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AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE SAFETY ASSESSMENT DOCUMENT

FEBRUARY 1980

WORK PERFORMED UNDER CONTRACT
NO. DE-AC08-76NV00410

REYNOLDS ELECTRICAL AND ENGINEERING CO., INC.
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Prepared for the U. S. Department of Energy
Nevada Operations Office under Contract
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ABSTRACT

The Area 5 Radioactive Waste Management Safety Assessment Document evaluates site characteristics, facilities and operating practices which contribute to the safe handling and storage/disposal of radioactive wastes at the Nevada Test Site. Physical geography, cultural factors, climate and meteorology, geology, hydrology (with emphasis on radionuclide migration), ecology, natural phenomena, and natural resources are discussed and determined to be suitable for effective containment of radionuclides. Also considered, as a separate section, are facilities and operating practices such as monitoring; storage/disposal criteria; site maintenance, equipment, and support; transportation and waste handling; and others which are adequate for the safe handling and storage/disposal of radioactive wastes. In conclusion, the Area 5 Radioactive Waste Management Site is suitable for radioactive waste handling and storage/disposal for a maximum of twenty more years at the present rate of utilization.

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CONTENTS

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FIGURES

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
SAFETY ASSESSMENT DOCUMENT

I. Introduction

A. Purpose

This Safety Assessment Document (SAD) was prepared at the request of the U. S. Department of Energy, Nevada Operations Office (DOE/NV) to satisfy provisions of ERDA Manual Chapter 0531 and DOE Order 5481.1. An effort has been made to provide a general assessment of the potential health and safety risks or consequences if a Radioactive Waste Management Site (RWMS) were subjected to natural phenomena occurring at the site or if the site were to experience a credible failure in radiological safety systems or procedures. Appropriate planning measures to mitigate such occurrences are listed where applicable.

B. Responsibility

The Reynolds Electrical and Engineering Co., Inc. (REECo) is responsible under DOE Contract DE-AC08-76NV00-410 for the safe management of radioactive waste, which includes the operation, maintenance, and surveillance of RWMS's at the Nevada Test Site (NTS). The REECo Waste Management Office (WMO) performs a number of functions relative to each RWMS which are set forth in Reference 1. All phases of the RWM program are conducted to ensure as low as practicable (ALAP) radiation exposures to individuals and population groups and that any such exposures do not exceed standards established by ERDA Manual Chapter 0524.

REECo is responsible for the five RWMS's established on the NTS for storage or disposal of radioactive waste. The five are:

1. U3ax (for bulk waste),
2. Horn Silver Mine in Area 26,
3. RWMS in Area 25 (R-MAD),
4. U3fi drill hole (shaft) in Area 3, and
5. RWMS in Area 5.

See Figure 1 for specific location of these sites.

This SAD will concentrate on the major RWMS located in Area 5 which is used for storage and disposal of several types of radioactive waste as well as classified and unclassified waste. (References to Frenchman Flat can be construed to hold true for Area 5, as shown in Figure 2.)

II. Site Characteristics

A. Description

1. Physical Geography

The Area 5 RWMS (Figure 1) is located in the northeast section of Area 5, at an elevation of approximately 910 meters (3000 feet). This location is ideal for waste storage/disposal not only because the public has been excluded from the area, but also because the rugged terrain surrounding the test areas provides natural barriers to unauthorized entry for both safety and security purposes. More detailed information on the physiography of NTS is contained in Reference 1.

2. Cultural Factors

The arid climate, lack of industrialization, exclusion of the public from NTS and the Nellis Air Force Range, and the federal

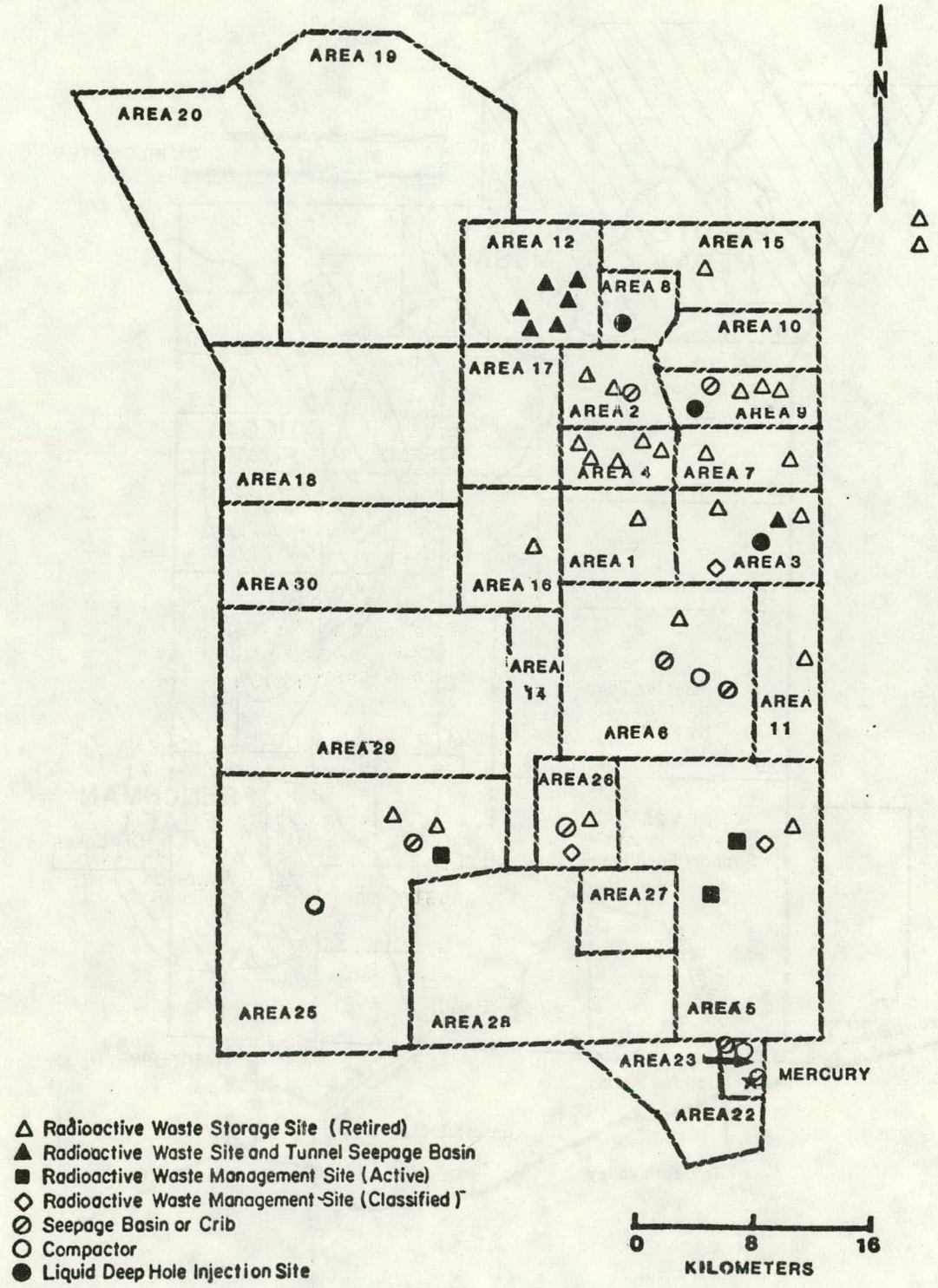

Figure 1. NTS Radioactive Waste Area Locations

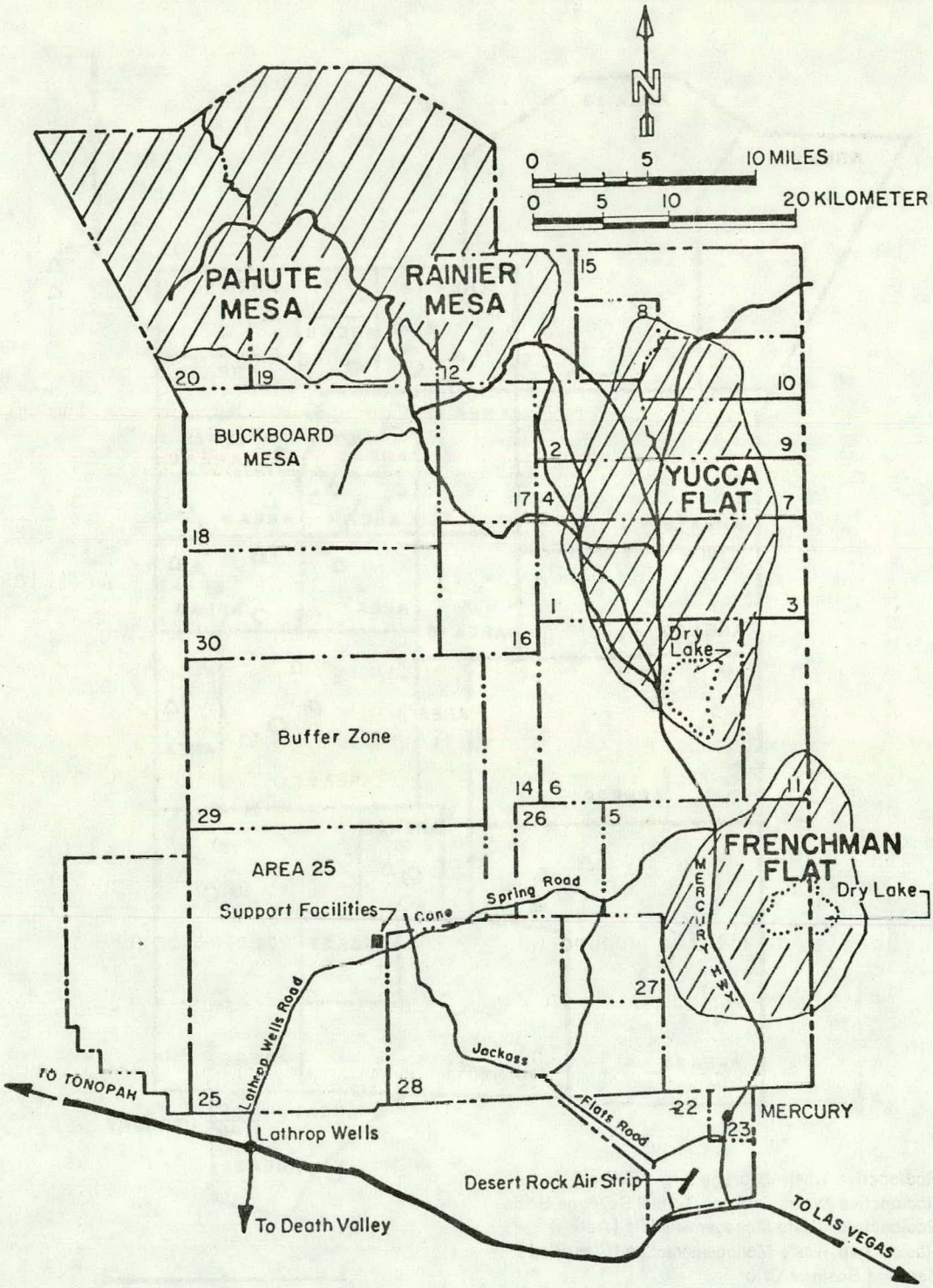

Figure 2. Nevada Test Site

government ownership of most of Nevada land are factors which result in a very low population density over most of southern Nevada and a very low percentage of privately-owned land in this area (Figure 3).

Las Vegas, located to the southeast from NTS, depends primarily on recreation and tourism. The smaller city of Henderson, further southeast, is industrialized with a few chemical and metal refining plants, and several communities to the southwest and northeast from NTS depend upon agriculture and cattle ranching. A few scattered mining operations are conducted to the west, northwest, and north of NTS. Thus, most nearby activities involve limited agricultural, cattle ranching, and mining operations.

It is unlikely that any dramatic increases in the present low population densities near NTS will occur within the next few decades. The typically low level of annual precipitation, limited available ground water, and sparse vegetation are not conducive to increases in agricultural and cattle grazing activities, and only a few of the mines are worked on a continuous basis.

Archaeological studies made on NTS have identified a number of sites which were occupied by various aboriginal cultures before the first known outside contact in 1849. Small hunting and gathering groups used temporary campsites and shelters in the area as indicated by artifacts.

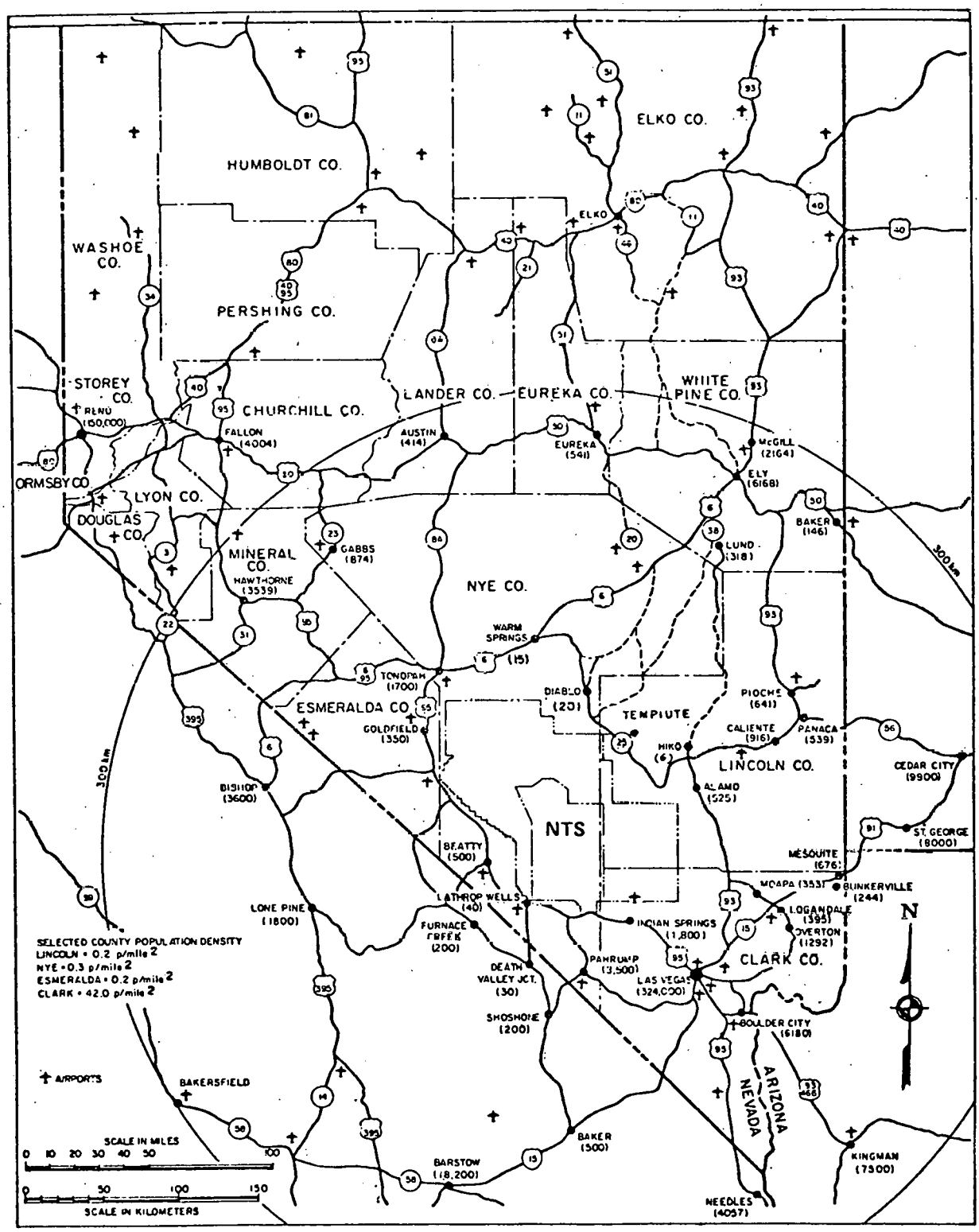

Figure 3. Population Map

3. Climate and Meteorology

The climate varies significantly over short distances in response to complex orographic influences and with pronounced variations from one year to the next. Extremes of climate are exemplified by conditions on the high plateaus in contrast to the dry lake beds.

Annual precipitation depends mainly on elevation and varies on the average from about 10 centimeters (4 inches) at an elevation of 910 meters (3000 feet) in Frenchman Flat to about 30 centimeters (12 inches) at an elevation of 2150 meters (7000 feet) on Pahute Mesa.

Average temperatures for the warmest and coldest hours in Frenchman Flat in January are 12° and minus 3°C (53° and 26°F). Corresponding temperatures in July are 36° and 17°C (97° and 62°F). Data on Rainier Mesa show corresponding temperatures of 3° and minus 3°C (37° and 26°F) in January and 25° and 16°C (77° and 61°F) in July.

The average annual wind speed in Yucca Flat is 12 kilometers (7.5 miles) per hour. April is the windiest month, with speeds averaging 15 kilometers (9.3 miles) per hour, but winds in excess of 80 kilometers (49.7 miles) per hour have ben recorded in every month.

4. Geology

The NTS geology includes deposition of limestone, dolomite, shale, and sandstone of substantial thickness during most of the

Paleozoic time; emergence and extensive erosion at the end of the Paleozoic Era; oscillation between marine and continental conditions which culminated in complete emergence; thrust faulting and intrusion by granitic plutons of Mesozoic age; faulting and erosion into Tertiary time; deposition of vast quantities of volcanic rocks during Tertiary and early Quaternary time; basin and range faulting related to caldera subsidence during late Tertiary time and Quaternary time; and erosion of surrounding mountains causing deposition of alluvium in the basins and as alluvial fans continuing until the present (Figure 4).

Most of the soils at NTS have developed on the alluvial deposits under conditions of high temperatures and low precipitation. They exhibit characteristics of desert soils: coarse texture; an accumulation of carbonates within a few feet of the surface contributing to formation of a caliche layer; low organic matter content; and low carbon/nitrogen ratios.

Soils in Mercury, Rock Valley, and Yucca Flat are low in exchangeable sodium and high in calcium and magnesium. Sandy soils from Jackass Flats are low in calcium, magnesium, and sodium. Soils in Frenchman Flat have the highest cation exchange capacity and exchangeable potassium-potassium concentrations sometimes exceed the exchangeable calcium and magnesium.

Studies have shown that, while areas of greater earthquake activity exist in California, central Nevada, and Utah, the local NTS earthquake activity is considered to be light. Areas of greater activity are all at least 160 kilometers (99.4 miles) from NTS.

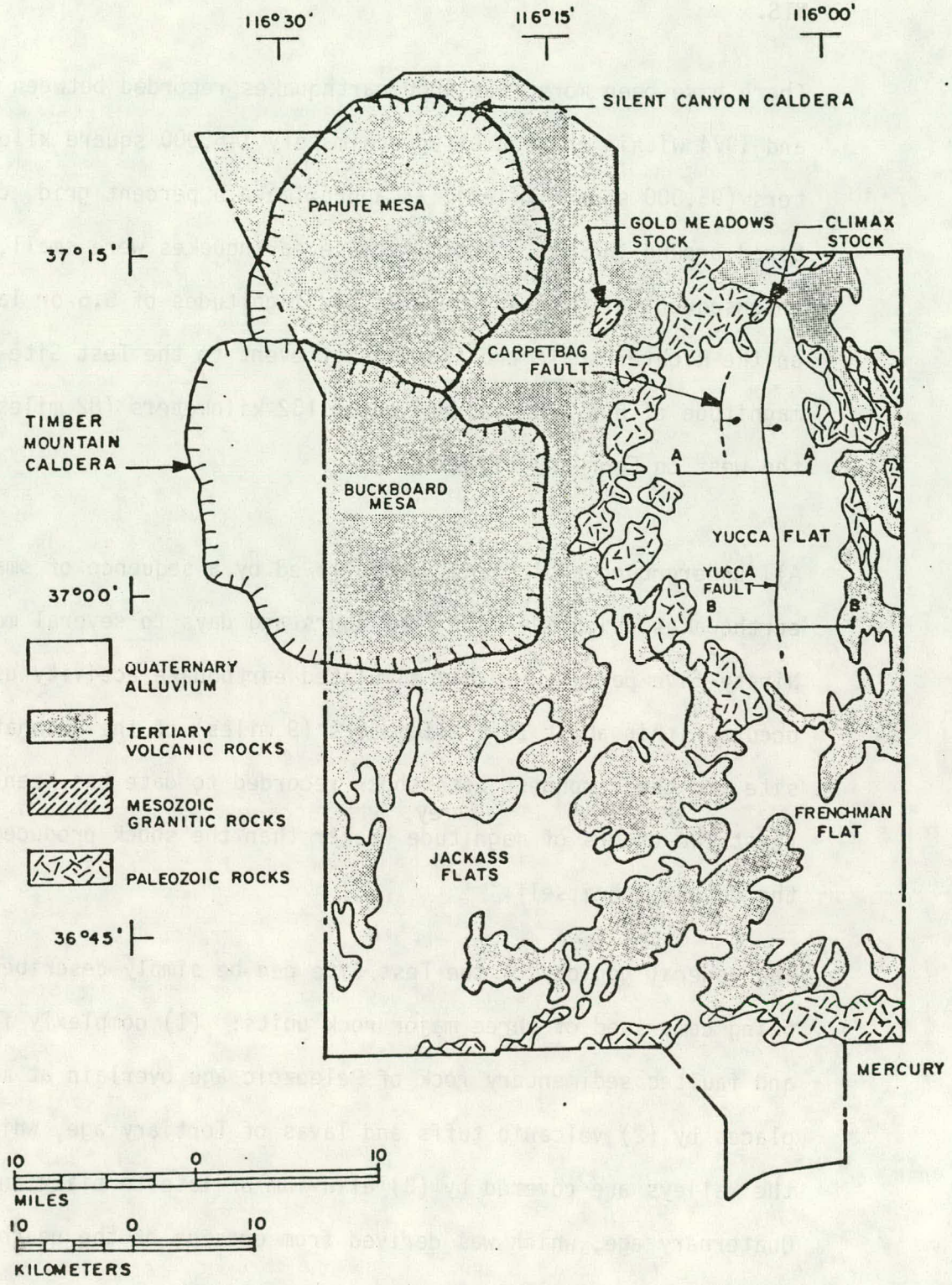

Figure 4. Principal Rock Types of the Nevada Test Site

There has never been a recorded earthquake of magnitude 6 or greater within 120 milometers (74.6 miles) of the boundaries of NTS.

There have been more than 4000 earthquakes recorded between 1900 and 1974 within an area of approximately 146,000 square kilometers (95,000 square miles), an approximate 5 percent grid, centered around the NTS. Most of these earthquakes were small, inconsequential events. Only 21 had magnitudes of 5.5 or larger on the Richter scale and the closest event to the Test Site had a magnitude of 5.6 and occurred about 132 kilometers (82 miles) to the west on February 11, 1949.

All underground explosions are followed by a sequence of small earthquakes which may last from hours and days to several months. Ninety-five percent of this simulated earthquake activity usually occurs within about 14.5 kilometers (9 miles) of the detonation site and the strongest aftershock recorded to date has been at least two orders of magnitude weaker than the shock produced by the detonation itself.

The general geology of the Test Site can be simply described as being comprised of three major rock units: (1) complexly folded and faulted sedimentary rock of Paleozoic age overlain at many places by (2) volcanic tuffs and lavas of Tertiary age, which in the valleys are covered by (3) alluvium of late Tertiary and Quaternary age, which was derived from erosion of the nearby hills of Tertiary and Paleozoic rocks.

5. Hydrology

Precipitation on NTS results in surface water runoff only during unusually intense or persistent storms. Runoff in the eastern half of NTS ultimately collects in the lake beds (playas) of the closed basins, Yucca Flat, and Frenchman Flat where it typically stands for a few days to a few weeks before being lost mainly by evaporation (Figure 5).

Groundwater

The eastern two-thirds of NTS are within the Ash Meadows groundwater system, which also drains a vast area to the north and east. Groundwater in this system generally moves downward through alluvium and volcanic rocks to the Paleozoic carbonate rocks, in which it then flows generally southwestward to discharge at the large springs in Ash Meadows, about 40 kilometers (25 miles) southwest of Mercury. The Ash Meadows system has an annual discharge of about 21 million cubic meters which is transpired by plants or evaporated from soil and playas in the Amargosa Desert.

The water recharging the NTS region ultimately flows toward the southwest in the regional goundwater flow systems. The flow system extends from the water table to a depth where the hydraulic conductivity of the rocks is extremely small. That depth is perhaps in excess of 1500 meters (5000 feet) in the area of the NTS.

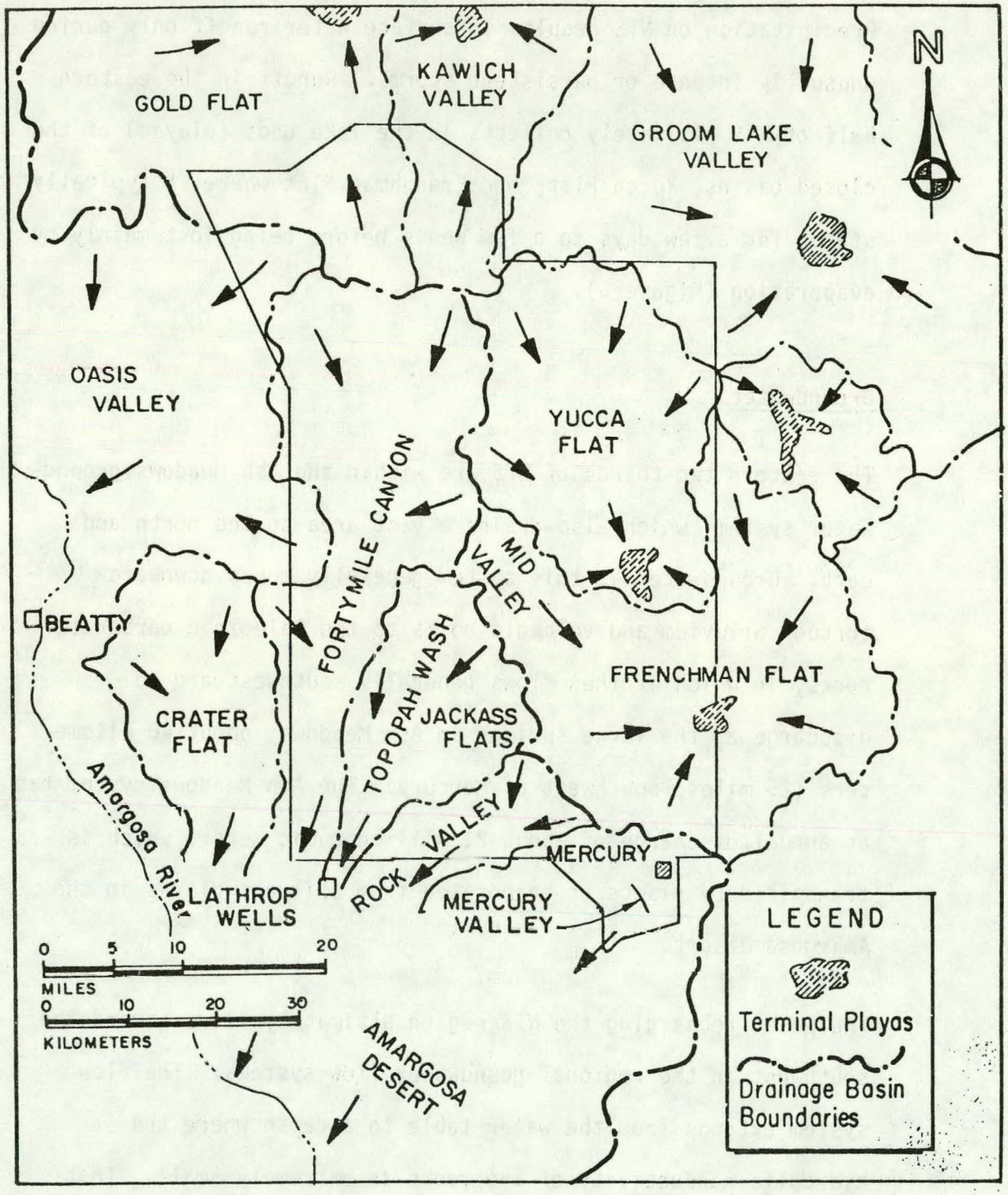

Figure 5. Boundaries of Basins and Direction of Surface Water Flow

Flow in both regional groundwater systems occurs mainly through fractures in the massive carbonate and volcanic rocks. Vertical flow through the volcanic rocks beneath Yucca Flat and Frenchman Flat is retarded by the bedded and zeolitized tuffs, which have interstitial hydraulic conductivities of less than 0.0002 meter per day (0.0007 feet per day) as determined from laboratory tests on cores. These confining beds limit downward flow to rates of less than 0.05 meter (0.2 feet) per year. Assuming that the tuff aquitard beneath Yucca Flat has an average saturated thickness of 305 meters (1000 feet), the fastest time for water to move vertically from the top to the bottom of the tuff aquitard is about 6000 years.

A long-term hydrologic monitoring program for the Nevada Test Site and vicinity has been designed to provide surveillance at points of public use, at "early warning" locations close to and down gradient from the centers of testing, and at points of groundwater exit from the Nevada Test Site. Sampling points were selected which are representative of the various components of the groundwater flow systems and where care can be exercised so that samples are free from contamination by surface water and atmospheric fallout. The groundwater sampling points are differentiated on the basis of sampling frequency into two networks-one is sampled monthly and one semiannually. Twelve stations (all deep wells) are sampled monthly and 20 stations (3 springs

and 17 wells) are sampled semiannually, forming a combined network of 32 stations. Except for those wells which are deliberately drilled into or near nuclear chimneys, the levels of radioactivity are low-up to 1.5×10^{-8} microcuries of tritium per milliliter.

6. Ecology

Because the NTS lies on the transition between the Mohave and Great Basin Deserts, the flora and fauna consist of species characteristic of both deserts. They are:

1,028 arthropods (80% insects)
711 types of vascular plants
190 species of birds
42 terrestrial mammals
32 species of reptiles
4 species of bats
no amphibians

Although none of the flora and fauna are presently listed in the Federal Register as being either endangered or threatened, a number of plant species found on the NTS have been proposed for designation by the Secretary of the Interior as either endangered or threatened.

7. Natural Phenomena

There have been no confirmed reports (by qualified observers) of tornadoes in the southern Nevada area. Lightning occurs in association with infrequent thunderstorms during the summer months,

however, such storms usually occur as isolated events covering relatively small shower areas.

Flash flooding may occur during unusually intense or persistent storms. However, even during extreme conditions, flooding is usually confined to well-defined channels which are normally dry. In the Yucca Flat and Frenchman Flat Basins, the flood water may either seep into the permeable sand and gravel of these normally dry channels, or collect on the relatively impermeable playas where it may stand a few centimeters deep for a few days or weeks until being lost primarily by evaporation.

The southern Nevada region is generally characterized as an area of moderate seismic activity although it is influenced by two zones of continuous high seismicity-the San Andreas fault system, extending along the entire California coast from the Gulf of California to San Francisco, and a fault system extending from southern California to north-central Nevada. Because of its proximity to these seismically active zones, the region lies astride the Zone 2-Zone 3 boundary in the 1969 NOAA Seismic Risk Map. The NTS commonly experiences earthquakes in the 4.8-5.7 magnitude due to underground tests with yields from 20 to 200 kilotons. Consequently, NTS structures are built to Uniform Building Code (UBC) Zone 3 specifications in order to withstand the above levels of ground shock. Figures 6 and 7 depict seismic activity within a 5° grid of the NTS.

MAGNITUDE 5.5 AND LARGER EARTHQUAKES
OCCURRING NEAR THE NTS SINCE 1900*
(WITHIN A 5° GRID)

Date	Latitude°	Longitude°	Magnitude	km Distance From NTS Center
11/10/16	35.5	117.0	6.1	177
12/21/32	38.75	118.0	7.2	248
1/5/33	38.75	118.0	5.7	248
1/30/34	38.0	118.5	6.3	227
5/11/39	38.0	118.0	5.5	190
8/9/43	38.2	118.2	5.5	217
7/18/46	34.5	116.0	5.7	277
4/10/47	35.0	116.6	6.4	222
2/11/49	37.1	117.75	5.6	132
7/23/52	35.3	118.6	6.1	281
7/29/52	35.3	118.8	6.1	294
7/6/54	39.5	118.4	6.6	336
7/6/54	39.0	118.5	5.5	297
7/6/54	39.5	118.5	6.6	341
8/24/54	39.5	118.4	6.8	336
8/31/54	39.5	118.5	5.8	341
9/1/54	39.5	118.5	5.7	341
12/16/54	39.3	118.0	7.8	299
12/16/54	39.3	118.0	6.8	299
12/16/54	39.5	118.0	5.8	318
8/16/66	37.4	114.2	5.6	189

*The Owens Valley earthquake March 26, 1872, was of an estimated magnitude of 8.3 on the Richter Scale.

Figure 6. Magnitude 5.5 and Larger Earthquakes

8. Natural Resources

Permanent surface water at NTS is limited to a few springs and ponds; however, the small amount of water available from springs is inadequate for irrigation purposes and is of use only to local fauna. Spring water is not used for NTS operations. Most of the water used at NTS is pumped from the water tables below the Yucca Flat, Frenchman Flat, Jackass Flats, and Mercury Valley basins. The current and anticipated future water withdrawal rate is expected to have little effect on the water table levels.

Migration of radionuclides deposited on the surface and in the alluvial fill or aquitards beneath the closed basins is prevented by a combination of NTS hydrologic conditions. Thus, there should be no deleterious effect on public water supplies off NTS from continued NTS operations.

The NTS has no timber resources. The only trees found in the area are small pinion and juniper pines at the higher elevations and a few cottonwood trees at one of the springs.

Due to the arid conditions and the cost of obtaining irrigation water from the deep water tables, NTS land has minimal usefulness for agricultural and grazing purposes.

Prospecting and exploration for minerals started in the NTS area before 1905, and numerous small pits, shafts, and tunnels at higher elevations remain as evidence of sporadic activity which continued until NTS was established.

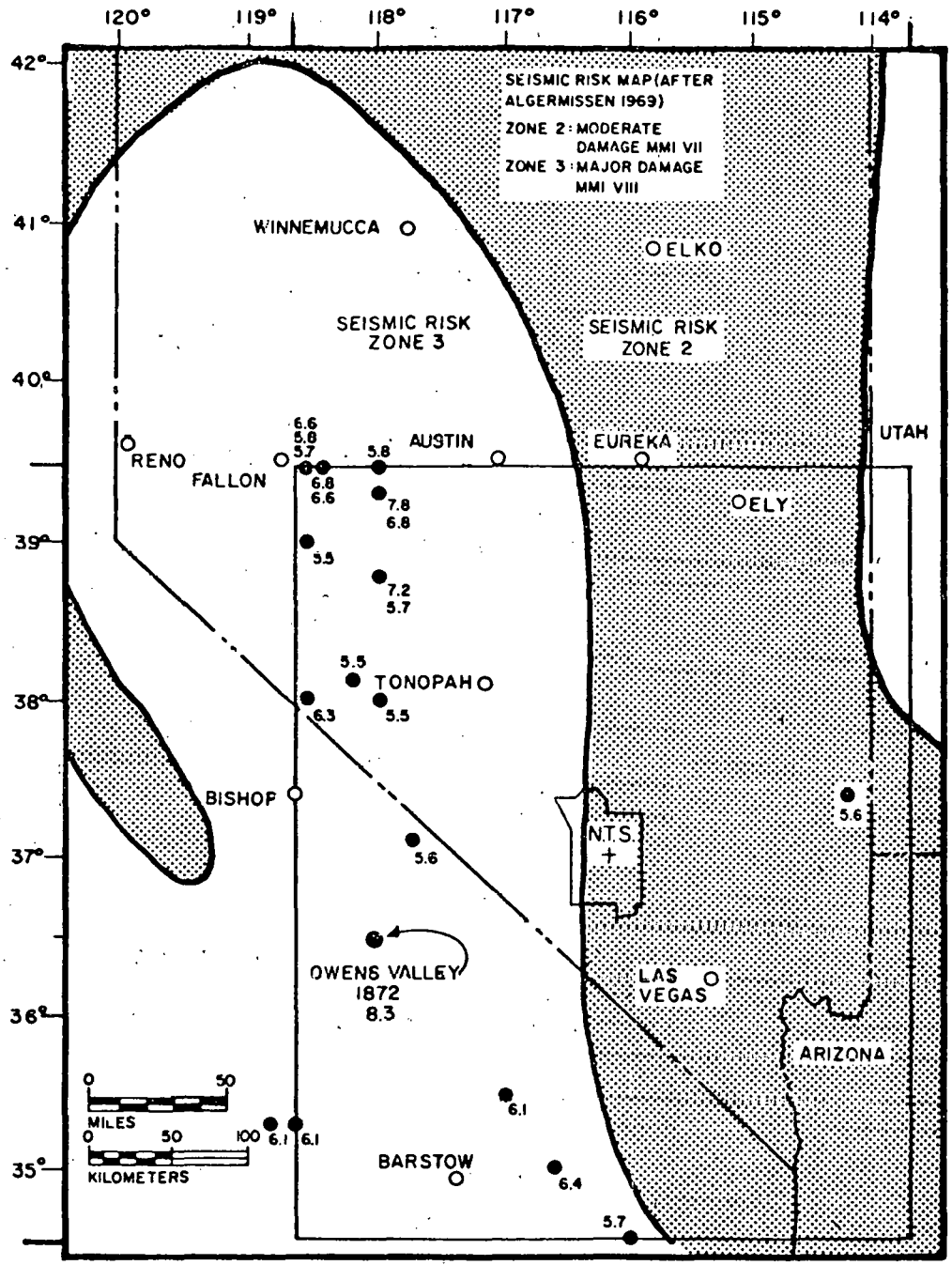

Figure 7. Magnitude 5.5 and Larger Earthquakes in the Vicinity of NTS

A few remaining undeveloped mineralized locations are at higher elevations in NTS areas not used for nuclear testing or waste management operations. These locations have limited potential for economic recovery of mineral resources. However, it is not anticipated that future NTS activities will cause these minor potential resources to be irretrievable or irreversibly committed to either the NTS nuclear testing or waste management programs.

B. Assessment

NTS is a very compatible location both for nuclear device testing and radioactive waste management. Continuation of these activities should have no deleterious effects on the environment, culture, or natural resources of the area. To the contrary, NTS activities have had a positive influence on development of the surrounding area and have significantly contributed to the economic base of southern Nevada.

The low population density of the surrounding area, buffer zones around NTS, physiographic barriers, arid climate, optimum geologic and hydrologic conditions, and minimal natural phenomena disturbances are all characteristics contributing to safe and effective confinement of radionuclides associated with waste management activities. The geological and hydrological conditions are particularly important.

The hydrology of the closed basins on NTS provides redundant hydraulic barriers to groundwater movement and radionuclide migration away from storage or disposal locations. Effectively zero porosity and permeability of unaltered quartz monzonite and grondiorite in the stocks

suggest that the amount of groundwater and movement of any water at depth in the stocks is minimal.

Age-dating of well water and investigation of groundwater velocities in the strata undrlying the closed basins indicate that movement of groundwater through the composite thickness of alluvium, lavaflow aquitards, tuff aquitards, and clays into the underlying carbonates is exceedingly slow, most probably being in the range of hundreds of thousands of years. Radionuclide decay alone during the long transit time would reduce radioactivity to harmless levels before radionuclides could migrate to offsite water supplies.

Even after undergoing ion exchange during the very long transit time to reach the underlying carbonates, water from the Yucca Flat and Frenchman Flat basin is diluted, first by underflowing water, and then by water from other origins before it reaches offsite water supplies. Estimates of the amount of water entering the carbonates from Yucca Flat and Frenchman Flat average 0.5 percent of the water discharging at and underflowing the Ash Meadows spring line. The maximum contribution of water from these basins to the Ash Meadows discharge and underflow is estimated at 0.8 percent.

Finally, estimates of the transit time in the underlying carbonates from Yucca Flat to the Ash Meadows spring line range from several hundred to 50,000 years. However, this time is minor compared to downward transit time in the tuff aquitard.

Natural phenomena disturbances at NTS sufficient to cause significant damage to waste management facilities are of low probability. NTS is

in a zone of relatively light earthquake activity, and small movements of major faults near large underground nuclear detonations indicate that no large tectonic stresses exist in the area. The geologic history of NTS is well known.

It is concluded that characteristics of NTS are suitable for effective containment of radionuclides, and that NTS should be useful as a radioactive waste management facility for a very long period into the future that may best be measured on a geologic time scale.

The nuclear testing areas are already committed to storing very large quantities of radioactive debris near the surface and at past underground nuclear detonation points. A considerable portion of the NTS surface area has not been used and is not committed to nuclear testing and could be used for waste management.

III. Facilities and Operating Practices

A. Description

1. Storage and Disposal

The Area 5 RWMS is approximately 37.2 hectares (92 acres) of land which is devoted to surface storage and disposal of radioactive wastes (Figures 8, 9, and 10). It is surrounded by a barbed wire fence (1.2-meter [3.9 feet] 3-strand for unclassified waste; 1.2-meter [3.9 feet] 6-strand for classified waste) with ingress and egress through locked gates.[1] Appropriate radiation warning signs (displaying the radiation warning symbol and the words "KEEP OUT") are clearly posted. A separately fenced area of

[1] WSI security personnel and WMO personnel have keys to the gates

disposal trenches is used for classified waste. The site is a significant distance from surface springs and is separated from the water table by a vertical distance of approximately 200 meters (656 feet). A thick tuff aquitard exists beneath the water table.

Facilities include trenches, pits, and pads for storage and disposal of tritium-contaminated waste, low-level transuranic (TRU) waste, and potentially reusable activated or contaminated hardware and equipment. This is the only NTS RWMS used for storage of TRU-contaminated wastes. Trenches and pits for disposal of radioactive wastes are excavated, and storage pads are prepared, in advance of anticipated needs. These trenches are 3.6 meters (12 feet) in depth and width and 220 meters (720 feet) long; the disposal pits are 6.1 meters (20 feet) deep, approximately 45 meters (147.6 feet) wide, and 200 meters (656 feet) long. An earth berm is provided during construction to allow a miniumum of one meter (3 feet) backfill as the trenches or pits are used, and diversion channels and earth berms are constructed around a major portion of the most desirable perimeter area to prevent surface water flooding from storms, and also to address the 100-year flood projection. The pits and trenches are filled to within one meter (3 feet) of surface grade with radioactive waste and covered with a minimum of 2 meters (6.56 feet) of soil which is at least one meter (3.3 feet) above the existing grade.

TRU-contaminated wastes containing greater than 10 nanocuries (nCi) per gram must be separated from other low-level wastes and

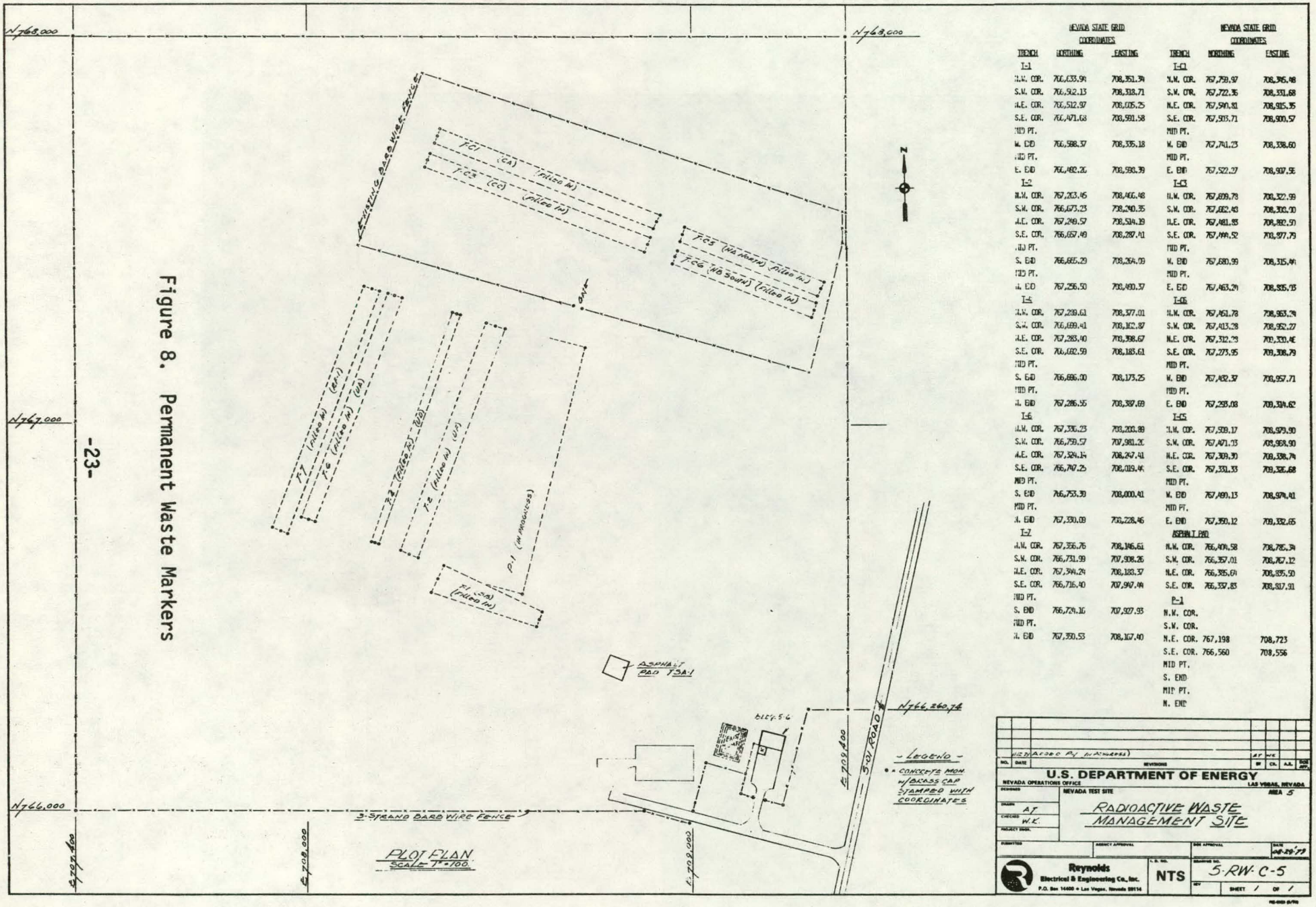

Figure 8. Permanent Waste Markers

TRENCH	NEVADA STATE GRID COORDINATES NORTHING	EASTING
T-1		
N.W. COR.	766,633.94	708,351.34
S.W. COR.	766,512.13	708,318.71
N.E. COR.	766,512.97	708,676.25
S.E. COR.	766,471.68	708,591.58
MID PT.		
W. END	766,588.37	708,335.18
MID PT.		
E. END	766,492.26	708,598.39
T-2		
N.W. COR.	767,203.45	708,466.48
S.W. COR.	766,673.23	708,240.35
N.E. COR.	767,249.57	708,514.19
S.E. COR.	766,657.49	708,287.41
MID PT.		
S. END	766,885.29	708,364.09
MID PT.		
N. END	767,256.50	708,490.37
T-4		
N.W. COR.	767,239.61	708,377.01
S.W. COR.	766,699.41	708,162.87
N.E. COR.	767,283.40	708,398.67
S.E. COR.	766,682.59	708,183.61
MID PT.		
S. END	766,886.00	708,173.25
MID PT.		
N. END	767,286.55	708,387.69
T-6		
N.W. COR.	767,336.23	708,200.89
S.W. COR.	766,759.57	707,981.26
N.E. COR.	767,324.14	708,247.41
S.E. COR.	766,747.25	708,019.44
MID PT.		
S. END	766,753.39	708,000.41
MID PT.		
N. END	767,330.09	708,228.46
T-7		
N.W. COR.	767,356.76	708,146.61
S.W. COR.	766,731.99	707,908.26
N.E. COR.	767,344.24	708,183.37
S.E. COR.	766,716.40	707,947.44
MID PT.		
S. END	766,724.16	707,927.93
MID PT.		
N. END	767,350.53	708,167.40

TRENCH	NEVADA STATE GRID COORDINATES NORTHING	EASTING
T-C1		
N.W. COR.	767,759.97	708,395.48
S.W. COR.	767,722.36	708,331.68
N.E. COR.	767,590.31	708,915.35
S.E. COR.	767,503.71	708,900.57
MID PT.		
W. END	767,741.23	708,338.60
MID PT.		
E. END	767,522.27	708,937.56
T-C3		
N.W. COR.	767,699.78	708,322.99
S.W. COR.	767,682.40	708,300.70
N.E. COR.	767,681.83	708,982.57
S.E. COR.	767,668.52	708,977.79
MID PT.		
W. END	767,680.99	708,315.44
MID PT.		
E. END	767,663.29	708,935.13
T-C5		
N.W. COR.	767,651.78	708,963.29
S.W. COR.	767,613.28	708,952.27
N.E. COR.	767,312.79	709,330.46
S.E. COR.	767,273.95	709,308.79
MID PT.		
W. END	767,632.37	708,957.71
MID PT.		
E. END	767,295.08	709,304.62
T-C5		
N.W. COR.	767,509.17	708,979.90
S.W. COR.	767,471.73	708,968.90
N.E. COR.	767,309.30	709,338.74
S.E. COR.	767,331.33	709,326.68
MID PT.		
W. END	767,491.13	708,974.41
MID PT.		
E. END	767,350.12	709,332.65
ASPHALT PAD		
N.W. COR.	766,404.58	708,785.34
S.W. COR.	766,357.01	708,767.12
N.E. COR.	766,385.64	708,835.50
S.E. COR.	766,337.83	708,817.91
P-1		
N.W. COR.		
S.W. COR.		
N.E. COR.	767,198	708,723
S.E. COR.	766,560	708,556
MID PT.		
S. END		
MID PT.		
N. END		

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U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

DESIGNED
DRAWN AT
CHECKED W.K.
PROJECT ENGR.

NEVADA TEST SITE — AREA 5

RADIOACTIVE WASTE MANAGEMENT SITE

SUBMITTED — AGENCY APPROVAL — DOE APPROVAL — DATE SEP 29 '79

Reynolds Electrical & Engineering Co., Inc.
P.O. Box 14400 • Las Vegas, Nevada 89114

L.D. NO. NTS

DRAWING NO. 5-RW-C-5

REV — SHEET 1 OF 1

Figure 9. Area 5 Waste Disposal Trench

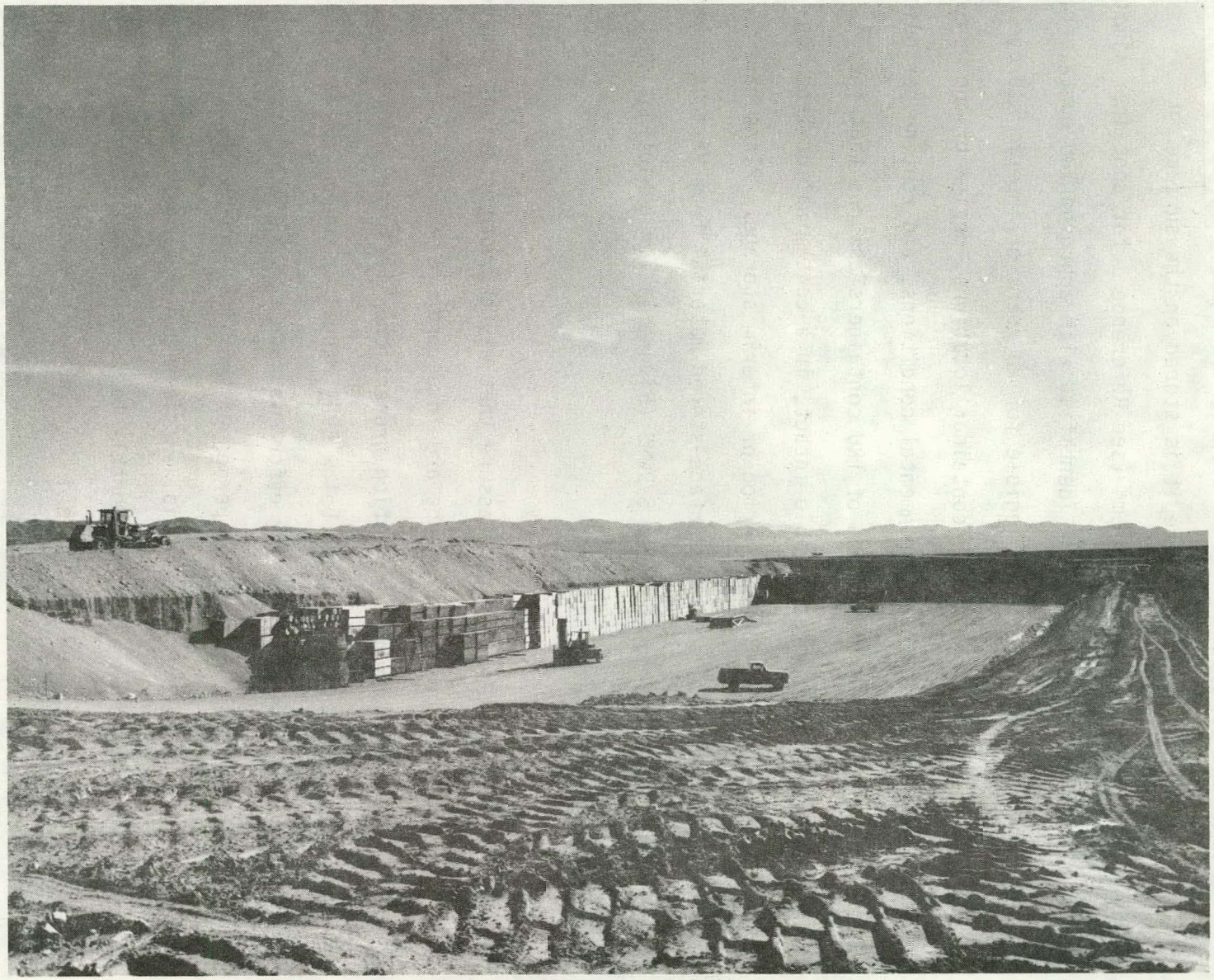

Figure 10. Area 5 Waste Disposal Trench

stored as retrievable waste. Most of these are shipped to NTS from the Lawrence Livermore Laboratory. Storage of TRU waste is restricted to Area 5 where it is stored on the surface in closely-spaced, sealed drums (see Reference 1 for container limit in grams). The drums are identified with approved TRU container markings designed to be legible for 20 years of interim storage. Permanent records of TRU container locations, design of the containers, ideal NTS environmental conditions, and routine periodic monitoring and inspection of TRU containers assures that they will be readily retrievable intact, in a contamination-free condition for the 20-year period of interim storage. Plans have also been made to move surface-stored material from various other NTS locations to the Area 5 RWMS (Figure 1) for consolidation.

2. Monitoring

REECo radiation monitors assure that waste transportation, disposal, and storage operations are in accordance with DOE standards regarding personnel radiation protection. Personnel radiation exposures are maintained below ERDA Manual Chapters 0524 and 0513 exposure guides and every effort is made to keep exposures below the ALAP level. All NTS personnel wear the approved NTS combination security credential and film badge holder. Film packets are changed on a routine monthly basis or when possible significant radiation exposure is indicated.

REECo personnel conduct a comprehensive environmental surveillance program which includes continuous air sampling for particulates and halogens at 34 NTS locations (3 at Area 5). Ten

separate tritium air samplers are located throughout the site (3 at Area 5). All samples are collected and analyzed for gross beta and gamma identification on a weekly basis.

The NTS water is radiologically evaluated at 62 locations (6 at Area 5) which include potable water, supply wells, open reservoirs, natural springs, effluent ponds, and contaminated ponds. The principal water system (potable, supply wells, and open reservoirs) is sampled to determine compliance with drinking water standards. Most are sampled monthly while the end use, potable water, is sampled weekly. The natural springs are sampled monthly to check for groundwater contamination in the outer sections of the NTS. Effluent and contaminated ponds are sampled monthly and analyzed to assure conformance with waste disposal standards.

The environmental surveillance program also includes 161 locations being monitored with thermoluminescent dosimeters (TLDs) for external gamma radiation (6 at Area 5). Being passive monitors, they are placed throughout the NTS with no regard to commercial power needs and therefore can be useful at the most remote locations. They are collected and analyzed quarterly and are primarily used to evaluate residual radioactivity from the atmospheric testing program and to check for any new testing input.

The three Area 5 air samplers for particulates and halogens showed minimal difference from the other 31 samplers on site;

i.e., worldwide background. The gross beta average for 1978 for these three locations was 9.7×10^{-14} µCi/cc as were the remaining 31 stations.

The 1970 plutonium concentration for these Area 5 locations was 9.0×10^{-17} µCi/cc as compared to a site average of 1.4×10^{-16} µCi/cc.

The three air samplers for tritium did show some small excess above normal background. The sampler at Area 5 Trench UD recorded high weekly values of 1.4×10^{-8} µCi/cc of HTO and 1.9×10^{-9} µCi/cc of HT with yearly averages of 3.8×10^{-10} µCi/cc and 4.0×10^{-10} µCi/cc, respectively. This was only 0.008 percent of the applicable concentration guide of 5×10^{-6} µCi/cc.

The water samples collected from the six locations surrounding the Area 5 RWMS showed only natural background. All variations from location to location in gross beta activity were due only to differences in potassium concentrations, i.e., ^{40}K. The highest yearly average was 1.3×10^{-8} µCi/cc at Well 5B.

The external gamma monitors at the six Area 5 locations showed that the radiation levels were low and consistent. The five stations directly surrounding the RWMS measured 140 mR/yr, while the station two miles south (Well 5B) measured 120 mR/yr. This small difference is known to be due to residual radioactivity from NTS testing.

3. Site Maintenance, Equipment, and Support

Area 5 RWMS is operated and maintained under the same general program as other NTS facilities and in accordance with AEC/ERDA Manual Chapters 0531, 0550, 0820, 5401, 6101, and 6301 with regard to the application of Environmental Safety and Health codes, standards and guides covering siting, design, construction, modification, operation, maintenance, decontamination, and decommissioning. These requirements are more specifically spelled out in References 1 and 2. Fencing is inspected periodically by REECo monitoring personnel working at the site. If repairs are necessary or if dry vegetation builds up on fence lines, maintenance personnel are asked to make repairs or remove vegetation which may constitute a fire hazard.

The extensive NTS heavy equipment inventory available to support RWMS includes a wide variety of earth-moving equipment, fork lifts, trucks, tankers, and cranes. However, this equipment must be obtained from one of several NTS construction yards which may be located at some distance from the Area 5 RWMS.

Equipment for compacting waste into 208-liter (55-gallon) drums is available at three centrally-located NTS facilities (Mercury, Area 25, and Area 6). Filled 208-liter (55-gallon) drums are transported to the Area 5 RWMS for disposal.

When heavy equipment is permanently assigned to the Area 5 RWMS and the site is expanded as planned, better space utilization will be accomplished by acquiring the capability and

available area to dig deeper and wider trenches with stable, sloping trench sides greater than the natural angle of repose that is compatible with soils at Area 5.

Decontamination equipment is located primarily at the Area 6 Decontamination Facility. Capability exists for decontaminating items ranging from heavy construction and drilling equipment to electronic hardware and anti-contamination clothing. In addition, a variety of mobile equipment can be made available for use at RWMS, including a water/sand blast unit, steam generators, tanker/pumper trucks, and personnel decontamination units. Mobile trailers containing offices, anti-contamination clothing and equipment, change rooms, and decontamination capabilities are normally deployed to areas of potential contamination as needed.

Fire protection equipment, other than approved portable extinguishers at the Area 5 RWMS, is located at fire stations in Mercury, Area 6, and Area 12.

All construction and operational activities are performed in compliance with the DOE, NV, and NTS safety, health, and environmental requirements, and with applicable federal, state, and local regulations. All buildings are constructed in conformance with applicable safety and fire protection codes.

4. Utilities

A large network of work, power distribution, and communications lines exists on NTS. Area 5 RWMS has water (bottled water for

drinking), power, and telephones. Portable or temporary utilities are provided during extensive operations.

5. Access to NTS and Area 5

Mercury Highway, a two-lane paved road, connects Highway 95 (Las Vegas and surrounding communities) to the Mercury main gate and locations north on the NTS. Subsidiary paved roads connect Mercury Highway to most NTS areas. Area 5 RWMS is reached by a paved road; however, roadways inside the RWMS are dirt/gravel.

At Desert Rock (on NTS), DOE has an airport suitable for aircraft with dual tandem wheel loads up to 3.85 megagrams (8500 pounds). Regularly scheduled government charter flights and some private aircraft presently use this airport.

The closest railroad is the Union Pacific line. A rail spur has been proposed (however, never funded) to connect a point northeast of Las Vegas with Mercury and Area 25.

6. Transportation and Waste Handling

All user organizations generating radioactive waste for storage or disposal at NTS are responsible for assuring that such wastes are in the appropriate form and are correctly packaged and labeled prior to delivery to NTS. No radioactive waste is shipped off of the NTS by RWMS personnel.

REECo monitoring personnel at the RWMS inspect and monitor shipments received for storage or disposal to further assure that

packaging and identification is adequate. These monitors also provide NTS organizations with information on packaging waste for storage or disposal and properly packaging those wastes generated by REECo. Where practical, wastes are compacted, oxidized, dehydrated, or otherwise concentrated to reduce wastes to a minimum storage or disposal volume. Radioactive organic wastes, or mixtures containing organic waste which may be affected by bacterial action, are dehydrated or otherwise preserved to permit indefinite storage.

Department of Transportation regulations apply to offsite users of NTS RWMS who ship waste to NTS. Regulations require, in addition to proper labeling, processing of waste containing unstable materials to make them inert or separate packaging of waste components which are radioactively unstable together. REECo monitoring personnel who instruct onsite users in packaging such materials or such REECo-generated materials assure that the above precautions are observed.

If required, special packaging techniques for some materials are used for onsite shipment. These include special shielding packaging to reduce radiation emanations from packages and protective overpacks for bottled radioactive gases.

A quality assurance program is currently being written in compliance with AEC/ERDA Manual Chapter 0820 requirements.

7. Site Security

Wackenhut Services, Inc. (WSI), provides NTS physical and personnel security. All personnel entering NTS are required to be security badged. WSI uses both on and offroad vehicles, helicopters, and light aircraft in providing security surveillance of the entire NTS. Procedures exist for barricading and controlling access to any area of NTS when the need exists. Property removal permits and radiological material clearance stickers are required to remove items from the NTS. The Area 5 RWMS is surrounded by barbed wire fence and ingress and egress are via locked gates.

8. Nuclear Criticality Safety

Fissile material stored or disposed of at the Area 5 RWMS has not been of sufficient quantity or concentration to possibly result in a critical configuration.(1) However, should such material be received for storage in the future, DOE/DOT nuclear safety transportation and storage procedures will be mandatory for the NTS RWM program.

9. Personnel and Training

The RWMS organization is as follows:

1 RWMS Project Manager
1 RWMS Supervisor
3 Monitors
3 Craft people
1 Planning Coordinator (vacant)

(1) The safeguards which are in effect to reduce the possibility of the introduction of a critical mass are spelled out in Reference 1. In addition, all paperwork is carefully checked and radiation readings are taken.

Every effort is made to hire only the most qualified applicants; recently this has included graduates of the REECo Environmental Sciences Department (ESD) Radiation Technician Training Program (RSTTP). This is an intensive six-month training course designed to bring personnel from a high school equivalency level to an entry level as radiation technicians. A one-week class entitled "Introduction to Radiation Protection Technology" is attended by new radiation monitors on an "as-needed" basis.

A radiation monitor is considered "qualified" when the following have been completed.

a. A 90-day "probation period"

b. A Probationary Employee/Trainee Evaluation form completed by the appropriate supervisor for each new monitor or trainee.

c. The on-the-job checklists for each monitor/trainee for the decontamination facilities operation, or the LASL, LLL, SL/DNA radsafe operations.

d. An additional 90 days of field training under the supervision of responsible ESD personnel and under the guidance of experienced monitors.

For experienced monitors, some of the above requirements may be waived. This waiver applies particularly to the second 90-day training period.

The ESD training program is set forth in ESD Standard Procedures Manual Section G11.

10. Emergency Plan

The Area 5 RWMS Emergency Action Procedure (Appendix G) is in compliance with AEC/ERDA and NV Manual Chapter 0502 with regard to notification, investigation and reporting of occurrences and the followup system to assure appropriate remedial action has been implemented. In addition, the REECo Emergency Preparedness Plan (Reference 5) includes emergency procedures for each area of NTS and provides specific direction regarding radiological safety, medical, fire protection, and other emergency response capabilities. REECo ESD Standard Procedures include separate sections for "Emergencies and Evacuations" (G13) and "Medical-Radiological Emergencies" (G12). REECo also provides team members for the DOE/NV Radiological Assistance Team 4, Region 7.

11. Permanent Records

Permanent records are maintained for the NTS RWM program in accordance with AEC/ERDA Manual Chapter 0511 and include the solid radioactive waste information required on DOE Form 735 and 736 and all other information required by the DOE/NV Operational Radioactive Waste Management Plan for the Nevada Test Site (NVO-185), Appendix B, Part IV.

REECo Form 0167 "Radioactive Waste Management-Storage and Disposal" is prepared with copies distributed to REECo Information Systems (for computer input), RWMS file, DOE, and the

agency or activity generating the waste. This form is a permanent record of waste description, and storage/disposal location. The form and the additional data required by DOE, as above, include pertinent information that is necessary for assessing and evaluating short- and long-term hazards associated with storage/disposal of the particular waste type.

Any accidents or spills involving radioactive materials are recorded in the RWMS Supervisor's logbook for Area 5. REECo Form 1616, "Radiological Occurrence Report", is used to document such occurrences and also becomes a permanent record of each accident.

The support contractor is requested to assure that waste containers received are marked in such a manner that the package can be identified from a separate set of records. Any accidents or spills involving radioactive materials and their subsequent cleanup are to be investigated and recorded. The appropriate form should be used to document such occurrences and become part of the permanent record of each incident.

Appropriate forms are used to document various aspects of the environmental surveillance program. Personnel, vehicle, and equipment radiation monitoring are documented and retained indefinitely. If decontamination is performed, a form is prepared to record both pre- and post-decontamination information.

B. Assessment

RWMS's at NTS have been adequate in the past for storing and disposing of wastes and preventing radionucludes from migrating beyond NTS boundaries on the surface or in groundwater, primarily due to favorable geographic, geologic, and hydrologic conditions combined with security and radiological safety restrictions. Increasing emphasis on radioactive waste management in recent years has resulted in significant progress toward upgrading NTS RWMS facilities and consolidating wastes. Proposals have been submitted and funds committed to construct basic facilities in AREA 5 RWMS and assign heavy equipment on a permanent basis for unloading waste, earth berm operations, and constructing and closing pits and trenches. Equipment is also used to maintain internal roadways.

Continued increases in RWM funding will be necessary of consolidation of the large quantities of waste and upgrading of active RWMS are to be accomplished within the next few years. NTS is ideal for effective management and containment of radioactive waste, but a concerted development effort and adequate funding will be required to achieve the ideal RWM program.

RWM programs at other DOE installations are being studied to best use the experience of others. With greater emphasis being placed on consolidation of wastes, maintenance of RWMS, waste management records, environmental monitoring, and emergency planning, the NTS RWM and Area 5 RWMS operating practices will continue to improve.

IV. Conclusions

Low population density, NTS buffer zones, optimum geologic and hydrologic conditions, arid climate, and minimal natural phenomena disturbances all contribute to safe and effective radionuclide confinement. All of the preceding factors have been investigated and documented. In this regard, present information shows no significant movement of radionuclides from disposal pits or trenches into the environment.

In addition to these factors, the NTS in general, and the Area 5 RWMS in particular, is not only a remote, isolated locale but also very protected because of man-made and natural security barriers. Radiological safety monitoring is carried on as a routine action. The RWMS program has the availability of proper equipment and manpower to use and maintain the Area 5 Site.

Significant progress has been made in upgrading the RWMS facility and consolidating wastes now stored in other NTS areas into the RWMS. At the present rate of forecast, the Area 5 RWMS will be able to accept radioactive wastes for storage/disposal for approximately 20 more years. This is a result of an additional 56 acres dedicated to RWMS activities.

APPENDIX A

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE

GENERAL

I. Notification and Receiving

A. Log all personnel entering the Area 5 Radioactive Waste Management Site (RWMS) on Area Access Dosage Register, Form RE-0621 (8/73).

B. Issue dosimeter if personnel are working in radiation area.

C. Issue full anti-C clothing as required.

II. Material Protection

A. Classified and unclassified material shall be covered to a minimum of 2 meters (6.56 feet) and at least 40 centimeters (15.7 inches) above existing grade.

III. Record Keeping

A. Complete permanent records are to be kept at the RWMS facility for each receipt and release of classified/unclassified radioactive waste.

APPENDIX B

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE
FOR
RECEIVING OF UNCLASSIFIED RADIOACTIVE WASTE

A. Notification and Receiving

1. Continuous surveillance of loading operations is maintained within the area to assure that materials free from radioactivity are segregated from radioactively contaminated materials, and to assure that contaminated materials are properly identified and placed in a manner which allows access to surfaces for purposes of decontamination.

2. Do not accept unclassified bulk waste. (Does not apply to classified bulk waste.)

3. Radiologically survey waste to be sure criteria are met for low level disposal.

4. Direct driver to proper location for disposal of waste.

5. Upon completion of unloading, transport vehicles are thoroughly monitored with portable instruments. A minimum of three swipes are taken and counted before vehicles are released for uncontrolled use.

6. If contaminated, send to Decontamination Pad for decontamination of vehicle.

7. Form RE-1685 will be completed for each vehicle survey.

B. Record Keeping

1. Complete permanent records are to be kept at the RWMS facility for each receipt and release of unclassified radioactive waste; and consigned to archives as box volume permits.

APPENDIX C

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE
FOR
RECEIVING CLASSIFIED RADIOACTIVE WASTE

I. Notification and Receiving

A. Use of the authorized classified disposal areas is controlled by the DOE Operations Coordination Center (OCC) at CP-1 (telephone 986-2731). Procedures for use of these areas are as follows:

1. When a request is received at the OCC for use of either of the disposal areas, a date and time is established by the OCC for delivery of the radioactive waste material to the selected waste site.

2. The ESD representative observes the disposal operation to assure proper disposal and handling of all radioactive material. All material placed in the Area 5 classified trench is covered by at least two meters (6.56 feet) of dirt. The Horn Silver Mine Shaft is secured with a locked steel cover.

3. The OCC notifies NTS Security headquarters to have a patrol stand by to unlock the inner gate, or metal cover, and to secure the inner gate, or metal cover, after the disposal operation is completed.

4. DOE Security is responsible to assure compliance with all Security requirements. Access to the classified disposal areas is limited to "Q"-cleared personnel.

II. Monitoring

A. Survey material upon arrival.

B. Upon completion of unloading, transport vehicles are thoroughly monitored with portable instruments. A minimum of three swipes is taken and counted before vehicles are released for uncontrolled use.

C. If contaminated, send vehicle to Decon Pad for decontamination.

D. Form RE-1685 will be completed for each vehicle survey.

III. Record Keeping

A. Complete permanent records are to be kept at the RWMS facility for each receipt and release of classified radioactive waste.

APPENDIX D

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE

LOW SPECIFIC ACTIVITY WASTE

I. Receipt of Waste

A. Open facility

B. Start log of activity, in duplicate, for daily activity at Area 5 RWMS.

C. Check tractor and trailer numbers upon arrival at the gate

D. Note time of tractor arrival

E. Notify REECo Traffic (telephone 6-0180) of arrival and departure time of tractor and trailers.

II. Off-Loading of Waste

A. Cut seals on trailers; retain metal seal for return to Rocky Flats

B. Stand by with radiation detection instruments while driver or iron-worker opens doors

C. Survey each trailer at door for radiation

D. Survey boxes and/or drums

E. Retrieve shipment list from rear box or drum

F. Take shipping memo from driver-retain back copy to turn in to REECo Traffic weekly

G. Notify OCC (telephone 6-2781) of number of shipments that arrived each week on the following Monday.

III. Record Keeping

A. Record box/drum numbers as material is unloaded and identify Nevada grid coordinates for disposal location

B. Take swipes from boxes/drums, trailer floors and tractor

C. Count swipes on scaler at facility

D. Complete Form RE-1685 upon completion of survey

E. Complete permanent records are to be kept at the RWMS facility for each receipt and release of Rock Flats waste.

IV. Release of Off-Loaded Trailer

A. Sign one copy of shipping papers for driver

B. Issue Form NV-164 to clear driver at Gate 100

V. Storage of Waste

A. Stack boxes/drums by Nevada grid coordinates

B. Indicate tier location for each box/drum

C. Enter location of material on computer printout

APPENDIX E

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE
FOR
RECEIPT AND HANDLING OF TRITIUM WASTE

I. Notification and Receiving

A. Traffic will notify RWMS that a shipment is due to arrive.

B. Shipment is received at the Area 5 RWMS.

C. Load of waste is surveyed to be sure criteria are met for disposal.

D. Direct driver to proper location for disposal of waste.

E. Vehicle Survey After Unloading

1. If uncontaminated, release vehicle.

2. If contaminated, send to Decon Pad for decontamination.

II. Monitoring

A. An ESD monitor will survey the super tiger with a portable tritium monitoring instrument prior to opening the truck and a continuous survey will be made during the off-loading operations. The monitor will insure that package integrity is maintained and in the event of a problem will halt the operation and take appropriate action.

B. Upon completion of unloading, transport vehicles are thoroughly monitored with portable instruments. A minimum of three swipes is taken and counted before vehicles are released for controlled use.

C. Tritium will be placed in jet engine containers used as overpacks and secured by means of a closure weld. A dye penetrant check of seal weld will be performed before initiating disposal.

III. Record Keeping

A. Nuclear Material Control Office, Post Office Box 296, Mercury, Nevada, will be notified of arrival of material and shipping papers and forms will be supplied as required.

B. Form RE-1685 will be completed for each vehicle survey.

C. Form RE-0167-6 will be prepared for each shipment.

D. Complete permanent records are to be kept at the RWMS facility for each receipt and release of tritium waste.

APPENDIX F

AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
STANDARD OPERATING PROCEDURE
FOR
HANDLING TRU MATERIAL FOR STORAGE

I. Notification and Receiving

A. Material is delivered by super tiger.

B. Survey exterior for level of radioactivity.

C. Open door of vehicle.

D. Survey material and swipe. Swipes will be counted on scaler prior to off-loading waste.

E. Off-load material.

F. Survey and swipe interior of vehicle.

1. Upon completion of unloading, transport vehicles are thoroughly monitored with portable instruments. A minimum of three swipes is taken and counted before vehicles are released for uncontrolled use.

2. If contaminated, send to Decon Pad for decontamination.

II. Record Keeping

A. Retain shipping papers which contain all information regarding shipment.

B. Form RE-0167/6 will be completed for each shipment by RWMS monitor.

C. Form RE-1685 will be completed for each vehicle survey.

D. Complete permanent records are to be kept at the RWMS facility for each receipt and release of TRU waste.

APPENDIX G

RADIOACTIVE WASTE MANAGEMENT SITE
EMERGENCY ACTION PROCEDURE

I. PURPOSE

To establish policy, assign responsibility, and set forth procedures for emergency action, including evacuation and reentry of the NTS Radioactive Waste Management Site (RWMS).

II. RESPONSIBILITIES

A. The RWMS Supervisor, or his/her alternate (see Annex A), shall be the Emergency Evacuation Director (EED). The EED shall have the authority to declare an emergency situation and determine what action shall be taken, generally following the guidelines of Annex B. These actions shall include:

1. evacuating all or specific areas of the RWMS;

2. initiating action to be taken when the Safety Coordinator notifies him/her of any emergency;

3. directing the reentry, fire fighting, rescue, or other teams needed to combat the emergency situation;

4. providing the verbal "ALL CLEAR" needed before normal operations can resume after the emergency situation is resolved;

5. notifying and maintaining contact with the Safety Coordinator by "3" net radio or telephone (ext. 123); and

6. wearing a "designated" hard hat during emergency situations.

B. The RWMS monitor on duty is the Evacuation Warden for the Transuranic Storage Area (TSA) and Sub-Surface Disposal Area (SDA). The Junior RWMS monitor is the Evacuation Warden for the facility building including the Waste Volume Reduction Area (WVRA). In the event that no exempt person is present (a monitor will always be on duty when personnel are in the area), the senior worker present will have the authority as Evacuation Warden. The duties of the Evacuation Warden include:

1. assuring that the area for which he/she is responsible is evacuated;

2. informing the EED of any missing personnel;

3. carrying detection instruments that may be needed with him/her;

4. assisting visitors during emergency action;

5. informing the EED of any emergency situation; and

6. ensuring that in the performance of these duties he/she does not endanger his/her own life.

C. The emergency responsibilities of all personnel include:

1. leaving an area of immediate danger safely and quickly;

2. informing the EED or his/her alternate of any emergency situation;

3. obeying instructions given by the EED or the area Evacuation Warden;

4. knowing the location of all emergency equipment (see Annex C); and

5. assuring that waste operational equipment that may be needed for emergency action is left running and in a safe condition. All other equipment should be shut down (see Section III.C., below).

D. Fire brigade members are responsible for:

1. combating fires at the RWMS until relieved by the NTS Fire Department or until the fire is out, and

2. rendering assistance, as requested, during any emergency.

III. PROCEDURES

A. Evacuation

1. General Evacuation

(a) The general evacuation signal is given by the EED and all RWMS area personnel shall be contacted using the RWMS radio system or other applicable communications method.

(b) Upon notification, all personnel are to report to the RWMS parking lot, unless specifically directed otherwise by the EED.

(c) When possible, workers shall leave equipment engines running and in a safe idling condition. A reentry team may require immediate use of these pieces of equipment.

(d) Assigned vehicles, when available, shall be driven to the designated staging area.

(e) In cases where a wind shift threatens to increase any hazards, the personnel shall be directed by the EED or the RWMS monitor to a new staging area.

2. Local Evacuation

(a) Local evacuation shall be accomplished by verbal command from the Evacuation Warden if there is evidence of any danger in an immediate area.

(b) When the decision to evacuate has been made, all personnel shall evacuate the premises and report to the RWMS parking lot unless directed otherwise by the EED.

(c) The Evacuation Warden shall immediately notify the EED of the local evacuation and describe the nature of the situation. The EED will decide what emergency action is necessary.

B. Alert

An alert signal is given when it appears that an emergency is eminent or information is received from the Safety Coordinator that Civil Defense warrants an alert. All personnel shall prepare for evacuation and remain where further communications are available.

C. Reentry

1. An emergency reentry team shall be assembled by the EED which shall consist of a supervisor from the RWMS area, an RWMS monitor and additional members as directed by the EED. Additional reentry team members may be organized as deemed necessary by the situation from other REECo personnel, especially those familiar with the RWMS operations.

2. After the emergency situation is resolved, the "ALL CLEAR" will be given by verbal contact from the EED before normal operations can resume.

D. Guidelines for specific emergency situations are covered in Annex B.

E. Location of Emergency and Safety equipment is shown as Annex C.

ANNEX A

DESIGNATED EED'S

EED - RWMS Supervisor

First Alternate - Lead Monitor

Second Alternate - Senior RWMS Monitor

Third Alternate - Junior RWMS Monitor

Fourth Alternate - Senior Worker Present

ANNEX B

EMERGENCY ACTION GUIDELINES

A. Earthquake

1. Nature of Threat

An earthquake is a shaking or trembling of the earth's crust caused by underground volcanic forces or the breaking and shifting of rock beneath the surface. Earthquakes are unpredictable and strike without warning. They may range in intensity from slight tremors to major shocks and may last from a few seconds to as much as five minutes. They could come in a series over a period of several days. The actual movement of the ground is seldom the cause of injury or death. Most casualties result from falling objects or debris.

2. Criteria

a. Shaking or trembling of buildings or articles in the buildings

b. Notification that an earthquake is occurring

3. Possible Consequences

a. Personnel injury and possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power and/or other utility services

d. Fire

e. Direct radiation and/or airborne activity hazards

4. Immediate Action

a. Evacuation of all buildings and other overhead hazards

5. Follow-Up Action

a. Attend injured

b. Assess situation and notify branch management and Safety Coordinator

c. Search and rescue as required

d. Fight fires

e. Control and reduce, as possible, electrical, radiological, chemical, and fire hazards

B. Tornado

1. Nature of Threat

A tornado is a violent local storm with high velocity, whirling winds. It appears as a rotating, funnel-shaped cloud which extends toward the ground from the base of a thundercloud. Tornadoes can be from 200 yards to one mile wide and can travel a path five to fifty miles in length at 30 to 75 miles per hour. They sometimes double back or move in circles and some have remained motionless for periods of time. These small short-lived storms are the most violent of all atmospheric phenomena and, over a small area, the most destructive.

2. Criteria

a. Visual observation of a tornado in the vicinity with a direction of travel indicating passage near the RWMS

b. Tornado warning notification by the Safety Coordinator or Weather Bureau

3. Possible Consequences

a. Personnel injury and possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power and/or other utility services

d. Fire

e. Direct radiation and/or airborne activity hazards

4. Immediate Action

a. Initiate ALERT

5. Follow-Up Action

a. Attend injured

b. Assess situation and notify branch management and Safety Coordinator

c. Search and rescue as required

d. Fight fires

e. Control and reduce, as possible, electrical, radiological, chemical, and fire hazards

C. Flood

1. Nature of Threat

Normally, flooding will be a relatively slow process, building up over a period of several days, such that adequate warning is possible. A flash flood, however, can occur with little or no warning and is probably the most likely type of flooding that would occur at the NTS.

2. Criteria

a. Notification of the existence of the potential flash flood condition, that is, severe rainstorms and/or snow melting such that small stream and mountain runoff constituted a flood threat.

3. Possible Consequences

a. Personnel injury - fatalities are unlikely.

b. Building and/or equipment damage.

c. Loss of electrical power and/or other utility services.

d. Spread of contamination, possibly outside RWMS confines.

4. Immediate Action

a. Assess situation and notify branch management and Safety Coordinator

b. Evacuate all nonessential personnel

c. Shut down all nonessential equipment

d. De-energize electrical systems not required for plant operation

5. Follow-Up Action

a. Seal all radioactive waste disposal and storage areas

b. Protect the RWMS proper by maintaining the present dike

c. Protect the buildings with dikes, insofar as possible

d. De-energize electrical systems in flooded areas as possible

D. Winter Storm

1. Nature of Threat

Blizzards are normally characterized by heavy, blowing snow accompanied by low temperatures. Warning of impending storms of this magnitude is the responsibility of the National Weather Service. Timely issuance of these warnings can normally be expected through the Safety Coordinator.

2. Criteria

a. Blizzard warnings are issued when wind speeds of at least 35 mph are accompanied by heavy, falling or blowing snow and temperatures of 20°F or lower are expected to prevail for an extended period of time.

b. Severe blizzard warnings are issued when a storm of extreme proportions is expected. Winds with speeds of at least 45 mph can be anticipated along with very heavy, falling or blowing snow and temperatures of 10°F or lower.

3. Possible Consequences

a. Personnel injury with low incidence of possible fatalities

b. Loss of electrical power and/or other utility services

c. Fire

d. Isolation for an extended period

4. Immediate Action

a. Assess facility status and notify branch management and Safety Coordinator

b. Establish checkpoint system for personnel

5. Follow-Up Action

a. Establish plans for combating fires

b. Establish plans for search and rescue operation if needed

c. Establish system for feeding and sheltering personnel

d. Establish plan for maintenance of evacuation routes and necessary plant roadways.

e. Maintain communication with branch management and the Safety Coordinator regarding plant status, storm conditions, and immediate needs

E. Range Fire

1. Nature of Threat

Any small fire in a wooded or brushy area, if not quickly detected and suppressed, can in a short period get out of control. Uncontrolled fires of this nature are one of the most destructive forces caused by nature or man.

2. Criteria

a. Any report, either visual or through established communication channels, of an uncontrolled range fire in the general vicinity of the RWMS

3. Possible Consequences

a. Personnel injury with low incidence of possible fatalities

b. Building and/or equipment damage or destruction

c. Loss of electrical power and/or other utility services

4. Immediate Action

a. Actuate alert warning

b. Assess situation, including a determination of the degree of immediate threat to the RWMS, fire spread potential, velocity and direction of wind; and notify branch management and the Safety Coordinator

c. Fight fire if immediately threatening RWMS confines

5. Follow-Up Action

a. Take steps to minimize water used except for fire fighting

b. Evacuate all unnecessary personnel

c. Maintain communication with branch management and the Safety Coordinator regarding plant status and immediate needs

d. Continue to provide fire fighting backup in support of the Fire Department if requested by the Fire Department

F. Nuclear Attack

1. Nature of Threat

Nuclear attack will result in major blast and heat damage followed by a radioactive fallout hazard. Personnel, structures, and equipment in the vicinity of the detonation will become blast, heat, and radiation casualties. Those personnel, structures, and equipment far enough away from the detonation to escape the major blast, heat, and radiation effects will probably survive and are the major concern of this procedure.

Upon hearing the sound of the alert signal, a continuous siren of non-varying intensity, all personnel shall seek, under the direction of the EED or Evacuation Warden, the best shelter available clear of radiation and contamination areas. The nearest immediate shelter is the facility building. The nearest fallout shelter area are Mercury shelters. RWMS personnel shall evacuate to the Mercury shelters.

2. Criteria

a. Notification of an attack warning or of a nuclear detonation

3. Possible Consequences

a. Personnel injury, radiation exposure, and possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power and/or other utility services

d. Fire

e. Radioactive fallout

4. Immediate Action

a. Initiate ALERT

b. As requested by Safety Coordinator, evacuate personnel to fallout shelters.

5. Follow-Up Action

a. Assess facility and personnel status and notify project management and the Safety Coordinator

b. Establish and activate radiological monitoring stations

c. Attend injured

d. Search and rescue as possible

e. Fight fires

f. Control and reduce, as possible, electrical, radiological, chemical, and fire hazards

G. Sabotage

1. Nature of Threat

No plant is immune to sabotage; however, the type of targets for sabotage can usually be predicted with reasonable accuracy. The saboteur will usually look for a target that is critical, vulnerable, accessible, and at least partially conducive to self-destruction. Saboteurs may be enemy agents, disgruntled employees, individuals who are mentally ill or have been duped by enemy propaganda.

2. Criteria

a. Notification or physical evidence that sabotage in or near the RWMS is strongly suspected, about to occur, or is occurring

3. Possible Consequences

a. Personnel injury with low incidence of possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power and/or other utility services

d. Fire

e. Contamination spread

4. Immediate Action

a. Evacuate personnel from threatened area

b. Assess plant and personnel status and notify project management and the Safety Coordinator

5. Follow-Up Action

a. Attend injured

b. Continue to assess status to make certain there are adequate forces on hand, or requested, to deal with the emergency as it develops

c. Search and rescue as required

d. Control and reduce, as possible, electrical, radiological chemical, and fire hazards

e. Obtain, as possible, the best description attainable of the device or method of sabotage and its location. So far as possible, preserve evidence

H. Riots and Protest Demonstrations

1. Nature of Threat

Recent years have seen a variety of demonstrations for different purposes and in many locations. Some demonstrations develop slowly; however, in other cases, there may be a sudden eruption of violence and disorder. Generally, even in the latter case there are usually earlier indications of a buildup of tensions and pressures. The violence can take the form of malicious damage, arson, and assult.

2. Criteria

a. Notification of physical evidence that a riot or demonstration in or near the RWMS is about to be held or is occurring.

3. Possible Consequences

a. Personnel injury with fatalities possible, but unlikely

b. Building and/or equipment damage

c. Fire

d. Loss of electrical power and/or other utility services

e. Possible radiological implications

4. Immediate Action

a. Assess situation and notify branch management and the Safety Coordinator

5. Follow-Up Action

a. Continue to assess situation to make certain there are adequate forces on hand, or requested, to deal with situations as they arise

b. Take steps to minimize plant employee reaction to or contact with (both verbal and physical) the demonstrators

c. Attend injured

d. Control and reduce, as possible, electrical, radiological, chemical, and fire hazards

I. Bomb Threats

1. Nature of Threat

Compared with other plant emergencies, the covert and criminal nature of bombing incidents makes a bomb threat a highly complex problem. Experience shows that over 95% of all bomb threats are hoaxes. However, the chance remains that the threat may be authentic, and appropriate action must be taken to provide for the safety of employees and property.

2. Criteria

a. Any notification of a bomb threat

3. Possible Consequences

a. Personnel injury and possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power, and/or other utility services

d. Fire

e. Direct radiation and/or airborne activity hazards

4. Immediate Action

a. Evacuate threatened area

b. Assess situation and notify EED and the Safety Coordinator. Request specialized assistance. If a threat is made by phone, obtain as much information as possible by expressing desire to save lives. The check list on the inside cover of the NTS telephone directory supplies an excellent guide for obtaining this valuable information.

5. Follow-Up Action

a. Organize teams of volunteer personnel familiar with the area to conduct a search for the purported bomb(s). Search teams should not utilize two-way radios, since a radio beam could cause premature detonation of electrically operated blasting caps.

b. If a strange object is found, assume it to be a bomb.

c. Open all doors and windows in affected area to minimize blast containment.

d. Evacuate and cordon off the area within a 300-foot radius as a minimum. Include area above and below as applicable. Station guards around area to prevent unauthorized entry.

e. Do not attempt to disarm the device--wait until specialized personnel arrive.

f. If bomb detonates:

(1) Attend injured

(2) Control and reduce, as possible, electrical, radiological, chemical, and fire hazards

J. Radiological Accident

1. Nature of Threat

A major radiological incident can be either reactor associated or the result of a handling accident involving irradiated material. Accidents of this nature can result in exposing extremely high direct radiation sources and/or a major release of airborne activity.

2. Criteria

a. Situations involving direct or airborne radiation levels or potential levels which, in the judgment of the RWMS Supervisor and/or Monitor, warrant immediate or total area evacuation.

3. Possible Consequences

a. Personnel injury with possible fatalities

b. Personnel radiation exposure in excess of guidelines. This may involve personnel outside the RWMS.

c. Severe radiological contamination of area

4. Immediate Action

a. Initiate evacuation

5. Follow-Up Action

a. Assess situation and notify branch management and the Safety Coordinator

b. Attend injured

c. Assess radiological situation and take action to safeguard personnel including those in areas outside the RWMS.

d. Control and reduce, as possible, nonradiological hazards, that is, fire, electrical, chemical, etc.

e. Develop and implement a plan to reduce or eliminate the radiological hazard.

K. Major Plant Fire

1. Nature of Threat

An uncontrolled fire is, perhaps, the most destructive force known to man. In fire fighting, the most important aspect is the ability to respond quickly and to confine the fire to manageable limits before it reaches the disaster stage.

2. Criteria

a. Notification or visible evidence of a fire in the plant area

3. Possible Consequences

a. Personnel injury with low incidence of possible fatalities

b. Building and/or equipment damage

c. Loss of electrical power and/or other utility services

d. Direct radiation and/or airborne activity hazards

4. Immediate Action

a. Fight fire

5. Follow-Up Action

a. Continue fire control measures until relieved by the Fire Department, then provide support function if requested

b. Attend injured

c. Assess situation and notify branch management and the Safety Coordinator. Request additional assistance as required.

d. Assess radiological situation and take action required to safeguard personnel, including those outside the RWMS.

e. Control and reduce, as possible, electrical and ehcmical hazards

f. Evacuate personnel as necessary

ANNEX C

LOCATION OF EMERGENCY AND SAFETY EQUIPMENT

1. Bolt cutters located at south evacuation road entrance.
2. Radiation detection instruments located at the facility building.
3. "Designated" hard hats for Evacuation Directors located at the facility building.
4. Necessary evacuation vehicles located at the facility building.
5. Emergency reentry kit located at RWMS facility office at all times.
6. "3" net radio located at the facility building.
7. Respirators located at the RWMS facility building.
8. Fire extinguishers located at the facility building.
9. RWMS radio system consisting of portable handie-talkies, or "3" net radio located at the facility building.

APPENDIX H

OPERATIONS SAFETY REQUIREMENTS

AEC/ERDA 0501 - "Patterns of AEC Health and Safety Responsibilities"

AEC/ERDA 0502 - "Notification, Investigation, and Reporting of Occurrences"

AEC/ERDA 0511 - "Radioactive Waste Management"

AEC/ERDA 0513 - "Effluent and Environmental Monitoring and Reporting"

AEC/ERDA 0524 - "Standards for Radiation Protection"

AEC/ERDA 0531 - "Safety of Nonreactor Nuclear Facilities"

AEC/ERDA 0550 - "Operational Safety Standards"

AEC/ERDA 0820 - "Quality Assurance"

AEC/ERDA 5401 - "Maintenance of Property"

AEC/ERDA 6101 - "Management of Construction Projects"

AEC/ERDA 6202 - "Site Selection"

AEC/ERDA 6301 - "Facilities General Design Criteria"

Operational Radioactive Waste Management Plan for the Nevada Test Site (NVO-185)

REFERENCES

1. Anonymous, 1979, Operational Radioactive Waste Management Plan for the Nevada Test Site: NVO-185 (Rev. 1), prepared cooperatively by the DOE Nevada Operations Office and the Reynolds Electrical and Engineering Co., Inc.

2. Anonymous, 1978, An Assessment of the Nevada Test Site for Low Level Waste Management: NVO-193, prepared cooperatively by the DOE Nevada Operations Office and the Reynolds Electrical and Engineering Co., Inc.

3. Anonymous, 1977, U. S. Energy Research and Development Administration Manual Chapter 0524, Standards for Radiation Protection.

4. Anonymous, 1976, U. S. Energy Research and Development Administration Manual Chapter 0531, Safety of Nonreactor Facilities.

5. Anonymous, Reynolds Electrical and Engineering Co., Inc., REECo Emergency Preparedness Plan

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