPHIC AND NTS AREA:

Mid Valley, Area 14.

MAP REFERENCE:

Mine Mountain, USGS 7.5 min. Topographic Quadrangle.

DATES OF FIELD RECONNAISSANCE:

September 22, 1988

PERSONNEL:

Alvin R. McLane and John Garrett.

INTRODUCTION AND EXECUTIVE SUMMARY:

The Department of Energy (DOE) wishes to develop the [redacted] facility test area and tank farm in Mid Valley, Area 14 (Figure 1). The project consists of three roads, a water tank site, the test area, and a transmission corridor. The area is off the Mid Valley Road, east of Shoshone Mountain, and is readily accessible by way of the Mine Mountain Road. The reconnaissance inspected an area of approximately 91.57 acres (37.05 ha).

Five archaeological sites were located during the reconnaissance. All of these were small sites that were collected. Therefore, additional cultural resources investigations are not required.

PREVIOUS CULTURAL RESOURCE STUDIES IN AREA:

The studied cultural resources of the Nevada Test Site (NTS) up to 1969 is presented in a report by Worman (1969). A discussion of the archaeology and literature of the Nevada Nuclear Waste Storage Investigations (NNWSI) area, located west and south of Area 14, is discussed by Pippin and Zerga (1981a, 1981b). Systematic cultural resources studies have been conducted in Mid Valley by the Desert Research Institute since 1980. In August of that year Zerga (1980) surveyed three drill hole pads and support facility in northern Mid Valley. Two archaeological sites were recorded. Site 26Ny1957 is a small lithic scatter with a Rose Spring projectile point. Site 26Ny1958 is was a large lithic scatter containing bifacial tools and a Great Basin Stemmed Lake) Series point.

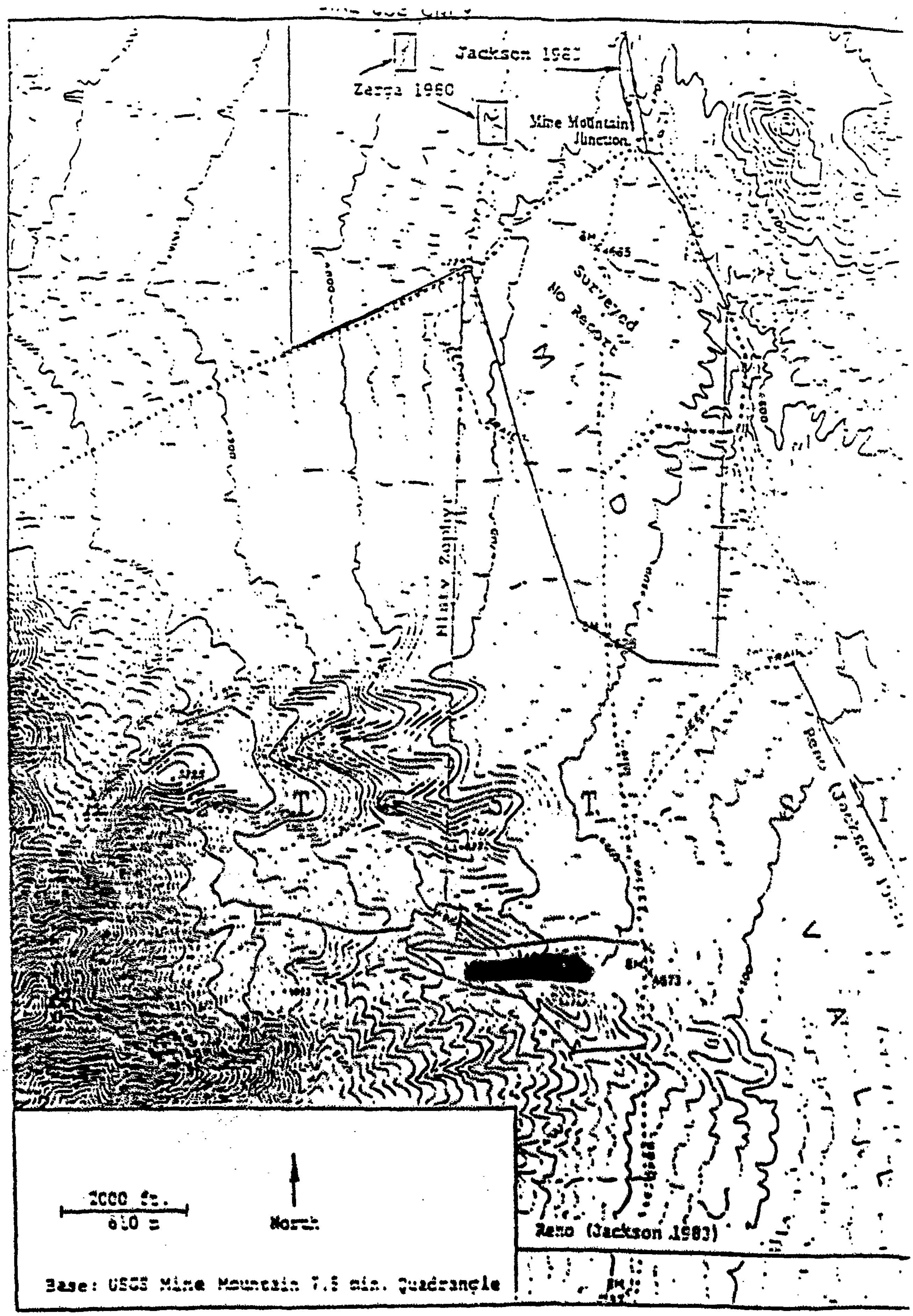

Figure 1. [redacted] Project and nearby Archaeological Surveys.

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A seismic area near Barren Spot was investigated by Pippin (1983). Eighteen small sites, mostly isolated obsidian flakes, were recorded and collected. A biface and a Pinto projectile point were among the artifacts recorded. Other DRI surveys have occurred along Barren Wash for drill Holes 14a, 14b, and three seismic lines, and along Mid Valley Road north of Mine Mountain Junction (Morgan 1983). Associated with Hole 14a and the seismic lines were 38 sites, including isolates, dense debitage concentrations (one containing three Great Basin Stemmed points), and one historic camp. Fourteen sites were recorded at Drill Hole 14b. About half of the sites were isolated flakes and the others were larger lithic scatters. Artifacts from the sites also included bifaces and an obsidian Pinto point. Twenty two sites were located along the Mid Valley Road. The sites were comprised of isolated flakes, lithic scatters, and temporary camps. Associated artifacts consist of metates, fire cracked rocks, burned bone, and an Elko Series projectile point.

ENVIRONMENTAL SETTING:

Mid Valley is a depressed basin located east of Shoshone Mountain. Elevations within the project range from 4560 ft. (1390 m) to 5100 ft. (1555 m). Several ephemeral drainages and ridges trend easterly across the project area. Barren Wash carries heavy precipitation southeast out of the valley. The ridges in the project area are made up of older alluvium of Quaternary age consisting of dissected unconsolidated fan and terrace gravels. The northern part of the project extends over Quaternary alluvium. This unit consists of gravels, sand, and silts (Orkild 1968).

Vegetation in the project consists of Juniper (*Juniperus osteosperma*), Joshua tree (*Yucca brevifolia*), little rabbitbrush (*Chrysothamnus spp.*), blackbrush (*Coleogyne ramosissima*), cliffrose (*Purshia covania*), Mormon tea (*Ephedra viridis*), and prickly pear (*Opuntia erinacea*). Fauna species consists of coyotes, cottontails, jackrabbits, badgers, and ravens.

RECONNAISSANCE METHODS:

The roads, test facility, and transmission route had been staked with laths and flagging. The two archaeologists worked as an individual team. The water tank area and test facility were inspected by walking north/south transects in 30-meter intervals. The roads and transmission line were surveyed in a one person one-way traverse. When encountered, all archaeological sites were recorded on DRI site forms. All sites were small, containing less than 20 artifacts, and were collected in accordance with BLM (1985) policy.

IDENTIFIED CULTURAL RESOURCES:

Five sites were identified within the project area (Figure 2, Table 1). Sites consisted of one to six artifacts. Most artifacts were obsidian debitage flakes. Site 26Ny5776 is a pink non-welded unifacial chopper, 12.5 cm long, 7.3 cm wide, and 2.4 cm thick. The only time sensitive artifact is a brown chert Rosegate Series point from Site 26Ny5778. A flake with a utilized edge is among the six debitage flakes recorded at site 26Ny5780.

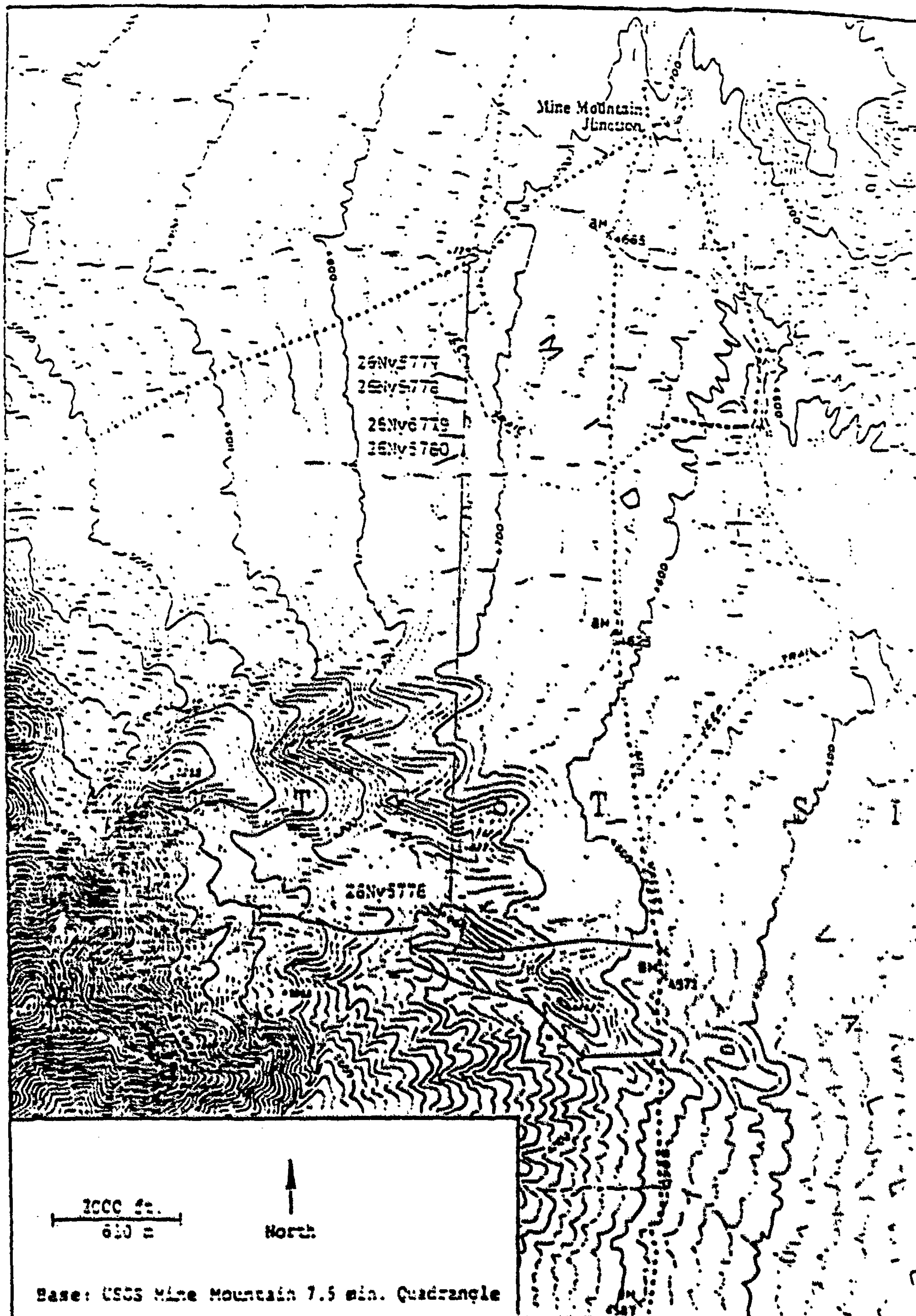

Figure 3. Archaeological Sites in [redacted] Project.

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Table 1. Archaeological Sites Recorded at Misty Zephyr Project.

Site No.	Site Description	Type	Collection
26Ny5776	Pink, non-welded tuff unifacial chopper.	LO	Complete
26Ny5777	Obsidian core reduction flake.	LO	Complete
26Ny5778	Brown chert Rosegate point and an obsidian core reduction flakes.	LO	Complete
26Ny5779	Obsidian biface thinning flake.	LO	Complete
26Ny5780	Six obsidian core reduction flakes, one has an utilized edge.	LO	Complete

SITE EVALUATIONS AND STATEMENTS OF SIGNIFICANCE:

All of the sites were small and collected at the time they were recorded. Since these sites were collected, their information potential has been realized in the recording, and they are not eligible to the *National Register of Historic Places*.

ASSESSMENT OF IMPACTS:

Since the five archaeological sites recorded in the proposed area of impacts were collected, there are no adverse impacts to the cultural resources.

RECOMMENDED PROCEDURES FOR THE PROTECTION OF CULTURAL RESOURCES:

There are no additional recommendation for the protection of cultural resources.

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1983 *Four Separate Class III Cultural Resources Surveys in Support of the Department of the Air Force's NEAS RDT&E Program, Nevada Test Site, Nye County, Nevada.* Desert Research Institute Cultural Resources Reconnaissance Short Report No. SR032983-1

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Worman, F.C.V.
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Alvin R. McLane 12/5/88
Prepared by Date
Alvin R. McLane

Gregory H. Fenton 12/5/88
Approved by Date
Gregory H. Fenton

DESERT RESEARCH INSTITUTE
Site Inventory Form

Project: [redacted]

Map: MINE MOUNTAIN

Permanent Site Number: 26NY5776
Temporary Site Number: S092288AM01

UTM Zone 11 572770 E / 4088660 N
Elevation: 4850 feet

Geographic Area: MIDVALLEY

Area ID Number: 14

Site Description:

Site Type: Locality/Isolate

Description: Site is a locality consisting of an isolated pink tuff, nonwelded, unifacial chopper. Covania Mexicana (cliffrose) is present over the [redacted] area.

Artifact Types Observed:
- Flaked Stone Artifact(s)

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Boundaries: Abrupt
Estimated Depth: Surface

Collection Status: Complete
Excavation Status: None

Location and Topography:

Slope: 3 degree(s)

Aspect: 100 degree(s)

Primary Substrate: Residual
Secondary Substrate: Bedrock

Desert Pavement: None

Topography:	Landform	Position
Macro	Mountain	Edge or side
Micro (Primary)	Ridge	Top, apex or head
Micro (Secondary)		

Owner: Department of Energy
Mercury, Nevada

Description of Division 1

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Artifact Types Observed:

- Flaked Stone Artifact(s)

Flaked Stone Artifact(s):	Count	Comments
- Chopper	1	Other Tuff

DESERT RESEARCH INSTITUTE
Site Inventory Form

Project: [redacted]

Map: MINE MOUNTAIN

Geographic Area: MIDVALLEY

Permanent Site Number: 26NY5777
Temporary Site Number: S092288AM02

UTM Zone 11 572860 E / 4090920 N
Elevation: 4720 feet

Area ID Number: 14

Site Description:

Site Type: Locality/Isolate

Description: Site is a locality consisting of an isolated obsidian core reduction flake. Covania Mexicana (cliffrose) is present over the [redacted] area.

Artifact Types Observed:
- Debitage

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Boundaries: Abrupt
Estimated Depth: Surface

Collection Status: Complete
Excavation Status: None

Location and Topography:

Slope: 3 degree(s) Aspect: 105 degree(s)

Primary Substrate: Alluvium
Secondary Substrate: N/A

Desert Pavement: None

Topography:	Landform	Position
Macro	Valley	Bottom, base, or toe
Micro (Primary)	Fan	Bottom, base, or toe
Micro (Secondary)		

Owner: Department of Energy
Mercury, Nevada

Description of Division 1

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Artifact Types Observed:

- Debitage

Debitage: Area for Sample (square meters): 1

Material	Decort	CR	Shatt	BF Thin	Press
- Obsidian	-	1	-	-	-

Debitage Density (art./square meter) = 1.000

DESERT RESEARCH INSTITUTE
Site Inventory Form

Project: [redacted]

Permanent Site Number: 26NY5778
Temporary Site Number: S092288AM03

Map: MINE MOUNTAIN

UTM Zone 11 572860 E / 4090830 N
Elevation: 4720 feet

Geographic Area: MIDVALLEY

Area ID Number: 14

Site Description:

Site Type: Locality/Lithic Scatter

Description: The core reduction flake was found 25m S of the Rosegate point. Cowania Mexicana (cliffrose) is present over [redacted] area.

Diagnostic Artifacts Present:
- Rose Spring/Eastgate Projectile Point(s)

Artifact Types Observed:
- Debitage
- Projectile Point(s)

Length (meters): 25 Width (meters): 1 Area (ares): 0.20

Boundaries: Abrupt
Estimated Depth: Surface

Collection Status: Complete
Excavation Status: None

Location and Topography:

Slope: 2 degree(s)

Aspect: 90 degree(s)

Primary Substrate: Alluvium
Secondary Substrate: N/A

Desert Pavement: Gravel

Topography:	Landform	Position
Macro	Valley	Bottom, base, or toe
Micro (Primary)	Fan	Bottom, base, or toe
Micro (Secondary)		

Owner: Department of Energy
Mercury, Nevada

Description of Division 1
Length (meters): 25 Width (meters): 1 Area (ares): 0.20

Artifact Types Observed:
- Debitage
- Projectile Point(s)

Debitage: Area for Sample (square meters): 20

Material	Decort	CR	Shatt	BF Thin	Press
- Obsidian	-	1	-	-	-

Debitage Density (art./square meter) = 0.050

Projectile Point(s):	Count	Comments
- Rosespring/Eastgate	1	Other Chert

DESERT RESEARCH INSTITUTE
Site Inventory Form

Project: [redacted]

Permanent Site Number: 26NY5779
Temporary Site Number: S092288AM04

Map: MIDVALLEY

UTM Zone 11 572860 E / 4090700 N
Elevation: 4720 feet

Geographic Area: MIDVALLEY

Area ID Number: 14

Site Description:

Site Type: Locality/Isolate

Description: Site is a locality consisting of an isolated obsidian core reduction flake 6 meters south of stake 2S. Cowania Mexicana (cliffrose) is present over [redacted] area.

Artifact Types Observed:
- Debitage

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Boundaries: Abrupt
Estimated Depth: Surface

Collection Status: Complete
Excavation Status: None

Location and Topography:

Slope: 2 degree(s)

Aspect: 90 degree(s)

Primary Substrate: Alluvium
Secondary Substrate: N/A

Desert Pavement: None

Topography:	Landform	Position
Macro	Valley	Bottom, base, or toe
Micro (Primary)	Fan	Bottom, base, or toe
Micro (Secondary)		

Owner: Department of Energy
Mercury, Nevada

Description of Division 1

Length (meters): 1 Width (meters): 1 Area (ares): 0.01

Artifact Types Observed:

- Debitage

Debitage: Area for Sample (square meters): 1

Material	Decort	CR	Shatt	BF Thin	Press
- Obsidian	-	-	-	1	-

Debitage Density (art./square meter) = 1.000

DESERT RESEARCH INSTITUTE
Site Inventory Form

Project: [redacted]

Permanent Site Number: 26NY5780
Temporary Site Number: S092288AM05

Map: MINE MOUNTAIN

UTM Zone 11 572860 E / 4090620 N
Elevation: 4720 feet

Geographic Area: MIDVALLEY

Area ID Number: 14

Site Description:

Site Type: Locality/Lithic Scatter

Description: Covania Mexicana (cliffrose) is present over the [redacted] site area.

Artifact Types Observed:
- Debitage
- Flaked Stone Artifact(s)

Length (meters): 30 Width (meters): 10 Area (ares): 2.36

Boundaries: Clear
Estimated Depth: Surface
Collection Status: Complete
Excavation Status: None

Location and Topography:

Slope: 3 degree(s) Aspect: 100 degree(s)

Primary Substrate: Alluvium
Secondary Substrate: N/A
Desert Pavement: None

Topography:	Landform	Position
Macro	Valley	Bottom, base, or toe
Micro (Primary)	Fan	Bottom, base, or toe
Micro (Secondary)		

Owner: Department of Energy
Mercury, Nevada

Description of Division 1

Length (meters): 30   Width (meters): 10   Area (ares): 2.36

Artifact Types Observed:

- Debitage
- Flaked Stone Artifact(s)

Debitage: Area for Sample (square meters): 236

Material	Decort	CR	Shatt	BF Thin	Press
- Obsidian	-	5	-	-	-

Debitage Density (art./square meter) = 0.021

Flaked Stone Artifact(s):	Count	Comments
- Debitage with Utilized Edge	1	Obsidian

Department of Energy
Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

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Distribution

DESERT TORTOISE ENDANGERED SPECIES ACT (ESA) COMPLIANCE

The desert tortoise was listed, on an emergency basis, as an endangered species on August 4, 1989. This action will affect the manner in which we carry out some of our tasks in desert tortoise areas in portions of Areas 5, 6, 11, 14, 22, 23, 25, 26, and 27. (See enclosed map.)

The Department of Energy, Nevada Operations Office (NV) must remain in full compliance with ESA. We, as a federal agency, must ensure that any action authorized, funded, or carried out by us will not jeopardize the continued existence of the species or result in the destruction or adverse modification of critical desert tortoise habitat.

Many conservation measures are currently in place; however, due to the importance of this action, the following items are effective immediately:

1. Off-road vehicle travel is not permitted within desert tortoise habitat without specific approval developing from the environmental impact review process.

2. All new and planned surface disturbing activities will require environmental impact review before proceeding regardless of prior approval. This includes land that has been previously disturbed but has not been actively used.

3. No trapping, transporting, injuring, harassing, or any other form of handling desert tortoises is permitted.

4. Proposed tests are suspended at the Liquefied Gaseous Fuels Spill Test Facility for new chemicals not approved in a previous environmental assessment (EA). Planned tests approved in an existing EA will be evaluated on a case-by-case basis.

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The current environmental impact review process will remain in effect in that all NV programs and project authorizing documents are coordinated with the Environmental Compliance Branch, Environmental Protection Division.

If you have further questions, please contact Les Monroe at FTS 575-1744.

for Nick C. Aquilina
Manager

EPD/ECB:LAM

Enclosure:
As stated

cc w/encl:
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  Director, DNA, Washington, DC
C. M. Borgstrom, EH (EH-25) FORS
J. E. Nuckolls, Director, LLNL,
  Livermore, CA
S. S. Hecker, Director, LANL,
  Los Alamos, NM
Albert Narath, President, SNL,
  Albuquerque, NM
Principal Staff

Distribution—Memorandum dated

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J. E. Ayres, Regional Administrator, Region IX, EPA, San Francisco, CA
R. N. Snelling, Acting Director, EPA/EMSL, Las Vegas, NV
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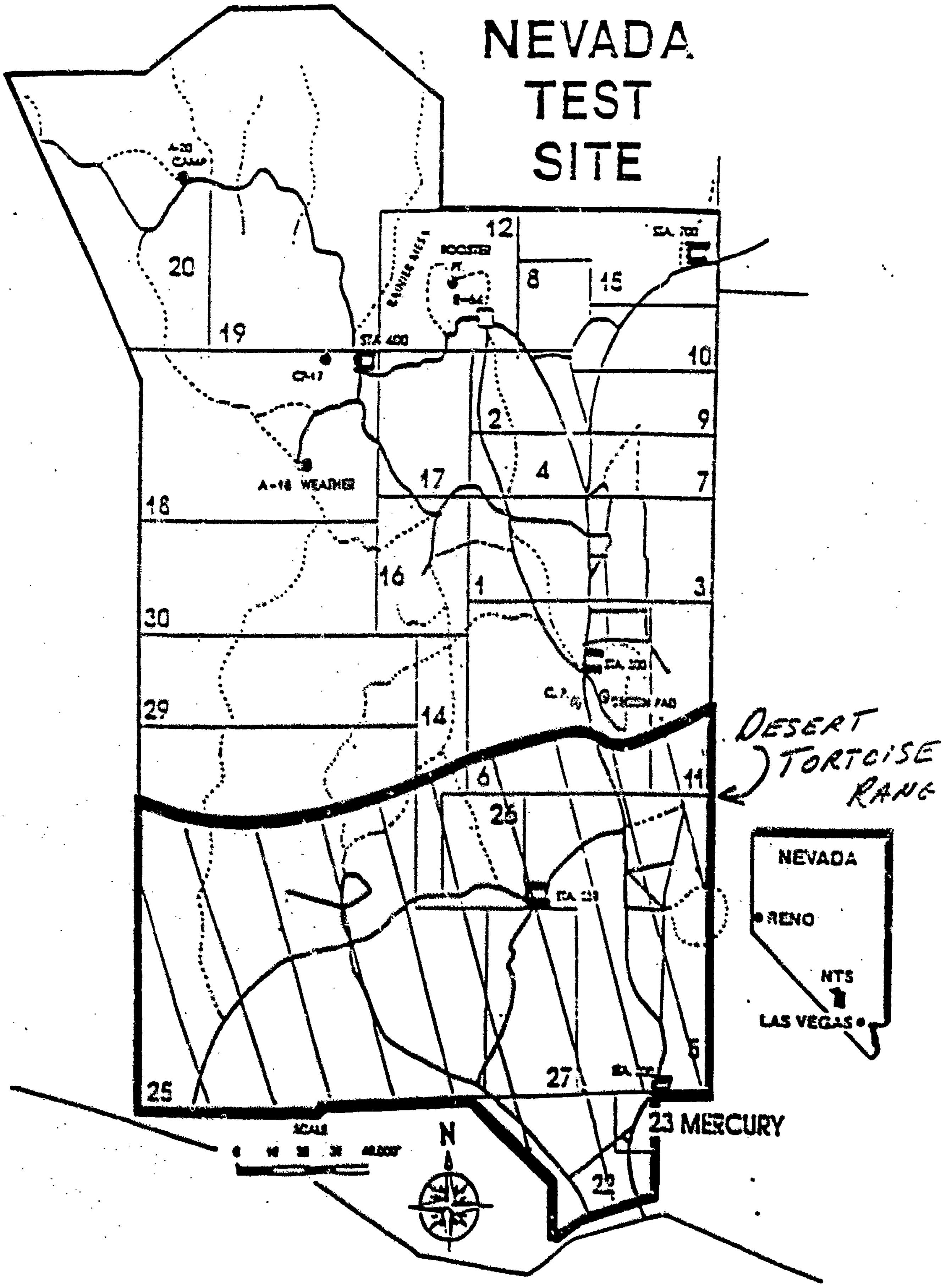
NEVADA
TEST
SITE
A-20 CAMP
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A-16 WEATHER
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23 MERCURY
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DESERT TORTOISE RANGE
NEVADA
RENO
NTS
LAS VEGAS
SCALE
N

[redacted]

APPENDIX G

BIOMONITORING (U)

[redacted]

[redacted]

APPENDIX G
BIOMONITORING (U)

Nevada Test Site (NTS) (U)

(U) During the summer of 1989, samples of produce were collected from farms in Utah and Nevada. Other than naturally-occurring ^{40}K, there were no detectable gamma-emitters, and none of the samples had a ^{3}H, ^{90}Sr, or ^{238}Pu concentration that exceeded the Minimum Detectable Concentration (MDC). There was only one sample, the Swiss chard from Rachel, Nevada, that had a detectable $^{239+240}Pu$ concentration (0.017 ± 0.013 pCi/g ash). This may have been due to incomplete washing of the soil from the sample (DOE, 1990d).

(U) Samples of animal tissue were collected in late 1988 and 1989 for radiochemical analysis. Other than naturally occurring ^{40}K, only one of the 107 samples had a detectable gamma emitter; the concentration of ^{137}Cs in a cow liver sample, which was 0.028 ± 0.016 pCi/g. The results of radiochemical analyses are reported as the median and range of concentrations detected in ashed samples. All of the ^{90}Sr levels in the 24 bone samples were above the MDC, but only one of the ^{238}Pu results was above the MDC. There were 10 detectable $^{239+240}Pu$ results; one in a cow bone sample and five in cow liver samples, although the maximum concentration was only 0.025 pCi/g ash. There were also two detectable concentrations in deer lung samples and three in deer rumen content samples as might be expected for animals that graze on the NTS (DOE, 1990d).

(U) The ^{3}H analysis of cow blood samples and bighorn sheep kidney samples showed only background levels, median values were <400 pCi/L, as is found in surface waters in this area. The blood samples from the deer, however, contained elevated levels of ^{3}H (a maximum of 580,000 pCi/L) due to the deer having access to the tunnel drainage ponds on the NTS (DOE, 1990d).

Idaho National Engineering Laboratories (INEL) (U)

(U) Data from animal species are generally obtained as part of DOE research programs rather than as part of the routine environmental surveillance program. Several animals that were killed in road accidents on INEL were submitted for analysis by gamma spectrometry. Samples collected from three mule deer killed on the roads near the Central Facilities Area contained detectable concentrations of manmade radionuclides. A fawn's muscle tissue contained Cs-137 at $9.3 \pm 1.2 \times 10^{-8}$ and its liver tissue contained Cs-137 at $2.3 \pm 2.0 \times 10^{-8}$ uCi/g wet weight. One adult had a liver concentration of Cs-137 at $2.5 \pm 1.0 \times 10^{-8}$ uCi/g. The second adult deer had Co-60 at $7.0 \pm 1.2 \times 10^{-8}$ uCi/g wet weight in the liver and a concentration of Cs-137 in muscle of $4.5 \pm 1.0 \times 10^{-8}$ uCi/g. All three mule deer were killed on roads near Central Facilities Area (DOE, 1990b).

(U) Among the eight pronghorn onsite road kills, three had detectable concentrations of Cs-137 in muscle tissue ranging .om $1.5 \pm 0.8 \times 10^{-8}$ uCi/g to $8.6 \pm 1.4 \times 10^{-8}$ uCi/g wet

[redacted]

weight, and two had detectable concentrations of Cs-137 in liver tissue at $1.9 \pm 1.2 \times 10^{-8}$ and $5.3 \pm 1.6 \times 10^{-8}$ uCi/g wet weight respectively (DOE, 1990b).

(U) While it is known that the soil around some facilities is contaminated with Cs-137, this nuclide was also a constituent of world wide fallout during atmospheric weapons testing and has been found in the soil at locations distant from INEL. As a result, game animals sampled from off-site distant areas (control animals) also frequently contain Cs-137 in their muscle and liver tissues. The average concentrations of Cs-137 found in tissues of control animals were 3.8×10^{-8} uCi/g for muscle and 4.7×10^{-8} uCi/g for liver tissues. Concentrations of Cs-137 above those levels, and the concentration of Co-60 in the liver tissue of the mule deer could be the result of the animals ingesting contaminated soil on vegetation around site facilities (DOE, 1990b).