AGENCY FOR NUCLEAR PROJECTS/
NUCLEAR WASTE PROJECT OFFICE

FINAL PROGRESS REPORT
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INTRODUCTION

The Nevada Agency for Nuclear Projects/Nuclear Waste Project Office (NWPO) was formally established by Executive Policy in 1983 following passage of the federal Nuclear Waste Policy Act of 1982 (Act). That Act provides for the systematic siting, construction, operation, and closure of high-level nuclear waste repositories. Spent reactor fuel, radioactive defense and research by-products and other forms of high-level radioactive waste from around the country will be stored at such repositories. In accord with the provisions of the Nuclear Waste Policy Act, the Secretary of Energy identified Yucca Mountain in Southern Nevada as a potentially acceptable site for a geologic repository. The NWPO was established to carry out oversight, independent studies, impact assessment and other responsibilities of the State of Nevada under the Act.

The 1985 Nevada Legislature formally established the NWPO as a distinct and statutorily authorized agency. The Legislature also created a Commission on Nuclear Projects to support the work of the NWPO and provide guidance to the Governor and State Legislature on matters concerning the high-level nuclear waste program. Specific statutory authority for the Office and the Commission is contained in NRS 459.

Nuclear Waste Project Office goals for the grant period were as follows:

- Advise the Governor and Legislature on matters concerning the potential disposal of high-level radioactive waste materials in the State;
- Develop and administer coordinated programs of planning and evaluation of federal high-level radioactive waste disposal activities in Nevada;
- Work closely and consult with affected local governmental entities and State agencies;
- Perform the duties and responsibilities of the State of Nevada as described in the Nuclear Waste Policy Act of 1982 (Public Law 97-425); and
- Assure that the health and safety of Nevada's citizens are adequately protected with regard to any federal high-level radioactive waste program within the State.

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The Nuclear Waste Project Office utilized a small, central staff supplemented by contractual services for needed technical and specialized expertise in order to provide high quality oversight and monitoring of federal activities, to conduct necessary independent studies, and to avoid unnecessary duplication of efforts and resources.

The work of NWPO specifically included:

- monitoring all DOE activities relative to the federal high-level nuclear waste repository proposed for Nevada;
- coordinating State and local responses and reviews of DOE technical and planning documents and proposals, and assuring that all affected State and local governmental agencies are appropriately involved in all phases of federal repository activities;
- conducting independent reviews of hydrological, geological, engineering and other technical aspects of the proposed federal repository project;
- conducting independent studies in areas of socioeconomics, transportation, and others as needed;
- consulting and coordinating with other appropriate State agencies for input and guidance regarding the design of the State program, for review and comment relative to federal documents, and for identifying potential impacts of the federal program and formulating mitigation strategies;
- coordinating and facilitating the involvement of affected local governments in planning for impacts associated with a potential repository in the State;
- identifying health, safety and environmental issues which are of concern to the State and developing State responses and strategies for addressing these issues;
- providing timely and accurate information to the Governor, the Legislature, local governments, and the public on all aspects of the federal program;
- identifying major legal issues arising out of the proposed repository project and developing strategies for effectively addressing such issues to the benefit of the State and affected local communities; and
- representing Nevada's interests at the national level, including participation in Nuclear Regulatory Commission deliberations and rulemaking activities concerning licensing of a waste repository; coordinating Nevada's activities with

those of other affected states; participating in task forces created by the National Governor's Association, the National Conference of State Legislators, and the National Attorneys General Association for reviewing federal nuclear waste storage activities; cooperating in evaluations and assessments of impacts and associated consequences of repository siting, construction, operation, and closure (such as the Western Interstate Energy Board activities on transportation); participating in Nuclear Waste Technical Review Board activities; and representing State of Nevada interests in other applicable forums and venues.

GRANT ACTIVITIES

In fulfilling its responsibilities, the NWPO carried out numerous studies and other activities during the grant period. As a result of these studies/activities, a variety of work products were generated. A listing of reports and other materials developed as products of the grant is attached (Attachment I). A description of work performed during the grant period is as follows:

HYDROGEOLOGY ACTIVITIES

Key technical issues in hydrogeology are moisture movement in the unsaturated zone, relation of the local groundwater aquifer to the regional flow system and future hydrogeologic conditions at Yucca Mountain. During the grant period, NWPO contractors continued to review the hydrogeologic studies of DOE's Yucca Mountain Project, monitor field and laboratory activities, and conduct independent confirmation research related to technical issues.

Technical review and monitoring activities began in 1984 and evolved to include the following major areas of independent study:

1. Evaluation of the unsaturated zone with moisture monitoring instrumentation and infiltration studies.
2. Studies of past weather patterns in Southern Nevada as a precursor for predicting future weather patterns was initiated in FY 1987 and continued into FY 1992.
3. A review of past climatic conditions in Southern Nevada provides a clue as to what future climates might be predicted. This prediction provides input data to modeling future water levels at the site and predicting rates of surface erosion. Field mapping of past spring and lake deposits, mapping of past vegetation patterns, and geochemical analysis and age dating of water-deposited materials provide data for predicting future climatic conditions. This study began in FY 1987 and continued through FY 1992.

4. An assessment of the relationship of the Yucca Mountain aquifer to the regional groundwater flow system involves a number of study approaches. Modeling of water chemistry to predict the degree of water mixing from both flow systems is one study approach. Sampling for chemistry began in FY 1988 and was completed in FY 1989. Analysis and modeling was initiated in FY 1990. Modeling of environmental isotopes contained in the groundwater is another study approach. Computer codes for modeling were developed in FY 1988; field sampling and laboratory analysis was initiated in FY 1989.
5. Validation studies of hydrogeologic models and computer codes proposed for use by the DOE during site characterization was initiated in FY 1988. A complete inventory of all applicable computer codes has been compiled. Systematic review and evaluation of the codes began in FY 1989 and continued into FY 1992. Re-review of models and codes will occur in the future as new site characterization data are developed.
6. Geochemical studies are a major component of the State's technical assessment of the Yucca Mountain Site. Geochemistry of rock-water interaction at both present temperature and anticipated repository temperature is the focus of the studies. Secondary minerals in the tuff volcanic rock are being evaluated for their chemical composition, stability states, and potential for alteration at elevated temperatures. Also the degree which these secondary minerals take up radionuclides transported in the groundwater. Other studies are reviewing the degree of alteration which may occur in the repository rock from thermal water from either volcanic emanations or from the postclosure repository environment. An important study potentially related to possible volcanic emanations is the assessment of calcite-silica veins encountered in the tuff volcanic rocks and overlying soils on Yucca Mountain and its vicinity. Mapping, geochemical sampling for laboratory analysis, and age dating are components of this study. These geochemical studies were initiated in the FY 1987 - FY 1989 time frame and are continuing through FY 1992.

GEOLOGY ACTIVITIES

Key technical issues in geology are the activity of faults at Yucca Mountain and the relation to the regional tectonic setting, potential for renewed volcanism, tuff rock stability and the natural resource potential of Yucca Mountain. During the grant period, NWPO contractors reviewed the geologic studies of DOE's Yucca Mountain project and conducted independent confirmation research related to technical issues.

Technical review activities began in 1986 and evolved to encompass the following major areas of study:

1. A review to identify potentially active faults in the Yucca Mountain region and to review Quaternary Stratigraphy and present fault dating techniques. Study was initiated in FY 1987 and continued through FY 1991 with detailed mapping and trenching of suspected active faults and dating of last fault movement. Evaluation of the relationship of faults to the regional tectonic setting was initiated in FY 1991 and carried on into FY 1992.
2. Evaluation of earthquake activity at Yucca Mountain was initiated in FY 1987 and expanded in FY 1988 to install an array of seismic monitoring stations in the Yucca Mountain area and tie the seismological laboratory into the Federal Southern Nevada Earthquake Monitoring Network. The seismic monitoring array was scaled-back in FY 1990 due to a reduction in funding. A micro-earthquake noise analysis was conducted on Yucca Mountain in FY 1990. Analysis of recorded earthquakes and their patterns and characteristics was begun in FY 1990 and continued through FY 1992.
3. Understanding of the regional tectonic setting provides important information for assessing present and future fault and earthquake activity and location. Studies of tectonic conditions in southern Nevada began in FY 1987. Field mapping combined with high resolution satellite imagery and three-dimensional computer modeling were used to identify, locate, and evaluate patterns of geologic structure and faults.
4. Companion with understanding of the tectonic setting and the earthquake processes acting in the setting are studies of the mechanisms of faulting and the stresses on the rocks of Yucca Mountain from such faulting. Such studies were initiated in FY 1989. Measuring instruments were planned for installation in FY 1991, as is installation of a strain monitoring station, but were deferred because of a lack of funds. These studies will provide data to establish the maximum earthquake for engineering design purposes and to determine the strains placed on the repository rock from earthquakes and fault movement.
5. An assessment of the mineral resource potential and the hydrocarbon resource potential was initiated in FY 1987. A detailed review of the geologic field relationships was accomplished in FY 1989. Geochemical sampling and laboratory analysis was initiated in FY 1989. Drill core review, postponed from FY 1987, was partially completed in FY 1991. Mapping and stratigraphic analysis of geologic formations which may have hydrocarbon potential began in FY 1989 and

continued through FY 1992. A study of the geothermal resource potential of Yucca Mountain was initiated in FY 1990.

6. Mapping, geochemical sampling, and age dating of young volcanic rocks in southern Nevada was initiated in FY 1987. Based upon this work, a study was initiated in FY 1990 to assess the volcanic craters in Crater Flats adjacent to Yucca Mountain. A study of the probability of future volcanism in the Yucca Mountain area was initiated in FY 1990 and continued into FY 1992.

QUALITY ASSURANCE ACTIVITIES

In FY 1986, the Office developed, with the assistance of a contractor, a quality assurance program for the State's technical study program. The QA program was designed to meet the nuclear quality assurance standards of the U.S. Nuclear Regulatory Commission. In FY 1987 the Office submitted the QA program to the NRC for its review and acceptance. In March 1988 the NRC accepted the program as meeting their standards. The Office subsequently implemented the QA program for its technical activities and those of its contractors. The program is administered by the Quality Assurance Manager.

Separately from the Office QA program, the QA Manager participated in a number of reviews, audits, inspections, and surveillances of the DOE quality assurance program and its contractor's programs. Observation reports were prepared and provided to interested parties.

REPOSITORY ENGINEERING ACTIVITIES

In FY 1986 the Department issued a conceptual design report for a repository at Yucca Mountain. The Office, with assistance from an engineering contractor, conducted a review of the design and issued a review report in mid-1988. Subsequent engineering activities consisted of reviews and monitoring of the Exploratory Shaft Facility designs and related aspects. An increased level of activity occurred in FY 1991 - 1992 when DOE initiated a major revision in its exploratory facility design.

ENVIRONMENTAL ACTIVITIES

The NWPO environmental oversight program for DOE site characterization activities at Yucca Mountain consists of the following activities: a review of available information on the Yucca Mountain environment to determine the extent of existing information useful for evaluating the site's environment; a plan developed and implemented for conducting a field study to provide additional environmental information needed to evaluate the site; a comprehensive environmental survey resulting from the review of available information and a field study which provides the basis

for evaluating potential adverse environmental impacts based upon descriptions provided by DOE of activities to be conducted during site characterization; the anticipated impacts provide the basis for reviewing the preliminary impact analyses performed by DOE; and environmental oversight, including impact monitoring and mitigation, of the DOE program for site characterization based upon the environmental survey and the impact evaluation carried out in the first two years of the NWPO environmental program.

An environmental program to establish baseline environmental conditions was initiated in FY 1989. Baseline field surveys were planned to be initiated in FY 1990, but were deferred because of site access restrictions.

LOCAL GOVERNMENT INVOLVEMENT AND COORDINATION

The State of Nevada is committed to active and direct involvement of affected local governmental entities in the high-level nuclear waste management program. The State facilitated the participation of these entities by providing for the establishment and maintenance of planning and policy analysis capabilities at the local level. During the grant period, local governments also established capabilities for monitoring socioeconomic indicators, maintaining databases, and otherwise implementing the transfer of impact assessment capabilities from the State's socioeconomic contractor to the local level, as practicable.

LEGISLATURE PARTICIPATION

The Act and subsequent congressional appropriations measures provided for the involvement of the Nevada State Legislature in the high-level nuclear waste management program. Specifically, the Nevada Legislature established a Committee to analyze and participate in both the State Executive and federal programs. The Committee was made permanent by the 1985 Legislature.

ACTIVITIES OF OTHER STATE AGENCIES

Given the nature of the HLW program and the role of the NWPO as a State entity, a number of State agencies needed to be involved in overseeing and/or monitoring specific aspects of DOE activities. Agencies such as the Department of Industrial Relations (Mine Inspection), the Department of Transportation, the Division of Emergency Management, the Public Service Commission, the Division of Historic Preservation and Archeology, the Division of Environmental Protection, the Department of Employment Security, and others assisted the NWPO in executing State mandates and responsibilities under the NWPA.

SOCIOECONOMIC ACTIVITIES

In 1986, the State of Nevada initiated a comprehensive study of the potential socioeconomic impacts of a high-level nuclear waste repository upon communities, individuals and institutions within the State. In addition to evaluating the standard, economic-demographic effects of a repository and repository-related activities, the State effort also involved an assessment of the "special" effects of the project which result from the nuclear nature of the undertaking and the associated risks which accrue to the State and its citizens.

The comprehensive nature of the State's study required a level of effort commensurate with the complexity of the undertaking. The Agency collected and analyzed data from a four-county potential impact area, including Nye, Clark, Esmeralda and Lincoln Counties. In addition, because many of the social/economic effects of a repository and repository-related transportation are expected to be felt State-wide, the study also examined possible impacts at the State level and the level of State/local government interaction.

Major areas of investigation and research during the grant period included project description, economic/demographic modelling, public facilities/services/fiscal impacts, social/cultural impacts, Native American studies, risk studies, monitoring and maintenance of databases, and technology transfer.

Project Description

This area of study involved the development and monitoring of comprehensive project description information. Since the characteristics of the repository project are the principle drivers of any socioeconomic impacts on the State and on local communities, an accurate and complete project description is crucial for impact assessment. During FY '87 - '88, a relatively detailed project description was prepared for use in the Interim Report on the State's Socioeconomic Studies. That description was necessarily incomplete given the major uncertainties about many aspects of the repository program.

In addition to the project description itself, a system for generating scenarios, developed from project description and baseline data, was initiated. This Project Description Scenario Development System (PDSDS) will enable the State and local governments to examine differential impact futures based upon differing project description variables (i.e., different work force settlement patterns, waste volumes, etc.). In this way, the State study will be able to take the unavoidable uncertainties of the project into account when preparing impact assessments. Work towards development of the PDSDS continued during the grant period.

Economic-Demographic Modelling

Economic-demographic model development was begun in 1987 and continued throughout the grant period. This group of tasks involved the development and ongoing maintenance of the REMI econometric model for the State of Nevada and for selected counties/regions. A fairly intensive round of research was undertaken in 1988 to calibrate the model to better reflect Nevada conditions. The model was run to generate both baseline and with-project projections during the impact assessment exercise conducted in 1989.

In addition to the REMI effort, less complex modelling efforts were undertaken for rural counties, including Nye, Esmeralda, Lincoln and the counties likely to be impacted by repository-related transportation. (Note: These modeling efforts were curtailed due to funding cutbacks during the grant period. However, such supplementary modelling efforts are required because of the difficulties inherent in applying REMI to rural economies. A small amount of modelling work was continuing during the grant period.

Fiscal Assessment

The State began development of a Fiscal Assessment System FY' 87 - '88, but the system was not fully developed due to lack of funds in subsequent years. This system was intended to provide a comprehensive analysis capability which allows the assessment of repository impacts on State/local revenues and expenditures and on the complex interaction of the State/local fiscal systems in Nevada. During the grant period, efforts continued to monitor county funded fiscal assessment work and incorporate useful data into the State databases.

Social-Cultural Studies

Social-cultural baselines for both Urban and Rural communities potentially affected by the repository project were begun during the grant period. Work in this group of tasks involved key informant research, analysis of previously generated data, survey research, and selected in-the-field ethnographic research and data collection, survey research. Areas targeted for social-cultural activities included the Las Vegas urban area, rural Clark County, Esmeralda County, Nye County, Lincoln County and selected rural communities located along potential transportation corridors. During the grant period, work continued, at a reduced level, to evaluate key findings of the Social-Cultural studies.

Native American Studies

During the grant period, baseline information for potentially affected Indian communities in Nevada was developed and updated. Research efforts concentrated on Western Shoshone and Southern Paiute groups in Clark, Nye and Lincoln counties and on communities located in proximity to Yucca Mountain and potential transportation routes.

Risk Studies

Very promising and important research was begun in FY '87 - '90 on the effects of repository risks and risk perception on economic conditions within Nevada. These studies included research on risk effects pertaining to tourism, conventions, economic development and migration and on the mechanisms that cause such impacts (i.e., the social amplification of risk). Work in this area continued during the grant period.

Research in this group of tasks involved survey research, analogous case studies, risk assessment research, and continuing work on the social amplification of risk processes.

Impact Assessment

A comprehensive, integrated preliminary impact assessment report was prepared in 1989 based upon findings and research in all study areas. This impact assessment exercise tested the adequacy of the assessment system as it existed and provided a detailed statement of findings relative to potential impacts of the repository project on the State and local communities.

The socioeconomic study was refined and revised based upon experience with the exercise. The impact system will be finalized for use in future impact assessments and will, to the extent practicable, be institutionalized within the State and local governments.

During the grant period, work was begun on a new summary report intended to identify and evaluate key findings of the socioeconomic studies.

Monitoring Program

Recommendations and suggestions for a comprehensive monitoring system were developed as part of the impact assessment exercise. The purpose of the monitoring system, once developed, will be to maintain databases and to serve as a repository of socioeconomic information. The monitoring program will entail systems for database maintenance for all elements of the comprehensive impact assessment system.

Monitoring will be a focus of FY '93 socioeconomic monitoring efforts.

PUBLIC INFORMATION ACTIVITIES

During the grant period, the NWPO provided Nevadans with objective, balanced information concerning the high-level nuclear waste effort. These public information activities were also aimed at facilitating the active involvement of the public in the repository decision-making process. A variety of activities were undertaken, including:

- design, layout, graphics and coordination required for production and distribution of the State's Newsletter, factsheets and maps;
- implementation of an effective information access system to provide citizens throughout Nevada with ready access to HLW program information;
- development of subject-specific informational materials for use by the Office in providing citizens, local governments, organizations, etc., with understandable information relative to HLW issues and the State's program;
- establishment and implementation of a comprehensive program for public participation in U.S. DOE and State HLW program activities and decision-making processes, including: (1) the establishment of a public information location in southern Nevada; (2) the development of publicly understandable summaries/commentaries of DOE and State technical documents, reports, etc., to promote public understanding of complex and often confusing technical issues; (3) the development of networks of civic groups and other organizations to promote public participation in the HLW program; and (4) the conduct of workshops, forums, meetings, and other events to provide opportunities for the public to better understand the program and participate in decision-making, consistent with the intent of the Nuclear Waste Policy Act;
- facilitating public meetings, conducting seminars, and bringing experts and speakers on HLW issues to Nevada for public information activities, etc.

TRANSPORTATION ACTIVITIES

During the grant period, the NWPO implemented a variety of transportation analyses and studies in coordination with the State Department of Transportation, affected local government entities, regional transportation commissions, the University of Nevada System, other State agencies and of the Legislative Study Committee on High-Level Radioactive Waste Disposal. A transportation plan

governing the Office's work in all areas of transportation analyses was developed in 1988. A breakdown of transportation study areas is as follows:

- ongoing reviews of federal and State transportation laws, regulations, etc., together with reviews of specific federal and State agencies' roles and responsibilities relative to HLW transportation issues;
- ongoing technical review of DOE's risk methodologies, computer models and other relevant analytical approaches to HLW transportation issues;
- design and implementation of Nevada-specific risk analyses, including the application of various risk models to specific highway and rail routes within Nevada;
- the development of Nevada-specific data bases relative to HLW transportation information and variables and Nevada-specific route analyses, including route surveys and the development of methodologies for monitoring changing route conditions, etc.;
- issue-specific studies aimed at providing the State and local governments with data and expertise relative to areas of HLW transportation that may be required to enable informed participation in DOE transportation decision-making. Issues to be investigated include inspection and enforcement, liability, cask design, notification, overweight trucks, and national route selection;
- the assessment of emergency preparedness conditions and needs within the State so that adequate planning can be done relative to repository-related HLW transportation;
- the examination of regional transportation issues such as route identification, analysis of potential regional route conditions, and coordination of regional transportation activities; and
- other studies needed to review DOE transportation documents, coordinate Nevada's transportation-related activities with other states, develop technical HLW transportation-related informational materials, etc.

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