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YUCCA MOUNTAIN

YUCCA MOUNTAIN PROJECT

YUCCA MOUNTAIN PROJECT OFFICE

METEOROLOGICAL MONITORING PLAN

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE/YUCCA MOUNTAIN PROJECT OFFICE

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METEOROLOGICAL MONITORING PLAN

FOR THE

YUCCA MOUNTAIN PROJECT

June 5, 1989

Prepared by the Yucca Mountain Project. The Yucca Mountain Project is managed by the Yucca Mountain Project Office of the U.S. Department of Energy, Nevada Operations Office, and sponsored by the U.S. Department of Energy Office of Civilian Radioactive Waste Management.

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Complete Revision

METEOROLOGICAL MONITORING PLAN

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1.0 INTRODUCTION

No facility for the permanent disposal of high-level radioactive waste currently exists in the United States. The site characterization, construction, and operation of such a facility has the potential to affect the ambient air quality in the area or, as a result of an operational mishap, to expose workers or members of the public to radiation in excess of natural background levels. To effectively evaluate such potential impacts, baseline data on local air quality and the dynamics of the local meteorological conditions must be collected.

The U.S. Department of Energy (DOE) established the Yucca Mountain Project (Project) to evaluate a potential site for a high-level radioactive waste repository. The proposed repository site is located on and adjacent to the southwest corner of the Nevada Test Site (NTS), approximately 26 km (16 miles) north of the community of Amargosa Valley, Nevada. This document presents the Meteorological Monitoring Plan (MMP) for supporting that investigation. The meteorological monitoring equipment for this program will be owned by the DOE and operated by Science Applications International Corporation (SAIC) under a Technical and Management Support Services (T&MSS) contract with the DOE.

Three regulatory agencies have established rules and regulations governing the repository approval process; these rules and regulations may affect the data collection and evaluation activities at Yucca Mountain. The State of Nevada Department of Environmental Protection (NDEP) grants permits for construction and operation of any facility within the State in accordance

with the provisions of the Nevada Administrative Code, Chapter 445. The NDEP is responsible for ensuring that the nonradiological air quality impacts from any activity do not exceed specified limits. The U.S. Environmental Protection Agency (EPA) develops and sets the ambient air quality standards used in evaluating a project's impacts. The EPA also reviews state programs, such as those administered by the NDEP, to ensure that adequate and enforceable steps are being taken to maintain acceptable ambient air quality within a state. Further, the EPA has established the Prevention of Significant Deterioration (PSD) program (40 CFR 52.21, 52 FR 24736, July 1, 1987, 52 FR 27286, July 20, 1987), which is designed to protect those areas of the country where air quality is better than the national standards. The EPA, however, has delegated the authority for administering the PSD program to the NDEP.

The EPA has also proposed standards governing the release of radioactive materials into the environment from high-level radioactive waste repositories (40 CFR Part 191), but sections of the regulations have been remanded (see Section 1.2.2.1). The U.S. Nuclear Regulatory Commission (NRC) has primary responsibility for implementing and enforcing the EPA standards and for ensuring that projects with the potential for radiological impacts are designed properly and operated safely. The NRC has also established standards for worker and public exposure to radiological hazards, and is responsible for granting construction authority and operating or possessing licenses for high-level radioactive waste repositories.

Each of these agencies has promulgated regulations or guidelines outlining the meteorological data required to conduct certain environmental

analyses, but none are specific to deep geologic repositories. The NRC regulations (10 CFR Part 60), under which a construction authorization and license for the repository would be issued, have been approved, but do not outline the scope and nature of the environmental analyses required to support those decisions. In lieu of specific guidelines concerning meteorological monitoring requirements, the Yucca Mountain monitoring program is based on an understanding of the following types of information: data and analyses required by the NRC for licensing other nuclear facilities (reactors, reprocessing plants, spent fuel storage facilities), and EPA's PSD monitoring requirements (40 CFR 52.21, 52 FR 24714, July 1, 1987). The collected data will be used in addressing the potential for degrading the air quality in the vicinity of the repository and in assessing how effectively routine operational and accidental radiological releases from the repository would be dispersed. The agency regulations and how they affect the meteorological monitoring requirements for this program are discussed in Section 1.2 of this MMP.

The Yucca Mountain monitoring network consists of four 10-meter (33-ft) towers and one 60-meter (197-ft) tower, each instrumented to collect data on wind speed, wind direction, standard deviation of horizontal wind direction (sigma theta), ambient temperature, atmospheric moisture, precipitation, and barometric pressure. In addition, the 60-meter (197-ft) tower includes instrumentation to measure net radiation (solar and terrestrial), atmospheric turbulence, and other meteorological parameters that will be discussed later in this MMP. The monitoring stations were installed and fully operational at the end of November 1985. SAIC was responsible for network design, equipment selection, and is responsible for operation of the network. The following

sections of this MMP provide a general description of the Yucca Mountain Project, the monitoring program, and the practices that are employed to ensure the validity of the collected data.

1.1 REPOSITORY DESCRIPTION

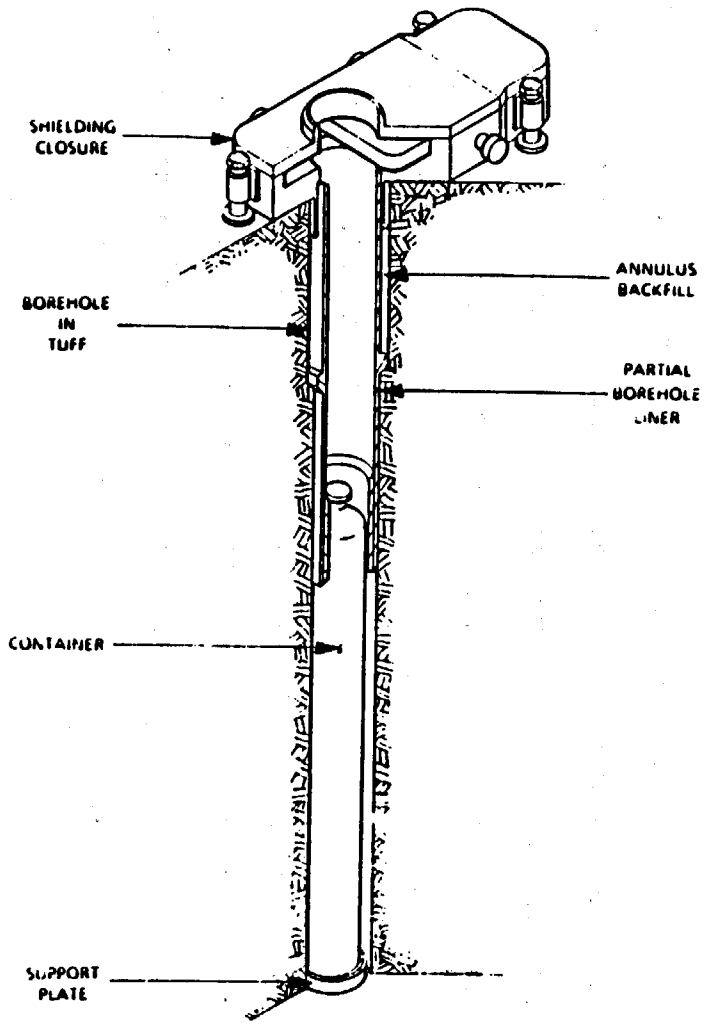
The facility for which this monitoring plan was developed is a deep geologic repository for the receipt, handling, and permanent safe isolation of high-level radioactive waste. In accordance with the Nuclear Waste Policy Act of 1982 (Public Law 97-425), nine sites throughout the United States in various geologic media were evaluated for this purpose. Five of these sites were recommended for further study by the Secretary of the DOE, three were selected by the President of the United States for site characterization, and one, the Yucca Mountain site, was designated by the Nuclear Waste Policy Amendments Act of 1987 (Public Law 100-203) for site characterization. Site characterization will consist of excavating two exploratory shafts and conducting tests and experiments (e.g., borehole drilling, trenching) designed to provide additional data on the capability of the site to permanently isolate and contain stored wastes. Only conceptual Project design information is presently available, however, and specifics on both the exploratory shaft configuration and repository operation or configuration may change as development proceeds.

The exploratory shafts will be an important aspect of the site evaluation process because they will be used to conduct extensive testing to determine the suitability of the site for development as a repository.

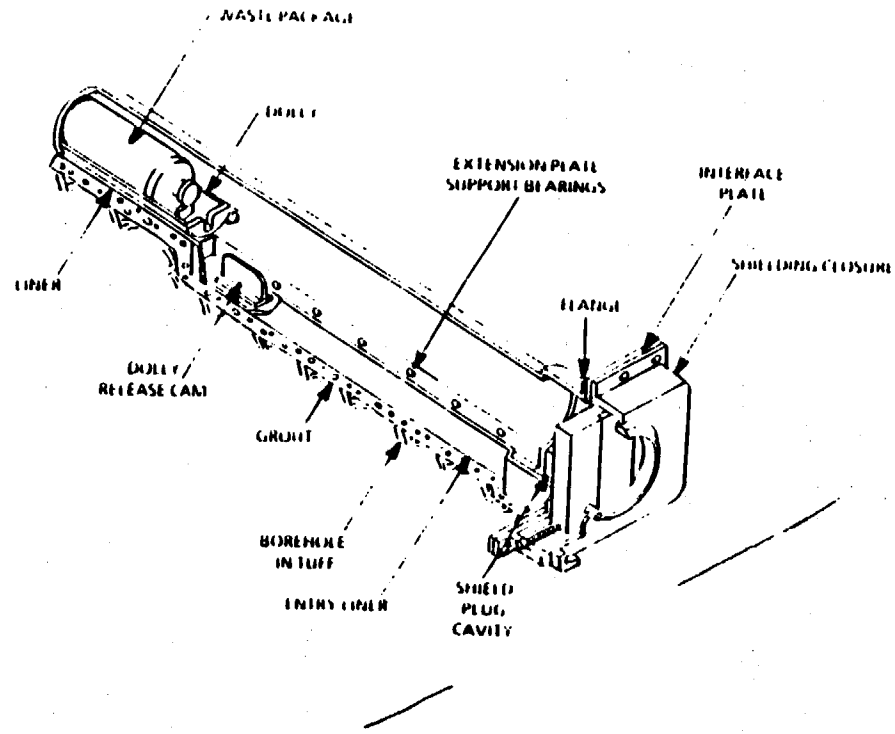
Exploratory shaft activities will not necessarily lead to repository construction, although current plans include incorporating the exploratory shafts as components of the repository, if the site is selected for that purpose. The meteorological monitoring program at Yucca Mountain is of sufficient scope to provide information in support of site characterization and repository development.

1.1.1 GENERAL PROJECT DESCRIPTION

As currently envisioned, the repository at Yucca Mountain would consist of an interconnected series of shafts and ramps leading to a disposal horizon located 366 meters (1,201 ft) below the surface, approximately under the ridge of Yucca Mountain. Geologically, this horizon is the Topopah Springs Member of the Paintbrush Tuff Formation. Two preliminary repository designs are being considered for development in this disposal horizon: one requiring vertical waste emplacement and one requiring horizontal waste emplacement. For vertical waste emplacement, tunnels (drifts) would be excavated using conventional room-and-pillar mining techniques. Single waste canisters would then be placed in vertical boreholes in the floor of the drift. For horizontal waste emplacement, several waste canisters would be placed in long horizontal boreholes involving fewer drifts. These emplacement methods are depicted graphically in Figure 1.1-1. Either emplacement method would provide permanent storage of up to 70,000 metric tons (MT) (77,000 tons) of heavy metal, or a quantity of solidified high-level radioactive waste resulting from the reprocessing of such a quantity of spent fuel.



Vertical borehole



Horizontal borehole

Figure 1.1-1. Horizontal and vertical waste emplacement configuration options.

Surface support facilities would include administrative, service, mine support, ventilation, and waste handling and receiving buildings. These facilities would be located along the eastern edge of Yucca Mountain and occupy approximately 30 ha (74 acres).

Access to the repository would require construction of an all-weather highway and a rail line. Highway construction would begin from a point along U.S. Highway 95 near the community of Amargosa Valley. The new rail line would originate from any of three regional carriers. Construction of the rail spur is scheduled to begin in 1998.

1.1.2 POTENTIAL EMISSION SOURCES

Emissions from repository operations (including construction) that could affect the environment will result from a variety of activities. Site preparation, shaft/drift excavation, movement of mined rock to storage piles, wind erosion of exposed surfaces, concrete preparation, and travel over unpaved roads would be the primary sources of particulate emissions associated with repository development. Gaseous emissions from fossil fuel combustion (NO_x, SO_2, CO, hydrocarbons) would be generated by construction equipment both at the surface and underground, by backup/emergency generators, by commuter

traffic, and by waste delivery vehicles such as trucks and trains. However, because of the number of potential sources of particulate emissions and the fact that many of the gaseous pollutant sources are exempt from permit requirements, particulate emissions are considered to have a greater potential to create ambient air quality impacts than do gaseous emissions. Specific types of emission sources are discussed below.

The drill/blast debris (muck) removal process used in excavating shafts, ramps, and emplacement drifts is a potentially significant source of particulate emissions. Two entry configurations would be used in the repository: a vertical shaft with conventional head frame/hoist facilities for personnel and materials, and sloped ramps for waste transport and muck removal. Mined debris would be delivered to the muck ramp using low-profile load/haul/dump (LHD) units and belt conveyers and would be conveyed directly to the rock stockpile on the surface as depicted in Figure 1.1-2. At the stockpile, the muck would be spread and compacted by a front-end loader or bulldozer. There are a number of points throughout the muck handling process that could be sources of particulate emissions.

The muck handling process is expected to continue throughout the operational life of the repository in production-line fashion. A vertical waste emplacement scenario is illustrated in Figure 1.1-3. For this scenario, approximately 9,100 MT (10,000 tons) of muck per day would be processed through the muck handling system. A total of nearly 23 million MT (25 million tons) of muck would be handled over the life of the repository. Conversely, horizontal emplacement would require processing only

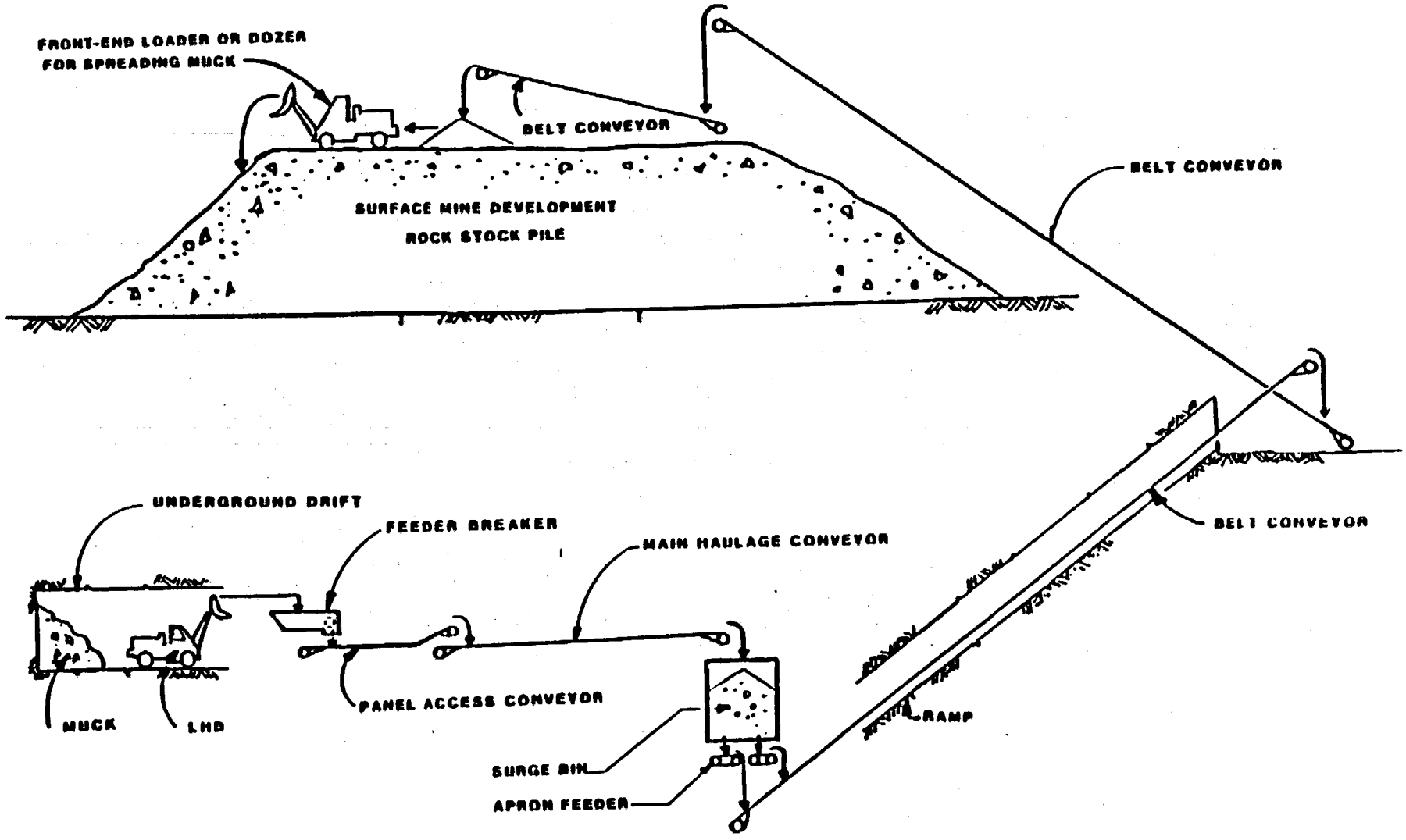


Figure 1.1-2. Schematic of the muck handling system.

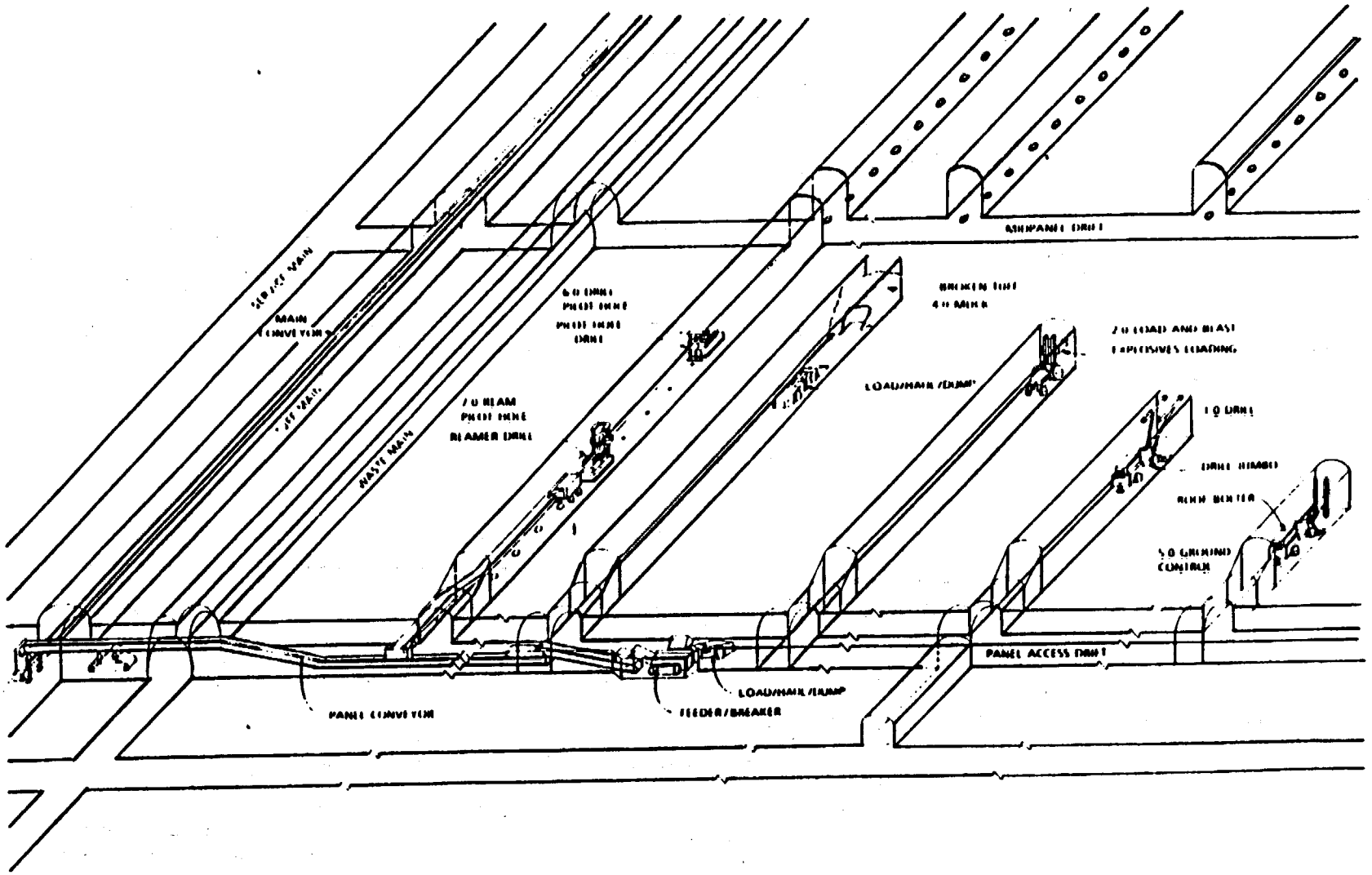


Figure 1.1-3. Typical underground mining operations for vertical waste emplacement.

1,360 MT (1,500 tons) of muck per day and would generate a total of 3.6 million MT (4 million tons) of mined material over the life of the repository.

Air vented from the repository would be divided between two separate systems: one for the mine development area and the other for the waste emplacement area. The mine development area ventilation system would be used to vent the exhaust from fuel-burning equipment operating underground and the dust associated with excavation of the drifts to the atmosphere. The personnel and materials shaft would serve as the intake to the mine development area ventilation system and the tuff ramp would be the exhaust.

The waste emplacement area ventilation system would be used in venting the exhaust from fuel-burning equipment operating underground to the atmosphere and would provide air needed in cooling the drifts after waste emplacement had occurred. The exploratory shafts and the waste ramp would serve as the intakes to the emplacement area system, and a separate shaft would be excavated for use as the waste emplacement area exhaust. Air vented through this exhaust shaft would normally not be filtered, but would be monitored continuously for radioactivity. If radioactivity were measured, the air would be routed through a train of filters, some of which would be classified as high efficiency particulate absolute (HEPA) filters. These filters are capable of removing from an air stream at least 99.97 percent of particulate matter as small as 0.3 microns in diameter.

As a precaution against radioactivity reaching the mine development area, the mine development area ventilation system would be maintained at

positive pressure and the emplacement area would be maintained at a negative pressure. By maintaining this pressure differential, any leakage occurring between the ventilation systems would occur from the mine development area to the waste emplacement area. The entire ventilation system is designed to ensure that radioactive material is not vented to the atmosphere.

Another potential source of particulate emissions would be the muck pile on the surface. During the operational phase of the repository, addition to the muck piles would be continuous and would always provide a "fresh" surface exposed to wind erosion. Intermittent watering would be used for dust control. Once the repository capacity had been reached, however, mining would cease and the pile would become stabilized.

Current repository plans indicate that backfilling the emplacement drifts will not be necessary. However, access and ventilation shafts and/or ramps may be backfilled during closure. If necessary, these backfilling operations would generate particulate emissions by disturbing the muck pile.

1.2 METEOROLOGICAL MONITORING REQUIREMENTS

Several aspects of repository development, permitting, and licensing require the collection and application of onsite meteorological data. However, specific regulations and guidelines that outline the length and extent of meteorological data required for a geologic repository have not yet been promulgated. The following sections examine the Federal and State of

Nevada regulations that were used as guidance in planning the meteorological monitoring program for Yucca Mountain.

1.2.1 EVALUATING AIR QUALITY IMPACTS

1.2.1.1 EPA Requirements

The EPA's PSD program (40 CFR 52.21, 52 FR 24714, July 1, 1987) was established to fulfill the Clean Air Act requirements to protect the ambient air quality in areas of the country where the existing air quality is better than the national standards. As part of the State Implementation Plan (SIP) process (40 CFR Part 51), each state is required to emplace a state-administered PSD program that is at least as stringent as the EPA program. The EPA reviews each SIP individually and, after resolving any outstanding issues, approves the SIP and delegates PSD authority to the state. Several states, including Nevada, have chosen to adopt the EPA PSD program without substantial deviations and have been successful in receiving EPA authority to administer PSD in their respective jurisdictions.

For the Yucca Mountain Project, PSD requirements may apply because the Project is in an area designated as Class II. The Class II designation indicates that the ambient air quality in the area is better than the national standards. The State of Nevada, however, considers the area unclassifiable because there are no monitoring data to support the Class II designation. Although this initial PSD applicability criterion is satisfied, the amount of pollutant emissions from the Project for each pollutant regu-

lated under the Clean Air Act must also be considered. Project emissions must be compared to PSD threshold values to determine if the PSD regulations actually apply. Because the repository is not one of the 28 specific source types that must comply with the PSD regulations, the PSD applicability threshold emission level is 250 tons/year. The repository is also not one of the 30 currently-listed source types that must include fugitive emissions in the threshold comparison. The Project, therefore, only needs to consider nonfugitive air pollutant emissions in determining PSD applicability. The Yucca Mountain Environmental Assessment (DOE, 1986a) indicated that nonfugitive emissions from either site characterization or repository operation would be below the PSD threshold value and that PSD requirements would not apply.

There are many factors that could change prior to the repository permitting stage and possibly affect the determination of PSD applicability for the Yucca Mountain site. For example, a refined repository design may change the operational characteristics, thereby increasing air pollutant discharges. The EPA could undertake further rule-making that includes deep geologic repositories on the list of "major stationary sources," which have a PSD applicability threshold of less than 250 tons/year. The EPA could also include deep geologic repositories on the list of source categories that must include fugitive emissions in determining PSD applicability. It was prudent, therefore, to consider PSD monitoring requirements and guidelines in developing this MMP. Considering PSD requirements ensured that the collected meteorological data would be of sufficient quality and duration to support the ambient air quality analyses required for a PSD review.

1.2.1.2 State of Nevada Requirements

The Nevada Air Quality Regulations (NAQRs) (Nevada Administrative Code, Chapter 445) specify that a registration certificate must be obtained prior to construction for each new source of air pollutants within the State, unless the source meets certain exemption criteria. The exemptions are based on "threshold" values of surface disturbance (20 acres per project), process rate (50 pounds per hour), or other factors. The most recent engineering design data for the Project indicate that site characterization (land disturbance, batch process plant, etc.) and the repository (land disturbance, batch process plant, etc.) would not be exempted on the basis of these threshold values. Therefore, the NAQR requirements for registration certificates and subsequent operating permits will apply to these activities. The application for a registration certificate may require an analysis of the potential air quality impacts of the Project. The scope of the meteorological monitoring required to support the impact analysis is determined by the NDEP on a case-by-case basis, but the EPA PSD monitoring guidelines (EPA, 1987) are typically the basis for the monitoring program.

Any air quality dispersion modeling performed in support of the permit application, which may be required under the NAQRs, must also comply with the EPA Guideline on Air Quality Models (EPA, 1986). This guideline establishes criteria for meteorological data used in dispersion modeling in terms of the proximity of a monitoring site to a project area, the complexity of the terrain, the exposure of the monitoring site, and the duration of monitoring. At Yucca Mountain, the complex terrain features make the nearest historical regional data from Yucca Flat (discussed in Section 2.3) unacceptable for

detailed modeling purposes. In such cases, the EPA modeling guideline calls for a period of record of onsite meteorological data that is sufficient to observe worst-case meteorological conditions and that can provide a representative spectrum of site-specific atmospheric dispersion characteristics.

1.2.2 EVALUATING RADIOLOGICAL IMPACTS

Both the EPA and NRC have established rules and regulations governing the operation of facilities that store, process, handle, or otherwise use radioactive material. The role of the EPA is to provide guidance and direction to other Federal agencies in developing and setting standards. These other agencies must then require their facilities to operate in compliance with the standards. These standards and regulations are discussed briefly in the sections that follow.

1.2.2.1 EPA Requirements

The EPA has promulgated regulations (40 CFR Part 191*) that were developed specifically for facilities like those envisioned at Yucca Mountain.

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*A decision on July 17, 1987 by the U.S. Court of Appeals for the First Circuit has vacated and remanded to the EPA for further proceedings, the postclosure standards (Subpart B) of 40 CFR Part 191.

However, neither these regulations nor the existing regulations concerning other nuclear facilities (40 CFR Part 190), provide specific guidance on the type of meteorological monitoring program needed in assessing compliance with the radiological exposure standards.

1.2.2.2 NRC Requirements and Guidance

The NRC has established regulations and guidelines concerning facilities that have the potential to release radioactivity into the environment. These regulations and guidelines establish what permits and licenses are required, the format and content of applications for permits and licenses, and allowable doses of radiation to both workers and members of the general public in the vicinity of NRC-licensed facilities. The primary NRC regulatory guideline which deals specifically with meteorological monitoring programs is Regulatory Guide 1.23 (NRC, 1980). The NRC has indicated that a revision to Regulatory Guide 1.23 is pending (NRC, 1986), but has not yet issued such a revision. Regulatory Guide 1.23 is not repository-specific but it is useful in defining the scope of the Yucca Mountain monitoring program. Sections C.2 (Siting of Meteorological Instruments), C.3 (Data Recorders), C.4 (System Accuracy), C.5 (Instrument Maintenance, Servicing Schedules, and Data Availability), and C.6 (Data Reduction and Compilation) of Regulatory Guide 1.23 were evaluated for guidance in developing the monitoring network described in this MMP. Other NRC documents which do not bear directly on the details of a monitoring program, but do specify the required use of the data from such a program, were also reviewed and are discussed below.

10 CFR Part 20 (Standards for Protection Against Radiation) outlines permissible radiation doses, allowable radiation levels, and precautionary steps to be taken in the event of a release. Disposal procedures, documentation requirements, and enforcement responsibilities associated with nuclear facilities are also outlined in the regulation. However, 10 CFR Part 20 does not specifically address the scope or nature of meteorological monitoring to be performed, or how to use meteorological data in fulfilling the requirements of the regulation.

10 CFR Part 51 (Licensing and Regulatory Policy and Procedures for Environmental Protection) sets forth the policy and procedures to be followed by the NRC in complying with the mandate of the National Environmental Policy Act of 1969 (NEPA). Section 51.5(a)(11) specifically lists "issuance of a construction authorization for a geologic repository" as an action that requires the preparation of an Environmental Impact Statement (EIS). Section 51.20(a) further specifies that an applicant for any facility covered by Section 51.5(a) must submit with the application a separate document entitled "Applicant's Environmental Report - Construction Permit Stage." This Environmental Report (ER) must include "a discussion of the status of compliance of the facility with applicable environmental quality standards and requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection" (Section 51.20(c)). The ER and the analysis of existing conditions and potential environmental consequences for an EIS dictate the need for a representative meteorological data base on which to base an air quality assessment. However, neither NEPA nor 10 CFR Part 51 provide any details regarding the implementation of a meteorological program to satisfy these requirements.

10 CFR Part 60 (Disposal of High-Level Radioactive Wastes in Geologic Repositories Licensing Procedures) and NRC Regulatory Guide 4.17, Standard Format and Content of Site Characterization Reports for High-Level Waste Geologic Repositories (NRC, 1982a), both specify that meteorological conditions must be addressed. However, neither document provides specific guidance on what parameters are to be monitored or the period of record needed in addressing meteorological conditions.

Other NRC documents provide guidance on the use of onsite meteorological data to analyze potential radiological and nonradiological air quality impacts from the construction and operation of nuclear facilities. These analyses are submitted in a Safety Analysis Report (SAR) and an EIS as part of the license application. In lieu of repository-specific regulations for SARs and ERs, similar NRC regulations for near-surface nuclear waste disposal sites and for nuclear power stations were evaluated for data needs that may be applicable to a geologic repository.

NRC Regulatory Guide 4.18, Standard Format and Content of Environmental Reports for Near-Surface Disposal of Radioactive Waste (NRC, 1983), recommends a minimum of one year of onsite meteorological data for "determining a water budget for the disposal site, analyzing the airborne pathway, and determining the frequency, probability, and potential consequences of severe meteorological phenomena." The onsite data can then be compared with historical records from nearby recording stations to assess whether the one-year period of record is representative of typical conditions. Longer periods of onsite data may be desirable if representative regional data are not available.

NRC Regulatory Guide 4.2, Preparation of Environmental Reports for Nuclear Power Stations (NRC, 1976), specifies that at least one year of onsite meteorological data be provided for a construction permit application, and preferably three or more whole years of onsite data be provided for an operating license application. The guide also outlines the parameters to be monitored. The meteorological record must be sufficient to characterize any terrain influences that might affect atmospheric dispersion at the site. These data are used in dispersion models to calculate potential air quality impacts from the Project.

NRC Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (NRC, 1978), provides guidance on the meteorological data needed to support calculation (modeling) of potential radiological impacts. At least one year of onsite data is suggested as appropriate for the submission of the preliminary SAR, and three or more whole years of data are recommended for the final SAR. Again, the intent is to ensure that the meteorological record is sufficient to characterize any terrain influences and limiting conditions that might affect the transport and dispersion of atmospheric releases from the facility.

1.2.3 EVALUATING METEOROLOGICAL CONDITIONS FOR PRECLOSURE GUIDELINES

The Nuclear Waste Policy Act of 1982 (the NWPA), as amended by the Nuclear Waste Policy Amendments Act of 1987, requires a detailed statement of the basis for nominating a site for development as a deep geologic repository. As directed by Section 112 of the NWPA (as amended), the DOE

developed general guidelines (10 CFR Part 960) that are to be used in the site selection process for the first repository. These siting guidelines are divided into implementation guidelines, postclosure guidelines, and preclosure guidelines. The implementation guidelines are not directly used in the evaluation of a site; their purpose is to specify how the postclosure and preclosure guidelines are to be applied in site screening and selection. The postclosure guidelines govern the siting considerations that deal with the long-term behavior of a repository; that is, its behavior after waste emplacement and repository closure. The preclosure guidelines govern the siting considerations that deal with the operation of the repository before it is closed. These preclosure guidelines reflect the considerations important in protecting workers and members of the general public from exposure to radiation during repository operations.

An evaluation of site meteorological conditions is required by one of the preclosure technical guidelines (10 CFR 960.5-2-3). The qualifying condition for this guideline is stated as follows:

> The site shall be located such that expected meteorological conditions during repository operation and closure will not be likely to lead to radionuclide releases to an unrestricted area greater than those allowable under the requirements specified in 10 CFR 960.5-1(a)(1).

While the available historical data were used to make an initial evaluation against this guideline, it is necessary to collect representative onsite meteorological data to fully evaluate whether the qualifying condition is satisfied. Accordingly, the meteorological monitoring program described in

this MMP was also structured to provide the data base necessary to characterize the Yucca Mountain site for evaluation against the meteorology guideline.

2.0 SOURCE ENVIRONMENT DESCRIPTION

2.1 TOPOGRAPHY, VEGETATION, AND LAND USE

The proposed repository is located in an area of southwestern Nevada that is approximately 26 km (16 mi) north of the community of Amargosa Valley (formerly Lathrop Wells), Nevada. The meteorological monitoring sites are located exclusively within lands controlled by the Federal government. The land parcel that is under consideration includes the proposed exploratory shaft facilities, the geologic repository, the repository surface operations area, and all proposed controlled areas. Ownership and control of the proposed site is divided between three entities: the DOE, which controls the eastern portion of the site through land withdrawn for use as the Nevada Test Site (NTS); the U.S. Air Force, which controls the northwestern portion of the site through land use permits for the Nellis Air Force Range; and the Bureau of Land Management (BLM), which controls the southwestern portion of the site as public trust lands. Figure 2.1-1 shows the relative location of the Project, and Figure 2.1-2 shows the location of the monitoring sites.

Yucca Mountain lies in a geographical region of generally linear mountain ranges dissecting alluvial piedmont valleys with rugged, complex terrain features. Elevations in the area range from 86 m (282 ft) below mean sea level (MSL) in Death Valley, 75 km (47 mi) to the southwest, to 3,633 m (11,919 ft) above MSL at Charleston Peak in the Spring Mountains, 100 km (62 mi) to the southeast. Yucca Mountain has an elevation of approximately 1,500 m (4,921 ft) above MSL. It slopes steeply (15° to 30°) to Crater Flat (elevation 1,200 m (3,937 ft)) on the west, as well as along some

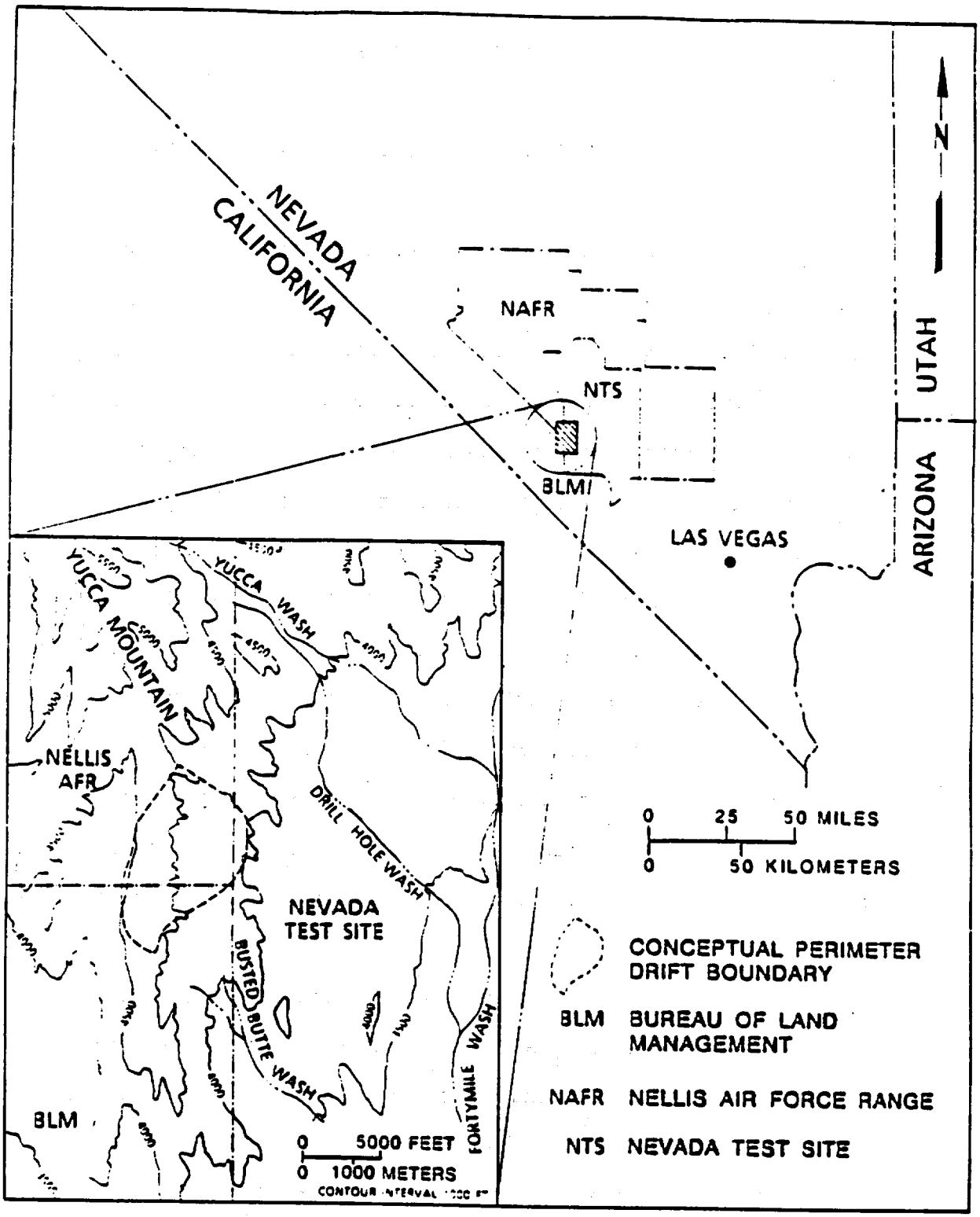
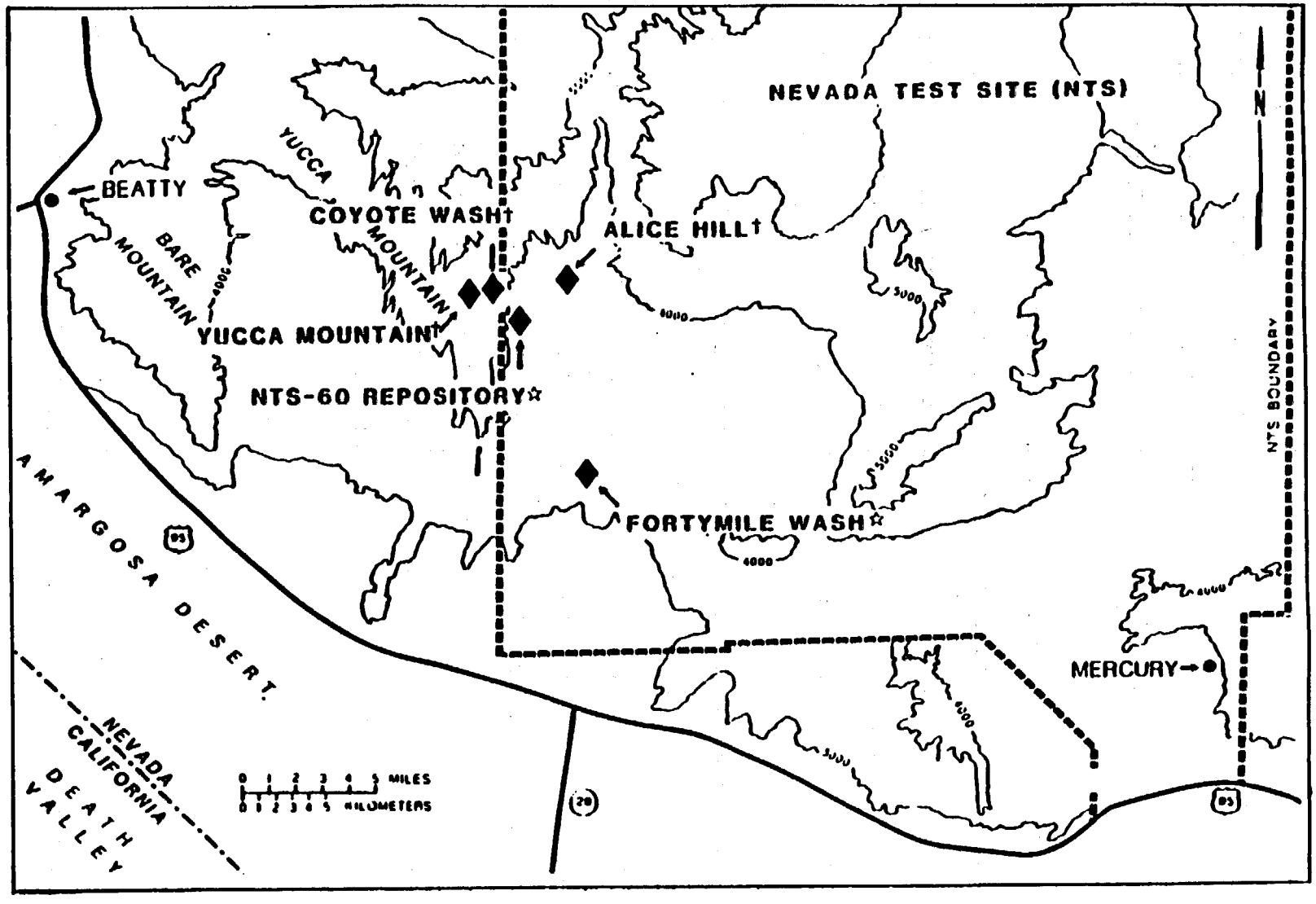


Figure 2.1-1. Relative location of the Project area.



☆Meteorological and proposed air quality monitoring station.

†Meteorological monitoring only.

Figure 2.1-2. Meteorological monitoring sites.

of the valleys that cut into the more gently sloping (5° to 10°) eastern slope leading to Jackass Flats (elevation 1,100 m (3,609 ft)). The major surface drainage for the area is Fortymile Wash, east of Yucca Mountain and cut 13 to 26 m (43 to 85 ft) into the surface of Jackass Flats. The area is bounded on the north by the rugged, volcanic terrain of Pinnacles Ridge.

The vegetation cover in the vicinity of Yucca Mountain is sparse, but uniform. The dominant species consist of sagebrush and other shrubs. However, a number of annual species can be found, as well as stands of both Yucca and Joshua trees. Pinyon-juniper associations are found at elevations higher than those in the Yucca Mountain area.

Because of the exclusive nature of the controlled land in the vicinity of the site, the land use is very limited. This area of the NTS is not presently being used for testing. Although grazing is possible on the BLM land, the vegetation is so sparse that vast amounts of land would be required to support grazing animals. There are no grazing permits active on the proposed site area. A few water wells are located in this area of the NTS, and there is some seismic instrumentation. A number of unpaved roads run through this portion of the NTS, but travel on these roads is limited.

2.2 EXISTING STATIONARY SOURCES AND MONITORING SITES

At the present time, there are no stationary sources of air pollutants within the Yucca Mountain area. Elevated levels of some pollutants that are either transported into the area or are due to wind-related sources of parti-

culates may occur occasionally. Ambient concentrations of other criteria pollutants are probably low because there are no significant sources of these pollutants on the NTS. The nearest significant source of pollutants is the Las Vegas area, which is about 150 km (93 miles) away.

Meteorological data have been collected at various sites on the NTS since the late 1950s, but in general the data are not specific to Yucca Mountain. The sites include, but are not limited to, a National Weather Service (NWS) station at Desert Rock, which is approximately 24 km (15 miles) east-southeast of Yucca Mountain. Sandia National Laboratories operated two ten-meter meteorological monitoring stations near the Yucca Mountain site from mid-1982 through late 1984. These stations were established to collect preliminary meteorological data and were not designed in accordance with PSD or NRC regulatory requirements. Nevertheless, these data are important background information for establishing general site meteorology.

2.3 CLIMATOLOGY OF SOUTHWEST NEVADA

Generally, the climate of the Yucca Mountain site and surrounding area is identified with strong solar insulation, limited precipitation, low relative humidity, and large diurnal temperature ranges; however, the climatic variation with altitude is substantial. The lowest elevations are characterized by hot summers and mild winters, which is typical of other Great Basin desert areas. As elevation increases, precipitation amounts tend to increase and temperatures decrease. However, minimum temperatures occasionally occur at low elevations in closed geologic basins during calm,

cloudless nights. Under these conditions, the ground surface cools quickly, thereby cooling the air near the surface. This cooler, denser air then "drains" down the terrain and pools within the basins. These conditions generally change quickly after sunrise when the ground surface becomes heated by the sun. Aside from these locally induced conditions, the overall weather patterns of the region are influenced primarily by continental air masses, which contain only limited amounts of moisture.

Table 2.3-1 gives a ten-year climatological summary for the weather station at Yucca Flat, which is 32 km (20 mi) east of the Yucca Mountain area. This summary is considered to be typical of conditions throughout the area, but near-surface conditions at Yucca Mountain may differ due to site-specific influences, particularly for the wind speed and wind direction.

Temperature is one of the most variable meteorological parameters of the Yucca Mountain region on both a daily and an annual basis. The hottest months are generally July and August, which have average monthly temperatures for the ten-year record at Yucca Flat of 24.8°C (76.6°F) and average daily maximums of 35.6°C (96.1°F) and 35.0°C (95.0°F), respectively. Average daily temperature spans during these months are nearly 22 Celsius degrees (40 Fahrenheit degrees). The highest temperature recorded at Yucca Flat of 42°C (107°F) occurred in June, July, and August. Conversely, December is usually the coldest month of the year, with a monthly average temperature of 1.8°C (34.3°F) and an average daily minimum temperature of -6.7°C (19.9°F). The extreme low temperature recorded in December was -25°C (-14°F). Minimum temperatures at the site can be affected by the drainage flows described previously and may differ from the temperatures recorded at Yucca Flat.

Table 2.3-1. Climatological summary for Yucca Flat, 1962 through 1971.

MONTH	TEMPERATURE[b] (°F)							DEGREE DAYS (Base 65°)		PRECIPITATION[b,c] (INCHES)											
	AVERAGES			EXTREMES													SNOW				
	DAILY MAXIMUM	DAILY MINIMUM	MONTHLY	HIGHEST	YEAR	LOWEST	YEAR	HEATING	COOLING	AVERAGE	GREATEST MONTHLY	YEAR	LEAST MONTHLY	YEAR	GREATEST DAILY	YEAR	AVERAGE	GREATEST MONTHLY	YEAR	GREATEST DAILY	YEAR
JAN	52.1	20.8	36.5	73	1971	-2	1970	877	0	.53	4.02	1969	T	1971#	1.25	1969	0.9	4.3	1962	4.3	1962
FEB	56.7	25.8	41.3	77	1963	5	1971#	662	0	.84	3.55	1969	T	1967#	1.16	1969	1.9	17.4	1969	6.2	1969
MAR	60.9	27.7	44.3	87	1966	9	1969	634	0	.29	.60	1969	.02	1966	.38	1969	2.0	7.5	1969	4.5	1969
APR	67.8	34.4	51.1	89	1962	13	1966	411	1	.45	2.57	1965	T	1962	1.08	1965	0.7	3.0	1964	3.0	1964
MAY	78.9	43.5	61.2	97	1967	25	1967	147	38	.24	1.62	1971	T	1970#	.86	1971	0	T	1964	T	1964
JUN	87.6	49.9	68.8	107	1970	29	1971#	35	154	.21	1.13	1969	T	1971	.45	1969	0	0		0	
JUL	96.1	57.0	76.6	107	1967	40	1964#	0	366	.52	1.34	1966	0	1963	.77	1969	0	0		0	
AUG	95.0	58.1	76.6	107	1970	39	1968	1	368	.34	1.04	1965	0	1962	.35	1971#	0	0		0	
SEP	86.4	46.7	66.5	105	1971	25	1971	51	103	.68	2.38	1969	0	1968#	2.13	1969	0	0		0	
OCT	76.1	36.9	56.5	94	1964+	12	1971	266	9	.13	.45	1969	0	1967#	.42	1969	0	T	1971	T	1971
NOV	61.8	27.6	44.7	82	1962	13	1966	602	0	.71	3.02	1965	0	1962	1.10	1970	0.5	4.8	1964	2.3	1964
DEC	50.7	19.9	35.3	70	1964	-14	1967	914	0	.79	2.66	1965	T	1969#	1.31	1965	2.3	9.9	1971	7.4	1971
ANN	72.5	37.4	54.9	107	AUG 1970#	-14	DEC 1967	4600	1039	5.73	4.02	JAN 1969	0	SEP 1968#	2.13	SEP 1969	8.3	17.4	FEB 1969	7.4	DEC 1971

Table 2.3-1. Climatological summary for Yucca Flat, 1962 through 1971 (continued).

MONTH	RELATIVE HUMIDITY (%) HOUR (PACIFIC STANDARD TIME)				WIND[b,d] (SPEEDS IN MPH)					STATION PRESSURE (INCHES)			AVERAGE SKY COVER SUNRISE TO SUNSET[e]	AVERAGE NUMBER OF DAYS[f]												
								RESULTANT (DIR/SP)						SUNRISE TO SUNSET			PRECIPITATION						TEMPERATURE			
																							MAXIMUM		MINIMUM	
	04	10	16	22	AVERAGE SPEED	PEAK SPEED	YEAR	23-02 PST	11-14 PST	AVERAGES	HIGHEST	LOWEST		CLEAR	PARTLY CLOUDY	CLOUDY	.01 INCH OR MORE	.10 INCH OR MORE	.50 INCH OR MORE	1.00 INCH OR MORE	1.0 INCH OR MORE OF SNOW	THUNDERSTORMS	90° F OR MORE	32° F OR LESS	32° F OR LESS	0° F OR LESS
JAN	67	49	35	60	6.6	58	1965	233/0.7	135/2.6	26.10	26.54	25.42	4.9	13	8	10	2	1	*	*	*	*	0	1	29	*
FEB	67	45	32	56	6.9	52	1967	275/1.1	118/2.7	26.05	26.42	25.56	5.0	11	8	9	3	2	*	*	1	0	0	*	23	0
MAR	58	31	23	44	8.4	55	1971	240/1.8	186/4.5	25.99	26.43	25.48	4.8	12	9	10	3	1	0	0	1	1	0	0	24	0
APR	52	27	21	38	9.1	60+	1970#	250/2.2	198/5.1	25.96	26.39	25.50	4.5	13	9	8	3	1	*	*	*	1	0	0	12	0
MAY	46	22	17	31	8.3	60+	1967	260/1.5	179/7.2	25.94	26.39	25.47	4.3	14	11	6	2	1	*	0	0	1	4	0	2	0
JUN	39	19	14	26	7.9	60+	1967	272/1.9	185/8.2	25.92	26.20	25.56	3.0	19	7	4	2	1	0	0	0	2	14	0	*	0
JUL	40	20	15	28	7.5	55	1971	278/0.9	185/12.0	26.00	26.19	25.68	3.0	19	9	3	3	2	*	0	0	4	29	0	0	0
AUG	44	23	16	30	6.7	60+	1968	222/1.5	182/12.0	26.00	26.22	25.71	3.0	20	8	3	3	1	0	0	0	4	27	0	0	0
SEP	43	21	17	32	7.0	52	1970	281/1.3	163/6.4	26.00	26.36	25.56	2.1	22	6	2	2	1	1	*	0	2	11	0	1	0
OCT	46	24	19	36	6.8	60	1971	286/1.3	138/3.7	26.06	26.40	25.52	2.9	20	7	4	1	1	0	0	0	*	2	0	9	0
NOV	61	39	31	52	6.1	51	1970	234/1.2	152/4.1	26.08	26.58	25.64	4.8	13	7	10	3	2	*	*	*	*	0	0	23	0
DEC	68	50	41	64	6.6	53	1970	288/1.9	109/1.0	26.07	26.59	25.49	4.6	14	8	9	3	1	1	*	1	*	0	1	29	1
ANN	53	31	23	41	7.4	60+	APR 1970#	—	—	26.01	26.59	25.42	3.9	190	97	78	30	14	3	1	3	14	87	2	152	1

[a]Data from Bowen and Egami (1983).
[b]# = most recent of multiple occurrences.
[c]T = trace (amount too small to measure).
[d]Average and peak speeds are for the period starting with December 1964.
The directions of the resultant wind are from a summary covering the period December 1964 through May 1969.
[e]Sky cover is expressed in the range from 0 for no clouds to 10 when the sky is completely covered with clouds. Clear, partly cloudy, and cloudy are defined as average daytime cloudiness of 0-3, 4-7, and 8-10 in tenths, respectively.
[f]* = one or more occurrences during the period of record but average less than one-half day.

Precipitation in the region is sparse: it averages only about 145 mm (5.7 in) annually at Yucca Flat. This sparse precipitation is due to the land-based air masses that influence the region's weather and the blocking effect of the Sierra Nevadas. Pacific air masses that could bring moisture to the region generally drop most of their moisture on the western slopes of the Sierra Nevadas and leave little precipitation to fall on the east side. Precipitation that does reach the area is concentrated in the winter months, but thunderstorms at other times of the year can also be significant sources of moisture for the area. Thunderstorms occur on 16 percent of the days in July and August, but occur on only 5 percent of the days annually. The greatest monthly precipitation recorded for Yucca Flat is 102 mm (4.02 in), and the greatest daily amount is 54 mm (2.13 in). With an average of only 145 mm (5.7 in) of precipitation annually, these maximums represent significant storm events. The statistical maximum 24-hour precipitation for 10-yr and 100-yr storm events for Yucca Flat is 38 mm and 57 mm (1.50 in and 2.25 in), respectively (DOC, 1963).

Other than temperature extremes, severe weather in the area includes thunderstorms, tornadoes, hail, lightning, and sandstorms. Severe thunderstorms create a potential for flash flooding, but such storms generally do not last longer than an hour (Bowen and Egami, 1983). Tornadoes have been observed within 80 km (50 mi) of Yucca Flat; but they are considered rare for this area (DOC, 1981).

High winds in the area are usually associated with winter storm frontal passages, but they can also accompany thunderstorms. Wind speeds in excess of 100 km/hr (60 mph), with gusts of up to 163 km/hr (101 mph), have been

recorded on several occasions (Quiring, 1968). Such velocities are not common, however, as is evidenced by the Yucca Flat annual average wind speed of 12 km/hr (7.4 mph). Monthly average wind speeds do not deviate significantly from this value; the average high of 15 km/hr (9.1 mph) is in March and the average low of 10 km/hr (6.1 mph) is in November.

Monthly distributions from the Sandia National Laboratories meteorological tower (now inactive) near the proposed repository surface facility location reveal that winds from the south account for nearly 30 percent of the summer season flow. Winds from the northwest and north-northwest each account for 12 percent of the summer wind distribution. On a diurnal basis, flow from the south accounts for more than 45 percent of the summer daytime hours, and winds from the northwest and north-northwest each account for about 25 percent of the summer nighttime hours. During the winter, the wind distribution is dominated by northwesterly and north-northwesterly flow, and the winds from the south are greatly reduced over those observed in the summer. On a diurnal basis, however, flows from the south still dominate the winter daytime hours at about 15 percent of the distribution; winds from the northwest and north-northwest dominate the winter nighttime hours at just over 25 percent each.

3.0 METEOROLOGICAL SAMPLING PROGRAM DESCRIPTION

At present, meteorological conditions are being monitored through a system of five towers. Four of the towers are 10 m high and are instrumented to continuously measure and record wind speed, wind direction, sigma theta (for determination of atmospheric stability), relative humidity, temperature, atmospheric pressure, and precipitation. These systems are battery-powered with photovoltaic solar cells to maintain battery service. Data are monitored continuously, averaged internally, and outputted to magnetic tape (cassette) at one-hour intervals. The fifth tower, which is also referred to as the Main Site, is 60 m high and is instrumented at both the 10-m and 60-m levels. The main site instrumentation measures and records wind speed, wind direction, standard deviation of vertical wind speed (sigma phi), sigma theta, temperature, temperature differential (between levels), net radiation (solar and terrestrial), dewpoint temperature, atmospheric pressure, and precipitation. Data are monitored by a data logger, averaged internally, and outputted to magnetic tape (cassette) on an hourly basis. Continuously recording strip charts at all sites provide hard-copy backup data in the event of digital system malfunctions. The meteorological sensors for both tower types are discussed in more detail in Section 5.0.

The station locations were selected to provide baseline meteorological conditions in the vicinity of the proposed repository considering local terrain influences. Every attempt was made to locate these stations so that meteorological information required to assess the potential effects of

emissions from repository operations will be readily available if the site is licensed for repository development. However, in addition to the towers mow located at Yucca Mountain, data on regional meteorological conditions will be needed before the licensing process could proceed.

4.0 MONITORING NETWORK DESCRIPTION

4.1 MAIN SITE

The main meteorological tower is positioned at an elevation of 1,143 meters (3,751 ft) above MSL near the proposed repository surface facility location. This area is bounded on the west by Yucca Mountain (with a peak elevation of nearly 1,523 m above MSL) and partially blocked from Jackass Flats (to the east) by three intermediate buttes with elevations of up to approximately 1,220 m (4,000 ft) above MSL. Data collected at this location will be used in assessing impacts associated with repository operations. The tower at this site is 60 m (197 ft) high and is referred to as NTS-60 Repository. The coordinates of the main site tower are given in Table 4.1-1.

Figure 4.1-1 is the view looking towards the southeast at the main site and shows the 60-meter tower and instrument shelter. Figure 4.1-2 is a view to the north, also from the main site tower location.

4.2 REMOTE SITES

The other four towers are used to collect data on overall meteorological conditions in the area so that a comparison with the data from the NTS-60 Repository site can be made. Data from these four remote sites is particularly useful in characterizing terrain-induced perturbations that may significantly affect dispersion and transport of pollutant emissions.

Table 4.1-1. Coordinates of the Yucca Mountain Project meteorological monitoring sites.

Site	UTM Coordinates Zone 11 (meters)	Nevada System (feet)	Latitude-Longitude (Deg. Min. Sec.)	Elevation (MSL)
NTS-60 Repository	550,776E 4,077,427N	569,127E 761,795N	36°50′33" 116°25′49"	3751 ft 1143 m
Yucca Mountain	547,660E 4,078,781N	558,862E 766,434N	36°51′20" 116°28′19"	4849 ft 1478 m
Coyote Wash	548,884E 4,078,689N	562,876E 766,195N	36°51′17" 116°27′05"	4193 ft 1278 m
Alice Hill	553,122E 4,079,787N	576,810E 769,661N	36°51′51" 116°24′14"	4047 ft 1234 m
40-Mile Wash	554,369E 4,068,691N	580,882E 733,230N	36°45′51" 116°23′27"	3124 ft 952 m

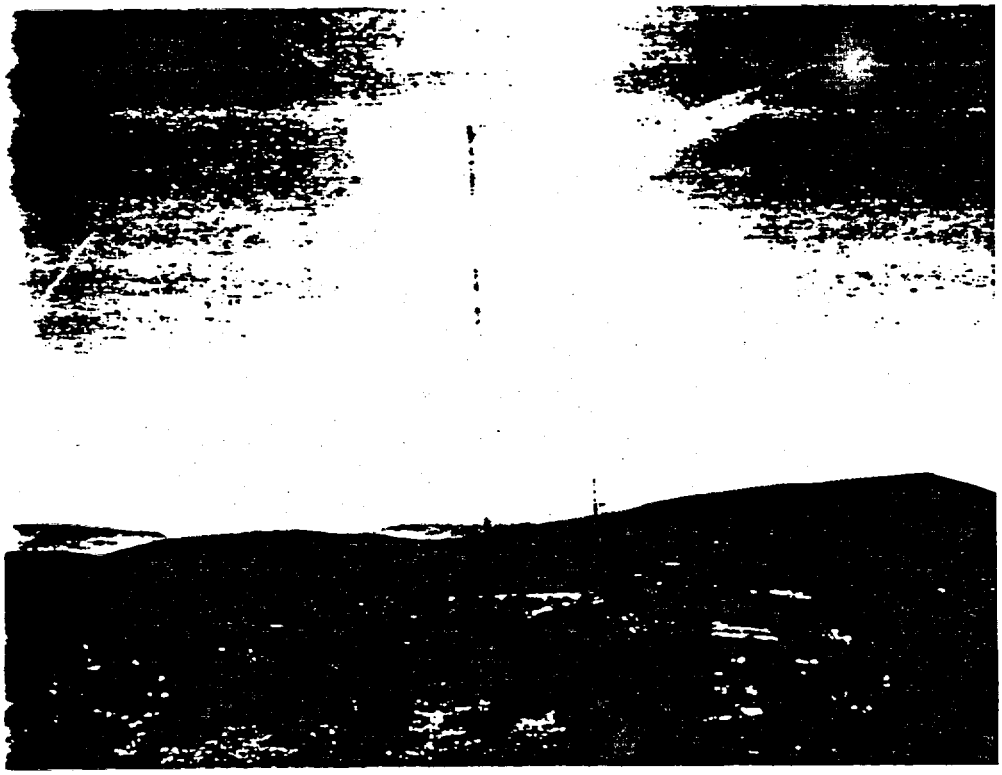


Figure 4.1-1. View looking southeast of the NTS-60 Repository site 60-meter tower and instrument shelter.

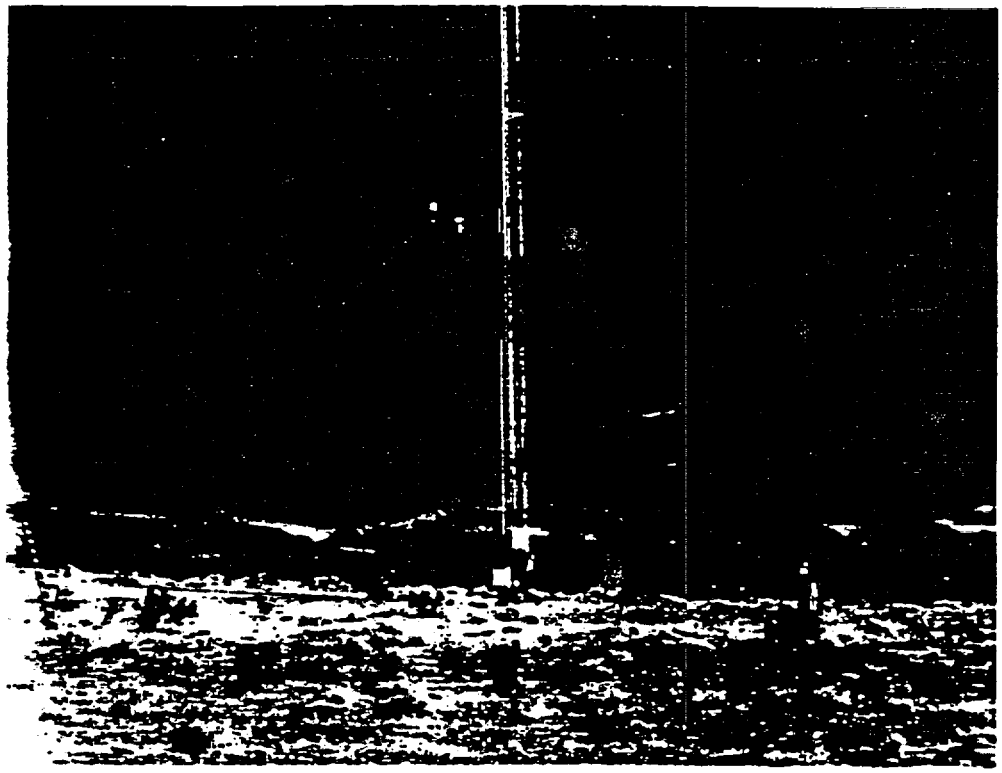


Figure 4.1-2. NTS-60 Repository site tower viewed from the south looking north.

The first of these remote locations is along the north-south trending ridge of Yucca Mountain, approximately 3.9 km (2.5 mi) west-northwest of the main site at an elevation of 1,478 m (4,849 ft) above MSL. This site is referred to as the Yucca Mountain site. The coordinates of the Yucca Mountain tower are given in Table 4.1-1. Data from this site, which has virtually unobstructed exposure in all directions, (as seen in Figure 4.2-1), are indicative of synoptic-scale weather conditions at certain times. Comparison of these data to data from NTS-60 Repository will provide insight into the relationship between synoptic-scale conditions and those conditions that occur at the surface facilities location. Figure 4.2-2 is a view from the tower location towards the north.

A second 10-m tower is placed at the site of the exploratory shaft, 2.7 km (1.7 mi) west-northwest of the main site at an elevation of 1,278 m (4,193 ft) above MSL. This tower is referred to as Coyote Wash and is located in one of the many drainages along the eastern side of Yucca Mountain. Figure 4.2-3 is a view up the wash towards the west-northwest, and Figure 4.2-4 shows the view down the wash looking towards the southeast. The coordinates of the Coyote Wash site are given in Table 4.1-1. Data from this tower will be used primarily to assess impacts from exploratory shaft operations, but will also be used in the overall repository evaluation.

A third 10-m tower sits on Alice Hill, one of the buttes separating the Project area from Jackass Flats. This site is 3.0 km (1.9 mi) northeast of the main site at an elevation of 1,234 m (4,047 ft) above MSL. The tower is referred to as Alice Hill. The Alice Hill site coordinates are shown in Table 4.1-1. Figure 4.2-5 is a view of Yucca Mountain from Alice Hill,

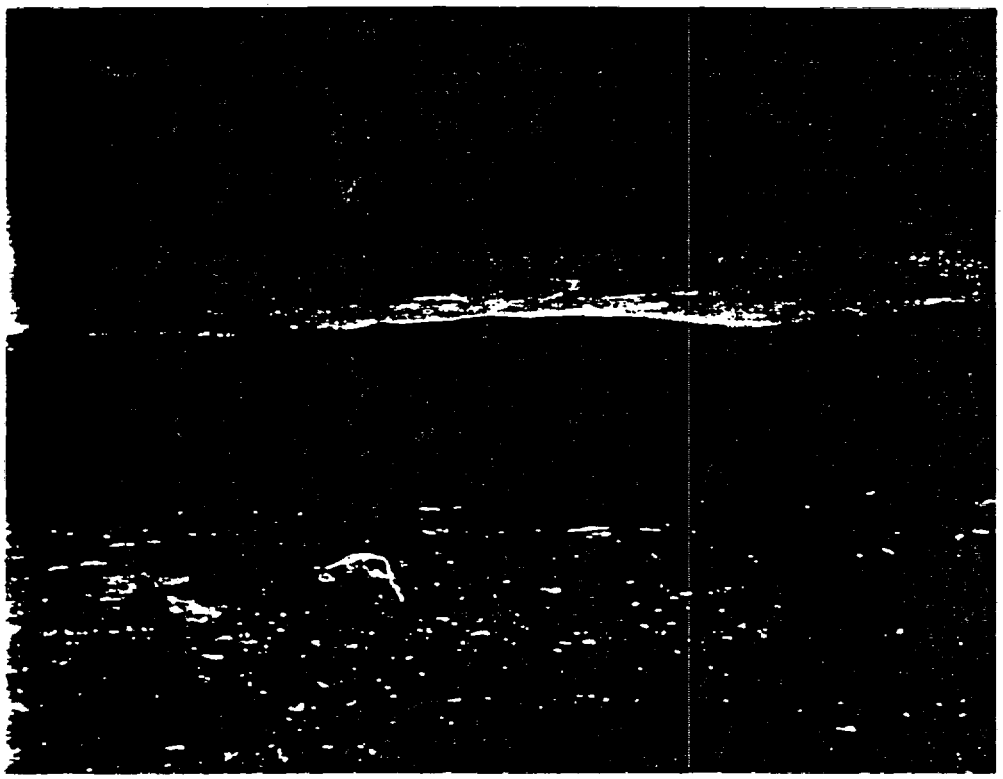


Figure 4.2-1. View from the Yucca Mountain tower location looking east towards Jackass Flats.

Figure 4.2-2. Perspective of the Yucca Mountain site 10-meter tower looking towards the north.

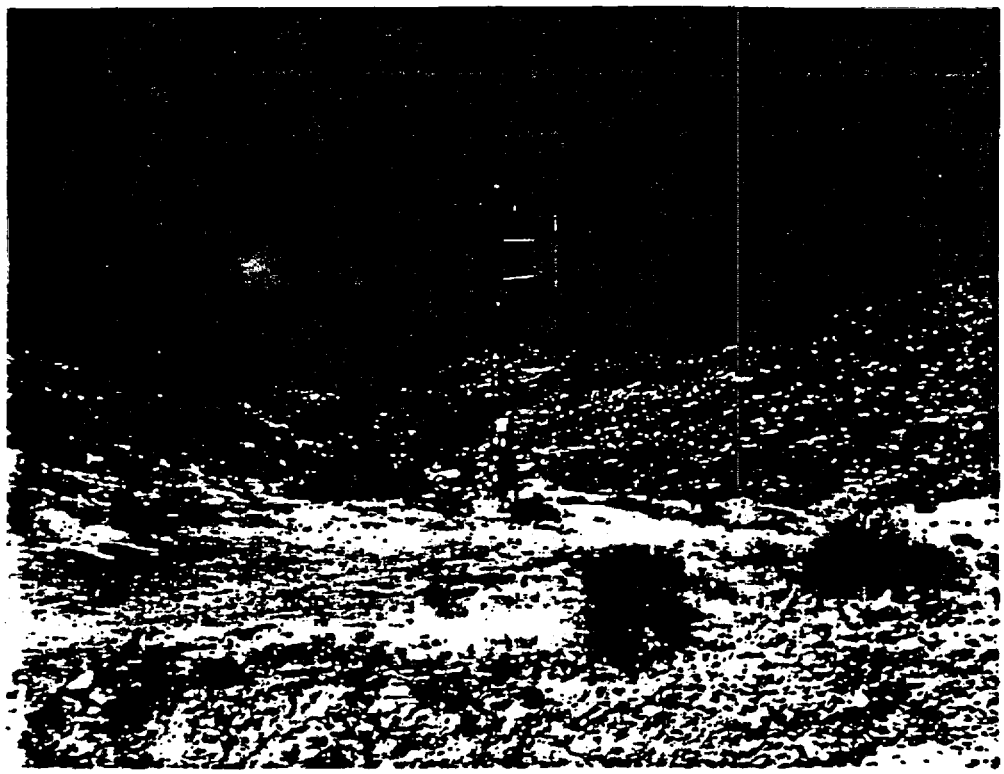


Figure 4.2-3. Coyote Wash 10-meter tower viewed from the south-southeast up the wash towards the west-northwest.

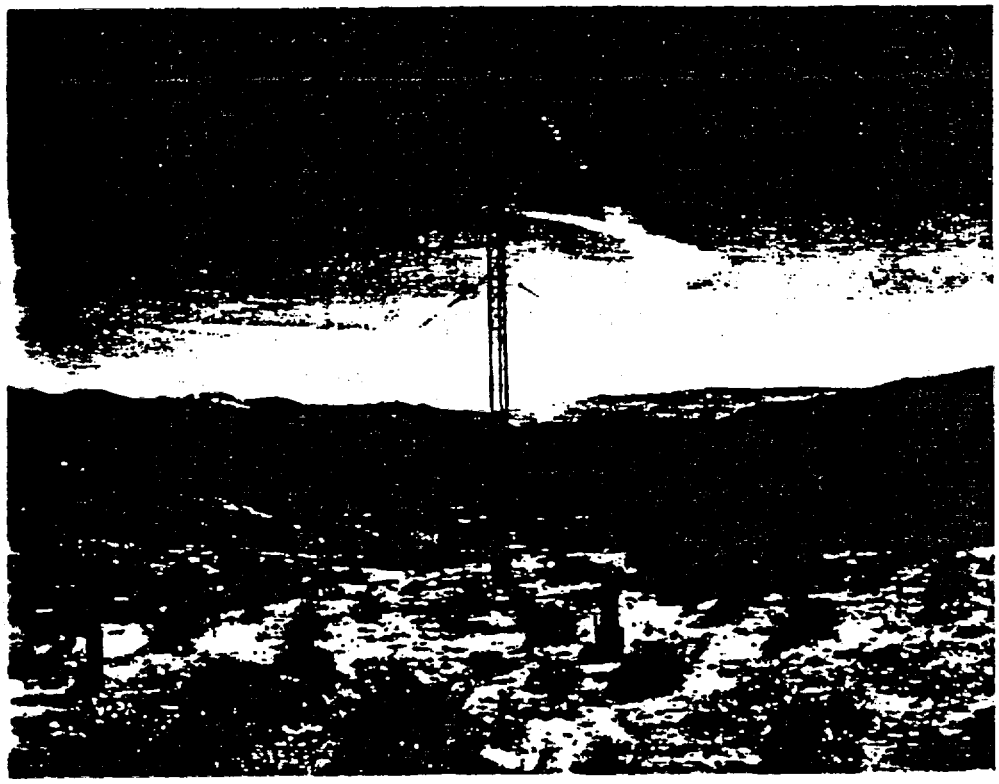


Figure 4.2-4. View looking towards the south-southeast from the Coyote Wash tower.

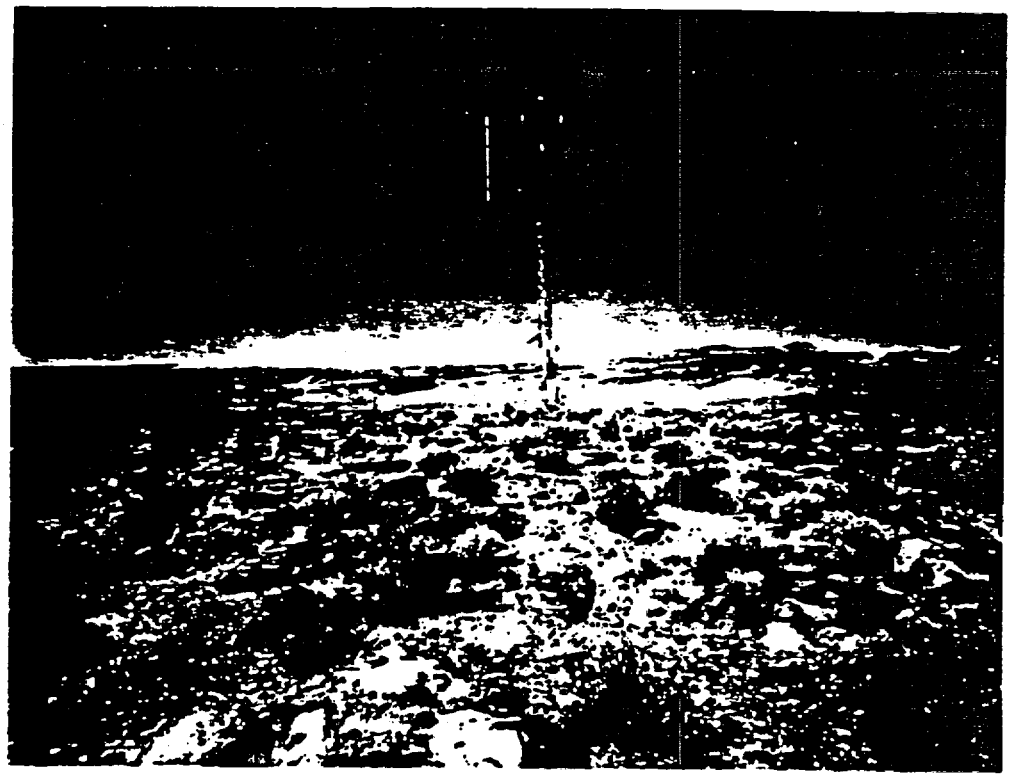


Figure 4.2-5. Yucca Mountain as seen looking west from the Alice Hill site.

and Figure 4.2-6 is the view from Alice Hill looking south. This tower is located such that data from Yucca Mountain, Coyote Wash, and Alice Hill will provide a cross-section of the atmosphere in the lee of Yucca Mountain. In addition, because Coyote Wash and Alice Hill are at approximately the same elevation, comparisons with the main site can be used to evaluate the characteristics of the drainage flow that may form.

The final 10-m tower is at the edge of Fortymile Wash, 9.2 km (5.7 mi) southeast of the main tower at an elevation of 952 m (3,124 ft) above MSL. The tower is referred to as 40-Mile Wash. The coordinates of the 40-Mile Wash site are provided in Table 4.1-1. Fortymile Wash, the major water drainage for the area, influences the air drainage during times when rapid nocturnal surface cooling causes air near the surface to subside. Under these drainage conditions, data from the 40-Mile Wash site will indicate how far down-valley repository emissions could be transported. Figure 4.2-7 is the view from the 40-Mile Wash site looking north, and Figure 4.2-8 shows the view towards the south from the site.

4.3 METEOROLOGICAL MONITORING STATION DESIGN AND PROBE SITING

All monitoring equipment and stations were designed and sited to ensure that all probes and samplers meet or exceed the requirements given in the PSD rules and regulations (40 CFR 52.21, 52 FR 24714, July 1, 1987) and the PSD probe siting guidelines (EPA, 1987). Sections C.2 through C.6 of NRC Regulatory Guide 1.23 (NRC, 1980) also provided guidance in designing the network and stations.

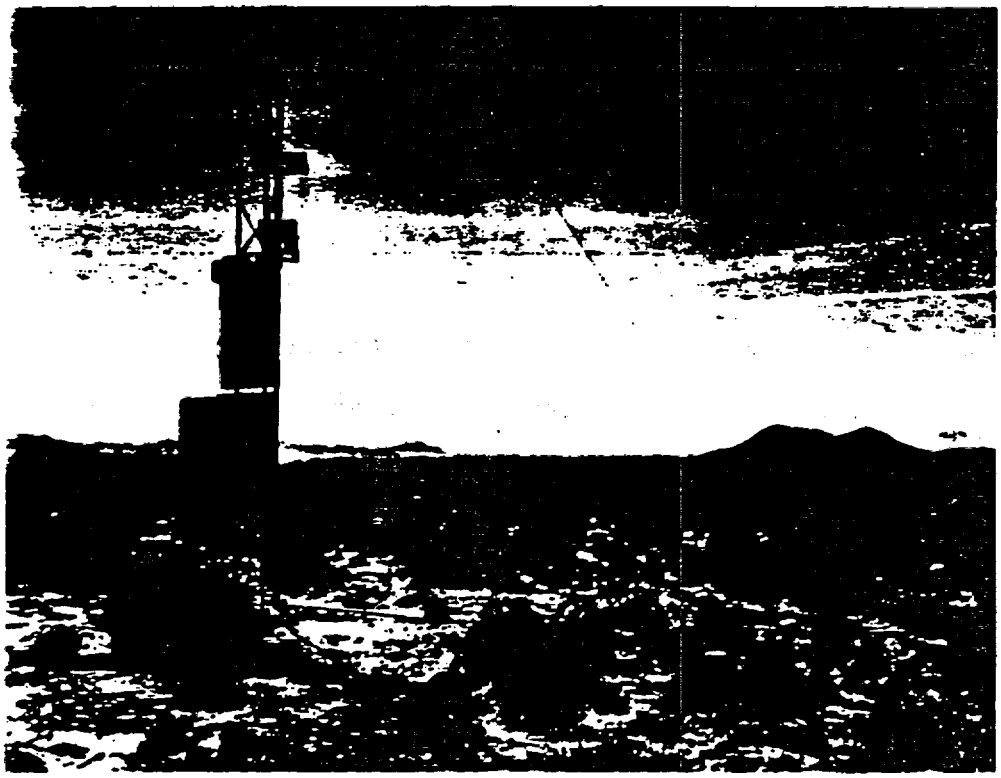


Figure 4.2-6. Vista of Jackass Flats and Fortymile Wash viewed from the Alice Hill site looking south.

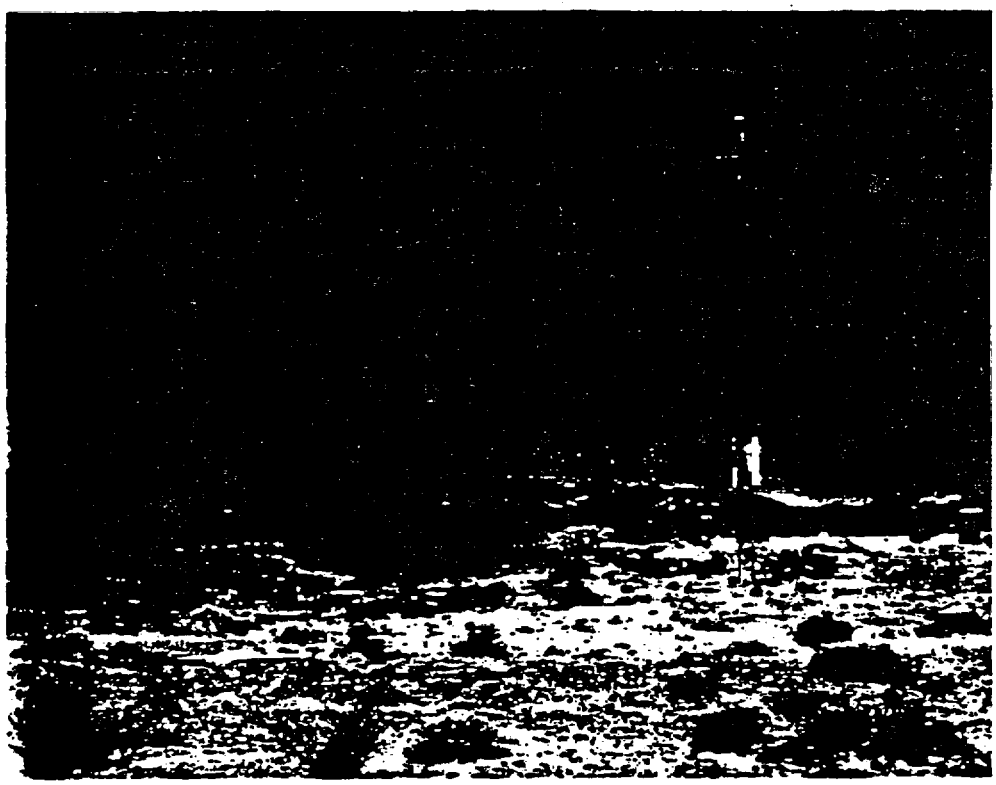


Figure 4.2-7. View from the 40-Mile Wash site looking up the wash to the north.

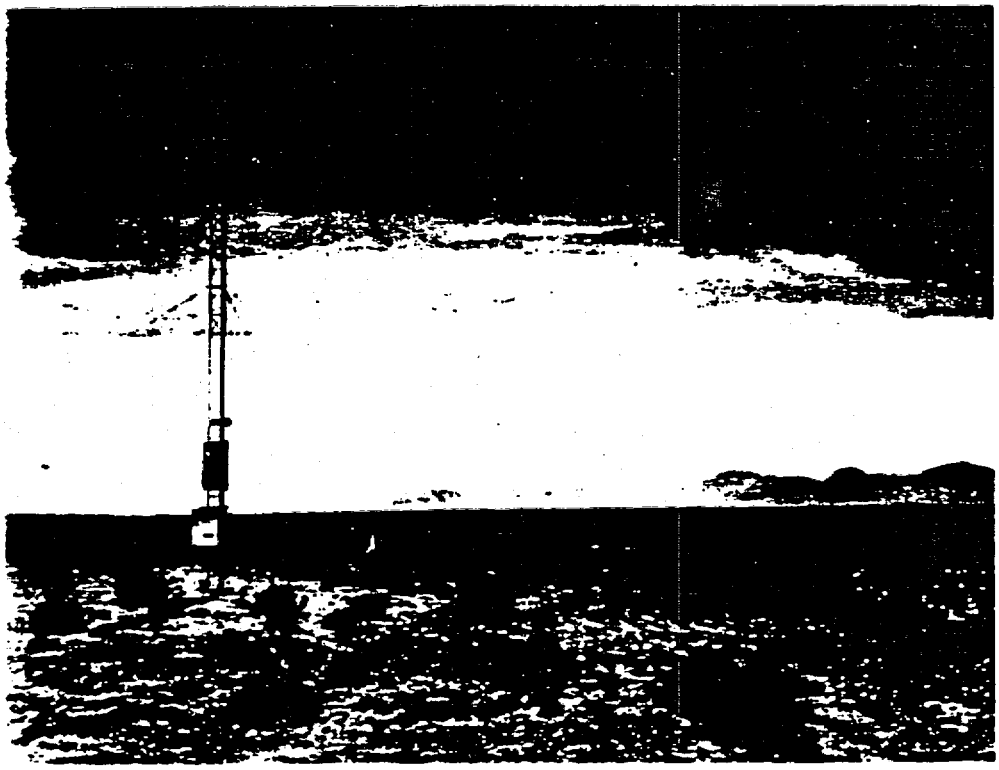


Figure 4.2-8. View looking south towards Amargosa Valley from the 40-Mile Wash site.

The meteorological sensors on the 10-m towers are mounted at the top of the towers, precluding tower-induced turbulence interference. For the 60-m tower, wind speed and direction sensors project approximately 1.8 m from the tower, in the direction of the prevailing wind, to minimize tower-induced turbulence effects.

The four 10-m towers are instrumented identically to measure wind speed, wind direction, sigma theta (for determination of atmospheric stability), relative humidity, temperature, atmospheric pressure, and precipitation. The 60-m meteorological tower is instrumented to measure wind speed, wind direction, and sigma theta at the 10-m and 60-m levels; sigma phi, temperature, and relative humidity at the 10-m level; temperature difference between the 10-m and 60-m levels; net radiation (solar and terrestrial) at approximately the 10-m level; atmospheric pressure; and precipitation at essentially ground level a short distance from the base of the tower. The sensors at the 10-m level satisfy the requirement for monitoring meteorological parameters at standard exposure heights over level, open terrain according to the PSD monitoring guidelines. It should be noted, however, that the Coyote Wash 10-m tower is located to characterize a specific terrain-induced flow pattern. The sensors at the 60-m level of NTS-60 Repository provide an indication of larger scale wind flow patterns. Other details of the monitoring program, such as temperature sensor ventilation and shielding, net radiometer (solar and terrestrial) exposure, and precipitation gauge heating, are all designed to be in full compliance with acceptable meteorological practice and applicable PSD and NRC regulations and guidelines.

5.0 MONITORING EQUIPMENT AND OPERATION

5.1 GENERAL EQUIPMENT CONSIDERATIONS

The equipment for implementing this monitoring plan has been identified, purchased, and installed. Procurement of the equipment complied with detailed procedures and instructions for activities that could affect the licensing of a repository. These procedures are outlined in the Yucca Mountain Project Office Quality Assurance Program Plan (Project Office QAPP) and Quality Management Procedures (QMPs) (DOE, 1988a). The equipment specifications given in the sections that follow are based on applicable PSD and NRC requirements and guidelines, as previously referenced. The absence of commercial electrical power at the four remote monitoring sites required selection of equipment with low power consumption and stand-alone operating capabilities. Minimum instrument specifications for these sites and for the main site equipment are presented in the following sections.

5.2 METEOROLOGICAL MONITORING EQUIPMENT

5.2.1 10-METER TOWERS--REMOTE SITES

Meteorological parameters at all four remote sites are monitored utilizing continuous analyzers to provide hourly average wind speed, wind direction, sigma theta, relative humidity, temperature, and atmospheric pressure (precipitation is recorded as an hourly total). Power is supplied by batteries that are trickle-charged by solar cells. A continuous recording

of the data on strip charts is also available at these sites. The meteorological equipment specifications comply with referenced PSD and NRC rules, regulations, and guidelines (see Section 5.2.3 for minimum required specifications).

5.2.2 60-METER TOWER--MAIN SITE

All meteorological parameters at this site are monitored with continuous analyzers. The continuously recorded meteorological parameters are reduced and averaged to produce the following meteorological data base:

- Hourly average wind speed (10- and 60-m levels).
- Hourly average wind direction (10- and 60-m levels).
- Hourly average standard deviation of wind direction (sigma theta) (10- and 60-m levels).
- Hourly average atmospheric stability based on Pasquill Stability Categories, using net radiation and wind speed, with differential temperature, sigma phi, and sigma theta data as backup.
- Hourly average temperature at standard height for climatological comparisons (10-m level).

- Hourly average differential temperature measurements between the 10- and 60-m levels.

- Hourly average dewpoint temperature and relative humidity.

- Hourly average atmospheric pressure.

- Hourly precipitation amounts for climatological comparisons.

In all cases, meteorological analyzers, equipment, and methodologies are in accord with referenced PSD and NRC rules, regulations, and guidelines.

5.2.3 INSTRUMENT SPECIFICATIONS

Instrument specifications meet or exceed those given in referenced PSD and NRC rules, regulations, and guidelines. For cases in which agency specifications differ, the more stringent specification was used in designing the monitoring program. The minimum instrument specifications are as follows:

- Wind direction: ±3° of true azimuth (including sensor orientation error) with a starting threshold of less than 0.45 m/s (1 mph).

- Wind speed: ±0.22 m/s (0.5 mph) for speeds above the starting threshold of 0.45 m/s (1 mph) but less than 11.1 m/s (25 mph), and

±5 percent of true speed, not to exceed 2.5 m/s (5.6 mph), at speeds greater than 11.1 m/s (25 mph).

- Sigma theta: wind vane damping ratio of between 0.4 and 0.6 (inclusive) with a 15° deflection and delay distance not to exceed 2 meters.

- Temperature: ±0.5 Celsius degrees (0.9 Fahrenheit degrees).

- Temperature difference (between levels): ±0.003 Celsius degrees (0.005 Fahrenheit degrees) per meter.

- Radiation (solar and terrestrial): ±5 percent.

- Precipitation: resolution of 0.25 mm (0.01 in) with recorded accuracy of ±10 percent of total accumulated catch.

- Time: within 5 minutes of actual time for all recording devices.

These specifications apply to digital systems; analog back-up systems can deviate by up to 1.5 times these values.

Although the NRC and EPA do not specify an accuracy for barometric pressure sensors, the pressure sensors used in the Yucca Mountain monitoring program have an accuracy of ±1 millibar (mb).

6.0 DATA REPORTING

6.1 GENERAL PROCEDURES

Following the collection, inspection, reduction, and quality control activities (see Section 7.0), the meteorological and quality control data are assembled and presented in reports. The periodic summarization of data is intended to identify any problems in the data as they occur.

All continuously collected data (all meteorological parameters) are collated in chronological order and tabulated according to observation time. All data units are in the SI System (International System of Units). All of the raw data, cassette tapes, log books, calibration data, performance audit results, and other information pertinent to the operation of the program are considered QA documents. These documents are retained in the Local Records Center and are processed and forwarded to the Central Records Facility to be entered into the Automated Records System.

6.2 DATA REPORTING FREQUENCY AND CONTENT

The meteorological and quality control data collected in operation of the monitoring program are summarized in three types of reports: monthly reports at the end of each monitoring month that are for internal data verification only; quarterly reports prepared after each monitoring quarter; and annual reports summarizing each baseline monitoring year.

The basic formats for the monthly, quarterly, and annual data reports are listed in Tables 6.2-1, 6.2-2, and 6.2-3, respectively. These reports are in a formats consistent with reporting requirements for the EPA, the NRC, and the State of Nevada. The monthly reports (Table 6.2-1) serve as a means to track the technical aspects of the monitoring program and are not submitted to the DOE for subsequent submittal to appropriate regulatory agencies. Quarterly and annual reports provide an indication of progress to date, a review of all site activities during the period of record, problems encountered and their resolution, percentage data recovery rates, and other pertinent information.

The quarterly reports (Table 6.2-2) also contain a summary description of the site equipment and operating methodologies and a hard copy of the hourly data listing for each monitored parameter. These data are in a form suitable for use in air quality modeling analyses and for modeling potential radiological impacts for the NRC SAR. A wind rose for each site showing the percent frequency distribution of wind speed and direction is included in each report. These reports present a chronology of data recovery, detailing the data recovery rates by parameter.

The annual reports (Table 6.2-3) contain discussions and data similar to the quarterly reports, but summarized for the entire monitoring year. In addition, meteorological summaries, such as temperature and wind speed

Table 6.2-1. Monthly report format

Subject Matter
Hourly Data Listing (includes daily and monthly tabular summaries and a summary wind rose)

Table 6.2-2. Quarterly report format

Volume	Section	Subject Matter
Vol. 1	1.0	Introduction (brief description of Project and goals)
Vol. 1	2.0	Significant Project Events (chronology of events, down times, data recovery rates)
Vol. 1	3.0	Meteorological Data Summary (wind roses, stability persistence and frequency, temperature means and extremes, precipitation amounts, etc.)
Appendix	N/A[a]	Monthly Wind Roses and Hourly Data Listing (includes monthly and quarterly averages)

[a]N/A: Not applicable.

Table 6.2-3. Annual report format

Volume	Section	Subject Matter
Vol. 1	1.0	Introduction (brief description of Project and goals)
Vol. 1	2.0	Site Description and Instrumentation (brief overview for general information)
Vol. 1	3.0	Significant Project Events (annual chronology of events, down times, data recovery rates)
Vol. 1	4.0	Meteorological Data Summary (seasonal/annual wind roses, stability persistence and frequency, temperature means and extremes, etc.)
Vol. 1	5.0	Quality Assurance Activities
Vol. 1	6.0	Audit Results
Appendix	N/A[a]	Hourly Data Listing (includes monthly, quarterly, and annual averages)

[a]N/A: Not applicable.

seasonal variations, are presented and discussed. In addition, the annual reports include a summary of the results of the quality assurance/quality control activities for the year.

6.3 DATA REPORTING FORMAT AND EXAMPLES

The monthly, quarterly, and annual meteorological data are in a format and scope that is consistent with referenced guidelines. Figure 6.3-1 is an example of the listing of one day's hourly meteorological data. The last day of the monitoring quarter was selected as the example so that the daily, monthly, and quarterly summary data would be shown. Figure 6.3-2 is an example of a quarterly wind rose. Wind roses for each month of the monitoring quarter, in the same telescopic format, are also included in the quarterly reports.

6.4 DATA INPUT TO DOSE ASSESSMENTS

As described in Section 1.2.2.2, 10 CFR Part 20 outlines permissible radiological doses to workers at NRC-licensed facilities and the general public in the vicinity of such facilities. The Yucca Mountain meteorological monitoring program addresses this regulatory requirement for the proposed repository by providing data inputs to the radiological monitoring program. Specifically, these inputs are used in calculations of a concentration parameter, χ/Q, for assessing radiological impacts. This parameter is calculated using a dispersion model, and represents the concentration (χ)

DATE: MAY-31-1987

HR	LWD 1hr deg	LWS 1hr mps	LSIG 1hr deg	UWD 1hr deg	UWS 1hr mps	USIG 1hr deg	TEMP 1hr deg C	DP 1hr deg C	DT 1hr C deg	RAD 1hr W/m2	VSIG 1hr mps	STAB 1hr	PCP 1hr mm	PCP 6hr mm	PCP 24hr mm
0	298.5	1.8	31.1	NR	0.7	152.4	19.5	-7.1	1.6	-50.7	0.14	E	0.00	0.00	2.03
1	317.6	2.6	18.4	NR	1.2	215.2	19.3	-7.0	1.2	-49.2	0.16	E	0.00	0.00	2.03
2	323.1	2.4	17.7	NR	1.2	135.1	18.5	-6.7	1.6	-47.2	0.14	E	0.00	0.00	2.03
3	323.0	2.4	20.5	NR	1.1	161.3	18.1	-6.2	1.3	-46.4	0.16	E	0.00	0.00	1.02
4	330.5	2.6	20.1	NR	1.5	42.6	17.6	-5.9	1.4	-42.2	0.17	E	0.00	0.00	0.00
5	358.0	1.8	30.7	NR	1.7	53.0	18.3	-4.8	0.5	12.8	0.18	D/D	0.00	0.00	0.00
6	95.4	1.7	73.6	NR	1.8	146.0	20.5	-3.1	-0.6	121.6	0.35	D/D	0.00	0.00	0.00
7	154.5	4.5	57.2	NR	5.2	90.1	21.9	-2.0	-0.9	267.0	0.67	C	0.00	0.00	0.00
8	165.4	6.2	52.1	NR	7.2	67.9	23.4	-2.2	-1.1	411.5	0.81	C	0.00	0.00	0.00
9	175.3	6.7	50.1	NR	7.7	70.3	24.5	-2.5	-1.2	520.4	0.88	C	0.00	0.00	0.00
10	183.1	7.5	52.5	NR	8.5	74.0	25.7	-3.6	-1.2	591.4	0.95	D/D	0.00	0.00	0.00
11	178.8	6.3	57.8	NR	7.2	82.5	26.4	-3.3	-1.2	614.0	0.89	C	0.00	0.00	0.00
12	173.1	6.7	56.8	NR	7.7	85.0	27.3	-3.0	-1.3	593.8	0.91	C	0.00	0.00	0.00
13	170.3	8.1	55.7	NR	9.5	77.3	28.4	-2.7	-1.3	543.7	1.03	D/D	0.00	0.00	0.00
14	176.3	7.6	50.5	NR	9.0	75.4	28.9	-3.0	-1.2	452.9	0.96	D/D	0.00	0.00	0.00
15	173.3	7.1	49.5	NR	8.2	71.2	29.3	-2.7	-1.1	332.1	0.84	D/D	0.00	0.00	0.00
16	174.8	6.3	50.6	NR	7.3	69.9	29.4	-2.5	-0.9	193.1	0.78	D/D	0.00	0.00	0.00
17	166.9	6.3	45.2	NR	7.7	57.4	29.1	-2.9	-0.7	-0.3	0.68	D/N	0.00	0.00	0.00
18	172.9	5.4	42.1	NR	7.5	47.0	27.8	-3.3	-0.1	-49.7	0.56	E	0.00	0.00	0.00
19	193.9	3.3	39.2	NR	5.4	70.4	26.3	-3.1	0.5	-62.0	0.34	E	0.00	0.00	0.00
20	253.0	1.6	34.3	NR	1.3	131.1	24.8	-3.3	1.0	-57.5	0.14	F	0.00	0.00	0.00
21	284.6	2.2	52.5	NR	2.0	135.3	23.7	-3.4	1.3	-54.3	0.19	E	0.00	0.00	0.00
22	324.4	2.5	42.7	NR	1.0	259.0	22.8	-3.4	1.9	-51.3	0.25	E	0.00	0.00	0.00
23	310.6	3.3	16.9	NR	1.5	83.6	22.6	-3.5	1.4	-52.1	0.18	E	0.00	0.00	0.00
DAILY															
MAX:		8.1			9.5		29.4	-2.0					0.00	0.00	2.03
AVG:		4.5			4.7		23.9	-3.8							
MIN:		1.6			0.7		17.6	-7.1				TOTAL:	0.00		
MONTHLY															
MAX:		10.9			13.3		29.5	10.9					6.86	10.67	11.18
AVG:		3.5			4.0		19.4	-1.2							
MIN:		0.6			0.3		8.0	-11.1				TOTAL:	28.45		
AVHI:							24.2								
AVLO:							14.2								
QUARTERLY															
MAX:		15.9			20.9		29.5	10.9					6.86	11.94	14.73
AVG:		3.6			4.1		15.3	-5.0							
MIN:		0.4			0.3		-0.5	-19.7				TOTAL:	65.53		
AVHI:							20.1								
AVLO:							10.2								

Figure 6.3-1. Example daily meteorological data.

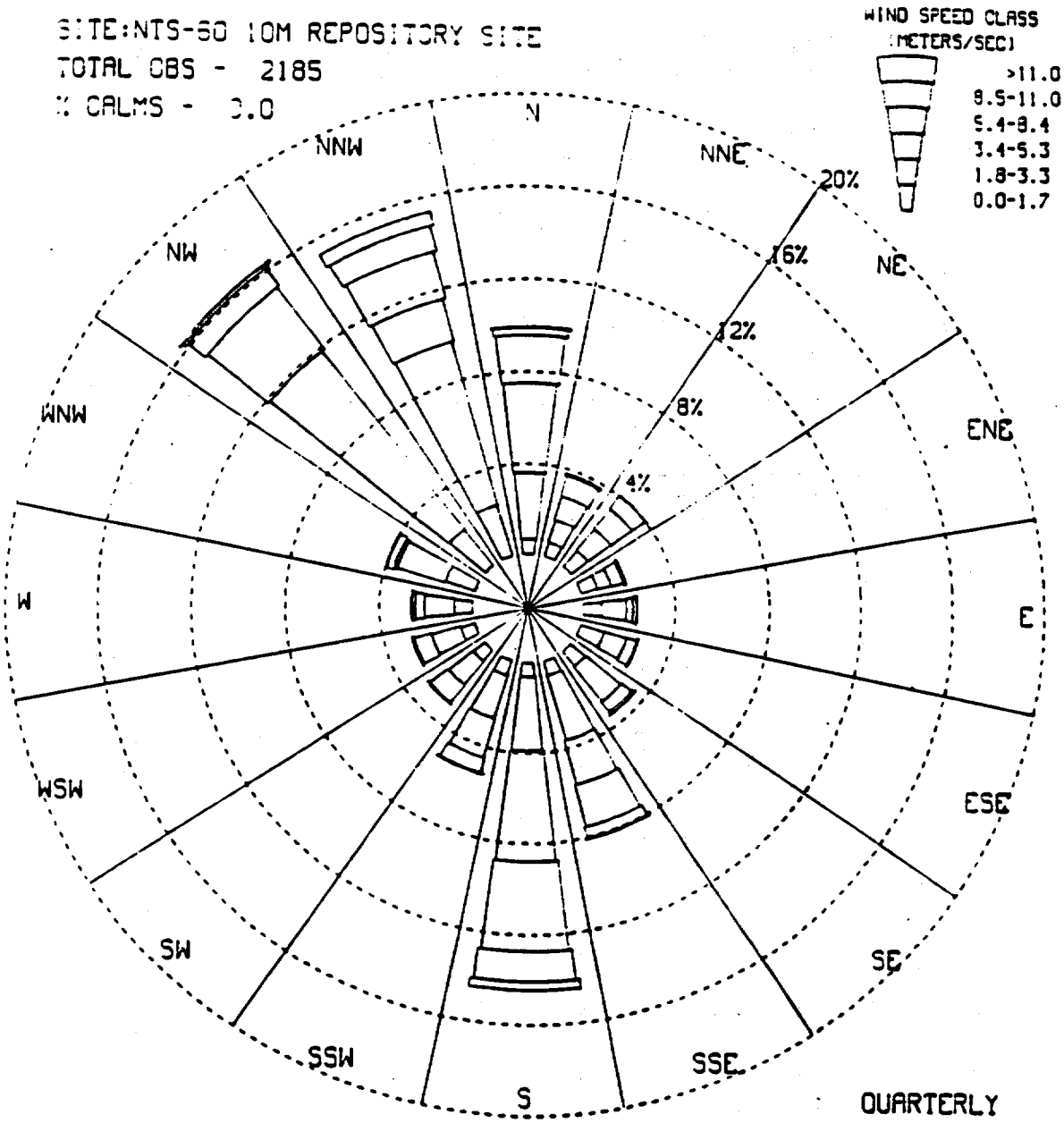


Figure 6.3-2. Example quarterly wind rose.

over the emission rate (Q). χ/Qs are calculated for several locations at various distances from the surface facilities. Calculating χ/Qs as opposed to concentrations allows the source term Q to be varied without rerunning the model. This permits rapid calculation of doses under accident, as well as routine emission scenarios.

The dispersion models are capable of simulating the meteorological and topographical influences on material emitted to the atmosphere as the material is transported and dispersed downwind. While many models have been developed for this purpose, most are appropriate only for use in flat or gently rolling terrain. The topography of the Yucca Mountain site warrants the use of a model that can simulate complex terrain effects. Both the EPA and the NRC have issued documents that provide guidance on the selection and use of the various models that have been developed. This guidance helps ensure that the appropriate model is used.

The NRC has issued at least four regulatory guides (NRC, 1977a; NRC, 1977b; NRC, 1982b; NRC, 1982c) that either reference, provide examples of, or suggest the use of models to determine χ/Q values, but none of the guides was developed specifically for geologic repositories. Nonetheless, some of the information in the guides is applicable to a repository. These regulatory guides are periodically reviewed to ensure that the dispersion analysis done for Yucca Mountain satisfies typical NRC requirements.

The χ/Q values are calculated at discrete locations, but the receptor grid is arbitrary in that no specific sites have been selected for evaluation. Instead, a radial receptor grid is used and χ/Q values at distances

of 2, 4, 8, 16, 24, 32, 40, 48, 56, 64, 72, and 80 km from an assumed source are calculated in each of the 16 cardinal directions for a total of 176 receptors. In the future, however, specific locations of interest will be included in the modeling efforts.

To ensure responsiveness to the design and performance issues, χ/Qs representing routine and accident release scenarios are calculated. Routine releases are evaluated by calculating an annual average χ/Q value at each of the receptors. Because the accident scenarios must be evaluated under meteorologically worst-case conditions (in terms of dispersion), one-hour χ/Q values are also required.

Other data needed as input to a dispersion model are the following: one year of hourly sequential meteorological data (wind speed, wind direction, temperature, mixing height, and Pasquill stability class), receptor terrain heights and their Universal Transverse Mercator (UTM) coordinates, and source characteristics (UTM coordinates, stack height, stack diameter, exit gas velocity, exit gas temperature, and building-stack configuration). When all these data have been put in the format required by the model, the model is run. Although the basic equations used in calculating a χ/Q value are not exceptionally complex, the large number of calculations required for a year of hourly meteorological data dictates the use of a computer.

A report presenting the χ/Q values and the information used in calculating those values is prepared at annual intervals.

7.0 QUALITY ASSURANCE

7.1 CONFORMANCE WITH DOE QUALITY ASSURANCE PLAN

The Yucca Mountain Project has developed and is implementing a Quality Assurance (QA) program in accordance with "The Quality Assurance Plan for High-Level Radioactive Waste Repositories" (DOE, 1986b). The QA program is implemented through the Project Office QA Plan and Administrative Procedures (APs). The Project Office QA Plan ensures that all applicable criteria in Appendix A of the NRC review plan entitled "Programs for Site Characterization of High-Level Waste Repositories" are satisfied. The Project Office QA Plan and/or applicable APs describe the following as applicable:

- The process by which the Project Office reviews and approves the QA programs of its contractors.

- The program being implemented to train and indoctrinate Project Office personnel who perform activities affecting quality. The program identifies the areas that require training, qualification, and/or certification, and outlines how training will be accomplished.

- The measures applied by the Project Office to ensure that the facility design is defined and changes to design bases are controlled, how the Project Office monitors contractors' design controls, and the extent to which the Project Office participates in design reviews.

- The Project Office peer review process and the controls applied by the Project Office over peer reviews performed by the contractor.

- The Project Office program for controlling internal documents, as well as documents being transmitted to and from contractors and other Project participants, to ensure controlled transmittal, receipt, internal distribution, and recall.

- The methods used by the Project Office to monitor contractors' inspection, testing, calibration, and sample identification activities.

7.2 YUCCA MOUNTAIN PROJECT QUALITY ASSURANCE REQUIREMENTS

As stated in Section 7.1, the Yucca Mountain Project Office developed a QA Plan (QAP) (DOE, 1988b) that incorporates the requirements given in the Office of Geologic Repositories (OGR) QA Plan for High-Level Radioactive Waste Repositories, OGR/B-3, and other related DOE and NRC QA documents. Additionally, quality related APs were developed to supplement the requirements contained in the Project QAP. Each Yucca Mountain Project participant is responsible for developing and maintaining a QA Program Plan (QAPP) and supporting procedures to implement the requirements of the Project QAP and the quality related APs. All work associated with the implementation of the meteorological monitoring plan was performed in accordance with applicable QA procedures.

The meteorological monitoring program at Yucca Mountain is also subject to the QA requirements of the EPA, which were developed to ensure the accuracy and validity of the collected data (40 CFR Part 58). The Project Office QAPP was used as the starting point for development of operational procedures that incorporate the requirements of the EPA. The Project Office QAPP contains specific QMPs that encompass a wide variety of activities. The monitoring program was broken into discrete activities, and the applicability of the QMPs to each activity was determined. Procedures incorporating the requirements of the various QMPs applicable to a given activity were then prepared. Project Office QA audit provisions ensure that the monitoring program is operated in accordance with the procedures developed in response to the EPA's goal of collecting accurate, valid data and the DOE's goal of complying with the Project QAP.

7.3 QUALITY ASSURANCE SPECIFIC TO METEOROLOGICAL MONITORING

The QA program specific to collecting accurate, valid data included a review of all aspects of the monitoring program (site selection, system design, report preparation, audits, data quality control) by staff who are independent of the daily operation of the program. The QA described herein represents the specific procedures necessary to ensure the quality of the collected meteorological data and to satisfy the regulatory requirements for PSD monitoring programs.

Monitoring instrumentation and meteorological sensors are calibration checked and performance audited on a routine basis. All calibration check,

test, inspection, and performance audit activities are fully documented and are an integral part of the Project data base. All the checks performed on the equipment are important in data reduction and analysis and are performed by specially trained individuals. The independent performance audits of the meteorological sensors are conducted using independent calibration devices and traceable standards and are performed on a quarterly basis in response to regulatory requirements. All activities conducted as part of the program were developed to ensure overall data accountability, traceability, and repeatability.

For the meteorological monitoring programs, two types of activities are used in ensuring the validity of the collected data: the QA program described above and Quality Control (QC). QC activities are the primary avenue by which the data are kept within prescribed control conditions. The field QC activities are carried out by the site technician, while in-house QC activities are performed by personnel who are involved with the data reduction and analyses. The QA program ensures that each QC function is performed completely and accurately and is documented in accordance with approved procedures. If a QA check indicates that an out-of-control condition has occurred, the related QC activity is modified or restructured to eliminate future occurrences.

7.4 FIELD QUALITY CONTROL ACTIVITIES

7.4.1 EQUIPMENT RECEIPT, INSPECTION, ACCEPTANCE TESTING, AND INSTALLATION

The initial quality control tasks include a receiving inspection and acceptance test of the meteorological monitoring equipment prior to installation. An equipment receiving form (Figure 7.4-1) is filled out for each package received. The form includes serial numbers, condition, and the presence of manufacturer's manuals and comments.

Acceptance testing is then conducted in accordance with Branch Technical Procedure (BTP)-MET-001, which was developed from information in manufacturers' manuals, the technician's experience, and Project Office QMPs. The acceptance testing includes troubleshooting and repair of all detected malfunctions and of all nonfunctioning equipment. An example of an acceptance test form is given in Figure 7.4-2.

The installation of each piece of monitoring equipment is performed after the equipment is inventoried, inspected, and acceptance tested. Installation, onsite tests, and related activities are performed in accordance with information from manufacturers' manuals and the technician's experience. These activities are fully documented.

7.4.2 CALIBRATION CHECKS

Calibration checks of the meteorological monitoring equipment are performed on a quarterly basis in accordance with BTP-MET-002.

Yucca Mountain Project Meteorological Monitoring Program	T&MSS Form No. T-QA-022 Revision 1 4/85

EQUIPMENT RECEIVING FORM

Received and Inspected by: _____ Date Equipment Received: _____

Shipping Company: _____ Driver's Initials: _____

Equipment Manufacturer: _____ Package External Appearance: Good _____ Damaged _____

Assigned Identification Number: _____ If Damaged Describe: _____

_____ _____

_____

Package Contents Inventoried and

Inspected by: _____ Date: _____

Item Description	Make/Model/Serial No./Property Tag No.	Physical Appearance OK	Physical Appearance Damaged	Accept	Reject	NCR#	P.O. Check Off

Figure 7.4-1. Equipment receiving form.

Comments: _____

Technician's Signature: _____ Date: _____

Figure 7.4-1. Equipment receiving form (continued).

Yucca Mountain Project Meteorological Monitoring Program	Form No. T-QA-023 Revision 1 4/85

WIND SPEED AND DIRECTION SENSOR ACCEPTANCE TEST FORM

Project Name: _____

Test Location: _____ Test Date: _____

Technician: _____ Verification/Date: _____

Site Name Where Equipment is to be Installed: _____

WS Sensor Make/Model/Serial Number/Property Tag Nunber:

_____

WD Sensor Make/Model/Serial Number/Property Tag Number:

_____

Test Method: _____

Test Equipment Make/Model/Serial Number: _____

_____

_____

WIND SPEED SENSOR TEST RESULTS

WS Sensor Response

In		Out	
RPM	m/s	Voltage	m/s

Threshold Verification

Maximum Torque Rating: _____

As Found Torque Rating: _____

(Must be Less Than Maximum Rating)

As Left Torque Rating: _____

(Must be Less Than Maximum Rating)

Sensor Performance: Accept/Reject (Circle One) If Reject, NCR Number: _____

Figure 7.4-2. Example acceptance test form.

WIND DIRECTION SENSOR TEST RESULTS

WD Sensor Response			Threshold Verification
In		Out	Maximum Torque Rating: _____
Degrees Azimuth	Voltage	Degrees Azimuth	
_____	_____	_____	As Found Torque Rating: _____
_____	_____	_____	(Must be Less Than Maximum Rating)
_____	_____	_____	As Left Torque Rating: _____
_____	_____	_____	(Must be Less Than Maximum Rating)

Sensor Performance: Accept/Reject (Circle One) If Reject, NCR Number: _____

Comments: _____

Technician's Signature: _____ Date: _____

Figure 7.4-2. Example acceptance test form (continued).

7.4.3 INSTRUMENT MAINTENANCE

To provide for continued proper operation of the meteorological monitoring equipment, scheduled maintenance is performed in accordance with BTP-MET-002. The procedure for performing maintenance on the equipment includes, but is not limited to, the following:

- Cleaning of the magnetic tape recording heads.

- Semi-annual replacement of wind speed and direction sensor bearings, if necessary, or as determined by the calibration check/performance audit process.

- Weekly checking of all sensor cables, tie-downs, power cords, etc.

- Weekly inspection of all sensors for proper operation.

- Weekly inspection of all digital and strip chart recorders for data reasonableness and proper timekeeping.

Each of these activities, as well as other checks and comparisons outlined in BTP-MET-002, are fully documented in logbooks and on various forms.

7.5 DATA HANDLING ACTIVITIES

7.5.1 DATA TRANSMITTAL AND SCREENING

To help ensure maximum data recovery, the site technician transmits all data collected onsite to the Data Manager on a weekly basis. Upon receipt by the Data Manager, data are inspected for gross errors in transmittal, recording, or documentation. Any errors thus noted are brought to the immediate attention of the Task Manager, who notifies the individuals involved to correct the errors. The data tapes are then transcribed onto a computer file. The digital data file is subjected to a screening process that identifies out-of-range conditions, such as extremely high or negative wind speeds, extremely high or low temperatures, or large hourly variations. Data identified through this screening are visually inspected to determine whether the event is real or is the effect of an instrument malfunction. If the out-of-range data are determined to be the result of an instrument malfunction, the Data Manager completes a digital data correction form (Figure 7.5-1). The Data Manager identifies the parameters and time period affected by the instrument malfunction and proposes a resolution. The form is then forwarded to the Task Manager and Quality Control Reviewer for approval. When the proposed resolution has been approved, the Data Manager makes the change. This process is also used in extracting data that were recorded during instrument maintenance and calibration checks, or were otherwise determined not to be valid.

Yucca Mountain Project
Meteorological Monitoring Program

Digital Data Correction Form

Name of Person Submitting: _____ Date: _____

Station(s) Involved: 1) _____ 4) _____
2) _____ 5) _____
3) _____ 6) _____

Parameter(s)/Levels Affected: 1) _____ 6) _____
(If all, enter 'ALL') 2) _____ 7) _____
3) _____ 8) _____
4) _____ 9) _____
5) _____ 10) _____

Time Period Affected: From (YR/MO/DA HR:MIN) _____
To (YR/MO/DA HR:MIN) _____

Description of Problem: _____

_____

_____

_____

_____

Recommended Corrective Action(s): _____

_____

_____

_____

_____

-- Reverse Side is for Final Disposition --

Figure 7.5-1. Digital data correction form.

Final Recommendation(s)/Responsibility for Implementation: _____

_____

_____

_____

_____

_____

_____

_____

_____

Approved: _____ Date: _____

Task Manager/Principal Investigator

_____ Date: _____

QC Reviewer

Verification (Final Action(s) Accomplished): _____

Implementor

_____

Date

Figure 7.5-1. Digital data correction form (continued).

7.5.2 DATA REDUCTION, VERIFICATION, AND VALIDATION

60-Meter Tower

As a means of verifying the digital data base, a random hour out of each day for each parameter is hand-reduced from the strip chart data at the same time the digital data base is undergoing the screening procedures described in the previous section. These hourly averages are extracted from the strip charts either by using graphical averaging techniques or, for rapidly changing traces, by using a data digitizer. The reduced data are recorded on a digital/analog data comparison form (Figure 7.5-2).

The hand-reduced data are then compared with the corresponding parameter and hour in the digital data base. This comparison with the digital data and corresponding verification data is reviewed by the Quality Control Reviewer and must agree within the prescribed tolerances given on the form. If it does not agree, the entire weekly record for that parameter is visually scanned to determined the source of the discrepancy. A digital data correction form is completed to document any corrections made in the digital data base. If significant gaps exist in the digital data base due to a failure of the digital data collection system, the corresponding period of strip chart data is hand-reduced to fill in the gaps. In such instances, the hand-reduced data are spot-checked with the original strip chart by independent staff to ensure agreement.

Yucca Mountain Project Digital/Analog Data Comparison Form (Page 1 of 2)

Month:_____ Data Analyst:_____ Date:_____ QC Reviewer:_____ Date:_____

Date		LWD (deg)			LWS (m/s)			LSIG (deg)			UWD (deg)			UWS (m/s)			USIG (deg)			Comments
Day	Hour	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	

Figure 7.5-2. Digital/analog data comparison form.

Yucca Mountain Project Digital/Analog Data Comparison Form (Page 2 of 2)

Month:_____ Data Analyst:_____ Date:_____ QC Reviewer:_____ Date:_____

Date		TEMP (°C)			DP (°C)			DT (°C)			RAD (W/m²)			VSIG (m/s)			PCP (mm total)			Tolerance Limits
Day	Hour	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	Chart	DDAS	Diff	

Figure 7.5-2. Digital/analog data comparison form (continued).

The digital data listing is further inspected by checking the high and low values for each parameter against the corresponding strip chart data. Any discrepancies are corrected as described in preceding sections, and the checking process is repeated. The final listing is visually scanned for any unexplained data gaps before the summarization activities for the monthly, quarterly, and annual reports.

10-Meter Towers

As with the 60-meter tower data, the data tapes from the remote site are transcribed onto a computer file. After the data have been screened as discussed above, the digital data are reduced and reformatted to the appropriate units. The collected digital data are compared with the strip charts from these sites as was discussed for the 60-meter tower, and are reviewed by experienced meteorologists for erroneous or suspicious data. Maximum, minimum, and average values for each parameter are compared with similar data from nearby stations for the period in question to provide a gross check on data reasonableness. Diurnal patterns at each site are reviewed in terms of the micrometeorological features that should drive these patterns. Finally, data from these sites are compared to each other and to the 60-m tower data to identify any suspicious data.

7.5.3 DATA SUMMARIZATION AND FORMATTING

After the digital data base has been verified and validated using the procedures described in the previous sections, the data are summarized for

inclusion in the monthly, quarterly, and annual reports. The formats for these data were presented in Section 6.2.

7.6 INDEPENDENT SYSTEM AND PERFORMANCE AUDITS

Certain QA activities that will be carried out under the meteorological monitoring program are defined differently than those for the overall Yucca Mountain Project Office QA programs. The following definitions apply to this MMP:

- System Audits encompass all aspects of the monitoring program (i.e., probe siting, data handling activities, calibration techniques and schedules, maintenance schedules, etc).

- Performance Audits involve challenging the meteorological sensors with known standards to determine monitoring accuracy.

Independent system audits of the monitoring installation and operational activities are conducted annually. The system audit, as outlined in EPA guidelines, includes a review of the monitoring stations to determine compliance with the EPA PSD probe siting criteria. This review also includes investigating the onsite data handling and transmittal activities as well as the schedule of calibration check activities and other QC functions in accordance with the Project Office QAPP, and BTPs. All nonconformances identified in any system audit are recorded in an audit report. The resolution of the nonconformance is documented in the Project records system.

Independent performance audits are also required by and outlined in EPA guidelines. They are performed quarterly in accordance with BTP-MET-001.

The quality control review staff have the responsibility for maintaining the internal data handling and analysis activities in accordance with referenced EPA and NRC guidelines and requirements. The review staff continuously assess the accuracy and reliability of these activities and correct any identified problems. As required by the EPA PSD regulations, SAIC participates in the EPA National Performance Audit Program.

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YMP/88-14

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

RADIOLOGICAL MONITORING PLAN

DECEMBER 1990

UNITED STATES DEPARTMENT OF ENERGY

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PDR WASTE
WM-11 PDR

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

RADIOLOGICAL MONITORING PLAN

DECEMBER 1990

Revision 1

Prepared by

U.S. Department of Energy
Yucca Mountain Site Characterization Project Office

Prepared for the Yucca Mountain Site Characterization Project as part of the Civilian Radioactive Waste Management Program. The Yucca Mountain Site Characterization Project is managed by the Yucca Mountain Site Characterization Project Office of the U.S. Department of Energy (DOE). Yucca Mountain Site Characterization Project work is sponsored by the DOE Office of Civilian Radioactive Waste Management.

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1.0 INTRODUCTION AND PLAN SUMMARY

The Radiological Monitoring Plan for the Yucca Mountain Site Characterization Project (RADMP) is the controlling Yucca Mountain Site Characterization Project document for radiological monitoring activities for the Yucca Mountain Site Characterization Project. This document contains the technical basis and criteria for this program.

If Yucca Mountain is (1) determined to be suitable by the Department of Energy (DOE), (2) approved by the President, and (3) licensed by the Nuclear Regulatory Commission (NRC), then the Project will oversee the final six of eight possible phases for the site. These eight phases overlap in some instances and include the following:

1. Site selection (selection of sites for further characterization; completed May 28, 1986).

2. Site characterization.

3. Data gathering for preparation of the EIS.

4. EIS preparation and review (the Project provides technical input to an OCRWM contractor who will prepare the EIS) and Safety Analysis Report (SAR) preparation and review.

5. Construction authorization/Construction.

6. License to receive and possess/operation.

7. Permanent closure and decommissioning.

8. Postclosure monitoring.

Details of the Project activities are discussed in the "Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area (NRDA), Nevada" (DOE, 1986a); "Site Characterization Plan Conceptual Design Report" (SNL, 1987); and "Site Characterization Plan, Yucca Mountain Site, NRDA, Nevada" (DOE, 1988b).

To allow proper planning, the RADMP addresses monitoring for all Project phases through site closure. During these phases, it is important to ensure compliance with applicable regulations, monitor the impacts of Project activities, and gather data required by the Yucca Mountain site and environmental program. The major environmental radiological monitoring activities necessary to support the phases of the Project are summarized in Figure 1-1. Because of the uncertainty associated with the requirements that may be applied to future phases of the Project, the activities detailed in this revision of the RADMP emphasize the site characterization phase. The RADMP is a dynamic document, and regular revisions are planned to accommodate the various phases of the Project, and nonroutine revisions as necessary. This document does not, however, indicate the final outcome of the repository selection process. If the Yucca Mountain site is not licensed as the repository site, Phases 5, 6, and 8 will be eliminated (since they will not occur) and the schedule shortened.

SITE PHASE (SEE SECTION 1.0)	RADIOLOGICAL MONITORING ACTIVITIES		MAJOR PROJECT ACTIVITIES
			PRE-SITE CHARACTERIZATION
1		5/86	ISSUANCE OF ENVIRONMENTAL ASSESSMENT SITE CHARACTERIZATION ACTIVITIES
		2/87	PRELIMINARY SITE CHARACTERIZATION RADIOLOGICAL MONITORING PLAN
2	PRELIMINARY SITE CHARACTERIZATION ENVIRONMENTAL RADIOLOGICAL BASELINE DATA COLLECTION	12/87	RADIOLOGICAL MONITORING PLAN (RADMP)
		7/90	RADMP (REVISION 1)
2	COLLECTION OF DATA PER COMPLIANCE WITH U.S. NUCLEAR REGULATORY COMMISSION (NRC) AND DEPARTMENT OF ENERGY (DOE) REGULATIONS AND GUIDANCE		INITIATE SURFACE-BASED TESTING EXPLORATORY SHAFT FACILITY (ESF) SITE PREPARATION START ESF CONSTRUCTION ENVIRONMENTAL IMPACT STATEMENT (EIS) SCOPING HEARING COMPLETED
			RADMP (REVISION 2)
3	EIS RADIOLOGICAL BASELINE ENVIRONMENTAL DATA COLLECTION AND SITE CHARACTERIZATION ENVIRONMENTAL RADIOLOGICAL MONITORING		
			EIS SUPPORT DOCUMENTS
			DRAFT EIS RADMP (REVISION 3)
4, 5	ENVIRONMENTAL RADIOLOGICAL BASELINE DATA MAINTENANCE AND CONSTRUCTION IMPACT MONITORING		FINAL EIS LICENSE APPLICATION
			CONSTRUCTION AUTHORIZATION FROM NRC
			RADMP (REVISION 4)
5	PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING		
			RADMP (REVISION 5) FIRST RECEIPT OF WASTE
6	OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING		
			RADMP (REVISION 6) DECOMMISSIONING
7	DECOMMISSIONING VERIFICATION ENVIRONMENTAL RADIOLOGICAL MONITORING		
			RADMP (REVISION 7)
8	LONG-TERM ENVIRONMENTAL RADIOLOGICAL MONITORING		

RMPTLINE.014/9-20-90

Figure 1-1. Radiological monitoring timeline. (See Section 1.1 for a description of the site phases.)

The RADMP describes the activities to collect data on the existing radiological environment in the Yucca Mountain area and to monitor any changes in these conditions as a function of time. The RADMP implements many of the requirements in the Yucca Mountain Site Characterization Project Safety and Health Plan (SHP) (DOE/NV, 1990). In addition, each Project Participant will operate within the requirement of its own safety and health plan, to ensure the implementation of applicable requirements. It should be emphasized that neither radiological monitoring nor site characterization activities will introduce radioactive waste into the Yucca Mountain environment. The radioactive materials associated with radiological monitoring that are not already present in the environment are radioactive sources that will be used for calibration or accuracy checking of instruments. These sources:

1. Contain extremely small quantities of radioactive material.

2. Are present in limited number.

3. Are carefully controlled by the T&MSS Radiological Field Programs Department, or by other Project Participants under the requirements of their approved safety and health plans.

4. Must be disposed of at an authorized radioactive waste disposal site when no longer needed, or removed from the site for use elsewhere; thus, they will not remain at Yucca Mountain.

Other than these radiation sources used during the radiological monitoring activities described in this document, the only radioactive materials that will be used at the site are part of activities commonly used in the mining, drilling, and construction industries. A few examples of the types of radioactive materials that might be present are standard well-logging instrumentation and weld analysis (nondestructive) radiographic equipment. Currently no radioactive hydrogeological tracers are planned for use.

As required by the NWPA, Project does not plan to introduce radioactive waste into the Yucca Mountain area unless a license to operate the facility has been granted by the NRC, and the DOE is fully satisfied with the adequacy of any facility constructed.

As specified in the SHP (DOE/NV, 1990), the RADMP is the controlling document for implementing the radiological monitoring activities. The RADMP describes the collection of required radiological data identified in the SCP (DOE, 1988b), EMP (DOE, 1990b), and other Project documents.

The RADMP complies with the requirements of the Project QARD (OCRWM, 1990a), QAPD (OCRWM, 1990b), and supporting documents, as well as with applicable Project and the supporting organizations' procedures.

The RADMP identifies the technical requirements for the implementation of procedures for the radiological monitoring activities. The procedures are prepared as described in instruction and procedural documents for each organization, such as the RMIM (SAIC, 1990b). Each organization in this activity issues technical procedures and instructions as part of the

controlled procedures manual, which is maintained in an updated, audited form by each user. In addition, upper tier Project-level procedures may be used to implement specific requirements affecting all organizations or the Project program as a whole.

2.0 ORGANIZATION AND RESPONSIBILITIES

The reporting structure for the radiological monitoring program is shown in Figure 2-1. Solid lines indicate the flow of technical direction and dashed lines indicate the flow of technical input and support. The day-to-day direction of this activity is the responsibility of the Operations Control Branch of the Yucca Mountain Site Characterization Project Office's Project Operations and Control Division. The T&MSS is responsible for implementation of all environmental radiological monitoring (ERM) activities with support from EG&G/EM as directed by the Project Office Operations and Control Division Director. T&MSS will perform the various activities in conjunction with EG&G/EM. The RFPD Manager is responsible for coordination of these activities.

Technical control, support, and direction is provided by the Project Office's Project Operations Control Division (POCD) Director. The Office of Environment, Safety, and Health (OESH) of the DOE/NV will also provide technical support to the Project Office.

The Project Office Manager is the approval authorities for this plan. The concurrence of the Project Office QA Manager verifies that the applicable QA requirements have been appropriately addressed in this document.

The radiological monitoring program will consist of six major tasks:

1. Program development and planning.
2. Specific program implementation (operation).
3. Data and sample archiving.
4. Quality control activities.
5. Analysis of data and reporting.
6. Program revision.

Under Task 1, there are several subtasks. These subtasks include the preparation of required documents (in accordance with the applicable organizations' administrative and technical procedures) and completion of the following activities:

1a. Technical plan(s).

1b. Hazard review/safety plan.

1c. Training program.

1d. Procedures.

1e. Identification of required equipment and services.

1f. Procurement specification after identification of the required equipment and services.

1g. QA/quality control implementation plans/procedures.

1h. Checklist for assessing an activity's operational readiness.

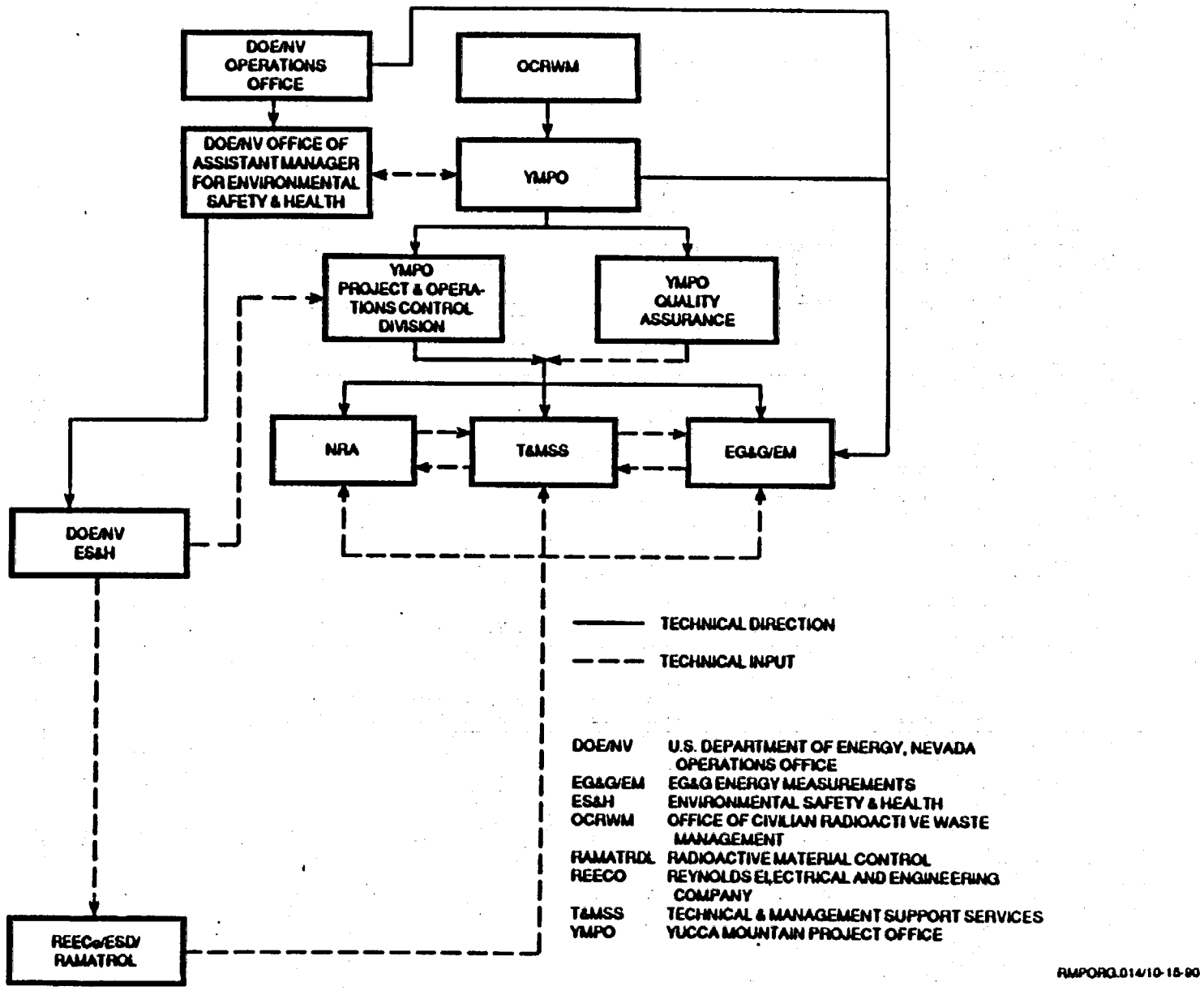


Figure 2-1. Environmental radiological monitoring activities organization chart.

1i. Budget and staffing requirements.

1j. Planning and scheduling of expected activities.

1k. Project Office authorization to initiate the expected activities.

Task 2 can also be broken into various subtasks:

2a. Procurement of required equipment.

2b. Procurement of outside services.

2c. Personnel training (procedures and equipment operation).

2d. Field data collection.

2e. Laboratory analyses.

2f. Field instrument calibration/accuracy checking.

2g. Preparation of quality control samples.

The balance of the tasks are essentially self-explanatory, with the exception of Task 6 (program revision), which is discussed in Section 7.2.

2.1 SUPPORTING ORGANIZATIONS

During site characterization, the primary organizations in this program will be the Project Office, the T&MSS Contractor (SAIC), and EG&G/EM. Other groups that will be organizations or provide needed support include the DOE/NV Office of Environment, Safety, and Health (DOE/NV-ESH); the EPA Office of Radiation Programs (ORP) (in Las Vegas, Nevada); REECo (the prime contractor at the NTS); DOE/NV; and the State of Nevada. Details of the management of this program are addressed in the EMP (DOE, 1990b).

2.1.1 YUCCA MOUNTAIN PROGRAM OFFICE

The Project Office, particularly the Project and Operations Control Division, has primary management responsibility for the entire radiological monitoring program. The program, future revisions to the program, the budget and schedule for implementation of the program, and the report issued by the program will have to be approved by the Project Office.

2.1.2 TECHNICAL AND MANAGEMENT SUPPORT SERVICES CONTRACTOR

The T&MSS Contractor has primary responsibility for implementation of the radiological monitoring program as indicated in the tasks in Section 2.1 The T&MSS Contractor is completing Task 1 with support from EG&G, DOE/NV-ESH, and the Project Office. The T&MSS Contractor will also implement Task 2, although subcontractors will be used for most of the analytical activities. Note: The T&MSS Contractor has primary responsibility for the radon monitoring program, and will have primary responsibility for the other major tasks (with significant support from EG&G). The T&MSS Contractor will also arrange through the Project Office for support facilities in Area 25.

2.1.3 DOE/NV OFFICE OF ENVIRONMENT, SAFETY, AND HEALTH

The DOE/NV-ESH provides support to the Project Office in implementing radiation safety requirements for the worker, the public, and the environment at the NTS. The DOE/NV-ESH will review the RADMP, all technical procedures, and all reports associated with the program to ensure RADMP activities comply with the standards, requirements, and guidance established by the DOE/NV-ESH, and to ensure minimal impact of the program on other DOE programs. In addition, the organizations in the radiological monitoring program will comply with all applicable DOE/NV-ESH standards and requirements.

2.1.4 EG&G/ENERGY MEASUREMENTS

EG&G/EM, as the Project and the Nevada Test Site Operations Office (NTSO) technical expert in the biological sciences, will be a organization in Task 1; Subtasks 2a, 2b, 2d, 2g; and Tasks 4, 5, and 6 (Section 2.1) with support from T&MSS. The area of participation is associated with the collection and evaluation of biota samples from the environment.

2.1.5 ENVIRONMENTAL PROTECTION AGENCY/LAS VEGAS OFFICE OF RADIATION PROGRAMS

The ORP has agreed to assist the T&MSS team in the preparation of quality concern (QC) control samples and the calibration of equipment for radon monitoring. This activity is consistent with their basic function within the EPA.

2.1.6 REYNOLDS ELECTRICAL AND ENGINEERING COMPANY

REECo is the prime contractor for the NTS. As such, REECo provides the general support services at the NTS. REECo will provide the support services to these radiological monitoring activities, including RAMATROL, general health physics control, emergency support, maintenance, and other services.

2.1.7 DOE NEVADA OPERATIONS OFFICE

The DOE/NV is the organization responsible for NTS operations. The radiological monitoring program will comply with all applicable NTS and DOE/NV requirements and standards. The radiological monitoring program will, through the Project Office, request the DOE/NV to obtain required NTS support services and approvals for the RADMP field activities.

2.1.8 STATE OF NEVADA

It is hoped that the State of Nevada, in the form of the Agency for Nuclear Projects, Nuclear Waste Project Office, or Nevada State Division of Health, may be a organization in this program. Details of this participation have not yet been established. When such details are available, this section will be revised to describe the State's participation. The State of Nevada has been offered an opportunity to be a organization in all monitoring activities consistent with program requirements.

In addition, the local county health officers have been offered the opportunity to observe these activities and/or receive the information generated as a result of these activities.

2.2 ORGANIZATION OF THE RADIOLOGICAL MONITORING PLAN

The radiological monitoring plan activities is broken into 3 basic tasks. One task is field data collection, which is addressed in Section 4.0. The second task is the collection of other supporting data, which is addressed in Section 5.0. The third task is data assessment and analysis, which are addressed in Section 6.0.

The RADMP has eight major parts: Section 1 provides introductory remarks and establishes the framework of the document. Section 2 provides a general discussion of the regulatory and control framework for the document. Section 3 provides a general discussion of the technical requirements and guidance mandating completion of the radiological monitoring activities discussed in the document. Section 4 provides criteria for and a general discussion of the radiological field monitoring activities and the activities related to the requirements in Section 3. Section 5 identifies nonmonitoring data required to support resolution of the issues and discusses how these data will be collected. Section 6 sets the forth the radiological analytical techniques used in collecting data for the resolution of the issues in the issues hierarchy. Sections 7 and 8 address administrative concerns and their resolution within the program. A listing of acronyms and abbreviations, and a glossary for the text are found at the end of the document.

3.0 RADIOLOGICAL COMPLIANCE

Under the requirements of the NWPA of 1982 (NWPA, 1983) as amended (NWPAA, 1987) and Presidential decisions, the DOE is required to site, construct, operate, and decommission a geologic facility for the disposal of commercial and defense high-level radioactive waste, including spent fuel (SF).

Other regulations and requirements are based on criteria established by the NRC (10 CFR Part 60), EPA (40 CFR Part 191), DOE (10 CFR Part 960), and DOE Orders. The State and Indian Tribes, in addition to their rights for consultation and cooperation, enforce certain Federal or State regulations. The applicable regulations, requirements, and guidance that drive the collection and use of radiological monitoring data for this program during the various phases of the Project are addressed in the following sections. The final section addresses how this document fits into the document hierarchy of the Project to support compliance with the applicable regulations and requirements.

The radiological monitoring and data collection activities at Yucca Mountain are intended to

1. Verify that adequate protection of the radiological health and safety of the public and workers and the environment is provided.

2. Support analyses to demonstrate with reasonable assurance that any impact on the health and safety of the public and workers or on the environment are within acceptable limits.

3. Provide data required for the completion of required program documentation (e.g., the Final Environmental Impact Statement (FEIS), SAR, Environmental Monitoring and Mitigation Progress Reports, and annual radiological environmental reports).

4. Provide data needed to demonstrate compliance with applicable requirements for design, construction, and operational activities.

5. Maintain consistency with existing NTS activities, thereby minimizing any potential conflicts and maximizing any potential benefits.

6. Allow for the detection and quantification of unplanned releases of radioactive materials.

7. Verify the accuracy of onsite radiological monitoring systems and release estimates (by comparing the analysis of the dispersion of release estimates with far-field actual field monitoring data to determine if they are consistent).

8. Establish radiological baseline data for the site during site characterization, and monitor the impacts of site characterization activities.

9. Monitor the impact of construction on the baseline until initiation of the preoperational radiological monitoring program.

10. Verify the baseline conditions existing just before operation, which will be done in the preoperational radiological monitoring program.

11. Monitor the impact of the full facility operations, if implemented, as specified in the Operational Radiological Monitoring Plan (to be issued).

12. Monitor the site to assess the impact of decommissioning and verify the effectiveness of the decommissioning process.

13. Monitor (long-term) the facility after closure to verify repository performance.

14. Comply with appropriate technical and scientific guidance, standards, historical precedent, and practices.

3.1 REGULATORY APPLICABILITY

3.1.1 SITING

The activities associated with siting occur in the period preceding the license application (LA). A list of these activities follows:

1. Data are collected to monitor the impacts of site characterization (DOE, 1988c).

2. Data are collected to satisfy requirements identified in the SHP (DOE/NV, 1990) to support siting preparation of the SAR (and other Project documents) and the EMP (DOE, 1990b).

3. Radiological data are collected and analyses performed to determine compliance with applicable regulations and requirements.

4. Radiological data are collected and analyses performed to assist facility design.

The primary regulatory authority during this phase is the DOE. Data collected in accordance with the RADMP will be controlled in a manner consistent with the Project Office QA and regulatory guidelines and requirements for ERM activities. Consideration of future NRC regulatory guidelines will allow inclusion of these data in a data base to support licensing, National Environmental Policy Act (NEPA), and SAR activities. The applicable

radiological protection regulations (public, worker, and environmental) will be addressed and summarized in the Environmental Regulatory Compliance Plan (ERCP) (DOE, 1988a). The applicable radiological protection (not related to environmental protection) requirements and regulations are addressed in the balance of this Section. Note that the NWPA exempts site characterization activities from formalized documentation requirements of NEPA of 1969 (Public Law 91-190) (NEPA, 1969). Instead, the NWPA has been interpreted to require monitoring and mitigation of adverse significant impacts to ensure there is minimal impact from siting-related Project activities.

3.1.2 CONSTRUCTION

Before construction of a repository can commence, an LA must be submitted to, and construction authorization received from, the NRC. Until a license to receive and possess has been issued, the DOE will remain the primary regulatory authority for overall radiological/environmental protection and safety activities, except as indicated in construction authorization constraints. The NRC will become the regulatory authority for facility construction activities through the construction authorization.

3.1.3 OPERATION

If Yucca Mountain is approved and licensed, then the operations phase will need to be addressed. When the NRC licenses the repository to receive high-level waste (HLW), the NRC regulations, 10 CFR Part 21 and 10 CFR Part 60, become applicable. Additional requirements may be included in the license as technical specifications. At this point, the NRC will have primary regulatory authority over all activities. With the exception of the NRC's enforcement authority (10 CFR Part 21), the regulatory environment will be essentially unchanged in any other way. In addition, the implementation of the Clean Air Act will fall under Subpart I of 40 CFR Part 61 and may require reporting to the State, the NRC, and directly to the EPA depending on the statutory requirements in existence at the time. At this time any requirements relative to the Safe Drinking Water Act (SDWA) must be implemented, based on resolution of the regulatory requirements discussed in the ERCP (DOE, 1988a).

3.1.4 PERMANENT CLOSURE AND DECOMMISSIONING

When the NRC authorizes the permanent closure and decommissioning of the Yucca Mountain site, the technical specifications will be modified to reflect the requirements of the decommissioning plan. With the exception of the change in technical specifications, the regulatory requirements will be essentially the same.

3.1.5 POSTCLOSURE

If a repository is built at Yucca Mountain, then the postclosure monitoring phase will need to be addressed. If the NRC license is terminated after the facility is decommissioned, authority will revert to the DOE or, if so determined, to the State of Nevada. If the State of Nevada takes over responsibility, State of Nevada law and the requirements of the legal agreement between the DOE and the State of Nevada will control site activities. Presently, the regulatory environment for this phase is still being developed by other Project organizations, the DOE, the State, the Tribes, and the NRC.

3.2 Yucca Mountain Site Characterization Project REQUIREMENTS

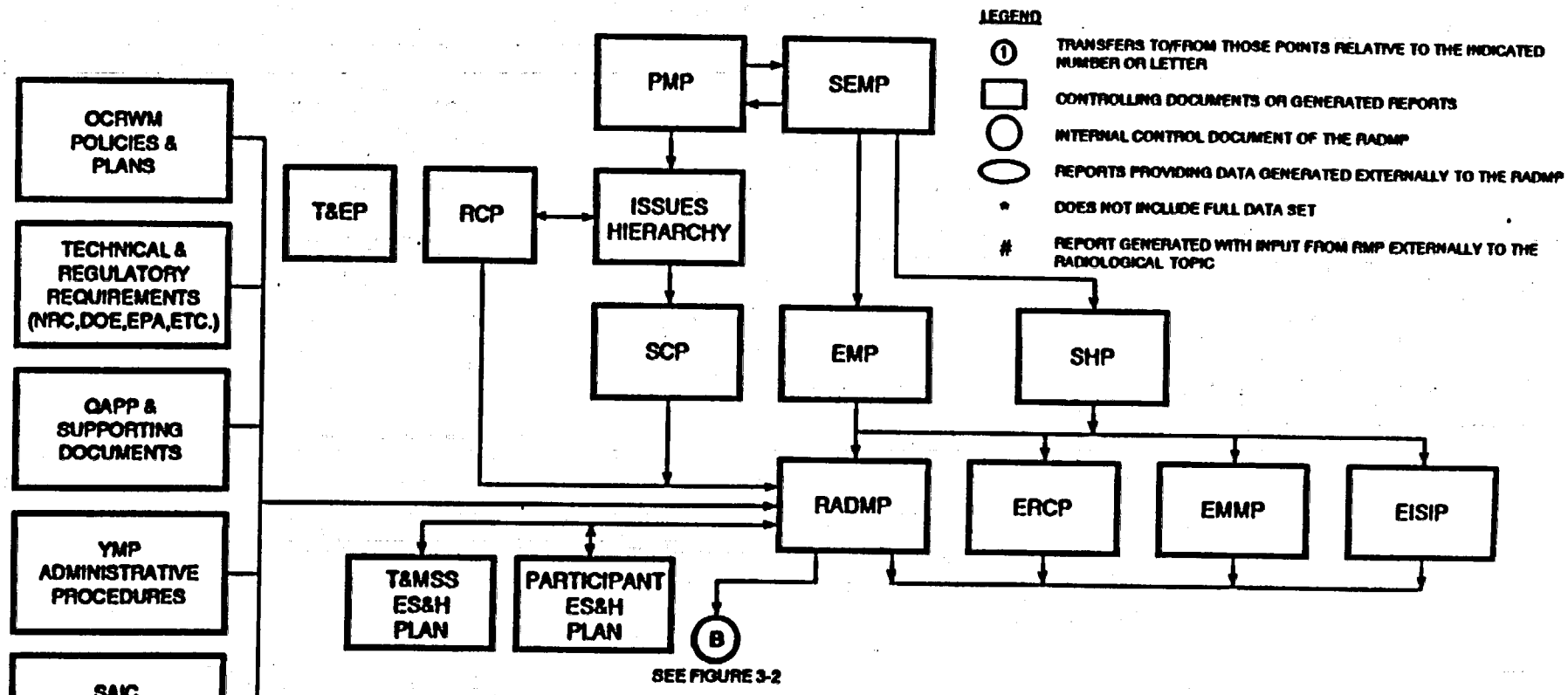
As part of the implementation of the NWPA, the Project has (or will develop) various plans to control Project activities and ensure compliance with the provisions of the NWPA and applicable regulations. The Project document hierarchy for the activities discussed in the RADMP is illustrated in Figures 3-1 and 3-2, with 3-2 providing details on the implementation and supporting documents of the RADMP. The various phases are controlled by different internal documents. The hierarchy shown is for the siting and construction phase. Limited documentation has been identified for later phases. This documentation will be discussed in later revisions of the RADMP.

3.2.1 SITE CHARACTERIZATION AND CONSTRUCTION

The specific plans and documents controlling activities during site characterization and construction are shown in Figure 3-2, although during construction the NRC construction authorization may also provide specific requirements. The RADMP-generated and related documentation is shown in Figure 3-2. The nonradiological technical reports providing input to future RADMP reports are illustrated in Figure 3-3. The primary controlling documents are the SHP (DOE/NV, 1990), the SCP (DOE, 1988b) and the EMP (DOE, 1990b). No NEPA documentation is required for the site characterization and construction phase. Each of the "input documents" specifies data requirements that are provided by this plan. The other documents, which contain technical requirements or constraints on activities to ensure compliance with applicable regulations, orders, and guidance, are also included in this figure.

3.2.2 OPERATION

During this phase, the specific plans and documents controlling activities will be the EIS and LA as shown in Figure 3-4.



DEIS	DRAFT ENVIRONMENTAL IMPACT STATEMENT
DERE	DESCRIPTION OF EXISTING RADIOLOGICAL ENVIRONMENT
DOE	U.S. DEPARTMENT OF ENERGY
EFAPRS	ENVIRONMENTAL FIELD ACTIVITY PLAN FOR RADIOLOGICAL STUDIES
EIS	ENVIRONMENTAL IMPACT STATEMENT
EISIP	EIS IMPLEMENTATION PLAN
EMP	ENVIRONMENTAL MANAGEMENT PLAN
EMMP	ENVIRONMENTAL MONITORING AND MITIGATION PLAN
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPASS	ENVIRONMENTAL PATHWAYS ANALYSIS SCOPING STUDY
EPIP	ENVIRONMENTAL PROTECTION IMPLEMENTATION PLAN
ERCP	ENVIRONMENTAL REGULATORY COMPLIANCE PLAN
ERMTP	ENVIRONMENTAL RADIOLOGICAL MONITORING TRAINING PROGRAM
ES&H	ENVIRONMENT, SAFETY, AND HEALTH
ESHD	ENVIRONMENT, SAFETY, AND HEALTH DOCUMENT
IMS	INFORMATION MANAGEMENT SYSTEM
LA	LICENSE APPLICATION
MMP	METEOROLOGICAL MONITORING PLAN
NRC	NUCLEAR REGULATORY COMMISSION
OCRWM	OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
PMP	PROJECT MANAGEMENT PLAN
PSCRMP	PRELIMINARY SITE CHARACTERIZATION RADIOLOGICAL MONITORING PLAN
QAPD	QUALITY ASSURANCE PROGRAM DOCUMENT
QAPP	QUALITY ASSURANCE PROGRAM PLAN (T&MSS)
RADMP	RADIOLOGICAL MONITORING PLAN
RCP	REGULATORY COMPLIANCE PLAN
RESMP	RADIOLOGICAL ENVIRONMENTAL AND SAFETY MONITORING IMPLEMENTATION PLAN
RMIM	RADIOLOGICAL MONITORING INSTRUCTION MANUAL
RMDS	RADIOLOGICAL MONITORING DATA SUMMARY
SAIC	SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SAR	SAFETY ANALYSIS REPORT
SCP	SITE CHARACTERIZATION PLAN
SEMP	SYSTEMS ENGINEERING MANAGEMENT PLAN
SENFCA	SURVEY AND EVALUATION OF NUCLEAR FUEL CYCLE ACTIVITIES
SHP	YMP SAFETY AND HEALTH PLAN
T&EP	TEST AND EVALUATION PLAN
T&MSS	TECHNICAL AND MANAGEMENT SUPPORT SERVICES CONTRACTOR
YMP	YUCCA MOUNTAIN PROJECT

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Figure 3-1. Site characterization document hierarchy.

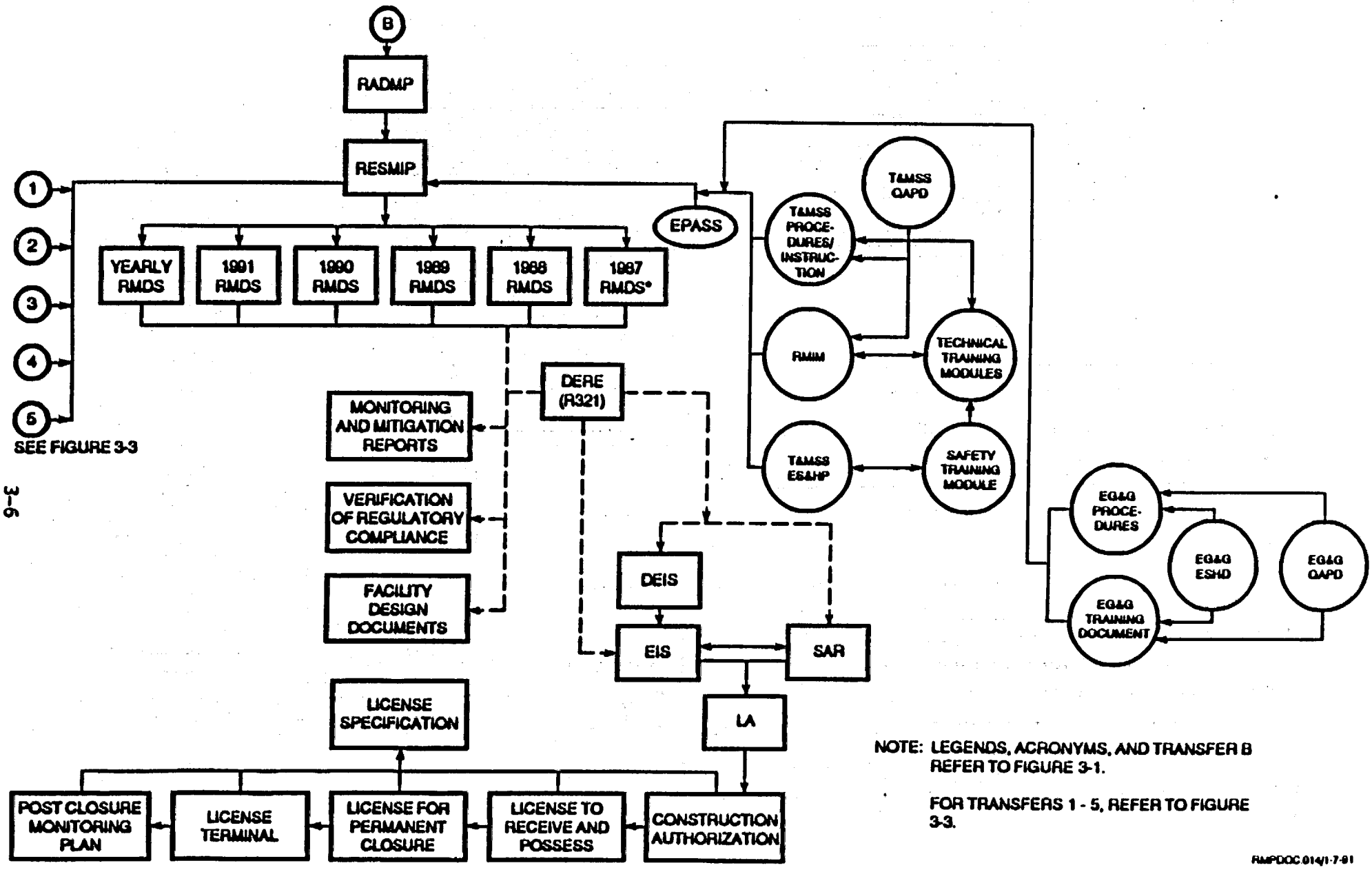

Figure 3-2. Radiological Monitoring Plan documentation.

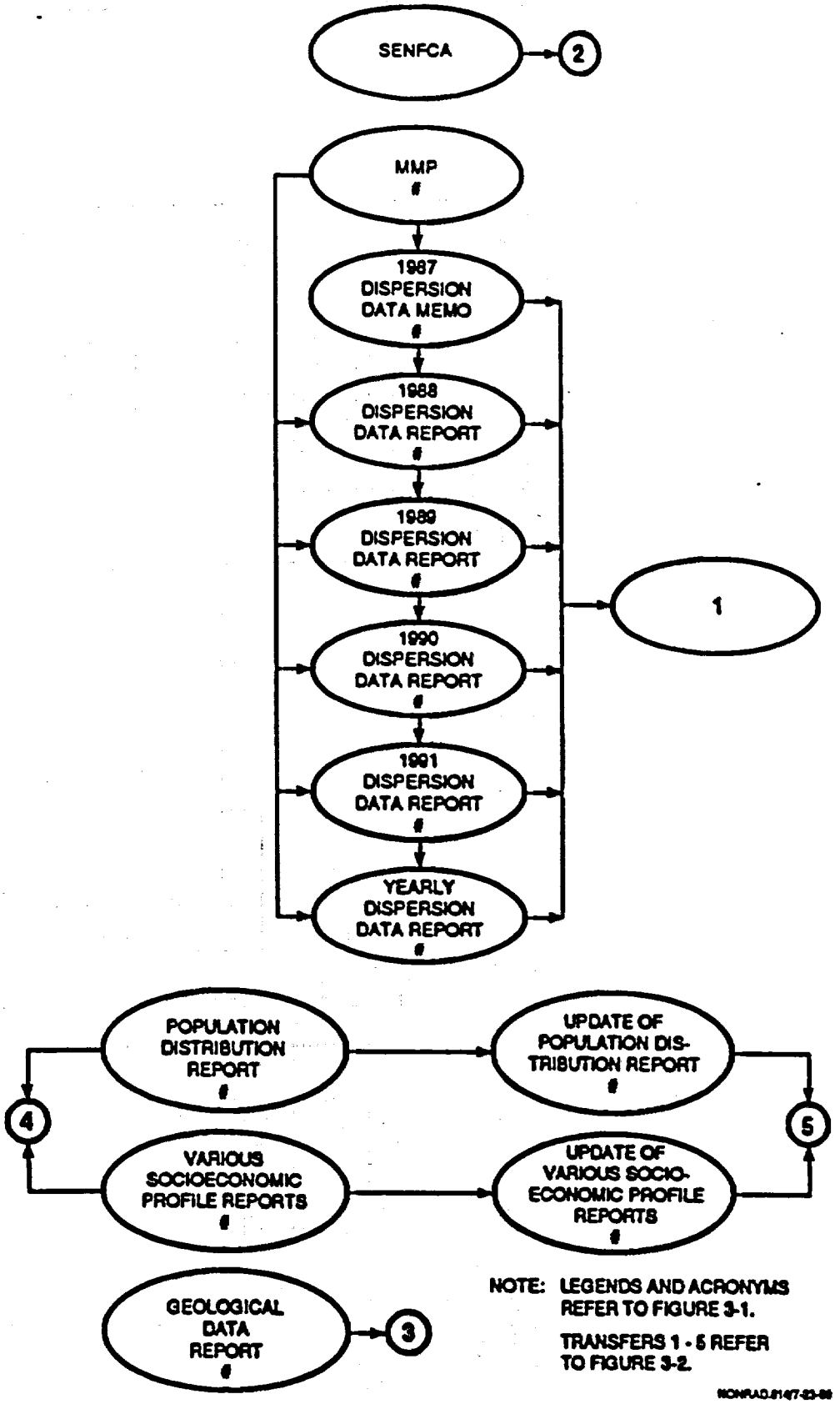

Figure 3-3. Nonradiological supporting technical reports.

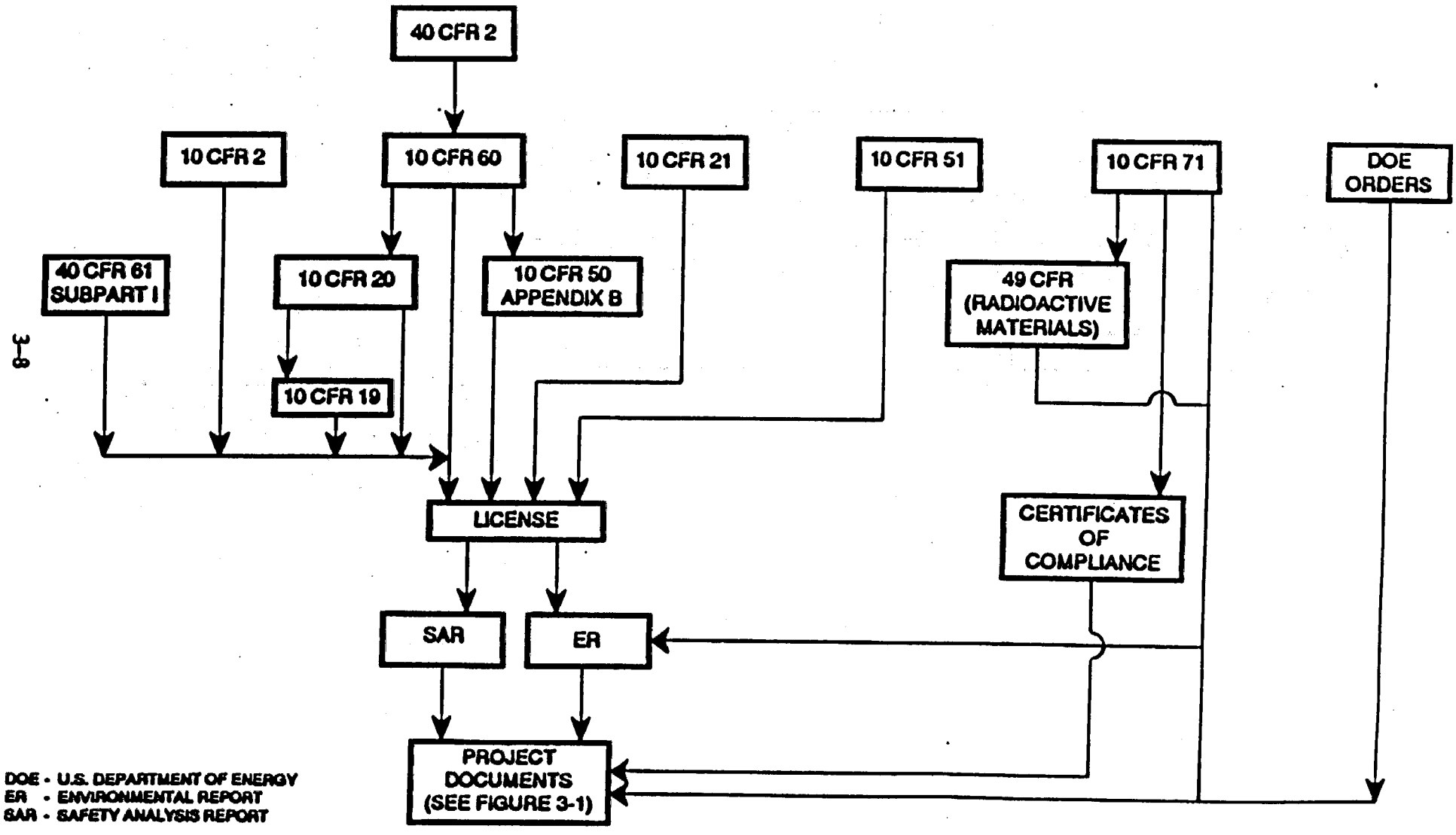

Figure 3-4. Document hierarchy for operations.

3.2.3 PERMANENT CLOSURE AND DECOMMISSIONING

During this phase, revisions to incorporate the decommissioning plans will be made to the controlling documents issued during operations; except for these revisions, the structure will remain basically the same.

3.2.4 POSTCLOSURE MONITORING

Responsibility, requirements, and control for the postclosure monitoring phase are presently not well-defined. As information becomes available, it will be added to this section.

3.3 REGULATORY AND OTHER REQUIREMENTS

This section addresses the various requirements that establish the need and content of the radiological monitoring program. The various regulatory requirements are discussed in the ERCP. The balance of this section addresses the other requirements.

The environmental impact assessment activities use the monitoring data to assess the impact of Project activities on the environment and the health and safety of the workers and the public. The activities will be atypical since this information is for a repository where both the period of interest (about 10,000 years) and the release pathways of interest are substantially longer than is characteristic of other nuclear facilities. The perceived hazards associated with the facility, as indicated by the political and public interest in this siting, are substantially greater than the actual hazards, which are minimal (DOE, 1986b). The perceived hazards must be addressed to the extent practicable, and increased monitoring activities may be necessary. Another atypical characteristic is a significant potential for a time-dependent radiological background in the Yucca Mountain area from past NTS activities. This is because activity is constantly moving from other areas into and out of the area of interest, since there are man-made sources of activity in the surrounding area.

The basic precepts under which the radiological monitoring program was developed are to

1. Meet or exceed all NWPA, NRC, EPA, and DOE requirements for this activity.

2. Collect all environmental radiological data required to support Project activities.

3. Produce and implement a program consistent with existing NTS environmental monitoring programs.

4. Minimize any potential impacts on other DOE activities in the area.

5. Monitor a sufficient range of parameters to identify any build-up, trends, or unexpected effects in the environment.

The following sections provide detailed descriptions of the requirements and scope of this program for each of the eight Project phases mentioned in Section 1.0.

The controlling documents for the Project are the Project Management Plan (PMP) (DOE/NV, 1987a), the Configuration Management Plan (CMP) (DOE, 1989), and the Systems Engineering Management Plan (SEMP) (DOE/NV, 1987b). However, the needs addressed by the RADMP are specifically identified in the Project Issues Hierarchy (DOE, 1986b) and the Regulatory Compliance Plan (RCP) (NNWSI Project, 1988), two Project documents shown in Figure 3-1.

3.3.1 REQUIREMENTS FOR MONITORING

The monitoring requirements and regulations related to environmental protection are addressed in the ERCP (DOE, 1988a).

The NWPA as amended (NWPAA, 1987) mandates that the DOE obtain a license for its commercial repository operations. To support this licensing process, the radiological monitoring program will comply with available NRC requirements and guidance. The DOE will also issue requirements and guidance, which must be met before the filing of the LA. Corley et al. (1981) and Walker (1987) are recommended as appropriate guidance by both the NRC and DOE, and this section relies on those documents as the primary source of the technical justification for the selection of radiological monitoring methodologies. The technical basis presented in these sections is primarily a paraphrase of this DOE guidance.

3.3.1.1 Site characterization

The environmental data collected during the site characterization phase may be used to assist in establishing the baseline environmental radiological condition, monitoring the impacts of site characterization activities, completing Project activities and facility design, and demonstrating regulatory compliance.

Another important reason for a comprehensive RADMP, beyond the regulatory compliance requirements specified in the ERCP (DOE, 1988a), is that it is simply good operational practice. Such a program will provide data for the following:

1. Evaluation of the adequacy and effectiveness of the containment and effluent control systems applied to facilities and operations at the site.

2. Detection of rapid changes and evaluation of long-term trends of concentrations in the environment, with the intent to (a) detect failure or lack of proper control of releases, and (b) initiate appropriate actions.

3. Assessment of the actual or potential doses to man from radioactive materials or radiation released to the environment as a result of DOE operations, or the estimation of the probable limits of such doses.

4. Collection of data bearing on the history of contaminants released to the environment, particularly with the intent of ensuring that the Project analyses did not fail to consider all appropriate pathways, synergistic effects, and modes of exposure.

5. Maintenance of a data base and capabilities for rapid evaluation and response to unusual releases of radioactivity.

6. Detection and evaluation of radioactivity from offsite sources to distinguish and compare the results of site operations.

7. Demonstration of compliance with applicable regulations and legal requirements concerning releases to the environment.

Furthermore, by gathering environmental radiological baseline data before the introduction of radioactivity into a new facility, any existing radiological impact can be correctly attributed. Otherwise, when activities that alter the baseline occur, it may not be possible to demonstrate the source of any radioactivity found outside the facility. By default, the facility would be presumed responsible. Correct attribution of responsibility may significantly reduce future costs and other impacts that could result from incorrectly assuming the source of the release to be the Yucca Mountain facility.

3.3.1.2 Construction

3.3.1.2.1 General

The radiological regulatory requirements applicable to construction remain essentially unchanged from those discussed in Section 3.3.1.1, except for those resulting from the NRC regulation of construction activities through issuance of a construction authorization. The NRC may also regulate other activities through specific conditions placed on the LA. There are no specific requirements for further collection of environmental radiological baseline data before initiation of the preoperational radiological monitoring program, since the required data for the EIS have been collected. However, a limited amount of data will be taken throughout this period to (1) verify compliance with applicable regulations; (2) establish a link between the site characterization data and preoperational monitoring data; and (3) verify the trends in the background variations, if any, identified during the site characterization phase.

3.3.1.2.2 Preoperational monitoring

In addition to the requirements in Section 3.3.1.2.1, the environmental radiological baseline must be verified before initiation of operation. This verification is mandated by DOE Order 5484.1, Chapter III, Section 1 (DOE, 1987b). Currently, there are no requirements specified by the NRC for this kind of mined geologic repository program; however, past NRC practice requires collection of an environmental radiological baseline for all major activities. Examples of such requirements are Regulatory Guide 4.1, Section B, for nuclear power plants (NRC, 1975); and Regulatory Guide 4.14, Section B, for uranium mills (NRC, 1980).

3.3.1.3 Operations

When a license to receive and possess is granted to the DOE (operations phase), the NRC becomes the primary regulatory authority. DOE Orders become internal requirements that may still be implemented. There is also a change to implementation of Subpart I of 40 CFR Part 61 (Clean Air Act) rather than Subpart H. This is essentially a change in the reporting system. In addition, a program must be implemented consistent with the SDWA discussed in the ERCP.

When operations are initiated, the operational environmental radiological monitoring program is implemented. The program is similar to the preoperational program, except the scope is typically reduced after the first year of operation and the environment is well-characterized.

The reduced-scope program is intended to provide a check on normal operations when facility activity has normalized following startup. In the event of actual release, the scope of the program will increase substantially.

The program is an outgrowth of the regulations and other requirements and guidance issued by the DOE and the NRC. Specifically, the operational program is based on the following:

1. DOE Order 5480.11 (DOE, 1988f).
2. DOE Order 5400.5, (DOE, 1990a).
3. The NRC guidance in 10 CFR 60.131(a)(4).
4. The NRC guidance in Regulatory Guides for similar facilities, and those issued for this type of facility.
5. Corley and Corbit (1982) and Walker (1987) with the guidance recognized by both the DOE and the NRC.

3.3.1.4 Decommissioning

The monitoring requirements during the decommissioning phase are unlikely to differ very much from those for the operations phase (Section 3.3.1.3). However, specific activities in such a program would be revised to reflect (1) the change in activities; (2) compliance with the NRC licensing amendment allowing decommissioning; (3) provision of sufficient data to verify adequacy of the decommissioning activities to the NRC, thereby permitting the NRC to terminate the license (10 CFR 60.52 and 10 CFR 60.5); and (4) compliance with other applicable requirements promulgated before the decommissioning activities were initiated.

3.3.1.5 Postclosure monitoring

Monitoring of the decommissioned facility is required for a period of time to be determined. This monitoring cannot impact the integrity or reliability of the repository. The exact program and program organizations have yet to be established. It is possible the program may be implemented by the DOE, the NRC, or some other outside agency, such as the EPA or the State. The monitoring is mandated in 40 CFR 191.14(b) and 10 CFR 60.51(a)(1). The data gathered throughout the program on the radiological conditions at the site, including any variations in the baseline values, will be used to develop this monitoring program.

3.3.2 PROJECT-GENERATED REQUIREMENTS AND COMMITMENTS

The controlling documents for the Project are the PMP (DOE/NV, 1987a), the CMP (DOE, 1989), and the SEMP (DOE/NV, 1987b). However, the needs addressed by the RADMP are specifically identified in the Project Issues Hierarchy (DOE, 1986b) and the RCP (NNWSI Project, 1988), two Project documents shown in Figure 3-1.

3.3.2.1 Issues hierarchy

The general issues hierarchy is prescribed by the OCRWM (DOE, 1986b). Therein key issues "are defined as the questions relating to the performance of the site and design" that must be resolved to demonstrate compliance with the applicable Federal regulations (including 10 CFR Part 60, 10 CFR Part 960, 40 CFR Part 191, and 10 CFR Part 20). Four key issues comprise the programmatic issues hierarchy:

Key Issue 1: Will the mined geologic disposal system at [Yucca Mountain] isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 40 CFR Part 191, 10 CFR Part 60, and 10 CFR Part 960?...

Key Issue 2: Will the projected releases of radioactive materials to restricted and unrestricted areas and the resulting radiation exposures of the general public and workers during repository operation, closure, and decommissioning at [Yucca Mountain], meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, 10 CFR Part 960, and 40 CFR Part 191?...

Key Issue 3: Can the mined geologic disposal system at [Yucca Mountain] be sited, constructed, operated, closed, and decommissioned, and can the associated transportation system be sited, constructed, and operated so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?

Note: The site-specific issues under Key Issue 3 will be finalized after environmental program planning efforts are complete and after the EIS scoping hearings. The Project Issues Hierarchy will be amended at that time.

Key Issue 4: Will the construction, operation (including retrieval), closure, and decommissioning of the mined geologic disposal system be feasible at [Yucca Mountain] on the basis of reasonably available technology, and will the associated costs be reasonable in accordance with the requirements set forth in 10 CFR Part 960?

Under these key issues are various issues or programs. Each issue or program is further defined at the Project level by sets of information needs or investigations. Note that general issues and information needs refer to environmental issues, while programs and investigations refer to geotechnical site characterization activities.

The RADMP collects a very limited amount of data to support the resolution of Key Issue 1. The data collected will support resolution of the compliance with postclosure standards primarily in the first 1,000 years after closure, and primarily as related to the groundwater systems. These RADMP activities will be closely tied to the Environmental Field Activity Plan for Water Resources (to be issued) and the site characterization study plans for hydrologic studies. The issues in Key Issue 1 for which the RADMP collects data include the following:

1. Will the mined geologic disposal system meet the system performance objective for limiting radionuclide releases to the accessible environment as required by 10 CFR 60.112 and 40 CFR 191.13?

2. Will the mined geologic disposal system meet the requirements for limiting individual doses in the accessible environment as required by 40 CFR 191.15?

3. Will the mined geologic disposal system meet the requirements for the protection of special sources of groundwater as required by 40 CFR 191.16?

4. Will the waste package meet the performance objective for containment as required by 10 CFR 60.113?

5. Will the waste package and repository engineered barrier systems meet the performance objective for radionuclide release rates as required by 10 CFR 60.113?

6. Do the data collected in order to describe the present and expected geohydrologic characteristics provide the information required by the design and performance issues?

A major portion of the data collected in this document will be used to support resolution of the issues that support preclosure radiological safety and compliance with applicable radiation protection limits (Key Issue 2). Limited input is also supplied to the geochemistry program and to support the higher level of findings required by the siting guidelines related to this area in Key Issue 2. The issues in Key Issue 2, for which the RADMP collects data, include the following issues:

1. During repository operation, closure, and decommissioning, will (a) the expected average radiation dose received by members of the public within any highly populated area be less than a small fraction of the allowable limits and (b) the expected radiation dose received by any member of the public in an unrestricted area be less than the allowable limits as required by 10 CFR 60.111, 40 CFR 191 Part A, and 10 CFR Part 20?

2. Can the repository be designed, constructed, operated, closed, and decommissioned in a manner that ensures the radiological safety of workers under normal operations as required by 10 CFR 60.111 and CFR Part 20?

3. Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestricted area, or workers in the restricted area, in excess of applicable limiting values?

4. Have the characteristics and configurations of the repository been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.130 through 60.133 and (b) provide information for the resolution of the performance issues?

The population density and distribution program discussed in the SCP (DOE, 1988b) will collect the following information to support the resolution of the previous issues:

1. Forecasts of the population of general public/members of the public in any highly populated area and in potential unrestricted areas during operation and closure; and forecasts of population in areas needed to assess public radiation exposures (Section 6 of the RADMP).

2. Forecast of the number of workers during operation and closure, in potential restricted and unrestricted areas (Section 6 of the RADMP, the Conceptual Design Report (SNL, 1987), and future design reports).

The meteorological program will provide the following:

1. Meteorological conditions in the vicinity of the site (the Meteorological Monitoring Plan (DOE/NV, 1989b) and Section 6 of the RADMP).

2. Atmospheric and meteorological phenomena at potential locations of surface facilities (the Meteorological Monitoring Plan (DOE/NV, 1989b) and Section 5 of the RADMP).

3. Location of population centers relative to wind patterns in the general region of the site (the Meteorological Monitoring Plan (DOE/NV, 1989b) and Section 5 of the RADMP).

4. Support data for assessing the potential impacts of nearby installations and operations (Section 4 of the RADMP with monitoring details in Section 4.3).

And, finally, the offsite installations program indicates the need for:

1. Collection of agricultural data required by the design and performance issues (Section 5 of the RADMP).

2. Collection of cultural data required by the design and performance issues (Section 6 of the RADMP).

The information needs associated with Key Issue 3 will not be finalized until the EIS Scoping Hearings are completed; however, as currently planned, the data to be collected include:

1. Potential levels of radionuclides and doses to which regional populations will be exposed for normal and accidental conditions, and their potential effects (Sections 4, 5, and 6 of the RADMP).

2. Potential for environmental and transportation-related impacts to the natural resources, flora, and fauna (outlined in the environmental characterization issues) and to the public health and safety that cannot be mitigated or otherwise avoided (Sections 4, 5, and 6 of the RADMP).

3. A detailed description of all sources of radioactivity associated with normal operations and expected operational occurrences (Section 4 of the RADMP relative to currently existing sources).

4. A detailed description of all onsite and offsite environmental effluent monitoring systems (Section 4 of the RADMP).

5. A detailed description of all solid, liquid, and gas effluents and emissions and associated waste processing systems, including a list of all EPA designated hazardous chemicals to be used at the site (Section 4 of the RADMP for radiological effluents).

6. Present expected levels of background radiation (Section 4 of the RADMP).

Furthermore, a detailed schedule of major site-related milestones and activities from the initiation of site activities through construction and decommissioning to the end of the post-surveillance period, including transportation, must be developed (Sections 1 and 7.1 of the RADMP). The data collected in the radiological monitoring activities and associated analyses will also provide limited support to the resolution of other issues addressed by key issues when finalized.

3.3.2.1.1 Site Characterization Plan

Each of the issues and information needs for Key Issues 1, 2, and 4 are addressed in the SCP (DOE, 1988b). Resolution of the information needs related to radiological monitoring activities is addressed in the RADMP. The RADMP provides either (1) a detailed discussion of the justification and implementation of the activities, or (2) a justification for activities conducted by others to provide required data (Section 6). The data collection mandated by this document will support preparation of the Project Site Suitability Report, EIS, SAR, and other documents.

Table 3-1 presents the data required, as well as the SCP section providing the information.

3.3.2.1.2 Safety and Health Plan

The SHP (DOE/NV, 1990) is Annex 3 of the PMP (DOE/NV, 1987a), as required in DOE Order 4700.1, "Project Management System" (DOE, 1987d). This plan specifies the requirements for the Project safety and health protection implementation program. This document is implemented by (1) various Project-level procedures, (2) lower tier documents (i.e., the RADMP), and (3) various organization safety and health plans. The SHP defines the minimal acceptable program in the area of safety and health protection required to implement the DOE Orders.

Table 3-1. Site Characterization Plan data requirements (page 1 of 2)

Data requirement	SCP section
METEOROLOGICAL DATA	
Wind speeds	8.3.1.12.1, 8.3.1.12.2
Wind direction	8.3.1.12.1, 8.3.1.12.2
Atmospheric stability	8.3.1.12.1, 8.3.1.12.2
Mixing layer depth	8.3.1.12.1, 8.3.1.12.2
Average ambient temperature	8.3.1.12.1, 8.3.1.12.2
Atmospheric moisture	8.3.1.12.1, 8.3.1.12.2
Barometric pressure	8.3.1.12.1, 8.3.1.12.2
Precipitation type, amount, intensity, etc.	8.3.1.12.1, 8.3.1.12.2
Size and distance of topographic features from release points	8.3.1.14.1
Meteorological data for offsite installations	8.3.1.12.1, 8.3.1.12.2
AGRICULTURAL DATAa	
Bioaccumulation of radionuclides in terrestrial flora	8.3.1.13
Bioaccumulation of radionuclides in terrestrial fauna	8.3.1.13
Types and amounts of crops raised	8.3.1.13
Types and amounts of crops consumed locally	8.3.1.13
Types and amounts of animals raised	8.3.1.13
Types and amounts of animals consumed locally	8.3.1.13
Animal consumption of forage locally	8.3.1.13

Table 3-1. Site Characterization Plan data requirements (page 2 of 2)

Data requirement	SCP section
Forage storage time	8.3.1.13
Grazing yield and period	8.3.1.13
Radius of crop and animal area	8.3.1.13

[a]Collection of these data is part of the planned activities in the Radiological Monitoring Plan (RADMP), and is discussed in Section 8.3.1.13 of the SCP.

3.3.2.1.3 Environmental Protection Implementation Plan

The Environmental Protection Implementation Plan (EPIP) (DOE/NV, 1989a) provides the detailed summary of the implementation of DOE Order 5400.1, "General Environmental Protection Program (DOE, 1988e)," for the Project as required by the Order. This document provides information on the approach the Project implements to satisfy DOE requirements for environmental protection. This approach is implemented through the EMP (DOE, 1990b), Environmental Monitoring and Mitigation Plan (EMMP) (DOE, 1988c), ERCP (DOE, 1988a), RADMP, Reclamation Implementation Plan (to be issued), and the Hazardous Materials Management and Handling Program documents.

3.3.2.1.4 Environmental Management Plan

The U.S. Department of Energy (DOE) is committed to performing its activities in an environmentally safe and sound manner and will comply with all applicable environmental statutes and regulations. To fulfill this commitment, the DOE has established an environmental program for the Yucca Mountain site that plans and performs the activities necessary to satisfy applicable environmental regulatory and programmatic requirements. The environmental program is structured to satisfy the statutory requirements of the Nuclear Waste Policy Act as amended; the National Environmental Policy Act; the Atomic Energy Act; and other applicable statutes, regulations, and DOE Orders. The environmental program is integrated with other programs under the direction of the DOE Office of Civilian Radioactive Waste Management (OCRWM) to evaluate the Yucca Mountain site as a candidate site for a high-level radioactive waste repository. OCRWM environmental programmatic policy requirements (as described in the Mission Plan and Mission Plan Amendment) have also been incorporated into the environmental program.

The techniques used to manage the environmental program are described in this EMP (DOE, 1990b). Systems engineering methodology is used in all aspects of the Yucca Mountain Site Characterization Project, including the environmental program, as described in the System Engineering Management Plan (SEMP) and directed by the Project Management Plan (PMP). The EMMP (DOE, 1988c) and the ERCP (DOE, 1988a) have been developed to assure implementation of the applicable laws and regulations by the EMP activities.

Details on RADMP activities that address implementation of EMMP activities can be found in the Environmental Field Activity Plan (EFAP) for Radiological Studies (DOE, 1988d). This document addresses those activities specifically required as a result of monitoring and mitigation activities in a manner consistent with other Project EFAPs.

3.3.2.2 Regulatory Compliance Plan

The RCP (NNWSI Project, 1988) addresses the licensing-related regulations that apply to the Project and how they are to be implemented. The RCP or support document will summarize other applicable regulations, requirements, and guidance in this area, such as DOE Orders, State regulations, EPA guidance, National Council on Radiation Protection and Measurements (NCRP) guidance, and International Commission on Radiation Protection (ICRP) guidance.

3.3.3 INTERNAL REQUIREMENTS AND DIRECTION

In addition to the technical data needs discussed in Sections 3.3.1 and 3.3.2, these activities are controlled by:

1. OCRWM policies and plans.

2. The OCRWM QARD (OCRWM, 1990a), QAPD (OCRWM, 1990b), and supporting documents.

3. Yucca Mountain Site Characterization Project Office administrative procedures.

4. The Project Technical Data Management System (DMS) and Information Management System (IMS).

5. The Project SEMP (DOE/NV, 1987b).

6. SAIC administrative procedures and policies.

3.3.3.1 Office of Civilian Radioactive Waste Management policies and plans

OCRWM policies and plans establish the basic criteria for all Project activities interacting with the Project Office. The expected milestones for the RADMP are based on the Draft Mission Plan Amendment of January 1987 (DOE, 1987c). The RADMP also implements some of the applicable sections of the OCRWM Safety Plan (DOE, 1986c). The activities completed within the RADMP implement the requirements of the OCRWM QARD (OCRWM, 1990a).

3.3.3.2 Activity-specific quality assurance programs

Implementation of the OCRWM QARD (OCRWM, 1990a) depends on the implementing organization and is discussed below.

3.3.3.2.1 OCRWM Quality Assurance Requirements Document and supporting procedures

All activities implemented by the Project Office are subject to the requirements of the QARD (OCRWM, 1990a) as implemented by the OCRWM QAPD (OCRWM, 1990b) and applicable organization QAPDs (see Section 3.3.3.2.3 and 4).

3.3.3.2.2 OCRWM Quality Assurance Program Description Document and supporting procedures

All activities implemented by the Project Office are subject to the requirements of the QAPD (OCRWM, 1990b) which implements the OCRWM QARD (OCRWM, 1990a). Satisfaction of these requirements is based on the QA grading packages prepared for this activity, consistent with Project Office Administrative Procedure (AP) 5.28Q, Quality Assurance Grading (DOE, 1990c).

3.3.3.2.3 T&MSS Quality Assurance Program Document and supporting procedures

All activities implemented by T&MSS are subject to the requirements of the T&MSS QAPD (SAIC, 1990a) and supporting documents. NRA/EPA 's activities will be conducted in accordance with the T&MSS QAPD (SAIC,1990a). Satisfaction of these requirements is based on the QA grading packages prepared for this activity, consistent with Project Office AP 5.28Q, Quality Assurance Grading (DOE, 1990c).

3.3.3.2.4 EG&G Quality Assurance Program Document and supporting procedures

All activities implemented by EG&G/EM are subject to the requirements of the EG&G QAPD and supporting documents. Satisfaction of these requirements is based on the QA grading packages prepared for this activity, consistent with Project Office AP 5.28Q, Quality Assurance Grading (DOE, 1990c).

3.3.3.3 Yucca Mountain Site Characterization Project administrative procedures

All organization activities are subject to the requirements of the Project APs. Specific APs implement the Project-wide requirements specified in the SHP (DOE/NV, 1990).

3.3.3.4 Project Technical Data Management System and Information Management System

The data collection and reduction activities associated with the radiological monitoring program will be conducted in a manner consistent with the requirements of the DMS. All reports, plans, procedures, and other documents will be controlled, issued, and distributed in a manner consistent with the IMS and the policies and procedures addressed in Sections 3.3.3.2, 3.3.3.3, and 3.3.3.5.

3.3.3.5 Yucca Mountain Site Characterization Project Systems Engineering Management Plan

The SEMP (DOE/NV, 1987b) will ensure that these activities are consistent with Project-wide activities, needs of the various Project organizations, and needs of the Project as a whole. The APs outlined in the SEMP also require baselining (reference to establishing a controlled change system) of the requirements in the RADMP and control of changes to these requirements.

3.3.3.6 Safety and health plans

The details for implementation of the SHP (DOE/NV, 1990) for radiological program activities is provided in safety and health plan documents for the T&MSS contractor (SAIC) and EG&G/EM. The radiological monitoring activities are referenced to the RADMP, whereas the radiological safety activities are specifically addressed in the organization safety and health plan documents. These documents are typically implemented by procedures/instructions.

3.3.3.7 Administrative and technical procedures and policies

The activities in the RADMP are completed as specified in the RESMIP (to be issued), supporting documents, and the supporting organizations' procedures and instructions. The RMIM (SAIC, 1990b) contains most of these T&MSS instructions. The Safety Plan for Project Operations Department Field Activities (SAIC, 1986c) addresses the safety related requirements for T&MSS activities. This safety plan will shortly be replaced by the T&MSS Environment, Safety, and Health Plan (TESHP). Either these documents or equivalent documents will be applied by EG&G/EM. NRA/EPA shall follow the T&MSS documents in implementing Project activities.

3.3.4 IMPLEMENTATION DOCUMENTATION

Based on the requirements in Section 3.3, various documents were issued to control the radiological monitoring activity directly (Figure 3-1). The primary documents are the RADMP and the PSCRADMP (SAIC, 1987a). Further details addressing implementation of the RADMP will be addressed in the RESMIP when issued. The RESMIP will be a T&MSS document that provides implementation clarification for the RADMP.

3.3.4.1 Technical and Management Support Services activities

The requirements specified in these RADMP and the RESMIP are directly controlled by the RMIM (SAIC, 1990b); the Safety Plan for Project Operations Department Field Activities (SAIC, 1986c) for T&MSS activities; and the EMP, TESHP (when issued), and T&MSS QAPD (SAIC, 1990a). This includes specific training of personnel per the environmental radiological monitoring training program.

3.3.4.2 EG&G/Energy Measurements activities

These activities are conducted in a manner consistent with the RADMP and RESMIP. The technical activities are completed as specified in applicable EG&G/EM documents, procedures, and instructions.

4.0 THE RADIOLOGICAL MONITORING FIELD DATA COLLECTION ACTIVITIES

This section addresses the collection of radiological baseline data to satisfy the regulations, requirements, and guidance discussed in Section 3 per the SHP (DOE/NV, 1990). The program described is for the site characterization phase; the program for other phases will be detailed in later RADMP revisions. As well as establishing the radiological background, the proposed program will collect data necessary meet the following objectives:

1. Characterize the work environment at the site.

2. Estimate potential impact of past and future NTS activities on present safety analysis and design activities.

3. Assist facility design (SNL, 1987) and prepare safety analysis reports.

4. Monitor the impacts of site characterization activities on the surrounding environment.

5. Verify the feasibility of monitoring the environment for appropriate radionuclides.

6. Support decontamination and decommissioning of the facility.

7. Verify compliance with NRC, DOE, and NTS requirements.

8. Meet the requirements specified in the SHP (DOE/NV, 1990) in association with the Project APs and applicable safety and health plans for the organizations, particularly the TESHP (when issued).

9. Monitor radioactivity in the environment for trends indicating changes in the existing environment.

The RADMP will be revised, as needed. Specifically, a revision will be needed after the EIS scoping process is completed, to incorporate the environmental baseline data required for the EIS. The entire program will also be evaluated in terms of available data to determine if changes are justified. Several revisions currently planned are detailed in Section 7.2. Some of the data currently being collected may be identical to the data that will be identified during the EIS scoping process. All data will be collected in a manner allowing their use in establishing the EIS environmental baseline. Much of the program in the far-field (beyond 15 kilometers) area already exists as part of the ongoing activities for the EPA Nuclear Radiation Assessment (NRA) to support DOE defense program activities at the NTS. These data are available to the Project. All relevant sampling locations are noted in the RADMP, and any new locations added in support of the Project will be identified. All near-field locations are strictly related to the Project. The monitoring activities during site characterization are designed to characterize the environment and identify and quantify any impacts on it.

4.1 SCOPE OF THE RADIOLOGICAL MONITORING PROGRAM

Data will be collected for this program to satisfy the objectives listed in Section 4.0. Each objective is addressed separately.

4.1.1 CHARACTERIZATION OF THE WORKSITE ENVIRONMENT

Two characteristics of the worksite environment will be addressed in this section: (1) the existing radioactivity concentrations in the background environment at the site, and (2) the potential radon emission from the site.

4.1.1.1 Existing background

The existing radiation levels and radioactivity concentration in the general environment are not expected to have any significant impact on worker health and safety. The radiological monitoring program has been established to determine the validity of these assumptions.

Implementation of the RADMP will evaluate various potential exposure pathways to man:

1. Direct exposure to radiation.

2. The inhalation of resuspended radioactivity.

3. Worker and equipment contamination contribution to the pathways noted in Items 1 and 2.

4. Other indirect pathways such as ingestion of radioactivity.

The direct exposure pathway is not projected to be significant. Various NTS organizations have identified and posted (or decontaminated) contaminated areas. There are presently no posted areas at the Yucca Mountain site. To confirm the insignificance of the direct exposure pathway, an array of passive radiation monitors, TLDs, and gamma radiation monitors will be installed throughout the site to monitor direct radiation. The posted areas within Area 25, which is the base for the Project activities, are very limited in number and contain minimal activity.

Airborne activity has been sampled by a continuous air sampler at the 60-meter meteorological tower located near Yucca Mountain as described in the Meteorological Monitoring Plan (DOE/NV, 1989b). Samplers will be added as part of the radiological monitoring program implementation. Air sampling (Section 4.2.4) for the program will monitor airborne radioactivity present at the site, and will include collection of particulate size data for assessment of the inhalation hazard. Surface soil samples also will be taken to assess the radioactive material available for resuspension.

4.1.1.2 Radon emissions

To comply with DOE Order 5480.4 (DOE, 1987a), requiring adherence to the State of California Mine Safety Orders (30 CFR 57.5-3), it is necessary to monitor radon/radon progenies to ensure worker safety. 30 CFR 57.5-37 is being revised to include the radon from natural thorium as well as uranium decay series. The surface facilities environment, the ambient background, and the exhaust from the underground workings will be monitored for radon and radon progenies from the uranium and thorium series. These data will be used to assess and control potential worker exposure and to demonstrate compliance with the applicable regulations. This activity will fall within the operational health physics program when the facilities are constructed.

4.1.2 CHARACTERIZATION OF NEVADA TEST SITE ACTIVITIES

It is essential to assess the impact of activities in the area surrounding the proposed Yucca Mountain facility to (1) fulfill the requirements of 10 CFR Part 960 (Section 3.3.1.1.3), (2) support preparation of the SAR, and (3) design a facility. NTS activities may have a radiological impact on the proposed Yucca Mountain facility. The radiological monitoring program will provide data to help quantify this impact. The information is needed to support potential design activities. Assessment of radiological conditions at the site will be performed by reviewing available documents, some of which are discussed in Section 4.2.1, and by collecting current data. These two data sets will then be used to document past and present conditions, and to project future conditions. Both data sets will be documented in the Radiological Data Base, currently being developed by T&MSS. Reduced data will be provided by this data base to the Site and Engineering Properties Data Base (SEPDB) and the Reference Information Base (RIB).

The radiological field data collection activities for assessing the impact of NTS include:

1. Determination of ambient airborne radionuclide concentrations in the Yucca Mountain area, including identification of potential sources and particle size distributions. These data will be used to establish intake-air filtration requirements, if any, and to project off-normal conditions for design, safety analysis, and site evaluation.

2. Evaluation of the radioactivity concentrations in the groundwater to verify that the radiological water quality is acceptable for use in the facility. No radioactive material above natural background is expected to be present in the groundwater at Yucca Mountain. These data are being collected for resolution of other needs (discussed in Sections 3, 4.1.4, 4.1.5, and 4.1.6), but can also be used to verify the absence of contamination in the water supply.

3. Surface water and sedimentation analyses of the ephemeral stream in Fortymile Canyon/Wash. These data will be used to project both the impacts of past NTS activities and the radioactivity due to airborne deposition, since this is the source of the man-made activity in excess of normal background, if any, that is present.

4. Performance of soil and driftwall sampling to establish the existing radiation background in the surface and underground work areas to support facility design and safety analysis activities. The primary purpose of driftwall sampling will be for radon and radon progeny product monitoring.

5. Biota sampling in the Yucca Mountain area to support the objectives of Items 2, 3, and 4, and to examine radioactivity already in the human food chain for the purpose of safety analysis and regulatory compliance.

4.1.3 FACILITY DESIGN AND SAFETY ANALYSIS REPORT PREPARATION

The data requirements discussed in Section 4.1.2 and the ambient radiation data are needed for facility design and preparation of the SAR. Collection of these data is discussed in Section 4.2.8.

Radon exposure data will also be needed to design the facility and prepare the SAR. The radon data collected before the construction of the exploratory shaft (SE), during underground mining activities associated with the ES, and during ES activities will be used to assess the radon emission rate in the proposed underground facility at Yucca Mountain. The results from evaluation of these data will then be used in the design of the facility ventilation system and safety analysis activities. The data from soil and driftwall samples will be used to assist in the estimation of the radon emission rates and resuspension of existing radioactivity for ventilation system design. These data can also be used in the design of airborne radioactivity monitoring systems for the facility. Radon progeny products collected by air samplers interfere with accurate assessment of the airborne radioactivity concentrations from other sources.

4.1.4 MONITORING IMPACT(S) OF SITE CHARACTERIZATION

There is a need to monitor site characterization impacts in three major areas. The potential sources of radioactivity are resuspended activity from the soil and sediments around Yucca Mountain, release from a groundwater source to the surface, and radon release resulting from excavation. To assess radioactivity resuspension from the site, particulate air samples will be taken and the source (the soils and sediments) analyzed. Any potential release from groundwater to the surface will be evaluated to assess the potential impact, if any. Finally, radon monitoring will provide data to Project offsite impacts of any radon release resulting from site characterization earth-disturbing activities.

4.1.5 FEASIBILITY OF RADIOLOGICAL MONITORING

Because there may already be a radiological background level in excess of typical background levels at the Yucca Mountain area, it is necessary to quantify existing conditions to determine if they will interfere with the ability to monitor releases from an operating facility. Special problems may exist in accurately performing routine measurements of I-129, Tc-99, and C-14 in environmental samples. This concern will be specifically addressed in later sections. Finally, it will be necessary to choose and characterize a local indicator species. The indicator species is an animal whose range is closely limited to the area of interest and whose characteristics result in significant intake of radionuclides in the environment. This animal can be used to indicate the presence or absence of unsuspected release pathways. A further discussion of this concept will be presented in the RESMIP (when issued).

4.1.6 DATA FOR DECONTAMINATION AND DECOMMISSIONING

Data or samples representing the original condition of the area will be needed for planning of decontamination and decommissioning activities. The required monitoring activities will be the same as those for site characterization except that some locations may be changed and the number of locations altered. Soil, biota, and water samples must be archived specifically for this purpose. Samples will be archived in the Project Sample Management Facility (SMF), where chain-of-custody will be maintained.

4.1.7 COMPLIANCE VERIFICATION

The radiological monitoring activities in the radiological monitoring program will allow the Project to determine compliance with the DOE Orders and NTS requirements during site characterization. These requirements cover the monitoring of effluents generated by the Project, including radiological emissions reporting and compliance requirements for the Clean Air Act.

The DOE Order 5400.5, Radiological Protection of Public and the Environment, (DOE, 1990a) specifically prohibits the use of soil columns for the removal of radioactive material from liquids. No significant quantity of any liquid is allowed to be released to the surface before the characteristics of the liquid are well established. This is mandated by applicable Project procedures. There should be no radioactivity above natural background in the groundwater in the Yucca Mountain area; this will be verified before release of significant quantities (a few gallons) of such water to the surface-water system. Samples will also be analyzed later as part of the routine RADMP activities. The isotope of interest in this determination will be tritium.

4.1.8 COLLECTION OF DATA FOR THE ENVIRONMENTAL IMPACT STATEMENT

The specific data required for preparation of the EIS will be identified during the EIS scoping process. Since approximately five years (or more) of data may be needed to establish any trends in the existing background at Yucca Mountain, the data taken in the activities discussed in Sections 4.1.1 to 4.1.6 should be collected over that interval of time. Given existing schedules, there will not be sufficient time to begin to collect these data after the EIS Scoping Hearings. The data collected for site characterization activities is expected to be similar to the data identified during EIS scoping. The data collected will be used, where appropriate, to supplement the data collected specifically for the EIS radiological baseline. Efforts will be made to keep the radiological monitoring activities discussed in Sections 4.2.1 to 4.2.6 consistent with the projected EIS radiological baseline data collection requirements and guidelines.

4.2 DESCRIPTION OF THE RADIOLOGICAL FIELD MONITORING PROGRAM

The radiological monitoring program is intended to gather environmental radiological data to satisfy the needs identified in the ERCP (DOE, 1988a) requirements. Details of the program are based on applicable DOE, NRC, and EPA guidance and requirements. Guidance from various other groups (e.g., NCRP, ICRP), consensus standards, historical precedent, and industry practice will also be used in the program's development. The program specifically addresses the site characterization phase; later phases will be discussed in subsequent revisions of this document.

4.2.1 SAMPLING INITIATION

The radiological monitoring program recognizes that there may be an elevated background in the Yucca Mountain area from the deposition and resuspension of particulates from past NTS activities. Also, this background may be changing with time because of radioactive decay and the movement of radioactivity into and out of the area from other locations. It is presently unknown whether this source is changing, and, if so, in which direction (increasing or decreasing). Indeed, the direction or rate of any changes may be highly dependent on radionuclide type. Consequently, it is important to characterize any changes in the source term and establish current conditions accurately.

Collection of background data typically requires two years at a pristine site for preparation of the EIS and prior to initiation of operation. This permits characterization of the seasonal, statistical, and spatial variability in the current background (Corley et al., 1981; Walker, 1987; and Regulatory Guide 4.1, Section C.1 (NRC, 1975)). Characterizing the variabilities will take substantially longer if the current background is changing with time. Any significant change in the current background should, however, be identifiable from five years of data. These data will have to be

collected for preparation of the EIS. Also, because it typically requires about one year to implement a program including procurement, training, and operational testing, the total time to establish an environmental background data base may be six years. This discussion does not address possible future unplanned releases at the NTS. Note that site characterization activities are not expected to alter the radiological background conditions in the Yucca Mountain area.

An exception to this time requirement just discussed is the characterization of the radon baseline. Because the radon parents have extremely long half-lives, the radon background at the site has not been affected by past NTS activities that released radionuclides. Consequently, two years of data collection before ES construction and mining activities would be desirable to characterize the radon source term. It is possible that only one year of data may be collected because of Project schedule constraints, and efforts are being made to maximize data collection within these constraints. The radon data collected using passive integrating radon monitors will be supplemented with continuous radon data to ensure adequate background information is obtained. The radon background data collection activities should be finished before shaft construction and mining activities. The effect on radon release rates of the weapons testing induced seismic activity would be characterized by this activity as well, if it exists. Any effect is unlikely to be detected on the surface because of the small size of the effect, the diffusion rate of radon through the soils (Rogers et al., 1984), and the half-life of radon.

Details of the RADMP monitoring activities are discussed in the following sections, and each type of sampling and analysis are addressed separately.

4.2.2 SAMPLING AREA

Based on the regulatory requirements and guidance, technical guidance, present NTS programs, public concern, and historical precedent, the general areas of interest for the radiological monitoring activities are (1) the area surrounding Yucca Mountain, and (2) (based on the 10 CFR 960.5-2-1 requirement for monitoring the newest highly populated urban area) the City of Las Vegas, Nevada. The Project sampling activities will be directed toward monitoring the radiological exposure pathways to man in these areas.

4.2.3 SOURCES OF RADIOACTIVITY

Potential sources of radioactivity in the environment at Yucca Mountain before receipt of nuclear waste are:

1. Resuspended radioactive materials originally present in the soils or attached to the biota.

2. Radioactive particulates released by other NTS activities or resuspended from other NTS locations.

3. Radioactive gases (H-3, C-14, various radioactive iodine isotopes and inert gases) released by NTS activities from other NTS locations that may, with time, become associated with soils, surface water, or the biota.

4. Radioactive releases from the commercial low-level waste disposal activities located near Beatty, Nevada. The major indicators of releases are similar to those from the NTS (Items 2 and 3).

5. Planned releases of short-lived radionuclide tracers and the potential for accidental release of longer-lived radionuclides used during site characterization activities at Yucca Mountain and associated with well-logging and hydrological modeling activities.

6. Radioactive material dissolved or suspended in the groundwater or surface-water systems from past NTS activities. (The groundwater source may be essentially zero due to the travel time required for the water to reach the saturated zone, radionuclide transport rate in the unsaturated and saturated zones, radionuclide decay rates, past NTS data referenced in Table 4-1, and projected groundwater flow paths.)

7. Radioactive material dissolved or suspended in the groundwater or surface-water systems from natural sources of radioactivity.

8. Radon and radon progeny products released to the atmosphere, including existing release rates, enhanced release rates resulting from excavation activities, and enhanced release rates resulting from mining activities.

9. Natural radioactive material present in the soils, in the atmosphere, or incorporated into the biota.

10. Worldwide fallout.

Activity in the Yucca Mountain area is expected to be predominately either naturally occurring or from NTS activities; neither of these is expected to be large. The contribution from the nearby commercial low-level waste disposal activity is also expected to be negligible since it has very limited releases and is 40 kilometers (22 miles) away. The impact of the facility will be verified. The radionuclides of interest are summarized in Table 4-1. The radionuclides were selected based on several criteria:

1. The significant radionuclides based on the EPASS (SAIC, 1989a), which may be derived from the various NTS activities.

2. The significant radionuclides based on the EPASS (SAIC, 1989a) that will be present at the site when operations are initiated.

Table 4-1. Radionuclides of interest[a] (page 1 of 4)

Radionuclides	Source: Spent Fuel[b] NTS[d]	Spent Fuel[b] > 0.01% 10 years	Spent Fuel[b] > 1% 10,000 years	Spent Fuel[b] HLW	Naturally[c] occurring	40 CFR 191 Table 2	Emissions[e]	Reference (See page 4 of table)
H-3	x						β (0.0186)	5, 6
Be-7					x		γ	
C-14					x	x	β (.156)	4
K-40					x		β, γ	
Fe-55		x					EC, x-rays	1
Co-60		x		x			β, γ	2
Ni-59			x				EC, x-rays	1
Ni-63		x		x			β (0.067)	1, 2
Kr-85	x	x					β, γ	1, 5, 6
Sr-89	0							5,6
Sr-90/Y-90	x	x		x		x	β	1, 2, 4, 6
Zr-93/Nb-93m				x			β (.06) x-rays	2
Tc-99			x	x		x	β (.292)	1, 2, 4
Ru-106/Rh-106		x					β, γ	1
Sn-126/Sb-126m/ Sb-126						x	γ, β	2, 4
Sb-125/Te-125m		x					β, γ 1	
I-129						x	β (.15) γ (.04) x-rays	4
I-131	0						β, γ	6
I-133	0						β, γ	6
I-135	0						β, γ	6
Xe-133	0						β, γ	5, 6
Xe-133m	0						γ	6
Xe-135	0						β, γ	6

Table 4-1. Radionuclides of interest[a] (page 2 of 4)

Radionuclides	Source: Spent Fuel[b] NTS[d]	Spent Fuel[b] > 0.01% 10 years	Spent Fuel[b] > 1% 10,000 years	HLW	Naturally[c] occurring	40 CFR 191 Table 2	Emissions[e]	Reference (See page 4 of table)
Cs-134		x		x			β, γ	2
Cs-135						x	β (.21)	4
Cs-137/Ba-137m	x	x		x		x	β, γ	1, 2, 4, 6
Ce-144/Pr-144		x					β, γ	1
Pm-147		x					β (.224)	1
Sm-151		x		x			β (.076) γ (.022)	1, 2
Eu-154		x					β, γ	1
Eu-155		x					β, γ	1
Rn-220/D					x		α, β, γ	3
Rn-222/D					x		α, β, γ	3
Ra-226			x		x	x	α	1, 4
Th-230					x	x	α, γ	4
Th-232					x	x	α	4
U-233					x	x	α	4
U-234			x		x	x	α	1, 4
U-235					x	x	α	4
U-236						x	α	4
U-238[f]	x	x	x		x	x	α	4
Np-237						x	α	1, 4
Np-239			x				β, γ	1
Pu-238	x	x		x		x	α	1, 2, 4
Pu-239	x	x	x			x	α	1, 4, 6
Pu-240	x	x	x			x	α	1, 4
Pu-241	x	x		x			β, x-rays	1, 2
Pu-242						x	α	1, 4
Am-241	x	x				x	α	1, 4
Am-243			x				α	1, 4
Cm-243		x					α	1
Cm-244		x					α	1

Table 4-1. Radionuclides of interest[a] (page 3 of 4)

Radionuclides	Source: NTS[d]	Spent Fuel[b]: > 0.01% 10 years	Spent Fuel[b]: > 1% 10,000 years	HLW	Naturally[c] occurring	40 CFR 191 Table 2	Emissions[e]	Reference (See page 4 of table)
Footnotes								

[a]HLW = High Level Waste; NTS = Nevada Test Site

[b]Percent of total activity per fuel element.

[c]These are naturally occurring radionuclides that must be addressed per 30 CFR 57. Note other naturally occurring radionuclides (K-40 and Be-7) will be included in the analysis to allow evaluation of the analytical techniques.

[d]The "0" indicates these radionuclides are not asssociated with projected Project activities but may be associated with NTS activities and could interfere with projected monitoring activities. Radionuclides not identified with a "0" also occur in potential waste forms for disposal at a repository. This is based on data reported in the annual environmental reports. It is projected that slight concentrations of all isotopes listed may be present.

[e]α = Alpha radiation, β = Beta radiation, and γ = gamma radiation. The energy values in MeV are provided for low energy b radiation as an indication of the difficulty in measurement. Also U and x-ray emitting radionuclides, except the energy (in MeV) indicated, will be detected using gamma spectral measurements.

[f]U-238 is not included in the actual percentage of activity assessment because of its low specific activity. It is, however, a very significant mass fraction, so it is included.

Table 4-1. Radionuclides of interest (page 4 of 4)

Reference Number Indicated Above	Source
1	ORNL/TM-9591/V1&2, Tables 3-5, 3-6, 3-7, 3-8, 3-9, 3-10 (ORNL, 1986) NOTE: >0.01% for 10 year old fuel. All listed isotopes to 10,000 year old fuel
2	DP-1606, Rev. 1 (August 1983). Table 5 and Table 11 (Baxter, 1983) NOTE: >0.01%
3	NCRP Report 50, Section 2.3.5 (NCRP, 1976)
4	40 CFR Part 191, Table 2
5	EPA/600/4-86-030. (Source of analytical interferences) (NRA, 1986a)
6	EPA/600/4-86/022. (Source of analytical interferences) (NRA, 1986b)

3. Radionuclides specifically addressed in the long-term release limits (40 CFR Part 191, Appendix A, Table 1) of the EPA's criteria for geologic disposal of HLW, to provide comparison data for long-term assessments.

4. Radon and radon progeny products per the 30 CFR Part 57 criteria for worker exposure. In addition, the radionuclide concentration will be compared with the public exposure criteria for uranium mills and mill tailings (40 CFR 192.12, 192.32, and 192.41).

5. Radionuclides of significant half-lives or existing in significant quantities in SF or HLW (references noted in Table 4-1).

6. Naturally occurring radionuclides will allow a check of the quality of the sample analysis, since these radionuclides are present in the samples as part of the natural environment (Be-7 in gamma spectroscopy).

4.2.4 AIRBORNE MONITORING

The radiological monitoring program will include activities to monitor airborne radioactive particulates, radioiodine, tritium, and inert gases.

4.2.4.1 Basis for monitoring airborne radioactivity

As indicated in Corley et al. (1981) and Walker (1987), the four categories of airborne radionuclides that should be considered for measurement in air sampling systems are particulates, gases (principally the inert gases), halogens (principally radioiodines), and tritium. Consideration of these airborne categories is important for environmental sampling and measurement because the categories account for most of the radioactive materials released from any site.

4.2.4.2 Location of air monitoring stations

Location of the air monitoring stations requires consideration of various technical factors. These factors included consideration of the location of the future facilities, past activities in the area, meteorology of the area, topography of the area, location of population (onsite and offsite), and others.

4.2.4.3 Sample collection frequency

It is essential that appropriate sampling frequencies be identified. With the exception of particulate size sampling, this discussion addresses sample change frequency, since sample collection activities are essentially continuous.

Based on DOE guidance (Corley et al., 1981; and Walker, 1987), the frequency of collection for air samples is adjusted to take into account the limitations of the sample collectors, the capabilities of the air movers, and the physical problem of retrieving samples from each location on a fixed frequency. Typically, frequency of collection is every one to two weeks. Dust loading of the filter will generally determine the sampling period. Dust loading increases the differential pressure across the filter to a point where the equipment can no longer ensure a constant flow rate.

4.2.4.4 Air sampling and monitoring systems

Six separate activities (based on the characteristics of the media to be collected) will make up airborne radioactivity sampling: airborne particulate sampling, iodine sampling, C-14 sampling (CO_2), tritium sampling, man-made inert-gas and radon/radon sampling/monitoring, and radon/radon progenies sampling and monitoring. Note that the ambient airborne radiation data (Section 4.2.8) will be used for cloud immersion dose assessment.

4.2.5 WATER SAMPLING

Corley et al. (1981) describes and justifies the water surveillance requirements at nuclear facilities. The principal exposure pathways from waterborne radionuclides to individuals (or groups of individuals) in the environment are ingestion of drinking water; consumption of fish, ducks, or other aquatic species; and the consumption of irrigated crops. Of secondary importance are external radiation dose contributions from surface water (swimming, boating, water skiing), sediment deposits along the shoreline, or deposits on an irrigated field. The radiation doses from these external sources are generally orders of magnitude less than doses from ingestion pathways (Denham et al., 1974; Soldat, 1971).

As a consequence of the desert ecosystem within which the site is located, the potential for radioactive material from Yucca Mountain reaching man through the water pathway is very small. Water pathways at Yucca Mountain may include the following:

1. Ephemeral streams and catch basins.

2. Groundwater.

3. Airborne deposition to the Amargosa River or streams.

4. Reservoirs or ponds supplied from groundwater sources.

No liquid effluent will be released to a surface-water source, because there are no through-flowing streams in the Yucca Mountain area. There is a large ephemeral stream (Fortymile Wash) located just east of the site.

Routine laboratory determinations from water samples typically include gross alpha and beta, tritium, radiostrontium, gamma spectrometry, and specific radio-chemical analysis for other selected nuclides. Alpha spectrometry may also be included, depending on potential release of alpha contaminants or the results of the screening. In addition to total activity analysis, it may be desirable to measure the distribution of activity between soluble and suspended materials, as well as the chemical form of a radionuclide.

4.2.5.1 Locations

Collection of water samples at the designated locations discussed in the following sections is based on site-specific conditions and guidance documents from DOE, NRC, and EPA. The proposed Yucca Mountain repository site hydrologic conditions are generally characterized by low precipitation, no perennial streams, few springs, rapid runoff during heavy precipitation (ephemeral streams), limited/intermittent catch basins, and deep underground aquifers (Alkali Flat-Furnace Creek Ranch groundwater basin). Other conditions such as local meteorology and absence of liquid effluent releases to surface-water sources are also important to the selection of water sampling locations.

4.2.5.2 Methods

The major concerns for water sampling are the collection of a representative sample and the preservation of radionuclides in their original concentrations before analysis. Most water measurements are made on samples taken in the environment and returned to the laboratory for analysis. The general problem of the measurement of radioactivity in environmental water samples has been discussed by Kahn (1972). Standardized methodologies for collection and handling of water samples are also discussed in numerous documents, including American Public Health Association (APHA) (1971), American Society for Testing and Materials (ASTM) (1987a,b), Manual of Ground Water Sampling Procedures United States Geologic Survey (USGS) (1977) and EPA (1977). All sampling activities will be consistent with Conti et al. (1978) and applicable NRC guidance.

4.2.5.3 Sampling frequency and analysis

Based on the recommendation of the various reviewers or the RADMP and the characteristics of the flow regime (regional hydrology) in the Yucca Mountain area, the water typically will be sampled annually. A gamma

spectroscopy evaluation will be completed on each sample. Approximately 10 percent of the samples collected will be analyzed for the radionuclides discussed in Section 4.2.3, with four possible exceptions: Fe-55, Ni-59, Ni-63, and Sm-151. Only about 5 percent of the samples typically being subjected to the full suite of analysis will be analyzed for Fe-55, Ni-59, and Ni-63 (these concentrations are expected to remain constant and the analyses are extremely difficult). Since it is very difficult to test for Sm-151, and because the radionuclide will behave in the environment like europium, analysis for Sm-151 will only be conducted when europium is detected. Note: The concentration of europium and samarium in the waste will be similar. Careful evaluation of preliminary results for these two nuclides will eventually determine the future frequency of analysis.

4.2.6 SOIL AND DRIFT SURFACE SAMPLING

The DOE (Corley et al., 1981; Walker, 1987) provides recommendations for soil sampling. The guidance indicates that soil provides an integrating medium that can account for contaminants released to the atmosphere (either directly in gaseous effluents, or indirectly from resuspension of onsite contamination), or through liquid effluents released to a stream that is subsequently used for irrigation. Hence, soil sampling and analysis will be used to evaluate the long-term accumulation trends and to estimate environmental radionuclide inventories. In addition to radionuclides that are specific to a particular operation or facility, naturally occurring and fallout radionuclides can be expected in soil samples.

During underground mining and operation, driftwall sampling will be used to characterize the uranium and thorium sources that produce the radon and radon progeny product inventory emanating from the mine.

4.2.6.1 Location and frequency

Background determinations will be based on soil sampling and analysis at points corresponding to background (or control) air sampling locations. Primary soil sampling locations have been selected to coincide with air sampling stations since the comparability of data may be important in achieving the objectives of the overall environmental sampling program. Soil samples will be collected in association with other sampling locations as appropriate.

4.2.6.2 Sampling methods

Several reports are available that should be used as guidance in sampling, preparing, and analyzing soil for plutonium (AEC, 1974; Sill and Williams, 1971), for radium (Fleischhauer, 1984; Meyer and Purvis, 1985; Myrick et al., 1983), and for other radionuclides (ASTM, 1986; Mohrand and

Franks, 1982). In addition, Healy (1984) has proposed a standard for comparing observed to allowable concentrations of plutonium. Note: Consideration will be given to cost effectiveness in analysis. A limited number of analyses will be completed with very high sensitivity, whereas most analyses will use standard analytical techniques.

4.2.6.3 Soil and drift surface sample analysis

The analyses for the soil and driftwall samples were selected based on the recommendations of the DOE guidance (Corley et al., 1981; Walker, 1987, etc.), good technical practices, and the specific concerns expressed in 40 CFR Part 191.

4.2.7 BIOTA SAMPLING

The DOE (Corley et al., 1981; Walker, 1987) indicates that samples of milk, crops, and animal produce from livestock and game are of greatest importance in environmental surveillance because they provide the most direct basis for assessing the radiation dose to man from ingestion. The principal pathways for radionuclide contamination of food pathways to Homo sapiens are (1) atmospheric deposition onto crops and animal forage crops from airborne releases, and (2) crop irrigation from water bodies receiving liquid effluents.

While this section briefly describes the biota sampling program, many details of the program cannot be presented until a detailed survey of the agricultural, recreational, and cultural activities within the area is conducted. The preliminary data necessary will be collected over the next two years as indicated in Section 6.1 of Corley et al. (1981).

Presently, the biota samples collected under this monitoring plan will represent direct dosage pathways, indirect dosage pathways, and animal indicator species of local environmental contamination. Direct pathways are represented by food items and will include samples of milk, crops (intended for human consumption), beef, poultry, and eggs collected in the far-field area. Near-field samples of game birds may be collected if population densities increase sufficiently. Venison samples from local mule deer will not be collected due to low population density and movement pattern considerations. Indirect pathway samples will include cattle and deer forage species. Several indicator species indigenous to the facility area have been selected to assist in detecting inadvertent releases of radioactivity and to monitor any long-term radionuclide accumulation in the local environment.

4.2.8 AMBIENT (BACKGROUND) RADIATION MONITORING

The exposure of environmental population groups (general public) to external radiation from nuclear facility operations includes exposure from cloud passage of airborne effluents, as well as exposure from previous radionuclide deposition patterns on soil, vegetation, sediment, or structures. External exposure from radionuclides in water should be insignificant during normal operations at a site such as the Yucca Mountain facility, although unique situations may still arise where recreational, commercial, or industrial use of a receiving body of water may incur some direct exposure.

The feasibility of distinguishing an annual incremental exposure even as low as 5 mR at a given location with the best available dosimetry is difficult in view of the variability of background radiation. The methods discussed in the balance of this section describe the range of available techniques, including those selected for use at Yucca Mountain.

4.2.8.1 Thermoluminescent dosimeters

Integrating dosimeters include such commonly used devices as TLDs and ionization chambers. Records of environmental exposure rates for the early years at the NTS were largely based on ionization chamber readings, and are generally not well-suited for comparison at low exposures (in terms of accuracy) with more recent results using TLDs. TLDs are the dosimeters of choice based on demonstrated sensitivity, reproducibility, reliability, and long-term stability. The individual dosimeter is relatively inexpensive, although a complete dosimeter/reader system can involve a large initial cost.

4.2.8.2 Exposure rate

Various instruments are available for continuous monitoring of the exposure rate as a function of time. For the monitoring of intermittent or unplanned releases, characterization of diurnal variations, and better identification of source terms, exposure rate instrumentation should be available.

4.2.8.3 Aerial surveys

Aerial surveys consist of overflights of the near-field area by an aircraft-borne radiation measurement and recording system. The AMS (Doyle, 1974; and Deal and Doyle, 1975) operated for the DOE by EG&G Inc., is the method currently planned for this survey. It provides detailed data analysis from aerial surveys of gamma radiation levels in and around nuclear facilities. Although developed primarily to provide improved radiation accident response capability, results from AMS helicopter surveys of major

DOE sites (Burson, in preparation; and Boyns, 1975) have provided an overview of the location, relative intensity, and identification of gamma-emitting radioactive contaminants. Particularly valuable is the definition of radioactivity levels in areas difficult to measure by ground survey techniques.

4.2.8.4 In situ gamma spectroscopy

In situ gamma spectroscopy will be used to characterize the ambient environment at each soil sampling location (Section 4.2.6). The data collection (site-specific spectral data) will initially occur at each soil sampling location, and will normally be repeated only if there is an indication that the radiological conditions have changed. A limited number of locations will be selected for quarterly reevaluation to provide some idea of the variability of these spectra over time.

The primary driving force for in situ spectroscopy, as for the radiological monitoring program, is the requirements and recommendations in the current draft of Corley et al. (1987). This document specifies in

1. Section 5.4.2 (p 5.12) that "before final placement of any environmental radiation measurement station (background or control and indicator locations), an initial on-the-spot survey should be performed and documented to determine the absence of possible naturally occurring anomalies that could affect interpretation of later measurements....An in situ gamma-ray spectrometer...can be used...."

2. Section 5.4.2 (p 5.14) that "in situ gamma spectroscopy should be used as a method of documenting environmental mixtures of radionuclides...."

3. Section 5.7.3 (p 5.36) that "[u]seful information about soil contamination levels can also be obtained using in situ gamma-ray spectroscopy."

The recommendations of the DOE/Headquarters (HQ) consultants during a review of the status meeting on the RADMP on May 13 and 14, 1987, was that in situ gamma spectral analyses should be included as part of the radiological monitoring program.

In addition to the DOE requirements, NCRP (1976) indicates that "[i]n situ measurements are valuable for the rapid assessment of radiation exposure, identification of radionuclides, and detection of trends in environment radioactivity due to man's activities."

International Atomic Energy Agency (IAEA) (1975) indicates that in situ measurements are extremely useful in evaluating the impacts of unplanned releases. However, this evaluation is only feasible if baseline in situ data have been collected before the release.

The DOE indicates in the Environmental Measurements Laboratory Health and Safety Laboratory (EML-HASL)/300 (Procedure C-02-01) that "[f]ield spectrometric techniques permit the rapid identification of particular radionuclides in the environment....(Harley, 1986)." Furthermore, DOE Environmental Monitoring Laboratory personnel indicated at the Institute of Electrical and Electronic Engineers, Inc. (IEEE) Nuclear Science Symposium (San Francisco, CA, October 21-24, 1981) that "in situ gamma spectroscopy results may be obtained more rapidly than laboratory counting a grab sample, and will generally be more representative of the area." Thus, the technical requirements and guidance indicate that in situ gamma spectroscopy is appropriate.

4.2.8.5 Public monitoring

Based on the precedent established by the existing NTS environmental monitoring program, this RADMP activity may also support the public monitoring activity associated with the NTS. A limited number of individuals in the public (1) are monitored with a personal dosimeter, (2) receive routine bioassay, and (3) receive routine in vivo counting in the NTS program.

4.3 IMPLEMENTATION OF THE RADIOLOGICAL MONITORING PROGRAM

4.3.1 DOE PROCEDURAL REQUIREMENTS AND OPERATIONS

All activities in the radiological monitoring program must be approved by the Project Office and implementation must be consistent with DOE/NV operations, as determined to be applicable by the Project Office. The program will follow all applicable DOE requirements and standards. The program and its major organizations have their own radiological and nonradiological safety requirements, which will be followed. The radiological monitoring program will also comply with the NTS Radiological Safety (DOE/NV, 1988) requirements and applicable organization environment, safety, and health plans, as applicable. These requirements are always applicable when conducting activities on NTS but outside the area of Project Office responsibility.

4.3.2 PROJECT INTERFACES

Activities in the RADMP that overlap with activities of other Project organizations or other organizations will be arranged to prevent duplication of effort. Two basic procedures will be followed: one for other Project organizations and one for within the T&MSS organizations. In both instances, the technical individuals (principal investigators) will meet and establish a

mechanism for sharing information. For activities involving various T&MSS organizations will be addressed within T&MSS. However, for other Project organizations, a Project Office representative may be involved in the technical discussion. Concurrence of the affected Technical Project Officers is required in the decision. Areas where this overlap appears to exist include the following:

1. The Sandia National Laboratories radiological assessment activities.

2. Water sampling for radionuclide constituents.

3. Air quality monitoring (particle size analysis).

4. Fauna and flora sampling for radionuclide analysis.

4.3.3 EQUIPMENT AND SERVICES

The equipment used in implementing the radiological monitoring program will normally be procured as commercial grade items as discussed in "Guidelines for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications" (EPRI, 1988). This is justified, since the equipment used in implementing this activity is

1. Not unique to nuclear facilities.

2. Used in other than nuclear facilities.

3. Can be ordered based on the manufacturer's/supplier's published specifications.

If a requirement is identified, as the program is implemented, for the procurement of unique equipment, this equipment will be addressed on a case-by-case basis. No such equipment has currently been identified.

Equipment purchased as commercial grade will be evaluated for adequacy prior to procurement. Documentation of this evaluation will be in the form of the signature of the requester and the responsible manager on the procurement documentation. Upon receipt, this equipment shall be subject to receipt inspection to provide assurance that the equipment received is the equipment ordered. Before use, the equipment will be subject to an operability test or acceptance testing as appropriate based on the complexity and intended use of the equipment.

5.0 OTHER SUPPORTING RADIOLOGICAL DATA COLLECTION ACTIVITIES

This section briefly discusses the collection of the data required to support radiological analyses. It does not include collection of the radiological monitoring data previously addressed in Section 4 and future Project radiological analytical activities. The specific data collection needs are addressed in the RESMIP (to be issued), based on the criteria in this section.

The primary data needed to support the radiological safety analysis are those data necessary for implementing computer programs. The primary area of emphasis is the calculation of radiation doses to the public using programs such as AIRDOS-EPA. These data will include radiological, meteorological, agricultural, cultural, and general biota data; characteristics of radioactive aerosols; and population demographics. Also required are

1. Resuspension and deposition data for radioactive particulates.
2. Solubility/leachability of radioactive materials.
3. Chemical form of radionuclides.
4. Radon emanation rate for various materials (or characteristics to assess this value).
5. Effects on radon emanation rates of meteorological conditions and expected site activities.
6. Characteristics of off-normal and accident scenarios for the activities (present and future).
7. Ventilation flow characteristics.
8. Environmental sensitivity to the impact of radionuclide uptake.

5.1 DATA REQUIREMENTS OF CALCULATION MODELS FOR USE IN THE ENVIRONMENTAL IMPACT STATEMENT, SAFETY ANALYSIS REPORT, AND OTHER ACTIVITIES

The data required in developing the EIS and SAR are essentially identical to those data required in assessing regulatory compliance and environmental monitoring commitments. The following sections address the collection of these data based on the potential data source. This set of data may require changes following the EIS Scoping Hearings. These data include:

- Radiological data.
- Characteristics of radioactive aerosols.
- Meteorological data.

- Agricultural data.
- Cultural data.
- Population demographics.
- General biota data.

5.2 DATA AVAILABLE IN THE TECHNICAL LITERATURE

A significant amount of the data mentioned in Section 6.1 is available in the technical literature. Major sources of this technical guidance are (1) Regulatory Guide 1.109 (NRC, 1977), which is applicable to nuclear reactors; (2) Till and Meyers, 1983; and (3) Elder et al., 1986. This guidance, however, recommends the use of local data rather than generic data. Because of the arid characteristics of the Yucca Mountain area, site-specific data are very important because most generic data (e.g., Regulatory Guide 1.109 (NRC, 1977)) were developed for non-arid environments. If site-specific data cannot be obtained, the data from Regulatory Guide 1.109 or other sources in the technical literature will be used. Specific details addressing the identification and collection of these data are found in the RESMIP (to be issued).

Should any plant or animal species having a high bioaccumulation factor (relative to assumptions in the Environmental Pathways Analysis Scoping Study (SAIC, 1989a)) or a high biological susceptibility to radiation be identified within the area, special monitoring will be added to that described in Section 4.0. The cited reference documents are intended as examples and should not be interpreted as prescriptive.

The data of interest includes:

- Radiological data.
- Characteristics of radioactive aerosols.
- Meteorological data.
- Agricultural data.
- Cultural data.
- Population demographics.
- General biota data.

5.3 PROCEDURE FOR ACQUIRING DATA NOT AVAILABLE IN THE TECHNICAL LITERATURE

Unavailable technical data are of two types. The first type is site-specific data, which need to be collected in the Yucca Mountain area. The second type is general technical data, which are needed to support these processes and are currently not available. The two types will be discussed separately.

5.3.1 SITE-SPECIFIC DATA

Site-specific data include the characteristics of radioactive aerosols at the site, the meteorology of the site, agricultural and cultural data for the Yucca Mountain area, population demographics, and general biota data for the site.

5.3.1.1 Characteristics of radioactive aerosols at the site

These data will be collected as part of the implementation of airborne monitoring activities discussed in Section 4.2.4. They will then be used to (1) assess the resuspension and deposition of radioactive aerosols at the Yucca Mountain site, and (2) determine the typical particulate size distribution for use in assessing dispersion and deposition of any potential radioactive aerosols and the resultant dose to man.

5.3.1.2 Meteorology of the site

The meteorological data collection needs are addressed in the existing Project Meteorological Monitoring Plan (DOE/NV, 1989b) and the Project Environmental Field Activity Plan for Air Quality Monitoring. Collection and reporting of data are essential to the successful completion of this activity.

5.3.1.3 Agricultural and cultural data for the site

The site-specific agricultural and cultural data for the Yucca Mountain site that are unavailable in the technical literature will be needed between 1991 and 1995. After a review of the technical data currently available, supplemental data will be developed by the T&MSS. When an initial data set is developed, it will require routine updating approximately every five years and just before preparation of the Draft Environmental Impact Statement (DEIS). The agricultural and cultural data collection activities will be separate activities and may also be reported separately.

5.3.1.4 The population demographics for the site and nearest highly populated area

The required demographic data will be developed by the T&MSS ûin cooperation with the EPA NRA Division and other organizations. These data will reflect currently available data(Section 6.2) and new data collected by the NRA or other organizations in support of general NTS activities. The initial data will be needed between 1988 and 1989. To collect changes that occur with time, these data should be updated at least every five years and just before preparation of the DEIS. Also, projections of population changes throughout the licensing and operation phases will be needed.

5.3.1.5 General biota data for the site

The biota data collection supporting the radiological analyses for the site is primarily addressed by those activities described in Section 4.2.7. Ongoing NTS biota monitoring activities and the Project Environmental Field Activity Plan for Terrestrial Ecosystems (to be issued) provide supporting data.

5.3.2 AREAS REQUIRING FURTHER RESEARCH

Presently the only area requiring further research, aside from the collection of site-specific data, is routine environmental sample analysis methods for Tc-99, C-14, and I-129. These isotopes are specified in 40 CFR Part 191, but have not (to date) been included in the routine analysis programs. The development of sampling techniques for these isotopes is underway at the SAIC with Project support. This work is expected to be completed in late FY 91 or early FY 92. The analytical technique for I-129 will involve gamma and beta anti-coincidence counting. The radionuclide analyses for Tc-99 and C-14 will use various wet chemical concentration techniques and existing counting and analysis methodologies.

6.0 RADIOLOGICAL DATA ASSESSMENT

In addition to the activities in Section 4, various computational and analytical methodologies are required to support the radiological monitoring program and various other Project site characterization radiological assessment activities. These methodologies can be relatively uncomplicated calculation models, or more comprehensive computer programs with varying degrees of complexity.

The analytical methods required to implement the radiological assessment element of the RADMP are partly determined by the reporting and analytical needs of the Project during site characterization. Most of the methodologies will be directed toward the estimation of potential radiation doses to the worker and the public, or the dispersion of activity into the environment from existing or planned activities. A limited number of computational methodologies are needed to support (1) resolution of other radiological issues, such as shielding design verification and impact analysis; (2) review of safety analysis, etc.; and (3) other assessment activities. The methodologies presently identified are briefly discussed in this section. The criteria for selecting methodologies for use in Project radiological impact assessments are also addressed. In addition, the probabilistic risk assessment methodology (PRAM) activities ongoing at various OCRWM organizations are considering many of these same analytical methods for use in repository design and licensing. Every effort will be made to ensure consistency of this activity with the PRAM activities.

6.1 REQUIREMENTS FOR THE METHODS

All radiological assessment methodologies require various types of input data. In many instances, the development of input data itself may require various levels of analytical effort. This activity would include the development of the basic analytical methodologies, the various inputs, or the assessment techniques necessary to support the required analyses. The analytical areas that should be addressed include the following:

- Source term assessment.
- Public radiation dose assessment.
- Worker radiation dose assessment.
- Risk assessment.
- Radon source terms.

6.2 SELECTION AND VERIFICATION, VALIDATION, OR DOCUMENTATION OF METHODS

All assessment methodologies/programs used in this task will be evaluated against a set of defined considerations. The T&MSS Contractor or other supporting organization will evaluate these methodological programs for use in assessing compliance during the site characterization and construction phases (and other phases as needed). When the evaluations are conducted by an organization others than T&MSS, the organization will attempt to obtain the concurrence of T&MSS on this evaluation. These evaluations will be submitted to the Project Office for approval when completed. These considerations include, but are not necessarily limited to, the following questions:

1. To what extent does the methodology/program provide the required data from available input?

2. How feasible is it to modify the methodology/program to provide the required data from available input?

3. Are there alternate methodologies/programs that can provide the required data from available input?

4. Has the methodology/program been accepted in NRC licensing proceedings?

5. Has the methodology/program been accepted (or will it be accepted) by the EPA, NRC, OCRWM, or other DOE organizations?

6. Is adequate documentation available for use of the methodology/program?

7. Has the methodology/program been verified?

8. Has the methodology/program been validated?

9. If the answer to Item 7 or 8 is no, can verification and validation be accomplished?

10. Can site-specific data be used in these methodologies/programs?

11. Does the methodology/program produce answers within an acceptable level of uncertainty?

12. Is the methodology/program consistent with statutory requirements, regulatory criteria, and technical guidance?

13. Is the methodology/program consistent with the other OCRWM programs, and is it consistent with state-of-the-art technology?

Evaluations of the various methodologies/programs within these constraints and considerations will rely on completion of the following activities:

1. Obtaining and reviewing a copy of documentation for the methodology of interest.

2. Performing a test case implementation of the methodology.

3. Documenting the selection process for a methodology. (Software documentation is discussed in the Project and/or T&MSS Software QA Plan (SQAP) and applicable procedures or the equivalent documentation for the applicable organization.)

4. Verification and validation, as appropriate.

5. Implementing QA and configuration management controls as described in the applicable SQAP and associated documents.

After completion of the evaluation activities, the methodology is approved for use. The evaluation process may be terminated at any step if it is determined that no significant benefit to the Project will result from completion of the process.

7.0 SCHEDULE AND REVISIONS

This section provides the needed administrative data to support implementation of the radiological monitoring program. These administrative data emphasize the future planning for the program.

7.1 SCHEDULE (MILESTONES)

The basic schedule for RADMP activities is summarized in Figure 1-1. The network reflects RADMP implementation, issuance of annual data reports each May, preparation of a summary data report in 1993, revision of the RADMP to reflect major changes in Project activities, and preparation of other relevant reports.

Supplementing the basic schedule, Table 7-1 provides a summary of the detailed initial RADMP implementation. The schedule described in Table 7-1 is based on expected procurement time, funding, land access, site activities, and perceived need. Most of the expected scheduling relates to potential procurement delays and to uncertainty in the scheduling of other Project activities.

7.2 REVISIONS

Planned revisions of the RADMP are shown in Figure 1-1. These revisions relate to presently identified changes in Project activities. If future Project activities or the data collection results indicate a need for additional revisions, the revisions may be initiated by the RFPD Manager or any individual. In addition to the planned and other revisions to the RADMP, modifications to the field activities may also occur. These changes will be documented by letters to the PM, QA, and RADMP organizations. These letters will be added to T&MSS Sample Location Document controlled copies as they are issued. This will allow the program to respond to needed changes in a timely and fully documented manner.

The planned revisions are expected to be primarily changes in scale of the activities. The revision following the EIS scoping hearings will reflect both recommendations from these hearings and results of the human food chain study discussed in Section 4.2.7.

The revision at the time of EIS preparation (October 1993) will reflect a reduction in the program and represent completion of major data collection. The program will be used to maintain data continuity and to monitor any changes in site conditions. This revision will also affect the current facility design.

Table 7-1. Implementation plan for Radiological Monitoring Plan activities (page 1 of 2)

Activity	Initiation	Completed[a]
Air sampling (60-meter tower/ particulate iodine only)	9/87	—
Air sampling/near field	1/91 to 6/91	—
Air sampling/far field	6/88 to 3/91	—
Water sampling (general)	1/91 to 9/91	—
Catch basin survey	6/91	10/91
Water sampling (catch basins)	10/91 to 10/91	—
Inert gas and tritium sampling	7/88 to 9/91	—
Radon integrating samplers	9/87	—
Radon continuous monitoring	3/91	—
Initiate analysis capability development for Tc-99, C-14, and I-129	3/91	7/91
Soil/sediment sampling	1/91 to 6/91	—
In situ gamma spectral analysis	1/91 to 9/91	—
Milk sampling	Ongoing[b]	—
Near-field biota sampling	5/88 to 2/89	—
Survey of far-field biota in human food chain	1/91	12/91
Preliminary assessment of sampling needs in the biota (human food chain)	10/91	3/91
Thermoluminescent dosimeter monitoring implemented	4/88 to 6/91	—

Table 7-1. Implementation plan for Radiological Monitoring Plan activities (page 2 of 2)

Activity	Initiation	Completed[a]
High pressure ion chamber monitoring	7/88 to 6/91	—
ARM survey	—	1/91 to 1/95
Public personnel monitoring	Ongoing[b]	—

[a] "—" indicates that this activity will continue throughout the program.
[b] This is simply an ongoing NTS activity from which data will be obtained.

A potential revision is expected to occur with construction authorization. This revision would reflect any changes made in the program as a consequence of the construction activities and the detailed knowledge of the facility's design at this stage. This revision is expected to be a relatively minor variation in planned activities.

8.0 OPERATIONS AND SAFETY

The radiological monitoring program will be conducted in a manner consistent with the SHP (DOE/NV, 1990); specific supporting organizations (e.g. T&MSS, EG&G/EM) environment, safety, and health plan(s); procedures/instructions; administrative procedures; and other applicable requirements. Requirements are documented in the procedures and instructions. Before initiating a field data collection activity, an internal hazards analysis and technical readiness evaluations will be conducted and documented. Personnel will receive appropriate and verified training for those activities which involve hazards significantly higher than those encountered in a normal office environment. The safety training portion will address the information in the hazards analysis and will be mandatory for all personnel involved.

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ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AMS	aerial measurement system
AP	Administrative Procedure
APHA	American Public Health Association
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CMP	Configuration Management Plan
DEIS	Draft Environmental Impact Statement
DERE	Description of Existing Radiological Environment
DMS	Project Technical Data Management System
DOE	U.S. Department of Energy
DOE/HQ	DOE Headquarters
DOE/NV	DOE, Nevada Operations Office
DOE/NV-ESH	DOE/NV Office of Environment, Safety, and Health
EA	Environmental Assessment
EFAP	Environmental Field Activity Plan
EG&G/EM	EG&G Energy Measurements
EIS	Environmental Impact Statement
EISIP	EIS Implementation Plan
EML	Environmental Measurements Laboratory
EMP	Environmental Management Plan
EMMP	Environmental Monitoring and Mitigation Plan
EPA	U.S. Environmental Protection Agency
EPASS	Environmental Pathway Analysis Scoping Study for the Yucca Mountain Site
EPIP	Environmental Protection Implementation Plan
ER	Environmental Report
ERCP	Environmental Regulatory Compliance Plan
ERDA	Environmental Research and Development Administration
ERM	Environmental Radiological Monitoring
ES	exploratory shaft
ES&H	Environmental Health and Safety
ES&HP	Environment, Safety, and Health Plan
ESHD	Environmental Safety and Health Document
FEIS	Final Environmental Impact Statement
FY	fiscal year
HLW	high-level waste
HASL	Health and Safety Laboratory
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
IMS	NNWSI Project Information Management System

KeV	thousands of electron volts
LA	License Application
MeV	millions of electron volts
MDL	minimum detection level
MMP	Meteorological Monitoring Plan
MREM	1 rem x 10^{-3}
NBS	National Bureau of Standards
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Protection Act
NNWSI	Nevada Nuclear Waste Storage Investigations
NRA	Nuclear Radiation Assessment Division (EPA)
NRC	U.S. Nuclear Regulatory Commission; National Research Council
NRDA	Nevada Research and Development Area
NTS	Nevada Test Site
NTSO	Nevada Test Site Support Office
NWPA	Nuclear Waste Policy Act of 1982
NWPAA	Nuclear Waste Policy Amendments Act of 1987
OCRWM	Office of Civilian Radioactive Waste Management
OESH	Office of Environment, Safety, and Health
OR	Office of Radiation Programs
ORNL	Oak Ridge National Laboratory
PIC	pressurized ionization chamber
PMP	Project Management Plan
POCD	Project Operations Control Division
PRAM	Preclosure Risk Assessment Methodology
Project Office	Yucca Mountain Site Characterization Project Office
PSCRADMP	Preliminary Site Characterization Radiological Monitoring Plan
QA	Quality Assurance
QAPD	Quality Assurance Program Document
QAPP	Quality Assurance Program Plan
QC	Quality Control
R	roentgen
rad	See Glossary
RADMP	Radiological Monitoring Plan
RAMATROL	Radioactive Material Control Group (REECo)
RCP	Regulatory Compliance Plan
REECo	Reynolds Electrical and Engineering Company
rem	See Glossary
RMIM	Radiological Monitoring Instruction Manual
RESMIP	Radiological Environmental and Safety Monitoring Implementation Manual
RFPD	Radiological Field Programs Department
RIB	Reference Information Base
RMDS	Radiological Monitoring Data Summary
RSED	Regulatory and Site Evaluations Division

SAIC	Science Applications International Corporation
SAR	safety analysis report
SCP	site characterization plan
SEMP	Systems Engineering Management Plan
SENFCA	Survey and Evaluation of Nuclear Fuel Cycle Activities
SEPDB	Site and Engineering Properties Data Base
SF	spent fuel
SHP	Safety and Health Plan
SMF	Sample Management Facility
SNL	Sandia National Laboratory
T&MSS	Technical and Management Support Services Contractor
TESHP	T&MSS Environmental, Safety, and Health Plan
TLD	thermoluminescent dosimeter
TRU	transuranic waste
TSLD	T&MSS Sample Location Document
USGS	United States Geological Survey
W	Westinghouse Electric Corporation
WHO	World Health Organization
WIPP	Waste Isolation Pilot Plant
WL	working level
WLM	working level month
YMP	Yucca Mountain Site Characterization Project
YMPO	Yucca Mountain Site Characterization Project Office
a	alpha particle
b	beta particle
g	gamma ray
X/Q	atmospheric dispersion coefficient (Atomic Energy and Meteorology)
μCi	1 curie x 10^{-6}
μR	1 roentgen x 10^{-6}

SCIENTIFIC INVESTIGATION

PACKAGE

FOR

RADIOLOGICAL MONITORING

Revision 1

Work Breakdown Structure (WBS) References:

WBS 1.2.5.4.5 Radiological Studies

T&MSS/RFPD-91/003

Prepared by: Technical and Management Support Services

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SECTION 1

INTRODUCTION

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

1.0 INTRODUCTION

This statement of work summarizes both the quality and non-quality affecting Yucca Mountain Site Characterization Project (YMP) radiological monitoring processes currently conducted or planned to be conducted by Technical and Management Support Services (T&MSS) as a project participant. Quality affecting work will be constrained by activities described in this and referenced documents and procedures. New "methods, procedures, or processes" will not be used in any of the processes identified in this plan. Should any "new methods, procedures, or processes" be required in the future, they shall meet the requirements identified in Section 20.6 of the T&MSS QAPD. This program will use existing nationally accepted practices as the criteria for determining methodologies.

Radiological Monitoring History

Radiological studies and monitoring in the vicinity of the Nevada Test Site (NTS) have been conducted since the first series of nuclear weapons testing was initiated. Most of these early radiological studies were test specific and are of limited value to current project studies. A formalized NTS radiological surveillance program was established in 1955. An intensified program of NTS monitoring is currently being performed onsite by Reynolds Electrical and Engineering Company (REECo), and offsite by the U.S. Environmental Protection Agency (EPA) Nuclear Radiation Assessment Division (NRAD). The REECo and NRAD monitoring data provide information concerning the radiological status of the NTS environs, but these programs provide very limited data specifically for the southwest region of the NTS and general Yucca Mountain Area. Because these studies are associated with the NTS the possibility exists for obtaining samples with levels of radioactive materials higher than natural background levels. While this is not expected to present any personnel exposure concerns all samples will be monitored.

This scientific investigation package serves as the Radiological Environmental and Safety Monitoring Implementation Plan (RESMIP) and was compiled in accordance with T&MSS Standard Procedure (SP) 2.2, Scientific Investigation Control. SP 2.2 requires, in part, preparation, review, and approval of the documentation which comprises this package, prior to initiation of the investigation described herein.

SECTION 2

APPROVAL MEMORANDUM

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

WBS #1.2.5.4.5
QA

INTEROFFICE MEMORANDUM

DATE: May 24, 1991

TO: Douglas K. Chandler, APM
Programs and Operations

FROM: C. Dennis Sorensen, Manager
Radiological and Environmental
Field Programs Department

SUBJECT: Request for Approval of Scientific Investigation Package Entitled "Radiological Monitoring"

The subject package has been compiled and completed in accordance with Standard Practice Procedure 2.2 entitled Scientific Investigation Control. All requisite documentation is attached or referenced herein. All prerequisites for start-up activities have been met, as determined by the T&MSS Readiness Review Committee. Any changes to this document or the associated implementing procedures will be reviewed and approved in accordance with the appropriate SP.

Your approval of this package is requested. Please indicate concurrence and approval by your signature below.

C D Sorensen 5/24/91
Manager, Radiological and Environmental
Field Programs Department — Approved

D K Chandler 5/29/91
Assistant Project Manager for
Programs and Operations — Concurrence

5-31-91
Quality Assurance Manager — Concurrence

SECTION 3

STATEMENT OF WORK

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

Summary

The Scientific Investigation for Radiological Monitoring consists of the monitoring of various elements to determine the existing radiation levels and radioactivity concentration at and around the proposed repository site and to determine the potential impact of site characterization activities on the environment. This will be a continuing scientific investigation through site characterization. Facilities will be used for follow-on studies at the conclusion of these investigations.

Overview of Site-Specific Environmental Radiological Monitoring

The radiological monitoring program includes monitoring of:

- soils (non-quality affecting)
- sediments (non-quality affecting)
- surface water (quality affecting)
- groundwater (quality affecting)
- airborne particulates and gaseous samples (quality affecting)
- biota (non-quality affecting)
- ambient radiation (non-quality affecting)

Figure 1 shows the overall study area. Within the study area, two regions of interest have been identified:

(1) Near-Field (NF): 16 km radius
(2) Far-Field (FF): 84 km radius

Details of monitoring locations and sampling are described in Section 3.3.

Overview of T&MSS Radiological Monitoring Activities and Tasks

In general, T&MSS Radiological Monitoring Activities include the following:

(1) Design/maintain monitoring program
(2) Determine and procure needed equipment and services
(3) Install and calibrate (as needed) equipment
(4) Operate and maintain equipment
(5) Obtain/record monitoring data
(6) Obtain and arrange for analyses of samples
(7) Obtain results of sample analyses
(8) Review and report results of monitoring
(9) Conduct population dose and environmental assessment evaluations
(10) Project management and quality assurance

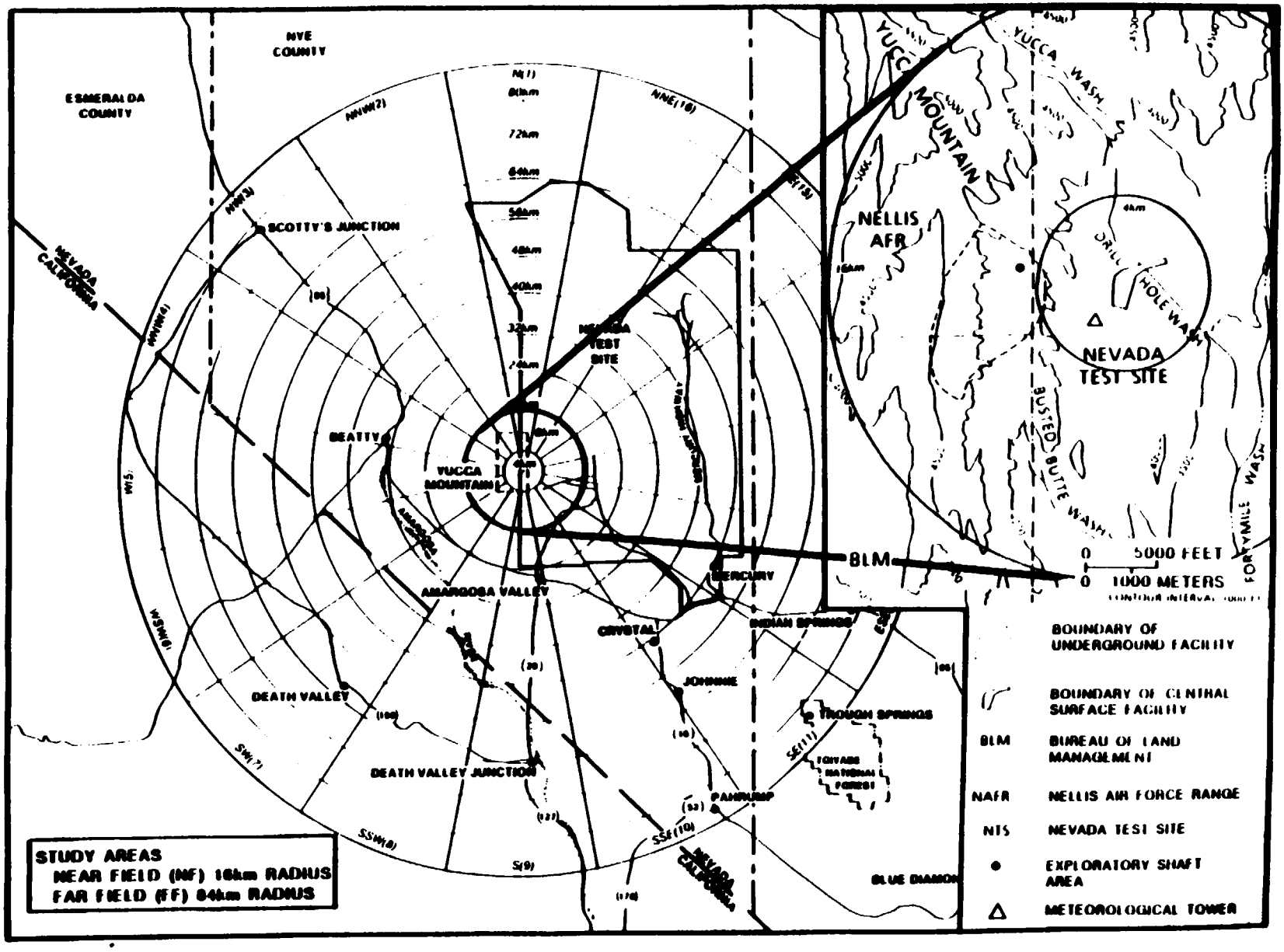

Figure 1. RADMP Study Areas.

For purposes of this statement of work, these activities are aggregated into five (5) tasks as follows:

Task No. 1 - Program Design
Task No. 2 - Equipment
Task No. 3 - Monitoring and Sampling
Task No. 4 - Review and Reporting of Monitoring and Sampling
Task No. 5 - Project Management and Quality Assurance

A description of each task is provided in the following sections.

3.0 STATEMENT OF WORK/TASK DESCRIPTIONS

3.1 Task No. 1 - Program Design

This task is currently complete. The documentation of the monitoring program design is provided in the Radiological Monitoring Plan (RADMP) (1990). The RADMP is a DOE Management Plan. The only identified constraint in the design of this monitoring program was the minimum detection level (MDL) of radionuclides in environmental matrices. Analytical results will be reviewed to determine acceptability of detection limits. Cost-benefit analysis will then be performed to modify, as appropriate, sampling or analytical techniques.

3.2 Task No. 2 - Equipment

This task involves determination of proper equipment to perform the radiological monitoring, its procurement, initial testing, its installation and continued operation and maintenance, including periodic calibration testing.

The equipment selected for the monitoring program is listed in Appendix 1. The equipment used for these tasks was selected based on standard industry and commercial practices. The range and accuracy of all equipment is maintained on the equipment list maintained by the Measuring and Test Equipment (M&TE) custodian.

Currently, a minimum of the equipment required for radiological monitoring has been selected, procured, and installed. Revisions to equipment requirements and procurement of new, different, or replacement equipment will be accomplished under this task. Any relocations of equipment or the installation of equipment at new monitoring locations will be implemented as part of this task.

The operation and maintenance of equipment to ensure its effective performance is also included in this task. Included in these activities are periodic calibration of monitoring devices and associated testing of equipment to ensure that performance is within acceptable ranges of test standards. Actions to repair or replace defective devices and equipment are also included in this task.

Periodic testing and calibration of equipment and associated maintenance is an integral part of the current radiological monitoring program.

3.3 Task No. 3 - Monitoring and Sampling

The activities entailed in this task comprise the data collection phase of the environmental radiological monitoring program. The following sections describe the monitoring program conducted under this task. This plan is descriptive of the sampling types used (e.g. grab, intermittent, continuous), however, specific methodologies, including degree of randomness of samples, will be described in the applicable T&MSS Work Instructions (WI's). WI's will provide detailed information on the sampling parameters to assure accurate representation. There are no mandatory hold points for monitoring prerequisites in these tasks except those identified in the applicable work instructions, and the following:

- Pre-activity Surveys - required by the Project Office prior to work in the field at Area 25 and NTS locations. This prerequisite will be completed for each applicable station location.

- Readiness Review - required by SP 1.60, "Readiness Review." This prerequisite has been completed for these activities.

3.3.1 Air Sampling

As indicated in DOE-EH-0173T and predicision documents (Corley et al. (1981)), the four categories of airborne radionuclides that should be considered for measurement in air sampling systems are particulates, gases (principally the inert gases), halogens (principally radioiodines), and tritium. Consideration of these airborne categories is important for environmental sampling and measurement because the categories account for most of the radioactive materials released from any site. In addition, the sampling and measurement parameters and methods were compared against the parameters required for models which are likely to be used in the future (AIRDOS, REMEDY). The specific requirements will be outlined in the software quality procedures.

Six separate activities (based on the characteristics of the media to be collected) will make up airborne radioactivity sampling: airborne particulate sampling, iodine sampling, C-14 sampling (CO_2), tritium sampling, man-made inert-gas and radon/radon sampling and monitoring, and radon/radon progenies sampling and monitoring. The ambient airborne radiation data will be used for atmospheric transport evaluations and dose assessment.

The airborne radioactivity monitoring program (air sampling) includes:

- Continuous collection of airborne particulate with some selected iodine samples using a particulate filter and charcoal cartridge, as applicable, attached to a constant flow controlled vacuum pump.

- Intermittent airborne particulate collection for particle size evaluation.

- Airborne tritium and inert gas sampling.
- Radon and radon progeny products monitoring.

Air Sampling Locations. Location of the air monitoring stations requires consideration of various technical factors. These factors included consideration of the location of the future facilities, past activities in the area, meteorology of the area, topography of the area, location of population (onsite and offsite), and others. Near-field and far-field sampling locations are shown on Figures 2 and 3, respectively.

Table 1 lists the near-field and far-field air sampling stations and the rationale for their location.

Inert gases, specifically radioxenons and radiokrypton (excluding radon), are monitored because of their presence as a result of NTS activities and potential influence on background assessments. The near-field inert gas/tritium (IGT) sampler location is shown in Figure 2.

The locations for integrating radon sampling units are shown in Figure 2. The radon monitoring system consists of both integrating samplers and continuous monitors. E-PERM^{tm} electret integrating samplers for the measurement of radon concentrations are the primary sampling unit in the field. Continuous radon trace level monitors (CRMs) will be used to provide hourly data on radon variability at selected sampling locations. Typically, a CRM will be used to monitor radon concentrations at the 60 m meteorological tower and in the vicinity of the proposed exploratory studies area. A CRM will also be available for making special radon measurements at other locations, as needed.

Air Samples Types, Methods, and Frequency. It is essential that appropriate sampling frequencies be identified. With the exception of particulate size sampling, this discussion addresses sample change frequency, since sample collection activities are essentially continuous.

Based on DOE guidance, the frequency of collection for air samples is adjusted to take into account the limitations of the sample collectors, the capabilities of the air movers, and the physical problem of retrieving samples from each location on a fixed frequency. Typically, frequency of collection is every one to two weeks. Dust loading of the filter will generally determine the sampling period. Dust loading increases the differential pressure across the filter to a point where the equipment can no longer ensure a constant flow rate. Table 2 summarizes the airborne radiological sampling program in terms of sample type, sample method, and nominal collection frequency.

Air Samples Laboratory Analysis. The laboratory analysis of most samples for radionuclide concentrations will be performed by a qualified vendor. Table 3 provides a summary of the analysis to be conducted on air samples.

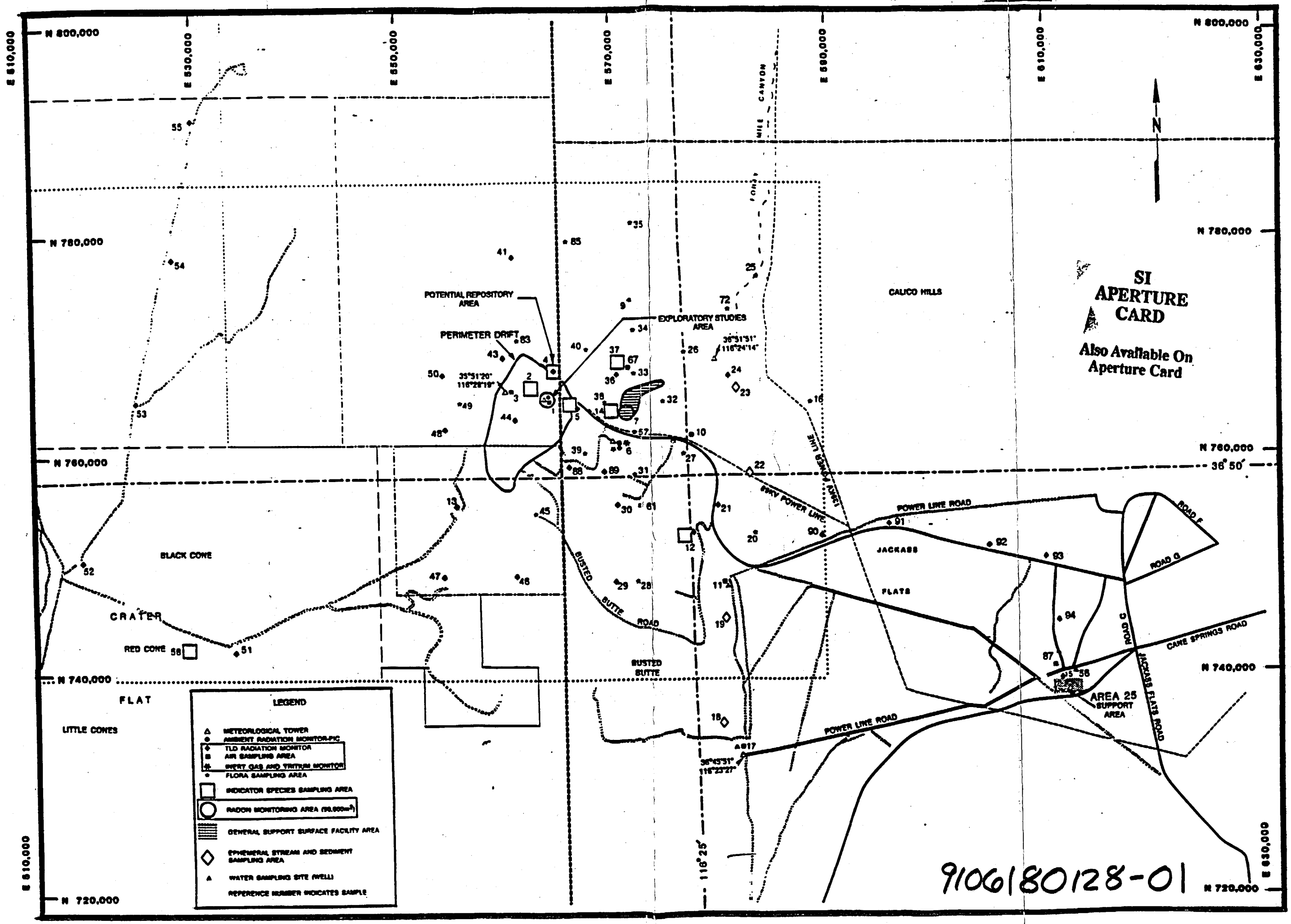

Figure 2 Near field sampling locations

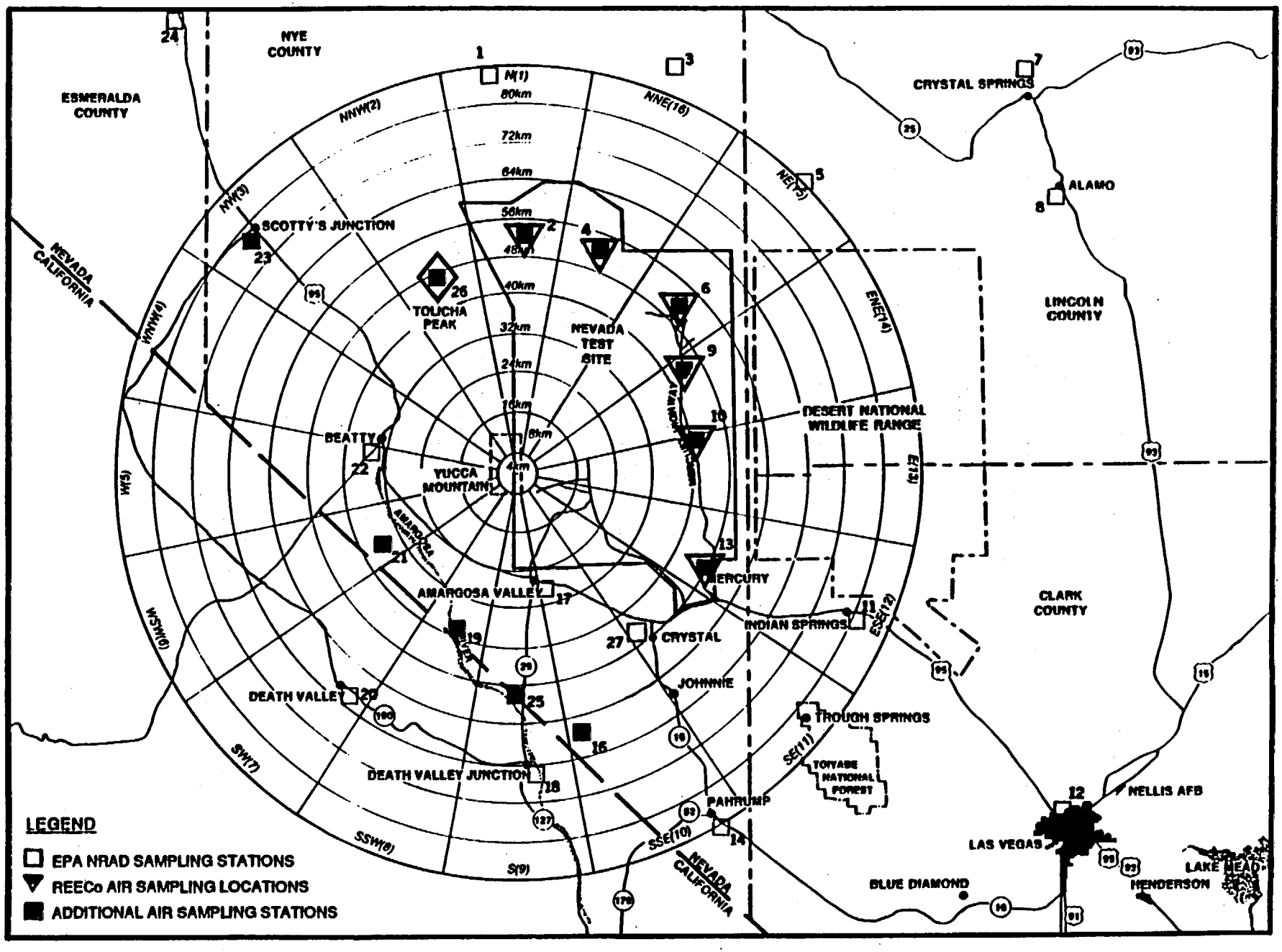

Figure 3. Far-field air sampling locations.

Table 1. Air Sampling Stations

Station	Rationale for Location
NEAR-FIELD	
8, 10, 11, 17	Monitor potential concentration of radioactivity airborne from NTS[a] source(s)
6[b], 67, 61	Monitor concentration at the surface facility area
1	Monitor concentration at the exploratory shaft area
3	Monitor concentration on top of Yucca Mountain due to topography
13	Monitor concentration moving offsite from easterly winds
FAR FIELD	
2, 4, 6, 9, 10, 13	Monitor radioactivity concentrations leaving the NTS based on existing REECo[c] monitoring
15, 16, 19	Monitor primary agricultural and rural population area; not monitored by NTS (EPA/NRAD) program
17[b]	Monitor radioactivity concentrations at nearby population centers; not monitored by NTS (EPA/NRAD) program
23, 26	Monitor significant area of the wind rose not covered by other monitoring

[a] NTS - Nevada Test Site
[b] Includes tritium and inert gas samplers
[c] REECo = Reynolds Electrical and Engineering Company, Inc.

Table 2. Airborne Radiological Sampling

Sample Type	Sample Method	Nominal Collection Frequency
Particulate filter	Continuous	Filter exchange weekly
Charcoal cartridge (as appropriate)	Continuous	Cartridge exchange weekly
Cascade impactor filters	Intermittent	Near-field stations annually
Radon	Integrating Continuous	Monthly sampler exchange Weekly data collection
Tritium	Continuous	Weekly
Inert gas	Continuous	Weekly

Table 3. Air Sample Analysis

Sample	Analysis
Air particulate filter	Gross beta counts - weekly filters(s) Gross alpha counts - weekly filters(s) Gamma spectroscopy - quarterly composite of weekly filters: Co-60, Cs-134, Cs-137/Ba-137m, K-40, Sn-126/Sb-126M/Sb-126, Ru-106, Sb-125/Te-125m,Ce-144/Pr-144, Pm-147
	Alpha spectrometry or specific radiochemical analysis on quarterly filter composite: Po-210, Pb-210, Th-230, Np-237, Ra-226, Pu-238, Pu-239, Pu-240, Am-241, Am-243, Th-232, Cm-243, and Cm-244
	Specific chemical analysis of quarterly composites: Sr-90/Y-90, Sr-89, Fe-55, C-14, I-129, Tc-99, and Pu-241
	Total uranium (nonroutine analysis)
Charcoal cartridge	Gamma spectral analysis of weekly collected cartridge for I-131
Inert-gas monitor	Xe-133, Xe-135, and Kr-85 weekly collection liquid scintillation counting
Tritium	H-3 collected weekly, liquid scintillation counting
Radon	
E-PERM^{tm} electret integrating sampler	Radon - Monthly collection
Continuously recording radon monitor	Radon - weekly data transfer
Particulate size sample	Low and high volume cascade impactor for size segregation and determination of weight fractions (nonroutine, particule size distributions)

3.3.2 Water Sampling

DOE-EH-0173T describes and justifies the water surveillance requirements at nuclear facilities. The principal exposure pathways from waterborne radionuclides to individuals (or groups of individuals) in the environment are ingestion of drinking water; consumption of fish, ducks, or other aquatic species; and the consumption of irrigated crops. Of secondary importance are external radiation dose contributions from surface water (swimming, boating, water skiing), sediment deposits along the shoreline, or deposits on an irrigated field. The radiation doses from these external sources are generally orders of magnitude less than doses from ingestion pathways (Denham et al., 1974; Soldat, 1971).

As a consequence of the desert ecosystem within which the site is located, the potential for radioactive material from Yucca Mountain reaching man through the water pathway is very small. Water pathways at Yucca Mountain may include the following:

1. Ephemeral streams and catch basins.

2. Groundwater.

3. Airborne deposition to the Amargosa River, streams, or other bodies of surface water.

4. Reservoirs or ponds supplied from groundwater sources.

No liquid effluent will be released to a surface-water source, because there are no through-flowing streams in the Yucca Mountain area. There is a large ephemeral stream (Fortymile Wash) located just east of the site.

Routine laboratory determinations from water samples typically include gross alpha and beta, tritium, radiostrontium, gamma spectrometry, and specific radio-chemical analysis for other selected nuclides. Alpha spectrometry may also be included, depending on potential release of alpha contaminants or the results of the screening. In addition to total activity analysis, it may be desirable to measure the distribution of activity between soluble and suspended materials, as well as the chemical form of a radionuclide.

The radiological water sampling program includes the collection of samples of ground (or well) water, surface water, and ephemeral stream sources. A description of sampling locations, methods, and analysis is provided in the following sections.

Water Sampling Locations. Collection of water samples at the designated locations discussed in the following sections is based on site-specific conditions and guidance documents from DOE, NRC, and EPA. The proposed Yucca Mountain repository site hydrologic conditions are generally characterized by low precipitation, no perennial streams, few springs, rapid runoff during heavy precipitation (ephemeral streams), limited/intermittent catch basins, and deep underground aquifers (Alkali Flat-Furnace Creek Ranch groundwater basin). Other conditions such as local meteorology and absence of liquid

effluent releases to surface-water sources are also important to the selection of water sampling locations. The locations of water sampling are shown in Figures 2 and 4. The sampling at near-field groundwater sampling location number 11 (NTS Well J-13) is of special interest because groundwater from this location is expected to be the primary source of water used during site characterization.

Surface water samples will be collected at those limited locations where surface water occurs. No perennial streams occur at or near Yucca Mountain within the NF study area. The only reliable sources of surface water are beyond 30 km from the proposed repository site at springs in the Oasis Valley north of Beatty, NV; in the Amargosa Desert southeast of Amargosa Valley community; in Death Valley, southwest of Amargosa Valley community; and at Crystal Reservoir and numerous spring-fed pools in Ash Meadows, south of Amargosa Valley community. Based on preliminary evaluations, groundwater is not a significant exposure pathway and annual samples will provide adequate background information.

A survey of catch basins in the Yucca Mountain area will be conducted and sampling expanded to include appropriate basins serving as natural watering stations for wildlife. Water samples will typically be collected once a year. Ephemeral surface water flows in Fortymile Canyon will be sampled as available at the locations indicated in Figure 2. Near-field groundwater sample collection will be coordinated with the project geohydrologic and water resource studies.

Water Sample Types, Methods, and Frequency. The major concerns for water sampling are the collection of a representative sample and the preservation of radionuclides in their original concentrations before analysis. Most water measurements are made on samples taken in the environment and returned to the laboratory for analysis. The measurement of radioactivity in environmental water samples has been discussed by Kahn (1972). Standardized methodologies for collection and handling of water samples are also discussed in numerous documents, including American Public Health Association (APHA) (1971), American Society for Testing and Materials (ASTM) (1987a,b), Manual of Ground Water Sampling Procedures United States Geologic Survey (USGS) (1977) and EPA (1977). All sampling activities will be consistent with Conti et al. (1978) and applicable NRC guidance. Table 4 summarizes the water sampling program in terms of sample type, methods, and frequency.

Laboratory Analysis of Water Samples. Based on the characteristics of the flow regime (regional hydrology) in the Yucca Mountain area, the water typically will be sampled annually. A gamma spectroscopy evaluation will be completed on each sample. The laboratory analyses to be conducted on water samples are listed in Table 5.

3.3.3 Soil and Sediment Sampling

The DOE provides recommendations for soil sampling. The guidance indicates that soil provides an integrating medium that can account for contaminants released to the atmosphere (either directly in gaseous effluents, or indirectly from resuspension of onsite contamination), or

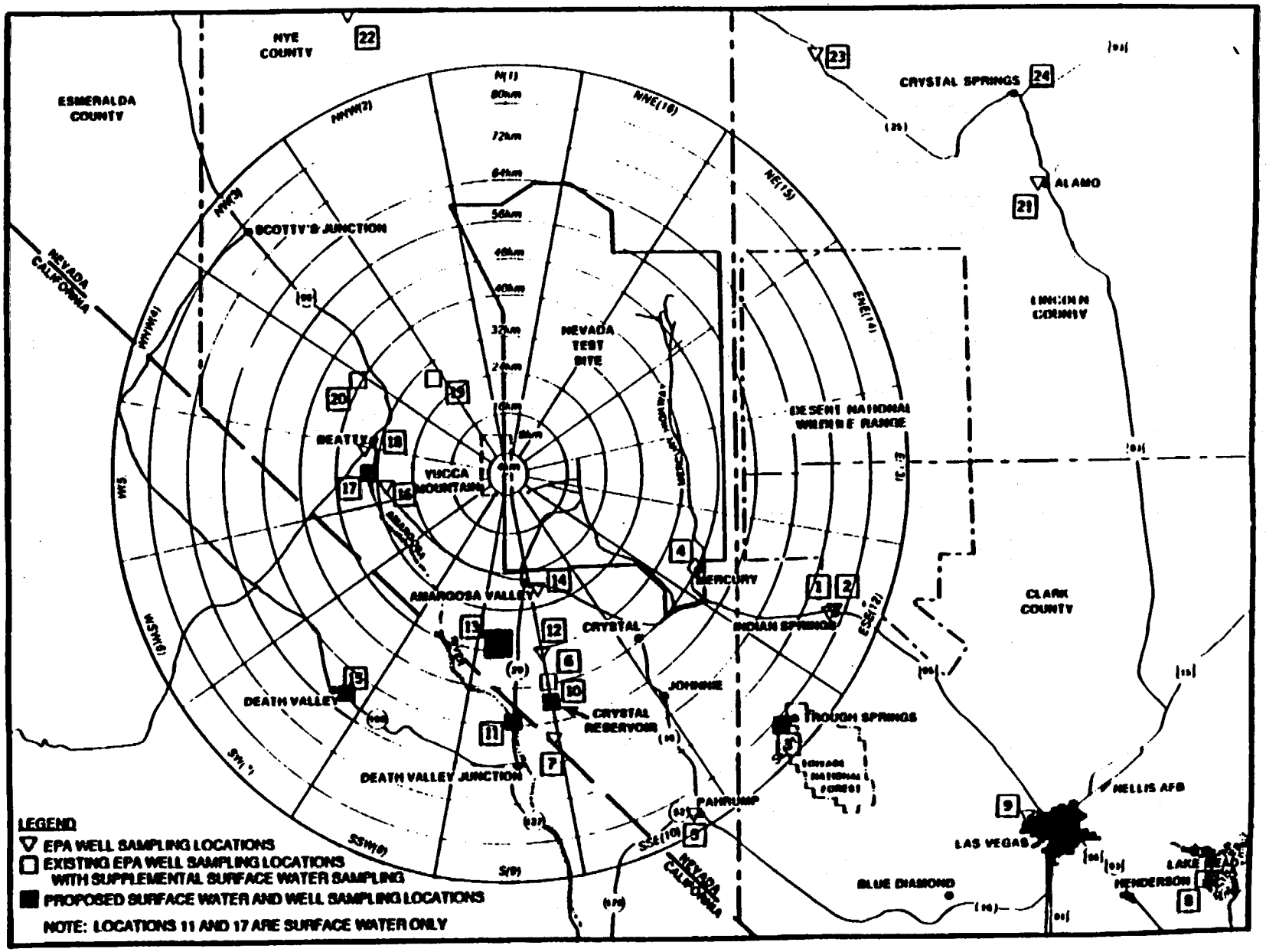

Figure 4. Far-Field Water Sampling Locations

Table 4. Water Sampling

Sample Type	Sample Method	Nominal Collection Frequency
Ground/drinking water	Grab	Annual at far-field and near-field apportioned wells. As available for USGS monitoring wells near-field.
Surface water	Grab	Annual
Ephemeral streams	Grab	As available

Table 5. Water Sample Analysis

Sample	Analysis
Groundwater and surface water	Gross alpha and gross beta screening counts Gamma spectroscopy for gamma emitters (see Air Sample Analysis, Table 4, for representative radionuclides of interest) Alpha spectroscopy for alpha emitters: Np-237, Am-241, Pu-238, Pu-239, Pu-240, Cm-242, and Cm-244 Specific radiochemical analysis: Tc-99, Ni-59, Zr-93/Nb-93m, Pm-147, Fe-55, and H-3
Drinking water	Same as groundwater and surface water, plus EPA drinking water criteria: Gross alpha and gross beta, H-3, Sr-90/Y-90, Ra-226, Ra-228, and Rn-222 Total uranium
Ephemeral streams	Same analysis as surface water

through liquid effluents released to a stream that is subsequently used for irrigation. Hence, soil sampling and analysis will be used to evaluate the long-term accumulation trends and to estimate environmental radionuclide inventories. In addition to radionuclides that are specific to a particular operation or facility, naturally occurring and fallout radionuclides can be expected in soil samples.

During underground mining and operation, driftwall sampling will be used to characterize the uranium and thorium sources that produce the radon and radon progeny product inventory emanating from the mine.

Soil and Sediment Sampling Locations. Background determinations will be based on soil sampling and analysis at points corresponding to background (or control) air sampling locations. Primary soil sampling locations have been selected to coincide with air sampling stations since the comparability of data may be important in achieving the objectives of the overall environmental sampling program. Soil samples will be collected in association with other sampling locations as appropriate. Soil and sediment samples will be collected annually from each air sampling location and Fortymile Wash. In addition, soil and sediment samples (as appropriate) will be obtained from all sampling locations after implementation of sampling at the location. Special soil samples will be collected from each area selected for indicator species (biota) sampling. A process for random collection of soil samples within a designated area will be used. Areas of construction or significant surface disturbance will also be sampled or monitored. Most samples will be archived for future analyses. Soil samples from air sampling locations and the sediment samples from Fortymile Wash will be split, so that a portion of the sample can be analyzed and the balance archived. In situ gamma spectral analysis will also be performed at each soil sampling location.

Soil and Sediment Sample Types, Methods, and Frequency. Several reports are available that are used as guidance in sampling, preparing, and analyzing soil for plutonium (AEC, 1974; Sill and Williams, 1971), for radium (Fleischhauer, 1984; Meyer and Purvis, 1985; Myrick et al., 1983), and for other radionuclides (ASTM, 1986; Mohrand). DOE sites (Boyns, 1975) have provided an overview of the location, relative intensity, and identification of gamma-emitting radioactive contaminants. Particularly valuable is the definition of radioactivity levels in areas difficult to measure by ground survey techniques. Table 6 summarizes the soil and sediment monitoring program in terms of sample type, methods, and collection frequency.

In Situ Gamma Spectroscopy. The ambient environment at each soil sampling location will be measured by in situ gamma spectroscopy. The data collection (site-specific spectral data) will occur at each soil sampling location, and will normally be repeated only if there is an indication that the radiological conditions have changed. A limited number of locations will be selected for reevaluation to provide some idea of the variability of these spectra over time.

The basis for use of in situ gamma ray spectroscopy are contained in the recommendations and regulatory guidance of agencies such as the DOE, International Atomic Energy Agency (IAEA) (1975), and NCRP (1976). In situ spectroscopy allows for rapid assessment of radiation exposure at a field location, direct estimation of individual radionuclide contribution to

Table 6. Soil and Sediment Sampling

Sample Type	Sample Method	Nominal Collection Frequency
SEDIMENT		
Shoreline at site's Surface water	Grab	Annual
Ephemeral streams		
Surface	Grab	Biannual
Depth	Grab	Once (concurrent with initial surface sample)
SOIL		
Surface	Grab	Annual at air sampling stations, once for archiving at all sample locations
Depth	Grab	At selected locations in association with in situ

ambient radiation levels from soil, evaluation of time dependent variability to spectra at a specific location and detection of trends in environmental radioactivity. Periodic re-evaluation of spectral data at specific locations will provide a cost effective, highly sensitive methodology for long-term trending of environmental radioactivity, which is indicative of redistribution of activity due to resuspension and atmospheric transport.

Soil and Sediment Samples Laboratory Analysis. The laboratory analyses to be conducted on soil and sediment samples are listed in Table 7.

3.3.4 Biota Sampling

The DOE (DOE-EH-0173T) indicates that samples of milk, crops, and animal produce from livestock and game are of greatest importance in environmental surveillance because they provide the most direct basis for assessing the radiation dose to humans from ingestion. The principal pathways for radionuclide contamination of food pathways to Homo sapiens are (1) atmospheric deposition onto crops and animal forage crops from airborne releases, and (2) crop irrigation from water bodies receiving liquid effluents.

While this section briefly describes the biota sampling program, many details of the program cannot be presented until a detailed survey of the agricultural, recreational, and cultural activities within the area is conducted. The preliminary data necessary will be collected as indicated in Section 6.1 of Corley et al. (1981).

The biota samples collected under this monitoring plan will represent direct dosage pathways, indirect dosage pathways, and animal indicator species of local environmental contamination. Direct pathways are represented by food items and will include samples of milk, crops (intended for human consumption), beef, poultry, and eggs collected in the far-field area. Near-field samples of game birds may be collected if population densities increase sufficiently. Venison samples from local mule deer will not be collected due to low population density and movement pattern considerations. Indirect pathway samples will include cattle and deer forage species. Several indicator species indigenous to the study area have been selected to assist in detecting inadvertent releases of radioactivity and to monitor any long-term radionuclide accumulation in the local environment.

Samples of locally produced food crops of importance in the human food chain exposure pathway or plants that may be indicative of localized agricultural conditions will be collected within the FF study area.

Near-field biota sampling includes small mammals (indicator species) and deer forage vegetation. Deer forage will serve as an indicator of potential human food chain exposure pathway. Small mammals provide indicator information for assessing localized changes in background radiological data.

Biota Sampling Locations. Locations of Biota sampling in near-field are shown in Figure 2. Far-field biota sampling locations will be determined on the basis of land use information.

Table 7. Soil and Sediment Analysis

Sample	Analysis
SOIL	
Surface soil	Gross alpha and beta (field screening) In situ gamma spectroscopy (periodic) Gamma spectroscopy for gamma emitters Specific radiochemical analysis: SR-90/Y-90, Zr-95/Nb-95, Ce-144/Pr-144, Pu-238, Pu-239, Pu-241, Am-241, Ra-226, Np-237, Te-99, I-129, C-14, Po-210, and uranium (total)
Soil at depth	Same radionuclides as for surface soil
SEDIMENT	
Shoreline	Same as surface soil
@ Depth	Same as surface soil

Biota Sample Types, Methods, and Frequency. Table 8 summarizes the biota sampling program in terms of sample type, methods, and collecction frequency.

Biota Samples Laboratory Analysis. The laboratory analyses to be conducted on biota samples are listed in Table 9.

3.3.5 Ambient Radiation Monitoring

The exposure of environmental population groups (general public) to external radiation from nuclear facility operations include exposure from cloud passage of airborne effluents, as well as exposure from previous radionuclide deposition patterns on soil, vegetation, sediment, or structures. External exposure from radionuclides in water should be insignificant during normal operations at a site such as the Yucca Mountain facility, although unique situations may still arise where recreational, commercial, or industrial use of a receiving body of water may incur some direct exposure.

The feasibility of distinguishing an annual incremental exposure even as low as 5 mR at a given location with the best available dosimetry is difficult in view of the variability of background radiation. The methods discussed in the balance of this section describe the range of available techniques, including those selected for use at Yucca Mountain.

The monitoring of ambient radiation will be conducted primarily by using thermoluminescent dosimeters (TLDs) on a quarterly exchange period (three month field exposure cycle). In addition to the TLDs, high-pressure ion chambers (PICs) will be used to monitor ambient radiation levels. The PICs will be used to continuously monitor exposure rates at various locations.

Ambient Radiation Monitoring Locations. Integrating dosimeters include such commonly used devices as TLDs and ionization chambers. Records of environmental exposure rates for the early years at the NTS were largely based on ionization chamber readings, and are generally not well-suited for comparison at low exposures (in terms of accuracy) with more recent results using TLDs. TLDs are the dosimeters of choice based on demonstrated sensitivity, reproducibility, reliability, and long-term stability. The individual dosimeter is relatively inexpensive, although a complete dosimeter/reader system can involve a large initial cost.

TLDs will be placed at each air sampling location and at most near-field locations shown on Figure 2. Figure 5 shows the far-field TLD locations. Figure 2 indicates the near-field locations for deployment of PICs. A portable PIC unit will be available to augment the PIC monitoring network.

Aerial surveys consist of overflights of the near-field area by an aircraft-borne radiation measurement and recording system. The AMS (Doyle, 1974; and Deal and Doyle, 1975) operated for the DOE by EG&G Inc., is the method currently planned for this survey. It provides detailed data analyses from aerial surveys of gamma radiation levels in and around nuclear

Table 8. Biota Sampling

Sample Type	Sample Method	Nominal Collection Frequency
Milk	Grab	TBD
Produce		
Vegetable	Grab	Annually
Meat	Grab	Annually
Field crops	Grab	Annually
Forage species	Grab	Annually
Game birds	Grab	TBD
Indicator species		
Small mammals	Grab	Semi-annually
Large herbivorous mammals	Grab	TBD
Predators	Grab	TBD

Table 9. Biota Analysis

Sample	Analysis
Milk	Gamma emitters (routine) H-3 (routine) Alpha spectroscopy Radiochemical analysis: I-129 (special) Sr-89 and Sr-90 (periodic)
Produce (human consumption)	Gamma emitters Alpha spectroscopy and specific radiochemical separation: Pu-239 and Pu-241 Specific radioanalytic analysis: C-14, Sr-89, Sr-90, and Ni-63
Beef	Gamma emitters Alpha spectroscopy and specific radio-analytical processes: Pu-239 and Am-241 Specific radioanalytic analyses: Sr-90, and C-14
Beef thyroid	I-129
Forage (deer and cattle)	Gamma emitters Alpha spectroscopy and specific radiochemical separation: Pu-239, Am-241, Cm-244, and Np-237 Specific radioanalytic analysis: Sr-90 and C-14
Indicator species (small mammal)	Gamma emitters Alpha spectroscopy and radioanalytical separation: Pu-239/240, Am-241, and Np-237 Specific radionuclide analysis: I-129, Pu-241, C-14, Tc-99, Sr-90/Y-90, Sr-89, Ni-63, and Ni-59

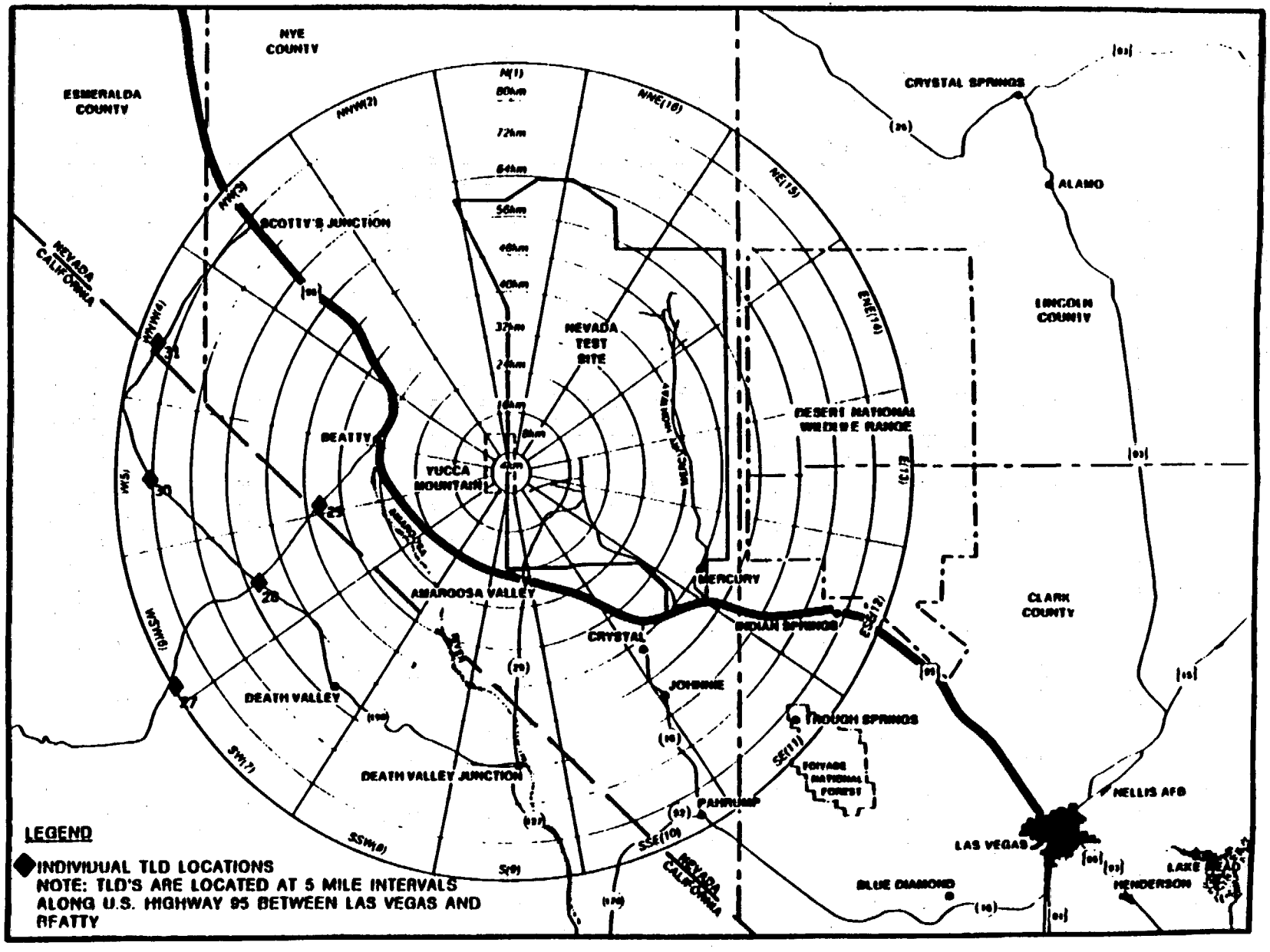

Figure 5. Far-Field Thermoluminescent Dosimeter (TLD) Monitoring Locations

facilities. In addition, the EG&G Energy Measurements, Aerial Measurements System group will be scheduled to conduct an airborne radiometric survey of the Yucca Mountain area. This survey will produce external exposure rate isopleths (μR/h at 1 meter) for the NF area.

Ambient Monitoring Types, Methods, and Collection Frequency. Ambient monitoring types, methods, and collection frequency are summarized in Table 10.

Ambient Monitoring Analysis. The ambient monitoring analysis is summarized in Table 11.

3.4 Task No. 4, Review and Reporting of Monitoring and Sample Data

This task entails the collection, compilation and reduction, review, and reporting of the results of radiological monitoring and sampling. Various computational and analytical methodologies are required to support the radiological monitoring program and various other Project site characterization radiological assessment activities. These methodologies can be relatively uncomplicated calculation models, or more comprehensive computer programs with varying degrees of complexity.

The analytical methods required to implement the radiological assessment element of the RADMP are partly determined by the reporting and analytical needs of the Project during site characterization. Most of the methodologies will be directed toward the estimation of potential radiation doses to the worker and the public, or the dispersion of activity into the environment from existing or planned activities. A limited number of computational methodologies are needed to support (1) resolution of radiological issues, (2) review of safety analysis, and (3) other assessment activities.

All radiological assessment methodologies require various types of input data. In many instances, the development of input data itself may require various levels of analytical effort. This activity would include the development of the basic analytical methodologies, the various inputs, or the assessment techniques necessary to support the required analyses. The analytical areas that will be addressed include the following:

- Source term assessment.
- Public radiation dose assessment.
- Worker radiation dose assessment.
- Radon source terms.

Data Collection. The results of the sampling and monitoring described in Task No. 3 will be collected and assembled. Scientific notebooks will not be used in this investigation. Specific conditions critical to the maintenance of investigative conditions for this program will be included in technical procedures. These conditions include the proper storage of M&TE and samples.

Table 10. Ambient Radiation Monitoring

Sample Type	Sample Method	Nominal Collection Frequency
Thermoluminescent dosimeters	Integrating	Quarterly dosimeter exchange
Pressurized ion chambers	Continuous	Weekly data collection
Aerial survey	Flyover	Initially during site characterization phase

Table 11. Ambient Radiation Monitoring Analysis

Sample	Analysis
Thermoluminescent Dosimeter	Dose (mrem/qtr)
Pressurized Ion Chamber	Exposure rate (μR/hr)
Aerial survey	Exposure rate (Cs-137 equivalent μR/hr)

Data Reduction. The collected data will be grouped in a statistical manner (i.e., data groups, distribution plots, and time sequence averages), to reduce the number of data points to a manageable number for analysis and reporting. Included in the data reduction will be a characterization of the environmental radiological data collected in an evaluation matrix, which relates meteorological data and other site parameters to the radiological data collected.

Data Review. The environmental radiological monitoring data will be reviewed using the following basic criteria as appropriate:

1. Uncertainty (95 percent confidence level) in the value, based on counting statistics.

2. Consistency with meteorological parameters and site disturbances.

3. Consistency variation with previous results.

4. Consistency with practical range of known variability based on past data and existing National Council on Radiation Protection and Measurements information on environmental radiation background.

5. Instrument problems and/or calibration data.

6. Quality control sample results.

7. Data with unresolved questions shall be clearly identified when used or reported.

Computer Software

All quality affecting computer software based assessment methodologies/programs used in this task will be evaluated against a set of defined considerations. The T&MSS Contractor or other supporting organizations will evaluate these methodologies/programs for use in assessing compliance during the site characterization and construction phases (and other phases as needed). When the evaluations are conducted by an organization other than T&MSS, the organization will attempt to obtain the concurrence of T&MSS on this evaluation. These evaluations will be submitted to the Project Office for approval when completed. These considerations include, but are not necessarily limited to, the following questions:

1. To what extent does the methodology/program provide the required data from available input?

2. How feasible is it to modify the methodology/program to provide the required data from available input?

3. Are there alternate methodologies/programs that can provide the required data from available input?

4. Has the methodology/program been accepted in NRC licensing proceedings

5. Has the methodology/program been accepted (or will it be accepted) by the EPA, NRC, OCRWM, or other DOE organizations?

6. Is adequate documentation available for use of the methodology/ program?

7. Has the methodology/program been verified?

8. Has the methodology/program been validated?

9. If the answer to Item 7 or 8 is no, can verification and validation be accomplished?

10. Can site-specific data be used in these methodologies/programs?

11. Does the methodology/program produce answers within an acceptable level of uncertainty?

12. Is the methodology/program consistent with statutory requirements, regulatory criteria, and technical guidance?

13. Is the methodology/program consistent with the other OCRWM programs, and is it consistent with state-of-the-art technology?

Evaluations of the various methodologies/programs within these constraints and considerations will rely on completion of the following activities:

1. Obtaining and reviewing a copy of documentation for the methodology of interest.

2. Performing a test case implementation of the methodology.

3. Documenting the selection process for the methodology. (Software documentation is discussed in the Project and/or T&MSS Software QA Plan (SQAP) and applicable procedures or the equivalent documentation for the applicable organization.)

4. Verification and validation, as appropriate.

5. Implementing QA and configuration management controls as described in the applicable SQAP and associated documents.

After completion of the evaluation activities, the methodology is approved for use. The evaluation process may be terminated at any step if it is determined that no significant benefit to the Project will result from completion of the process.

Data Reporting. When data quality has been evaluated against the above criteria, the data will be placed in the Project technical data base for use by appropriate technical staff and for informational purposes to designated Project participants and interested parties including tribal, state, and local officials. This will be done in accordance with AP-5.1Q "Control and

Transfer of Technical Data on the Yucca Mountain Project". Annual summary reports will also be prepared. The intended use of all data derived is stated in this document. All other uses of this data must be separately evaluated and justified for appropriateness.

3.5 Task No. 5, Project Management and Quality Assurance

This task comprises the effort necessary to assure quality data. Included in this task are the efforts necessary to assure compliance with all applicable project requirements and procedures, including but not limited to, assurance of staff qualifications and training. The T&MSS Quality Assurance Program Description provides the basis for the QA program which is implemented in this activity. All portions of the program have been through a formal QA grading process and NQA-1 criteria implemented as applicable.

The data obtained, the methods, the reduction of the data, analysis, and the physical samples taken will all be subject to the appropriate quality assurance criteria. Qualified data is critical in the licensing effort and assuring compliance with regulatory requirements. Examples of QA controls are listed below:

Periodic Calibration or Performance Checks. Each instrument or equipment used to obtain data shall be either calibrated or performance checked as required in the operating manual, guidelines, standard methods or operating instructions for the specific measurement being taken.

Calibration and Performance Tests. Calibration or Performance Tests of each sampler or analyzer will be performed on a routine basis. These calibrations and performance tests shall be performed by qualified personnel.

Personnel. Each person who performs any quality affecting work concerning this scientific investigation shall be qualified and trained and the qualification and training shall be documented.

The person who performs any such quality performing task shall be designated to perform that task by a responsible manager.

Prior to the performance of the task, the responsible manager shall review the designated person's qualifications and training and shall specify any additional training which the responsible manager may require to bring the designated person to the level of qualification and training the responsible manager believes is required to perform the given task.

The designated person shall successfully complete this specified training before performing the given task.

3.6 Program Management

The program outlined herein will be carried out under the general direction of an Assistant Project Manager of a T&MSS project organization. Direct management responsibility for the program will be vested in the Radiological Field Programs Division (RFPD) Manager of T&MSS. The Division

Manager will be responsible for the day-to-day direction of field activities. RFPD personnel and other specifically designated personnel, trained and qualified to perform the activities assigned, will perform the activities associated with the work described herein, as directed by the RFPD manager.

3.7 Applicable Plans, Procedures, and Work Instructions

The program described herein will be conducted in accordance with applicable Project plans and procedures and T&MSS procedures. Work instructions, compiled in the Radiological Monitoring Instruction Manual, provide detailed guidance on the activities to be performed.

SECTION 4

WORK BREAKDOWN STRUCTURE

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

YUCCA MOUNTAIN PROJECT WORK BREAKDOWN STRUCTURE DICTIONARY

WBS: 1.2.5.4.5

TITLE: Radiological Studies

PARTICIPANT: EG&G, EPA, T&MSS

SCP REFERENCE:

OBJECTIVE: Provide radiological health and safety documentation for the Project, radiological monitoring planning documents, field data, and topical reports containing the results of field data analyses.

DESCRIPTION OF WORK: All efforts required to:

- prepare and update, as required, a Radiological Monitoring Plan and associated technical implementing procedures
- prepare and update, as required, an Environmental Field Activity Plan for radiological studies and associated technical implementing procedures
- implement the radiological field monitoring program as described in planning documents
- operate, calibrate, maintain, and audit field and laboratory equipment
- collect, reduce, edit, and validate the data
- prepare data reports for publication and distribution
- analyze radiological data relative to public health and safety
- present radiological data relative to existing conditions in the project area
- develop impact assessments of proposed actions on the ambient radiological conditions
- develop mitigation strategies for identified significant adverse impacts
- provide radiological engineering (health physics) and training support to other activities, as required
- provide input to and review of the radiological monitoring program

NBS: 1.2.5.4.5 (continued)

- o provide laboratory support for implementation of the monitoring program
- o provide field support for implementation of the program, as required
- o prepare appropriate field and laboratory procedures/instructions in accordance with quality assurance guidelines.

CR: 89/051
APPROVED: 28-aug-1989
REV: 0

SECTION 5

SCHEDULE

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

Radiological Monitoring Schedule

Air Sampling using the continuous air sampling stations began in mid-January 1991. Filters will be changed weekly. This sampling will continue through the term of this investigation. Additional sampling stations will be initiated as approvals are given.

Ambient Radiation Detection using thermoluminescent dosimeters (TLDs) began in mid-January 1991. TLDs will be changed on a quarterly basis beginning April 1991. This program will continue through the term of this investigation. Additional sampling stations will be initiated as approvals are given.

Soil Sampling began in mid-January 1991. Soil sampling will be initiated prior to starting any major site characterization activities and also annually at air sampling locations. This program will be continued through the term of this investigation.

Ground Survey began in mid-January 1991 and will be conducted as needed prior to soil sampling and any site characterization activity. This program will be continued through the term of this investigation.

Radon Detection began mid-January 1991 using "E-PERMS." The "E-PERMS" will be read at least monthly and changed as needed. This program will continue through the term of this investigation. Additional sampling stations will be initiated as approvals are given.

Aerial Measurement - Airborne radiometric survey - schedule TBD.

In situ Gamma Spectrometry is scheduled to start by October 1991.

Analytical lab analysis is scheduled to start by July 1991.

Biota sampling has commenced for some leafy and animal specimens near field. Additional sampling will be implemented through the term of this investigation.

SECTION 6

RESOURCES AND REFERENCES

SCIENTIFIC INVESTIGATION IMPLEMENTATION PACKAGE

RADIOLOGICAL MONITORING

RESOURCES AND REFERENCES

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APPENDIX 1

EQUIPMENT LISTING

SCIENTIFIC INVESTIGATION IMPLEMENTATION PACKAGE

RADIOLOGICAL MONITORING

Appendix 1. Equipment (Page 1 of 3)

Item	Function	Number	Reference Information
Continuous Radon Monitor (high sensitivity)	Continuous radon monitoring	3	Pylon, Model PMT-TEL
Limited sensitivity radon detector	Radon monitoring (short timeframe)	1	Pylon, Model PRD-1
Working level detector for radon	Working level measurement	1	Pylon, Model AEP-47
Passive Radon Monitor	Integrated Measurement of radon in air	20	E-PERM System
Continuous air sampling station	Particulate and selected iodine sampling	25 6	RADECO, Model HD-28A HiQ, Model CF-1500
Radioactive standards to support analysis activities	All measurements except operability checks	N/A	NIST traceable or equivalent (various suppliers)
High pressure ion chamber	Environmental exposure rate measurements	5	Reuter-Stokes, Model RSS-1012 and RSS-111
Tritium Sampler	Sample Tritium	3	TBD
In situ Gamma Spectral Analysis Equipment	In situ Gamma Spectral Analysis	1	Canberra Nuclear Products
Noble gas sampler	Noble gases sampled	3	TBD
TLD for environmental measurement	Ambient radiation detection	100-300	Teledyne Isotope Products

Appendix 1. Equipment (Page 2 of 3)

Item	Function	Number	Reference Information
Particulate size samplers and support equipment	Measurement of airborne mean particulate size	2	Anderson, Model 210 Cascade Impactor and Model 112 sampler (K-flow)
Soil/sediment sampling equipment	Collection of soil samples	1 set	AMS, Soil Recovery Auger system, templates and splitter
Analytical balance	Weighing of various samples	1 each	Sartorius, Analytical Model A120S/FW, & Mettler
Water sampling equipment	Water sample collection	1 set	TBD
ADP analysis support equipment	Data collection and analysis	3	VAX compatible
Beta/gamma portable survey instrument	Field surveys	3	Ludlum Model 12 w/pancake probes
		1	TSA Model 440 w/external & internal probes
Alpha portable count rate meter	Field surveys	3	Ludlum, Model 12 w/air proportioned probe
"Cutie Pie"	Dose rate monitoring	3	Victoreen, Model 471
μR meter	Dose rate monitoring	4	Ludlum Model 19

APPENDIX 2

QUALITY ASSURANCE GRADING REPORTS

SCIENTIFIC INVESTIGATION PACKAGE

RADIOLOGICAL MONITORING

Appendix 1. Equipment (Page 3 of 3)

Item	Function	Number	Reference Information
Flow Calibrator	Portable/field Air Flow checks	3 1	RADeCo C-812 Kurz 1540
Flow Elements	Instrument Air Flow Calibration	5	Meriam, Models 50MJ10-1, -11, -13 & -9 50MW20-1
Portable MCA Multi-Channel Analyzer	Field Monitoring for specific radionuclides	2	TSA, Model HHMCA460
Portable Barometer	Barometric and temperature data	2	A.I.R. Inc., AIR-HB-1A
Oven	Sample drying	3	Blue Max
Furnace	Sample ashing	2	Thermolyne
Mass set	Checking balances	1	Tromelyne
Scaler	Gross α/β counting of smear	1	Ludlum 2929
Rad. Sources	Instrument checking	15	Various radionuclides and activities
Freezer	Biological Storage	1	Forma Scientific

N-QA-095
7/90

QUALITY ASSURANCE GRADING REPORT

PART I. IDENTIFICATION AND DEFINITION: [ ] ITEM [X] ACTIVITY PAGE 1 OF 6

TITLE/DESCRIPTION WBS 1.2.5.4.5, Radiological Monitoring Plan for Air and Water (Page 4) REPORT NO. RFP-1 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

REVISION(S) OF Q-LIST, QUALITY ACTIVITIES LIST, PROJECT REQUIREMENTS LIST, AND SUPPORTING DOCUMENTATION USED:

See Page 2

(Attach additional definitive information as necessary to fully define the subject item or activity and support the position expressed in this QAG report)

PART II. STATEMENT OF IMPORTANCE

Section A: (Check the appropriate areas) [ ] Public Radiological Safety (Q-List) [ ] Waste Isolation (Q List)

[X] Performance Assessment (QAL) [X] Site Characterization (QAL) [X] Potential Adverse Impact on Natural Barrier(s) (QAL) [ ] NA (Complete Section B)

Section B: (Check the appropriate areas) [X] Worker Radiological Safety (Att:) See Page 5 [ ] Operational Reliability (Att:) See Page 5

[ ] Other (Provide explanation) (Att:) See Page 5 [ ] N/A (Provide explanation) (Att:)

PART III. GRADING

INFORMATION COPY

QA CRITERIA	APPLICABLE (YES OR NO)	JUSTIFICATION IF NOT APPLICABLE (REFERENCE)*	EXCEPTION(S) TO CRITERIA SUBPARTS (REFERENCE)*
1. ORGANIZATION	Yes	N/A	No Exceptions
2. QA PROGRAM	Yes	N/A	No Exceptions
3. DESIGN CONTROL	No	See Page 6	N/A
4. PROCUREMENT DOCUMENT CONTROL	Yes	N/A	No Exceptions
5. PLANS, PROCEDURES, INSTRUCTIONS, AND DRAWINGS	Yes	N/A	No Exceptions
6. DOCUMENT CONTROL	Yes	N/A	No Exceptions
7. CONTROL OF PURCHASED ITEMS AND SERVICES	Yes	N/A	See Page 6
8. IDENT. & CONTROL OF MTRLS, PARTS, CMPNTS, & SMPLS	Yes	N/A	No Exceptions
9. CONTROL OF PROCESSES	No	See Page 6	N/A
10. INSPECTION	No	See Page 6	N/A
11. TEST CONTROL	No	See Page 6	N/A
12. CONTROL OF MEASURING AND TESTING EQUIPMENT	Yes	N/A	No Exceptions
13. HANDLING, STORAGE, AND SHIPPING	Yes	N/A	No Exceptions
14. INSPECTION, TEST, AND OPERATING STATUS	Yes	N/A	No Exceptions
15. CONTROL OF NONCONFORMING CONDITIONS	Yes	N/A	No Exceptions
16. CORRECTIVE ACTION	Yes	N/A	No Exceptions
17. QA RECORDS	Yes	N/A	No Exceptions
18. AUDITS	Yes	N/A	No Exceptions
19. COMPUTER SOFTWARE	Yes	N/A	See Page 6
20. SCIENTIFIC INVESTIGATION CONTROL	Yes	N/A	No Exceptions

* Reference attached justification or explanations

PART IV. APPROVALS:

Preparer's Signature 11/5/90 Date

Preparer's Signature 11/5/90 Date

TPO's Signature Nov. 5 1990 Date

QRB ACCEPTANCE:

QRB Chairman's Signature 11/5/90 Date

Part I - Revision of Q-List, Quality Activities List, Project Requirements List, and Supporting Documentation Used:

1) Quality Activities List (YMP/90-56, Rev. 0, page 12 of 17, Radiological Studies (Radiological Monitoring Plan - Airborne Radionuclide, Surface Water, and Groundwater Monitoring

2) Radiological Monitoring Plan (NNWSI/88-14, Rev. 0)

WORK SHEET FOR EVALUATION OF CHARACTERISTICS

N-QA-094
02/90

TITLE OF ITEM [ ] OR ACTIVITY [X]

WBS 1.2.5.4.5, Radiological Monitoring Plan for Airborne and Water

REPORT NO. RFP-1 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

NAME OF PREPARER C. D. Sorensen

CHARACTERISTIC **EVALUATION STATEMENT**

1. REPRODUCIBILITY OR EASE OF REPLACEMENT:

Activity is readily reproducible because of ease and redundancy of sampling.

2. COMPLEXITY:

There are no complex steps inherent in the performance of this activity. All sampling is done to commercially acceptable standards and practices.

3. QUALITY HISTORY:

Data measurements from monitoring conducted under this activity are standard industry practices with well defined quality histories. All outside labs performing measurements will be on the T&MSS Qualified Suppliers List.

4. STANDARDIZATION:

Radiological Monitoring collection,and analysis equipment for airborne and water samples are commonly available from multiple suppliers.

5. AVAILABLE CODES AND STANDARDS:

Monitoring of Air and Water for determination of radioactive constituents is performed in accordance with DOE, EPA, NRC, and State of Nevada regulations.

6. NEED FOR PROCESS CONTROL:

No special processes are used.

7. SPECIAL HANDLING, SHIPPING, AND STORAGE:

No extraordinary precautions are required for this activity. Standard commercial practices apply.

C. D. Sorensen 11/5/90

PREPARER (Signature and Date)

RADIOLOGICAL MONITORING PLAN FOR AIRBORNE AND WATER DESCRIPTION SUMMARY

The purpose of the radiological monitoring plan for air and water is to:

1) Establish a background data base to determine any impacts to the Yucca Mountain site from site characterization activities and NTS activities

2) Verify the feasibility of monitoring the air and water environments for certain radionuclides

3) Collect air and water data in support of the Safety Analysis Report and the Environmental Impact Statement

The data from this activity are input to site characterization of natural barriers and their performance assessment for waste isolation. As such, the data, while not necessary to determine the suitability of Yucca Mountain as a geological repository, will be used to determine the impact of the repository during operation and after closure.

Part II - Statement of Importance

1) Worker Radiological Safety

Personnel performing work under this activity may occasionally be exposed to low-level radioactive sources. The likelihood of exceeding the limits specified in the Regulatory Document Manual (YMP/88-11), Section 5.1 and 5.11, and applicable DOE orders is remote. All work conducted under this activity involving radioactive sources will however be subject to the monitoring requirements of the T&MSS Radiological Monitoring for Health and Safety Program.

2) Operation Reliability

Subject activity does not involve the operation or testing of systems whose reliability is critical to the project mission.

3) Other Categories of Importance

There are no categories of importance relevant to this activity other than those already identified in Part II, Sections A and B.

Part III - Grading

QA Criteria - Justifications of Non-Applicability

3) Design Control: This activity is for the collection and analysis of air and water samples for the determination of radionuclide content. The data collected may be used as part of input to the facility design. However, this activity of collection and analyses of samples is performed under Criterion 20: Scientific Investigation Control.

9) Control of Processes: This activity does not involve any special or unique processes.

10) Inspection: This activity is a data-gathering and analysis function and does not involve the inspection of engineered items.

11) Test Control: Radiological Monitoring does not conduct tests on engineered items. Therefore, the provisions of this criteria do not apply.

QA Criteria - Exceptions to Criteria Subparts

7) Control of Purchased Items and Services: This activity utilizes only commercially available equipment and items. Therefore, only the provisions of Section 10 Supplement 7S-1 to NQA-1 apply. Sections 3, 4, 8, and 9 of supplement 7S-1 are the responsibility of T&MSS QA under WBS 1.2.9.3.5.

19) Computer Software: This activity utilizes existing commercial software only. Therefore, only the requirements of Section 19.6 of the QARD apply.

N QA 095
7/90

QUALITY ASSURANCE GRADING REPORT

PART I. IDENTIFICATION AND DEFINITION: [ ] ITEM [X] ACTIVITY

TITLE/DESCRIPTION WBS 1.2.5.4.5 General RMP, Biota, Soil, and Ambient Monitoring/Sampling (See Page 4) REPORT NO. RFP-2 PAGE 1 OF 6 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

REVISION(S) OF Q-LIST, QUALITY ACTIVITIES LIST, PROJECT REQUIREMENTS LIST, AND SUPPORTING DOCUMENTATION USED:

See Page 2

(Attach additional definitive information as necessary to fully define the subject item or activity and support the position expressed in this QAG report)

PART II. STATEMENT OF IMPORTANCE

Section A: (Check the appropriate areas) [ ] Public Radiological Safety (Q-List) [ ] Waste Isolation (Q List)

[ ] Performance Assessment (QAL) [ ] Site Characterization (QAL) [ ] Potential Adverse Impact on Natural Barrier(s) (QAL) [X] NA (Complete Section B)

Section B: (Check the appropriate areas) [X] Worker Radiological Safety (Att: NA) See Page 5 [ ] Operational Reliability (Att: NA) See Page 5

[X] Other (Provide explanation) (Att: N/A See Page 5 [ ] N/A (Provide explanation) (Att:)

PART III. GRADING

INFORMATION COPY

QA CRITERIA	APPLICABLE (YES OR NO)	JUSTIFICATION IF NOT APPLICABLE (REFERENCE)*	EXCEPTION(S) TO CRITERIA SUBPARTS (REFERENCE)*
1. ORGANIZATION	Yes	N/A	No Exceptions
2. QA PROGRAM	Yes	N/A	No Exceptions
3. DESIGN CONTROL	No	See Page 6	N/A
4. PROCUREMENT DOCUMENT CONTROL	Yes	N/A	No Exceptions
5. PLANS, PROCEDURES, INSTRUCTIONS, AND DRAWINGS	Yes	N/A	No Exceptions
6. DOCUMENT CONTROL	Yes	N/A	No Exceptions
7. CONTROL OF PURCHASED ITEMS AND SERVICES	Yes	N/A	See Page 6
8. IDENT. & CONTROL OF MTRLS, PARTS, CMPNTS, & SMPLS	Yes	N/A	No Exceptions
9. CONTROL OF PROCESSES	No	See Page 6	N/A
10. INSPECTION	No	See Page 6	N/A
11. TEST CONTROL	No	See Page 6	N/A
12. CONTROL OF MEASURING AND TESTING EQUIPMENT	Yes	N/A	No Exceptions
13. HANDLING, STORAGE, AND SHIPPING	Yes	N/A	No Exceptions
14. INSPECTION, TEST, AND OPERATING STATUS	Yes	N/A	No Exceptions
15. CONTROL OF NONCONFORMING CONDITIONS	Yes	N/A	No Exceptions
16. CORRECTIVE ACTION	Yes	N/A	No Exceptions
17. QA RECORDS	Yes	N/A	No Exceptions
18. AUDITS	Yes	N/A	No Exceptions
19. COMPUTER SOFTWARE	Yes	N/A	See Page 6
20. SCIENTIFIC INVESTIGATION CONTROL	Yes	N/A	No Exceptions

* Reference attached justification or explanations

PART IV. APPROVALS

Preparer's Signature — Date 11/5/90

TPO's Signature — Date 11/5/90 — W W Macartt Nov. 5, 1990

QRB ACCEPTANCE:

QRB Chairman's Signature — Date 11/5/90

Part I - Revision of Q-List, Quality Activities List, Project Requirements List, and Supporting Documentation used:

1) Project Requirements List, Section 2, Rev. 0, page 7 of 26, Radiological Studies (Radiological Monitoring Plan activities except Airborne Radionuclide, Surface Water, and Ground Water), WBS 1.2.5.4.5.

2) Radiological Monitoring Plan (NNWSI/88-14, Rev. 0)

WORK SHEET FOR EVALUATION OF CHARACTERISTICS

N-QA-094
02/90

TITLE OF ITEM [ ] OR ACTIVITY [x]

WBS 1.2.5.4.5 General RMP Monitoring/Sampling

REPORT NO. RFP-2 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

NAME OF PREPARER C. D. Sorensen

CHARACTERISTIC **EVALUATION STATEMENT**

1. **REPRODUCIBILITY OR EASE OF REPLACEMENT:**

   Activity is readily reproducible because of ease and redundancy of sampling.

2. **COMPLEXITY:**

   There are no complex steps inherent in the performance of this activity. All sampling is done to commercially acceptable standards and practices.

3. **QUALITY HISTORY:**

   Data measurements from monitoring conducted under this activity are standard industry practices with well defined quality histories. All outside labs performing measurements will be on the T&MSS Qualified Suppliers List.

4. **STANDARDIZATION:**

   Radiological monitoring, collection, and analyses equipment for soil, ambient radiation, and biota samples are commonly available from multiple suppliers.

5. **AVAILABLE CODES AND STANDARDS:**

   Monitoring of soil, biota, and ambient radiation is performed under DOE, EPA, NRC, State of Nevada, and industry concensus codes, standards, and regulations.

6. **NEED FOR PROCESS CONTROL:**

   No special processes are used.

7. **SPECIAL HANDLING, SHIPPING, AND STORAGE:**

   No extraordinary precautions are required for this activity. Standard commercial practices apply.

C D Sorensen 11/5/90

PREPARER (Signature and Date)

General Radiological Monitoring Plan Description Summary

The purpose of the General Radiological Monitoring Plan is to:

1) Establish a background data base of information on the environmental levels of radiation present in the soil and biota on and adjacent to Yucca Mountain.

2) Establish a background data base of information on the ambient levels of radiation dose rates at and adjacent to Yucca Mountain.

3) Verify the feasibility of monitoring the environments specified in items 1 and 2 above for certain selected radionuclides.

4) Collect soil and biota data and establish background dose levels in support of the Safety Analyses Report and Environmental Impact Statement.

This activity consists of gathering data for the above named purposes and has no bearing on the determination of suitability of Yucca Mountain as a repository for high-level nuclear waste.

Part II - Statement of Importance

1) Worker Radiological Safety

Personnel performing work under this activity may be occasionally exposed to low-level radioactive sources. The likelihood of exceeding the limits specified in the Regulatory Document Manual (YMP/88-11), Sections 5.1 and 5.11, and applicable DOE Orders is remote. All work conducted under this activity will however be subject to the monitoring requirements of the T&MSS Radiological Monitoring for Health and Safety Program.

2) Operational Reliability

Subject activity does not involve the operation or testing of systems whose reliability is critical to the project mission.

3) Other Categories of Importance

Environmental investigation activities in this package are of special programmatic importance because of their relationship to assurance of regulatory compliance.

Part III - Grading

QA Criteria - Justification of Non-Applicability

3) Design Control: This activity is for the collection and analysis of soil and biota samples and for the determination of background or ambient radiation dose levels. The data collected will be used as input to the Reference Information Base.

9) Control of Processes: This activity does not involve any special or unique processes.

10) Inspection: This activity is a data gathering and analysis function, and does not involve inspection of engineered items.

11) Test Control: Radiological Monitoring does not conduct tests of engineered items. Therefore, the provisions of this criteria do not apply.

QA Criteria - Exceptions to Criteria Subparts

7) Control of Purchased Items and Services: This activity utilizes only commercially available equipment and items. Therefore, only Section 10 of supplement 7S-1 to NQA-1 apply. Sections 3, 4, 8, and 9 of supplement 7S-1 are the responsibility of T&MSS QA under WBS 1.2.9.3.5.

19) Computer Software: This activity utilizes existing commercially available software. Therefore, only the requirements in Section 19.6 of the QARD apply.

N QA 095
7/90

QUALITY ASSURANCE GRADING REPORT

PART I. IDENTIFICATION AND DEFINITION: [ ] ITEM [X] ACTIVITY

PAGE 1 OF 6

TITLE/DESCRIPTION WBS 1.2.5.4.5, Radiological Monitoring for Health and Safety (See Page 4) REPORT NO. RFP-3 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

REVISION(S) OF Q-LIST, QUALITY ACTIVITIES LIST, PROJECT REQUIREMENTS LIST, AND SUPPORTING DOCUMENTATION USED:

See Page 2

(Attach additional definitive information as necessary to fully define the subject item or activity and support the position expressed in this QAG report)

PART II. STATEMENT OF IMPORTANCE

Section A: (Check the appropriate areas) [ ] Public Radiological Safety (Q-List) [ ] Waste Isolation (Q List)

[X] Performance Assessment (QAL) [ ] Site Characterization (QAL) [ ] Potential Adverse Impact on Natural Barrier(s) (QAL) [ ] NA (Complete Section B)

Section B: (Check the appropriate areas) [X] Worker Radiological Safety (Att:) See Page 5 [ ] Operational Reliability (Att:) See Page 5

[ ] Other (Provide explanation) (Att:) See Page 5 [ ] N/A (Provide explanation) (Att:)

PART III. GRADING

INFORMATION COPY

QA CRITERIA	APPLICABLE (YES OR NO)	JUSTIFICATION IF NOT APPLICABLE (REFERENCE)*	EXCEPTION(S) TO CRITERIA SUBPARTS (REFERENCE)*
1. ORGANIZATION	yes	N/A	No exceptions
2. QA PROGRAM	yes	N/A	No exceptions
3. DESIGN CONTROL	no	See page 6	N/A
4. PROCUREMENT DOCUMENT CONTROL	yes	N/A	No exceptions
5. PLANS, PROCEDURES, INSTRUCTIONS, AND DRAWINGS	yes	N/A	No exceptions
6. DOCUMENT CONTROL	yes	N/A	No exceptions
7. CONTROL OF PURCHASED ITEMS AND SERVICES	yes	N/A	See page 6
8. IDENT. & CONTROL OF MTRLS, PARTS, CMPNTS, & SMPLS	yes	N/A	No exceptions
9. CONTROL OF PROCESSES	no	See page 6	N/A
10. INSPECTION	no	See page 6	N/A
11. TEST CONTROL	no	See page 6	N/A
12. CONTROL OF MEASURING AND TESTING EQUIPMENT	yes	N/A	No exceptions
13. HANDLING, STORAGE, AND SHIPPING	yes	N/A	No exceptions
14. INSPECTION, TEST, AND OPERATING STATUS	yes	N/A	No exceptions
15. CONTROL OF NONCONFORMING CONDITIONS	yes	N/A	No exceptions
16. CORRECTIVE ACTION	yes	N/A	No exceptions
17. QA RECORDS	yes	N/A	No exceptions
18. AUDITS	yes	N/A	No exceptions
19. COMPUTER SOFTWARE	yes	N/A	See page 6
20. SCIENTIFIC INVESTIGATION CONTROL	no	See Page 6	N/A

* Reference attached justification or explanations

PART IV. APPROVALS:

Preparer's Signature: [signature] Date: 11/5/90

Signature: [signature] Date: 11/5/90

TPO's Signature: [signature] Date: Nov. 5, 1990

QRB ACCEPTANCE:

QRB Chairman's Signature: [signature] Date: 11/5/90

Part I - Revision of Q-List, Quality Activities List, Project Requirements List, and Supporting Documentation used:

1) Quality Activities List (YMP/90-56, Rev. 0, page 12 of 17, Radiological Studies (Radiological Studies) (Except Radiological Monitoring Plan Activities)

2) DOE Order 5480.11.

WORK SHEET FOR EVALUATION OF CHARACTERISTICS

N-QA-094
02/90

TITLE OF ITEM [x] OR ACTIVITY [ ]

WBS 1.2.5.4.5 Radiological Monitoring for Health and Safety

REPORT NO. RFP-3 REV. NO. 0

RESPONSIBLE ORGANIZATION T&MSS (Radiological Field Programs Department)

NAME OF PREPARER C. D. Sorensen

CHARACTERISTIC **EVALUATION STATEMENT**

1. REPRODUCIBILITY OR EASE OF REPLACEMENT:

Activity is readily repeatable because of redundant systems and ease of calculations.

2. COMPLEXITY:

No complex procedures are required. This activity is performed on a step-by-step basis in accordance with procedures and is based on common industry practices and standards.

3. QUALITY HISTORY:

Some radiological monitoring has been on-going by T&MSS RFPD personnel using NTS requirements without problems. This type of work is common in industry resulting in high quality history and is based on national codes and standards.

4. STANDARDIZATION:

Radiological Health and Safety equipment, tools, and sources are commonly available from multiple suppliers.

5. AVAILABLE CODES AND STANDARDS:

Radiological Health and Safety monitoring is addressed in numerous national and federal codes and standards, including ANSI, 29 CFR, 10 CFR, 49 CFR, NRC Reg. Guides, DOE Orders (e.g. 5480.11) and NCRP.

6. NEED FOR PROCESS CONTROL:

No special processes are used.

7. SPECIAL HANDLING, SHIPPING, AND STORAGE:

None required for this activity.

C D Sorensen 11/5/90

PREPARER (Signature and Date)

Radiological Monitoring for Health and Safety (RADH&S) Description Summary

The purpose of the RAD H&S Program for the Yucca Mountain Project is to assure worker Health and Safety is maintained and that there is a plan established to assure that all exposures to radiation are maintained at levels considered as low as reasonably achievable (ALARA).

The data to support this program is collected by routine monitoring and surveying and through the use of personal radiation detection equipment and in-vivo monitoring.

Rad H&S monitoring on the Yucca Mountain Project is required in order to show compliance with DOE Order 5480.11.

The Rad H&S Monitoring activity exists solely for the purpose of assuring personnel Health and Safety. There is no relationship between this activity and:

1) Site characterization of natural barriers.

2) Potential impacts on the system of natural barriers.

Part II - Statement of Importance

1) Worker Radiological Safety

This activity is essential in determining that all worker exposures to radiation are maintained below the limits specified in Regulatory Document Manual (YMP/88-1), Section 5.1 and 5.11, and applicable DOE Orders (5480.11). While workers in this activity will occasionally be exposed to sources of radiation in excess of background levels, the likelihood of exceeding the above stated limits is extremely small.

2) Operational Reliability

This activity does not involve the operation or testing of systems whose reliability is critical to the project mission.

3. Other Categories of Importance

There are no categories of importance relevant to this activity other than those specified in Part II, Section B.

Part III - Grading

QA Criteria - Justification of Non-Applicability

3) Design Control: This activity is solely concerned with worker Health and Safety. The data collection activities have no applicability to design control.

9) Control of Processes: This activity does not involve any special or unique processes.

10) Inspection: this activity is a data gathering and analysis function and does not involve inspection of engineered items.

11) Test Control: This activity does not conduct tests on engineered items, therefore, the provisions of this criteria does not apply.

20) Scientific Investigation Control: Since no data collected as part of this task will be used in characterization of the site, scientific investigation control does not apply.

QA Criteria - Exceptions to Criteria Subparts

7) Control of Purchased Items and Services: This activity utilizes only commercially available equipment and items. Therefore, only Section 10 of supplement 7S-1 to NQA-1 apply. Sections 3, 4, 8, and 9 of supplement 7S-1 are the responsibility of T&MSS QA under WBS 1.2.9.3.5.

19) Computer Software: This activity utilizes existing commercially available software. Therefore, only the requirements in Section 19.6 of the QARD apply.

N QA 095
7/90

QUALITY ASSURANCE GRADING REPORT

PART I. IDENTIFICATION AND DEFINITION: [ ] ITEM [X] ACTIVITY PAGE 1 OF 6

TITLE/DESCRIPTION WBS 1.2.5.4.5 Radiological Engineering Activities related to Scoping and information development for Institutional Work (See Page 3) REPORT NO. RFP-4 REV. NO. 0

RESPONSIBLE ORGANIZATION TAMSS (Radiological Field Programs Department)

REVISION(S) OF Q-LIST, QUALITY ACTIVITIES LIST, PROJECT REQUIREMENTS LIST, AND SUPPORTING DOCUMENTATION USED:

QAL, YMP/90-56, Rev. 0, Pg 12 of 17, Radiological Studies (except Radiological Monitoring Plan Activities)WBS 1.2.5.4.5

(Attach additional definitive information as necessary to fully define the subject item or activity and support the position expressed in this QAG report)

PART II. STATEMENT OF IMPORTANCE

Section A: (Check the appropriate areas) [ ] Public Radiological Safety (Q List) [ ] Waste Isolation (Q List)

[ ] Performance Assessment (QAL) [ ] Site Characterization (QAL) [X] Potential Adverse Impact on Natural Barrier(s) (QAL) [ ] NA (Complete Section B)

Section B: (Check the appropriate areas) [X] Worker Radiological Safety (Att: See page 4) [ ] Operational Reliability (Att.) See page 4

[X] Other (Provide explanation) (Att:) See Page 4 [ ] N/A (Provide explanation) (Att:)

PART III. GRADING

INFORMATION COPY

QA CRITERIA	APPLICABLE (YES OR NO)	JUSTIFICATION IF NOT APPLICABLE (REFERENCE)*	EXCEPTION(S) TO CRITERIA SUBPARTS (REFERENCE)*
1. ORGANIZATION	yes	N/A	No exceptions
2. QA PROGRAM	yes	N/A	No exceptions
3. DESIGN CONTROL	no	See page 5	N/A
4. PROCUREMENT DOCUMENT CONTROL	no	See page 5	N/A
5. PLANS, PROCEDURES, INSTRUCTIONS, AND DRAWINGS	yes	N/A	No exceptions
6. DOCUMENT CONTROL	yes	N/A	No exceptions
7. CONTROL OF PURCHASED ITEMS AND SERVICES	no	See page 5	N/A
8. IDENT. & CONTROL OF MTRLS, PARTS, CMPNTS, & SMPLS	no	See page 5	N/A
9. CONTROL OF PROCESSES	no	See page 5	N/A
10. INSPECTION	no	See page 5	N/A
11. TEST CONTROL	no	See page 5	N/A
12. CONTROL OF MEASURING AND TESTING EQUIPMENT	no	See page 5	N/A
13. HANDLING, STORAGE, AND SHIPPING	no	See page 5	N/A
14. INSPECTION, TEST, AND OPERATING STATUS	no	See page 5	N/A
15. CONTROL OF NONCONFORMING CONDITIONS	no	See page 5	N/A
16. CORRECTIVE ACTION	yes	N/A	No exceptions
17. QA RECORDS	yes	N/A	No exceptions
18. AUDITS	yes	N/A	No exceptions
19. COMPUTER SOFTWARE	no	See page 6	N/A
20. SCIENTIFIC INVESTIGATION CONTROL	no	See page 6	N/A

* Reference attached justification or explanations

PART IV. APPROVALS:

Preparer's Signature — Date 11/9/90

QA Manager's Signature — Date 11/9/90

TPO's Signature — Date 11/9/90

QRB ACCEPTANCE:

QRB Chairman's Signature — Date 11/9/90

WORK SHEET FOR EVALUATION OF CHARACTERISTICS

N-QA-094
02/90

TITLE OF ITEM [ ] OR ACTIVITY [X] PAGE 2 OF 4
NOS ...5.4.3 Radiological Engineering Activities related to Scoping and information development for Institutional work.

REPORT NO. RFP-4 REV. NO.

RESPONSIBLE ORGANIZATION T&MSS Radiological Field Programs Department)

NAME OF PREPARER C. D. Sorensen

CHARACTERISTIC	EVALUATION STATEMENT

1. REPRODUCIBILITY OR EASE OF REPLACEMENT:

Activities are performed such that repeatability is an inherent part of the process.

2. COMPLEXITY:

The complexity of tasks typically performed in this activity are low. Sampling activities for scoping and information development work will be done to commercially acceptable standards and practices.

3. QUALITY HISTORY:

Scoping and information development work is performed using standard industry practices with well defined quality histories.

4. STANDARDIZATION:

Equipment and supplies are usually readily available to support this activity.

5. AVAILABLE CODES AND STANDARDS:

Codes and Standards describing the accomplishment of tasks in this activity are typically readily available from National Consensus Groups, Education facilities, Governmental entities, and Manufacturers of radiological equipment.

6. NEED FOR PROCESS CONTROL:

No special processes are used.

7. SPECIAL HANDLING, SHIPPING, AND STORAGE:

No extraordinary precautions are required for this activity. Standard Commercial practices will apply.

C D Sorensen 11/9/90

PREPARER (Signature and Date)

Radiological Engineering Activities related to Scoping and Institutional Work Description Summary

The purpose of this element of the Radiological Engineering Program is to perform informal scoping studies and evaluations to provide input to outside organizations and to institutional affairs in support of the following:

(1) Radiological Engineering (Health Physics) support to organizations, other than RFPD, such as:

a. Development of alternate and improved methodologies associated with radiological monitoring techniques. Any methodology developed will be subject to rigorous qualification, testing, and peer review under a qualified program.

b. Order of magnitude estimates of existing conditions in support of institutional requests. None of the information will be used to support license application.

(2) Preparation and/or presentation of public health information or radiation and health effects.

(3) Support of Educational Facility requests for information and educational input.

Part II - Statement of Importance

1. Worker Radiological Safety - (Section B)

Personnel performing work under this activity may occasionally be exposed to low-level radioactive sources. The likelihood of exceeding the limits specified in the Regulatory Document manual (YMP/88-11), Sections 5.1 and 5.11, and applicable DOE Orders is remote. All work conducted under this activity involving radioactive sources will, however, be subject to the monitoring requirements of the T&MSS Radiological Monitoring for Health and Safety Program.

2. Operational Reliability -

Activities in this work scope do not involve or impact any safety related systems or components whose reliability is critical; to the project mission.

3. Other categories of Importance -

Activities in this package are important to the development of a positive public perception of the Project.

Part III Grading

Justification of Non-Applicable Criteria

3. Design Control: This activity includes no design effort or responsibility.

4. Procurement Document Control: Procurement under this activity is limited to administrative, maintenance, and commercial grade developmental test equipment, supplies, and consumables.

7. Control of Purchased Items and Services: Procurement under this activity is limited to administrative, maintenance, and commercial grade developmental test equipment, supplies, and consumables.

8. Identification of Materials, Parts, Components, and Supplies: This criteria is not selected because Scoping and Information Development Activities do not involve the physical inventory of engineered materials, parts, components, and samples.

9. Control of Processes: This activity does not involve any special or unique processes.

10. Inspection: No inspection is performed as part of this activity.

11. Test Control: No tests are conducted as part of this activity.

12. Control of Measuring and Test Equipment: All M&TE used under this activity will be commercial grade and will be used for Scoping and Information Development activities only. None of the information gathered from this activity will be used in support of license application without complete and rigorous qualification.

13. Handling, Storage, and Shipping: Materials, parts, components, or samples handled under this activity are limited to administrative, maintenance, and commercial grade test equipment used for scoping and information development only.

14. Inspection, Test, and Operating Status: This activity requires no identification or control of inspection, test or operating status.

15. Control of Non-conforming Activities: This criterion does not apply since this activity involves no items used in site characterization, or in the design, analysis, performance assessment, or operation of repository structures, systems, or components.

19. Computer Software: The only computer software used in the conduct of this activity are commercially available programs used for tasks such as word processing, spreadsheets, or flow charts.

20. Scientific Investigation Control: This activity involves no scientific investigation.

TMSS/182/1
11/13/90
REVISION NO.: 0

TECHNICAL & MANAGEMENT SUPPORT SERVICES
APPLICABLE PROCEDURES LISTING (APL)

WBS: 1.2.5.4.5
QA: QA

Quality Assurance Grading Report No.: RFP-1 Revision No.: 0

WBS No.: 1.2.5.4.5 Activity Title: Radiological Monitoring Plan for Air and Water

Quality Assurance Controls:

Applicable (Yes/No)		Specify Applicable Controls: Quality Affecting Procedures	Specify Applicable Controls: Non-Quality Affecting Procedures
Yes	1. Organization		
Yes	2. Quality Assurance Program		
No	3. Design Control	N/A	N/A
Yes	4. Procurement Document Control		
Yes	5 Instructions, Procedures, Plans, and Drawings		
Yes	6. Document Control		
Yes	7. Control of Purchased Items and Services	See attached for all other categories.	
Yes	8. Identification and Control of Mtrls, Parts Components, and Samples		
No	9. Control of Processes	N/A	N/A
No	10. Inspection	N/A	N/A
No	11. Test Control	N/A	N/A
Yes	12. Control of Measrng. & Test Equip.		
Yes	13. Handling, Shipping, & Storage		
Yes	14. Inspection, Test, & Opering. Status		
Yes	15. Control of Non-conforming Items		
Yes	16. Corrective Action		
Yes	17. Quality Assurance Records		
Yes	18. Audits		
Yes	19. Software Quality Assurance		
Yes	20. Scientific Investigation Control		

C A Sorenson 1/10/91
Preparer (Sign and Date)

C A Sorenson 1/10/91
Responsible Manager (Sign and Date)

1-15-91
QA Manager (Sign and Date)

D K Chandler 1/14/91
Assistant Project Manager (Sign and Date)

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
IAGR RFP-1, Rev. 1
(Page 1 of 3)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
1.	Organization	SP 1.22, SP 1.23 SP 1.28, SP 1.31, SP 1.37, SP 1.41, AP-5.13Q, WI-RM-101	SP 1.5, SP 1.9, SP 1.15, SP 1.20, SP 1.29
2.	Quality Assurance Program	SP 1.21, SP 1.22, SP 1.23, SP 1.31, SP 1.32, SP 1.37, SP 1.42, SP 1.60, SP 1.63, AP-5.28Q	None
3.	Design Control	N/A	N/A
4.	Procurement Document Control	SP 1.12, SP 1.25, SP 1.28	SP 1.29
5.	Instructions, Procedures, Plans, and Drawings	SP 1.1, SP 1.7, SP 1.30, SP 2.3	None
6.	Document Control	SP 1.34, SP 1.35,	None
7.	Control of Purchased Items and Services	SP 1.12, SP 1.25, SP 1.28	None
8.	Identification and Control of Materials	SP 1.25, SP 1.29, SP 1.50, WI-RM-104, WI-RM-139, WI-RM-150, WI-RM-151, WI-RM-153, AP-6.3Q	WI-RM-156

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
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(Page 2 of 3)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
9.	Control of Processes	N/A	N/A
10.	Inspection	N/A	N/A
11.	Test Control	N/A	N/A
12.	Control of Measuring & Test Equipment	SP 1.23, SP 2.4 WI-RM-104, WI-RM-113, WI-RM-139, WI-RM-141, WI-RM-153, WI-RM-190, WI-RM-197, WI-RM-312, WI-RM-451, WI-RM-455, WI-RM-471	None
13.	Handling, Shipping, & Storage	SP 1.12, SP 1.23, SP 2.4, AP-6.3Q, WI-RM-113	None
14.	Inspection, Test, & Operating Status	SP 1.22, SP 1.23 SP 1.25, SP 1.37, SP 2.4, WI-RM-114, WI-RM-197, WI-RM-310	None
15.	Control of Non-conforming Items	SP 1.23, SP 1.25 SP 1.37,	None
16.	Corrective Action	SP 1.22, SP 1.23, SP 1.25, SP 1.37	SP 1.3
17.	Quality Assurance Records	SP 1.25, SP 1.36, WI-RM-104	None
18.	Audits	SP 1.37,	None
19.	Software Quality Assurance	WI-RM-125	AP-1.5Q, SP 1.44, SP 1.45

		Quality Affecting Procedures	Non-Quality Affecting Procedures
20.	Scientific Investigation Control	SP 1.31, SP 2.3 SP 2.4, AP-5.13Q, AP-5.21Q, WI-RM-101, WI-RM-104, WI-RM-113, WI-RM-114, WI-RM-116, WI-RM-125, WI-RM-139, WI-RM-190, WI-RM-197, WI-RM-201, WI-RM-202, WI-RM-203, WI-RM-204, WI-RM-205, WI-RM-206, WI-RM-207 WI-RM-208 WI-RM-310, WI-RM-312, WI-RM-450, WI-RM-451, WI-RM-455, WI-RM-470, WI-RM-471, WI-RM-601, WI-RM-602, WI-RM-604, WI-RM-610, WI-RM-611, WI-RM-620, WI-RM-624, WI-RM-630, WI-RM-631, WI-RM-632, WI-RM-702	SP 1.10, SP 1.11

TMSS/182/1
11/13/90
REVISION NO.: 0

TECHNICAL & MANAGEMENT SUPPORT SERVICES
APPLICABLE PROCEDURES LISTING (APL)

WBS: 1.2.5.4.5
QA: QA

Quality Assurance Grading Report No.: RFP-2 Revision No.: 0

WBS No.: 1.2.5.4.5 Activity Title: Radiological Monitoring/Sampling - RMP, Biota, Soil, and Ambient

Quality Assurance Controls:

Applicable (Yes/No)		Specify Applicable Controls: Quality Affecting Procedures	Specify Applicable Controls: Non-Quality Affecting Procedures
Yes	1. Organization	See Attached	See Attached
Yes	2. Quality Assurance Program		
No	3. Design Control		
Yes	4. Procurement Document Control		
Yes	5. Instructions, Procedures, Plans, and Drawings		
Yes	6. Document Control		
Yes	7. Control of Purchased Items and Services		
Yes	8. Identification and Control of Mtrls, Parts Components, and Samples		
No	9. Control of Processes		
No	10. Inspection		
No	11. Test Control		
Yes	12. Control of Measmg. & Test Equip.		
Yes	13. Handling, Shipping, & Storage		
Yes	14. Inspection, Test, & Opering. Status		
Yes	15. Control of Non-conforming Items		
Yes	16. Corrective Action		
Yes	17. Quality Assurance Records		
Yes	18. Audits		
Yes	19. Software Quality Assurance		
Yes	20. Scientific Investigation Control		

[illegible] 1/10/91
Preparer (Sign and Date)

[illegible] 1/10/91
Responsible Manager (Sign and Date)

[illegible] 1-15-91
QA Manager (Sign and Date)

[illegible] 1/14/91
Assistant Project Manager (Sign and Date)

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
2AGR RFP-2, Rev. 0
(Page 1 of 3)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
1.	Organization	SP 1.22, SP 1.23 SP 1.28, SP 1.31, SP 1.37, SP 1.41, AP-5.19Q, WI-RM-101	SP 1.5, SP 1.9, SP 1.15, SP 1.20, SP 1.29
2.	Quality Assurance Program	SP 1.21, SP 1.22, SP 1.23, SP 1.31, SP 1.32, SP 1.37, SP 1.42, SP 1.60, SP 1.63, AP-5.28Q	None
3.	Design Control	N/A	N/A
4.	Procurement Document Control	SP 1.12, SP 1.25, SP 1.28	SP 1.23
5.	Instructions, Procedures, Plans, and Drawings	SP 1.1, SP 1.7, SP 1.30, SP 2.3	None
6.	Document Control	SP 1.34, SP 1.35,	None
7.	Control of Purchased Items and Services	SP 1.12, SP 1.25, SP 1.28	None
8.	Identification and Control of Materials	SP 1.25, SP 1.28, SP 1.50, WI-RM-104, WI-RM-139, WI-RM-150, WI-RM-151, WI-RM-153, AP-6.3Q	WI-RM-156

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
2AGR RFP-2, Rev. 0
(Page 2 of 3)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
9.	Control of Processes	N/A	N/A
10.	Inspection	N/A	N/A
11.	Test Control	N/A	N/A
12.	Control of Measuring & Test Equipment	SP 1.23, SP 2.4 WI-RM-104, WI-RM-113, WI-RM-139, WI-RM-141, WI-RM-153, WI-RM-190, WI-RM-197, WI-RM-451, WI-RM-455	None
13.	Handling, Shipping, & Storage	SP 1.12, SP 1.28, SP 2.4, AP-6.3Q, WI-RM-113	None
14.	Inspection, Test, & Operating Status	SP 1.22, SP 1.23 SP 1.25, SP 1.37, SP 2.4, WI-RM-114, WI-RM-197,	None
15.	Control of Non-conforming Items	SP 1.23, SP 1.25 SP 1.37,	None
16.	Corrective Action	SP 1.22, SP 1.23, SP 1.25, SP 1.37	SP 1.3
17.	Quality Assurance Records	SP 1.25, SP 1.36, WI-RM-104	None
18.	Audits	SP 1.37,	None
19.	Software Quality Assurance	WI-RM-125	AP-1.5Q, SP 1.44, SP 1.45

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
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		Quality Affecting Procedures	Non-Quality Affecting Procedures
10.	Scientific Investigation Control	SP 1.31, SP 2.3 SP 2.4, AP-5.13Q, AP-5.21Q, WI-RM-101, WI-RM-104, WI-RM-113, WI-RM-114, WI-RM-116, WI-RM-125, WI-RM-139, WI-RM-190, WI-RM-197, WI-RM-201, WI-RM-202, WI-RM-203, WI-RM-204, WI-RM-205, WI-RM-206, WI-RM-207 WI-RM-208 WI-RM-450, WI-RM-451, WI-RM-455, WI-RM-470, WI-RM-471, WI-RM-601, WI-RM-602, WI-RM-604, WI-RM-610, WI-RM-611, WI-RM-620, WI-RM-624, WI-RM-630, WI-RM-631, WI-RM-632, WI-RM-702, WI-RM-760, WI-RM-801, WI-RM-802, WI-RM-803, WI-RM-804, WI-RM-901	SP 1.10, SP 1.11

TMSS/162/1
11/13/90
REVISION NO.: 0

TECHNICAL & MANAGEMENT SUPPORT SERVICES
APPLICABLE PROCEDURES LISTING (APL)

WBS: 1.2.5.4.5
QA: QA

Quality Assurance Grading Report No.: RFP-3 Revision No.: 0

WBS No.: 1.2.5.4.5 Activity Title: Radiological Monitoring for Health and Safety

Quality Assurance Controls:

Applicable (Yes/No)		Specify Applicable Controls: Quality Affecting Procedures	Specify Applicable Controls: Non-Quality Affecting Procedures
Yes	1. Organization	See Attached	See Attached
Yes	2. Quality Assurance Program		
No	3. Design Control		
Yes	4. Procurement Document Control		
Yes	5. Instructions, Procedures, Plans, and Drawings		
Yes	6. Document Control		
Yes	7. Control of Purchased Items and Services		
Yes	8. Identification and Control of Mtrls, Parts Components, and Samples		
No	9. Control of Processes		
No	10. Inspection		
No	11. Test Control		
Yes	12. Control of Measmg. & Test Equip.		
Yes	13. Handling, Shipping, & Storage		
Yes	14. Inspection, Test, & Operng. Status		
Yes	15. Control of Non-conforming Items		
Yes	16. Corrective Action		
Yes	17. Quality Assurance Records		
Yes	18. Audits		
Yes	19. Software Quality Assurance		
No	20. Scientific Investigation Control		

1/10/91
Preparer (Sign and Date)

1/10/91
Responsible Manager (Sign and Date)

1-15-91
QA Manager (Sign and Date)

1/14/91
Assistant Project Manager (Sign and Date)

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-3, Rev. 0
(Page 1 of 4)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
1.	Organization	SP 1.22, SP 1.23 SP 1.28, SP 1.31, SP 1.37, SP 1.41, AP-5.19Q, WI-RM-101	SP 1.5, SP 1.9, SP 1.15, SP 1.20, SP 1.29
2.	Quality Assurance Program	SP 1.21, SP 1.22, SP 1.23, SP 1.31, SP 1.32, SP 1.37, SP 1.42, SP 1.60, SP 1.63, AP-5.28Q	None
3.	Design Control	N/A	N/A
4.	Procurement Document Control	SP 1.12, SP 1.25, SP 1.28	SP 1.28
5.	Instructions, Procedures, Plans, and Drawings	SP 1.1, SP 1.7, SP 1.30, SP 2.3	None
6.	Document Control	SP 1.34, SP 1.35,	None
7.	Control of Purchased Items and Services	SP 1.12, SP 1.25, SP 1.28	None
8.	Identification and Control of Materials	SP 1.25, SP 1.28, SP 1.50, WI-RM-104, WI-RM-139, WI-RM-150, WI-RM-151, WI-RM-153, AP-6.3Q	WI-RM-156

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-3, Rev. 0
(Page 2 of 4)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
9.	Control of Processes	N/A	N/A
10.	Inspection	N/A	N/A
11.	Test Control	N/A	N/A
12.	Control of Measuring & Test Equipment	SP 1.23, SP 2.4 WI-RM-104, WI-RM-113, WI-RM-139, WI-RM-141, WI-RM-153, WI-RM-190, WI-RM-197, WI-RM-312, WI-RM-451, WI-RM-455	None
13.	Handling, Shipping, & Storage	SP 1.12, SP 1.28, SP 2.4, AP-6.3Q, WI-RM-113	None
14.	Inspection, Test, & Operating Status	SP 1.22, SP 1.23 SP 1.25, SP 1.37, SP 2.4, WI-RM-114, WI-RM-197, WI-RM-310	None
15.	Control of Non-conforming Items	SP 1.23, SP 1.25 SP 1.37,	None
16.	Corrective Action	SP 1.22, SP 1.23, SP 1.25, SP 1.37	SP 1.3
17.	Quality Assurance Records	SP 1.25, SP 1.36, WI-RM-104	None
18.	Audits	SP 1.37,	None
19.	Software Quality Assurance	WI-RM-125	AP-1.5Q, SP 1.44, SP 1.45

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-3, Rev. 0
(Page 3 of 4)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
20.	Scientific Investigation Control	None	SP 1.10, SP 1.11 SP 1.31, SP 2.3 SP 2.4, AP-5.19Q, AP-5.21Q, WI-RM-101, WI-RM-104, WI-RM-113, WI-RM-114, WI-RM-116, WI-RM-125, WI-RM-139, WI-RM-141, WI-RM-142, WI-RM-143, WI-RM-144, WI-RM-146, WI-RM-147, WI-RM-148, WI-RM-149, WI-RM-150, WI-RM-151, WI-RM-153, WI-RM-156, WI-RM-170, WI-RM-190, WI-RM-197, WI-RM-201, WI-RM-202, WI-RM-203, WI-RM-204, WI-RM-205, WI-RM-206, WI-RM-207 WI-RM-208 WI-RM-310, WI-RM-312, WI-RM-450, WI-RM-451, WI-RM-455, WI-RM-470, WI-RM-471, WI-RM-601, WI-RM-602, WI-RM-604, WI-RM-610,

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-3, Rev. 0
(Page 4 of 4)

	Quality Affecting Procedures	Non-Quality Affecting Procedures
20. Scientific Investigation Control (Continued)		WI-RM-611, WI-RM-620, WI-RM-624, WI-RM-630, WI-RM-631, WI-RM-632, WI-RM-702, WI-RM-760, WI-RM-801, WI-RM-802, WI-RM-803, WI-RM-804, WI-RM-901

TMSS/182/1
11/13/90
REVISION NO.: 0

TECHNICAL & MANAGEMENT SUPPORT SERVICES
APPLICABLE PROCEDURES LISTING (APL)

WBS: 1.2.5.4.5
QA: QA

Quality Assurance Grading Report No.: RFP-4 Revision No.: 0

WBS No.: 1.2.5.4.5 Activity Title: Radiological Engineering Activities Related to Scoping and for Institutional Work

Quality Assurance Controls:

Applicable (Yes/No)		Specify Applicable Controls: Quality Affecting Procedures	Specify Applicable Controls: Non-Quality Affecting Procedures
Yes	1. Organization	See Attached	See Attached
Yes	2. Quality Assurance Program		
No	3. Design Control		
No	4. Procurement Document Control		
Yes	5. Instructions, Procedures, Plans, and Drawings		
Yes	6. Document Control		
No	7. Control of Purchased Items and Services		
No	8. Identification and Control of Mtrls, Parts Components, and Samples		
No	9. Control of Processes		
No	10. Inspection		
No	11. Test Control		
No	12. Control of Measmg. & Test Equip.		
No	13. Handling, Shipping, & Storage		
No	14. Inspection, Test, & Opering. Status		
No	15. Control of Non-conforming Items		
Yes	16. Corrective Action		
Yes	17. Quality Assurance Records		
Yes	18. Audits		
No	19. Software Quality Assurance		
No	20. Scientific Investigation Control		

C A Sorenson 1/10/91
Preparer (Sign and Date)

C A Sorenson 1/10/91
Responsible Manager (Sign and Date)

1-15-91
QA Manager (Sign and Date)

D K Chandler 1/16/91
Assistant Project Manager (Sign and Date)

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-4, Rev. 0
(Page 1 of 4)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
1.	Organization	SP 1.22, SP 1.23 SP 1.28, SP 1.31, SP 1.37, SP 1.41, AP-5.19Q, WI-RM-101	SP 1.5, SP 1.9, SP 1.15, SP 1.20, SP 1.29
2.	Quality Assurance Program	SP 1.21, SP 1.22, SP 1.23, SP 1.31, SP 1.32, SP 1.37, SP 1.42, SP 1.60, SP 1.63, AP-5.28Q	None
3.	Design Control	N/A	N/A
4.	Procurement Document Control	None	SP, 1.12, SP 1.25, SP 1.28
5.	Instructions, Procedures, Plans, and Drawings	SP 1.1, SP 1.7, SP 1.30, SP 2.3	None
6.	Document Control	SP 1.34, SP 1.35,	None
7.	Control of Purchased Items and Services	None	SP 1.12, SP 1.25, SP 1.28
8.	Identification and Control of Materials	None	SP 1.25, SP 1.28, SP 1.50, WI-RM-104, WI-RM-139, WI-RM-150, WI-RM-151, WI-RM-153, WI-RM-156, AP-6.3Q

Attachment to
Applicable Procedure Listing
WBS #1.2.3.4.5
CAGR RFP-4, Rev. 0
(Page 2 of 4)

		Quality Affecting Procedures	Non-Quality Affecting Procedures
9.	Control of Processes	N/A	N/A
10.	Inspection	N/A	N/A
11.	Test Control	N/A	N/A
12.	Control of Measuring & Test Equipment	None	SP 1.23, SP 2.4, WI-RM-104, WI-RM-113, WI-RM-139, WI-RM-141, WI-RM-153, WI-RM-190, WI-RM-197, WI-RM-312, WI-RM-451, WI-RM-455
13.	Handling, Shipping, & Storage	None	SP 1.12, SP 1.28, SP 2.4, AP-6.3Q, WI-RM-113
14.	Inspection, Test, & Operating Status	None	SP 1.22, SP 1.23 SP 1.25, SP 1.37, SP 2.4, WI-RM-114, WI-RM-197, WI-RM-310
15.	Control of Non-conforming Items	None	SP 1.23, SP 1.25 SP 1.37,
16.	Corrective Action	SP 1.22, SP 1.23, SP 1.25, SP 1.37	SP 1.3
17.	Quality Assurance Records	SP 1.25, SP 1.36, WI-RM-104	None
18.	Audits	SP 1.37,	None
19.	Software Quality Assurance	None	AP-1.5Q, SP 1.44, SP 1.45, WI-RM-125

		Quality Affecting Procedures	Non-Quality Affecting Procedures
20.	Scientific Investigation Control	None	SP 1.10, SP 1.11 SP 1.31, SP 2.3 SP 2.4, AP-5.19Q, AP-5.21Q, WI-RM-101, WI-RM-104, WI-RM-113, WI-RM-114, WI-RM-116, WI-RM-125, WI-RM-139, WI-RM-141, WI-RM-142, WI-RM-143, WI-RM-144, WI-RM-146, WI-RM-147, WI-RM-148, WI-RM-149, WI-RM-150, WI-RM-151, WI-RM-153, WI-RM-156, WI-RM-170, WI-RM-190, WI-RM-197, WI-RM-201, WI-RM-202, WI-RM-203, WI-RM-204, WI-RM-205, WI-RM-206, WI-RM-207 WI-RM-208 WI-RM-310, WI-RM-312, WI-RM-450, WI-RM-451, WI-RM-455, WI-RM-470, WI-RM-471, WI-RM-601, WI-RM-602, WI-RM-604, WI-RM-610,

Attachment to
Applicable Procedure Listing
WBS #1.2.5.4.5
QAGR RFP-4, Rev. 0
(Page 4 of 4)

	Quality Affecting Procedures	Non-Quality Affecting Procedures
20. Scientific Investigation Control (Continued)		WI-RM-611, WI-RM-620, WI-RM-624, WI-RM-630, WI-RM-631, WI-RM-632, WI-RM-702, WI-RM-760, WI-RM-801, WI-RM-802, WI-RM-803, WI-RM-804, WI-RM-901

OFFICE OF CIVILIAN
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

SHEET 1 OF 1
AUDIT/SURVEILLANCE/INSPECTION NO YMP 91-06

QUALITY ASSURANCE CHECKLIST

ORGANIZATION EVALUATED SAIC (T&MSS)	[X] EXTERNAL [ ] INTERNAL	[X] AUDIT [ ] SURVEILLANCE [ ] INSPECTION	PREPARED BY Audit Team Members DATE 05/17-31/91 CONCURRED BY N/A DATE N/A APPROVED BY [signature] DATE 05/31/91
DATE(S) OF EVALUATION June 17-21, 1991			
CONTROLLING DOCUMENT (Title, Number, Revision)			ACTIVITY EVALUATED

ITEM NO.	CHARACTERISTIC TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	* RESULTS
	See attached.	See attached.	

* INDICATE RESULTS: SATISFACTORY (SAT), UNSATISFACTORY (UNSAT), NOT APPLICABLE (N/A)

OCRWM AUDIT CHECKLIST NO. 91-06-1

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
	QAPD, Rev. 3, Sect. 1.0,	ORGANIZATION The T&MSS organizational components consisting of the following management positions listed BELOW (1-1) are responsible for those functions assigned to T&MSS as a YMP participant as well as those functions associated with support of the YMP office. In addition these positions established the requirement for and provide training and indoctrination of assigned T&MSS personnel, and management assessments of the portions of their QA program, and the preparation and review of departmental procedures and instructions. The T&MSS organization is depicted in Exhibits 1 through 7 of this section. These exhibits reflect the reporting relationships, titles and organizational units that are assigned YMP participants.			

9 AUDITOR SIGNATURE 10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-1

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
1-1	QAPD, Rev. 3, Sect. 1.0	1. Verify that Exhibits 1 through 7 reflect the reporting relationships, titles, and departments for the following: o T&MSS Project Manager o T&MSS Deputy Project Manager o APM, Project Manager o APM, Technical Support o APM, Program and Operations o APM, Resource Management o APM, Regulatory and licensing o T&MSS QA Manager 2. Verify that procedures adequately describe all the responsibilities identified in Paras. 1.3, and 1.3.1 through 1.3.7.			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-1

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
	QAPD, Rev. 3, Sect. 1.0, Para. 1.12	QUALITY ISSUES T&MSS shall identify in procedures the methodology for elevating disputes regarding differences of opinion involving quality issues at any given organizational level where such disputes cannot be resolved at the working level.			
1-2		1. Verify that Procedures are in place which identify the methodology for elevating disputes.			
		2. Verify through reviews of training records and interview with T&MSS personnel that there is acknowledgment of the methods to evaluate disputes and resolve allegations.			

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	QAPD, Rev. 3, Sect. 1.0, Para. 1.10	INTERFACES Interfaces between the Yucca Mountain Project Office, other participants, and T&MSS shall be described in procedures, plans, or instructions, as appropriate.			
1-3		Verify that Interfaces between the YMPO, other participants, and T&MSS are described in procedures, instructions, or plans as appropriate.			
1-4	AP-5.19Q, Rev. 1, Para. 5.0	Verify that Para. 5.0 is being implemented adequately.			

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1-5	QAPD, Rev. 3, Sect. 1.0, Para. 1.11	DELEGATION OF WORK The T&MSS organizations may delegate work under the T&MSS QA Program to others, as directed by OCRWM, but shall retain the responsibility for that work. If work is delegated, the work and associated QA Program requirements shall be described and documented. T&MSS shall be responsible for evaluating any delegated work by audits and surveillances. Verify that: 1. The delegation of work is described in procedures or instructions. 2. Any T&MSS delegated work has been described and documented.			

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	QAPD, Rev. 3, Sect. 1.0, Para. 1.14	STOP WORK PROVISIONS Provisions for issuing and lifting stop work orders/ requests shall be developed and implemented. Provisions shall include the following factors:			
1-6		Verify that: 1. Criteria and methodology for stopping work and for lifting stop work orders/requests. 2. Exact definition of work being stopped.			

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	QAPD, Rev. 3, Sect.2.0, Para. 2.2.1	QA Requirements The Quality Assurance requirements for the T&MSS QA program are identified in the OCRWM QARD and its Appendix A, Applications of Quality Assurance Program Requirements for the Mined Geological Disposal System (MGDS). Attachment A to this document lists the requirements documents upon which this program is based.			
2-1		Verify that Attachment A to the T&MSS QAPD lists all the requirements documents for the T&MSS QA Program.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.2	QA PROGRAM PLANNING Quality assurance program planning shall consider, as a minimum, the following elements: o Definition of activities; o Selective application of appropriate QA program requirements and procedural controls to items and activities; o Assignment of responsibilities for QA program control and verification activities; o Identification of the specific scientific or technical information to be collected, analyzed or used; o Identification of applicable technical and QA program management control and verification activities; and o Identification of required QA records.			
2-2		Verify the above listed elements are considered in QA planning.			

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	QAPD, Rev, 3, Sect. 2.0, Para. 2.2.3	YMP APQs The quality-related YMP Administrative Procedures (APQs)provide the implementing interface controls utilized between the Project Office and the T&MSS participant organization activities. T&MSS procedures and instructions shall address the YMP APQs as necessary to implement its QA program. The applicability of APQs used directly by T&MSS participant activities are identified in Attachment B to this document.			
2-3		Verify that: 1. Attachment B identifies Project Office procedures (APQs) directly implemented by T&MSS and that T&MSS is in fact implementing these procedures. 2. Verify that applicable APQs are appropriately implemented into T&MSS procedures as required by Para. 2.2.2.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.4	The T&MSS QAPD is reviewed by appropriate T&MSS management, reviewed and approved by the T&MSS Project Manager and Manager and T&MSS QA Manager, and submitted to the Project Office for approval.			
2-4		1. Verify that the T&MSS QAPD and all subsequent revisions have been reviewed by appropriate T&MSS management.			
		2. Verify that the QAPD was approved by the T&MSS Project Manager and the T&MSS QA Manager.			
		3. Verify that the QAPD has been approved by the Project Office.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.5	The T&MSS QA Department maintains QA Program Requirements Matrices that describe how T&MSS implements the NRC Review Plan, OCRWM QARD, ASME NQA-1 1989, and this QAPD. The Matrices link the requirement to implementing procedures or instructions.			
2-5		Verify that these Matrices exist.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.6	T&MSS IMPLEMENTING PROCEDURES AND INSTRUCTIONS The T&MSS implementing procedures and instructions delineate the specific administrative and quality assurance controls used to implement the QA requirements. The three categories of implementing procedures are as follows: o Standard Practice Procedure (SP) o Organizational Procedure (OP) o Work Instruction (WI)			
2-6		Verify that these documents are reviewed and approved by appropriate management.			

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	QAPD, Rev. 3. Sect. 2.0, Para. 2.2.8	QUALITY ASSURANCE PROGRAM CONTROLS Quality assurance controls are applied to items and activities affecting quality under suitably controlled conditions that are performed by the T&MSS organization. The T&MSS QA program invokes controls over activities through procedures and instructions, internal audits and surveillances of the QA program by an independent QA staff, external audits and surveys of T&MSS suppliers of items and services, document reviews and management assessments.			
2-7		Verify that procedures or instructions are in place which invokes controls over the following: o Internal and external audits and surveillances by an independent QA staff; o Document reviews; o Management assessments; and o External audits and surveys of suppliers of items and services.			

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	QAPD, Rev.3, Sect. 2.0, Para. 2.2.9	READINESS REVIEWS T&MSS management performs readiness reviews as deemed appropriate. Readiness reviews are used to ensure that specified prerequisites and programmatic requirements of major scheduled/planned activities have been satisfied prior to starting that activity.			
2-8		1. Verify that procedures or instructions are in place which describe the responsibilities to perform readiness reviews.			
		2. Verify that management readiness reviews are performed to ensure that specified prerequisites and programmatic requirements have been satisfied prior to starting any activity.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.10	GRADED APPROACH The determination of importance of items and activities and the application of the "graded" approach to QA shall be consistent with the OCRWM QARD and Project Office procedures. T&MSS shall utilize Project Office procedures or develop T&MSS procedures as appropriate to identify items and activities important to radiological safety and waste isolation in accordance with NUREG 1318. These procedures shall enable T&MSS to identify controls for each item and activity; identify the scientific or technical information to be collected, analyzed, and/or used for design or site characterization; identify provisions for the identification of the required QA records related to these activities; and, identify QA program management controls.			
2-9	AP-5.28Q, Para. 5.0	Verify that T&MSS utilizes Project Office procedures or has developed T&MSS procedures to identify items and activities important to radiological safety and waste isolation.			

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2-10	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.10	Verify that procedures: 1. Enable T&MSS to identify controls for each item and activity. 2. Identify provisions for the identification of the records related to these activities.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.11	QUALIFIED DATA The T&MSS QA program provides for the acceptance of data or data interpretations for use in licensing activities that were not generated under the controls of the YMP Quality Assurance program. Once accepted, these data are classified as "qualified" for licensing purposes. Specific methods for acceptance of these data shall be described in T&MSS procedures and/or Project Office procedures consistent with the requirements of NUREG 1298.			
2-11		Verify that T&MSS utilizes Project Office or T&MSS procedures which provides for the acceptance of data or data interpretations.			

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	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.12	PERSONNEL SELECTION, INDOCTRINATION AND TRAINING			
		T&MSS personnel assigned to perform activities that affect quality shall receive appropriate indoctrination or training prior to performing work. T&MSS procedures shall address the personnel selection, performance of indoctrination, training, and qualification activities.			
2-12		Verify that T&MSS procedures:			
		1. Mandates the indoctrination and training of personnel assigned to perform activities that affect quality prior to performing work.			
		2. T&MSS Managers establishes job descriptions for each position in the quality program.			
		3. Requires initial qualification to be documented.			

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2-12 Cont'd	QAPD, Rev. 3, Para. 2.2.12	4. Requires classroom training be performed I/A/W documented and approved lesson plans.			
		5. Requires annual proficiency evaluation be documented and discussed with the individual.			

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QAPD SECTION 2

AUDIT 91-06

Audit Items 2-13

Manager/Supervisor	-1 SP 1.42 Para. 5.2.1		-2 SP 1.21 Para. 5.2 & 5.3		-3 SP 1.31 P. 5.1.5a	SP 1.31 p. 5.2.1 & 5.2.3
	QA Classif. TMSS 035/1	Position Description	Education Verified T-AD-036	Experience Verified T-AD-037	Employee Qualified T&MSS 025/1	Annual Evaluation T&MSS 024/1

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2-13	QAPD, Rev. 3, Sect. 2.0, Para. 2.2.12	Select random employees for five (5) managers/ supervisors, and verify the following:			
	SP 1.42, Rev. 1, Para. 5.2.1	1. Verify that QA classifications have been determined and that job position descriptions have been established.			
	SP 1.21, Rev. 0, Paras. 5.2 & 5.3	2. Verify that education and experience have been verified by the Personnel Office.			
	SP 1.31, Rev. 3, Paras. 5.1.5a & 5.2.1	3. Verify that the evaluation and qualification requirements have been satisfied.			

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AUDIT 91-06

Audit Item 2-13

		-4					-5
Manager/Supervisor	Employee	SP 1.31 Para. 5.1.2 Assign Training T&MSS 027/4	SP 1.31 Para. 5.1.4 Training 027/4	SP 1.31 Para. 5.1.7 Lesson Plan 051/1	SP 1.31 Para.5.1.13 Instructs Employee 049/1	SP 1.31 Para. 5.2.2 Complete Training 023/1	SP 1.31 Para. 5.4 Files

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2-13 Cont'd	SP 1.31, Rev. 3, Paras. 5.1.2, 5.1.4, 5.1.7, 5.1.8, 5.1.9, 5.1.13 & 5.2.2	4. Verify that the training requirements are satisfied.			
	Para. 5.6.2	5. Verify that the required records are in each of the personnel files.			

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	QAPD, Rev. 2, Sect. 2.0, Para. 2.2.132	MANAGEMENT ASSESSMENT T&MSS shall have management assessments of the T&MSS Q program conducted at least annually. The assessment shall be performed by management above or outside the T&MSS QA organization by, or at the direction of, the T&MSS Project Manager. The management assessment shall determine the effectiveness of the system and management controls that are established to achieve and assure quality, and the adequacy of resources and personnel provided to the QA program. These evaluations are performed, documented, and reported to upper management. Any conditions adverse to quality identified in these assessments shall be documented, tracked and corrected.			
2-14		Verify that annual management assessments conducted by management above or outside the T&MSS QA organization are conducted to evaluate the effectiveness of the program.			
2-15	SP 1.32, Rev. 1, Paras. 5.0 & 7.0	Verify that management assessments were performed.			

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3-1	SP 2.3, Rev. 1,	TECHNICAL REVIEWS Request a list of technical reviews that have been completed by T&MSS since 2/14/91. Choose 10 reviews and request copies from the LRC. Do not select Peer Reviews and select from several originating organizations.			
3-2	Para. 5.1.4 thru 5.3.1	1. Review each technical review for complete records. Use attached matrix for checklist and record. 2. Assure all required signatures and dates are filled in as appropriate. 3. List all reviewers and management signers on a separate sheet and verify that all have had training prior to performing the review on procedures. SP 2.3, Rev. 1.			

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	SP 1.62 Rev. 0	PEER REVIEW The following requirements apply to requests for peer review which were determined not required by the Project Manager/Technical Director.			
3-3	Para. 5.1.1 thru 5.1.4	1. Request a listing of all peer review request from the Assistant Project Manager of Technical Technical Support (Site Characterization support) for the period 11/15/90 to present. Retrieve the record package of each unaccepted request from the LRC and verify the package contains as a minimum: A. A copy of the request memo the RPM; B. A copy of the response memo from the RPM to the Project Manager and Technical Director; C. A copy of the decision memo rejecting the request from Project Manager/Technical Director to the RPM and requester;			

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3-4 Cont'd	SP 1.62, Rev. 0, Paras. 5.1.1 thru 5.1.4	D. Any pertinent back-up documentation mentioned in the above memo;			
		E. Memos from the peer review group accepting or disagreeing with comment resolutions (see Para. 5.4.2).			
		2. Verify that all record packages in 2 above were submitted to the LRC within 10 days of the date the record package was authenticated (SP 1.36, Para. 5.2.3.5).			
		3. Verify that during the interim between authentication and record package submittal to the LRC, all records are kept in 1-hr fire rated containers (SP 1.36, Para. 5.4.1).			

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3-5	SP 1.62, Rev. 0, Paras. 5.1.1 thru 5.1.4 & 7.1	The following requirements apply to all Peer Review packages with approved Peer Review requests. Record on attached matrix.			
		1. Retrieve all other Peer Review packages submitted since 11/15/90 at the LRC and verify the packages contain as a minimum:			
	Para. 5.1.1	A. Copy of the request memo to the RPM;			
	Para. 5.1.2	B. Copy of the response memo from RPM to Project Manager and Technical Director;			
	Para. 5.1.3	C. Copy of the decision memo requiring a Peer Review to the RPM and requester by Project Manager/Technical Director;			

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3-5 Cont'd	SP 1.62, Rev. 0, Para. 7.1	D. Copies of any backup documentation mentioned mentioned in the memo above;			
		E. Minutes of all Peer Review meetings;			
		F. The Peer Review Plan (NOTE: The following records must be part of the Peer Review Plan per SP 2.3):			
		o completed form TMSS/095/2 and form TMSS/098/1 and all attachments			
		o records of applicable documented communications			
		o any references cited on form /095/2			
		o the original document, and			
		o the final document.			
		Record on attached Matrix.			

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3-5 Cont'd	SP 1.62, Rev. 0 Para. 7.1	G. The Peer Review Report			
		H. All comment resolution			
		I. Documentation memos from the Peer Review Group accepting or disagreeing with comment resolution (see Para. 5.4.20).			
		2. Verify that all record packages were submitted to the LRC within 10 days of the authentication date on the record package.			

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3-6	SP 1.62, Rev. 0, Para. 5.2.1	1. Review all Peer Review Plans developed between 11/15/90 and present for minimum content of: o Description of work to be reviewed; o Review scope and objectives; o Size and composition of peer group; o Method and schedule for preparation of the Peer Review Report; o Potential reviewer identification; o Designated chairperson; o Designated secretary; and o Estimated cost of the Peer Review. Record on attached Matrix. 2. Audit technical advisor to review plan for adequacy.			

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3-6 Cont'd	SP 1.62, Rev. 0, Para. 5.2.1	3. Verify that as a minimum all APMs and the QA Manager have reviewed and approved the Peer Review Plan: o APM Project Management o APM Quality Assurance o APM Technical Support o APM Regulatory & Licensing Support o APM Programs & Operations o APM Resources Management o T&MSS QA Manager Record on attached Matrix. 4. Verify that the Peer Review Plan is reviewed as a Technical Document (SP 2.3). Steps 5.1.1 through 5.2.12 of SP 2.3 apply.			

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3-7	SP 1.62, Rev. 0, Para. 5.2.2	The Peer Review Plan is a QA record when all signatures have been affixed to form 098/1 per SP 1.36. Verify that if the original is transmitted to the Project Manager or the Technical Director , it must be protected as in Para. 5.4.1 of SP 1.36, unless dual storage requirements are met, until transferred to the LRC.			
3-8	Para. 5.2.3	Verify that in addition to the signatures required on T&MSS form 98/1 attached to the Peer Review Plan, the T&MSS Project Manager and the Technical Director have signed the plan.			

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3-9	SP 1.62, Rev. 0, Para. 5.4.1	Audit Technical advisor to review minutes of peer Reviews for adequacy and compliance to NUREG 1297 2/88.			
3-10		On a separate sheet of paper list all reviewers and all management signers. Verify that all had been trained to SP 1.62, Rev. 0, prior to signing or reviewing the Peer Review.			

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4-1	QAPD, Rev. 3, Section 4, Para. 4.0	T&MSS shall procure items and services in accordance with approved procedures.			
		1. Verify that approved procedures implement requirements set forth in paragraph 4.0. (OP 1.4, R1, OP 1.7., R3, OP 1.3, R1)			
4-2		2. Verify inclusion of following attributes in approved procedures.			
	Para. 4.1	A. Scope of work or services to be performed by supplier.			
	Para. 4.2	B. Specification of technical requirements, codes, standards, reference drawings, etc.			
	Para. 4.3	C. Approval of QA program by T&MSS QA.			
	Para. 4.4	D. Right of access.			
	Para. 4.5	E. Documentation to be required by procurement action to assure T&MSS inspection, surveillance, or audit of supplier facility and records as necessary.			
	Para. 4.6	F. QA requirements for items and services are provided.			

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4-2 Cont'd	QAPD Rev. 3, Sect. 4,	G. Control of nonconformances.			
	Para. 4.8	H. Controls for evaluation, identification, et al., for spare and replacement parts.			
	Para. 4.9	I. Acceptance criteria for procured items and services.			
	Para. 4.10	J. Review of technical specification by technical organization procuring item/service.			
	Para. 4.11	K. Changes to procurement documents controlled in same manner as original document.			

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4-3	OP 1.7, Rev. 3	Verify qualified supplier list.			
	Para. 5.1	1. Supplier Evaluation Report prepared for each supplier.			
		2. Qualified Supplier List Form (QSL) completed, Form T&MSS/004/1.			
		3. QSL Index, Form T&MSS/005/01.			
		4. Signature of T&MSS QA Manager.			
4-4	Para. 5.2	Verify quarterly revision of QSL.			
4-5	Para. 5.3	Revision of QSL, as required.			

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4-6	OP 1.3, Rev. 1	Verify evaluation of suppliers through any of several methods.			
	Para. 5.6	1. Commercial Grade Supplier Evaluation Report T&MSS/016/04, QA Manager approval.			
		2. Quality Affecting - Report as in #1 above.			
		A. Quality Records review			
		B. Supplier history review			
		C. Facility survey			
		D. Preview YMP qualification and approval			
		E. ASME, NBC, or other certified supplier recognized by national organizations			
4-7	Para. 5.1	3. Re-evaluation of suppliers.			

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4-8	OP 1.4, Rev. 1	Verify QA review: 1. Procurement Document Review Log, T&MSS/007/1. o T&MSS/008/03, Quality affecting o T&MSS/002/04, Commercial grade 2. Completion of procurement documents; enter information in log above.			

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5-1	SP 1.1, Rev. 4, Para. 5.1.1.2	Verify that a custodian has been assigned for the preparation and maintenance of each SP, OP procedures.			
5-2	Para. 5.1.1.8	Verify that each review package of a new procedure contains: o Document approval form with list of designated reviewers (TMSS/098/1); o Document Review and Comment form (TMSS/095/2); o Draft procedure; and o Any new or revised forms			
5-3	Para. 5.1.2.4	Verify that "mandatory" comments have been resolved and documented on appropriate form (TMSS/095/2).			

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5-4	SP 1.1, Rev. 4 Para. 5.1.2.5	Verify that major changes are resubmitted to the original reviewers for a new cycle of review and comments			
5-5	Para. 5.1.2.7	Verify that reviewer concurrence is documented on form TMSS/098/1.			
5-6	Para. 5.1.2.9	Verify that: o SPs procedures have been approved by T&MSS Project Manager and QA Manager; and o OPs procedures have been approved by responsible APM and QA Manager.			

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5-6	SP 1.1, Rev. 4, Para. 5.2.1.4	Verify that revised procedures are issued with revision bars or marked as "complete revision."			
5-7	Para. 5.2.1.5	Verify that revised procedures have been reviewed and documented in accordance with steps 5.1.1.6 through 5.1.1.10, Section 5.1.2 and Section 5.1.3 of SP 1.1.			
5-8	Para. 5.3.6	Verify that ICN's review package contains: o Form TMSS/098/1 with item to be reviewed and a list of all designated reviewers; o Form TMSS/095/2; and o The ICN.			

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5-9	SP 1.1., Rev. 4, Para. 5.3.10	Verify that comments received during the review cycle of an ICN have been resolved and documented on form TMSS/095/2.			
5-10	Para. 5.3.12	Verify that issued ICNs contain TMSS Project Manager and QAM approvals.			
5-11	Para. 5.4.2	Verify that canceled procedure(s) have been done using a written statement approved by the pertinent APM (SPs) and the QAM.			

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5-12	SP 1.1, Rev. 4, Para. 5.4.4	Verify that canceled procedures have been transmitted to the LRC as a record package in accordance with Para. 7.4.			
5-13	Para. 7.1	Verify that a record package containing o A copy of the signed procedure, o Form TMSS/098/1, and o Reference form(s) have been submitted to the LRC within 10 working days of a new or revised procedure.			
5-14	Para. 7.3	Verify that a record package containing o Form TMSS/098/1, o Form TMSS/030/1, and o Signed ICN have been submitted to the LRC within 10 working days of the submission of each ICN to the DCC.			

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5-15	SP 1.2., Rev. 5, Para. 5.4.2	Verify that revision bars are used on revised versions of the QAPD unless the entire QAPD is revised.			
5-16	Para. 5.4.3	Verify that Sections 5.1 through 5.3 of SP 1.2 have been followed in order to issue a revised version of the QAPD.			
5-17	Para. 7.0	Verify that a record package for each revision to the QAPD containing the following: o Copy of approved QAPD revision and o Form TMSS/098/1.			

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5-18	SP 1.30, Rev. 3, Para. 5.1.1.8	Verify that a review package for each Work Instruction (WI) exist and contains the following: o Form TMSS/098/1 with a list of all designated reviewers; o Form TMSS/095/2, o The draft WI, and o Any new or revised forms.			
5-19	Para. 5.1.2.4	Verify that major changes resulting from the review are reflected in a resubmittal to the original reviewers with a new comment resolution form.			
5-20	5.1.2.6	Verify that reviewers document approval or concurrence on form TMSS/098/1.			

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5-21	SP 1.30, Rev.3, Para. 5.2.1.4	Verify that revision bars are used on revised WI or "complete revision" is indicated on page one.			
5-22	Para. 5.2.1.5	Verify that steps 5.1.1.6 through 5.1.1.10 and Sections 5.1.2 and 5.1.3 are followed in the revision review/approval and issuance of each revised WI.			

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5-23	SP 1.30, Rev. 3, Para. 5.3.1.6	Verify that ICN review package for applicable WI contains the following: o Form TMSS/098/1 and a list of all designated reviewers, o Form TMSS/095/2, and o The ICN.			
5-24	Para. 5.3.1.10	Verify that discrepancies are resolved and documented on form TMSS/095/2.			
5-25	Para. 5.3.2.3	Verify that verbal ICN are approved within 24 hours by the responsible T&MSS APM and QAM.			

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5-26	SP 1.30, Rev. 3, Para. 7.1	Verify that a record package is submitted to the LRC within 10 working days of the submission of a new or revised WI to the DCC and contains the following: o Approved WI, o Form TMSS/098/1 and o Reference form(s).			
5-27	Para. 7.3	Verify that a record package is submitted to the LRC within 10 working days of the submission of each ICN to the DCC and contains the following: o Form TMSS/098/1, o Form TMSS/030/1 and o Approved ICN.			

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5-28	SP 1.35, Rev. 1, Para. 5.1.1.6	Verify that Non-Technical Documents (NTDs) review packages consist of: o Form TMSS/098/1 and a list of all designated reviewers; o Form TMSS/095/2 (DRC form); and o The draft document.			
5-20	Para. 5.1.2.5	Verify that substantive changes to a document are reflected in a resubmittal of the NTD for review comments to the original reviewers.			
5-21	Paras. 5.1.2.1 & 5.1.2.6	Verify that "mandatory" comments are resolved in forms TMSS/095/2 and 098/1 respectively.			

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5-22	SP 1.35, Rev.1, Para. 5.2.1.5	Verify that revisions to NTD are done in accordance with steps 5.1.1.4 through 5.1.1.8 and Sections 5.1.2 and 5.1.3.			
5-23	Para. 7.1	Verify that record packages of each NTD are sent to the LRC within 10 working days of the approval and contain the following: o Approved NTD and o Form TMSS/098/1			

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6-1	SP 1.34, Rev. 3, Para. 5.2.1	Verify that controlled documents are stamped in red to indicate their status.			
6-2	Para. 5.2.2	Verify that documents are transmitted to document holders using Document Transmittal Acknowledgment Record (DTAR).			
6-3	Para. 5.3.2.2	Verify that DTAR not returned 15 working days after transmittal are tracked and document holders notified of such action.			

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6-4	SP 1.34, Rev. 3, Para. 5.6.1	Verify that a Master List (ML) of controlled documents is maintained by DCC.			
6-5	Para. 5.6.2	Verify that the ML is transmitted to the LRC monthly.			
6-6	Para. 5.6.6	Verify that document holders verify their document holdings annually and documentation is sent to DCC.			

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6-7	SP 1.65, Rev. 0, Para. 5.1.3	Verify that Vendor Manauals (VM) have been authenticated in accordance with SP 1.36.			
6-8	Para. 5.1.7	Verify that VMs are controlled documents and are handled like that by the DCC.			
6-9	Par. 7.1	Verify that VMs and changes are submitted to the LRC within 10 working days of being transmitted to the DCC.			

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	QAPD, Rev. 3 Sect. 7, Para. 7.1; SP 1.28, Rev. 3	T&MSS shall plan procurement activities as early as practical and shall include the following, as practical:			
	Para. 5.5 & 5.1	o Procurement documentation preparation, review, and change control.			
	Para. 5.3	o Selection of procurement sources.			
	Para. 5.4	o Bid evaluation and award.			
	Para. 5.5	o Identification of minimum specifications.			
	Para. 5.3	o Pre-award survey or audit of supplier and establishing of hold points as necessary.			
	Para. 5.8.2.1.4	o Control of NCRs.			
	Para. 5.7	o Corrective Actions.			
	SP 1.25	o Acceptance of item or service.			
	SP 1.25	o QA Records.			
7-1		Verify above attributes for procurement actions.			

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7-2	QAPD, Rev. 3, Sect. 7, Para. 7.2; OP 1.7, Rev. 3	Verify supplier selection establishment of QSL and appropriate documentation.			
7-3	Para. 7.3, OP 1.7, Rev. 3	Verify bid/proposal evaluation to technical and quality requirements.			
7-4	Para. 7.4; OP 1.7, Rev.3, Para. 5.2	Verify Supplier Performance evaluation: o Method used; o Initial evaluation; and o Annual evaluation.			

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7-5	Para. 7.5	Verify control of changes in technical or quality requirements.			
7-6	Para. 7.6, OP 1.7, Rev. 3	Acceptance of Items and Services. 1. Verify recurring inspection performed on items per receiving inspection requirements; 2. Verify past installation testing per the test requirements and acceptance criteria; 3. Verify certificate of conformance are received, traceable, and periodically evaluated by audit, independent inspection or test.			

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7-7	SP 1.28, Rev. 3, Para. 5.8.2	Verify on-site and off-site receipt of items per SP 1.25:			
		o Initiation of Receipt Inspection Report, TMSS/038/03;			
		o RIR contains acceptance criteria;			
		o Performance of required inspections;			
		o Post-Receipt Testing, as applicable; and			
	Para. 7.7; SP 1.25, Rev. 3, Para. 5.7	o Acceptance of Services Only, TMSS/094/1.			

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7-8	Para. 7.8; SP 1.25, Rev. 3, Para. 5.6	Verify implementation of NCE identified by T&MSS (to T&MSS Program) (SP 1.23).			
7-9	Para. 7.9; SP 1.25, Rev. 3, Para. 5.3, Exhibit 3	Commercial-Grade Items - Verify: o Inspection for acceptance; and o Identification on procurement document.			
7-10	Para. 7.10; SP 1.25, Rev. 3 Para. 5.3	Verify supplier generated documents received as part of RIB.			

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7-11	Para. 7.11	Verify records content of procurement packages: o Receiving Inspection Reports; o Basis of Acceptance of Services; o Purchase Requisition; o Purchase Order; o Supplier documentation; and o NCRs			

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	QAPD, Rev. 3, Sect. 8	T&MSS procedures and instructions shall describe the methods for ensuring that only correct and accepted items, samples, and data are utilized. Identification shall be traceable to the appropriate documentation such as drawings, specifications, purchase orders, technical reports, drilling locations, and logs (including well bore and depth), test records, installation and use records, inspections documents, and nonconformance reports.			
8-1		Verify that procedures are in place which address the requirements of QAPD, Section 8.			

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10-1	SP 1.25, Rev. 3 Para. 4.2	Verify that inspection personnel are qualified and certified to the requirements of approved procedures.			
10-2	Para. 4.3	Verify that receiving inspection is performed at the receiving location Hold Area.			
10-3	Para. 5.1	Verify that a pre-numbered Receipt Inspection Record (RIR) (T&MSS/038/3) is in the Procurement Package.			

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10-4	SP 1.25, Rev. 3 Para. 5.3.1.c	Verify that the suppliers furnished items were procured from a supplier identified on the Qualified Supplier List (OSL).			
10-5	Paras. 5.3.2 & 5.3.6	Verify that inspection as required by the RIR (TMSS/038/3) and applicable sections (5.3.2 through 5.3.6) of SP 1.25 was performed.			
10-6	Para. 5.3.7	Verify that Acceptance of Service only was performed per Para. 5.3.7 of SP 1.25 using TMSS/094/1.			

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10-7	SP 1.25, Rev. 3 Paras. 5.4 & 5.5	Verify that "accept" and "hold" tags are attached to the items as applicable.			
10-8	Para. 5.6	Verify that nonconforming items are documented as Para. 5.6 of SP 1.25 was form TMSS/189/1 used?			
10-9	Para. 5.6.5	Verify that reject items are physically separated from acceptable items.			
10-10	Para. 7.0	Verify that RIRs (Form T&MSS/038/3) with applicable exhibits and basis for Acceptance of Service (Form/T&MSS/094/1) are processed as QA records as required.			

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10-11	SP 1.12, Rev. 0 Para. 3.2.3	Verify that an "RFPD Designee" has been designated by the Radiological Field Programs Department (RFPD) Manager to oversee the possession, receipt, and shipment/transportation of radioactive material.			
10-12	Paras. 5.1, 5.2 & 5.3	Verify that radioactive material is controlled and processed in accordance with the specified requirements.			

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12-1	SP 2.4, Rev. 2, Sect. 5.1.1.1	Verify that a T&MSS M&TE Custodian has been assigned by the Assistant Project Manager (Programs and Operations) and that the assignment has been documented in accordance with SP 1.42.			
12-2	Sect. 5.1.5.1	Verify that the M&TE Custodian has established an M&TE Equipment List (Exhibit 1).			
12-3	Sect. 5.1.5.2	Verify that the M&TE Custodian has established a component history file for each M&TE component.			

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12-4	SP 2.4, Rev. 2, Sects. 5.1.3.2 & 5.1.3.3	Verify that upon receipt of M&TE reworked/ recalibrated by a vendor the M&TE Custodian performs the following, as required: o Verifies the component is in operable condition; o If acceptable, attaches a calibration sticker and completes TMSS/094/1 in accordance with SP 1.25; o Issues an an NCR in accordance with SP 1.23 if not acceptable; and o Updates equipment list and history file.			
12-5	Sect. 5.1.6	When performing a calibration/performance audit, verify the Responsible Manager prepares a work instruction in accordance with the requirements listed in Section 5.1.6			

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12-6	SP 2.4, Rev. 2, Sect. 5.1.7.2	1. Verify that the Responsible Manager assures traceability, accuracy, and designates calibration standards in writing to the M&TE Custodian.			
		2. Verify proper storage of calibration standards by the M&TE Custodian/Technician.			
12-7	Sect. 5.2.1	Verify recall of M&TE is accomplished as required by the M&TE Custodian.			

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12-8	SP 2.4, Rev. 2, Sect. 5.3	Verify the calibration of equipment is performed in accordance with approved work instructions and that calibration labels (or calibration not required labels) are attached to equipment, as specified.			
12-9	Sect. 5.4	Verify identification and investigation of out-of-tolerance conditions found during calibration.			

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12-10	SP 2.4, Rev. 2, Sect. 5.5	Verify performance of calibration frequency review by the M&TE Custodian.			
12-11	Sect. 5.6	Verify calibration frequency extensions are requested and concurred with in accordance with requirements.			

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	QAPD, Rev. 3, Sect. 13	T&MSS procedures shall describe the methods for handling, storage cleaning, packaging, shipping and preservation of items to prevent loss or damage and to minimize deterioration. Such methods shall be in accordance with design and procurement requirements and manufacturer's recommendations. T&MSS QA shall monitor implementation of the procedures and instructions through audits and surveillances. QA shall also perform technical document reviews as necessary for special equipment and/or equipment requiring protective environments.			
13-1		Verify that procedures are in place which address the requirements of QAPD, Section 13.			
13-2	SP 1.12, Rev. 0 Para. 5.1	Verify that the RFPD Manager completed the evaluation noted in 5.1.2 and completed distribution in accordance with 5.1.3.			
13-3	Para. 5.2	Verify that procurement and receiving activities addressed in Section 5.2 comply with applicable T&MSS procedures (SP 1.28). Coordinate with E. Cocoros.			

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13-4	SP 1.12, Rev. 0 Paras. 5.3.3, 5.3.4 & 5.3.5	Verify that the RFPD Designee inspects packaging and completes the required paperwork in accordance with 5.3.3, 5.3.4 and 5.3.5			
13-5	Paras. 5.3.6, 5.3.7 & 5.3.8	Verify that the SCFRM and packing list is reviewed by the RFPD Manager in accordance with 5.3.6, 5.3.7 and 5.3.8.			
13-6	Paras. 5.3.9 & 5.3.10	If the activity being shipped meets or exceeds the quantities in 49 CFR for "normal form Type A," verify that a copy of the documentation is sent to the APMPO for authorization to make the shipment.			

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14-1	QAPD, Rev. 3, Sect. 14	Verify that procedures/instructions provide for identifying the status of inspection and test activities to ensure that required inspections and tests are performed and to ensure that unacceptable items are not inadvertently installed, used, or operated.			
14-2	Sect. 14.1	1. Verify that provisions are made for the use of status indicators, as appropriate and that authority for application and removal of status indicators is defined. 2. Verify that examples of status indicators are provided in appropriate procedures.			
14-3	Sect. 14.2	Verify that procedures control altering the sequence of tests, inspections, and other operations important to safety or waste isolation and that such actions are subject to the same controls as the original review and approval.			

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15-1	SP 1.23, Rev. 3, Para. 5.0	Verify that indeterminate or nonconforming items are reported on a Nonconformance Report (Form T&MSS/189/1) and the requirement of Paras. 5.1 through 5.8 are implemented particularly audit item numbers 15-2 through 15-9. NOTE: The test of Para. 5.0 does not offer a smooth transition from the text to the entries required by Form T&MSS/189/1.			
15-2	Para. 5.1.1	Verify that quantitative and qualitative information are reported in the NRC (Item 11).			

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15-3	SP 1.23, Rev. 3, Para. 5.1.3	Verify that a Hold Tag(s) with appropriate information entered is affixed to the item or to the container, package or segregated storage area if tagging is impractical.			
15-4	Para. 5.1.4	Verify that indeterminate or nonconforming items are segregated from acceptable items and are placed in a cleared designated Hold Area.			

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15-5	SP 1.23, Rev. 3, Para. 5.7.1	Verify that Conditional Releases (TMSS/190/1) are initiated provided all of the conditions specified in Para. 5.7.1 are met.			
15-6	Paras. 5.7.2 & 5.7.12	Verify that requirements of Paras. 5.7.5, 5.7.8, 5.7.10, 5.7.11 & 5.7.12 are implemented.			

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15-7	SP 1.23, Rev. 3, Para. 5.8.1	Verify that a Nonconformance Log is maintained which contains the information required by Para. 5.8.1 of SP 1.23, Rev. 3.			
15-8	Para. 5.8.2	Verify that a file of NCRs is maintained until closure.			
15-9	Para. 5.8.3	Verify that a closed NRC package with required supporting documentation required is submitted to the LRC within 10 working days of closure of the NRC.			

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16-1	SP 1.22, Rev. 0, Paras. 5.1 through 5.4	Verify that when an occasion occurred that a Stop Work Order was required that the requirements of Paras. 5.1 through 5.4 were satisfied. 1. Verify that a SWO Log (Form T&MSS 61-11) is maintained current. 2. Verify that SWO form T&MSS 61-10 is properly completed. 3. Select two (2) SWOs and follow process from start to completion.			

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16-2	SP 1.37, Rev. 3, Para. 5.1.1	Verify that Conditions Adverse to Quality are identified on Form TMSS/057/2.			
16-3	Paras. 5.1 through 5.5	Verify that the referenced paras of SP 1.37, Rev. 3, are being adequately implemented. NOTE: No reference is made to block 13 in the text of the referenced paras.			
16-4	Para. 5.2	Verify that responses to QFRs and MCARs are provided within 20 and 10 working days respectively.			

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16-5	SP 1.37, Rev. 3 Paras. 5.1.9 & 5.4.1	Verify that a QA Deficiency Reporting System Status Log is maintained and tracked to ensure that processing between responding organization and QA is satisfactory and that responses/resolutions are being processed in a timely manner.			
16-6	Para. 5.4.3	Verify that the QFR/MCARs are revised to the next revision when responses have not been completed within the response times defined in Para. 5.2.			

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16-7	SP 1.37, Rev. 3, Paras. 5.4.4 & 5.4.5	Verify that the Log is annotated to reflect latest revision, issue date and response due date for the revised QFR/MCAR.			
16-8	Para. 7.0	Verify that record packages contain the documents defined in Para. 7.0.			

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16-9	OP 1.6, Rev. 2, Para. 5.1.1	Verify that Trend Analysis information is assimilated on a quality (3-month) basis and a Trend Analysis Report is prepared.			
16-10	Para. 5.1.10	Verify that the report includes: o Summary for 3-month period; o Positive/negative trends; o Trend Analysis charts (as applicable); o Results of any investigations for potential adverse trends; and o Identification of deficiency reports issued as a result of investigations.			

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16-11	OP 1.6, Rev. 2, Para. 5.1.11	Verify that when the report is approved by the QA Manager issues the report with the minimum distribution to the following: o T&MSS Project Manager; o T&MSS Assistant Project Manager; and o Project Office Quality Assurance Division Director.			

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	SP 1.36, Rev. 3, Para. 5.1.1	RECORDS MANAGEMENT Identification and preparation of Individual Hard Copy Records to the LRC.			
17-1		Verify that the Records Sources accomplish the following tasks:			
	Para. 5.1.1.1.	o Verify records to be generated, supplied, or maintained.			
	Para. 5.1.1.2	o Draft documents are clearly marked "DRAFT' on the first page.			
	Para. 5.1.1.4	o Determine if the the document(s) is part of a record packate and prepared in accordance with Para. 5.2.2 for a segment or Para. 5.2.3 for a completed package.			

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17-1 Cont'd	SP 1.36, Rev. 3, Para. 5.1.1.5	o Place a WBS number and a quality affecting designation of either QA or QA:N/A in the upper right-hand corner of individual records.			
	Para. 5.1.1.6	o Records are complete and include all attachments or enclosures.			
	Para. 5.1.1.7	o Records must be legible. Illegible records must be transcribed or enhanced, authenticated, and submitted with the illegible QA record.			

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17-1 Cont'd	SP 1.36, Rev. 3, Para. 5.1.1.8	o Record data must be in black ink against a light background.			
	Para. 5.1.1.10	o Use only stamps or other marks that do not intersect and obliterate the text.			
	Para. 5.1.1.11	o Fill in all blanks on records, including signature, or enter "N/A."			
	Para. 5.1.1.12	o Mark ups on drafts must be initialed and dated by the originator or preparer.			

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	SP 1.36, Rev. 3, Para. 5.1.2	RECORDS MANAGEMENT			
17-2		Preparation of Final Technical and Scientific Reports. Verify that the Record Sources take the following steps:			
	Para. 5.1.2.1	o Contact the LRC and obtain a pre-assigned accession number. (Journal articles, bulletins, or professional papers must be submitted but do not require pre-assigned accession numbers.)			
	Para. 5.1.2.2	o Place the accession number on the inside of the back cover or within the acknowledgment section.			

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	SP 1.36, Rev. 3, Para. 5.1.3	RECORDS MANAGEMENT Preparation of Machine Readable Records-			
17-3		Verify that the Record Sources take the following steps:			
	Para. 5.1.3.1	o Generate (or convert) all electronic data records to magnetic tapes. Use separate tape for temporary records.			
	Para. 5.1.3.3	o Convert microfiche and microfilm to hard copy.			

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	SP 1.36, Rev.3, Para. 5.1.4	RECORDS MANAGEMENT Corrections to Records-			
17-4		Verify that Record Sources take the following steps:			
	Para. 5.1.4.1	o Correct errors by drawing a line of black ink through the incorrect information, placing the correct information in close proximity, and initialing or signing and dating the correction.			
	Para. 5.1.4.2	o If a QA record does not meet legibility requirements,either (a) transcribe the information or (b) write over (enhance) a copy of the record, authenticate, and submit with record.			

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	SP 1.36, Rev. 3, Para. 5.2.1	RECORDS MANAGEMENT Submittal of Individual Hard Copy Records to the LRC-			
17-5		Verify that Record Sources perform the following:			
	Para. 5.2.1.1	o Submit individual hard copy QA records with a Record Source Transmittal Form (RSTF). If submitted directly to the LRC, submit the RSTF and two copies of the QA record. If distributed by the Mail Distribution Center (MDC), submit the original record with a RSTF.			
	Para. 5.2.1.2	o Include the following information on the RSTF: - WBS designation; - QA designation; - Date of transmittal; - Record source name; - Record date; - Complete title of record; - Individual page counts; and - Special codes or identification numbers.			
	Para. 5.2.1.7	o Submit individual records no later than 10 working days after the completion or receipt.			

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	SP 1.36, Rev. 3, Para. 5.2.2	RECORDS MANAGEMENT Submittal of Record Package Segments to the LRC-			
17-6		Verify that Record Sources perform the following:			
	Para. 5.2.2.2	o Submit record package segments to the LRC along with a RSTF.			
	Para. 5.2.2.3	o Ensure the following is included on the RSTF: - WBS designation; - QA designation; - Date of transmittal; - Record Source name; - Appropriate record package tracking number; - Title of records; - Date(s) of the individual record or group of records that constitute the package segment; - Page counts; and - Any special codes or identification numbers.			

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17-7	SP 1.36, Rev. 3, Para. 5.2.2.4	RECORDS MANAGEMENT Notify the LRC when submitting the final segment of a record package.			
	Para. 5.2.2.5	o Review the completed record package after it has been compiled by the LRC, to ensure applicable steps in prior sections of this procedure have been adhered to.			
	Para. 5.2.3	o Submittal of Completed Record Packages to the LRC.			

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17-8	SP 1.36, Rev. 3 Para. 5.2.3.1	Verify that Record Sources perform the following: Complete a Table of Contents/Record Package Transmittal Form and submit it as the first record of each completed record package.			
17-9	Para. 5.2.3.4	Provide a complete description of special process or oversized records that are part of a record package, but are handled separately in accordance with section 5.2.4.of this procedure.			
17-10	Para. 5.2.3.5	Submit record packages upon completion of the activity or phase of the activity (i.e., within 10 working days of completion of the last record in the package).			

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		RECORDS MANAGEMENT			
	SP 1.36, Rev. 3 Para. 5.3	Resolution of discrepancies-			
17-11		Verify that Record Sources perform the following:			
	Para. 5.3.1	Resolve discrepancies with the LRC. Make necessary corrections as requested on the LRC Bounce Back Form (BBF).			

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	SP-1.36, Rev. 3, Para. 5.4	RECORDS MANAGEMENT Record Storage-			
17-12		Verify that the Record Sources do the following:			
	Para. 5.4.1	Store and protect records prior to submittal to the LRC in "one hour" fire-rated containers bearing the UL label (or equivalent) certifying 1-hour protection or be certified by a person competent in the technical field of fire protection.			
	Para. 5.5	Retrieval of Records-			
17-13		Verify that the Records Sources take the following steps:			
	Para. 5.5.1	Contact the LRC (e.g., via telephone , in person, electronic mail, interoffice mail) to retrieve a record or complete a Retrieval Request Form (RRF) and submit it to the LRC.			

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	QAPD, Rev. 3, Sect. 18	This program shall provide independent verification of the status, adequacy, compliance, and implementation of the T&MSS QA program and its elements. T&MSS procedures and instructions for this program shall include the following provisions: o audits o audit scheduling o audit team o audit plan and process o audit report o supplier audits and evaluations o surveillances			
18-1		Verify that procedures are in place which address the requirements of QAPD, Section 18.			

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18-2	OP 1.1, Rev. 2, Para. 4.1	Verify that audits are conducted and personnel are selected for auditing assignments in accordance with 4.1.			
18-3	Para. 5.1	Verify that audit schedules are developed, prepared, issued and reviewed in accordance with 5.1.			
18-4	Para. 5.2	Verify that audit plans are developed in accordance with 5.2.1.			
18-5	Paras. 5.2 & 5.6	Verify that audit checklists are developed and completed in accordance with 5.2 and 5.6.			

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18-6	OP 1.1, Rev. 2, Para. 5.6	Verify that the audit is documented in accordance with 5.6.			
18-7	Paras. 5.3 & 5.5	Verify that pre- and post-audit attendance lists are generated in accordance with 5.3 and 5.5.			
18-8	OP 1.2, Rev. 0, Para. 5.1	Verify that audit scheduling is completed in accordance with 5.1.			
18-9	Para. 5.2	Verify that assignment of surveillance personnel is completed in accordance with 5.2			

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18-10	OP 1.2, Rev. 0, Para. 5.4	1. Verify that the Surveillance Report Status Log is maintained in accordance with 5.4.			
		2. Verify that the Surveillance Report is completed, approved and distributed in accordance with 5.4.			

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18-11	OP 1.3, Rev. 1, Para. 5.1	Verify that the evaluation of suppliers is performed in accordance with Para. 5.1.1, 5.1.2 or 5.1.3.			
18-12	Para. 5.2	Verify that supplier evaluations are documented in accordance with 5.2.			
18-13	Para. 5.5	Verify that annual performance evaluations are performed and documented in accordance with 5.5.			
18-14	Para. 5.6	Verify that the supplier evaluation report for commercial grade suppliers is completed and processed in accordance with 5.6.			

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18-15	OP 1.5, Rev. 2, Para. 5.1	1. Verify that auditors or technical specialists have appropriate training or orientation in accordance with 5.1. 2. Verify that both training needs and training completion is documented in accordance with SP 1.31. Coordinate with R. Constable.			

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18-16	OP 1.5, Rev. 2 Para. 5.2	Verify that the Qualification/Certification of Lead Auditors is completed in accordance with 5.2.			
18-17	Para. 5.3	Verify that the maintenance of Qualifications of Lead Auditors is completed in accordance with 5.3.			
18-18	Para. 5.4	Verify that Requalification of Lead Auditors is completed in accordance with 5.4.			

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	T&MSS SQAP, Rev. 0, Para. 2.6	Verify that procedures are in place which implement the requirements of this SQAP. The "T&MSS procedures are used to implement this SQAP, assign specific T&MSS Organization responsibilities, generate appropriate QA records, and provide acceptance and rejection criteria to demonstrate compliance with the controls define by this SQAP. OPs are used to perform specific technical and administrative tasks defined in T&MSS procedures." As shown in Figure 2-3, these procedures are as follows: o SP 1.52 Software Quality Management Process o SP 1.53 Verification/Validation o SP 1.54 Software Use o SP 1.55 Documentation and Review Process o SP 1.56 Configuration Management			
19-1	Para. 5.2.1	Verify that Software Classification Forms have been completed in accordance with Para. 5.2.1.			
19-2	Para. 5.2.2	Verify that the Software Life Cycle has been applied to software classified as quality affecting.			

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	QAPD, Rev. 3,	Audit Items 20-1 through 20-10 evaluation scientific investigation requirements as they apply to environmental monitoring activities.			
20-1	Sect. 20.1	Verify that prior to the start of scientific investigations, a planning document containing the attributes in Section 20.1 is developed.			
20-2	Sect. 20.2	Verify that planning document review and approval including changes thereto is accomplished in accordance with the requirements of Section 20.2.			
20-3	Sect. 20.3	Verify that when Technical Procedures are used to control scientific investigations, the procedures provide for the attributes listed in Section 20.3			

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20-4	QAPD, Rev. 3 Sect. 20.4	Verify that when Scientific Notebooks are used to control scientific investigations, the notebooks are maintained in accordance with the requirements of Section 20.4 and the OCRWM QARD.			
20.5	Sect. 20.5	Verify that T&MSS has identified ongoing field investigations to preclude inadvertent interruption, to assure operational compatibility, and that the location of field investigations is clearly identified.			
20.6	Sect. 20.6	Verify that activities used to develop new methods or procedures for scientific investigations or critical processes are documented, reviewed for adequacy and approved by qualified persons prior to use.			

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20-7	QAPD, Rev. 3, Sect. 20.7	Verify documentation and qualification of personnel for data interpretation and analysis is accomplished in accordance with the requirements of Section 20.7.			
20-8	Sect. 20.8	Verify that reporting of scientific investigation results is accomplished in accordance with the requirements of Section 20.8.			
20-9	Sect. 20.9	Verify that records of scientific investigations are processed in accordance with the requirements of Section 20.9 and Section 17 of the T&MSS QAPD.			
20-10	Sect. 20.10	Verify the performance of technical reviews of activities associated with scientific investigations in accordance with Section 20.20 and T&MSS procedures and instructions.			

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	SP 2.2, Rev. 0,	SCIENTIFIC INVESTIGATION CONTROL This checklist is made specifically for "the Environmental Investigation Implementation Package for Radiological Monitoring," TMSS/RFPD-91/003 and compliance to SP 2.2			
20-11	Sect. 7.0,, Para. 7.1	Withdraw this Environmental Investigation Implementation Package for Radiological Monitoring, Rev. 0, from LRC. 1. Verify that the package contains: o QA Grading Reports - Signed Approval Memo (Exhibit 1) - Scope of Work - WBS Element Reference o Criteria Listing (Exhibit 1 of SP 1.63) o Technical Procedures or Scientific Notebook or both. o Environmental Controls if applicable. o Schedule 2. Verify that the package in Item 1 above was submitted to the LRC within 10 days of approval of Exhibit 1 above.			

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20-12	SP 2.2, Rev. 0, Para. 5.0, Step. 5.1.9	Was Environmental Investigation Implementation Package for RAD Monitoring properly submitted to the LRC with Forms T&MSS-20, T&MSS/095/2, T&MSS 098/1, TMSS/137/2 and TMSS/010/2?			
20-13	SP 2.2, Rev. 1, Para. 7.2.1	Verify that any records maintained during implementation are protected until transmitted to the LRC (1-hour fire-rated container with UL label). See SP 1.36, Para. 5.4.1.			
20-14	SP 2.2, Rev. 0, Para. 7.2.2	There should be no data collected in temporary storage with a date of 3/17/91 or before Rev. 1 became effective 4/17/91.			

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20-15	SP 2.2, Rev. 1, Para. 5.3.1	If Scientific Notebooks are in use, has the Investigation Implementation Document been revised to authorize use?			
20-16	Para. 5.3.2	If Scientific Notebooks are in use, has a PI been assigned responsibility?			
20-17	Para. 5.3.3	If Scientific Notebooks are used, were they made to include all of the entries in Section 1.0 of Exhibit 3 of SP 2.2?			
20-18	Para. 5.3.4	If notebooks are used are changes controlled?			

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20-19	SP 2.2, Rev. 1, Para. 5.3.5	Subsequent entries in the notebook must include all entries in Section 2.0 of Exhibit 3.			
20-20	Para. 5.3.6	Each volume of the notebook signed as well as at the completion of the investigation?			
20-21	Para. 5.4.7	Signature of technical reviewers at completion of investigation in the Scientific Notebook?			
20-22	Para. 5.4	Verify that any new procedure, method or process, since 4/17/91 complies with the requirements of Paras. 5.4.1 through 5.4.5.			

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20-23	SP 2.2, Rev. 1, Para. 3.2.3	If a Scientific Notebook is used, are the pages numbered or the notebook bound?			
20-24	Para. 5.4.3	Verify that all procedures for monitoring activities currently in process are readily available to the investigators.			
20-25	SP 2.2, Rev. 0 Para. 5.1.5(E)	Verify that the scheduled start of Rad Monitoring began mid January and that all the necessary procedures were approved and issued prior to start of monitoring. (All procedures are listed in the implementation package.)			

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20-25	SP 131, Rev. 3,	List all investigators and supervisors involved in monitoring. Have all received the necessary procedure training to the latest revision and also initial project orientation? Verify training in responsible manager working file.			
20-26	SP 131, Rev. 3, & SP 2.2, Rev.1, Para. 7.1.1	Verify that the training records have been transmitted to the LRC within 10 days of becoming a record and that any records not yet transmitted are in dual storage or a 1-hour rated container with UL label.			
20-27	SP 2.2, Rev. 1, Paras. 5.5.4 thru 5.6.7	Audit Technical Advisor - Review any compiled data for compliance to Exhibits 4 and 5 of SP 2.2. Are storage requirements being met for any documents, data, etc., that are QA records?			

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	QARD, Rev. 2, Sect. 20	T&MSS will develop and implement instructions, procedures, and plans as required by the activity to control scientific investigations. These instructions are described in the OCRWM QARD and reflect the following provisions: o scientific investigation planning; o planning document review and approval; o technical procedures; o scientific notebooks; o interface controls; o new methods, procedures, or processes; o data interpretation and analysis; o scientific investigation results; o records of scientific investigations, and o peer and technical reviews.			
20-28		Does the Implementation Package address these items?			

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TA-1	EFAP for Air Quality, Para. 6.1	1. Do the air monitoring and meteorological monitoring programs have a technical training/ orientation program for site technicians? Describe the programs.			
		2. Describe the formal training in air monitoring survey design and sampling techniques of the technical training program director.			
		3. Are new personnel supervised until training is completed?			

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TA-1 Cont'd	EPAF for Air Quality, Para. 6.1	4. How many technicians are currently working on the monitoring program?			
		5. Are site technicians' activities reviewed periodically by an independent reviewer? How often?			
		6. Do field technicians have a basic understanding of the general principals under which air quality and meteorological instruments operate?			

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TA-2	EPAF for Air Quality, Para. 7.2	1. Is there a general knowledge of the applicable Quality Management Procedures (QMP) that encompasses ongoing monitoring activities?			
		2. Is the site technician able to combine his/her understanding of air monitoring and meteorological instrumentation with a knowledge of the applicable QMP such that all data collected are valid and accurate?			
		3. Is annual refresher training conducted for site technicians?			

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TA-3	General	1. Has the Environmental Field Activity Plan (EFAP) for Air Quality been approved? If no, what stage of the approval process is it in?			
		2. Have the Software QA Plan been approved?			
		3. Has any dispersion modeling been attempted? If not, when do you plan to begin?			

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TA-4	EFAP, Para. 3.1	1. Explain the rationale for siting the particulate samplers (PM10 and TSP).			
		2. Has the network of gaseous pollutant samplers been developed?			
		3. If so, where, how many, and what was the rationale for siting the gaseous samplers?			
		4. What particulate sizes are monitored through use of a cascade impactor?			

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	WI-AQ-001	Technical Checklist for WI-AQ-001 Air Quality "Ambient Particulate Sampling."			
TA-5	Para. 4.3.3	Explain how a particulate sampler is set up for automatic operation.			
TA-6	WI-AQ-002	Technical Checklist for WI-AQ-002 Air Quality "Reviewing, Acceptance Testing, and Performance Auditing of Particulate Monitoring Equipment.			
TA-7	Para. 4.2.2	When performing acceptance testing on an elapsed time indicator, what "known time piece" is used?			

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TA-8	WI-AQ-002 Paras. 4.2 & 4.3	Please present Sampler Performance Audit Form, form TMSS/103/2 for the samplers currently deployed and for new samplers, if any. Also, present Particulate Sampler Acceptance Test Form, form TMSS/102/2 and Miscellaneous Acceptance Test Form, TMSS/124/2.			

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TA-9	WI-AQ-003	Technical Checklist for WI-AQ-003, Air Quality: Particulate Sampler Filter Preparation and Handling.			
	Para. 4.1	Explain, in detail, pre-sampling filter handling procedures including: o Examination, equilibration and weighing; o Repeat weighing; and o Installing in cassettes.			
TA-10	Para. 4.2	1. Explain post-sampling handling procedures: o Filter examination and equilibration; o Weighing and recording data (Form TMSS/101/2); and o Storage of filters.			
		2. Are the temperature and RH instruments in the desiccant cabinet and the room calibrated?			

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	WI-AQ-004	Technical Checklist for WI-AQ-004: Calibration Checks of Particulate Sampling Equipment.			
TA-11	Para. 4.1 Calibration Check	What "weather conditions" affect the samplers during calibration? How are samplers affected.			
TA-12	Para. 4.2 Flow Calculations	What criterion determines if a sampler is out of calibration? If so, explain what must be done.			

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TA-13	WI-AQ-004 Para. 4.3 Electronic Pressure Transducer Calibration Checks	Explain in detail, how electronic pressure transducers are calibrated.			
	WI-AQ-005 Para. 4.0 Procedure	Technical checklists for WI-AW-005: Calculating Particulate Concentrations.			
TA-14		1. Explain how the particulate concentration is calculated?			
		2. Is there a unique TMSS/114/2 per sample? Where are these forms sent? Are they independently reviewed for accuracy?			

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	WI-AQ-006	Technical Checklsit for WI-AQ-006: Receiving, Acceptance Testing, and Performance Auditing of Gaseous Monitoring Equipment.			
TA-15		Describe the program for monitoring gaseous pollutants.			

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	WI-AQ-007	Technical Checklist for WI-AQ-007: Calibration of the DASIBI Ozone Analyzer.			
TA-16		1. Describe, in detail, the calibration of the Ozone Analyzer.			
		2. Provide a copy of Calibration Data Sheet and Calibration Chart (TMSS/077/1).			

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	WI-AQ-008	Technical Checklist for WI-AQ-008: Calibration of the CO Analyzer.			
TA-17		1. Describe the calibration procedure.			
		2. Provide a copy of TMSS/078/2 and TMSS/077/1 for a recent calibration.			
		3. What is the disposition of the records?			

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	WI-AQ-009	Technical Checklist for Calibration of the NO Analyzer.			
TA-18		Explain how the NO Converter Efficiency is determined.			
	WI-AQ-010	Technical Checklist for Calibration of the SO Analyzer.			
TA-19		Explain how the SO Analyzer is calibrated.			

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	WI-AQ-011	Technical Checklist for Zero/Level 1 and Precision Checks.			
TA-20		1. How frequently are the following checks performed for gaseous analyzers: o Multipoint Calibration; o Zero/Level QC; and o Precision Check.			
		2. Explain, in detail, how to perform a Zero/Level 1 QC Check.			

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	WI-AQ-013	Technical Checklist for Maintenance and Repair/Rework.			
TA-21		1. Please present the maintenance log on one or two samplers.			
		2. Are there any recurring or chronic problems with any of the sampler equipment.			

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TA-22	EFAP-AQ Para. 4.1.2	1. How are data tapes and strip charts transported from the field to the data manager?			
		2. Is a chain-of-custody implemented?			

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	WI-MET-001	Technical Checklist for WI-MET-001, Meteorological Monitoring: Receiving, Acceptance, Testing and Performance Auditing of Meteorological Monitoring Equipment.			
		WIND SPEED SENSOR			
TA-23	Para. 4.2.1	1. What is the starting threshold (i.e., minimum wind speed that the instrument can accurately measure) of the Wind Speed Sensors used?			
		WIND DIRECTION SENSOR			
		2. Explain how the Sigma-Theta Zero Test is performed for the main site.			

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TA-24	WI-MET-001 Para. 4.2.2	1. Verify placement of the Solar North Stake for calibration of the wind direction sensor.			
		2. Explain how the stake is used to calibrate the direction sensor.			
		3. How are parallax errors minimized?			
		4. Explain how bearing condition in the sensor is checked?			

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TA-25	WI-MET-001 Para. 4.2.4	DIFFERENTIAL TEMPERATURE SENSORS			
		Explain how the sensors are calibrated. Is the reference thermometer NIST traceable?			
		NET RADIATION SENSOR			
TA-25	Para. 4.2.6	1. Are field audits conducted on clear days?			
		2. What instrument is used for comparison? Is it NIST traceable?			

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	WI-MET-001	HUMIDITY SENSOR			
TA-26	Para. 4.2.5	1. What is the operational range of the RH Sensor?			
		2. Which do you use - the Rotronics hygrometer or the Assman psychrometer?			
		3. Show that it is NIST traceable?			

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TA-27	WI-MET-001 Oke, Tr, 1978	Net radiation is measured as the temperature differences across the upper and lower surfaces of a thermopile (i.e., an expression of the difference in the energy balance of the two faces). How is the effect of wind differences over the two faces compensated for?			

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TA-28	MMP Para. 5.2.3	1. Verify that the measured net radiation meets the standard ± 10%.			
		2. According to your measurements how much radiation is absorbed by a desert?			
	WI-MET-001	Precipitation Sensor-Tipping Bucket			
TA-29	Para. 4.2.7	Explain the field auditing procedure.			

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TA-30	WI-MET-001 Para. 4.3.1.2c	Explain how sites were selected for meteorological representativeness.			
TA-31	Para. 4.3.1.2d	1. Describe site inspection practices. 2. Are completed inspection checklists available for review?			

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OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-32	WI-MET-001 Para. 4.3.1.2F	1. How are calibration instructions and practices evaluated?			
		2. Are calibration schedules and records for meteorological instrumentations available for each site? (Coordinate with C. Warren)			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-33	WI-MET-001 Para. 4.3.2	Are results of in-house meteorological monitoring system audits of data handling activities (form T&MSS/134/2) available for review? Results should document: o Data log-in practices; o Cursory data inspections; o Data reduction practices; o Spot checking of data; o Data editing practices; o Data summarization practices; o Data reporting; and o Logging and documentation of activities (Coordinate with C. Warren)			
TA-34	Para. 4.3.1.1	Are the monitoring stations verified against EPA criteria annually?			

9 AUDITOR SIGNATURE _____ 10 DATE _____

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
	WI-MET-002	Technical checklist for WI-MET-002: Operation and calibration checks of meteorological monitoring equipment.			
TA-35	Para. 4.1.1	Does the site technician check the operational status of the system at least twice each week?			
TA-34	Para. 4.1.1.3	1. Does the site technician review and evaluate the data being collected for consistency and out-of-range reading?			
		2. How?			
		3. What happens if data are found to be out-of-range?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-35	WI-MET-002 Paras. 4.1.1.1 & 4.1.2.1	1. Examine the site logbook(s) for meteorological monitoring activities. Is the operational status determined for each instrument?			
		2. Are the results of each status check recorded in the logbook(s) and on the Site Visit Checklist (form TMSS/107/2 - Remote Sites/form TMSS/110/3/ Main Site)?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-36	WI-MET-002 Para. 4.1.2.2	1. Are equipment failures reported immediately? Are follow-up activities documented? (Coordinate with C. Warren)			
		2. How are deficiencies/equipment malfunctions noted?			
		3. Is the method and interval of calibration for each instrument defined?			
		4. Are comparison instruments traceable for NIST standards?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-37	WI-MET-002 Para. 4.2.6	What procedures are followed to heat the precipitation gauges at the remote sites during winter? NOTE: Gauges will not measure frozen precipitation accurately.			
TA-38	Para. 4.4	1. Are calibration checks performed quarterly? (Check with C. Warren)			
		2. Are there any instrument-specific considerations (i.e., equipment stability, required accuracy, intended use, etc.) which require more frequent calibration of a particular instrument to maintain its required accuracy?			
		3. Has a specific meteorological event (i.e., wind/dust storm, flash flooding, etc.) ever prompted the recalibration of the monitoring network?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
	WI-MET-003	Technical Checklist for WI-MET-003 Meteorological Monitoring: Data Processing Instructions.			
TA-39	Para. 4.1.1	Explain the data log-in procedure.			
TA-40	Para. 4.1.2	1. How are data files verified and edited?			
		2. How frequently are the data retrieved from each site?			
TA-41	Para. 4.1.3.10	Is the hourly stability class computed from main site or remote site data?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-42	Para. 4.1.3.12	Explain how the range check routine identifies out-of-range data.			
TA-43	Para. 4.2	Explain how the task manager reviews the processed data prior to generating quarterly and annual data summaries.			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-44	WI-MET-004 Para. 4.3	Explain how the Digital Data Acquisition System (DDAS) validation is accomplished?			
TA-45	Para. 4.4.2	1. What is done when data are found out-of-tolerance?			
		2. Can a paper trail from data in the quarterly reports be traced back to entries in the original data tapes?			
		3. How are data from the different monitoring stations integrated?			

9 AUDITOR SIGNATURE

10 DATE

OCRWM AUDIT CHECKLIST NO. 91-06-2

1 ORGANIZATION SAIC

3 AUDIT ITEM NO.	4 QUALITY REQUIREMENT REFERENCE(S)	5 QUALITY REQUIREMENT/GUIDELINE	6 RESULTS S,X,N/A	7 SUMMARY OF INVESTIGATION	8 PERSON CONTACTED
TA-46	MMP	The YMP meteorological monitoring program provides inputs to the radiological monitoring program which are used to calculate a concentrations parameter for assessing radiological impacts (i.e., X/Q concentration emission rate).			
	Para. 6.4	1. How is X/Q inputted into the dispersion model?			
		2. What meteorological and topographic influences are considered in the model?			

9 AUDITOR SIGNATURE

10 DATE

RADIOLOGICAL MONITORING

CHECKLIST

(LATER)

Department of Energy
Yucca Mountain Site Characterization
Project Office
P. O. Box 98608
Las Vegas, NV 89193-8608

WBS 1.2.9.3
QA

MAY 7 1991

John H. Nelson
Technical Project Officer
for Yucca Mountain
Site Characterization Project
Science Applications International Corporation
The Valley Bank Center, Suite 407
101 Convention Center Drive
Las Vegas, NV 89109

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT OFFICE APPROVAL OF THE SCIENCE APPLICATIONS INTERNATIONAL CORPORATION/TECHNICAL AND MANAGEMENT SUPPORT SERVICES (SAIC/T&MSS) QUALITY ASSURANCE PROGRAM DESCRIPTION DOCUMENT (QAPD), REVISION 3

Reference: Ltr, Harper to Horton, dtd 5/6/91

The Yucca Mountain Quality Assurance Division has completed its review of the subject QAPD for SAIC/T&MSS, and has determined that it is consistent with the requirements of the Office of Civilian Radioactive Waste Management Quality Assurance Requirements Document, Revision 4. The SAIC/T&MSS QAPD, Revision 3, is approved for use on the Yucca Mountain Site Characterization Project, effective May 7, 1991.

Upon receipt of this letter, please submit a controlled copy of the SAIC/T&MSS QAPD, Revision 3, and all controlled documents that implement this plan (e.g., matrices, instructions, procedures, and drawings), and any subsequent revisions to the office for reference and use.

Your cooperation regarding this matter is appreciated. If you have any questions, please contact either Nancy A. Voltura at 794-7972 or Kerby L. Tyger at 794-7250.

James Blaylock for
Donald G. Horton, Director
Yucca Mountain Quality Assurance Division

YMQAD:NAV-3636

cc:
K. L. Tyger, MACTEC, Las Vegas, NV, 402
J. B. Harper, SAIC, Las Vegas, NV, 517/T-38
K. B. Johnson, SAIC, Las Vegas, NV 517/T-22
M. B. Blanchard, YMP, NV
W. R. Dixon, YMP, NV
V. F. Iorii, YMP, NV
E. H. Petrie, YMP, NV
W. A. Wilson, YMP, NV

TECHNICAL AND MANAGEMENT SUPPORT SERVICES

QUALITY ASSURANCE PROGRAM DESCRIPTION

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC)

LAS VEGAS, NV

TECHNICAL & MANAGEMENT SUPPORT SERVICES (T&MSS)

QUALITY ASSURANCE PROGRAM DESCRIPTION

APPROVAL/SIGNATURE PAGE

James B. Harper, Manager
T&MSS Quality Assurance

5/7/91
Date

for John H. Nelson
T&MSS Project Manager

5-7-91
Date

T&MSS QUALITY ASSURANCE PROGRAM DESCRIPTION

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1.0 ORGANIZATION

The T&MSS organization consists of Science Applications International Corporation (SAIC), and its subcontractors: Harza Engineering Company and Westinghouse Electric Corporation. T&MSS has a participant role in the Yucca Mountain Site Characterization Project (YMP) as described in this section. T&MSS also has a support contractor role which is not within the scope of this document.

This section describes the T&MSS participant organization that executes the quality requirements in this program description. As work is assigned to T&MSS by the Yucca Mountain Site Characterization Project Office each T&MSS Assistant Project Manager and the T&MSS Quality Assurance (QA) Manager shall ensure that the scope of work assigned to them as delineated by the YMP is executed under the requirements of this QAPD. All T&MSS participant work is directed and controlled by T&MSS management from the T&MSS Las Vegas Office location.

The T&MSS organizational components, consisting of the management positions listed below, are responsible for those functions assigned to T&MSS as a YMP participant as well as those functions associated with support of the YMP Office (YMPO). (The QA responsibilities for Project Office support are defined in the OCRWM QAPD).

T&MSS Project Manager
T&MSS Deputy Project Manager
Assistant Project Manager, Project Management
Assistant Project Manager, Technical Support
Assistant Project Manager, Programs and Operations
Assistant Project Manager, Resource Management
Assistant Project Manager, Regulatory and Licensing
T&MSS Quality Assurance Manager

The above managers shall establish and maintain QA program implementing procedures (see Section 2.0). The development and implementation of controlling procedures is based upon an integration of QA and line staff input for the determination of the QA controls applied to participant activities.

In addition, these managers are responsible for the performance of quality-related activities by personnel who are appropriately trained and qualified. They are also responsible for conducting management assessments of the programs under their control.

The entire T&MSS organization is depicted in Exhibit 1. Exhibits 2 through 7 reflect the reporting relationships, titles, and organizational units that are assigned YMP participants. The description of functional activities by APM and department that follows is limited to participant activities.

1.1 T&MSS Project Manager

The T&MSS Project Manager is the Technical Project Officer for T&MSS with overall responsibility for implementation of the T&MSS QA program. This individual reports directly to the YMP Project Manager for technical direction and has authority over all T&MSS personnel assigned to work under the scope of services provided by T&MSS as a participant in support of the YMP. The T&MSS Deputy Project Manager assists the T&MSS Project Manager, as required and acts in the capacity of the T&MSS Project Manager during the absence of, or at the explicit direction of the T&MSS Project Manager. The T&MSS Project Manager's responsibilities include, but are not limited to the following:

a. Planning and directing work activities;

b. Complying with quality requirements imposed by quality program documents;

c. Satisfying staff resource needs, cost, and schedule objectives, and deliverable requirements;

d. Approving and implementing the T&MSS QAPD and the T&MSS implementing procedures;

e. Implementing the YMP procedures as they apply to the T&MSS scope of work;

f. Implementing corrective actions for deficiencies identified within the T&MSS quality program;

g. Providing periodic assessment to the YMPO regarding the adequacy and effectiveness of the T&MSS quality program; and

h. Approving and implementing Stop Work Orders.

1.2 Assistant Project Manager (APM), Project Management

The APM, Project Management reports directly to the T&MSS Project Manager and is responsible under the participant QA Program for the following:

a. Reviewing assigned data collection and evaluation activities;

b. Management, integration and performance of technical and scientific studies in support of the site characterization programs as assigned by DOE, e.g., climatology, and

c. Preparation and control of technical requirements documents for structures, systems, components and site characterization.

1.3 Assistant Project Manager (APM), Technical Support

The APM for Technical Support reports directly to the Project Manager. Reporting to this individual for participant site characterization activities are managers for the following departments:

1.3.1 Engineering Department

The Engineering Department is responsible for the following:

a. Performance of technical evaluations of data and related reports, technical reports, and conclusions relative to site characterization of the Yucca Mountain Mined Geologic Disposal System as assigned by the DOE;

b. Performance of technical and scientific studies in support of the site characterization programs as assigned by DOE;

c. Preparation of technical requirements documents for structures, systems, components and site characterization as assigned by the DOE; and

d. Development of engineering plans and procedures as assigned by DOE.

1.3.2 Systems Engineering Department

The Systems Engineering Department is responsible for the following:

a. Performance of technical evaluations of data and related reports, technical reports, and conclusions relative to site characterization of the Yucca Mountain Mined Geologic Disposal System as assigned by the DOE;

b. Performance of technical and scientific studies in support of the site characterization programs as assigned by DOE;

c. Preparation of technical requirements documents for structures, systems, components and site characterization as assigned by DOE; and

d. Development of system engineering plans and procedures as assigned by DOE.

1.3.3 Geotechnical Department

The Geotechnical Department is responsible for the following:

a. Performance of technical evaluations of data and related reports, technical reports, and conclusions relative to site characterization of the Yucca Mountain Mined Geologic Disposal System as assigned by the DOE;

b. Performance of technical and scientific studies in support of the site characterization programs as assigned by DOE;

c. Preparation of technical requirements documents for structures, systems, components and site characterization as assigned by DOE; and

d. Development of geotechnical plans and procedures as assigned by DOE.

1.3.4 Field Operations Support Department

The Field Operations Support Department is responsible for the following:

a. Development of field operations management plans and procedures as assigned by DOE; and

b. Support of field operations activities as assigned by DOE.

1.3.5 Training Department

The Training Department is responsible for providing training support to T&MSS as requested.

1.4 Assistant Project Manager (APM), Programs and Operations

The APM, Programs and Operations reports directly to the Project manager. Reporting to this individual are managers of the following departments:

1.4.1 Regional Studies Department

The Regional Studies Department is responsible for:

a. Identifying potential repository related soci :o-nomic effects;

b. Assessment and monitoring of regional socioeconomic structure;

c. Developing strategies to mitigate adverse socioeconomic impacts; and

d. Socioeconomic support for financial assistance programs.

1.4.2 Transportation Studies Department

The transportation Studies Department's responsibilities include the conduct of studies for the following:

a. Rail and highway access;

b. Transportation safety risk; and

c. Transportation interface for repository/operation planning.

1.4.3 Records Management Department

The Records Management Department's responsibilities include the following:

a. Control of YMP documents;

b. Operation of the T&MSS Local Records Center (LRC); and

c. Operation of the YMP Central Records Facility (CRF).

1.4.4 Environmental Field Programs Department

The responsibilities of the Environmental Field Programs Department include the following:

a. Program planning and coordination; and

b. Site reclamation planning and coordination; and

c. Operation and maintenance of field equipment for air quality and meteorological monitoring;

1.4.5 Radiological Field Programs Department

The responsibilities of the Radiological Field Programs Department include the following:

a. Program planning and implementation;

b. Operation and maintenance of radiological field monitoring equipment;

c. Site analysis and reporting;

d. Field analysis and reporting;

e. Radiological laboratory analysis;

f. Radiological protection (safety); and

g. Radiological engineering requirements, implementation and support.

1.4.6 Information Systems Department

The Information Systems Department's responsibilities include the following:

a. Computer software development and maintenance;

b. Computer software life cycle planning;

c. Computer software documentation;

d. Computer software verification and validation;

e. Computer software configuration management;

f. Computer software qualification and acquisition; and

g. Computer software access and use.

1.5 Assistant Project Manager (APM), Resource Management

The APM for Resource Management reports directly to the T&MSS Project Manager. The following Department Managers report to the APM for resource management:

1.5.1 Contract Services Department

The Contract Services Department is responsible for the Procurement of items and services in support of T&MSS participant; and

1.5.2 Administrative Services Department

The Administrative Services Department is responsible for verifying the education and experience of T&MSS personnel.

1.6 Assistant Project Manager, Regulatory and Licensing Support

The APM for Regulatory and Licensing reports directly to the Project Manager. Reporting to this individual are the following departments:

1.6.1 The Safety and Health Compliance Department (SHCD)

The SHCD is responsible for the following:

a. Identifying the applicability of safety and health requirements and ensuring that appropriate regulations, orders, procedures and policies are uniformly considered and applied by all YMP participants;

b. Developing programs to ensure compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, Department of Energy (DOE) orders, and Project Office plans and procedures;

c. Coordinating the activities of a safety committee, reviewing field activities procedures for compliance to health and safety requirements, coordinating inspections and abatement of identified safety and health deficiencies, and T&MSS record keeping and reporting;

d. Reviewing and documenting, as required, unplanned non-radiological events that have potential for safety or health impact; and

e. coordinating responses to employee complaints and unsafe conditions.

1.6.2 Environmental Compliance and Permitting Department

The Environmental Compliance and Permitting Department has responsibility for supporting the T&MSS organization with regulatory surveillance assistance to ensure compliance with federal, state, and local environmental and land access requirements, as they apply to T&MSS activities.

1.6.3 Nuclear Regulatory Compliance Department

The Nuclear Regulatory Compliance Department has responsibility for the following:

a. Performing evaluations of site data and related reports,

b. Preparing technical reports; and

c. Developing conclusions relative to regulatory and licensing requirements of the Yucca Mountain Mined Geologic Disposal System, as assigned by DOE.

1.7 T&MSS Quality Assurance Manager

The T&MSS quality assurance responsibilities are executed through the T&MSS Quality Assurance (QA) Manager. The T&MSS QA Manager reports directly to the T&MSS Project Manager and has specific interface responsibilities with the YMPO QA organization. This individual shall have unencumbered access to higher levels of management on quality issues. The T&MSS QA Manager is at the same or higher organizational level as the highest line manager responsible for quality-related activities. The individual shall have knowledge and experience in the areas of quality assurance and management. This position has the appropriate organizational position, responsibilities and authority to exercise proper control over the T&MSS QA program. The QA organization is involved in all portions of the T&MSS participant programs that affect safety and waste isolation. Controls include complete responsibility and authority for the following:

a. Coordinating T&MSS QA activities;

b. Initiating, reviewing, verifying and approving those documents used to identify QA program deficiencies; and

c. Indoctrination and training of the QA staff.

1.8 Independence of the QA Organization

The QA organization shall have sufficient authority, organizational freedom, independence from cost and schedule (regarding quality issues) and access to work areas to carry out the duties and responsibilities previously described.

1.9 DOE Contracted Support Organizations

Selected DOE contracted support organizations, at the direction of the DOE, may perform their work scope activities under the provisions of the T&MSS QA program. Under such an arrangement those organizations receive functional direction from T&MSS management and administrative direction from DOE. Organizational relationships are illustrated in Exhibit 8.

1.10 Interfaces

Interfaces between the YMPO other participants, and T&MSS shall be described in procedures, plans, or instructions, as appropriate.

1.11 Delegation of Work

The T&MSS organization may delegate work under the T&MSS QA program to others as directed by OCRWM, but shall retain the responsibility for that work. If work is delegated, the work and associated QA Program requirements shall be described and documented. T&MSS shall be responsible for evaluating any delegated work by audits and surveillances.

1.12 Resolution of Disputes

T&MSS shall identify in procedures the methodology for elevating disputes regarding differences of opinion involving quality issues at any given organizational level where such disputes cannot be resolved at the working level.

1.13 Quality Concerns

Allegations of inadequate quality shall be resolved in accordance with procedures established by the YMPO.

1.14 Stop Work Orders

The T&MSS organization shall identify procedures for issuing and lifting Stop Work Orders. Provisions shall include the following:

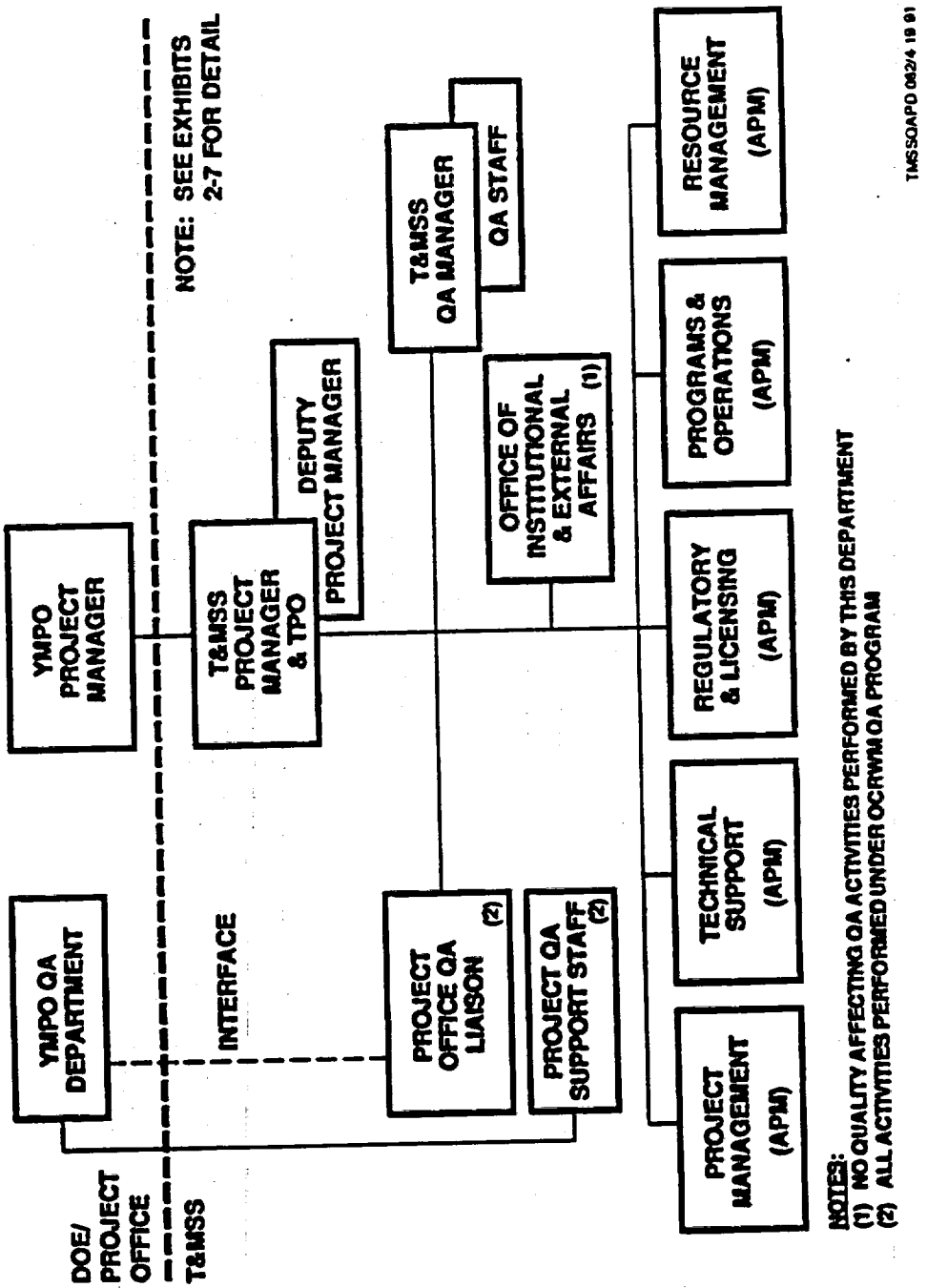
a. Criteria and methodology for stopping work and for lifting Stop Work Orders.

b. Exact definition of work being stopped; and

c. Authorities and responsibilities.

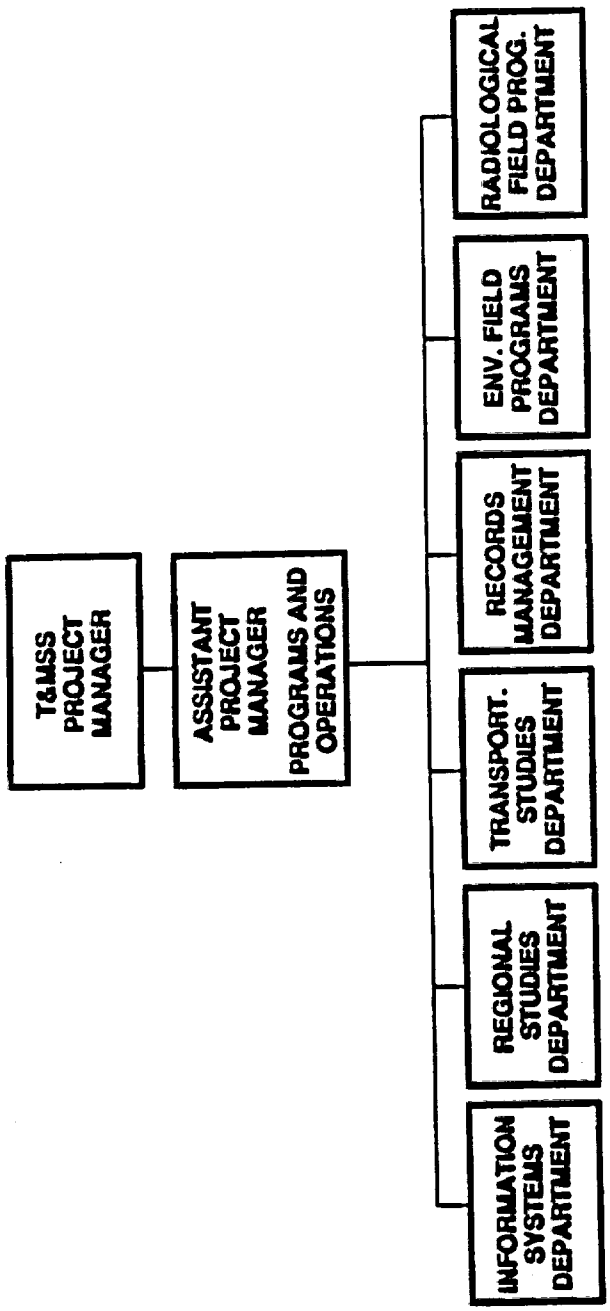
The T&MSS QA organization has the authority to issue a Stop Work Order to line management.

EXHIBIT 1
T&MSS ORGANIZATION



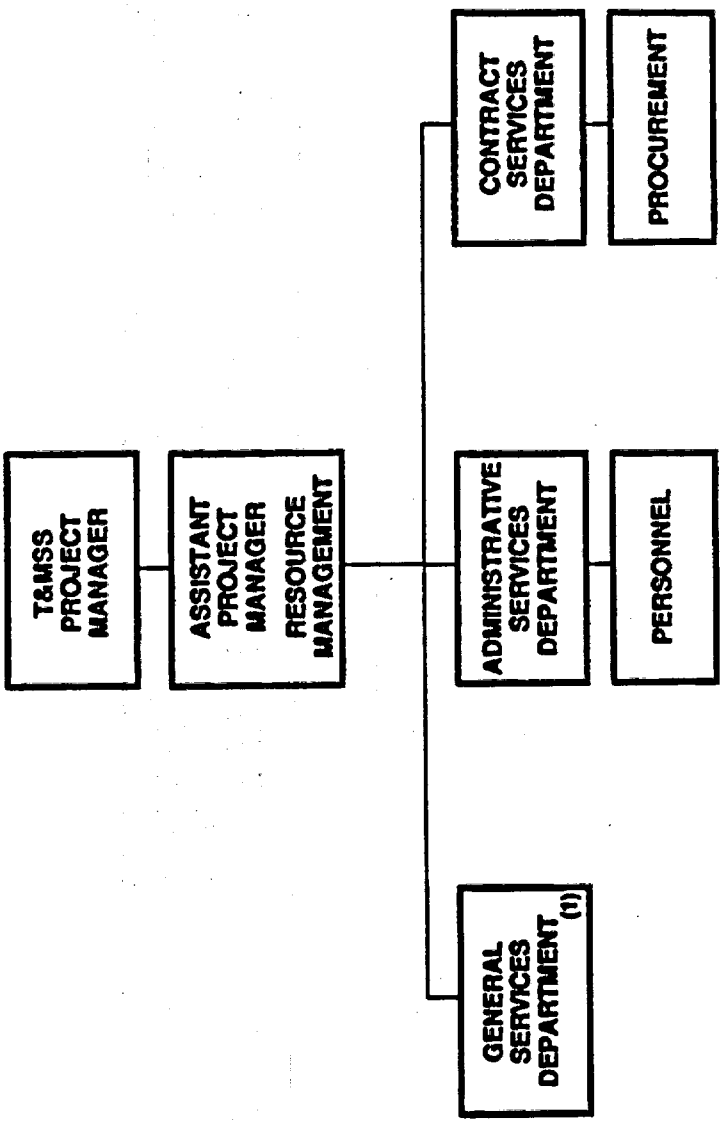
NOTES:
(1) NO QUALITY AFFECTING QA ACTIVITIES PERFORMED BY THIS DEPARTMENT
(2) ALL ACTIVITIES PERFORMED UNDER OCRWM QA PROGRAM

EXHIBIT 2



TMSSQAPD 082/4-19-91

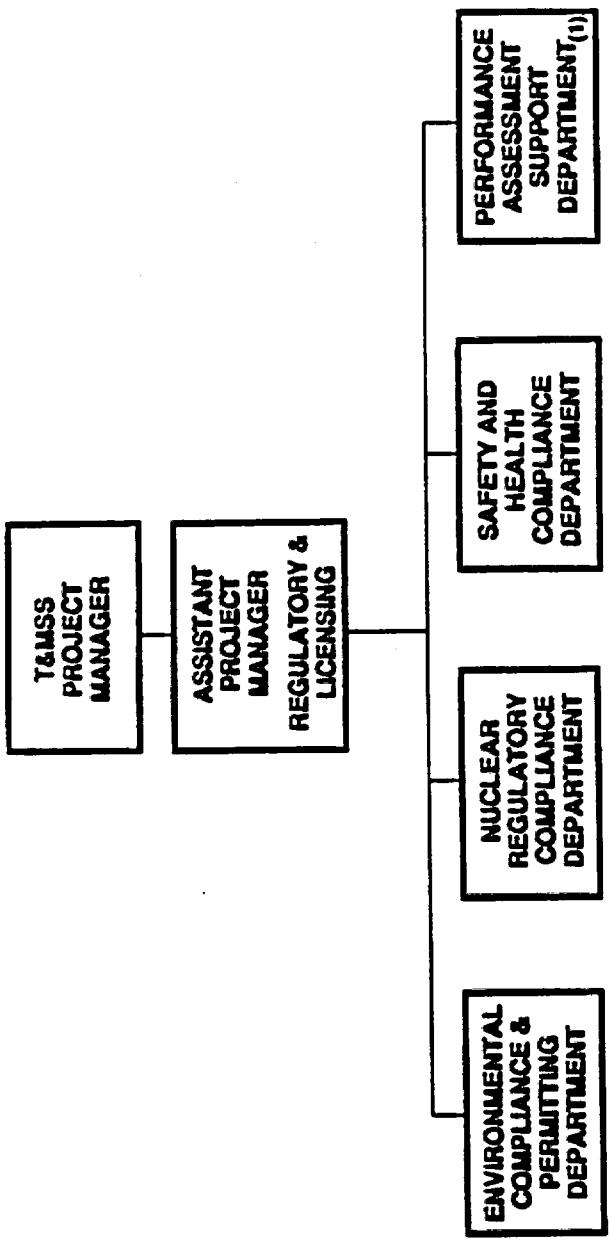
EXHIBIT 3



NOTE:
(1) NO QUALITY AFFECTING QA ACTIVITIES PERFORMED BY THIS DEPARTMENT

TMSSQAPD 062/4-19-91

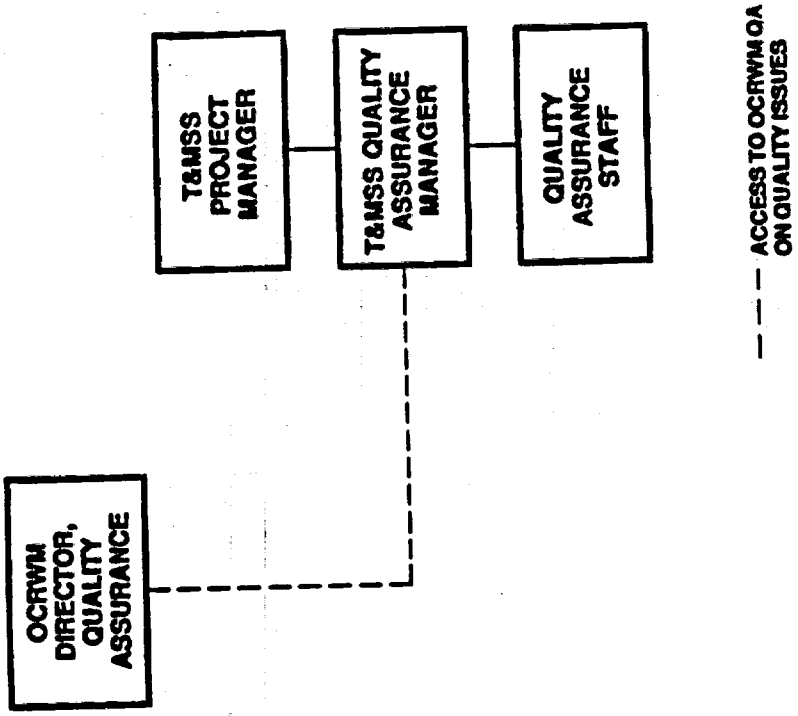
EXHIBIT 4



NOTE:
(1) ALL ACTIVITIES PERFORMED UNDER OCRWM QA PROGRAM

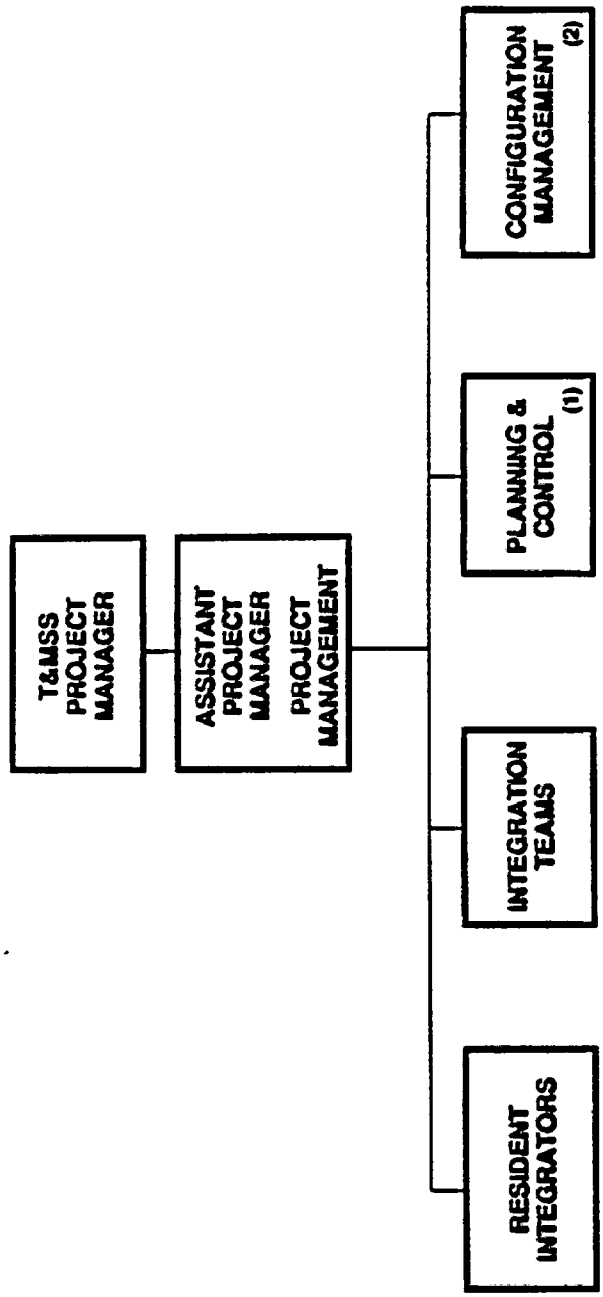
TMSSQAPD.062/4 19 91

EXHIBIT 5



T&MSSQAPD 062/4-19-91

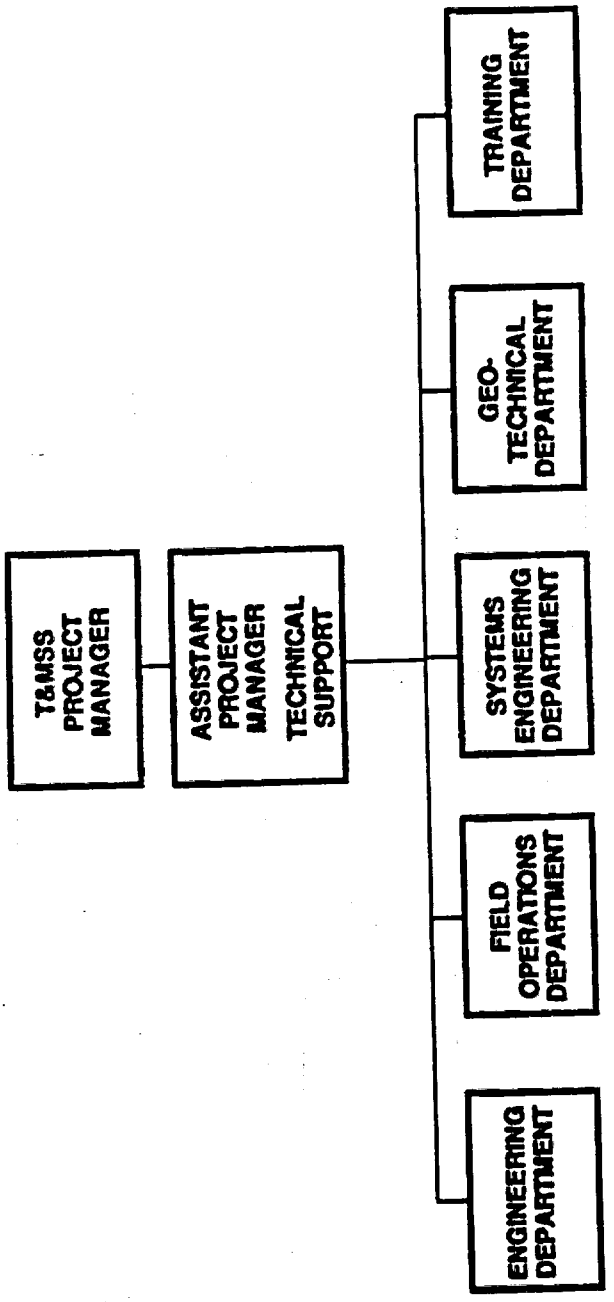
EXHIBIT 6



NOTES:
(1) NO QUALITY AFFECTING QA ACTIVITIES PERFORMED BY THIS DEPARTMENT
(2) ALL ACTIVITIES PERFORMED UNDER OCRWM QA PROGRAM

T&MSSQAPD 062/4 19 91

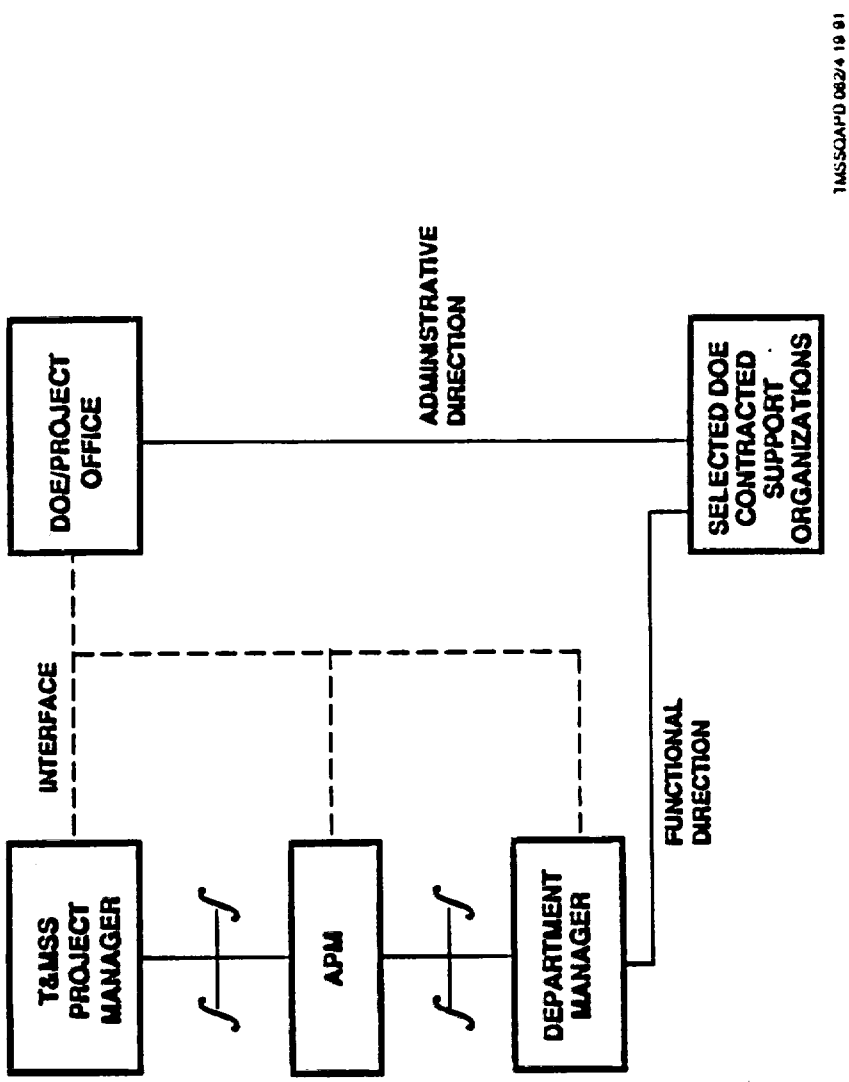
EXHIBIT 7



T&MSSQAPD.002/4-19-91

EXHIBIT 8

T&MSS INTERFACE WITH SELECTED DOE SUPPORT ORGANIZATIONS



TMSSQAPD 082/4 19 91

2.0 QUALITY ASSURANCE PROGRAM

The T&MSS organization has developed this document as its description of the quality assurance program that it shall implement. The T&MSS quality assurance program consists of the T&MSS QAPD and related procedures and instructions and complies with the OCRWM QAPD requirements that are applicable to the T&MSS participant activities for the Yucca Mountain Project.

2.1 Scope

The scope of activities that constitute the T&MSS QA program includes Regional Studies, Transportation Studies, Information System Programs, Site Characterization Activities as requested by DOE, Procurement, Records Management, Document Control, and Environmental Compliance Management. Exhibit 1 of this section depicts the document hierarchy which sets forth requirements and guidance that the T&MSS QA Program must incorporate, as appropriate, to its scope of work. The T&MSS QA Program is implemented by line organization staff, management, and the quality assurance staff.

2.2 T&MSS QA Program

2.2.1 QA Requirements

The quality assurance requirements for the T&MSS QA program are identified in the OCRWM QARD and its Appendix A, Amplifications of Quality Assurance Program Requirements for the Mined Geologic Disposal System (MGDS). Attachment A to this document lists the requirements documents upon which this program is based. When upper tier requirements, identified in the OCRWM QARD, are revised or changed, the T&MSS QAPD shall be revised to incorporate these changes within 20 working days and submitted to the Project Office for approval.

2.2.2 QA Program Planning

Quality Assurance program planning shall consider, as a minimum, the following elements:

a. Definition of activities.

b. Selective application of appropriate quality assurance program requirements and procedural controls (that is, a graded approach) to items and activities.

c. Assignment of responsibilities for quality assurance program control and verification activities.

d. Identification of the specific scientific or technical information to be collected, analyzed, or used.

e. Identification of applicable technical and quality assurance program management control and verification activities.

f. Identification of required quality assurance records.

2.2.3 YMP APQs

The quality-related YMP Administrative Procedures (APQs) provide the implementing interface controls utilized between the Project Office and the T&MSS participant organization activities. T&MSS procedures and instructions shall address the YMP APQs as necessary to implement its QA program. The applicability of APQs to T&MSS participant activities are identified in Attachment B to this document.

2.2.4 T&MSS QAPD

The T&MSS QAPD describes the provisions established by T&MSS to implement the applicable requirements of the OCRWM QARD, the T&MSS organizational responsibilities and authorities for achieving and verifying quality, the interfaces between T&MSS and the Project Office, and the overall QA program. Provisions are described in the T&MSS QAPD to meet each section of the OCRWM QARD. The T&MSS QAPD is reviewed by appropriate T&MSS management, reviewed and approved by the T&MSS Project Manager and T&MSS QA Manager, and submitted to the Project Office for approval.

2.2.5 QA Program Requirements Matrices

The T&MSS QA Department maintains QA Program Requirements Matrices that describe how T&MSS implements the NRC Review Plan, OCRWM QARD, ASME NQA-1 1989, and this QAPD. The Matrices link the requirement to implementing procedures or instructions.

2.2.6 T&MSS Implementing Procedures and Instructions

The T&MSS implementing procedures and instructions delineate the specific administrative and quality assurance controls used to implement the QA requirements. The three categories of implementing procedures are as follows:

A. Standard Practice Procedures (SP) - Procedures that assign responsibilities for action to personnel from more than one APM/Department Manager with the purpose being to tie together the activities into one flow relative to an activity or task. SPs are reviewed and approved by the T&MSS Project Manager and QA Manager.

B. Organizational Procedures (OPs) - Applies to activities and work associated with a requirement or responsibility contained within an organizational entity such as an Assistant Project Manager organization (can be used for Department/Divisions within an APM). OPs are reviewed and approved by the appropriate APM and QA Manager.

C. Work Instructions (WIs) - Implementing procedures that detail all essential work steps for the worker associated with a task or function. These procedures typically include step-by-step work instructions that may or may not require performer sign-off as each step is completed. WIs are reviewed and approved by the appropriate APM and QA Manager.

As required, T&MSS shall implement YMP Project Office Site Characterization Project Office procedures as part of its QA program. Attachment B identifies the applicability of quality related Project Administrative Procedures (APQs). When directed by DOE its contractors/suppliers may perform their work scope in accordance with T&MSS approved instructions, procedures, plans, or drawings.

2.2.7 Delegated Work

The delegation of work activities through consultants, subcontractors, etc. is controlled by provisions contained in procurement documents. The T&MSS QA organization reviews and approves subcontractor QA program description documents.

2.2.8 Quality Assurance Program Controls

Quality assurance controls are applied to items and activities affecting quality under suitably controlled conditions that are performed by the T&MSS organization. The T&MSS QA program invokes controls over activities through procedures and instructions, internal audits and surveillances of the QA program by an independent QA staff, external audits and surveys of T&MSS suppliers of items and services, document reviews and management assessments. The extent of QA controls is determined by the line staff in combination with the QA staff and is dependent upon the specific activity, its complexity, and its importance to safety or waste isolation as defined in 10CFR, Part 60.2. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity, such as adequate cleanness; and assurance that all prerequisites for the given activity have been satisfied

SHALL, SHOULD, and MAY have unique meanings as used in the QAPD and implementing procedures:

A. SHALL denotes an action required by a T&MSS commitment, by regulations, orders, or directive of T&MSS management. In playscript format, SHALL is implied when no specific verb (should or may) is used.

B. SHOULD denotes an action to be completed unless there is (are) good reason(s) not to comply. Treated the same as SHALL by T&MSS personnel, but not subject to compliance auditing by NRC.

C. MAY denotes an action which is completed at the discretion of the person implementing the procedure.

2.2.9 Readiness Reviews

T&MSS management performs readiness reviews as deemed appropriate. Readiness reviews are used to ensure that specified prerequisites and programmatic requirements of major scheduled/planned activities have been satisfied prior to starting that activity.

2.2.10 Determination of Importance and Graded QA for Items and Activities

The determination of importance of items and activities and the application of the "graded" approach to QA shall be consistent with the OCRWM QARD and Project Office procedures. T&MSS shall utilize Project Office procedures or develop T&MSS procedures as appropriate to identify items and activities important to radiological safety and waste isolation in accordance with NUREG 1318. These procedures shall enable T&MSS to identify controls for each item and activity; identify provisions for the identification of the required QA records related to these activities; and identify QA program management controls.

It is important to recognize that the implementation of the graded approach covers the totality of the project items and activities as covered by the Project Work Breakdown Structure (PWBS), i.e., the graded approach is not limited to those items and activities which are subject to the regulatory requirements of 10CFR60 Subpart G. In addition, it is a requirement that no work may be initiated on an item or activity until a grading report covering same has been approved in accordance with the NUREG 1318 approach adopted by OCRWM.

2.2.11 "Qualified" Data

The T&MSS QA program provides for the acceptance of data or data interpretations for use in licensing activities that were not generated under the controls of the YMP Quality Assurance program. Once accepted, these data are classified as "qualified" for licensing purposes. Specific methods for acceptance of these data shall be described in T&MSS procedures and/or Project Office procedures consistent with the requirements of NUREG 1298.

2.2.12 Personnel Selection, Indoctrination and Training

T&MSS personnel assigned to perform activities that affect quality shall receive appropriate indoctrination or training prior to performing work. They shall be instructed as to the purpose, scope, and implementation of quality related manuals, instructions and procedures. T&MSS procedures shall address the requirements for personnel selection, performance of indoctrination, training, and qualification activities.

An individual's manager is responsible for assuring that he(she) is trained and qualified. T&MSS management establishes job descriptions for each job position in the T&MSS scope of work. The extent and need of training for T&MSS personnel is based on an evaluation of the scope, complexity, and nature of the job position and associated activity and on the education, experience and proficiency of the person. The T&MSS Resource Management staff verifies the education and work experience of T&MSS personnel. DOE contracted support organizations working under the T&MSS QA Program shall verify the education and work experience of their personnel. Methodology and documentation shall be consistent with T&MSS QA Program Provisions.

Personnel selected for T&MSS quality affecting positions shall have the education, experience, and training commensurate with the functions associated with the job position description. Initial qualification shall be documented. Proficiency shall be maintained. Responsible managers shall evaluate and assess the need for additional indoctrination and training, as applicable, as assignments, position and procedures change. Retraining needs are determined by an annual evaluation.

Verification personnel such as lead auditors and inspectors shall be certified and qualified in the principles, techniques, and requirements of the verification activity being performed (e.g., Audits, Inspections) in accordance with approved procedures and instructions which reflect the requirements established in the OCRWM QARD and ASME NQA-1. Qualification and certification records for these personnel shall be maintained.

Classroom training shall be performed in accordance with documented and approved lesson plans. Other forms of training include group instructions, on the job training, and procedural reading assignments.

Personnel shall receive annual proficiency evaluations which shall be documented and discussed with the person evaluated. The evaluations shall consider retraining needs.

Records associated with indoctrination and training shall reflect attendance sheets, objective and content of the program material presented, and date(s) of attendance as applicable.

Indoctrination and training are evaluated through the audit, surveillance, and trend programs.

2.2.13 Management Assessments

T&MSS shall have management assessments of the T&MSS QA program conducted at least annually. The assessment shall be performed by management above or outside the T&MSS QA organization by, or at the direction of, the T&MSS Project Manager. The management assessment shall determine the effectiveness of the system and management controls that are established to achieve and assure quality, and the adequacy of resources and personnel provided to the QA program. These evaluations are performed, documented, and reported to upper management. Any conditions adverse to quality identified in these assessments shall be documented, tracked, and corrected.

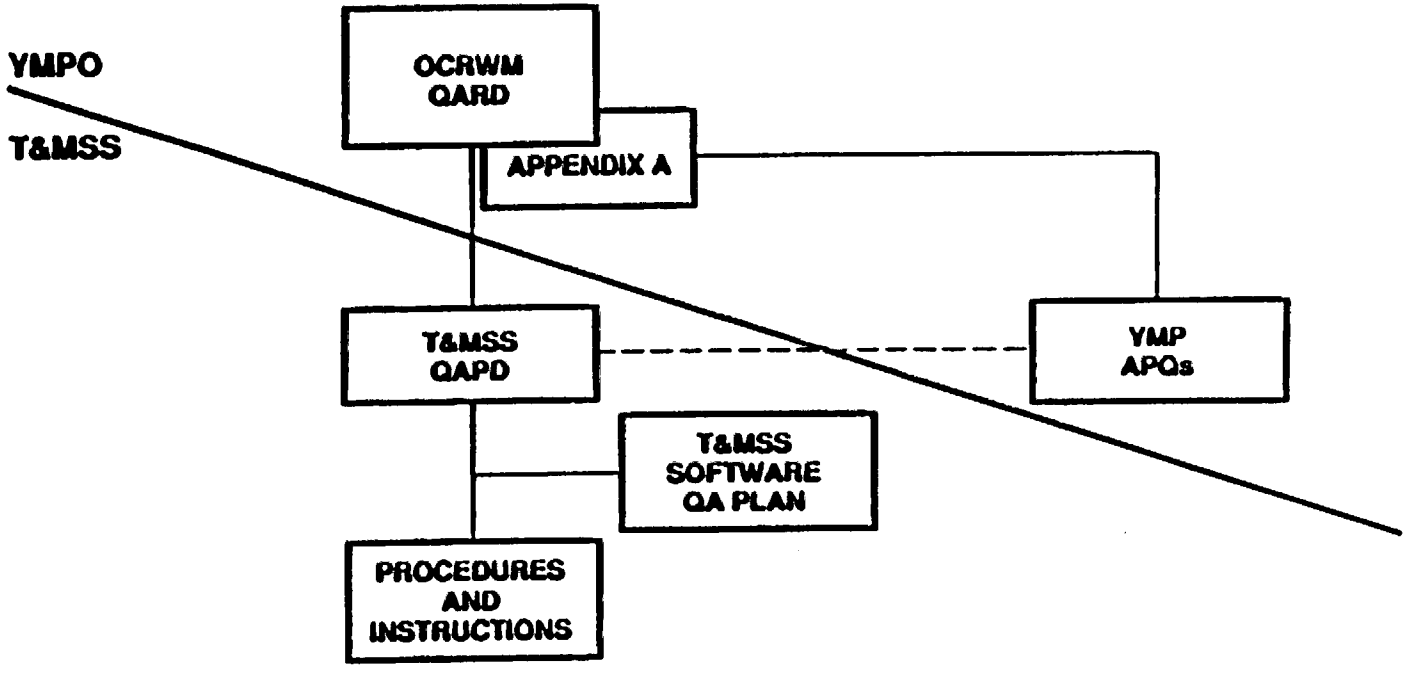
Management of other organizations participating in the T&MSS QA program shall regularly review the status and adequacy of that part of the QA program which they are executing.

2.2.14 Management Information Reporting and Tracking

Communication and information systems shall be established to ensure timely reporting, dissemination, and tracking of quality assurance management information such as the status of QA program implementation, status of resolutions of significant conditions adverse to quality, and summaries of management overview results. This information may be found in meeting minutes, audits and surveillances reports, trending reports, and other documents. It shall be furnished to T&MSS upper management and to the Project Office on at least a quarterly basis.

EXHIBIT 1
SECTION 2

QUALITY ASSURANCE PROGRAM
T&MSS DOCUMENT HIERARCHY



—— REQUIREMENTS
— — INTERFACE*

* EXCEPT WHERE IDENTIFIED IN ATTACHMENT B OF THIS QAPD

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3.0 DESIGN CONTROL

Design activities shall be accomplished in accordance with written procedures. Those procedures shall describe the process by which the specification of technical requirements are planned, controlled, and implemented. Design inputs, interfaces, outputs, reviews, changes, and deficiencies shall be controlled by approved procedures.

3.1 Engineered Structures, Systems and Components.

3.1.1 Design Input

Applicable design inputs, such as design bases, performance requirements, regulatory requirements, codes, and standards, shall be identified and documented, and their selection reviewed and approved by the responsible design organization. The design input shall be specified and approved on a timely basis and to the level of detail necessary to permit the design activity to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verifycation measures, and evaluating design changes. Changes from approved design inputs, including the reason for the changes, shall be identified, approved, documented, and controlled.

3.1.2 Change Control

Changes to design input documents are subject to the control measures commensurate with those applied to the original design input. Chanegs shall be approved by the same affected groups or organizations which reviewed and approved the original design documents.

3.1.3 Interface Control

Design interfaces shall be identified and controlled and the design efforts shall be coordinated among the participating organizations. Interface controls shall include the assignment of responsibility and the establishment of procedures among participating design organizations for the design input review, approval, release, distribution, and revision of documents involving design interfaces.

Design input information transmitted across interfaces shall be documented and controlled. Transmittals shall identify the status of the design input information or document provided and, where necessary, identify incomplete items which require further evaluation, review, or approval. Where it is necessary to initially transmit design input information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document.

3.1.4 Design Deficiency Control

Deficiencies in approved design input information documents shall be documented and corrective action shall be taken in accordance with Section 16.

3.1.5 Technical Review

Technical reviews shall be used when documents, activities, material, or data require technical evaluation for applicability correctness, adequacy, completeness, and assurance that established requirements are satisfied.

Technical reviews shall be performed when the information or document under review is within the state of the art and is based on accepted standards, criteria, principles, and practices.

Technical reviews shall be performed by individuals with sufficient technical knowledge of the area under review and the results of the review documented.

3.1.6 Peer Review

Peer review shall be employed when necessary to provide adequate confidence in the work under review where the work is a design, a plan, a test procedure, a research report, a material choice, or other item requiring expert judgment to assess the adequacy of work.

Procedures for peer reviews shall address the requirements of NUREG-1297.

3.1.7 Documentation and Records

Design input documentation and records which provide evidence that the design input processes were performed in accordance with QA requirements shall be collected, stored, and maintained in accordance with documented procedures.

3.2 Computer Software

The program description for computer software controls is defined in Section 19 of this document.

3.3 Scientific Investigations

The program description for Scientific Investigations is defined in Section 20.

4.0 PROCUREMENT DOCUMENT CONTROL

The procurement of items and services by the T&MSS organization shall be accomplished in accordance with approved procedures. These procedures shall describe the process by which procurement planning is accomplished, and the process by which procurement documents are prepared, reviewed and approved, revised and controlled. The following criteria shall be applied to all tiers of procurement as applicable and shall be set forth in the procurement documents.

4.1 T&MSS shall have a statement of the scope of work or services to be performed by the supplier.

4.2 Technical requirements as well as codes, standards, reference drawings, and specifications as applicable shall be specified.

4.3 Supplier QA programs shall be reviewed and approved by the T&MSS QA organization for quality-related purchases. To the extent necessary subcontractors quality programs shall be acceptable based on the scope, complexity, and importance to radiological safety or waste isolation of the item or service being procured. T&MSS may authorize some or all supplier activities to be performed under T&MSS's QA program when performance under a supplier's quality assurance program would be impractical. Material, items, and services shall be purchased from approved procurement sources.

4.4 Right of access shall be established by the procurement documents at each tier to assure that T&MSS can inspect, surveil, or audit the supplier facilities and records as necessary.

4.5 Requirements shall be established which identify the specific documentation to be furnished by the supplier (Certificates of Conformance, Calibration Certificates, etc.).

4.6 The quality assurance requirements for items and services shall be provided.

4.7 Requirements for control of nonconformances shall be established.

4.8 Controls shall be established for the evaluation, identification, and requirements for spare and replacement parts.

4.9 Acceptance criteria shall be identified for procured items and services and compliance with such criteria shall be verified by an approved acceptance, inspection, and verification program.

4.10 Reviews of procurement documents shall be performed by the technical organization procuring the item/services and T&MSS QA as a minimum. Persons performing these reviews shall have access to pertinent information and an adequate understanding of the requirements and intent of the procurement documents. QA reviews shall assure that documents are prepared in accordance with procedures; that these documents reflect adequate and appropriate quality assurance requirements; and, include applicable regulatory, design basis, and related technical information, and that these requirements are correctly stated.

4.11 Changes to procurement documents shall be controlled in the same manner as the preparation and issuance of the original documents.

5.0 INSTRUCTIONS, PROCEDURES, PLANS, OR DRAWINGS

All quality affecting work performed under the T&MSS quality program shall be implemented through approved procedures, instructions, plans, or drawings that are appropriate to the work or activity. These instructions, procedures, plans, and drawings shall be consistent with the quality requirements of the documents identified in Attachment A and this QAPD. Compliance with approved instructions, procedures, plans, and drawings by T&MSS personnel is required.

Instructions, procedures, plans, or drawings, as applicable, shall include or reference appropriate quantitative or qualitative acceptance criteria as required for determining that described activities have been satisfactorily accomplished, and have been reviewed and approved by T&MSS QA.

5.1 Preparation, Distribution, and Control

5.1.1 Instructions, procedures, plans, or drawings (as applicable) shall be prepared by the department or organization responsible for implementing the activity.

5.1.2 These documents shall be reviewed, approved, distributed, and controlled as described in Section 6 of this document.

5.1.3 When scientific notebooks are used to document scientific investigations, the requirements of Section 20 shall prevail.

5.2 QA Program Compliance

T&MSS shall demonstrate through a matrix system or other means that each of the applicable requirement of the OCRWM QARD, the NRC Review Plan, ASME NQA-1, and this QAPD is properly documented and implemented by procedures and/or instructions.

T&MSS implements the APQs. Attachment B identifies those APQs directly and indirectly implemented by T&MSS and those that do not apply to T&MSS participant activities.

5.3 Change Control

All changes to instructions, procedures, plans, and drawings are required to be processed in accordance with approved procedures prior to implementation.

5.4 Implementation Verification

T&MSS QA shall verify appropriate implementation of T&MSS instructions, procedures, plans, or drawings through internal audits and surveillances.

6.0 DOCUMENT CONTROL

T&MSS shall develop and implement procedures that describe the methodology for preparing, reviewing, approving, revising, issuing and tracking quality related program documents in a controlled manner.

The documents controlled include those generated for applicability to all project participants, to the Project Office only, to T&MSS as a participant only, to other Project Office contractors, or others. Documents to be controlled may be submitted to T&MSS for issuance by the Project Office, by other participants, or by the Department of Energy/Office of Civilian Radioactive Waste Management for sub-distribution.

6.1 Document Preparation, Review, Approval, and Revision

Preparation of documents for quality related activities shall include as a minimum the following requirements:

A. Identification of the individuals or organizations responsible for the preparation, review, approval, revision, and release of the document.

B. Independent review of documents by qualified personnel, who were not materially responsible for the content of the document, for technical adequacy, completeness, correctness, and inclusion of appropriate quality requirements prior to approval and issuance.

C. Access by the reviewer to pertinent background information or data to assure a complete review.

D. Documented resolution of review comments for those comments considered mandatory by the reviewer prior to approval and issuance of the document.

E. An effective date shall be identified.

F. T&MSS QA shall provide appropriate reviews and concurrences of all T&MSS quality related documents including revisions. Approvals shall be described in procedures appropriate to the work or activity.

6.2 Issuance and Distribution

Document issuance and distribution shall be controlled to assure that correct, applicable, and current documents are available to personnel performing activities at work locations. Control shall either be through the Document Control Center at T&MSS, the Document Control Center at the Yucca Mountain Site Office (YMSO) or through established procedural controls. T&MSS Document Control

shall perform the controlled document distribution, tracking, and maintenance functions for the Project Office. Documents such as Nonconformance Reports, Quality Finding Reports, Audit and Surveillance Reports, and Inspection Reports shall be controlled through their respective governing procedures.

6.2.1 Controls for issuing quality related documents include:

A. Identifying and marking of documents including documents that are released as drafts prior to the completion of the approval process. Any document that is released before approval shall be uniquely identified, controlled, authorized for release, and shall reflect the basis for release. The unverified (approved) portions of the document shall be identified and the use of the document shall be prescribed. Quality affecting work shall only be accomplished using approved documents.

B. Maintaining document distribution lists.

C. Marking, removal, or destruction of obsolete or superseded documents.

D. Maintaining of an index of the revision status for documents.

E. Assigning responsibility for document release.

6.2.2 Implementing procedures or instructions shall define the criteria for identifying documents that are to be controlled Documents such as instructions, procedures, plans, drawings, etc. which have been identified as "CONTROLLED" shall be submitted to the T&MSS Document Control Center. The following provisions describe additional controls to 6.2.1 for these documents:

A. Use of a receipt acknowledgment system for controlled documents.

B. Maintaining a master list of controlled documents.

C. Personnel using "CONTROLLED" documents are responsible for acknowledging document receipt, using only the latest revision, and marking, returning, or destroying obsolete or superseded documents.

6.3 Change Control

All changes to documents except for "minor" changes shall be reviewed and approved by the same organization that approved the original, unless another organization is specified by the Project

Manager. Minor changes such as inconsequential editorial changes do not require such a review and approval. T&MSS procedures shall identify the responsibility for authorizing, reviewing, and approving such changes.

An evaluation of changes to study plans and engineering design documents, if applicable, shall be conducted to determine any potential impact on the waste isolation capability of the site, or interference with other site characterization activities. Any impact on previous work shall be determined and evaluated, as required.

7.0 CONTROL OF PURCHASED ITEMS AND SERVICES

Procedures describing the procurement process shall be developed to ensure that delivered items and services and computer software comply with purchasing documents and quality assurance requirements. The T&MS procedures and instructions shall comply with the following provisions:

7.1 Procurement Planning

T&MSS shall plan its procurement activities as early as practical to assure interface compatibility and a uniform approach to the procurement process. Procurement of items and services shall not be initiated until these requirements are satisfied. Procurement planning shall provide for the following as applicable:

A. procurement document preparation, review, and change control;

B. selection of procurement sources;

C. bid evaluation and award;

D. identification of minimum specifications;

E. T&MSS audits or surveillances of suppliers including the establishment of witness or hold points as necessary;

F. control of nonconformances;

G. corrective action;

H. acceptance of item or service; and

I. quality assurance records.

7.2 Supplier Selection

T&MSS QA is responsible for the evaluation and determination of acceptability of suppliers based on input from the technical personnel procuring items/services and on the capability of the supplier to furnish the required items or service in accordance with procurement document requirements. Acceptable suppliers shall be listed on a Qualified Suppliers List (QSL), maintained and controlled in accordance with T&MSS procedures. Measures for evaluation and selection of suppliers shall include one or more of the following:

7.2.1 Documented evaluation of the supplier's history of providing an identical or similar product that performs satisfactorily in actual use.

7.2.2 Review of the supplier's current QA records supported by documented qualitative and quantitative information that can be objectively evaluated.

7.2.3 An evaluation by T&MSS QA and technical staff of the supplier's facilities, personnel, implementation of their QA program or the ability of the supplier to use the T&MSS QA program, as applicable, to ensure the adequacy of the supplier's technical and quality capability.

7.3 Bid/Proposal Evaluations

The procuring and technical organizations and QA participate in evaluating bids and proposals for conformance to procurement, technical, and quality assurance requirements.

7.4 Supplier Performance Evaluation

7.4.1 As required, T&MSS shall establish interface measures with the supplier to ensure that the performance evaluation methods are appropriate, adequate, and understood. These methods include:

A. requiring the supplier to identify planning techniques and processes,

B. reviewing supplier generated documents relative to the procurement activity,

C. providing change control criteria in procurement documents,

D. documenting information exchange between the supplier and T&MSS, and

E. establishing the extent of source surveillance and inspection activities necessary.

7.4.2 Verification of Supplier Performance

The extent of verification of supplier performance by T&MSS is dependent on the relative importance, complexity, and quantity of the item or services procured. Evaluation of established performance objectives, review of records,

audits, surveillances, and inspections are methods by which verification of suppliers performance may be accomplished. The purchaser's verification activities shall not relieve the supplier of his responsibilities for verification of quality achievement.

7.4.3 When a supplier has an established QA program, T&MSS QA shall evaluate it to determine program adequacy prior to the supplier being qualified.

7.5 All technical and quality changes to procurement documents for items or services shall be initiated by a purchase requisition change notice and evaluated and processed in the same manner and with the same criteria as the original procurement documents.

7.6 Acceptance of Items

T&MSS procedures shall establish criteria for accepting an item being furnished by a supplier. Supplier certificates of conformance, source verification, receiving inspection, or post installation testing, or combinations of these methods are suitable means of acceptance.

7.6.1 Receiving Inspection

Receiving inspection shall be performed by T&MSS personnel to verify conformance of supplied items to specified requirements per approved procedures. These inspection personnel shall be independent of the organization for which the item was procured, and assure problems are resolved prior to further use, processing, or delivery of an item. If these personnel are not part of the formal QA organization then this inspection activity shall be overviewed by the T&MSS QA organization. Inspection personnel shall be trained and qualified.

7.6.2 Post Installation Testing

When T&MSS elects to use post installation testing, test requirements, and acceptance criteria shall be established. Verification of the test performance, acceptance criteria, and results shall be documented.

7.6.3 Certificates of Conformance

Certificates of conformance shall be traceable to items by purchase order number, part number, serial number, or some other approved method. Certificates of conformance for items, services and software shall be periodically evaluated by audits, independent inspections or tests to assure they are valid and the results documented.

7.7 Acceptance of Services

When procuring services only, the services shall be accepted by one or more of the following methods:

1. Results of audits or surveillances, as appropriate, of the service provided.

2. Technical verification of data produced.

3. Review of objective evidence for conformance to the procurement document requirements.

4. Evaluation of suppliers certificates of conformance for services to ensure validity and documentation of results.

7.8 Control of Supplier Nonconformances

Nonconformances identified by T&MSS shall be identified and processed in accordance with Section 15 of this QAPD and approved T&MSS procedures. Where suppliers have a QA program, deficiencies identified in-process or at the supplier facility shall be identified per their program. Interfaces shall be established that ensure that supplier generated Nonconformance Reports with a "use-as-is" or "repair" recommendation for disposition are provided to T&MSS for approval.

7.9 Commercial Grade Items

Where T&MSS quality related activities require or provide for the use of commercial-grade items (as defined in this QAPD), then the following provisions are an acceptable alternative to the other requirements of this section. T&MSS procedures and instructions shall provide the detail for implementation of these requirements.

7.9.1 For an item to be considered a commercial-grade item, it must be described in the supplier or manufacturer's catalogue. This published product description shall be referenced in T&MSS procurement documents.

7.9.2 Procurement documents shall identify the use of commercial-grade items. The T&MSS department requiring commercial-grade items for its defined work activity shall determine if an alternate commercial-grade item can be used based on its intended function and application.

7.9.3 Source evaluation and selection requirements for commercial-grade items are applicable (see para. 7.2) as determined by T&MSS QA and the T&MSS procuring organization based on the complexity of the item and importance to safety or waste isolation.

7.9.4 Commercial-grade software used to support quality affecting activities shall be acquired and controlled according to the requirements of the T&MSS Software QA Plan (SQAP).

7.9.5 After receipt of a commercial-grade item, it shall be determined that:

A. the item is not damaged;

B. the item received was the item ordered;

C. inspection, testing, or both are performed to ensure conformance to the manufacturer's published description; and

D. documentation, as applicable to the item, was received and is acceptable.

7.10 Control of Supplier Generated Documents

T&MSS procedures and instructions shall ensure that controls for documents that are provided by the supplier and furnished in accordance with procurement requirements include provisions for receipt, review, and evaluation. These documents include but are not limited to drawings, specifications, designs, and QA program plans.

7.11 QA Records

All procurement documentation required to demonstrate quality, including supplier generated documents, surveillance reports, receiving inspection reports, purchase orders/requisitions, and change requests associated with procuring items or services, evaluating and approving suppliers, or receiving and evaluating items and services are QA records. They shall be processed and controlled in accordance with Section 17 of this QAPD.

8.0 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

T&MSS procedures and instructions shall describe the methods for ensuring that only correct and accepted items, samples, and data are utilized. Identification shall be traceable to the appropriate documentation such as drawings, specifications, purchase orders, technical reports, drilling locations, and logs (including well bore and depth), test records, installation and use records, inspections documents, and nonconformance reports. Control of software is identified in Section 19.

8.1 Samples

The T&MSS procedures and instructions for the identification and control of samples shall be generated by the organization responsible for the activity and shall ensure that the following provisions are met.

A. Samples shall be identified and controlled in a manner consistent with their use.

B. Interfaces with the Sample Management Facility and other organizations shall be established to define responsibilities for the collection, identification, handling, storage, transportation, traceability, testing, and disposition of samples. Records generated from these activities shall be identified.

C. T&MSS shall either physically identify samples or identify samples on records traceable to the sample. Traceability of samples from acquisition to final disposition is required, including traceability to appropriate documentation.

D. Controls shall be established to preclude the mixing of samples or the contamination of samples. Verification of identification of samples shall be performed prior to the transfer or release by T&MSS or the receipt from other organizations. Samples whose identification or integrity cannot be verified shall not be used in quality related or quality affecting activities.

8.2 Data

T&MSS procedures shall establish measures ensuring that data resulting from T&MSS activities are properly identified and traceable to the source from which it was generated. This identification and traceability shall be maintained through final disposition. Unacceptable data shall be controlled to prevent inadvertent use; its disposition shall be justified and documented.

Data gathered under a QA program that does not meet the requirements of the OCRWM QARD shall be qualified per the requirements of Section 2.2.9 of this QAPD and NUREG 1298.

8.3 Items

Items shall be controlled as follows:

A. Materials, parts, components, and equipment shall be identified either by physical markings or by records traceable to the items at all times during the life of the item.

B. Marking materials and methods shall be applied using materials and methods which provide a clear and legible identification and do not detrimentally affect the function or service life of the item marked.

C. Marking or identification requirements shall be identified in procurement documents or specifications as necessary.

D. Identification of items shall be verified and documented as appropriate prior to use or release.

E. Items having limited calendar or operating life or cycle shall be identified and controlled to preclude inadvertent use of items whose shelf life or operating life has expired.

F. The provisions for control of item identification shall be consistent with the planned duration and conditions of storage

G. Plans, Procedures, or Instructions shall identify items necessary to support scientific investigations.

9.0 CONTROL OF PROCESSES

This section is not applicable to the T&MSS scope of work.

The OCRWM QARD requirements for special processes apply to engineered items and do not apply to scientific investigation activities. The T&MSS scope of work does not include special processes of engineered items.

10.0 INSPECTION

Inspection criteria apply only to engineered items and not to scientific investigation activities. As such, inspection for T&MSS activities is limited to "receiving and source inspection" as described in Sections 7.6 and 7.6.1 of this QAPD. Procedures describing these activities and which provide criteria for determining where inspections are to be performed shall be developed and implemented.

10.1 Inspection Planning

Inspection planning shall provide for:

a. Criteria for determining when inspections or each work operation are to be conducted,

b. Identification of required procedures, drawings, and specifications including revisions, and

c. Specification of necessary measuring and test equipment, including accuracy requirements.

10.2 Inspection Procedures, Instructions, or Checklists

T&MSS procedures and instructions or checklists developed for receiving or source inspection activities shall incorporate the requirements of ASME NQA-1 Basic Requirement 10 and Supplement 10S-1 as applicable, and shall provide for the following:

a. Identification of characteristics and activities to be inspected,

b. A description of the method of inspection.

c. Identification of the individuals or groups responsible for performing the inspection operation,

d. Acceptance and rejection criteria,

e. Identification of required procedures, drawings, and specifications and revisions,

f. Recording inspector or data recorder and the results of the inspection operation, and

g. Specifying necessary measuring and test equipment including accuracy requirements.

Procedures shall identify, if deemed appropriate by QA, mandatory inspection hold points beyond which work may not proceed until inspected by a designated inspector.

Both inspection and process monitoring shall be provided when control is inadequate without both.

10.3 Inspection Personnel

Individuals performing inspections are members of the T&MSS QA organization or are qualified individual independent of the organizational unit responsible for the activity being inspected. In either case, inspectors shall be certified under the provisions of ASME NQA-1, Supplement 2S-1 by the T&MSS QA manager as being qualified to perform specific inspections. Such qualifications/certifications shall be documented and kept current.

10.4 Inspection Results

Inspection results are documented and evaluated, and their acceptance determined by the T&MSS QA organization.

10.5 Inspection Records

In addition to NQA-1 requirements, inspection records generated from controlling procedures and instructions shall contain the following, when applicable.

a. Identification of the item inspected and the inspection procedure used,

b. A description of the type of observation (characteristics inspected),

c. Inspection criteria or reference documents used to determine acceptance, and evidence as to the acceptability of inspection results with signature and organization,

d. Measuring and test equipment used during the inspection,

e. Any special expertise used,

f. The date and results of the inspection,

g. Inspection identification, and

h. Action taken to resolve any discrepancies noted.

11.0 TEST CONTROL

Test Control for T&MSS activities shall be limited to equipment and instruments that apply to engineered items only. Scientific investigation activities are controlled under the provisions of Section 20. Instructions and procedures shall be developed to ensure that equipment and instruments procured by T&MSS shall perform satisfactorily in service as determined by testing and that the items conform to specified requirements. These procedures and instructions for tests shall establish controls as described in the OCRWM QARD.

11.1 Tests shall include prototype qualification tests as necessary.

11.2 Test procedures shall provide for the following, as appropriate:

A. test objectives, methods, and characteristics.

B. criteria for determining when a test is required.

C. mandatory inspection hold points (witness points, as required).

D. test requirements and acceptance limits.

E. trained and qualified personnel.

F. instructions for performing the test.

G. test prerequisites shall consider the following as applicable; calibrated instrumentation, appropriate equipment, condition of test equipment, item to be tested, suitable environmental conditions, and provisions for data acquisition and storage.

H. acceptance and rejection criteria, including required levels of precision and accuracy.

I. recording of test data and results and evaluation of data to insure that test requirements have been satisfied

J. test records that include description of item tested, date of test, identification of tester or data recorder, type of observation, results and acceptability, action taken and in connection with any deviations noted, identification of person evaluating test results.

K. required tests shall be controlled in accordance with approved procedures.

L. identify potential sources of uncertainty and error and that parameters affected by potential sources of uncertainty shall be identified and controlled.

M. provisions for assuring that test prerequisites have been met.

11.3 In lieu of test procedures, T&MSS may utilize appropriate sections of American Society for Testing and Materials (ASTM) documents, supplier manuals, drawings, and other such documents where adequate instructions exist to assure the required quality of work.

12.0 CONTROL OF MEASURING AND TEST EQUIPMENT

T&MSS procedures shall describe the methods by which tools, gauges, instruments, and other measuring and test equipment (M&TE) used for quality related activities are controlled, calibrated, recalled, and adjusted at specific intervals to maintain accuracy within established limits. Devices such as rulers, tape measures, levels, watches where normal commercial practices provide adequate accuracy do not fall within the scope of this section. T&MSS procedures shall be provided for calibration (techniques and frequency), maintenance, and control of measuring and test equipment. The T&MSS M&TE program shall be consistant with OCRWM QARD requirements.

12.1 M&TE Program

The T&MSS procedure shall specify and establish a M&TE custodian, and responsibility of implementing personnel, recall system, a master log of M&TE including calibration due dates, methods to identify where M&TE is used, and a history file for each M&TE used by T&MSS.

The T&MSS QA organization shall monitor the implementation of the M&TE program through audits and surveillances.

12.2 Calibration Systems

In addition to the requirements described in Para. 12.1 the M&TE program established by T&MSS shall provide for the following:

A. Use of calibration standards traceable to nationally recognized standards or reviewing and documenting the basis for calibration when no standard exists.

B. Unless limited by state of the art, calibration standards shall have accuracy greater than the equipment being calibrated. Calibration standards with the same accuracy may be used if they can be shown to be adequate for the requirements, and the basis for acceptance is documented by management. The management authorized to perform this function shall be identified.

C. Application requirements shall determine selection of M&TE.

D. Identification of calibration status by tagging or other appropriate means.

E. Repairing or replacing damaged equipment or equipment consistently out of calibration.

F. M&TE shall be calibrated at specified intervals based on the intended use, type of equipment, degree of usage, etc., and when accuracy is suspect.

G. Devices out of calibration shall be identified and not used. When M&TE is found to be out of calibration, evaluations shall be made and documented to determine the validity and acceptability of measurements performed since the last calibration. Inspections or tests are repeated as necessary on items determined to be suspect.

H. Calibration records shall identify the procedure and revision used to perform the calibration.

I. Nonconformances resulting from defective M&TE or re-evaluations resulting in erroneous data shall be processed in accordance with Sections 15 or 16 as appropriate.

13.0 HANDLING, STORAGE, AND SHIPPING

13.1 ENGINEERED ITEMS

T&MSS procedures shall describe the methods for handling, storage cleaning, packaging, shipping and preservation of items to prevent loss or damage and to minimize deterioration. Such methods shall be in accordance with design and procurement requirements and Manufacturer's recommendations. T&MSS QA shall monitor implementation of the procedures and instructions through audits and surveillances. QA shall also perform technical document reviews as necessary for special equipment and/or equipment requiring protective environments. These procedures and instructions shall provide for the following criteria:

13.1.1 Implementation by suitably trained personnel. Operators of special handling and/or lifting equipment shall be experienced or trained in the use of that equipment. This experience and/or training shall be documented.

13.1.2 Special handling tools and equipment shall be inspected and tested, as necessary, to assure that equipment is properly maintained. Any inspection or test shall be documented. Use of this equipment shall be controlled as necessary to assure safe and adequate handling.

13.1.3 Procedures shall describe measures (e.g. environmental controls, special packaging) appropriate to the circumstances for sensitive items. Storage provisions for any item shall consider the planned duration and intended use of the item. Its integrity shall be maintained as appropriate.

13.2 GEOTECHNICAL SAMPLES

Handling, storing, and shipping requirements are applicable to samples collected for site characterization.

13.2.1 Geotechnical Sample Handling and Shipping

Samples shall be controlled during handling, storage, and shipment to preclude damage or loss and minimize deterioration. Controls shall be established for appropriate packaging, handling, and modes of transportation, with consideration being given to type of

containers, time constraints on perishable materials (that is, shelf life), and any other environmental or safety considerations applicable to the samples. Measures shall be taken to avoid sample contamination during handling and shipment. Where multiple organizations are involved, appropriate procedures shall describe interface and custody responsibilities. Sample identification shall be verified and maintained when samples are handled, transported, or transferred from one organization's responsibility to another.

13.2.2 Geotechnical Sample Storage

Provisions shall be made to maintain sample characteristics, integrity, and identification while in storage. These provisions shall be consistent with the planned duration and conditions of storage and shall describe actions to be taken where samples have a maximum life expectancy while in storage. Storage methodology shall be developed and implemented to assure that samples are maintained in predetermined environmental conditions commensurate with the samples' intended purposes.

Samples shall be controlled to preclude unintentional mixing of like samples or contamination. Provisions shall be made for identification and storage of tested samples in an area physically separated from untested sample materials.

14.0 INSPECTION, TEST, AND OPERATING STATUS

Although the scope of this section does not include scientific investigations, the following activities shall comply with the provisions of this section: receiving inspection activities, post installation testing and use of environmental and radiological monitoring equipment by T&MSS. Procedures and instructions shall provide for identifying the status of inspection and test activeties to ensure that required inspections and tests are performed and to ensure that unacceptable items are not inadvertently installed, used, or operated.

14.1 Provisions shall be made for the use of status indicators as appropriate (tags, markings, inspection records, etc.). Authority for application and removal of such status indicators shall be defined. T&MSS shall provide examples of these indicators in the appropriate procedures.

14.2 Procedures shall control altering the sequence of tests, inspections, and other operations important to safety or waste isolation. Such actions shall be subject to the same controls as the original review and approval.

15.0 CONTROL OF NONCONFORMING ITEMS

T&MSS procedures and instructions shall describe the methods used to identify and control nonconforming items (e.g., damaged, improperly installed, etc.) to prevent inadvertent use or installation. Replacement, adjustment, and repair of items due to routine maintenance and operations of equipment shall be described and controlled through maintenance procedures and are not required to be addressed on nonconformance reports. Programmatic or procedural deficiencies, software, and documentation discrepancies shall be identified and processed as described in Section 16. T&MSS procedures and instructions shall include the following provisions for the control of nonconformances:

15.1 Identification and Control

T&MSS personnel shall identify any nonconforming item immediately upon detection to the organization responsible for the item or associated activity and to T&MSS QA. The nonconformance shall be documented in accordance with approved procedures requiring the identification of the nonconforming condition, item description and location. The nonconforming item shall be tagged or segregated to prevent inadvertent use. Further use or work relating to this item is prohibited pending disposition of the nonconformance.

15.2 Tracking

A nonconformance control log shall be utilized to track and status the nonconformance.

15.3 Conditional Releases

Prior to disposition, a request for conditional release may be made contingent on four conditions: (1) the subject item can be corrected at a later date without impairing other items or facilities or further damage to itself, (2) it remains accessible for inspection or examination, (3) its limitations for use are defined and documented, and (4) traceability and identification of the item is maintained. Responsible T&MSS technical and QA personnel must approve this conditional release.

15.4 Evaluation and Disposition

Nonconformances shall be documented on a report form with a unique identifier and submitted to the applicable APM for review, evaluation, and disposition. T&MSS QA shall evaluate the identified condition prior to disposition and document

their concurrence with the proposed disposition. The APM responsible for the disposition or a designee having the technical expertise to evaluate the nonconformance shall provide a disposition of accept, use-as-is, reject, repair or rework. Rejected items may be returned to vendor or scrapped. This disposition shall be signed by the responsible authority. Instructions for carrying out the disposition shall be provided as necessary and technical justification provided for use-as-is or repair dispositions.

15.5 Verification and Closure

T&MSS shall verify satisfactory disposition of the nonconformance and document the verification activity. Repaired or reworked items shall be re-examined in accordance with the original acceptance criteria unless the disposition establishes alternate acceptance criteria. Upon satisfactory verification of nonconformance dispositions, the nonconformances shall be closed.

15.6 Trending

Nonconformances shall be trended and reviewed for significance per Section 16 of the QAPD and analyzed by T&MSS QA to identify quality trends and root causes of nonconformances. Results of these trend analyses shall be reported to the Project Manager for review and assessment.

16.0 CORRECTIVE ACTION

T&MSS procedures and instructions shall be implemented to assure that conditions adverse to quality, such as malfunctions, deficiencies, nonconforming and defective items, samples, procedures, software and records are promptly identified and corrected. Significant conditions adverse to quality as determined by criteria established in T&MSS procedures require the root cause to be determined, investigative action to evaluate the deficiency including generic implications to the QA program, and corrective actions to prevent recurrence. A trend analysis program shall also be established to measure the achievement of quality. Significant conditions adverse to quality and adverse trends shall be identified to the T&MSS Project Manager for evaluation and subsequent corrective action.

16.1 Hardware or engineered items that are deficient, damaged, or malfunctioning shall be processed in accordance with nonconformance control criteria in Section 15. Programmatic and procedural anomalies associated with these nonconformances shall be addressed in accordance with this section of the QAPD as necessary, based on the nature and extent of the problem.

16.2 Programmatic, procedural, documentation, and data deficiencies shall be processed by T&MSS QA in accordance with procedures describing the T&MSS deficiency document reporting system. These procedures shall incorporate the following provisions:

A. Describing the deficiency in the deficiency reports such that the full extent, scope, and nature of the problem is fully defined.

B. Providing criteria for evaluating the significance of the deficiency and identifying the adverse condition to the responsible T&MSS organization for a response.

C. Require remedial actions to correct the identified deficiency and corrective action to prevent recurrence if necessary.

D. Determination of root cause and investigative actions as necessary relative to the significance of the deficiency.

E. Concurrence of the proposed response from the responsible organization by T&MSS QA.

F. Verification by T&MSS QA that all corrective action commitments have been satisfactorily accomplished and that the corrective actions resolved the adverse conditions.

G. Concurrence with proposed corrective action or verification of corrective actions shall be within prescribed time limits.

H. Providing to responsible management at all levels, copies of documentation of corrective actions that involve significant conditions adverse to quality.

I. A tracking system for all deficiencies to assure that they are appropriately addressed, prioritized and trended.

16.3 Procedures for trend analysis shall assure that the results of audits, surveillances, inspections and other activities which produce results (e.g. QFRs, NCRs) of an evaluation of quality related items and activities are utilized in the analysis of the QA program and help identify root causes at specified intervals. T&MSS QA shall perform trend analyses in a timely manner such that any adverse trends shall be promptly identified and corrected.

17.0 QUALITY ASSURANCE RECORDS

T&MSS shall process Quality Assurance Records in accordance with approved procedures and instructions. T&MSS generated records shall be processed through the T&MSS Local Records Center (LRC) or the Yucca Mountain Site Office (YMSO) LRC. T&MSS procedures and instructions shall provide interfaces for submittal of these records to the Central Records Facility (CRF). The following provisions apply to T&MSS and shall be reflected in procedures and instructions.

17.1 Generation of Records

T&MSS procedures and instructions, scientific investigation plans, procurement documents, and other quality-related documents shall identify the quality records to be generated, supplied, or maintained. QA records include: scientific, engineering, and operational data and logs; Geotechnical data; results of reviews; inspections; tests; audits and material analysis; monitoring of work performance; qualification of personnel, procedures, and equipment; and other documentation such as drawings, specifications; procurement documents, calibration procedures and reports; design review reports; peer review reports; nonconformance reports; and corrective action reports. QA records shall be legible, identifiable, accurate, retrievable, and completed appropriately for the work or activity.

17.2 Records Validation

T&MSS documents that furnish documentary evidence of quality become a valid QA record only if stamped, initialed, or signed and dated by authorized personnel, or otherwise authenticated in accordance with approved procedures or instructions. Authentication may take the form of a statement by the responsible individual or organization. Originals or copies may be furnished as records.

17.3 Index, Identification, Distribution

T&MSS QA records shall be indexed, identified, and distributed to the CRF in accordance with T&MSS procedures and instructions. The location of indexed records shall be identified. Records and/or indexing shall provide sufficient information to permit identification between the record and the item(s) or activity(ies) to which it applies. Procedures and instructions shall control in-process records and provide for the timely submittal of complet records into the records system.

17.4 Records Correction

Provisions for correcting records (and documents that will become records) shall ensure that corrected records are reviewed and approved by the originating organization. Such corrections shall include the date and the identification of the person making the correction. Previous information shall not be obliterated by the correction. Provisions shall be established for supplementing or amending records. Controls shall be established for transcribi and authenticating illegible or un-reproducible data or documents.

17.5 Local Records Center

17.5.1 T&MSS QA records shall be submitted to the LRC for processing in accordance with T&MSS procedures and instruction Records submitted to the LRC shall be stored in dual facili ties or in a one-hour fire rated container. One-of-a-kind records shall be stored in a one-hour fire rated safe or vault. Where dual facilities are used, such facilities are located sufficiently remote from each other to eliminate th chance of exposure to a simultaneous hazard.

17.5.2 Procedures and instructions shall identify the LRC receipt control system for identifying the records received, receipt and inspection of incoming records, and temporary storage of the records.

17.6 Central Records Facility

17.6.1 The CRF shall be established and maintained by T&MSS in accordance with the OCRWM QARD.

17.6.2 The CRF shall receive and process records in accordance with written procedures.

17.6.3 Indexing of all project records shall be done in accordance with procedures or instructions that are consistent with OCRWM direction and instructions. Procedures and instructions shall define a receipt control system which will permit a current and accurate assessment of the status of records during the receiving process.

17.6.4 Records received by the CRF shall be stored in accordance with procedures and instructions. The procedures and instructions shall include the following, as a minimum:

a. description of the storage facility;

b. filing system to be used;

c. method for verifying records received are in agreement with the transmittal and the records are legible;

d. a method for verifying the records received are those designated as required records;

e. rules governing access to and control of the records files;

f. a method for maintaining control and accountability of records removed from the storage facility;

g. a method for filing supplemental information and disposing of superseded records.

17.6.5 The CRF storage system shall provide for retrieval of information in accordance with planned retrieval times based upon the record type. A list shall be maintained designating those personnel who shall have access to the files.

18.0 AUDITS AND SURVEILLANCES

The T&MSS Quality Assurance organization shall implement an audit and surveillance program in accordance with this section and OCRWM's QARD. Both internal audits and surveillances of the T&MSS quality program and external audits and surveillances of T&MSS suppliers and/or contractors that furnish quality related items or services shall be performed by the T&MSS QA organization. This program shall provide independent verification of the status, adequacy, compliance, and implementation of the T&MSS QA program and its elements. T&MSS procedures and instructions for this program shall include the following provisions:

18.1 Audits

T&MSS shall implement procedures which define responsibilities and methods for conducting planned and scheduled quality assurance audits by qualified personnel to accomplish the following:

- o verify compliance and determine effectiveness of the program;
- o provide objective evaluation of program implementation;
- o determine effectiveness of achieving quality objectives;
- o involve T&MSS management at all levels in the audit process, and
- o evaluate the technical adequacy of procedures, plans, software, test data, items and activities.

18.1.1 Audit Scheduling

The audit schedule shall address all quality-related activities and criteria under T&MSS responsibility and the evaluation shall consider results of previous surveillances and audits, and the impact of significant changes in personnel, organization or quality assurance program. Each area of activity shall be audited at least annually or during the life of the activity whichever is shorter, except for supplier audits. The audit schedule shall be reviewed periodically and updated as necessary. Supplemental audits may be performed as necessary to provide adequate coverage. Audits are regularly scheduled, based upon the status and safety importance of the activities being performed and shall be initiated early enough

to assure effective QA during design, procurement, site characterization, manufacturing, construction, installation inspection and testing. Copies of the T&MSS audit schedule shall be furnished to APMs and the T&MSS Project Manager for review, assessment, and appropriate action. Information copies are provided to OCRWM QA Director.

18.1.2 Audit Team

A. An audit team comprising of one or more auditors (one of whom shall be qualified and certified as a Lead Auditor) shall be identified prior to each audit in an audit notification letter/memo to the organization to be audited. Technical specialists shall be utilized where necessary, e.g. to audit scientific investigations and experiments. The Lead Auditor is responsible for directing and organizing the audit, determining that the audit team is qualified to conduct the audit, preparing and issuing the audit report, and evaluating the responses.

B. Lead Auditor qualifications and certifications shall comply with requirements established in ASME NQA-1 Supplement 2S-3 and Appendix 2A-3.

C. Technical members of the audit team shall be indoctrinated in audit techniques. Auditors shall not have had any direct responsibility for the activity being audited.

18.1.3 Audit Plan and Process

A. Planning shall involve the review of previous audits for the activity/area being audited and shall address previous findings (deficiencies, concerns, corrective actions etc.) surveillances, and assessments. Reviews of appropriate documents, procedures, and instructions shall also be performed.

B. An audit plan shall be developed which identifies the audit scope, requirements, audit personnel, activities to be audited, organizations being audited, applicable documents, schedule, and written procedures or checklists.

C. T&MSS shall conduct pre-audit and post-audit conferences with the audited organizations to identify the scope and methodology of the audit, establish interfaces, and identify audit findings, observations, and overall results of the audit.

D. Requirements from the audit checklist or procedures shall be used to evaluate the elements selected for the audit.

18.1.4 Audit Report

The audit report is prepared and signed by the Lead Auditor and issued to the audited organization, the APM of the audited organization, or management of the supplier/contractor being audited, Project Office QA, and the T&MSS QA Manager. An analysis of audit results and audit reports shall be made in accordance with an applicable provisions of Section 16. The Project Manager shall be copied on all T&MSS audit correspondence.

Documentation of identified deficiencies that are not corrected during the course of the audit shall be in accordance with Sections 15 and 16 of this QAPD as shall be the review, verification, and closure of deficiencies.

18.1.5 Supplier Audits and Evaluations

A. Audits of suppliers shall be conducted as necessary based on the scope, complexity, importance to safety or waste isolation, procurement document and/or contractual requirements. When T&MSS determines that an external audit of a supplier is required, the supplier shall be audited on a triennial basis, as a minimum. The controls and responsibilities previously described in this section shall be utilized.

B. Regardless of audit requirements, all T&MSS suppliers on the Qualified Suppliers List shall be evaluated on an annual basis. The results of previous audits and previously identified deficiencies and nonconformances shall be considered in this evaluation. This evaluation shall be based on some combination of: reviews of supplier documents; results of previous source verifications, audits and receiving inspections; or, demonstrated reliability of an item in service; and results of audits from other sources.

C. After award of the contract and based on the determination of the quality assurance program applicability of each item or service to be procured, the need for external audits shall be evaluated. A determination may be made that external audits are not necessary for procuring items that are:

1. Relatively simple and standard in design, manufacture, and test;

   or

2. Adaptable to standard or automated inspections or tests of the end product to verify quality characteristics after delivery. The rationale for not performing an external audit shall be documented and maintained as part of the QA records.

18.2 Surveillances

T&MSS QA shall be responsible for implementing the surveillance program. Surveillance functions by non-QA personnel may be conducted in accordance with approved work instructions for a specific activity (e.g. Radiation Monitoring) as long as the personnel do not directly report to the supervisors responsible for the activity. T&MSS QA shall implement a surveillance program described in T&MSS procedures which assesses in-process work or activities through observation and/or examination. Technical adequacy and quality implementation of the activity shall be evaluated. QA Surveillance personnel shall be knowledgeable in the activity being surveilled, and shall not be directly responsible for the work/activity under surveillance. Surveillances shall be planned and documented and shall identify acceptable and deficient conditions. Surveillances shall be conducted at times commensurate with work schedules and shall be relevant to project milestones. Deficiencies that are not corrected during the course of the surveillance shall be evaluated and handled in accordance with Sections 15 and 16 of this QAPD as appropriate.

Surveillance reports shall be issued to the department or organization being surveilled and to the appropriate APM. The Project Manager shall be copied on all such reports.

19.0 SOFTWARE QUALITY ASSURANCE

For quality related software, T&MSS shall develop a software development and control program to meet the applicable requirements of Section 19 of the OCRWM QARD. The program shall be consistent with guidelines contained in NUREG-0856 and will be designed based on a Software Life Cycle (SLC) model tailored to T&MSS activities.

Application of software QA requirements shall be graded according to software function, nature, and other characteristics of each software type. Criteria shall be established that result in the application of different controls depending upon software relative importance, intended end-use, regulatory significance, degree of complexity, requirement relevance, software origin and the type of software to be employed by T&MSS organizations. Software controls are graded depending on criteria such as:

1. Whether the software is to be used to support Project safety and licensing activities (i.e., does the software support "Activities Affecting Quality" as defined in the OCRWM QARD).

2. Whether the software function is considered scientific or engineering in nature, as defined by NUREG-0856.

3. Whether the software is developed for and by participating organizations (i.e., developed per the OCRWM QARD).

4. Whether the software is procured or otherwise acquired for the T&MSS from sources other than project participating organizations.

5. Whether the software is relatively complex in nature and will require extensive effort to verify and/or validate.

6. Whether the quality of a software product will depend upon SLC controls employed during design, development, and testing.

7. Whether the software will be used to generate primary data.

19.1 SOFTWARE QUALITY ASSURANCE PLAN (SQAP)

T&MSS shall implement the software quality assurance requirements contained in OCRWM's QARD, when applicable, in a manner commensurate with the methods, criteria, and controls described in the T&MSS Software QA Plan (SQAP).

The T&MSS SQAP shall establish administrative controls to be used by T&MSS organizations that use quality-related software to perform analysis to support a high-level nuclear waste repository license application. The SQAP shall govern the

SLC, including the process of software planning, determination of software type, requirements development, structured analysis and design, coding and documentation, testing, verification and validation, installation, certification for release, operational use and change for all quality-related software.

This SQAP shall prescribe controls and a systematic process to reduce the likelihood of software defects entering executable computer software during development. It also ensures that the end-product software implements software quality assurance requirements for the intended application, and reduces the likelihood that software defects will be introduced into executable code during maintenance.

T&MSS Organizations shall control specific software types in accordance with the applicable Standard Practice Procedures (SPs), Organizational Procedures (OPs), or Work Instructions (WIs).

The main objective of the SQAP is to define a structured, disciplined process that controls the acquisition, design, development, qualification, documentation, usage, and maintenance of quality-related software. Specific software management objectives to be met by the SQAP include the following:

1. Establishment of a SLC approach to development, acquisition, testing, and use of quality-affecting software.

2. Definition of a prescribed set of software products to be generated and maintained as QA records.

3. Establishment of controlled software libraries which form a baseline for a software configuration management system.

4. Creation of a software development library for control of unverified or invalidated software.

5. Creation of a software production library for use of software that is developed, acquired, and modified according to the controls of the SQAP.

The SLC process as described in the SQAP shall contain several phases that apply to specific software types which are distinct and separate. Each phase contains specific tasks, activities, and work that contributes to the control of computer program acquisition, development, use and maintenance. T&MSS organizations will adhere to the following SLC phases, as applicable:

SLC Phase	Title Used
I	Software Classification
II	Requirements Development
III	Software Acquisition
IV	Software Design
V	Code Development
VI	Installation and Operational Use
VII	Software Verification/Validation
VIII	User Application

The SQAP shall apply to quality-related software used for primary data analysis, data reduction, data acquisition, data generation, or quality-affecting activities that produce or manipulate primary data that is used directly to perform technical calculations in support of site characterization, repository design, design analysis, performance assessment, and operation of repository structures, systems, and components.

This SQAP also applies, in part, to system software (high-level software languages, etc.), acquired software, and proprietary off-the-shelf commercial software packages developed outside the Project.

The SQAP shall contain descriptions of processes employed, requirements established, methodologies used, and criteria to be met for quality-related software in the following areas:

a. Software Quality Management Program
b. Organization and Responsibilities
c. Software Requirements Applicability
d. Software Life Cycle Management Process
e. Software Documentation, Control and Review
f. Software Verification and Validation Process
g. Software Configuration Management System
h. Qualification and Acquisition of Existing Software
i. Software Use and Application.

19.2 SOFTWARE VERIFICATION AND VALIDATION

Software may be used extensively in quality related scientific and engineering computations. Since error in such software could have serious impacts on activities affecting safety and waste isolation, it is necessary that computer programs exhibit a high level of reliability.

Verification and validation is a systematic process for improving reliability that includes:

- Computer software verification - a process that demonstrates that the computer software performs correctly, that software requirements are implemented in software design, and that the software design is implemented in the computer code.

- computer model verification - an independent assessment that software performs the operations specified in a numerical model correctly.

- computer model validation - an independent assessment for a specific computer software application that demonstrates that the mathematical model embodied in the software is an adequate representation of the process or system for which it is intended.

The T&MSS SQAP shall describe the processes used to assure software verification and validation is planned, performed, documented, and justified consistent with NUREG-0856 requirements and the SLC.

19.3 SOFTWARE CONFIGURATION MANAGEMENT

In order to satisfy configuration management program requirements of the OCRWM QARD, a Software Configuration Management System (SCMS) shall be established by T&MSS and described in the SQAP. The SCMS shall be controlled and managed by the T&MSS Information Systems Department (ISD) according to implementing procedures or instructions. The purpose and scope of the SCMS is to:

- Uniquely identify, control, and track T&MSS organization computer software products.

- Control and record change to software products during development and maintenance of quality-related software.

- Control the transfer of T&MSS organization computer software between the software production library, the software development library, and outside organizations.

- Maintain the status of T&MSS organization quality-related software and any changes made to software products.

The SCMS shall provide for six basic functions which shall be described in the T&MSS SQAP. These include:

1. Identify each software product.

2. Enter software products into the SCMS.

3. Provide change control over the baseline.

4. Facilitate software discrepancy reporting.

5. Assure that software defects are corrected.

6. Identify and maintain status of the baseline.

Two software libraries shall be established and maintained by T&MSS for the purpose of controlling software with different status. The software libraries utilized are:

A. The Software Production Library. This library contains System Software and software approved for use in Project license application activities. User access to the library is controlled by the ISD Manager. Software in this library must have completed all applicable phases of the SLC.

B. The Software Development Library. This library contains software approved for use which shall be controlled until verification and/or validation is completed. Access to the library is controlled by the ISD Manager. Once verified and validated, computer programs in this library will be transferred to the Software Production Library. The computer results obtained from use of computer programs in the Software Development Library shall be marked or stamped to identify and control the use of such data in quality-affecting activities.

19.6 QUALIFICATION OF EXISTING SOFTWARE

All T&MSS software that is acquired from commercial or non-Project sources is considered existing software and shall be evaluated or qualified prior to use in quality affecting activities. The qualification process for existing software ensures that the software and associated documentation can meet applicable technical and QA requirements.

System software is a special software type that is procured based on proven commercial use without qualification.

19.7 SOFTWARE DOCUMENTATION

T&MSS quality related software shall be documented in accordance with the SLC control process and procedures. Each SLC phase results in the preparation of one or more software products documenting the tasks, activities, and work conducted during the phase. These software products are prepared, reviewed, and approved according to the criteria provided in the T&MSS SQAP.

Computer programs are documented and controlled during each phase of SLC. The documentation shall meet the minimum acceptable levels established by the SQAP. The documentation of scientific and engineering software shall be consistent with the guidance contained in NUREG-0856, "Final Technical Position on Documentation of Computer Codes for High-Level Waste Management."

19.8 SOFTWARE REVIEWS

Reviews of computer software and associated documentation shall be performed in accordance with a T&MSS software review procedure. Reviews shall be performed for each software product completed during the SLC as specified in the T&MSS SQAP. Reviews shall be performed according to a document review process that includes T&MSS comment resolution prior to entry of documentation into the SCMS.

19.9 DISCREPANCY REPORTING AND CORRECTIVE ACTION

A formal software operational problem and defect reporting system shall be established and integrated with the SCMS. Software problems shall be evaluated to determine their potential impact and whether or not a software defect exists. The evaluation considers the following:

1. Does the software problem involve a condition adverse or potentially adverse to quality?

2. Could the software problem, if not corrected, affect the quality of primary data?

3. Is the software product used to perform scientific and engineering computations in support of the Project license application?

4. Is the software product in use in the Software Production Library?

Once a software defect is identified and affected users are notified, it is the responsibility of the prime user to take corrective action. This includes documentation of the software defect, determination of its impact on any prior user applications, and correction of the software defect by modification of the software.

A software defect may be cause to withdraw the software from either the Software Production or Development Library.

19.10 MEDIA CONTROL AND PHYSICAL SECURITY

Master copies of physical media containing the images of software shall be physically protected to prevent their inadvertent damage, degradation or loss. Media control and security is ensured by the Yucca Mountain Site Characterization Project (YMP) computer center, the magnetic tape storage system, the software library, and the Project Office computer protection system.

19.11 ACQUIRED COMPUTER SOFTWARE

T&MSS shall establish procedures or instructions to control the following software acquisition activities:

1. Acquisition of system software

2. Acquisition of existing software

3. Conversion of existing software

4. Transfer of existing software

5. Change to acquired software

Existing software and system software are acquired as non-quality affecting items and qualified or evaluated prior to use in quality-related activities.

19.12 COMPUTER SOFTWARE APPLICATION

Each T&MSS organization using software installed in the Software Production or Development Library to perform technical calculations in support of site characterization, design analysis, performance assessment and operation of repository structures, systems, and components, shall follow approved technical procedures or instructions to:

1. Control the application, documentation, review and verification of scientific and engineering computations.

2. Control electronic calculations as required by the SQAP.

3. Control the use of unverified or unvalidated software.

19.13 T&MSS SOFTWARE QA PROCEDURES AND INSTRUCTIONS

T&MSS shall develop specific implementing procedures or instructions to control the software activities described in the SQAP, as appropriate.

If specific software activities are anticipated, planned, or expected to be conducted, and the initiation date of such activities is uncertain, implementing procedures or instructions may be deferred until the activities are defined and their need is certain.

T&MSS organizations developing software QA procedures or instructions will adhere to the following provisions, as appropriate:

1. A series of procedures or instructions based on any hierarchial relationship that is consistent with the T&MSS SQAP.

2. Issuance of one or more procedures or instructions only when they are needed to perform specific activities.

3. The complete freedom to refer, cite, apply, specify, and utilize information or criteria contained in the SQAP.

4. Avoid, wherever feasible, duplication and redundancy between the SQAP and its implementing procedures and instructions.

5. Preclude, whenever possible, the introduction of new acceptance or rejection criteria not specified, defined, or provided in the SQAP.

6. Clarifications, explanations, definitions and interpretations of the SQAP will be documented by the T&MSS Information Systems organizations in memoranda and correspondence to primary users and affected parties.

7. The software quality assurance analyst reporting to the T&MSS Information Systems organization will be responsible for concurring with clarifications, explanations, definitions and interpretations of the T&MSS SQAP.

8. If the SQAP does not require the use of standards, conventions, techniques, or methodologies, implementing procedures, or instructions may reference such methods and assure compliance by a memorandum stating those portions of the reference to be followed.

20.0 SCIENTIFIC INVESTIGATION CONTROL

T&MSS shall develop and implement instructions, procedures, and plans, as appropriate, to control scientific investigations. These instructions, procedures, and plans shall implement the requirements described in the OCRWM QAPD and reflect the following provisions.

20.1 Scientific Investigation Planning

a. Prior to the start of any scientific investigation, a scientific invstigation planning document (for example, study plan) shall be developed. Planning documents shall contain:

1. Description of work to be performed.
2. Rationale and justification of the information to be obtained.
3. Proposed methodology.
4. Rationale and justification for the proposed methodology.
5. References to applicable documents.
6. Identification, explanation, and justification for areas where scientific notebooks are to be used.
7. Description of constraints.
8. Description of the application of the scientific investigation's results.
9. Description of schedules and milestones.

b. These planning measures shall include or reference provisions for assuring that:

1. Prerequisites for the given scientific investigation have been met.
2. Adequate instrumentation is available and used.
3. Necessary monitoring including witness or hold point have been performed.
4. Suitable laboratory conditions are maintained.

5. Scientific investigations at each step are compatible with applicable conceptual or mathematical models used at each applicable stage.

6. The evaluation of data quality to assure that generated data is valid, comparable, complete representative, precise, and accurate.

7. Sources of error and uncertainty and input data that is suspect or whose quality is beyond the control of the performing organizations is identified.

c. Prerequisites

The following prerequisites shall be considered:

1. Calibrated instrumentation.

2. Appropriate equipment.

3. Trained personnel.

4. Readiness of facilities, equipment, supplies, and items or samples.

5. Suitable environmental conditions.

6. Provisions for acquisition and recording of data.

7. Disposition of facilities after completion of scientific investigation activities.

8. Environmental compliance and land access approval.

The responsible T&MSS organization shall conduct a technical review or peer review of the scientific investigation planning document prior to data collection or analysis activities. In exceptional cases, the originator's immediate supervisor can perform the technical review if the supervisor is the only technically qualified individual, and if the need is individually documented and approved in advance with the concurrence of the QA manager of the originating organization. The results of this technical or peer review, and the resolution of any comments by the reviewer or reviewers, shall be documented, and shall become a part of the QA records.

All changes in scientific investigation planning documents shall go through the same review and approval process as the original planning documents.

The intended use of data shall be documented as part of the planning for scientific investigations. Any alternate use of the data shall be evaluated for appropriateness and the justification documented.

The range, accuracy, and precision of equipment used for scientific investigations shall be specified in order to be commensurate with requirements. In developing quality assurance program requirements for equipment, consideration shall be given to whether proper performance of a scientific investigation can be determined during or after the scientific investigation (that is, whether failure or malfunction of equipment can be detected). Where special quality assurance program requirements are found to be necessary, specific performance verification requirement shall be established and described to govern the use of the equipment.

Scientific planning documents, study plans, or other documents, defining and planning the activity, shall identify the use of commercial-grade items. The T&MSS department requiring commercial grade items for its defined work activity shall determine if an alternate commercial-grade item can be used based on its intended function and application.

20.2 Planning Document Review and Approval

T&MSS shall conduct either a technical review or peer review of the scientific planning document with qualified personnel who did not develop the original planning document.

In exceptional cases, the originator's immediate supervisor may perform the technical review if he or she is the only technically qualified individual and if the need is documented and approved. T&MSS QA must concur. The results of the technical or peer review and concurrence with the resolution of any comments shall become QA records in accordance with Section 17.

All changes in scientific investigation planning documents shall go through the same review and approval process as the original planning documents.

The intended use of data shall be documented as part of the planning for scientific investigations. Any alternate use of the data shall be evaluated for appropriateness and the justification documented.

20.3 Technical Procedures

The use of technical procedures is one method by which scientific investigations are controlled. This method is used to perform repetitive work that does not require a high degree of professional judgment or trial and error methods, or when it is not possible to deviate from a prescribed sequence of actions without endangering the validity of the expected results.

Technical procedures shall provide for the following as appropriate:

a. Requirements, objectives, methods, and characteristics to be tested or observed;

b. Prerequisites such as calibrated instrumentation, adequate equipment, readiness of facilities, controlled environments, etc.;

c. Mandatory verification points, as applicable;

d. Acceptance and rejection criteria including required levels of accuracy and precision as appropriate;

e. Methods of documenting or recording data and results including precision and accuracy;

f. Methods of data reduction if it is part of a test, or reference to procedures containing the information;

g. Provisions for ensuring that prerequisites have been met, special training or qualification requirements for personnel performing scientific investigations are met, and personnel responsibilities are defined;

h. Procedures are detailed to the extent that the investigation can be repeated by personnel who are skilled in the state of the art of the field of investigation without recourse to originator(s).

i. Potential sources of uncertainty and error in technical procedures are controlled as required; and

j. Suspect input data are identified and controlled as required.

20.4 Scientific Notebooks

The scientific notebook system is another method for controlling scientific investigations where a high degree of professional judgment or trial and error methods are used or a methodology is required to be developed to accomplish an activity. When this system is used, the scientific investigation planning document or study plan shall control the activities. The notebook shall contain specific detail such that the investigation can be repeated by another qualified individual without recourse to originator(s) and achieve the same results. Logbooks or note books are used to document the activities undertaken and comprise the scientific notebook system. Requirements are established in OCRWM's QAPD for initial and subsequent entries into the scientific notebook regarding title of research, names of persons performing the research, objectives, methodology, etc. The initial entries may be modified as necessary by authorized personnel and subsequent entries shall be detailed step-by-step implementation of the prescribed methodology. The final entries in the record shall have as a minimum the signature of the experimenter and the signature of a technical reviewer.

20.5 Interface Controls

T&MSS shall identify ongoing field investigations to preclude inadvertent interruption and to assure operational compatibility. The location of field investigations shall be clearly identified.

20.6 New Methods, Procedures, or Processes

Activities used to develop new methods or procedures for conducting scientific investigations or critical processes shall be documented. Results of scientific investigations or critical processes shall be documented and reviewed for adequacy and approved by qualified persons prior to use.

20.7 Data Interpretation and Analysis

T&MSS procedures, instructions, and plans shall ensure that the data interpretation and analysis are documented in sufficient detail as to purpose, method, assumptions, input references and units such that technically qualified personnel are able to review, understand, and verify the analysis without recourse to the originator. Because these verifications may not be examined and used for an extended period of time the documentation of the analysis shall include the following:

a. Statement of objectives;

b. Identification of input, input sources, and assumptions;

c. Listing of applicable references;

d. Results of literature searches or other background data;

e. Identification of any computer calculation including computer type, program name and subject, revision, input, output, evidence of program verification, and the bases of application to the specific problem;

f. Calculations identifiable by subject, originator, reviewer and dates;

g. Signatures and dates of reviews and approval by appropriate personnel; and

h. Description of the methods of control of erroneous, rejected, or otherwise unsuitable data.

T&MSS is responsible to assure that equipment and methods used to obtain and analyze data are technically adequate and properly selected. Data transfer and reduction controls shall, as appropriate, be such that errors are held within prescribed limits and not lost in the outputs. Any computer programs utilized are controlled as described in Section 19 of this document.

20.8 Scientific Investigation Results

T&MSS shall document and summarize the results of all scientific investigations in a technical report. The documentation results shall include a discussion as to whether or not the research or experiment objectives were achieved. The following shall be included, as appropriate:

a. Unreviewed data and data with unresolved questions shall be clearly identified when used or reported. Uncertainty limits shall be assigned prior to use of such data.

b. Peer reviews or technical reviews shall be performed on the results of these investigations by T&MSS in accordance with approved procedures; and

c. Data collection and analysis are to be technically reviewed by qualified T&MSS personnel other than those who performed the investigation. Questions shall be resolved before the results are used as a baseline.

Any procedural deficiencies or nonconformances identified during or subsequent to the scientific investigations shall be handled in accordance with the requirements of Sections 15 and 16 of this QAPD.

20.9 Records of Scientific Investigations

The original recorded data, reports, and scientific notebooks are all considered QA records and processed per Section 17 of this document. These records include technical reviews, peer reviews, technical reports, notebooks, logs, deficiency documentation, etc. Documentation resulting from scientific investigations shall be reviewed to assure that QA records for the investigation are adequate and complete. Procedures shall be established describing methods of documenting, recording, reviewing, and confirming accuracy of records. Such records include laboratory and field notebooks and log books, data sheets, data reduction documents and software.

20.10 Peer and Technical Reviews

Peer reviews and technical reviews utilized in the activities associated with scientific investigations shall be performed in accordance with T&MSS procedures and instructions.

Technical reviews shall be performed when the information or document under review is within the state of the art and is based on accepted standards, criteria, principles, and practices. Technical reviews shall be used when documents,

activities, material, or data require technical evaluation for applicability, correctness, adequacy, completeness, and assurance that established requirements are satisfied. Technical reviews shall be performed by individuals with sufficient technical knowledge of the area under review.

A peer review should be used when the adequacy of information (e.g., data, interpretations, test results, design assumptions, etc.) or the suitability of procedures and methods essential to showing that the respository system meets or exceeds its performance requirements with respect to safety and waste isolation cannot otherwise be established through testing, alternate calculations or reference to previously established standards and practices.

The results of technical and peer reviews shall be documented.

ATTACHMENT B

APPLICABILITY OF YMP APQS

I. APQs Directly Implemented by T&MSS as a Participant

AP-1.6Q	Release of Unpublished Information
AP-1.10Q	Preparation, Review and Approval of SCP Study Plans
AP-3.5Q	Field Change Control Processes
AP-3.6Q	Configuration Management
AP-5.1Q	Control and Transfer of Technical Data on the Yucca Mountain Project
AP-5.2Q	Technical Information Flow to and from the Yucca Mountain Project Technical Data Base
AP-5.3Q	Information Flow into the Project Reference Information Base
AP-5.9Q	Qualification of Data or Data Analyses not Developed Under the Yucca Mountain Project Quality Assurance Plan
AP-5.19Q	Interface Control
AP-5.20Q	Hold Control
AP-5.21Q	Field Work Activation
AP-5.27Q	Control of Nonconformances
AP-5.28Q	Quality Assurance Grading
AP 5.32Q	Test Planning & Implementation Requirements
AP-6.3Q	Interaction of Participants and Outside Interests with Yucca Mountain Project Sample Management

ATTACHMENT B (Cont.)

II. APQs Implemented by T&MSS through T&MSS Participant Procedures

AP-1.5Q	Issuance and Maintenance of Controlled Documents
AP-1.17Q	Forms Control
AP-4.1Q	Procurement
AP-5.13	Readiness Review
AP-6.1Q	Project Office Document Development, Review, Approval, and Revision Control

III. APQs Not Applicable to T&MSS as a Participant, but may be implemented by T&MSS personnel performing direct support to the Project Office under the OCRWM QA Program.

AP-3.3Q	Change Control Process
AP-5.10Q	Use of NTS Contractors on the NNWSI Project
AP-5.16Q	Field Technical Compliance
AP-5.18Q	ESF Design Control
AP-5.24Q	Preparation and submittal of As-built Drawings and Specifications
AP-6.2Q	Management and Operation of Sample Handling Activities at Borehole Sites
AP-6.4Q	Procedure for the Submittal, Review, and Approval of Requests for Yucca Mountain Project Geologic Specimens
AP-6.6Q	Field Collection, Documentation, and Specimen Removal of Exploratory Shaft and Drift Rock
AP-6.17Q	Determination of the Importance of Items and Activities

ATTACHMENT C

T&MSS QA GLOSSARY

This Glossary contains only those terms and definitions that are unique to the T&MSS QA Program. The terms and definitions of NQA-1 Supplement S-1, the Yucca Mountain Glossary, and the OCRWM QARD shall also apply to all T&MSS participant activities. Where differences exist between this document and others, the definitions in this document shall take precedence.

Acceptance - An act performed after methods for verifying that items and services being furnished comply with the procurement requirements have been satisfied.

Computer Program - A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution as well as to execute it.

Commercial Grade Item - An item satisfying all of the following:

a. Not subject to design or specification requirements that are unique to Mined Geologic Disposal System, and

b. Used in applications other than Mined Geologic Disposal System, and,

c. Is to be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description (e.g. a catalog).

Controlled Document Information System (CDIS) - A computerized data base system which stores the controlled document master list of documents, controlled document distribution lists, and controlled document log and performs search and retrieval of controlled document information.

Deficiency - A deviation from established requirements, which, if left uncorrected could have an impact on the quality of item or activity.

Document Control Center (DCC) - A facility dedicated to the distribution, recall, and tracking of documents and their protection from loss, damage, or deterioration.

Facility Survey - A direct evaluation of the supplier's facility, personnel, and implementation of his program to determine the capabilities of the supplier to satisfy the requirements of the purchase order or contract.

Form Custodian - The person who is responsible for creating, revising, or maintaining a form(s) associated with a T&MSS procedure or T&MSS activity.

Functional Change - A change in the title, functions, responsibilities, or lines of reporting authority of an organization.

Job Position Description - Documentation of the duties to be performed and the minimum qualifying experience, education, and professional training required for a position.

Major Revision - Changes to a document that affect a process within the document, the basic content, or a major change in concept.

Minor Revision - Changes such as department name changes; typographical errors; minor wording changes for clarity; and editorial corrections in grammar, punctuation, or spelling where the basic content of the document does not change.

Mandatory Comment -Comments that identify significant problems or weaknesses regarding technical content, concept, practice, implementation, or responsibilities that render a document unacceptable for implementation or out of compliance with established requirements. All comments designated as mandatory must be resolved with the reviewer and the resolution documented.

Management Assessment - Determination of effectiveness of establishing, planning and implementing quality requirements which conform to applicable regulations, standards, procedures, and related program requirements. It verifies that responsible managers have defined the quality objectives and requirements for their activities; planned and established the organizations resources and means for performing their activities; communicated their objectives, requirements, plans, procedures and assignments to involved organizations and individuals; and monitored the performance of activities to verify that objectives are being achieved.

Nonmandatory Comment - Suggestions regarding the organization or content of a document that provide helpful additions or deletions, typographical corrections, punctuation, etc., but do not constitute a significant problem or weakness. Nonmandatory comments may be incorporated at the discretion of the author.

Non-technical Document - A document that does not contain technical subject matter. A description of Yucca Mountain Project technical activities and technical documentation are defined in the Systems Engineering Management Plan, NNWSI/88-3.

Organization Chart - A graphic representation of the structure of the T&MSS organization that illustrates organizational titles, lines of reporting authority, names of individuals assigned to the organization, and remarks about the current status of the organization or individuals within the organization.

Organizational Change - A change in the functional structure or personnel of an organization, which is reflected in the T&MSS organization chart.

Organization Procedure (OP) - Applies to activities and work associated with a requirement or responsibility contained within an organizational entity such as an Assistant Project Manager organization (can be used for Department/Divisions within an APM).

Obsolete Document - An obsolete document is a document that is no longer required for use, will not be superseded, and is removed from controlled distribution.

One-over-One Approval - The approval, by signature, of the originator of a document and originator's immediate manager or higher tier manager.

Occurrence - Any deviation from planned or expected behavior or course of events in connection with any Department of Energy or Department of Energy-controlled operation if the deviation has environmental protection, safety, or health protection significance.

Position Description - Documentation of the duties to be performed and the minimum qualifying experience, education, and professional training required for a position, synonymous with job position description.

Provisional Status - An asterisk on the organization chart that indicates that procedures/controlled documents are being revised to reflect a functional change or that training is still being conducted in response to a personnel change.

Personnel Change - The addition, deletion, or transfer of an individual within an organization.

Procedure Category - Identification and numbering of procedures and instructions based on groups or categories that best satisfy task requirements. Categories are typically determined by subject, frequency, or criteria.

Procurement Record - Consists of those procurement documents (pre-award and post-award) necessary to adequately delineate procurement, requester, and Quality Assurance (QA) requirements for procurement.

Procurement Package Table of Contents - An open-ended document initiated upon generation of a PR Package which lists each document as it is added to the PR Package and Procurement Record.

Qualified Supplier List (QSL) - A controlled list of qualified suppliers determined to have the capability to supply items or services meeting the requirements of procurement documents.

Qualified Supplier List Change Notice - The form used to modify the QSL during the period between required revisions of the QSL. (e.g., additions, deletions, or adjustments to the existing list).

Qualified Supplier List Index - The index is a compilation of suppliers which features a matrix which provides a quick reference to vendor capabilities.

Qualified Supplier - A supplier which has been evaluated and determined to be capable of fulfilling the quality and technical requirements applicable to the actual or anticipated scope of work.

Quality-Affecting Items - Those manufactured or engineered strutures, system and components which could impact the safety, reliability, or operability of the repository within the context of 10CFR60 Subpart G.

Quality Assurance Program Description (QAPD) - The document that describes T&MSS' Quality Assurance (QA) Program as a participant, the organizational responsibilities for achieving and assuring quality at T&MSS, and defines how compliance with QA criteria will be accomplished for T&MSS' scope of work that is performed as a participant.

Quality Finding/Management Corrective Action Report (QF/MCAR) - A pre-formatted form used to document identified conditions adverse to quality (programmatic or implementation), significant conditions adverse to quality and their associated follow-up.

Receipt - Activities conducted upon receipt of items to check such elements as the quantity received, part number and the general condition of the freight package.

Receiving Inspection Report - The document used to identify items to be received, the inspection method(s) used to accept the item(s), the characteristics to be inspected, and the results of the inspections.

Receiving Office - Any designated receiving function approved to perform receipt inspection.

Off-site - Any designated drop shipment point, other than the standard T&MSS on-site receiving function, that has approved procedures for receipt and control of quality affecting items or services which have been reviewed and accepted by T&MSS Quality Assurance (QA).

On-site - The receiving function located at Office Services, Room 407, 101 Convention Center Drive, Las Vegas, Nevada.

Resolution - Agreement between staff member and reviewer that disposition of a mandatory comment is mutually satisfactory or has been reconciled by appropriate management personnel.

Responsible Manager - The manager to whom the assigned staff member reports administratively and has one-over-one approval authority.

Senior Manager - For the purpose of this procedure, a Senior Manager includes the Project Manager and any manager with direct reporting responsibility to the Project Manager (e.g., Assistant Project Managers, T&MSS Quality Assurance Manager, Manager of the Office of Institutional and External Affairs, and the Project Office QA Liaison).

Service - The performance of activities such as design, fabrication, inspection, nondestructive examination, investigation, site characterization, calibration, repair, installation, or other service as defined in the procurement document.

Software Requirements Specification - The Software Product resulting from the software requirements phase of the Software Life Cycle. A definition of User needs and Computer Program functions.

Standard Practice Procedure (SP) - A procedure that assigns responsibility for action to Personnel from more than one APM Organization with the purpose being to tie together the activities into one system or flow relative to an activity or task.

Stop Work Action - An action documented on a Stop Work Order (SWO) and issued as a directive to cease and desist the identified activity when, in the view of the Quality Assurance Manager and T&MSS Project Manager, continuing work could result in:

Failure to adequately control the processing, delivery, installation, modification, or operation of a nonconforming item.

Serious failure or breakdown of the T&MSS Quality Assurance Program.

Significant hazard to those items or activities that are important to safety and/or waste isolation.

Superseded Document - A superseded document is a previously released document, which has been replaced in its entirety by another controlled document.

Supplemental Audit - Audits which are conducted in addition to regularly scheduled audits. They cover specific subjects deemed necessary by the T&MSS QA Manager or Lead Auditor.

Supplier Generated Document - Those documents generated by a supplier in accordance with procurement document requirements.

Technical Coordinator (TC) - The staff member with functional responsibility for a specific DOE Order area (e.g., managers of T&MSS Quality Assurance, Radiological Field Programs, Safety and Health Compliance, Information Systems, etc.). Functional responsibility is generally determined by the current T&MSS Organization Chart.

Technical Document - A document of technical subject matter other than institutional materials developed for one-time use for specialized audiences, or financial, property control, management, or contractual information that is administrative in nature. Technical documents may include (but are not limited to) the following:

- topical reports, final reports, and letter reports;
- technical data for programmatic decisions;
- conceptual designs, schematics, block diagrams, drawings, and maps;
- any nonadministrative documents (e.g., regulatory, socioeconomic, or environmental) required or developed to support project objectives.

Testing - an element of verification for the determination of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions.

Unplanned Event - A situation that occurs outside of normal planned activities and occurrences. Examples of unplanned events include serious injury, fire, release to the environment of radioactive materials or hazardous chemical, loss or theft of hazardous or radioactive material, and other significant events which may concern the public.

Unusual Occurrence (UO) - The term UO applies only to such occurrences as are reportable to DOE under applicable DOE Orders.

Work Instruction (WI) - Implementing procedure that details all essential work steps for the worker associated with a task or function. These procedures typically include step-by-step work instructions that may or may not require performer sign-off as each step is completed.

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WBS 1.2.9.3
QA

DEC 07 1990

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YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION (YMQAD) AUDIT 90-08 OF THE SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC) QUALITY ASSURANCE (QA) PROGRAM

Enclosed is the report of QA Audit 90-08, which was conducted by the YMQAD at the SAIC facilities in Las Vegas, Nevada from November 13 through 19, 1990.

During the course of the audit, the audit team generated five Corrective Action Requests (CARs). Responses to the CARs (which were transmitted via separate letter) are due as dated on each CAR. The subject audit is considered completed as of the date of this letter; however, any open CARs will continued to be tracked until each has been closed to the satisfaction of the Audit Team Leader and the Director, YMQAD.

If you have any questions, please contact James Blaylock at (702) 794-7913 (FTS 544-7913) or Richard L. Maudlin at (702) 794-7290 (FTS 544-7290).

Donald G. Horton, Director
Yucca Mountain Quality Assurance Division

YMQAD:JB-1136

Enclosures:
Audit Report 90-08

~~9012170009~~ 2 pp.

YMP-5

DEC 07 1990

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OFFICE OF QUALITY ASSURANCE AUDIT REPORT FOR

THE AUDIT OF

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

QUALITY ASSURANCE PROGRAM

AUDIT 90-08

CONDUCTED NOVEMBER 13 THROUGH 19, 1990

Prepared by: _____ Date: 12-06-90
Richard L. Maudlin
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Approved by: _____ Date: 12/7/90
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9012170011 35 pg

ENCLOSURE

EXECUTIVE SUMMARY

The Quality Assurance (QA) qualification audit of Science Applications International Corporation's (SAIC) QA Program and quality related activities were conducted over a one-week period in the SAIC offices located in Las Vegas, Nevada.

In the opinion of the audit team, the SAIC QA Program is adequate for initiation of quality-affecting activities. However, specific elements of the QA Program were identified as either indeterminate (due to a lack of implementation), marginally effective or ineffective. The following is a summary of those elements of the SAIC QA Program judged by the audit team to be indeterminate or marginally effective.

1. Due to the lack of sufficient implementation, the effectiveness in the areas of Criteria 8 (Identification and Control of Items, Samples, and Data); Criteria 11 (Test Control); Criteria 13 (Handling, Shipping, and Storage); Criteria 14 (Inspection, Test and Operating Status); Criteria 19 (Software Quality Assurance); and Criteria 20 (Scientific Investigation Control) could not be determined.

2. In the area of Criteria 4 (Procurement Document Control), the audit team found several disconnects within the implementing procedures related to the process for the purchase of commercial grade items. Based on these conditions found in the procedures, the area was considered marginally effective.

3. In the area of Criteria 12 (Calibration), the audit team found implementation to be ineffective. This was based on SAIC's Quality Finding Reports (QFRs) which had been written to identify deficiencies found in implementation of the program procedures. The measures that have been taken by SAIC's management to date have not appeared to satisfactorily resolved the conditions.

The results of the audit documented five (5) Corrective Action Requests (CAR) that identified conditions adverse to quality found during the course of the audit investigation. The CARs related to deficiencies found in the areas of: Indoctrination and Training (1), Procurement (1), Instructions, Procedures and Plans (1), Inspection (1), and Corrective Action (1). None of the CARs generated as a result of the audit, either collectively or individually, represent a breakdown in the QA Program. What they do represent is a need for management attention to bring the SAIC QA Program into full compliance. Nine potential CARs were resolved during the course of the audit. The details regarding the CARs and potential CARs resolved during the audit are described in this report.

It is recognized by the audit team that the SAIC QA Program has only been in effect since May 21, 1990. The audit team would like to commend SAIC's management and personnel for the effort that has been put forth in establishing the QA Program.

1.0 INTRODUCTION

This report contains the results of a Quality Assurance (QA) audit of the activities conducted by the Office of Civilian Radioactive Waste Management (OCRWM). The audit was conducted at the SAIC facilities in Las Vegas, Nevada during the period of November 13, through 19, 1990.

2.0 AUDIT PURPOSE AND SCOPE

The purpose of this qualification audit was to evaluate the adequacy and effectiveness of implementation of the SAIC Quality Assurance Program associated with the Mined Geologic Disposal System (MGDS). The audit focused on the period between May 21, 1990 (approval of SAIC's QAPD) and November 13, 1990.

The scope of the audit covered those quality affecting activities associated with the MGDS. The scope of the audit encompassed a review of applicable implementing procedures and procedure implementation. In addition, technical aspects specifically related to Meteorological Monitoring and Radiological Monitoring activities were evaluated.

The following program elements were audited to assess compliance with the SAIC's Quality Assurance Program Description (QAPD), Revision 1 and associated implementing procedures:

1.0 Organization
2.0 Quality Assurance Program
4.0 Procurement Document Control
5.0 Instructions, Procedures, Plans, and Drawings
6.0 Document Control
7.0 Control of Purchased Items and Services
8.0 Identification and Control of Items, Samples, and Data
10.0 Inspection
11.0 Test Control
12.0 Control of Measuring and Test Equipment
13.0 Handling, Shipping, and Storage
14.0 Inspection, Test, and Operating Status
15.0 Control of Nonconforming Items
16.0 Corrective Action
17.0 Quality Assurance Records
18.0 Audits
19.0 Software Quality Assurance
20.0 Scientific Investigation Control

3.0 AUDIT TEAM PERSONNEL AND OBSERVERS

Responsibility	Individual
Audit Manager	James Blaylock
Audit Team Leader	Richard L. Maudlin
Auditors	A. Edward Cocoros
	Robert B. Constable
	Kerby L. Tyger
	Mario R. Diaz
	Catherine E. Hampton
	Charles C. Warren
	Albert C. Williams
Auditors-In-Training	Thomas Rogers
	Sam Smith
Technical Specialists	Diane Harrison-Giesler
	Byron Kesner
Observers	Teak Verma US Nuclear Regulatory Commission (USNRC)
	John Buckley USNRC
	Thomas Trbovich USNRC
	John Gilray USNRC
	Phillip Niedzielski-Eichner Nye County, Nevada
	Englebrecht Von Tiesenhausen Clark County, Nevada
	Susan W. Zimmerman State of Nevada

4.0 SUMMARY OF AUDIT RESULTS

4.1 Statement of Program Effectiveness

In the opinion of the audit team, the SAIC QA Program is adequate for the initiation of quality-affecting activities. However, specific elements of the QA Program were determined as either indeterminate (due to the lack of implementation), marginally effective, or inadequate as noted below:

1. Criteria 1 (Organization) -- An organizational structure has been established and procedures put in place which adequately define the organizational responsibilities. Requirements which address interfaces, stop work, and for evaluating disputes have been adequately covered in implementing procedures. This area was considered effective for the work performed to date.

2. Criteria 2 (QA Program) -- The QA Program requirements have been adequately defined in implementing procedures. The concerns that were noted in this area have been previously identified by SAIC QA on corrective action documents. Implementation that has occurred in this area to date appears to be effective.

3. Criteria 4 & 7 (Procurement Document Control and Control of Purchased Items and Services) -- The procedural system established by SAIC for the procurement of items is detailed in six (6) individual procedures. The process was found to be fragmented and difficult to follow. Due to this problem, the controls applied to procurement documents is marginally effective.

   The procedures and implementation for the controls applied to purchased items and services appeared to be effectively implemented.

4. Criteria 5 (Instructions, Procedures, Plans and Drawings) -- The process established for the generation, review, and approval of quality related documents were considered to be effective with one exception. A deficiency was identified relating to the controls applied to vendor manuals.

5. Criteria 6 (Document Control) -- This process established for the control of documents was considered to be effective with no specific deficiencies identified.

6. Criteria 8 (Identification and Control of Items, Samples, and Data) -- Effectiveness in this area is indeterminate due to the lack of sufficient implementation.

7. Criteria 10 (Inspection) -- To date, implementation in this area has been limited to receipt inspection. Based on the objective evidence reviewed, this area was considered effective.

8. Criteria 11 (Test Control) -- Effectiveness in this area is considered indeterminate due to the lack of implementation.

9. Criteria 12 (Control of Measuring and Test Equipment) -- The controls being applied in this area were found to be inadequate. SAIC has written several QFRs which identify lack of implementation of the procedures.

10. Criteria 13 (Handling, Shipping, and Storage) -- The process established for effectively controlling materials, parts, components, and samples were limited at this point in time. Due to the lack of implementation this area is considered indeterminate.

11. Criteria 14 (Inspection, Test, and Operating Status) -- Effectiveness in this area could not be determined due to lack of any ongoing activities.

12. Criteria 15 (Control of Nonconforming Items) -- The process for the control of nonconforming items was considered to be effective. The procedures appeared to adequately address the requirements of the QAPD.

13. Criteria 16 (Corrective Action) -- The controls being applied to corrective action appeared to be effective, except in one instance.

14. Criteria 17 (Quality Assurance Records) -- Evaluation of this area included the review of documentation packages. The results reflect that implementation is effective.

15. Criteria 18 (Audits) -- Evaluation of this area covered both audits and surveillances. The process for audits and surveillances was found to be adequately addressed in procedures and was found to be effectively implemented.

16. Criteria 19 (Software Quality Assurance) -- Due to the lack of a documented Software Quality Assurance Plan and no quality affecting software under development, effectiveness of this area was considered indeterminate.

17. Criteria 20 (Scientific Investigation Control) -- The effectiveness in this area was considered indeterminate.

In the area of Meteorological and Air Quality Monitoring, the audit team found that implementing procedures were in place and being used. However, the upper-tier plan, Environmental Field Activity Plan (EFAP) for Air Quality, is only in draft form. Also, data interpretation and analysis cannot be performed at this time due to the lack of an approved Software QA Program.

In the area of Radiological Monitoring, no activity has been implemented. Procedures are still in the process of being developed to prepare for when site activities commence.

4.2 Summary of Programmatic Activities

1. Criteria 1 -- The SAIC organizational structure is defined in the SAIC QAPD, Section 1. The audit revealed that the organizational structure is in place, that procedures adequately describe managerial responsibilities, and organizational changes are processed monthly. The elements of interface control as described in AP 5.19Q were found to be satisfactory. These areas were considered to be effectively implemented. The only areas where sufficient implementation has not occurred to evaluate effectiveness are resolution of disputes, stop work, and quality allegations. Objective evidence utilized to evaluate this area can be found in Enclosure 1 of this report.

2. Criteria 2 -- The broad overview requirements for the QA Program are described in the SAIC QAPD, Section 2, and respective implementing procedures. Other aspects of Criteria 2 that were evaluated included QA Controls, QA Grading, Management Assessment, and Indoctrination, Training and Qualification of personnel. Several personnel training and qualification packages, including those for audit and inspection personnel, were evaluated for compliance to such procedures as SP 1.21, SP 1.31, SP 1.42, and OP 1.5. The results of the review identified one instance where required training had not been completed prior to initiation of the activity. This was documented in CAR YM-91-012.

   The only area where implementation had not occurred to date is the conduct of readiness reviews. The only other condition that existed which had been previously documented on a SAIC's QFR was related to a procedure on the control of noncompliances as required by AP 5.27Q. It should be noted that SAIC has issued and is implementing a procedure for the control of nonconforming items (SP 1.23). Objective evidence reviewed to evaluate compliance in this area can be found in Enclosure 1.

3. Criteria 4 -- A review and evaluation of procedures SP 1.12, SP 1.25, SP 1.28, OP 1.4, and SP 1.43 were performed to verify implementation. The objective evidence evaluated for compliance to these procedures are referenced in Enclosure 1 to this

report. The results of the evaluation revealed that one purchase requisition did not provide justification for commercial grade items and two purchase requisitions for commercial grade items did not contain signatures and dates of approval. These conditions are documented on CAR YM-91-013.

The activities in this area were found to be marginally effective. This was attributed to the current program structure in which six (6) individual procedures have been issued for controlling the procurement process. It should be noted that SAIC's management concurred with this evaluation and has begun assessing changes to "streamline the system."

4. Criterion 5 -- A review was performed to verify that the OCRWM program requirements have been appropriately factored into the SAIC QAPD. This was accomplished by a review of Attachment "A" of Revision 0 to the SAIC QAPD and was found to be satisfactory. The preparation, review, and approval of Standard Practices (SPs), Operating Procedures (OPs), and Work Instructions (WIs) were found to be satisfactorily accomplished in accordance with SP 1.1 and SP 1.30. Verification of the document review process was accomplished by the review of Form Number T&MSS/098. SP 1.1 describes the process for Interim Change Notices (ICNs). Form Number T&MSS/099 was reviewed to verify implementation. Forms control is handled in accordance with SP 1.3 and SP 1.7. The results of the review of criteria were found to be satisfactory.

5. Criteria 6 -- Documents are controlled in accordance with the requirements specified in SP 1.34 and SP 1.35. Objective evidence in the form of a record review package for the review of the SAIC QAPD was selected to verify compliance. The review and issuance of the QAPD were found to be satisfactory. Also Form Numbers T&MSS/029, 030, and 033 were reviewed to determine compliance. Only one discrepancy was noted in this area. There does not appear to be any procedures in place which describe the process for receipt and control of vendor manuals. This is documented in CAR YM-91-014.

6. Criteria 7 -- A review of procedures SP 1.12, SP 1.25, SP 1.28, SP 1.43, OP 1.3, OP 1.4, OP 1.7 and an evaluation of the process was performed to verify implementation. A review of Procurement Documents and Supplier Qualification Packages identified in Enclosure 1 was performed to verify implementation. The results of the review of objective evidence indicate effective implementation in this area. It is recommended by the audit team that suppliers of "Commercial Grade Items" be controlled separate from those supplying quality-related items and/or services.

7. Criteria 8 -- Activities in this area have been very limited at this point in time. AP 6.3 describes the process for identification of items. Air quality monitoring filter samples are controlled by inking in a number on the filter paper. The numbers are then entered on a Particulate Sampler Data Record (PSDR), Form Number T&MSS/101/2. The filters and PSDRs are transferred to the SMF every 90 days. The activities evaluated were found to be satisfactory.

8. Criteria 10 -- Inspection is performed in accordance with SP 1.12 and SP 1.25. To date, implementation of these criteria has been limited to receipt inspection. To verify implementation, a review of applicable procedures, Receipt Inspection Reports, and other related evidence as noted in Enclosure 1 was used. There was only one deficiency noted in this area. The problem noted was "Hold For Test" tags have not been used where required. This condition has been documented on CAR YM-91-015.

   Other than the one condition noted above, implementation in this area was considered effective.

9. Criteria 11 -- SAIC test control is limited to equipment and instruments that apply to engineered items only. As of this date, there are no plans to acquire any engineered equipment or instruments. Purchases have been only off the shelf commercial grade items.

10. Criteria 12 -- The requirements for Calibration are specified in SP 2.4. During the course of the audit it was observed that the requirements of the procedure were not being appropriately implemented. As a result, it was identified to the audit team that SAIC had written several QFRs which documented this condition. Since a review of the QFRs revealed that they adequately addressed the audit teams concerns, no CAR was written. Implementation in this area was considered inadequate.

11. Criteria 13 -- Procedures which specify requirements for the shipping, handling and storage of purchased items are described in SP 1.28, SP 1.12, SP 1.25, WI-RM-113, WI-RM-114, and WI-RM-141. There was only one piece of equipment found in storage. This equipment was identified as "NUMELEC" NU114 ALPHA SPECTROMETER. No problems were observed in this area. Due to the lack of sufficient implementation, this area was considered indeterminate.

12. Criteria 14 -- The requirements for inspection and test are defined in SP 1.25. The only activities that have occurred to date were those described under Criteria 10. No testing has been performed to date. This area was considered indeterminate.

13. Criteria 15 -- The control of nonconforming items is accomplished in accordance with SP 1.23. A review of the objective evidence referenced in Enclosure 1 was performed to verify implementation of the requirements in SP 1.23. The results revealed that compliance in this area was satisfactory.

14. Criteria 16 -- The process for Corrective Action is specified in SP 1.22 and SP 1.37. No activity has occurred in the area of Stop Work. Implementation of the requirements of SP 1.37 was accomplished by the review of evidence referenced in Enclosure 1 of this report. The results of the review noted a deficiency regarding the evaluation of QFRs for significance. This condition was documented on CAR YM-91-016.

    Aside from this one deficiency, implementation was considered satisfactory. The audit team would like to make a recommendation which applies to both Criteria 15 and 16. The logs currently used by the SAIC Quality Assurance Department are manual. These logs do not allow for effective statusing. It is recommended that SAIC develop and implement a computerized system of logging. A computerized logging system will increase the effectiveness of and responsiveness to the corrective action system. In addition to providing input for the trending process, computerized logs will allow the QA staff to status management via periodic reports.

15. Criteria 17 -- The processing and control of records are accomplished in accordance with SP 1.36 and WI-REC-001. Objective evidence as noted in Enclosure 1 of this report was used to verify compliance. The results of the review in this area revealed that implementation was satisfactory.

16. Criteria 18 -- Activities related to the performance of audits and surveillances are addressed in procedures OP 1.1, OP 1.2, OP 1.5, and SP 1.21. Audit and surveillance report as noted in Enclosure 1 were reviewed to verify compliance with the above procedures. The results revealed that compliance was satisfactory.

17. Criteria 19 -- To date there has been no software developed to perform quality related activities. SAIC does not have an approved SQAP as of the date of this audit. Subsequently, no implementation could be verified in this area.

18. Criteria 20 -- A review and evaluation of planning documents were not performed at this time due to the fact that no planning documents have been prepared since the approval of the SAIC QA Program. The planning documents which address the areas of Meteorological, and Radiological Monitoring are the responsibility of the Yucca Mountain Project Office for control. The only planning document within SAIC control is the

Environmental Field Activity Plan (EFAP). In a review of this document it was found that the document was issued only in "Draft" form. This problem has been previously identified on Standard Deficiency Report (SDR) 398.

Limited work has occurred in the meteorological and air quality area since the approval of the SAIC QA Program. What work has occurred, compliance with instructions was found to be satisfactory with one exception. This condition was resolved prior to concluding the audit. As of this date, the only meaningful work that has occurred in the area of Radiological Monitoring is the preparation of Work Instructions. As a result of the audit, implementation of procedures for the control of activities related to Air Quality, Meteorological, and Radiological Monitoring is considered indeterminate.

4.3 Summary of Technical Activities

1.0 Meteorological/Air Quality Monitoring

The Air Quality/Meteorological Monitoring Programs were technically reviewed for consistency with the T&MSS Quality Assurance Program Description (QAPD), the Environmental Field Activity Plan (EFAP) for Air Quality, the Meteorological Monitoring Plan, and the implementing Work Instructions.

Only those T&MSS documents dated between May 21, 1990, and the present (the time frame of the audit) were considered in support of the technical evaluations presented in this summary.

Activities conducted under both the Meteorological and the Particulate Sampling programs are generally in accordance with approved Work Instructions, the EFAP-Air Quality, and the Meteorological Monitoring Plan.

However, as specified in SDR No. 398, the EFAP-Air Quality is still not approved (i.e., not a controlled document). This open SDR should be remedied as soon as possible, since many of the requirements of sample design and frequency (specified in 40 CFR 58) are incorporated into the EFAP but not into the lower-level implementing Work Instructions.

40 CFR 58, Appendix B, specifies 13 operational procedures for PSD Air Monitoring Programs. A summary of the audit's technical results and a list of the objective evidence examined is included with the description of the operational procedure:

1. Selection of methods, analyzers, or samplers: Adequate - but could only be evaluated for the particulate sampling program and the meteorological instrumentation. This technical evaluation is based on an examination of the equipment specification list, status reports, the equipment maintenance and repair records, and completed particulate sampler acceptance test forms.

2. Training: Adequate - Personnel are qualified for their assigned positions, and training records are complete. This technical evaluation is based on a review of training records of environmental monitoring program personnel (Ms. Monica Dussman, Task Manager; Mr. Joe Conway, Field Technician; Mr. Peter Luthiger (closed file); and Mr. Steve Cameron), and interviews with Ms. Dussman.

3. Installation of Equipment: The required acceptance inspection, installation and calibration procedures were completed for the particulate samplers and the meteorological monitoring equipment. Gaseous pollutant monitoring equipment has not yet been installed.

   For the meteorological monitoring and particulate sampling programs for this technical evaluation were based on an examination of complete Particulate Sampler (or other appropriate) Test Forms, and entries in the Air Quality Logbook, which is kept in Building 4522, Area 25, at the Nevada Test Site (see WI-MET-001 for the appropriate T&MSS form listing).

4. Selection and control of calibration standards: Could not be evaluated - gaseous pollutant monitoring program not in effect.

5. Calibration: Addressed under programmatic Criteria 12. Certain calibration requirements for meteorological instrumentation were verified during the field portion of the audit on November 15, 1990 (e.g., placement of the North directional stake for wind direction measurements, uses of calibration tags, etc.). In addition, Particulate Sampler Calibration Check Forms (T&MSS/105/2) were reviewed for the particulate sampling program.

6. Zero/span checks and adjustments of automated analyzers: Not yet applicable nor evaluated.

7. Control checks and their frequency: Adequate. This technical evaluation is based on a review of Calibration Documentation forms (for both Particulate and Meteorological instruments). Control checks for the particulate monitoring program were evaluated by reviewing the filter cartridge

preparation procedures with the Field Technician and examination of the Filter Weight Log Book (T&MSS/104/2), and examination of calibration records for the balance used in weighing the filters.

8. Control limits for zero, span and other control checks, and respective corrective actions when such limits are surpassed: Not yet applicable nor evaluated.

9. Calibration and zero/span checks for multiple range analyzers: Not yet applicable nor evaluated.

10. Preventive and remedial maintenance: Adequate - records indicate that preventive maintenance occurs on a regularly scheduled basis, and remedial maintenance occurs in a timely fashion. The technical evaluation was based on a review of the Preventive Maintenance Log, Preventive Maintenance Status Reports, and interviews with the Task Manager and Field Technician.

11. Recording and validating data: Adequate - records indicate that meteorological data are recorded on tape with backup. Once data are transported from the site to the Project Office, an initial check is made to ensure that they are reading correctly. This technical evaluation is based on an interview with the Task Manager and Mr. Grover Prowl.

12. Data quality assessment (precision and accuracy): Instruments are periodically calibrated and the monitoring systems are independently audited on a regularly scheduled basis. However, because neither statistical summaries nor data interpretation is being performed, it is difficult to assess data quality.

    Use of the In-house Meteorological Monitoring Station System Audit Form (T&MSS/134/2) became effective 9/90. This program is currently in place, but a scheduled audit has not yet occurred. Although an assessment of data quality proved inconclusive, the prescribed independent calibration of instruments is being performed and noted in the Air Quality Logbook.

13. Documentation of quality control information: Adequate. Addressed by examining entries in the Air Quality Log Book and the above mentioned T&MSS forms.

At this time it is premature to draw any conclusion as to the effectiveness of the Air Quality and Meteorological Monitoring Programs. The installation of the gaseous pollutant monitoring network is necessary to complete the ambient air quality monitoring effort prescribed in the EFAP-Air Quality.

Effectiveness of these monitoring programs can only be judged through a review of the collection and evaluation of data. Only raw data from particulate samplers and the meteorological monitoring program are being collected at this time. All data summary/ interpretation activities are currently on hold pending approval of the Software QA Plan.

Finally, one of the primary goals of these programs is to provide data inputs to the radiological monitoring program. Specifically, these inputs are used in calculations of a concentration parameter for assessing radiological impacts. Because software development has not occurred and statistical and data interpretation activities are on hold, dispersion modeling using the collected air quality and meteorological data is on hold. Consequently, the effectiveness of these programs is indeterminate at this time.

2.0 Radiological Monitoring

As a result of this audit of the technical activities based on the Radiological Monitoring Plan (RMP), Rev. 0, there were no deficiencies identified. However, there are two recommendations which are described later in this section. In general, there appeared to be a good attitude by the technical personnel in meeting quality assurance objectives. As of this date, there has been little site activity. The primary emphasis has been placed on procedural development so that when activities commence, the program is in place. As a result, effectiveness could not be evaluated due to the lack of implementation of the technical activities.

Objective evidence examined to during the course of the technical evaluation listed in Enclosure 1 of this report. Based on the objective evidence evaluated and interviews with staff, the following conclusions are noted:

1. The technical staff appeared to be qualified for the work that they were doing based both on records and responses provided to technical questions. Personnel appeared to be knowledgeable of procedural requirements.

2. The technical procedures were adequate, although effectiveness could not be evaluated due to lack of implementation.

3. The RMP (a Project Office document) includes the Scientific Investigation Plan for radiological monitoring activities. The RMP is also a support document for scientific investigation plans which produce nonradiological data to support radiological activities which are prepared by other participants. The Operation Procedures and Work Instructions implement the RMP. The interface between the SPs and WIs and the RMP could be strengthened.

Recommendations for the technical activities based on the Radiological Monitoring Plan are as follows:

1. Review and evaluate the planned interface between NRAD/EPA and SAIC, and the training of NRAD/EPA personnel who will be involved with the data collection beginning January 1991. (Prior to start of data collection activities.)

2. Since the RMP is a Project Office document, it should be a management document containing the requirements for the conduct of the Radiological Monitoring Program, not a technical document specifying "how" to perform the monitoring. The RMP should be rewritten as a requirements document at the Project Office level and SAIC should prepare an implementation document (e.g., Study Plan) describing how those requirements will be satisfied and implemented by the participant. The WIs and SPs would then reference the implementing document. This would strengthen the interface between the RMP and the WIs and SPs.

4.4 Summary of Audit Findings

A total of five (5) CARs were generated as a result of this audit. Information copies of the CARs are attached as Enclosure 3 to this report. A synopsis of CARs is presented in Section 6.0 of this report. Additionally, included in this report is a brief summary of potential CARs that only required remedial action and were resolved during the audit.

5.0 AUDIT MEETINGS

5.1 Pre-audit Conference

A pre-audit conference with key staff was conducted at 9:00 a.m. at the SAIC facilities in Las Vegas, Nevada, on November 13, 1990. The purpose, scope, and proposed agenda for the audit were presented and the audit team and observers were introduced. A list of those attending is attached as Enclosure 2.

5.2 Persons Contacted During the Audit

(See Enclosure 2 for a list of those persons contacted during the audit.)

5.3 Post-audit Conference

The post-audit conference was conducted at 3:00 p.m. on November 19, 1990 at the SAIC facility in Las Vegas, Nevada. A synopsis of the CARs identified during the course of the audit were presented to SAIC management and staff. A list of those attending the post-audit conference is attached as Enclosure 2.

5.4 Audit Status Meeting

Audit status meetings were held with the SAIC TPO and his staff and the SAIC QA Manager each morning of the audit. A status of how the audit was progressing and identification of potential deficiencies and/or comments were discussed.

6.0 SYNOPSIS OF CORRECTIVE ACTION REQUESTS AND POTENTIAL CARs CORRECTED DURING THE AUDIT

6.1 Corrective Action Requests

YM-91-012 Personnel in the Radiological Field Program are performing quality affecting activities without receiving some of the required training.

YM-91-013 Purchase Requisitions for commercial grade items do not, in all cases contain the justification and/or the signature and date of the APM.

YM-91-014 No procedure(s) exist for the control of submittal, identification, distribution and maintenance of vendor manuals.

YM-91-015 A review of procurement packages revealed that "Hold for Test" tags had not been utilized as required by procedure for items that have been received, inspected, and require testing.

YM-91-~~015~~ 016 SAIC Quality Finding Reports (QFRs) identified conditions which by definition should have been designated as serious or significant conditions.

6.2 Concerns Corrected During the Audit

1. Checklists of surveillance SR-90-007 did not contain source information related to the attributes checked during the surveillance and the results, (i.e., sat, unsat, N/A), as required by procedure OP 1.2. The checklist in question was reviewed by SAIC staff and the appropriate information was entered to correct the observation.

2. The designation of a M&TE custodian by the T&MSS Assistant Project Manager and the QA Manager had not been accomplished as required by procedure SP 2.4, para. 4.0. Prior to concluding the audit, a M&TE custodian was named in order to initiate, administer and coordinate the M&TE program.

3. QA records returned to the record source are required to be protected after work hours as required by procedure SP 1.36, para. 5.4.1. A record package was returned to the Manager of the Radiological Field Programs Department on Friday, November 16, 1990. The auditor requested documented evidence to be produced after the weekend to attest that the QA records package was protected accordingly and such document was provided on November 21, 1990.

4. The SAIC Audit Schedule did not contain the organizations that were going to be audited as required by procedure OP 1.1, para. 5.1.2.d. A revised schedule was issued November 16, 1990 containing this type of information.

5. Contrary to the requirements of WI-AQ-001, site logbook entries covering maintenance activities were not being transmitted to the Local Records Center (LRC) within 10 working day of completing the entry. Prior to completion of the audit, WI-AQ-001 was revised to indicate that site logbooks were records rather than each entry. Also requirements were established which require that site logbook be submitted to the LRC every ninety days. All past logbook entries have been submitted to the LRC.

6. It was noted during the audit that Purchase Order No. 14-910054 was "voided" after issuance, however, the related procedure, SP 1.28, Rev 2, only addresses voiding of a Purchase Requisition. ICN No. 1 was approved and issued on 11/19/90 revising SP 1.28 to address the process for voiding Purchase Orders.

7. At the time of the audit, procedural controls did not exist which would assure that procurement activities would terminate when a supplier was removed from the Qualified Suppliers List (QSL) subsequent to issuance of the purchase order. As a result, Purchase Order No. 14-910054 remained in effect until 11/09/90, even though the supplier was removed from the QSL on 09/25/90. ICN No. 1 was approved and issued on 11/19/90 revising SP 1.28 to

provide controls for terminating suppliers who have active purchase orders and have been removed from the QSL. In addition, the audit team determined that no services or items were procured from the affected supplier after their removal from the QSL.

8. The procedure for Receipt Inspection, SP 1.25, Rev 2, specifies that a Nonconformance Report (NCR) will be generated for damaged items identified during receipt inspection. Receipt Inspection Report (RIR) No. 14-910062-1A identified "creases" found in the air filters received. However, this condition was documented and accepted on the RIR instead of being documented on an NCR as required. ICN No. 1 was approved and issued on 11/19/90 revising SP 1.25 to provide instructions and parameters for identifying and accepting these conditions on an RIR in lieu of an NCR.

9. Based upon the requirements of SP 1.23, several deficiencies were noted in the area of "Nonconformance Control." These deficiencies included: (a) inadequate logging system, (b) application of inappropriate hold tags resulting in the exclusion of information, and (c) lack of adequate flow down from the procedure to the NCR form. Prior to the conclusion of the audit, all of the noted conditions had been satisfactorily corrected.

7.0 REQUIRED ACTIONS

Responses to each CAR (delineated in Section 6.0) are due within the time frame stated in Block 10 of each CAR, as detailed in the CAR transmittal letter. Upon responses, and satisfactory verification of all remedial and correction actions, the CARs will be closed and SAIC will be notified (by letter) of the closure.

ENCLOSURE 1

LIST OF OBJECTIVE EVIDENCE

CRITERIA 1

1. T&MSS Personnel Organization Status as of 11/01/90

2. Interoffice Memos, Roberts to Bostian to T&MSS staff dated 08/01/90, 09/05/90, 10/08/90, and 11/06/90

3. T&MSS/034/1 T&MSS Organizational Change dated 10/02/90

4. T&MSS/035/1 T&MSS QA Classification dated 07/27/90

5. T&MSS/036/1 T&MSS Job Change effective 07/01/90

6. IMOUs 66003, 66015, and 63019

CRITERIA 2

1. Basic Requirements Matrix Document, Rev 4, dated 10/22/90 for OCRWM QARD

2. Basic Requirements Matrix Document, Rev 4, dated 10/22/90 for NQA 1, 1989

3. Basic Requirements Matrix Document, Rev 2, dated 10/15/90 for NRC Standard Review Plan

4. DOE Letter C. Gertz to TPOs dated 03/15/90, subject, "Implementation of NUREG 1318 Procedures ... Procedures AP 6.17Q and AP 5.28Q"

5. QA Grading Report YMPO-EDD002, Rev 0

6. QA Grading Report YMPO-RSE-003, Rev 0

7. QA Grading Report YMPO-QAG001, Rev 0

8. Interoffice memo, J.B. Harper to Distribution, dated 06/07/90, subject, "Assessment"

9. Management Assessment Plan submitted by Assessment Leader, W.A. Ruhlman and approved to J. Harper and J. Nelson

10. Letter J. Harper to J. Nelson, Serial JBH:sb:M90-0422, dated 06/21/90

11. Personnel records for twenty six (26) persons including six (6) Auditors/Lead Auditors identified in the report titled, "Summary of Programmatic Activities":

J. Nelson	W. McNabb	J. Harper
J. Doyle	K. Gilkerson	S. Nolan
G. Fasno	W. Jacobs	K. Shank
C. Turn	M. High	C. Roberts
M. Smith	K. Moore	J. Ryan
W. Clark	J. Conway	G. Powell
M. Dussman	D. Rhode	K. Hodges
A. Temple	K. Wirtz	J. Carlson
C. Roe	G. Williams	A. Kirk
J. Narron	C. Tung	C. Roberts

12. QFR Status Report, SDR Status Report, NCR Status Report, Surveillance Report Status Log, and Internal Audit Log

CRITERIA 4

1. Purchase Requisition No's 5581268, 5591128, 5515997, 5557084, 5580891, 5581271, 5591116, and 5581020

2. Purchase Order No's 14-910055, 14-910062, 14-910074, 14-910075, 74-910080, 14-910076, 14-910056, 14-910068, 14-910054, and 14-910085

3. Qualified Suppliers Lists 90-03, Rev 9 and 90-04, Rev 4

4. Reviewed the following vendors from the QSL: Amersham, Whatman Lab, Wedding & Associates Inc., Princeton Gamma Tech.

CRITERIA 7

1. Purchase Order No's 14-910055, 14-910062, 14-910074, 14-910075, 74-910080, 14-910076, 14-910056, 14-910068, 14-910054, and 14-910085

2. Certificate of Conformance for P.O. No 14-910055 (Traceable to Solution #R9/50/61 and R9/50/62)

3. Certificate of Conformance for P.O. No 14-910074 (Traceable to the PO)

4. QSL 90-03, Rev 9 and 90-04, Rev 4
   Change Notices to QSL:
   10/17/90 - Added "Belfort" for calibration services (Affected QSL 90-04, Rev 0)
   10/26/90 - Added "Aartec" to QSL 90-04, Rev 1
   Qualified Supplier Evaluation Files:
   General Physics, Ametec, Amersham, Belfort Instrument, John Fluke, Ringold Metrology, TMA/Eberline, Pacific Northwest Lab, and Rotronics Instrument Corp.

CRITERIA 10

1. Purchase Requisition No's 5581268, 5591128, 5515997, 5557084, 5580891, 5581271, and 5559997

2. Purchase Order No's 14-910055, 14-910062, 14-910074, 14-910076, 14-910028, 14-910054, 14-910065, 14-910078

3. Receipt Inspection Reports (RIR) No's 14-910028-1A, 14-910062-1A, 14-910054-1A, 14-910050-1A, 14-910065-1A, 14-910065-1B, 14-910065-1C, 14-910074-1A, 14-910076-1A, 14-910078-1A

CRITERIA 15

1. NCR Log T-QA-093 dated 06/90

2. NCR No's 90-001, 90-002, 90-003, 90-004, 90-005, 90-006, 90-007

3. Hold Tag No's 90-001 (1), 90-002 (1,2,3, and 4), 90-003 (1,2, and 3)

CRITERIA 16

1. T&MSS Stop Work Log

2. QA Deficiency Reporting System Status Log

3. Quality Finding Reports (QFRs) 90-001, 90-004, 90-006, 90-010, 90-013, 90-014, 90-15, 90-029

CRITERIA 17

1. Database printouts: TM-0154 dated 07/30/90, TM-0237 dated 10/03/90, TM-0293 dated 11/12/90, TM-0141 dated 07/17/90, and TM-0183 dated 08/16/90

2. Records Package Segments: TM-0019 dated 06/05/90, TM-0027 dated 06/08/90, TM-0108 dated 06/15/90, TM-0080 dated 06/18/90, TM-0089 dated 06/15/90, and TM-0094 dated 06/19/90

3. LRC Access Authorization List dated 09/20/90

4. Two (2) hour fire rated safe UL Rating Class 350

5. Record Packages:
   14-91-0028-65 Purchase Order/Belfort Instruments
   NNA. 900830.0068 dated 08/27/90 AP 2.4 Rev 0
   NNA. 900821.0003 dated 08/15/90 BTP-SMF-006
   PO-14-9100-62 Purchase Order-In Process

6. Final Reports: NNA 900808.0038

CRITERIA 18

1. Audit Schedule dated 11/16/90

2. Audit Record Packages for audits: A-90-001, A-90-002, A-90-003, and A-90-004

3. Surveillance Records Packages for surveillances: SR-90-003 and SR-90-006

CRITERIA 20

1. Site Logbook

RADIOLOGICAL MONITORING

1. "Radiological Monitor Instruction Manual."

2. Table of Contents/Revision Control Sheet, effective 9/25/90, which lists planned and completed procedures.

3. "Purchase Requests Status," as of 9/28/90.

4. "Radiological Monitoring Instruction Manual," controlled copy no. 27, Rev. 0, dated 8/24/90, RM 228, Valley Bank Center.

5. "Radiological Monitoring Instruction Manual," controlled copy no. 8, Rev. 0, dated 8/24/90, located at building 4522, NTS.

6. "Radioactive Source Log," located in the Radioactive Materials Cabinet, Health Physics Trailer, NTS.

7. "Source Material Inventory," data sheet, located in the Radioactive Materials Cabinet, Health Physics Trailer, NTS.

8. NWBETA Coding Form, dated 4/20/89, received from EPA November 1990.

9. "PU in Soil Samples," dated 8/7/86, received from EPA November 1990.

10. LTR (10/8/90): Sorensen to REECo, RAMATROL, transmitting source leak check results; CDS. YMS:L90-4593, with 2 enclosures. Encl. 1: 4th Quarter Leak Check Forms; Encl. 2: 4th Quarter RAMATROL Analysis.

11. LTR (8/30/90): Sorensen to REECo, RAMATROL, transmitting source leak check results; SWW. YMS:L90-4184, with 4 enclosures. Encl. 1: 2nd Quarter Leak Check Forms; Encl. 2: 2nd Quarter RAMATROL Analysis; Encl. 3: 3rd Quarter Leak Check Forms; Encl. 4: 3rd Quarter RAMATROL Analysis.

12. Receipt Inspection form, T&MSS/040/2, RI#000-093090, for receipt of Ra-226 solutions R95062 and R95061.

13. Amersham Certificates of Calibration for receipt of Ra-226 solutions R95062 and R95061.

14. Packing Sheet for receipt of Ra-226 solutions R95062 and R95061.

15. RAMATROL Incoming Radioactive Material Checklist for receipt of Ra-226 solutions R95062 and R95061.

16. Receipt Inspection records for Cs-137 source, bar code no. 03047.

17. WI-RM's-101, 104, -105, -113, -116, -139, -141, -142, -143, -150, -151, -153, -197, 18), -312, -702. SP's 1.10, 1.12, 1.30.

ENCLOSURE 2

AUDIT 90-08
SAIC QUALIFICATION AUDIT

PERSONNEL CONTACTED

NAME	ORGANIZATION	TITLE	CONTACTED PRE-AUDIT	CONTACTED DURING AUDIT	CONTACTED POST-AUDIT
Andrews, William R.	SAIC/T&MSS	Transp Dept Mgr	X		
Ashton, John D.	SAIC/T&MSS	Sys Analysis Sftwr	X		
Beall, Ken	SAIC/T&MSS	Actng APM/Proj Mgr	X		
Bean, Elaine	SAIC/T&MSS	Supv/Doc Control	X		
Beck, Colleen	DRI	Archaeology	X		
Beers, R. H.	SAIC/T&MSS	Acting APM	X		X
Blaylock, James	DOE/YMP	QA Engineer	X		X
Blue, Jacalie	SAIC/T&MSS	Info Sys Mgr	X		X
Bostian, R. S.	T&MSS/APM	APM	X	X	X
Buckley, John T.	NRC	QA Engineer	X		
Caldwell, Henry H.	T&MSS/P&O	Staff Advisor	X	X	X
Caldwell, Joseph R.	MACREC	QA Consultant	X		
Cardenas, Elsa B.	SAIC/T&MSS	Clerk			X
Chandler, D. K.	SAIC/T&MSS	Asst Project Mgr	X	X	X
Clark, James E.	SAIC/T&MSS	QA Liaison	X		
Cocoros, Anthony E.	MACTEC	Sr QA Specialist	X		X
Constable, Robert B.	DOE/YMP	QA Engineer	X		X
Conway, Z. Joseph	SAIC/T&MSS	Site Technicial		X	
Davis, Allen F,	SAIC	Lakeville, MD		X	
Diaz, Mario R.	DOE/YMP	QA Engineer	X		X
Dunham, Joseph F.	SAIC/T&MSS	Staff Advisor	X		X
Dussman, Monica M.	SAIC/T&MSS	Dept Mgr EFPD	X	X	X
Ebner, Hans	SAIC/T&MSS	Manager DRC	X	X	X
Estella, John W.	SAIC/T&MSS	Staff Advisor	X	X	X
Fasano, Gregory	SAIC/T&MSS	Senior Scientist			X
Foley, Michael I.	T&MSS/PM	Staff Advisor to PM	X		X
Frey, William	SAIC/T&MSS	User Svcs Mgr	X		X
Gilkerson, K. O.	SAIC/T&MSS	QA Verification	X	X	X
Gilray, John	NRC	On-Site Resident	X		X
Gonzales, Roger	SAIC/T&MSS	Dep APM Res Mgr	X	X	X
Hampton, Catherine E.	DOE/YMP	QA Specialist	X		X
Harper, James B.	T&MSS/QA	QA Manager	X	X	X
Harris, Michael W.	SAIC/T&MSS	Mgr/Reg Studies	X	X	
Harrison-Giesler, D.	DOE/YMP	Materials Enginer	X		X
Hedden, Judith A.	SAIC/T&MSS	Personnel Admin	X		
Hodges, Kristi	SAIC/T&MSS	QA Specialist		X	
Horton, Donald G.	DOE/YMP	Director, OQA	X		X
Johnson, Kent B.	SAIC/T&MSS	QA Program Leader	X	X	X
Johnson, S.	SAIC/T&MSS	Personnel Admin	X		
Kamna, Marilyn	SAIC/T&MSS	Art Advisor	X		
Kesner, Byron T.	MACTEC	Environmental Spec	X		X
Kimble, Robert L.	SAIC/T&MSS	Regional Studies	X		X
King, Jerry L.	SAIC/T&MSS	Asst Project Mgr	X		X

NAME	ORGANIZATION	TITLE	CONTACTED PRE-AUDIT	CONTACTED DURING AUDIT	CONTACTED POST-AUDIT
Kirk, Ann R.				X	
Lee, Lynda J.	T&MSS/RMD	Supv MDC	X	X	X
Low, James	SAIC/T&MSS	Dept Mgr Info Sys	X		X
Marchand, Robert	SAIC/T&MSS	Mgr Sys & Comm	X		
Martin, Jennifer G.	SAIC/T&MSS	Property Coord		X	
Matthews, S.	SAIC/T&MSS	Config Mgr		X	
McCann, Edward W.	SAIC/T&MSS	Deputy Mgr Env	X	X	X
McNabb, William V.	SAIC/T&MSS	Deptuy Project Mgr	X	X	X
Narron, J. R.	SAIC/T&MSS	QA Specialist		X	
Nelson, John H.	T&MSS/TPO	Project Manager/TPO	X	X	X
Niedzielski-Eichner, P.	Nye County	Observer	X		
Niles, Penny A.	SAIC/T&MSS	Integration	X		
Nolan, S.	SAIC/T&MSS	QA Specialist		X	
Pane, T.	SAIC/T&MSS	Records Mgt Assist		X	
Powell, G.	SAIC/T&MSS	Meterologist		X	
Prince, J. K.	SAIC/T&MSS	Health Physics	X	X	X
Rhode, David	DRI	Asst Res Prof	X		X
Rodgers, Thomas E.	CER	QA Engineer/AIT	X		X
Ryan, James F.	SAIC/SEES	Procurement	X	X	
Smith, Samuel R.	Weston	QA Engineer	X		
Sorensen, Dennis C.	T&MSS/RFPD	Mgr RFPD		X	X
Spangler, Elaine L.	SAIC/T&MSS	Tech Coordinator	X		X
Spink, John	SAIC	Lakeville, MD	X		
Standish, Paul N.	SAIC/T&MSS	Engineer			X
Statler, Jan	T&MSS/RMD	Manager RMD	X		
Stephenson, Alan R.	SAIC/T&MSS	Gen Serv Dept Mgr		X	
Tacelli, Arlene	SAIC/T&MSS	Supv LRC	X	X	
Tappen, Jeffrey	SAIC/T&MSS	Engr Transp Dept	X		
Taylor, Charles	SAIC/T&MSS	QA Specialist		X	
Tiesenhasuen, E.	CCCP	Observer	X		
Therien, John	SAIC/T&MSS	QA Intergration	X		X
Thomas, Wanda F.	SAIC/T&MSS	Resource Mgmt	X		X
Tompkins, A.	SAIC/T&MSS	Radiological Spec		X	
Trbevich, Thomas C.	NRC	QA Engineer	X		
Tyger, Kerby L.	MACTEC	Sr QA Spec	X		X
Verden, Janice D.	SAIC/T&MSS	Dept. Mgr. RMD	X	X	X
Verma, Tilak	NRC	QA P.M.	X		
Voegele, Michael D.	SAIC/T&MSS	Tech Dir	X		
Warren, Charles C.	MACTEC	Sr QA Spec	X		X
Weaver, Jeff	T&MSS/R&LS	Dep Asst Proj Mgr	X		X
Weston, Jim	SAIC/T&MSS	Deputy APM	X		X
Williams, Albert C.	DOE/YMP	General Engineer	X		X
Witham, D.	SAIC/T&MSS	Sr Radio Chemist	X		
Wolverton, K.	SAIC/T&MSS	QA Engineer		X	

ENCLOSURE 3

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: YM-91-012
DATE: 11/27/90
SHEET: 1 OF 2
QA
WBS No.: N/A

CORRECTIVE ACTION REQUEST

1 Controlling Document QAPD	2 Related Report No. Audit 90-08
3 Responsible Organization SAIC	4 Discussed With D. Sorensen

10 Response Due 12/27/90	11 Responsibility for Corrective Action D. Sorensen	12 Stop Work Order Y or N N

5 Requirement:

QAPD, Revision 1, Paragraph 2.2.11 states in part, "T&MSS personnel assigned to perform activities that affect quality shall receive appropriate training prior to performing work."

SP 1.31, Revision 2, Paragraph 5.2.2 states in part, "Responsible manager assigns training (per T&MSS 027/4) the individual is expected to accomplish when it has been determined they will be performing quality affecting work. This will be done prior to execution of the initial qualification evaluation."

Paragraph 5.3, Training on New and Revised Procedures. Paragraph 5.3.1 and 5.3.2 states in part, "As new procedures are issued, determine which staff members, if any, should be trained on the procedure. As revised procedures are issued, determine which staff members, if any, must be trained on the revisions: Training shall be assigned if the procedure that has been

6 Adverse Condition:

Personnel in the Radiological Field Program Department are performing quality affecting activities without receiving some of the required training as determined by the initial training form or as determined by additional training requested by the responsible manager on September 11, 1990. Furthermore, the training program at this time does not require to document the revision and/or changes affecting the documents used for training. Therefore, it is very difficult in some cases to verify or attest to this information.

7 Recommended Action(s):

8 Initiator M. R. Diaz Maria Diaz 11/16/90	9 Severity Level - 1☐ 2☐ 3☒	13 Approved By: QQA James Blanford Jr. 11/21/90

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: QQA _____

OFFICE OF CIVILIAN
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

CAR NO.: YM-91-012
DATE: 11/27/90
SHEET: 2 OF 2

CORRECTIVE ACTION REQUEST
(continuation sheet)

5 Requirements (continued)

revised was previously identified as part of the employee's required training. In such a case, the training must be completed prior to the performance of quality affecting work using the procedure, or within 30 calendar days, whichever is sooner."

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: YM-91-013
DATE: 11/27/90
SHEET: 1 OF 1
QA
WBS No.: N/A

CORRECTIVE ACTION REQUEST

1 Controlling Document	2 Related Report No.
SP 1.43, Revision 0 (8/10/90)	Audit 90-08

3 Responsible Organization	4 Discussed With
SAIC	J. Harper

10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N
12/27/90	J. Harper	N

5 Requirement:

1. SP 1.43, Section 5.1 requires the identification and justification for commercial grade items to be delineated on a document suitable for attachment to the Purchase Requisition.

2. SP 1.43, Section 5.2.2 requires the requester's APM to "indicate approval and verification of the statements made by signing and dating the description document."

6 Adverse Condition:

1. Purchase Requisition #5602921 for commercial grade items does not have the justification attached as required.

2. Justifications for commercial grade items were attached to Purchase Requisitions #5544376 and #5591128. However, the justifications were not signed and dated by the APM.

7 Recommended Action(s):

1. Review affected Purchase Requisitions (in addition to the above) and provide justifications as required.
2. Provide procedural changes and/or training to prevent recurrence.

8 Initiator	Date:	9 Severity Level -	13 Approved By:	Date:
K. L. Tyger Kathy L. Tyger	11/19/90	1☐ 2☒ 3☐	OQA James Blaylock jr	11/21/90

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted:	17 Closure Approved By:
QAR _____ Date _____	OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: YM-91-014
DATE: 11/27/90
SHEET: 1 OF 1
QA
WBS No.: N/A

CORRECTIVE ACTION REQUEST

1 Controlling Document SAIC QAPD, Revision 1	2 Related Report No. Audit 90-08
3 Responsible Organization SAIC	4 Discussed With J. Harper

10 Response Due 12/27/90	11 Responsibility for Corrective Action D. Chandler	12 Stop Work Order Y or N N

5 Requirement:

SAIC QAPD, Revision 1 states in part, "Paragraph 5.1.1. Instructions, Procedures, Plans, or Drawings (as applicable) shall be prepared.... Paragraph 5.1.2. These documents shall be reviewed, approved, distributed...."

6 Adverse Condition:

Contrary to these requirements, no procedure exists to control the submittal, identification, control, distribution, and up-dating of vendor manuals currently identified in quality related work instructions for work performed on quality related equipment.

7 Recommended Action(s):

Issue a Standard Practice Procedure to control vendor technical manuals and vendor technical information.

8 Initiator R. B. Constable Robert B Constable 11/19/90	9 Severity Level 1☐ 2☐ 3☒	13 Approved By: OQA James Blaylock Jr. 11/21/90

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: YM-91-015
DATE: 11/27/90
SHEET: 1 OF 1
QA
WBS No.:

CORRECTIVE ACTION REQUEST

1 Controlling Document SP 1.25, Revisions 1 and 2	2 Related Report No. Audit 90-08
3 Responsible Organization SAIC	4 Discussed With J. Harper

10 Response Due 12/27/90	11 Responsibility for Corrective Action J. Harper	12 Stop Work Order Y or N N

5 Requirement:

SP 1.25, Revisions 1 and 2, Paragraph 5.5.2 states, "Complete the "Hold for Test" tag, Ref. Exhibit 7, and attach to item. Annotate the RIR remarks section to indicate "Hold for Test" tag attached."

6 Adverse Condition:

A review of Procurement Packages (i.e., #14-910056 and #14-910074) revealed that "Hold for Test" tags have not been utilized for items that have been received, inspected, and require testing. (Note: The inspector concurred that the tags had not been used.)

7 Recommended Action(s):

1. Identify those items that have been accepted and require "Hold for Test" tags. Apply the tags and annotate the RIR.
2. Re-emphasize the requirement to the inspectors.

8 Initiator Date: K. L. Tyger Kathy L. Tyger 11/19/90	9 Severity Level - 1☐ 2☐ 3☒	13 Approved By: Date: OQA James Blaylock 11/21/90

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: YM-91-016
DATE: 11/27/90
SHEET: 1 OF 2
QA
WBS No.: N/A

CORRECTIVE ACTION REQUEST

1 Controlling Document SP 1.37, Revision 1	2 Related Report No. Audit 90-08
3 Responsible Organization SAIC	4 Discussed With J. Harper

10 Response Due 12/27/90	11 Responsibility for Corrective Action J. Harper	12 Stop Work Order Y or N N

5 Requirement:

SP 1.37, Paragraph 5.0, number 4, QA Manager, "Evaluate whether the finding constitutes a significant condition adverse to quality in accordance with criteria established below:

a. A significant or serious breakdown in any portion of the quality assurance program.

6 Adverse Condition:

QFR 90-001, Revision 0 and Revision 1, QFR 90-013, 90-014, and 90-015 identified conditions which fulfill the above cited definition but were not identified as significant conditions.

NOTE:

QFR 90-001, Revision 0 and Revision 1 was written to identify an average 39.1 failure rate for training records.

Block 8 of the QFR stated, "Documentation deficiencies were noted in all surveilled departments. Files are incomplete and forms are inconsistently used." Response to QFR (Nelson 6/11/90) stated, "It can neither be satisfactorily demonstrated nor verified that T&MSS personnel are fully trained to perform quality affecting

7 Recommended Action(s):

8 Initiator Date: Catherine Hampton Catherine Hampton 11/19/90	9 Severity Level - 1☐ 2☒ 3☐	13 Approved By: Date: OQA Jerry Blaylock 11/21/90

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

CAR NO.: YM-91-016
DATE: 11/27/90
SHEET: 2 OF 2

CORRECTIVE ACTION REQUEST
(continuation sheet)

6 Adverse Condition (continued)

activities."

QFR 90-013, 90-014, and 90-015 were written to document the deficiencies identified as a result of surveillance SR-90-006. The surveillance summary (dated 10/4/90) identified that the "overall program is insufficient to meet the requirements of the T&MSS QAPD."

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14 CAR NO.: _____
DATE: _____
SHEET: ____ OF ____
QA
WBS No.: _____

CORRECTIVE ACTION REQUEST

1 Controlling Document		2 Related Report No.
3 Responsible Organization	4 Discussed With	
10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N

5 Requirement:

6 Adverse Condition:

7 Recommended Action(s):

8 Initiator Date:	9 Severity Level - 1☐ 2☐ 3☐	13 Approved By: Date: OQA _____ _____

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: _____
DATE: _____
SHEET: ____ OF ____
QA
WBS No.: _____

CORRECTIVE ACTION REQUEST

1 Controlling Document		2 Related Report No.
3 Responsible Organization	4 Discussed With	
10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N

5 Requirement:

6 Adverse Condition:

7 Recommended Action(s):

8 Initiator Date:	9 Severity Level - 1☐ 2☐ 3☐	13 Approved By: Date: OQA _____ _____

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: _____
DATE: _____
SHEET: _____ OF _____
QA
WBS No.: _____

CORRECTIVE ACTION REQUEST

1 Controlling Document		2 Related Report No.
3 Responsible Organization	4 Discussed With	
10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N

5 Requirement:

6 Adverse Condition:

7 Recommended Action(s):

8 Initiator Date:	9 Severity Level - 1☐ 2☐ 3☐	13 Approved By: Date: OQA _____ _____

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14CAR NO.: _____
DATE: _____
SHEET: ____ OF ____
QA
WBS No.: _____

CORRECTIVE ACTION REQUEST

1 Controlling Document		2 Related Report No.
3 Responsible Organization	4 Discussed With	
10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N

6 Requirement:

6 Adverse Condition:

7 Recommended Action(s):

8 Initiator Date:	9 Severity Level - 1☐ 2☐ 3☐	13 Approved By: Date: OQA _____ _____

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

14 CAR NO.: _____
DATE: _____
SHEET: ____ OF ____
QA
WBS No.: _____

CORRECTIVE ACTION REQUEST

1 Controlling Document		2 Related Report No.
3 Responsible Organization	4 Discussed With	
10 Response Due	11 Responsibility for Corrective Action	12 Stop Work Order Y or N

5 Requirement:

6 Adverse Condition:

7 Recommended Action(s):

8 Initiator Date:	9 Severity Level - 1☐ 2☐ 3☐	13 Approved By: Date: OQA _____ _____

15 Verification of Corrective Action:

16 Corrective Action Completed and Accepted: QAR _____ Date _____	17 Closure Approved By: OQA _____

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WASHINGTON, D.C.

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QA
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3 Responsible Organization	4 Discussed With	
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