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**UNITED STATES
DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE**

**COMPLETION REPORT
OPERATION KLAXON
FISCAL YEAR 1993**

**EDITED AND PUBLISHED
BY
RAYTHEON SERVICES NEVADA
JUNE 1994**

MASTER

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INTRODUCTION

The U.S. Department of Energy, Nevada Operations Office (DOE/NV), Completion Report provides a summary of activities conducted at the Nevada Test Site (NTS) between October 1, 1992, and September 30, 1993, associated with Operation KLAXON. (In the past, each annual Completion Report dealt with a series of underground nuclear detonations; however, because no nuclear tests were conducted during FY 1993, this Report summarizes continuing nonnuclear and nuclear test readiness activities at the NTS sponsored by DOE/NV.) The report serves as a reference for those involved with the planning and execution of Operation KLAXON and also serves as a planning guide for future operations. Information in the report covers the logistics and management of activities. Scientific information and data associated with NTS activities are presented in technical documents published by participating agencies.

In September 1992, Congress legislated a nine-month moratorium on the testing of nuclear weapons. The bill also provided for a resumption of testing (with no more than five tests per year, or a total of 15 during the next three years) in July 1993, and mandated an end to nuclear testing, entirely, by 1996. President Bush signed the bill into law in October 1992.

President Clinton extended the moratorium in July 1993, and in March 1994 again extended it until September 1995, with the goal of establishing a Comprehensive Test Ban. At the same time the President directed the Department of Energy to retain a capability to resume testing if necessary.

A number of government agencies and contractors provided valued assistance to DOE/NV in preparation of this document.

- Defense Nuclear Agency (DNA)
- Department of Defense (DoD)
- Desert Research Institute (DRI), University of Nevada System
- EG&G Energy Measurements, Inc. (EG&G/EM)
- Field Command Defense Nuclear Agency (FCDNA)
- Lawrence Livermore National Laboratory (LLNL)
- Los Alamos National Laboratory (LANL)
- Professional Analysis, Incorporated (PAI)
- Raytheon Services Nevada (RSN)
- Reynolds Electrical & Engineering Co., Inc. (REECO)
- Sandia National Laboratories (SNL)
- URS/John A. Blume & Associates, Engineers (URS/JAB)
- National Oceanic and Atmospheric Administration/Weather Service Nuclear Support Office — Las Vegas (NOAA/WSNSO)
- U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory — Las Vegas (EPA/EMSL-LV)
- U.S. Geological Survey (USGS)
- Wackenhut Services, Inc. (WSI)

1.0 PLANNING AND REVIEW

1.1 PROGRAM IMPLEMENTATION

Operation KLAXON is the code name for activities conducted at the NTS during FY 1993. No nuclear tests were conducted by the United States during FY 1993. Activities carried on at the NTS were conducted within guidelines established in the Threshold Test Ban Treaty (TTBT) and in NVO-176 (Rev. 4), *Planning and Operations Directive, Underground Nuclear Test Operations*.

Consistent with DOE Headquarters (DOE/HQ) directives and Limited Test Ban Treaty provisions, emplacement designs and firing conditions for a test series would be maximized to prevent release of radioactive materials to the environment. Nuclear tests would be coordinated and approved in accordance with the following policies and procedures:

- Nuclear weapons development tests and experiments are planned and executed in such a manner as to minimize the probability that the test will place measurable amounts of radioactive debris beyond the boundaries of the United States under circumstances which could credibly relate the debris to the test.
- Data on weapons development experiments prepared for execution at the NTS are forwarded, after review by the laboratories, Containment Evaluation Panel (CEP), and DOE/NV, to the DOE/HQ Office of Military Application for consideration of the test and possible referral to the National Security Council Undersecretaries Committee and to the Special Assistant to the President for National Security Affairs.
- The Deputy Assistant Secretary for Military Application (DASMA) further provides and directs that a failure to obtain diagnostic information, such as an early radiochemical sample (which failure then results in essential loss of an experiment and, in turn, requires possible reexecution of the event), is preferable to any significant risk of treaty violation or accusation thereof. This policy recognizes the attendant cost in time and effort associated with the loss of an initial experiment and requirement for reexecution.
- The CEP periodically reviews data associated with proposed experiments and reports the results of its deliberations and conclusions to the Manager, DOE/NV, with a Panel-recommended category for each event.

1.2 ONGOING ACTIVITIES

1.2.1 Nevada Test Site Planning Board

The Nevada Test Site Planning Board (NTSPB) (Table 1) ensures coordination and planning of programs and projects conducted at the NTS and other sites within DOE/NV responsibilities. The Planning Board reviews all activities that may impact principal DOE/NV missions and makes recommendations concerning these activities to the DOE/NV Manager.

During Operation KLAXON, the Planning Board met eight times; these meetings are summarized below:

October 21, 1992 ■ Members reviewed the FY 1993 Weapons Testing budget. DOE/NV should receive \$244M of the \$375M approved for Weapons Testing in the conference mark. It was agreed that DOE/NV did not want to pursue projects or purchase equipment that would not be required for a finite testing program and that all items should be thoroughly evaluated with this in

TABLE 1. NEVADA TEST SITE PLANNING BOARD

Member	Organization
Deputy Manager, Chairperson	DOE/NV
J. H. Norman	LANL
(Alternate) R. A. Cosimi	LANL
R. J. Fortner	LLNL
(Alternate) L. J. Ferderber	LLNL
J. E. Powell	SNL
(Alternate) M. J. Navratil	SNL
J. W. LaComb	FCDNA
(Alternate) D. B. Williams	FCDNA
Ex-Officio, Chief, Weapons Testing	DOE/HQ

mind. Implementation of the RADCON Manual is expected to cost \$18.6M. The Test Group Directors (TGD) Committee requested that the Planning Board consider a six-month closure of the NTS Steak House for an estimated savings of \$50,000. An update was given on the security helicopter. DOE/NV will continue with the ground alternative and use the helicopter for daytime operations only. Procurement of a B-105 is in process as well as an overall evaluation of required aircraft and pilots.

December 10, 1992 ■ The Assistant Manager for Administration (AMA) discussed the DOE/NV reorganization and pointed out major areas of change. The NTSPB was briefed by the Test Group Director, LLNL, on the current status of the Joint Test Organization (JTO). A meeting with RADM W. G. Ellis, DOE/HQ, DP-20, was scheduled for January 8, 1993, to cover JTO status and problems. Two options for the future of the Hydrology/Radionuclide Migration Program, predicated by the Support Operations Review Team (SORT), were discussed. The national laboratories and DOE/NV briefed representatives of DP-20 and the Deputy Assistant Secretary for Planning Resources Management (DP-50) December 3, 1992, on the requirement for an additional \$100M to conduct the Weapons Test Program as outlined in the Hatfield Amendment. With the change in the Weapons Test Program, it was agreed that a process must be developed to evaluate capital and construction requirements at the NTS to include all programs, not just Weapons Test. This will be on the January agenda. It was reported that the TGD Committee endorsed a four-day work week for the NTS. Safety concerns and contract labor issues are being discussed.

January 20, 1993 ■ The Planning Board heard updates on JTO developments, minimization of Special Nuclear Material and/or nuclear devices at the NTS, and the Bussing Study results. The DOE/NV AMA reported that the NTS Steak House would not be closed at the current time. A revised process for reviewing capital equipment was presented. The NTSPB agreed to this new process and requested that it be initiated as soon as possible. It was reported that 18 of the 40 Test Operations Review Team (TORT) recommendations that monitored by the NTSPB were closed.

March 24, 1993 ■ The Chairman of the Earth Science Advisory Panel (ESAP) reported on the three major programs dealing with earth sciences (Defense Programs, Environmental Restoration and Waste Management, and Yucca Mountain Site Characterization). The ESAP has found that even

though contractors may study the same disciplines, it may be for different reasons. There does not appear to be the duplication of efforts originally thought to exist. An Earth Sciences Conference is scheduled for May 4 and 5. The members were updated on the latest Capital Equipment Review Committee (CERC) meeting and approved the capital equipment items presented. However, concern was expressed regarding the amount of funding identified for vehicles. It was decided that DOE/NV management would make the decision on vehicle procurements for FY 1993. The DOE/NV Deputy Manager (DMGR) discussed issues relating to the NTS after FY 1996. The DOE/NV DMGR recommended that Management and Operating (M&O) contractor managers be invited to all future NTSPB meetings.

April 21, 1993 ■ This meeting initiated the new policy of inviting representatives of the four M&O contractors to attend Planning Board meetings. The DOE/NV DMGR updated the members on new NTS initiatives. The Planning Board discussed the need for unified political backing, to include not only Congressional support, but also support of state and local officials. The Planning Board was briefed on a space consolidation study being conducted, given the current program downsizing. The intent of the study is to maximize the effectiveness of available space, both in terms of reducing property lease expenses and increasing the efficiency of operations. The Planning Board heard a briefing regarding the establishment of the Program Management and Planning Division (PMPD) and its mission.

May 19, 1993 ■ Considerable progress was reported in the effort to combine laboratory support activities. Activities that are complete or have been fully agreed upon include: logging functions, common device assembly facility, travel services, vehicle (common pool), communications (one combined radio net), warehousing (one crew shared by three laboratories), and postshot drilling. The Planning Board was presented with a number of scenarios that portrayed funding levels that could be expected for DOE/NV given a variety of programmatic assumptions. Results of the recent Earth Sciences symposium were presented. One of the goals was to air the interaction difficulties between Defense Programs and Environmental Restoration.

June 16, 1993 ■ It was reported that there has been a significant increase in inquiries regarding the Spill Test Facility recently and there is potential for a significant increase in activity and funding in FYs 1994 and 1995. Meetings are continuing with SNL and DOE/AL on using the Device Assembly Facility (DAF) for weapons disassembly. An update was provided on the activities to follow up the initial SORT effort in FY 1991. The DOE/NV DMGR directed that a more structured effort be implemented to investigate areas where support costs and activities could be reduced. The Program Management and Planning Division was assigned to develop a charter and key assumptions for that effort. The Planning Board was briefed by the chairman of the M&O Contract Consolidation Study. The results of the study are expected to produce a recommendation as to whether the division of labor among existing contractors (REECo, EG&G/EM, RSN) should continue or whether some other option would be more effective and/or efficient. The study should be completed by March 1994. DOE has begun efforts to document activities required to maintain readiness during the moratorium. This should preclude the requirement for an Operational Readiness Review in the event that resumption of testing is required.

September 16, 1993 ■ The Planning Board was briefed on the status of Environmental Baseline Studies. The development of an Environmental Baseline data base and the weaknesses of the current Environmental Impact Statement were discussed. A proposal recently submitted to DOE/HQ regarding a potential role of the NTS in the Weapons Complex Reconfiguration was discussed. The DOE/NV Acting Chief Financial Officer presented the Board with the most current status of the FY 1994 Authorization and Appropriation process. The final Weapons Testing budget was estimated at between \$350M and \$375M.

1.2.2 Test Group Directors Committee

The TGD Committee (Table 2) reviews, evaluates, and makes recommendations to the NTSPB on activities at the NTS which may have significant operational, economical, or technical impact on the nuclear weapons test program. They also review and make recommendations on General Plant Projects (GPP) and assist in the early identification of requirements which may involve plant construction and land use. The Committee carries out special studies of various aspects of the NTS operations, including methods, practices, and utilization of resources with the intent of optimizing such operations and ensuring efficiency and economies. They evaluate scheduling of tests and other activities to coordinate and optimize use of equipment and contractor personnel.

TABLE 2. TEST GROUP DIRECTORS COMMITTEE

Member	Organization
Chairperson (as designated)	LANL, LLNL, SNL
Test Directors from:	LANL, LLNL
Members and Alternates from:	DNA, SNL
Director, Test Operations Division (TOD)	DOE/NV
(Alternate) Chief, Operations Management Branch, TOD	DOE/NV
Director, NTSO	DOE/NV
(Alternate) Chief, Logistics Branch, NTSO	DOE/NV
Director, Program Management & Planning Division (PMPD), Executive Secretary	DOE/NV

The following TGD Committee meetings were held during Operation KLAXON:

February 4, 1993 ■ Members were briefed on the DOE/NV approach to implementing the DOE initiatives for self-assessment. They also heard a presentation on the recent DOE/NV reorganization. One of the goals for reorganizing was to reduce Defense Programs staffing levels to be in line with the current full-time equivalent ceiling. An update on the NTS light vehicle fleet utilization was presented. The TGD tasked the Nevada Test Site Office (NTSO) with revisiting their formula for determining "average use" and considering the inclusion of costs associated with vehicle usage in their monthly report to users. The group was updated on the Yucca Mountain Project (YMP) power requirements. The TGD approved a 69-kV temporary power line. The group requested a briefing in June on the load shedding scheme.

April 1, 1993 ■ RSN gave a presentation regarding the increase in their overhead. Actions taken by RSN to recover an under distribution by implementing a complete overhaul of the overhead process was discussed. The FY 1993 GPP list was reviewed. Three of REEC's projects (Cementing Services Facility, Gas Bottle Facility, and Decon Facility) were discussed in detail. Also discussed was a list of projects at the Decon Facility that were not on the GPP list. The TGD requested that these items be evaluated in conjunction with the Decon projects already on the list and addressed at the next meeting. The impacts on the NTS—if it were designated a Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) site—were discussed. LLNL gave an update of the chemical kiloton test. All permitted work was

complete on March 15 and the tunnel was closed March 17 and placed in a standby mode. A multi-agency working team was formed to write/modify plans, procedures, and checklists for a mid-July submittal to DOE/NV. The detonation date was expected to be between late August to early January 1994. LANL presented an update on the JTO.

May 13, 1993 ■ The group was briefed on interim findings of the Space Consolidation Study. The final study is due June 30, 1993. The TGD Committee endorsed the concept of a master plan for the North Las Vegas Facility and was supportive of the funding requirements to bring about the consolidation. The group reviewed the status of FY 1993 GPP funding and heard presentations on items for which GPP funding had been requested (Decon Facility, Cementing Services, Gas Bottle Facility). A review conducted by a working group of the Cable Committee established a declining need for cable support at the NTS. The Committee was told that significant downsizing in the RSN cable group was already underway. DNA reported that they plan to reduce staffing levels in Nevada over the next two years. In February 1993 the TGD established a committee to review the downhole nuclear package emplacement process. A summary of the committee findings was presented. After the report is finalized, it will be presented to the laboratories around the May 1993 time frame. The group concurred with the suggestion that this same kind of review should take place for postshot operations.

July 1, 1993 ■ A plan for the Decon Facility was presented and three additional GPPs were proposed (Upgrade and Repair of Buildings 6-605 and 6-607, Waste Handling Improvements, and Supervisor's Building, Area 6). A new effluent lagoon, a line item to be funded by DOE/HQ, was also proposed. The Space Consolidation Study has been published and an update was presented. Employee statistics and estimated cost savings pertaining to the four-day week were presented. Implementation took place on May 3, 1993. LLNL presented an overview of the DoD-funded Mine Detection Research Project. Additional funds have been requested to continue this research. Staffing plans for the LANL Test Program were presented. A reduction in staff by either a reduction-in-force or by the implementation of a retirement offer in October is anticipated. The group was also briefed on the staffing plans for the DOE/NV. REECo presented a plan for dust control related to downhole stemming operations. The TGD agreed that there should be a common stemming system among the laboratories and that REECo should proceed with demonstration tests of the proposals.

August 12, 1993 ■ Laboratory exercise plans were discussed. LLNL reported that the emplacement and insertion for the NOVITE exercise were in process and should be closed by mid-September. A combined postshot exercise was shifted from September to early FY 1994. A Nonproliferation Experiment (NPE) is expected to be conducted at 12:01 a.m., September 22, 1993. This is a major seismic experiment with a host of participants, including the National Science Foundation, between 30 and 40 international observers, and Senator Bryan. It was also reported that ABC Television is scheduled to tour the site on August 23, 1993. REECo presented an overview of their downsizing methods for union and non-bargaining employees. By the end of this calendar year there will be an 11 percent reduction. Test results of the dust control proposals were presented. The group was briefed on LLNL and SNL staffing plans. Both laboratories planned for decreases in full-time equivalents for FY 1994.

September 23, 1993 ■ A status update on the Test Readiness Study was provided. Completion of the study and a published document is expected in early November 1993. The group was briefed on the background, purpose, and results of the NPE. LLNL reported that the NPE was successfully executed as planned at 12:01 a.m. on Tuesday, September 22, 1993. There were no unexpected incidents reported. The TGD heard a presentation from LANL on the Ground-Based Earth Observing Network (GEONET) program. Los Alamos is using the diagnostic tools developed

in the weapons program to conduct climate research studies regarding impacts of the biosphere on the lithosphere, atmosphere, and hydrosphere. RSN reported that two-week termination notices had recently been sent to approximately 36 employees. RSN weapons staff totals were reported to be down approximately 35 percent since FY 1991.

1.2.3 Containment Evaluation Panel

The Containment Evaluation Panel (Table 3) was established in March 1971 to assist the Manager, DOE/NV, in review of proposed underground nuclear tests by evaluating the technical adequacy of containment measures for each test. Panel judgments are not to be affected by costs, schedules, real-time weapons development, or effects investigations. Successful containment is defined in the committee's Charter as a test that "results in no radioactivity detectable off site as measured by normal monitoring equipment and no unanticipated release of radioactivity on site within a 24-hour period following execution. Anticipated releases will be designated to conform to specific guidance from DOE/Office of Military Application, Headquarters." During Panel meetings, evaluations and actions are recorded for future review or reference.

The evaluation process consists of presentations on a test by the sponsoring laboratory; each Panel member then judges the test to be within one of the categories identified within the committee Charter. Categories used for evaluation are:

CATEGORY A ■ Considering all containment features and appropriate historical, empirical, and analytical data, the best judgment of the member indicates a high confidence in successful containment.

CATEGORY B ■ Considering all containment features and appropriate historical, empirical, and analytical data, the best judgment of the member indicates a lesser, but still adequate, degree of confidence in successful containment.

CATEGORY C ■ Considering all containment features and appropriate historical, empirical, and analytical data, the best judgment of the member indicates some doubt that successful containment will be achieved.

UNABLE TO CATEGORIZE ■ Available information is insufficient to categorize the test. The test will be categorized when additional information is acquired.

PANEL EVALUATIONS ■ During Operation KLAXON, the CEP met twice (200th and 201st CEP meetings). Two tests were presented for categorization for the first time, but neither test was conducted due to the moratorium.

LLNL presented GABBS to the 200th CEP in October 14, 1992; the containment plan received nine A's. The GABBS detonation authority request was sent to DASMA. (On October 13, 1992, a dinner was held in Las Vegas, Nevada, to commemorate the 200th meeting of the CEP.)

LANL presented ICECAP to the 201st CEP on April 28, 1993. The ICECAP containment plan received unanimous A's, with the understanding that additional material concerning the dewatering system would be prepared and made available to the Panel members. LANL presented the design

TABLE 3. CONTAINMENT EVALUATION PANEL

Member	Organization
J. E. Carothers, Chairman	LLNL
R. R. Brownlee, Alternate Chairman	RSN
G. C. Allen, Manager's Representative	DOE/NV
(Alternate) Richard Navarro	DOE/NV
Richard Navarro, TOD, Executive Secretary	DOE/NV

Laboratory Representatives

T. D. Kunkle	LANL
(Alternate) F. N. App	LANL
J. W. LaComb	*DNA/FCTK
(Alternate) B. L. Ristvet	DNA
C. W. Smith	SNL
(Alternate) A. J. Chabai	SNL
C. W. Olsen	LLNL
(Alternate) B. C. Hudson	LLNL

Consultants

R. R. Brownlee	RSN
G. H. Higgins	RSN
E. E. Peterson	S-Cubed
R. L. Jacobson	DRI
(Alternate) G. F. Cochran	DRI
P. P. Orkild	USGS
(Alternate) E. C. Jenkins	USGS
C. E. Keller	RSN

Official Observers

Designees from: EPA/EMSL, NOAA/WSNSO, USGS, REECO, and RSN

Noncategorizing members of the Panel include the Chairman; a representative of the Manager, DOE/NV; and the Executive Secretary.

*DNA/Field Command Test Containment Division

of the dewatering system to the Panel on June 7, 1993; and after reviewing the design, the Panel did not change its original categorization. The detonation authority request package for ICECAP was prepared; however, it was not sent to DASMA.

Due to the moratorium, no nuclear tests were conducted during the KLAXON period; however, the NPE, CHEMICAL KILOTON, was conducted on September 22, 1993, in the N Tunnel complex. The NPE involved the detonation of approximately one kiloton of blasting agent in an effort to

determine whether discriminators between conventional and nuclear detonations of similar yield exist. During the experiment, a limited exercise was conducted at CP (Control Point) 1. Both the experiment and exercise were successful. The NPE was open to the public and had international news media exposure.

1.2.4 Containment Review Committee

The Containment Review Committee (Table 4) reports directly to the NTSPB. The purview of the Committee extends both to containment of nuclear explosions and to the consequences of noncontainment. In this regard, the Committee assists the Manager, DOE/NV, in reviewing and understanding containment activities of the laboratories, DNA, DOE/NV contractors, and other agencies involved in the weapons testing program.

TABLE 4. CONTAINMENT REVIEW COMMITTEE

Member	Organization
R. R. Brownlee, Acting Chairman	RSN
G. H. Higgins	RSN
J. W. LaComb	DNA
C. W. Olsen	LLNL
J. D. Plimpton	SNL
S. H. Leedom, Executive Secretary	DOE/NV

The Committee is specifically charged with the following missions:

- Advise the Manager, DOE/NV, through the NTSPB, of containment issues and provide recommendations concerning containment research and development which may affect the conduct of nuclear detonations at the NTS.
- Advise the Manager, DOE/NV, through the NTSPB, as to the scope and effectiveness of studies relating to containment and make appropriate recommendations.
- Advise the Manager, DOE/NV, through the NTSPB, about the causes for containment failure of nuclear tests and suggest appropriate remedial actions.
- Perform other functions relating to containment as requested by the NTSPB.

The Committee did not meet during Operation KLAXON.

1.2.5 Threshold Treaty Review Panel

The Threshold Treaty Review Panel (Table 5) was established in January 1977 to ensure that each nuclear test with a design yield of 125 kilotons or greater is conducted in conformance with the U.S. policy for limiting yields to 150 kilotons. The mission of the Panel is defined by its Charter, which states the following requirements:

- Evaluate and validate preshot design yield estimates on the basis of accepted device design practice, including the relationship of the calculations to prior testing experience and other

appropriate considerations. This evaluation and validation may be based on an individual work location review of the device design summary provided by the sponsoring laboratory or by a formal Panel meeting, depending on the conditions.

- Evaluate the preshot estimate of underground yield based on emplacement design, geology, geophysical properties at the working point, and test device characteristics to ensure that the design yield, plus the estimated underground yield enhancement, does not exceed the estimated underground yield in the range normally expected for a device with a design yield of 150 kilotons.
- Evaluate special measures, if necessary, for enhanced radiation devices to ensure that the design yield of such devices, plus the estimated underground yield enhancement, does not exceed the estimated underground yield for a nonenhanced radiation device with a design yield of 150 kilotons tested under the same conditions.
- Individually indicate confidence in TTBT conformity.

TABLE 5. THRESHOLD TREATY REVIEW PANEL

Member	Organization
J. K. Magruder, Chairman	DOE/NV
R. M. Nelson, Alternate Chairman	DOE/NV
D. M. Wrathall, Executive Secretary	DOE/NV
 <u>Laboratory Representatives</u>	
S. S. Hecker	LANL
(Alternate) J. H. Norman	LANL
J. H. Nuckolls	LLNL
(Alternate) R. J. Fortner	LLNL
J. E. Powell	SNL
(Alternate) J. D. Plimpton	SNL

During FY 1993, the Panel did not meet because no underground nuclear tests were conducted.

1.2.6 Ground Motion and Seismic Evaluation Committee

The Ground Motion and Seismic Evaluation Committee (Table 6) is specifically charged with the following missions:

- Advise of seismic problems and provide related information that may affect the conduct of nuclear or nonnuclear detonations by DOE/NV.
- Advise and make recommendations as to the scope and effectiveness of seismic programs related to DOE/NV test activities.
- On request of the Manager, DOE/NV, perform other functions concerning related seismic considerations that may affect the test program.

On request of the Committee chairman, DOE/NV makes available appropriate contractors, consultants, and management centers for presentation of information or technical advice. Additionally, the Committee may request, through appropriate DOE/NV Contract Administrators, studies and/or data analyses.

TABLE 6. GROUND MOTION AND SEISMIC EVALUATION COMMITTEE

Member	Organization
W. D. Weart, Chairman	SNL
K. H. Olsen	LANL
B. L. Ristvet	FCDNA
F. J. Tokarz	LLNL
Richard Navarro, Executive Secretary	DOE/NV

The Ground Motion and Seismic Evaluation Committee did not meet during Operation KLAXON.

2.0 TEST EXECUTION

2.1 PROGRAM IMPLEMENTATION

2.1.1 Mission Statement

The basic purpose of Operation KLAXON was to develop and test nonproliferation technology without the use of nuclear devices. A secondary objective was the concurrent maintenance of the capability for testing nuclear devices should changing world conditions call for such actions in the future.

2.1.2 Program Oversight

NVO-176 (Revision 4), *Planning and Operations Directive, Underground Nuclear Test Operations*, served as the guideline for Operation KLAXON activities. Proposed technical programs were submitted to the DOE Office of Military Application for approval; approved activities were incorporated into the FY 1993 schedule by the Nevada Operations Council. The Test Controller assigned to each specific test was responsible for operational coordination.

2.2 ONGOING ACTIVITIES

2.2.1 Test Summary

Three readiness exercises and two nonnuclear explosives experiments were conducted during Operation KLAXON as summarized in Table 7. Additional comments regarding these exercises follow the table. For simplicity, and to distinguish from nuclear tests, these exercises and experiments will be referred to as "activities" in the remainder of the report.

TABLE 7. READINESS EXERCISES AND NONNUCLEAR EXPERIMENTS
OPERATION KLAXON

EXERCISE	DATE	TIME	USER	LOCATION	EXPLOSIVE	YIELD	MEDIA
NPE Calib.	10/30/92	0500	LLNL	U12n.25	C-4	300 lb.	Tuff
ZACATOSA	12/03/92	N.A.	LANL	CP-1	None	N.A.	N.A.
TAJON	02/11/93	N.A.	LANL	CP-1	None	N.A.	N.A.
APLITE	04/22/93	1030	LLNL	CP-9	None	N.A.	N.A.
NPE	09/22/93	0001	LLNL	U12n.25	ANFO	1.0 kt	Tuff

N.A. = Not Applicable

NPE = Nonproliferation Experiment

ZACATOSA ■ ZACATOSA was a tabletop exercise to simulate activities for an Area 3 event based on parameters of the DIVIDER event (09/23/92). All activities were confined to CP-1. The exercise began with D-1 briefings and concluded with simulated event execution.

TAJON ■ TAJON was a tabletop exercise to simulate activities for an Area 7 event based on parameters of the FLOYDADA event (08/15/91). The scenario included an accident simulation involving an unsatisfactory containment with a resulting release of radioactivity to the atmosphere. Only D Day activities were exercised and—with the exception of field use of the Blue Bird Team—were confined to CP-1.

2.2.2 Radioactive Releases

Operation KLAXON exercises and experiments were nonnuclear, so no radioactive effluents were generated, nor were any preexisting radioactive effluents released as a result of these exercises and experiments.

2.2.3 Maintenance of Capability For Future Tests

Test-related activities at the NTS during Operation KLAXON were given new direction as a result of the nuclear testing moratorium in effect since July 3, 1993. Emphasis was on downsizing and adjustment from the active underground test program of the past. This downsizing was pursued consistent with the constraints imposed by current funding, an understanding of the requirements of the remaining testing opportunities through FY 1996, and recognition of the importance of preserving a core capability for the future from which a new test capability could be built if required. Critical skills will be maintained through test preparation and exercises of specific test-related functions, as well as weapons physics laboratory experiments and limited dual-use applications of test technologies.

Operation KLAXON funding was used to transfer people off of the test program in an orderly way while maintaining facilities, people, and technologies required for possible future testing activities. These capabilities and facilities include underground nuclear test diagnostics, underground nuclear test containment expertise, underground phenomenology measurement technologies, nuclear chemistry expertise and laboratories, device systems and device assembly specialties, and the infrastructure to field experiments at the NTS.

LLNL conducted activities in support of defining and preparing for future nuclear tests to the extent possible given the continued uncertainty in the planning process. GREENWATER was closed out at the start of the fiscal year. LLNL responded to changes in GABBS definition as Hatfield guidance was developed and laboratory responsibilities were established for the final tests. A "universal" diagnostic system was designed and fabrication begun for part of the DOLOMITE event. Test locations on Pahute Mesa were prepared for tests with yields approaching 150 kt, and sites for lower-yield experiments were prepared on Yucca Flat. LLNL terminated development of new diagnostic systems except as appropriate for new dual-use applications. These activities are supported within the resources required to maintain a test capability. Nondefense program funding for LIMESTONE design allowed retention of certain key nuclear test staff who could remain focused on test issues. Funding for this effort was terminated at the end of FY 1993.

An LLNL objective in the field was to minimize costs consistent with preparing for an uncertain future. EG&G/EM and REECO support staffs were sized for approximately 2 1/2 events of moderate complexity per year. During FY 1993, remaining contractor field personnel worked on consolidation issues, perfecting operation and analysis techniques for digital diagnostics, archiving old data, and standing "at-the-ready" for a 90-day restart.

The LLNL field operations team worked closely with LANL, SNL, DNA, and DOE/NV to consolidate field support activities under a single Joint Test Organization. Similar functions in the several organizations were combined in tasks such as logistics, hole logging, device assembly, postshot drilling, and field engineering.

Readiness exercises were conducted to maintain test operation and execution skills.

3.0 OPERATIONS COORDINATION

3.1 PROGRAM IMPLEMENTATION

3.1.1 Mission Statement

The Operations Management Branch is located in Area 6 of the NTS at the CP in Building CP-LB. The Branch is responsible for monitoring various operational activities at the NTS. During Operation KLAXON, the Branch was staffed by personnel from DOE/NV TOD, who provided staff support to the Test Controller and the associated laboratories. Staff support was also provided to other government agencies, contractors, and entities having programs or activities at the NTS.

The normal operating schedule of the Branch was 0700 to 1730, Monday through Friday. For nuclear test execution periods, coverage is extended to 24 hours a day from D-1 until released by the Test Controller.

The Branch representative coordinates and monitors nonweapons test programs and activities to ensure noninterference with weapons testing activities.

3.1.2 Program Oversight

Program oversight of contractor and user operations of surface ground zeros (GZs) was accomplished by periodic field inspection and surveillance by Branch personnel. Field operations were evaluated for compliance with DOE Orders and with DOE/NV, contractor, and user written procedures.

When discrepancies were found, they were referred to the contractor or user for resolution.

3.1.3 Functional Responsibilities

Branch responsibilities include providing the necessary coordination for facilitating wide-load movements within the confines of the NTS to ensure noninterference with source and special material movements, emergency runs, other wide loads, or current field projects; coordinating requests by REECo Power and Communications for periodic power outages required to perform maintenance, repair damage, upgrade equipment, and/or troubleshoot equipment failure; briefing NTS tour groups on event-related subjects such as on-site and off-site safety precautions, procedures in the Test Control Center, and duties of the involved personnel; coordinating high-explosive detonations, excluding those in conjunction with postshot drilling, to ensure that safety procedures were in effect and that the detonation would not adversely affect other projects, personnel, or aircraft; monitoring source and special material movement on the NTS to avoid interference by wide loads, emergency vehicles, road repair, and inclement weather; and assuring positive, rapid action in response to emergencies occurring during normal duty hours and notification of appropriate personnel for reporting purposes. During nonduty hours, emergencies and notifications are handled by the DOE/NV Duty Officer at the NTS.

3.2 ONGOING ACTIVITIES

3.2.1 Access to Closed Areas

Nellis Air Force Range Entries ■ The Branch coordinated access into the Nellis Air Force Range by NTS users, including both ground and aerial projects related to the weapons testing program.

Entries Into Contaminated Areas ■ The Branch coordinated entries into certain radiation exclusion areas on the NTS and Tonopah Test Range. Safety requirements were stated to personnel prior to granting entry approval.

Key or Combination Control ■ The Branch controlled keys or combinations for unlocking certain bunkers, buildings, barricades, and facilities in the weapons test area. Persons or user agencies desiring access coordinated through the Branch.

3.2.2 Aircraft Activities

Aircraft Penetrations ■ The NTS (R-4808N) is special-use airspace and, except for emergencies, all aircraft penetrating must have prior authorization. Penetrations normally are restricted to aircraft performing official DOE/NV missions. Upon request for penetration, pertinent information as to altitude, flight path, and landing areas is obtained and logged. Pilots of approved flights were also advised of airspace restrictions within the NTS.

From time to time, special military operations required the Branch to close portions of the Nellis Air Force Range airspace for low- and high-altitude flights.

The Branch maintained an awareness of all potential hazards to airspace such as high-explosive detonations, laser operations, and weapons-firing activities. Landings of aircraft containing hazardous material also required special coordination with the Branch.

Airspace usage on the NTS was generally confined to flights for aerial survey, pre- and postshot aerial photography, cargo transport, passenger transport, test support, radiation monitoring, occasional distinguished visitor tours, security inspections, and U.S. Air Force fixed-wing overflights.

Aircraft Support ■ During simulated nuclear operations, air support was provided for operational flights, security sweeps, survey flights, photography, and postdetonation aerial monitoring and tracking, as well as distinguished visitor flights. These aircraft were provided by the U.S. Department of Energy Remote Sensing Laboratory.

During operational test periods, control of aircraft over the closed or restricted airspace of the NTS was provided by an Air Force Communications Command through the Air Operations Center, under operational control of the Chief, Operations Management Branch, DOE/NV.

Other Aircraft Activity ■ The Operations Management Branch also:

- Monitored RED FLAG (Joint Military Flight Operations) schedules to avoid NTS-related operational problems.
- Reviewed and approved requests from the U. S. Air Force for both high- and low-level overflights of the NTS to prevent interference with NTS testing operations.

- Provided authorization, coordination, and support for USGS aircraft operations overflying the NTS in support of DOE YMP.

3.2.3 Closures

Airspace Closures ■ The Branch closed the airspace over designated areas during laser testing, hazardous chemical spill tests, special DoD situations, or any other situation where possible hazard to aircraft, personnel, or security might occur.

Area Closures ■ The Branch temporarily closed ground access to areas where certain hazards existed or special projects required closure such as laser tests in Area 25 and high-explosive tests in Rainier Mesa.

Road Closures ■ The Branch authorized all road closures and reopenings as the result of road repairs, weather conditions, special movements, and wide loads.

3.2.4 Permits and Transfers

The Branch coordinated the registry and use of continuous-wave lasers on the NTS and issued operations permits to agencies having special projects or operations. Any binding restrictions were incorporated within these permits.

3.2.5 Test-Related Activities

Preparation of the Test Controller's Operations and Security Plan began approximately four weeks before each scheduled activity. The Test Controller required that the Branch be made aware of the name, exact location, function, and communication contact of all personnel in the forward area during the time from H-3 hours in the closed area, and H-30 minutes in the controlled area, through H hour. An additional item of record was the number of vehicles available to each group and the radio nets available for control. During Operation KLAXON, this procedure commenced on D-2 when forms from each agency were received and the tabulation of stations and listed personnel was begun. (D Day personnel accounting was accomplished through use of the DOE "ABC" form.) A typical activity had 350 to 500 individuals at 15 to 20 different locations. Alphabetized computer printouts of lists were sent to a limited distribution.

The operational phase continued through the completion of the activity.

3.2.6 Other Coordination Activities

Those personnel invited by the Test Controller to attend prereadiness briefings and readiness briefings were notified by the Branch as to the date, time, and location.

Verbatim minutes were taken of all Containment and Readiness Briefings and then transcribed and sent to a limited distribution. Briefings were tape-recorded and the tapes were maintained by the verbatim reporter.

Assurance was made on D-1 that all aircraft scheduled to participate in an activity were available.

Pre- and posttest reports containing pertinent information relating to the results of the activity were compiled and sent to a limited distribution.

On D Day, the Branch was also responsible for coordinating test area clearances. By H-30 minutes, actual counts of the number of personnel at each location and job functions, plus hard core personnel, were submitted to the Test Controller. A Test Log was kept on pertinent times of important information on all individual activities.

A representative of the Branch was designated as Evacuation Coordinator during this series. The Evacuation Coordinator was responsible for critiquing evacuation rehearsals from Test Controller-approved stations and was responsible for assuring the Test Controller that all personnel were on assigned stations as required.

3.3 SPECIAL STUDIES/ACTIVITIES

3.3.1 Photographic Albums

The Branch maintained photographic albums of all manmade structures (buildings, bunker facilities, etc.) in the weapons test areas and all NTS security barricades, fallout shelters, and non-event-related mines and shafts. The albums contain both photographic records and pertinent narrative data.

The Branch coordinated activities of various agencies conducting nonnuclear tests or projects so as to avoid interference between users and the weapons test program.

Coordination activities during Operation KLAXON, with totals for the fiscal year, are presented in Table 8.

TABLE 8. OPERATIONS MANAGEMENT BRANCH ACTIVITY SUMMARY

Activity		Number
Wide Loads		279
Airspace Closures		56
Aircraft Penetrations Over R-4808N		55,042
Power Outages		46
Source and Special Material Moves		1
Operations Permits		26
Tours and Briefings		187
Readiness Briefings	(actual)	1
	(exercise)	3
Operations Plans	(actual)	1
	(exercise)	3

3.3.2 Duty Officers

Members of the Branch were assigned as Duty Officers, at least one of whom was available at the NTS at all times.

4.0 SAFEGUARDS AND SECURITY

4.1 PROGRAM IMPLEMENTATION

4.1.1 Mission Statement

The DOE/NV Safeguards and Security Division provides planning, guidance, and staff support on safeguards and security matters for the weapons testing and nuclear emergency response programs, as well as special programs of other government agencies. The Division Director, in the capacity of Security Advisor to the Test Controller, provides continuous staff support and guidance on these matters during all weapons tests and other related activities. (No nuclear tests were conducted during Operation KLAXON).

4.1.2 Program Oversight

The Division oversees and directs security services provided by WSI. These services include furnishing armed Security Police Officers and unarmed Security Officers; operating pass and badge offices and the Visitor Control Office; and providing special shipment security, escort services, security education, and protection measures to ensure the safety and security of material and personnel.

4.1.3 Functional Responsibilities

Office of the Director ■ The Office of the Director manages the DOE/NV Safeguards and Security program; interprets guidance and establishes procedures to develop, implement, and prioritize the program's plans and budget; appraises the performance of the security contractor at DOE/NV and NTS; oversees liaison with federal, state, and local law enforcement agencies; and manages, develops, and implements the Division's internal control system and Quality Assurance program. The Office also arranges for and/or conducts special Operations Security studies, analyzes security reports, recommends corrective action on perceived operational deficiencies, and provides the Chairman for the DOE/NV Operations Security Working Group.

Internal Security Branch ■ The Internal Security Branch plans and directs the DOE/NV personnel security and visitor control programs, conducts the DOE/NV Security Education Program, provides policy guidance and assistance, and maintains uniform standards and procedures. As a part of these functions, the Branch oversees issuance of security clearances for DOE/NV and contractor employees, provides security certification of all personnel assigned to critical duty assignments, and conducts the continuing Reinvestigation Program. The Branch also conducts interviews, arranges administrative review hearings, and initiates additional investigations as necessary to resolve questions of clearance eligibility. Notifications of proposed sensitive-country travel are also processed by the Branch, which administers procedures for control of classified and foreign visits to DOE/NV and contractor facilities.

Physical and Technical Security Branch ■ The Physical and Technical Security Branch provides assistance to DOE/NV and contractor organizations in coordination of all phases of security and the development of long-range safeguards and security plans, activities, and budgets. The Branch develops local standards and procedures for implementing DOE policies pertaining to physical and technical security and reviews and approves design of the appropriate systems, such as closed-circuit television, intrusion detection and duress alarm systems, and defense against clandestine

listening devices. The Branch is also delegated the responsibility for conducting all facility security surveys in accordance with DOE orders.

The Branch also administers the security contracts and the physical security and property protection program at off-site locations. Management of the program to determine the level of Foreign Ownership Control or Influence is also a branch responsibility. Branch personnel assist in the administration and operation of secure communications, and serve as armed federal officers when requested.

Additional Branch responsibilities include establishment of control procedures and channels for storage and shipment of classified documents and materials other than nuclear material, and security during nuclear emergency response deployments.

Safeguards and NTS Security Branch ■ The Safeguards and NTS Security Branch assists contractors in development and implementation of procedures to control and safeguard classified information and federally owned property at the NTS and to prevent access to classified information by unauthorized personnel. The Branch monitors the activities of the security contractor guard forces at DOE/NV and the NTS, controls channels for transmittal of classified documents and shipments of classified material, supports security surveys at the NTS, controls badging requirements to ensure that only authorized visitors and participants are permitted to enter the NTS, investigates reports of alleged or suspected violations of security or property protection interests at the NTS and ensures that necessary actions are taken, and provides courier services to and from the NTS as required.

The Branch also serves as the Safeguards and Security Division point of contact for DoD special projects at the NTS and administers the Security Air Operations program.

Branch nuclear-material responsibilities include development of policies and procedures for accountability and control of nuclear materials used in operations under DOE/NV's cognizance; review and evaluation of contractor and user procedures; monitoring and appraisal of operational activities to ensure compliance with the appropriate policies and procedures; receipt, shipment, storage, and accountability for nuclear materials used in operations under DOE/NV cognizance; and maintenance of detailed records.

4.2 ONGOING ACTIVITIES

4.2.1 Device Movement, Control, and Accountability

The Manager, DOE Albuquerque Operations Office (AL), is responsible for movement of all assembled test devices to the NTS. Movement of explosive components is the responsibility of the Manager, DOE/NV, the Manager, DOE/AL, or the Manager, DOE Oakland Operations Office (formerly San Francisco, DOE/SAN), as appropriate. The Manager, DOE/NV, is responsible for accepting custody of and providing for secure storage and movement of test devices and related classified material at the NTS.

All special and source materials are accounted for and controlled through the Nuclear Material Facility at the NTS. Control and accountability activities include arranging for receipt, transfer, storage, transportation, security, and safety of special and source material; maintaining records; and preparing supporting records and documents. All special and source material expenditures are verified against existing inventories; Certificates of Expenditure are prepared by the appropriate User Test Group Director and approved by the DOE/NV Test Controller. Movement of nuclear

explosives and components to GZs is arranged at user request with the concurrence of the Manager, DOE/NV, and involves arrangements for the necessary equipment and personnel to coordinate the movement and ensure safety, security, and fire protection.

Tritium used in LLNL tests is stored and disbursed under the direction of the DOE/NV Special and Source Materials Representative.

4.2.2 Technical Security

The DOE/NV Safeguards and Security Division maintains technical security capability for the detection of clandestine listening devices at DOE/NV facilities, DOE/NV contractor facilities, and user organizations at the NTS, in Las Vegas, and at other locations. Capabilities also exist for the design, engineering, installation, maintenance, and repair of intrusion detection and strategic alarm systems; closed-circuit television for security monitoring and surveillance; security locking mechanisms and classified storage containers; secure computer systems; and radio equipment of security significance.

During Operation KLAXON, the central alarm station system was used to monitor approximately 400 alarm points, including volumetric intrusion detection alarm sensors and magnetic door switches.

Another system was used to monitor approximately 400 portable exterior sensors at the NTS.

4.2.3 Personnel Security Clearances

Security clearance processing actions conducted during Operation KLAXON are summarized in Table 9.

TABLE 9. SUMMARY OF SECURITY CLEARANCE PROCESSING ACTIONS

Action	Number
Requests to the Federal Bureau of Investigation for Full Field Investigation for "Q"	0
Requests to Office of Personnel Management for Full Field Investigation for "Q" (227 Initial - 1038 Reinvestigations)	1,265
Requests for National Agency Checks for "Q"	86
Cases Requiring Additional Field Investigations	47
"Q" Clearances Granted (including reinstatements)	409
"L" Clearances Granted (including reinstatements)	32
Cancellations of Clearance Requests (73 "Q"; 10 "L")	83
Clearances Terminated (1,417 "Q"; 17 "L")	1,434

Clearance processing actions included 269 personnel interviews by DOE/NV security personnel, nine of whom were afforded psychiatric examination to resolve questions of clearance eligibility. There were no denials, no revocations of clearance, and no cases referred to the Federal Bureau of Investigation pursuant to Title 18, U.S. Code. Two cases were handled under the Privacy Act of 1974, and three cases were handled under the Freedom of Information Act.

4.2.4 Pass and Badge Operations

WSI operates pass and badge offices in Las Vegas and Mercury, Nevada. The Las Vegas office was open five days per week during normal working hours to badge DOE/NV and DOE/NV contractor new hires, official visitors, and tour groups to the NTS. The Mercury office was operational Monday through Friday from 0600 to 1800.

Pass and badge office activities during Operation KLAXON are summarized in Table 10.

TABLE 10. SUMMARY OF PASS AND BADGE OFFICE ACTIVITIES

Activity	Number
Photographic Identification Badges Issued	5,856
Visitor Passes Issued	8,060
Temporary Badges Issued	6,289
Film Badges Issued	37,249
Fingerprints Taken	2,801
Badge Request Cards Processed	8,778
Group Access Badges Issued	12,247
Security Indoctrinations	1,233
Terminations Processed	2,202
Permits Issued (Firearms, Optical, etc.)	480
Outstanding Badges	890
Unauthorized Items Received for Storage	1,233
Lost Identification Badges Processed	305
Foreign Visitors Processed	472
Salvage Inspection/Sales Passes	430

4.2.5 Security Education

DOE Order 5631.1B requires annual security education refresher briefings for all employees with security clearances. Briefings comply with the policies and are being presented to all applicable employees. DOE/NV continues to use large security posters, outdoor signs, security slogans in the telephone directory, and security-oriented articles in the NTS News & Views to enhance security awareness.

4.2.6 Security Contractor Manpower

Figure 1 shows the number of hours WSI guards were scheduled to work during Operation KLAXON and the actual number of hours worked.

4.3 SPECIAL STUDIES/ACTIVITIES

During Operation KLAXON, anti-nuclear protesters were fewer than in previous years. No major anti-nuclear protests occurred during this fiscal year. The number of people arrested during the reporting period was 250.

WACKENHUT SERVICES INC.

TEST MANAGER'S REPORT DIRECT SECURITY SUPPORT FY 93

REVISED

Figure 1. Wackenhut Services, Inc., Guard Hours Scheduled Versus Guard Hours Worked

5.0 OPERATIONS COSTS AND MANPOWER

5.1 COSTS FOR OPERATION KLAXON

Costs for Operation KLAXON are summarized in Table 11.

TABLE 11. COST SUMMARY FOR OPERATION KLAXON

(Period Ended September 30, 1993)
(In thousands)

Program Direction - Testing	\$ 19,551
Weapons Testing	220,024
Change in Inventories	<u>-579</u>
SUBTOTAL	\$ 238,996
Reimbursable Work for the Defense Nuclear Agency	\$ <u>41,749</u>
TOTAL COSTS OPERATION KLAXON	\$ 280,745

5.2 PROPERTY DAMAGE COMPLAINTS/CLAIMS

The review and investigation of property damage complaints and claims as the result of DOE/NV testing activities and the recommendation for settlement of any claims are functions of the Office of the Assistant Manager for Environment, Safety, Security, and Health. These responsibilities are carried out in accordance with Section 167 of the Atomic Energy Act of 1954, as amended.

By Presidential directive, the terms of the TTBT of 1974 limit the testing of nuclear weapons to those with yields not to exceed 150 kilotons. This limitation has greatly reduced the number of property damage complaints and claims arising from ground motion generated by the detonation of underground nuclear tests. No complaint or claim was received during the period from October 1, 1992, through September 30, 1993.

5.3 EMPLOYMENT LEVELS

Employment at the NTS continued to decrease during 1993. The decrease is attributed to the budget reductions in defense-related activities. In October 1992, total employment was 9,522; by September 1993, the number had decreased to 8,917.

Contractor minority employment remained constant during FY 1993. In October 1992, 26.32 percent of the total work force was minority. By the end of the fiscal year, minority employment showed a slight increase to 26.60 percent of the total work force. Even though the overall number of females in the work force decreased, the percentage of females in the work force increased from 25.92 percent (1,962) to 27.23 percent (1,856).

5.4 LABOR RELATIONS

REEC Co completed negotiations for 24 new collective bargaining agreements in early FY 1993.

WSI completed negotiations and signed a new collective bargaining agreement with the Independent Guard Association of Nevada, Local Union No. 1.

A total of 28 labor unions represent approximately 2,000 employees at the NTS.

6.0 EXTERNAL AFFAIRS

6.1 PROGRAM IMPLEMENTATION

External affairs activity during Operation KLAXON was conducted under the External Affairs Plan for Test Operations, with news handling of test-related activities in accordance with the U.S. DOE/HQ Test Operations Center Standard Operating Procedures (SOPs).

6.2 ONGOING ACTIVITIES

6.2.1 Information Classification

Classification Guidance ■ Although no nuclear weapon tests were conducted during Operation KLAXON, and since July 1993 the United States has been observing a unilateral moratorium on testing, there has been no change in the classification of information related to previously conducted tests. Guidance for weapons-related tests continues to be provided by TCG-WT-1, *Joint DOE/DoD Topical Classification Guide for Weapon Testing*. This guide is based on CG-W-5, *Joint DOE/DoD Nuclear Weapon Classification Policy Guide*, which is the basic classification guide for all nuclear weapons activities. Classification guidance for the DoD Underground Nuclear Weapons Effects Test Program remains unchanged and is provided by the DNA through the basic classification guide issued September 11, 1974, *Classification Guide for DoD Underground Test Events*, and supplemental guides for each individual effects test. Additional detailed classification guidance for specific events has been provided by LLNL and LANL.

Classification guidance for information related to nuclear weapons activities subject to the Treaty on the Limitation of Underground Nuclear Weapon Tests, and its protocols, is provided by CG-ACTV-1, *Classification and UCNl Guide for Arms Control and Verification Technology*, issued January 1992; and CG-NV-TV-2 (Rev.1), *Classification and UCNl Guide for Verification Activities at the Nevada Test Site*, issued February 1992.

Declassification Proposals ■ The NV Classification Officer argued before the Technical Evaluation Panel in favor of NV-proposed declassifications related to unannounced tests, yields of atmospheric tests in the Pacific, radioactive source terms for NTS underground tests, and identification of the weapon employed in certain military systems proof tests. Approval of these proposals will demonstrate willingness on the part of DOE to be open about the weapon test program.

NTS Classification Symposium ■ On September 14-15, the classification office held its annual NTS Classification Symposium at which papers are presented by program scientists and managers describing latest developments on a wide variety of weapon test programs. Optimism was expressed that despite the apparent demise of weapon testing as we now know it, the NTS would continue to be an important resource for the weapon program.

Classification Briefings ■ Cessation of testing by no means reduced the need for maintaining vigorous classification education programs as required by DOE orders for employees of DOE and its contractors and others who generate or have access to classified information. It is anticipated that will become increasingly important as the Department embarks upon its new program of "openness."

6.2.2 Public Announcements

The NPE, involving 2.9 million pounds of conventional explosives, was announced publicly approximately six weeks prior to its detonation on September 22. News reporters and photographers were escorted to the NTS on September 1st and 7th to observe the pre-experiment cavity in N Tunnel (Figure 2), and to be briefed on the status of the test. High-level U.S. officials, American Indian tribal leaders, and foreign scientists also were briefed at the cavity site.

Ten news reporters, both foreign and domestic, observed the NPE from CP-1. They were briefed just prior to the detonation and just after the 12:01 a.m. experiment. The reporters included five Japanese, three with Fiji Television, and two with Kyodo News Service. U.S. reporters included Las Vegas Sun and Review-Journal writers, a local CBS-TV affiliate film crew, and a New York City freelance writer.

Approximately 30 visitors, including officials from China, Japan, New Zealand, Egypt, Italy, Indonesia, Finland, Romania, France, Germany, and the United Kingdom, observed the NPE from CP-1.

6.2.3 Test Site Activities

NTS Visits ■ During FY 1993, 360 visits, totaling 9,997 persons, were conducted at the NTS and other DOE/NV facilities. These visits included those arranged through DOE/NV's Office of External Affairs (OEA) support Visit Coordination Staff for the DOE, the DNA, the Yucca Mountain Site Characterization Project Office, and other programmatic offices. Among the visitors were 269 foreign citizens from 31 countries: Germany, Canada, Sweden, Japan, Australia, India, Mexico, Austria, France, Russia, Thailand, Norway, Iran, the Philippines, Finland, Republic of Korea, Brazil, United Kingdom, Jordan, Cuba, Taiwan, Bulgaria, the Netherlands, Ukraine, China, New Zealand, Spain, Romania, Italy, Egypt, and Indonesia. Of the foreign visitors, 54 were Japanese.

News Media Visits to NTS ■ OEA conducted 21 NTS visits during FY 1993 for news media with 76 participants from local, national, and international news organizations. Included are four Las Vegas television stations, the Las Vegas Review-Journal, Las Vegas Sun, and local radio stations.

Domestic news media outside Nevada included Village Voice, Los Angeles Weekly, Washington Bureau of Donrey Newspapers, Esquire Magazine, Simon & Schuster Publishing Co., Bauer Publishing Co., Mega Productions, Global Photo Association, Boston Globe, CBS News, CNN-TV Special Projects, Las Vegas Business Press, Swat Magazine, ABC-TV's Good Morning America, ABC-TV's Turning Point, Public Broadcasting Corporation's MacNeil/Lehrer News Hour, Valley Times, NBC-TV's Nightly News, ABC-TV News, ABTV, Tijeras, New Mexico; and the Center for War, Peace, and News Media.

Foreign news media included the Korean Broadcasting System, Nippon Television International Corp., the Yomiuri Shimbun, Pan Asian Newspaper Alliance, Nikkan Kogyo Shimbun, Fuji Television Network, Frankfurter Allgemeine Zeitung, Kyoto News Service, Asahi Shimbun, Axel Springer Publications, Fuji Sankei International News Service, NHK-Japan Broadcasting Corp., Technical Services, British Broadcasting Corporation News, Austrian Radio and Television News, Black Hills Productions, Poole Dorset-England, Kyodo News Service, and Nihon Keizi Shimbun.

Figure 2. N Tunnel, N25 Nonproliferation Experiment: Cavity Prior to Explosive Emplacement

NTS VIP Visitors ■ Elected VIP visitors to the NTS during FY 1993 included U.S. Senator Richard H. Bryan, Nevada; U.S. Representative John T. Myers, Indiana, ranking minority member of the House Energy and Water Development Appropriations Subcommittee; and Nevada State Senator, Raymond D. Rawson.

6.2.4 Public Interest

Weapons-Related Activities ■ News media inquiries continued at high levels due to public interest in extending the moratorium on nuclear weapons testing, the DOE environmental restoration program to clean up sites involved with radioactive materials, and the NPE that pertained to verification of nuclear and nonnuclear tests and provided data for possible future negotiations for a Comprehensive Test Ban Treaty. During FY 1993, OEA logged 1,058 news media contacts.

Protests ■ Approximately 606 anti-nuclear protesters demonstrated at the NTS during FY 1993, resulting in 250 arrests, compared with 2,567 demonstrators and 1,267 arrests in FY 1992. FY 1993 arrests were primarily for trespass onto NTS property but outside the permanent manned guard stations. Three protesters were also arrested and charged with trespass under federal law after they penetrated the NTS. Two of the three were arrested on two separate occasions.

Anti-nuclear organizations demonstrating during the fiscal year were American Peace Test, Nevada Desert Experience, Alliance for Atomic Veterans, and Citizen Alert.

DOE did not incur any additional costs for controlling demonstrations during FY 1993. This was a savings over the \$289,646 in additional costs incurred in FY 1992.

Education Outreach Program ■ The 20th annual "Science Now" program for outstanding high school mathematics and physical and natural science students was conducted April 22, 1993, in the DOE/NV auditorium. Thirty Southern Nevada and Southwestern Utah high schools sent more than 120 students and teachers to the annual day-long event. Students and teachers received hands-on experience working in technical research areas with government and contractor scientists. Thirteen students each received \$1,000 scholarships.

DOE/NV established partnership agreements with eight additional schools within the Clark County School District. They are Dell H. Robison Middle School, Frank F. Garside Middle School, John C. Fremont Junior High School, Roy W. Martin Middle School, Sunrise Acres Elementary School, Washington Opportunity School, Halle Hewetson Elementary School, and Rancho High School. In addition, two memorandums of understanding were signed with the Community College of Southern Nevada and the Lincoln County School District.

The DOE's second annual Regional Science Bowl competition was held on February 27-28, 1993. Thirty-two teams, 13 more than in FY 1992, participated. The students represented 27 high schools from Nevada, Arizona, and Utah. The Meadows School from Las Vegas won the final competition and represented Nevada at the National Science Bowl on April 16-19, 1993, in Washington, D.C.

The JASON Project was funded through a \$238,500, two-year DOE grant to the Clark County School District. The funds covered costs of telecommunications equipment and related necessities to allow about 20,000 students and teachers to view via satellite the JASON project's live underwater explorations. In addition to live broadcasts, students participated in interdisciplinary curriculum related to the expedition. They also toured related exhibits at Cheyenne High School after the broadcast.

The Teacher Research Associates program attracted seven teachers from Nevada and five from four other states. The teachers worked at DOE facilities for eight weeks during the summer on research projects that could be transferred to the classroom.

Freedom of Information ■ OEA received and responded to 133 Freedom of Information Act requests during FY 1993. The majority of the Freedom of Information Act requests were for DOE/NV contracts and historical nuclear weapons test data.

6.2.5 Conclusions and Recommendations

The external affairs activities and policies used in the KLAXON test-related activities continued with generally favorable news media coverage and general public acceptance of DOE/NV's programs. News media and selected public visits to the NTS should be continued with occasional experiments open to the news media and government officials. The DOE/NV open information policy should also be continued within classification limits.

7.0 VERIFICATION MANAGEMENT

7.1 PROGRAM IMPLEMENTATION

7.1.1 Mission Statement

The Threshold Test Ban Treaty (TTBT) signed in July 1974 and the Protocol to the treaty signed in June 1990 between the United States and the former Union of Soviet Socialist Republics (now the Russian Federation) provides rights and responsibilities for both parties relative to the conduct of nuclear weapons test verification activities. The ratification of the TTBT and the Protocol required the U.S. testing community to expand its activities to ensure that U.S. tests are conducted in compliance with the specifications of the Protocol.

7.1.2 Program Oversight

DOE/NV and associated national laboratories are responsible for the application of the technical provisions of the TTBT Protocol at the NTS and to oversee the technical operations of the Russian verification team. The goals of this oversight are to ensure that the Russian team does not compromise the United States ability to achieve the scientific objectives of the experiments or to conduct nuclear weapons tests safely and to ensure that national security interests are properly safeguarded.

7.1.3 Functional Responsibilities

The Verification Management Division (VMD) is responsible for the development of DOE/NV policies, procedures, and operational plans for verification activities conducted at the NTS to ensure compliance with the TTBT. VMD is the focal point for coordination of verification activities with DOE/HQ, the On-Site Inspection Agency (OSIA), laboratories, contractors, and associated agencies. Staff support is provided to the Assistant Manager for Operations, the Test Controller, and the Verification Representative during operational activities. VMD maintains a reference set of all reports, notifications, and exchanges of information, data, and photographs as specified in the TTBT Protocol.

7.2 ONGOING ACTIVITIES

The United States notified the Russian Federation that the verifiable nuclear tests MEXIA and ICECAP would be conducted at the NTS during 1993.

On July 16, 1992, the Russian Federation notified the United States that they declined their rights to verify the MEXIA test.

On January 16, 1993, the Russian Federation notified the United States that they declined their rights to verify the ICECAP test.

The Russian Federation, on February 10, 1993, notified the United States that the verifiable nuclear test PRILIV would be conducted at the Russian test site at Novaya Zemlya during 1993.

On February 15, 1993, the Russian Federation was notified that the United States would exercise its right to verify the PRILIV nuclear test. A Coordinating Group meeting was held in Moscow from March 16, 1993, through April 3, 1993, with Designated Personnel from both the United States

and Russia, for the purpose of developing a Coordinated Schedule of events to support the PRILIV test. The Coordinated Schedule for the PRILIV test was completed and signed on April 3, 1993, and provided to the representatives of both the U.S. and Russian governments. The first U.S. scientists were scheduled to arrive at Novaya Zemlya in July.

A delegation of U.S. scientific personnel made a familiarization visit to the Russian Northern Test Site at Novaya Zemlya during June 14-18, 1993. This was the first time any foreigners were invited to the Russian test site.

The United States, on July 3, 1993, followed by the Russian Federation on July 12, 1993, announced that they would observe a moratorium on the testing of nuclear weapons until September 30, 1994, and both countries postponed all previously announced tests.

7.3 SPECIAL STUDIES/ACTIVITIES

The United States conducted a Nonproliferation Experiment at 1201 a.m., September 22, 1993. The NPE was successfully detonated in N Tunnel at the NTS and was witnessed by national and international dignitaries, international and local news media, as well as interested stakeholders. The NPE, with an explosive force equal to 1,000 tons of TNT (one kiloton), was sponsored by the DOE Office of Intelligence and National Security. LLNL was the lead laboratory, with participation from LANL and SNL. Also participating were representatives from the governments of the United Kingdom and France.

The purpose of the NPE was to compare seismic measurements from this conventional explosion with those of previously detonated nuclear tests of similar explosive force. The experiment also provided information to help DOE develop techniques which can discriminate between small nuclear detonations and conventional explosions.

7.4 REPORTS

No reports were prepared during Operation KLAXON relating to the nuclear weapons testing program. One report related to the NPE was prepared during Operation KLAXON. This report discussed the activities previously presented under the Special Studies/Activities heading.

Completion Report: Nonproliferation Experiment (NPE), September 1993, DOE/NV.

8.0 EMERGENCY RESPONSE MANAGEMENT

8.1 PROGRAM IMPLEMENTATION

8.1.1 Mission Statement

The DOE/NV Emergency Management Division (EMD) develops, administers, and evaluates programs for management of emergencies that occur at DOE/NV facilities. In addition, DOE/NV has the responsibility for managing national emergency response programs in response to radiological emergencies. This includes response to any release from an underground nuclear test. Emergency management responsibilities include review of plans, operations, and work to ensure the requirements are met and emergencies will receive adequate response. The national emergency response programs include the Nuclear Emergency Search Team (NEST), the Aerial Measuring System, and the Federal Radiological Monitoring and Assessment Center (FRMAC).

8.1.2 Program Oversight

The division's oversight activities include program reviews, project reviews, appraisals, and functional monitoring of specific activities. Additionally, the program responsibilities include review of plans for emergency response to a prompt massive venting resulting from an underground nuclear test. Oversight of specific activities is accomplished using staff with appropriate background for specific functional areas. In addition, EMD provides a full-time employee at the NTS as the Emergency Management Site Representative. This employee conducts a comprehensive oversight program of all emergency management functions at the site.

8.1.3 Functional Responsibilities

The EMD responsibilities are to:

- Review emergency management and preparedness plans.
- Review implementing procedures for all DOE/NV programs.
- Provide the lead for development of the NTS Radiological Emergency Response Plan for a prompt massive venting resulting from a nuclear test.
- Oversee the development of procedures for implementing DOE 5500 series orders for emergency management and 5530 series orders for emergency response.
- Provide organizational support and oversight for the NEST, Aerial Measuring System, and FRMAC programs.
- Conduct functional appraisals, surveillances, project reviews, and other reviews to ensure compliance with DOE Emergency Management Orders.
- Observe and participate in drills, exercises, and training in emergency management for all facilities and programs under the jurisdiction of DOE/NV.
- Observe and participate in exercises for response to a prompt massive venting.

8.2 ONGOING ACTIVITIES

8.2.1 Participation In and Support of Nuclear Tests

EMD assigns personnel to CP-1 during test execution to provide appropriate emergency response support to the nuclear testing program. EMD observes each test to provide action guidance should a testing emergency arise. Input is in the form of comments on briefings, or on occurrences that

may take place during the period before the test. During Operation KLAXON, EMD provided support for all readiness exercises and nonnuclear experiments.

8.2.2 Emergency Plans and Procedures

The EMD oversees the development, preparation, and finalization of emergency plans and procedures for DOE/NV operations. Plans and procedures include plans for responding to major U.S. radiological incidents, and smaller emergencies such as fires at NTS facilities, and procedures for evacuation and deployment to remote areas. DOE/NV uses a number of orders and directives to carry out mission requirements as delineated in the following DOE Orders:

- 5000.3A Occurrence Reporting and Processing of Operations Information
- 5500.1B Emergency Management System
- 5500.2B Emergency Categories, Classes, Notification and Reporting Requirements
- 5500.3A Planning and Preparedness for Operational Emergencies
- 5500.4 Public Affairs Policy and Planning Requirements for Emergencies
- 5500.7A Emergency Operating Records Program
- 5500.8 Energy Emergency Planning and Management
- 5500.9 Emergency Planning, Preparedness, and Response to Continuity of Government Emergencies
- 5500.10 Emergency Readiness Assurance Program
- 5530.2 Nuclear Emergency Search Team
- 5530.3 Radiological Assistance Team
- 5530.4 Aerial Measuring System
- 5530.5 Federal Radiological Monitoring and Assessment Center

8.2.3 Appraisals, Surveys, Inspections, and Reviews

During FY 1993, EMD developed a schedule for surveillances and reviews to be conducted over all emergency management programs under its purview. Appraisals of the full scope of the emergency management programs of seven site contractors/users were conducted during FY 1993.

8.3 SPECIAL STUDIES/ACTIVITIES

In FY 1993, EMD participated in a number of NEST and FRMAC drills and exercises. The following is a list of activities:

<u>Name of Activity</u>	<u>Type</u>	<u>Location</u>	<u>Date</u>
Last Hand Drill	NEST Access	Nevada Test Site, Nevada	Dec '92
FRMAC 1993 Ex	Nuclear Power Plant	Omaha, Nebraska	Jun '93
Palo Verde Ex	Nuclear Power Plant	Phoenix, Arizona	Sep '93
Fremont Ex	DOE Facility	Richland, Washington	Sep '93

EMD conducted or participated in nearly 100 meetings, conferences, training seminars, or exercise planning meetings throughout FY 1993. Many NEST and FRMAC plans were revised, and the first draft of the FRMAC Operations Plan was developed and reviewed.

9.0 METEOROLOGICAL SUPPORT

9.1 PROGRAM IMPLEMENTATION

9.1.1 Mission Statement

The mission of the NOAA/WSNSO is to provide all weather observational, meteorological forecast, and radiation prediction services required to support the DOE/NV programs at the NTS and other DOE/NV project sites.

9.1.2 Program Oversight

WSNSO is administered by the National Weather Service (NWS) Western Region Headquarters, NOAA, U.S. Department of Commerce. WSNSO fulfills its mission responsibilities through reimbursable funding determined by an Interagency Agreement with DOE/NV. The DOE/NV Assistant Manager for Operations administered the agreement with WSNSO during Operation KLAXON.

9.1.3 Functional Responsibilities

WSNSO responsibilities for each weapons test (none during FY 1993) or readiness exercise are to provide a senior representative as Weather Advisor on the Test Controller's Advisory Panel, observe local meteorological conditions, make preshot predictions of meteorological parameters pertinent to event execution, estimate potential radiological exposures, document zero-time weather conditions, and evaluate postshot weather conditions throughout the period of interest.

These meteorological support responsibilities are divided among four functional sections. An observation section is responsible for operating surface and upper-air sounding stations and processing meteorological data, an equipment maintenance section is responsible for preventive maintenance and repairs, an analysis and prediction section prepares briefing charts and makes weather forecasts, and a radiation estimates section presents potential radiological exposure predictions essential to decisions on safe event execution by the Test Controller and the Test Controller's Advisory Panel.

9.2 ONGOING ACTIVITIES

9.2.1 Local Upper-Air Observations

Upper-air observations of pressure, temperature, humidity, and wind velocity were taken twice daily from the weather observatory located near the Desert Rock Airstrip on the NTS. These upper-air soundings were taken routinely at 0400 and 1600 Pacific Standard Time (1200 and 0000 Coordinated Universal Time) and reached altitudes of nearly 90,000 feet (27,400 meters)¹ mean sea level (MSL). On D Day, similar observations were taken in Yucca Flat to at least 25,000 feet (7,620 meters) MSL. One sounding was taken four to six hours prior to the event and the other

¹ In the text, approximate metric equivalents are shown in parentheses following the English units. However, only English units are shown in figures and tables.

at H Hour. Additional upper-air soundings were taken as required for complete forecast support and to meet operational requirements.

Winds-aloft data from over the NTS and from locations surrounding the NTS were taken to support nuclear test readiness exercises. Up to eight preselected locations are used routinely. Winds-aloft data from these stations were obtained via the WSNSO digital pilot balloon (DIGIPI) system. DIGIPI is a mobile array of microprocessor-based pilot balloon stations connected by a radio communications network interfaced with the WSNSO computer network. These system connections permit interactive analysis and display of the winds-aloft data. DIGIPI data supplemented the National Meteorological Network data and permitted a complete definition of air-flow patterns on a scale appropriate to the needs of the KLAXON test operations.

9.2.2 Local Surface Observations

Continuous records of pressure and wind, as well as hourly values of temperature, humidity, and other weather elements were available from the observing facility at Desert Rock.

Surface wind information from numerous meteorological data acquisition towers at representative on-site locations is radio-telemetered every 15 minutes into the CP Weather Office. This information provided data for evaluation of the low-level wind flow during the entire period of operations, as well as immediately before each activity conducted during Operation KLAXON. Lightning ground-strikes over the NTS and much of Southern Nevada are automatically detected and located by the WSNSO Automatic Lightning Detection System. A broadband radio frequency direction finder unit is located in each of the four principal corners of the NTS. Three additional direction finders are located off the NTS from Las Vegas to the Warm Springs area. The direction finder signals are multiplexed to a central position analyzer that computes lightning locations and characteristic data. Graphical lightning displays are available on the Network Display System located at the CP Weather Office. The WSNSO Automatic Lightning Detection System ensures that accurate, continuous, real-time, lightning information is available throughout the year.

9.2.3 Local Communications

Radio and telephone equipment is used to collect on-site weather information. Off-site upper-air wind speed and direction data from the DIGIPI system are automatically received via the Net 12 radio system and interfaced to a computer, which interactively displays the upper winds.

9.2.4 Large-Scale Data Acquisition

The primary source of large-scale meteorological data is the NWS Automation of Field Operations and Services (AFOS) system. The AFOS system provides analyzed charts of large-scale weather systems, guidance forecasts of major weather phenomena, and prognostic charts of essential meteorological parameters produced by numerical computer models at the National Meteorological Center (NMC). AFOS additionally displays hourly airways weather reports, area and terminal forecasts, 3- and 6-hourly synoptic weather charts, 12-hourly rawinsonde reports, and regional guidance reports available to the forecaster. The Federal Aviation Administration Air Route Traffic Control radar network provides hourly AFOS graphics showing those areas of the Western United States experiencing heavy amounts of precipitation. Additional information from the WSR-74C weather radar at the Las Vegas Weather Service Office is available to WSNSO when detectable precipitation occurs within the 200-mile (322-kilometer) range of the radar.

Geostationary Operational Environmental Satellite imagery is obtained through the use of a Satellite Weather Information System permanently linked to the NWS Forecast Office at Redwood City, California. A color copier permits WSNSO personnel to copy satellite pictures and Pacific weather charts on transparent film for display at weather briefings.

The NMC transmits special trajectory forecasts based on numerical computer models on each D-1 and D Day to the CP Weather Office AFOS.

The Bureau of Land Management operates an extensive network of lightning detection stations throughout the Western United States. This large-scale lightning information is made available to WSNSO by the NWS Western Regional Headquarters through the Boise Weather Service Forecast Office AFOS.

9.2.5 Data Utilization and Analyses

Large-scale data from the National Meteorological Network and mesoscale data from the WSNSO network were analyzed to determine the air flow regime between the ground and 14,000 feet (4,270 meters) MSL. These analyzed charts and a wide spectrum of national model guidance products were used by the forecaster to predict the winds aloft over GZ for a 12-hour period (Figure 3) and to predict constant-level, air-parcel trajectories at various levels in the atmosphere.

Vertical temperature soundings provide the basis for estimates of cloud rise and atmospheric stability in the event of an accidental release of radioactivity.

Local network and AFOS data were used to assess and predict weather conditions. Radar weather charts were particularly useful in defining areas of precipitation. Satellite pictures were helpful in locating cloud fields and thunderstorms. Lightning information was useful in identifying active thunderstorms. The radar, satellite, and lightning data can be combined to determine movement and intensity changes in thunderstorms.

Locally developed objective prediction aids and computer models are used to augment guidance available from the NWS. Special streamline charts for 10,000 feet (3,050 meters) MSL and other appropriate levels are prepared for the Western United States. The streamlines are generated by a WSNSO computer model and transmitted to the CP Weather Office AFOS. These charts are used during weather briefings to portray the air flow over the NTS.

All tabulated weather data for each KLAXON activity were archived and distributed to interested principal participants after each activity.

9.2.6 Radiation Estimates

The WSNSO Radiological Estimates and Research Branch (RERB) is responsible for preparing radiation estimates, during nuclear testing operations, for the Test Controller and the Test Controller's Advisory Panel. The primary operational function of the WSNSO Radiation Briefer is to prepare and present D-1 and D Day radiation briefings during event support.

Following the final pre-event briefing, the Radiation Briefer continues to monitor meteorological conditions and to revise radiological estimates as appropriate.

WIND TIME-SECTION FORECAST

HGT	D/S	05	07	09	TIME	13	15	17
14	2839							
12	2729							
10	2620							
9	2518							
8	2417							
7	2316							
6	2215							
5	2113							
SFC	2008							
		05	07	09	TIME	13	15	17

VALID AT: 0500-1700 MO/DY/YR

FORECASTER (INITIALS): NSO

PRESENTED (DATE/TIME): MO/DY 1400

Figure 3. Typical Presentation of the Forecast Winds-Aloft Time-Section

If any event were to release radioactivity detectable off-site, WSNSO Meteorologists would participate in the activities of the Data Acquisition and Assessment Center and the FRMAC. Assistance would be rendered to those organizations engaged in aerial tracking and environmental surveillance by furnishing trajectory predictions of radioactive clouds and by suggesting areas where additional monitoring might provide more complete data to assess the degree of radioactive contamination. The RERB is responsible for post-event documentation of any episodes in which released radiation is detected off site. The transport, diffusion, and deposition of released radioactive debris are analyzed using event-related radiological and meteorological data. Post-event analyses are also used to assess the validity of currently employed WSNSO estimation techniques and to augment available prediction models.

An analog scaling technique incorporating the NTS venting model would be employed to estimate potential radiological exposures. The fallout estimation method involves ratio scaling applied to estimated (new event) and observed (NTS model event) parameters. The parameters include the total equivalent fission yield, the fraction of the total equivalent fission yield production deposited in the fallout pattern (fallout fraction), the depth of the radioactive cloud layer, the mean transport speed of the cloud, and the fallout sector, wind-direction shear.

The total equivalent fission yield for each event would be provided by the sponsoring laboratory. An accepted standard fallout fraction is assumed for each event. An empirical relation developed by WSNSO is used to obtain the potential radioactive cloud depth. Estimates of cloud mean transport speed and fallout sector shear are based on space-time projections of winds aloft that would influence the transport and deposition of cloud debris.

The parametric scaling technique is applied to the NTS-venting model fallout centerline curve (H + 1 hour exposure rate versus distance) to obtain the estimated (new event) curve of the potential fallout centerline H + 1 hour exposure rate with distance. The estimated fallout exposure rates are converted to total first-year external-gamma exposures along the centerline. Total exposure estimates include external-gamma exposure from both cloud passage and deposition. Estimates of potential cloud passage exposure are derived from the fallout estimates using empirical relations. The estimated fallout exposure rates are also used to make estimates of the total first-year infant thyroid ^{131}I dose due to drinking milk from cows eating fallout-contaminated green or dry feed. The Knapp² relationship relating open field exposure rates to levels of ^{131}I in cows milk is used to derive the infant thyroid ^{131}I dose estimates. These ^{131}I dose estimates, along with the external-gamma exposure estimates, are provided to the EPA briefers for the preparation of their briefing materials.

Computer programs are used in the preparation and plotting of the potential fallout exposure estimates. The RERB computer programs are also installed as ready backup in the DOE/NV building in Las Vegas. Backup output from these programs can be transferred through the Las Vegas AFOS computer to the CP Weather Office AFOS computer via telephone link and through dedicated data lines to the plotter and terminals. Additional radiological programs remain in the CP Weather Office AFOS computer to be used as additional backup, as necessary.

² KNAPP, H. A., " ^{131}I in Fresh Milk and Human Thyroids Following a Single Disposition of Nuclear Test Fallout," TID-19266, July 1963.

9.2.7 Briefings

D-1 and D Day event weather briefings were prepared at the CP Weather Office. The event-time winds-aloft forecast, completed about one hour before briefing time, was given to the event Radiation Briefer for preparation of the radiological estimates.

Formal pre-event weather briefings were presented to the Test Controller and his Advisory Panel by the Weather Briefer who is responsible for the final decision on the forecast and briefing aids to be used.

Normal briefing materials include graphic displays of the following types of forecasts:

- A 12-hour time cross-section of winds above surface GZ (Figure 3).
- Vertical profiles of event-time temperature above surface GZ (Figure 4).
- Clouds and weather over a period spanning event time (Figure 5).
- Streamlines at 10,000 feet (3,050 meters) MSL or at other appropriate levels at event time (Figure 6).
- Trajectories at low-level and 10,000 feet (3,040 meters) MSL (and at other significant levels) showing expected 6-hour positions over a 24-hour period beginning at event time (Figure 7).
- Terminal aviation weather and en route flying weather in the forecast trajectory sector (Figure 8).

After the final pre-event briefing, the Weather Briefer continued to monitor and interpret incoming weather data and to revise forecasts as necessary. In the event of any release of radioactivity, WSNSO Meteorologists are prepared to provide meteorological data and forecasts until termination of tracking activities associated with the radioactive debris cloud.

Radiation briefings normally include graphic displays of geographical delineation of the fallout sector; orientation of the fallout activity centerline, including selected exposure levels and arrival times of peak activity along the fallout centerline for both on-site (Figure 9) and off-site areas (Figure 10); centerline potential total first-year and cloud passage whole-body external-gamma exposure (Figure 11); and deposition peak exposure rate (Figure 12).

Fallout hodographs are plotted and displayed beginning several hours before event time and continue as required by the Test Controller. Wide-screen, graphical displays of these hodographs are generated, as well as hard copies. Potential fallout sectors and exposure estimates were revised and displayed as dictated by changing meteorological conditions.

9.3 SPECIAL STUDIES/ACTIVITIES

Forecasts of surface GZ winds presented during the KLAXON series were compared with observed event-time winds. The results, summarized in Table 12, show error statistics for both D-1 and D Day forecasts.

D-1 forecasts are normally valid for periods beginning approximately 24 hours after the time of the principal atmospheric observations upon which the forecasts are based. D Day forecasts are typically valid for periods starting roughly 14 hours after the time of the principal National Meteorological Center atmospheric observations and 3 to 6 hours after the time of the latest local network observations upon which these forecasts are based.

VERTICAL TEMPERATURE PROFILE FORECAST

DATE: MO/DY/YR
 VALID TIME: ZERO TIME

PRESENTED (DATE/TIME): MO/DY 1400
 FORECASTER (INITIALS): NSO

Figure 4. Typical Presentation of the Forecast Vertical Temperature Profile

CLOUDS AND WEATHER FORECAST

SUNRISE: 0600

SUNSET: 1810

VALID (DATE/TIME) MO/DY 0500

VALID (DATE/TIME) MO/DY 0700

VALID (DATE/TIME) MO/DY 1300

FORECASTER (INITIALS): NSO

VALID (DATE/TIME) MO/DY 1900

PRESENTED (DATE/TIME): MO/DY 1400

Figure 5. Typical Presentation of Forecast Clouds and Weather

Figure 6. Typical Presentation of Forecast Streamlines

Figure 7. Typical Presentation of Forecast Air Parcel Trajectories

Figure 8. Typical Presentation of the Forecast Trajectory Sector Aviation Weather

Figure 9. Typical Presentation of the Geographical Delineation of the On-Site Fallout Sector, Centerline Orientation, and Arrival Time (H + Hours) of Peak Activity Along the Fallout Centerline

Figure 10. Typical Presentation of the Geographical Delineation of the Off-Site Fallout Sector, Centerline Orientation, and Arrival Time (H+Hours) of Peak Activity Along the Fallout Centerline

Figure 11. Typical Presentation of Centerline Potential Total First-Year and Cloud Passage Whole-Body External-Gamma Exposure

Event: 0500-1700 MO/DY/YR

Figure 12. Typical Presentation of Deposition Peak Exposure Rate

TABLE 12. WIND FORECAST ERROR STATISTICS FOR OPERATION KLAXON

DIRECTION ERROR								
Degrees of Error	$\leq 10^\circ$		$\leq 20^\circ$		$\leq 30^\circ$		Average	
Day	D-1	D	D-1	D	D-1	D	D-1	D
Height (Ft. MSL)	Percent of Cases						Degrees	
10,000	20	60	60	60	60	80	42	38
9,000	20	40	60	80	60	80	48	39
8,000	60	40	60	80	60	80	28	19
7,000	40	80	40	100	80	100	20	06
6,000	20	40	60	80	60	100	20	12
5,000	20	20	40	40	60	60	30	25
Surface	40	00	40	00	40	20	58	68

SPEED ERROR								
Speeds	≤ 5 kts		≤ 10 kts		≤ 15 kts		Average	
Day	D-1	D	D-1	D	D-1	D	D-1	D
Height (Ft. MSL)	Percent of Cases						Degrees	
10,000	20	60	60	60	80	80	7.4	11.2
9,000	20	40	60	80	80	80	7.6	8.6
8,000	60	40	60	80	80	80	6.0	9.0
7,000	40	80	40	80	100	80	7.0	6.4
6,000	20	40	60	80	60	100	8.6	5.8
5,000	20	20	40	80	100	100	9.4	8.0
Surface	40	00	40	80	100	100	7.0	6.2

10.0 RADIOLOGICAL SAFETY

10.1 PROGRAM IMPLEMENTATION

10.1.1 Mission Statement

A health physicist assigned to HPD during Operation KLAXON provided line management oversight of the Radiological Safety Operations at the NTS. This oversight was conducted to ensure that NTS Radiological Safety Programs restricted radiation exposures received by NTS occupational safety workers and the general public to limitations established by the DOE. In addition, all contractors and users were required to plan and implement procedures that kept personnel radiation exposures to levels As Low As Reasonably Achievable.

10.1.2 Program Oversight

Program oversight was accomplished by periodic inspection and surveillance of radiological field operations conducted by contractors and users. The health physicist evaluated field operations in terms of procedures written by contractors and users. Discrepancies were noted and referred to the contractor (user) for resolution. Independent oversight was conducted by the DOE/NV Health Protection Division.

10.1.3 Functional Responsibilities

The health physicist was responsible for ensuring that each contractor/user developed and implemented radiation safety procedures that complied with DOE Order 5480.11.

The health physicist, when serving as the Radiological Operations Officer, was responsible for the following:

- Readiness coordination and deployment of REECO Health Physics event support personnel.
- Readiness coordination and deployment of REECO Health Physics event radiological monitoring and dosimetry equipment.
- Readiness briefing to the Test Controller's Scientific Advisory Panel.
- Providing advice and assistance regarding radiation protection to the Test Controller during test execution periods.
- Providing Senior On-Site Radiological Advisor service to the NTS office during the 24-hour period after Test Controller return of test site control to the NTS office.

10.2 ON-SITE RADIOLOGICAL SAFETY

The REECO Health Protection Department is responsible for providing radiological safety support as required by the testing laboratories and DOE. Additional services provided are as follow:

- Monitoring and decontaminating personnel, equipment, and work sites.
- Control of personnel radiation exposure through the use of protective clothing, breathing apparatus, and appropriate measuring devices.
- Documentation and reporting of personnel radiation exposures.
- Documentation and reporting of radiation levels.
- Collection of samples for laboratory analysis.
- Calibration and maintenance of radiation detection, counting, and analytical instrumentation.

10.2.1 Radiation Exposure Criteria

DOE and NV Orders 5480.11, *Requirements for Radiation Protection*, serve as the guideline for on-site radiological protection operations. In summary, these radiation protection standards require that the total effective whole-body dose equivalent shall not exceed 5 rem per year, and the dose to the extremities shall not exceed 50 rem per year annual dose equivalent. These criteria are implemented in NV Order 54XG.1A, *NV Radiological Safety Manual*.

10.2.2 Radiation Monitoring

No posttest radiation monitoring was conducted during Operation KLAXON because no nuclear tests were conducted.

10.2.3 Laboratory Operations

The REECO Analytical Services Department performed the following laboratory sample analyses during Operation KLAXON:

<u>Activity</u>	<u>Number</u>
Tritium—water, urine, swipe, air (water bubbler)	49
Tritium—soil (Drierite)	34
Gamma Analysis	752

10.3 OFF-SITE RADIOLOGICAL SAFETY

Under an Interagency Agreement (DE-AI08-91NV10963) between DOE and the Environmental Protection Agency, the EMSL-LV provides off-site radiological surveillance and safety support for nuclear weapons tests and projects sponsored by DOE/NV. During FY 1993, this support was provided for Operation KLAXON and for other sites used in the past for underground nuclear detonations. This report summarizes the responsibilities, radiation safety criteria, operational procedures, and results of radiological surveillances connected with these activities. During FY 1993, no radioactivity above ambient levels was detected by any of the monitoring and sampling networks.

From the analytical results of all samples and measurements obtained from the routine surveillance networks off the NTS, no radionuclides that could be associated with NTS operations were detected beyond the Test Range Complex.

10.3.1 Operational Procedures

The Director, EPA/EMSL-LV, is responsible for compliance with the following:

- Deploying radiation monitoring technicians before each activity.
- Providing senior personnel to serve on the Test Controller's Advisory Panel.
- Determining the extent of off-site airborne, surface, and subsurface radiological contamination resulting from test operations.
- Maintaining a complete record of surveillance activities.
- Taking emergency actions should an unacceptable radiological situation develop.
- Conducting public and community information programs in the areas and communities surrounding the NTS to maintain the public confidence in the safe conduct of nuclear tests.

10.3.2 Safety Criteria

The radiological and meteorological guidelines contained in DOE Order NVO-176, Revision 4, would be followed for all test executions. These criteria are reproduced below:

"For tests at the NTS, when considering the event day weather conditions and the specific event characteristics, calculations should be made using the most appropriate hypothetical release models which estimate the off-site exposures that could result from the most probable release scenario. Should such estimates indicate that off-site populations, in areas where remedial actions to reduce whole-body exposures are not feasible, could receive average whole-body exposures in excess of 0.170 R/year, the event shall be postponed until more favorable conditions prevail. In addition, events may only proceed where remedial actions against uptake of radionuclides in the food chain are practicable and/or indications are that average thyroid doses³ to the population will not exceed 0.5 rad/year.

"In those areas where trained radiation-safety monitors are available, where communications are effective, where people can be expected to comply with recommended actions, and where remedial actions against uptake of radionuclides in the food chain are practicable, events may proceed where indications are that individuals in those areas would not receive whole-body exposure and thyroid dose in excess of 0.5 R/year and 1.5 rad/year, respectively.

"Should there be any release of radioactive material which may move off site, aircraft and ground radiation monitoring systems will be employed, along with detailed meteorological data, to predict radioactive cloud trajectories and potential exposure rates at downwind locations. Based upon these predictions and subsequent radiological monitoring observations, every effort will be made to keep total dose and exposure commitments from both internal and external emitters to the lowest practicable levels. To this end, remedial actions will be employed which are compatible with the provisions of the Clean Air Act (CAA) and the reportable quantities of radionuclide release under CERCLA (40 CFR 30), a coordinated emergency action plan and the basic philosophy of the Environmental Protection Agency Manual of Protective Action Guides and Protective Actions for Nuclear Incidents. Appropriate emergency response procedures shall be in place to handle situations which may arise from such releases."

10.3.3 Exposure Measurements

EPA/EMSL-LV provided radiation monitoring support to DOE/NV only in the context of tabletop exercises. Had nuclear tests been conducted, approximately 20 EPA radiation monitoring technicians and vehicles equipped with monitoring and sampling instrumentation would be positioned for deployment in the expected downwind direction of the test site.

³ For a discussion of the concept of average dose to a suitable sample of the exposed population, see the statement of the National Council on Radiation Protection and Measurements (NCRP) entitled, "Control of Air Emissions of Radionuclides," dated September 18, 1984, and the NCRP reports referenced therein. Also see the Federal Register Notice dated October 22, 1982, from the Food and Drug Administration entitled, "Accidental Radioactive Contamination of Human Food and Animal Feeds."

Additionally, EPA personnel were available to provide Test Controller's Advisory Panel support for any test conducted.

10.3.4 Networks and Monitoring

The off-site surveillance networks provide monitoring of pathways which could result in human radiological exposure. Data from the networks are used to calculate annual (calendar year) committed effective doses to off-site residents. The subsections below summarize activities within each network during FY 1993. Available data results are also discussed. However, except for the first quarter of FY 1993 (October through December 1992), data results are to be considered preliminary. Not all analyses have been completed, particularly for the last three quarters (January through September 1993), and results have not yet been verified.

Air Surveillance Network ■ The primary purpose of the Air Surveillance Network (ASN) is to detect airborne radioactivity that may be related to NTS activities. The ASN consists of two parts: active or continuous sampling stations, and a Standby Air Surveillance Network (SASN). The ASN consists of a variable number of air sampling stations, currently 30 located around the NTS; 19 of the air samplers are at the Community Radiation Monitoring Stations (CRMS) discussed in Section 10.3.5. The SASN currently consists of 78 stations located in states west of the Mississippi River. Each sampler is equipped with a 5-cm (2-inch) diameter glass fiber filter and a charcoal cartridge to collect radioactive particulates or reactive gases. In case of a venting on the NTS or a suspected increase in airborne radioactivity from other sources, the SASN would be activated so that the fallout path, area, and duration could be estimated and possible inhalation exposure to the general public could be calculated. Also, in case of an accidental venting, portable air samplers would be deployed downwind to measure the extent and degree of contamination off site so that remedial actions could be planned.

The air samplers in use are constant-volume samplers equipped with running-time meters. They are fitted with stainless steel heads that hold a glass fiber filter and charcoal cartridge. About 80 m³/day (2800 ft³/day) are collected during operation. The filters are changed weekly and sent to the EPA/EMSL-LV laboratory for radioanalysis. Running-time data applicable to each filter is also sent so the volume of air sampled can be calculated.

The filters and charcoal cartridges are analyzed by high-resolution gamma spectrometry. Should fresh fission products be detected, radiochemical analyses of the glass fiber filters (prefilters) for radiostrontiums and plutonium would be performed. In routine operation, the prefilters from four continuous stations are composited monthly and prefilters from two standby stations in each of the 13 states are composited quarterly for plutonium analysis. For trend analyses, the prefilters from all stations are analyzed for gross alpha and gross beta activity.

The SASN is activated for a one-week period each quarter by a telephone call to the operators. Each station is equipped with the same type of air sampler. The SASN would be activated in the case of a venting of a nuclear test on the NTS or when a release of radioactivity occurs elsewhere (e.g., Chernobyl, Three-Mile Island, Chinese nuclear tests). Filters from the SASN are analyzed for gamma-emitting radioisotopes by high-resolution gamma spectrometry. As in previous years, the gross alpha and gross beta results exceeded the Minimum Detectable Concentration (MDC) for the associated analysis.

Noble Gas and Tritium-in-Air Networks ■ In FY 1993, the Noble Gas and Tritium Surveillance Network (NGTSN) consisted of 13 locations where samples of air were continuously collected for radiokrypton and radioxenon analyses, and samples of atmospheric moisture were collected for

tritium analysis. One site, Salt Lake City, has a noble gas sampler on standby status and an active tritium sampler.

In recent years, the concentration of ^{85}Kr in the atmosphere has been increasing while radionobles and tritium are only rarely detected. Rarely, ^{133}Xe and ^{135}Xe have been detected because of drillback releases at the NTS, ground seepage, or tunnel purging. The network stations surround the NTS to detect these releases. As with the ASN stations, availability of a suitable individual to operate the equipment and a source of commercial power are both necessary, so the stations may not be ideally spaced. For known, controllable releases, portable samplers are placed in downwind locations and adjusted for collection periods that can be as short as a few hours.

Noble gas samples are collected by compressing air into storage tanks. Air is continuously sampled over a seven-day period, collecting approximately 0.6 m^3 (21 ft^3) of air. EPA monitoring technicians collect these samples each week and check sampler operation.

In the laboratory, the samples are condensed at liquid nitrogen temperature. Gas chromatography is used to separate the various gas fractions, including radiokrypton and radionobles. The radioactive gases are dissolved in scintillation cocktails for counting in a liquid scintillation counter.

A peristaltic pump is used to push air through a container of molecular sieve to collect atmospheric moisture. The exhaust is directed through a dry gas meter to measure the volume of air sampled. EPA technicians collect these samples, service the equipment, and record the sample volume. The moisture from approximately 10 m^3 (350 ft^3) of air is collected. These operations are normally conducted on a weekly basis.

Under heat and vacuum, the water is removed from the molecular sieve and condensed in a cold trap using liquid nitrogen. The captured moisture sample is warmed and then added to a scintillation cocktail for liquid scintillation counting.

For the noble gas samples, all Xe results were below the MDC average of 16 pCi/m^3 . All ^{85}Kr results, averaging 27.6 pCi/m^3 , exceeded the MDC average of 5.7 pCi/m^3 which is consistent with enhanced background levels resulting from worldwide use of nuclear power and past atmospheric nuclear testing. The majority of tritium in air results were below the MDC. For those very few samples with results exceeding the MDC, all results were within one standard deviation of the MDC. Tritium results were comparable to previous years.

Milk Surveillance Network ■ The Milk Surveillance Network has three components: a routine network, a standby network, and a dairy animal and population census. Because dairy animals consume vegetation that represents a large area of ground cover and because many radionuclides can be transferred to milk, analysis of milk samples may yield information on the deposition of small amounts of radioactivity over a relatively large area. In case of prompt releases of radioactivity, radioiodine concentrations in milk would be responsible for the largest early-time exposure to infants and children. As in the other networks, collection locations are distributed around the NTS but are limited to those places that have family dairy cows or goats or where commercial dairies exist.

EPA monitors conduct monthly sample-collecting visits to about 25 locations in the near off-site area (the number varies depending on availability of milk to be sampled). At most of these locations only a family cow or some milk goats are present so the samples may not be collected if the animal is not lactating or not enough milk is available for various reasons. The samples are collected in 3.8-l (1-gal) plastic containers, and formaldehyde is added as a preservative.

All of the routine Milk Surveillance Network samples are analyzed by high-resolution gamma spectrometry, and selected samples are analyzed for tritium and $^{89,90}\text{Sr}$ each quarter.

Each area in the standby network is activated at least once a year to monitor trends and to ensure proper operation in case of an emergency. The standby network consists of approximately 115 dairies or processing plants in all states west of the Mississippi River. The network is activated by contacting the Food and Drug Administration Regional Milk Specialists who in turn contact State Dairy Regulators to enlist cooperating milk processors or producers. The samples (described below) from the standby network are analyzed by high-resolution gamma spectrometry. Selected samples are also analyzed for tritium and $^{89,90}\text{Sr}$.

The dairy animal and population census is continually updated for those areas within 400 km (240 mi) north and east of CP-1 and within 200 km (126 mi) south and west. The remainder of the Nevada counties and the western-most Utah counties are surveyed every two to three years. The locations of processing plants and commercial dairy herds in Idaho and the remainder of Utah can be obtained from the State agencies dealing with milk and food regulation.

Naturally occurring potassium, stable and radioactive, averaging 1.6 g/l, was the only gamma emitter detected above the MDC for all routine and standby milk samples. The majority of the ^3H , ^{89}Sr , and ^{90}Sr results were below the MDC. With very few exceptions, the majority of the results exceeding the MDC were within or very close to one standard deviation of the MDC which indicates that the result is within the expected statistical variation. Similar results have been seen in both the routine and standby sampling locations for the past several years, and no significant changes in regional areas were noted.

Biomonitoring ■ One mule deer was collected from the NTS during each quarter of FY 1993. Four beef cattle (two cows and two calves) were purchased from Dahl Ranch (Alamo, Nevada) on October 1, 1992. An additional four beef cattle (two cows and two calves) were purchased from Medlin's Ranch (Tempiute, Nevada) on May 22, 1993. Samples were collected from all animals and submitted for routine analysis. Licensed hunters in Nevada were asked to collect samples of bighorn sheep. Only eight sets of samples and data were returned.

Locally grown fruits and vegetables were collected from the Uhalde's Ranch, Complex 1, Alamo, Hiko, and Rachel, Nevada, areas. These were submitted for radionuclide analysis. On September 7, 1993, one vegetation and 50 soil samples were taken at Rachel, Nevada, at the request of LLNL. Each of these samples is currently being analyzed for $^{239+240}\text{Pu}$.

All collected animals were sacrificed and necropsied. Cattle and mule deer muscle, kidney, lung, liver, and thyroid samples were analyzed for gamma emitters, as were samples of mule deer rumen contents and bighorn sheep kidney samples. Bone samples from all animal species were ashed by the REECo laboratory and returned to the EPA/EMSL-LV Radioanalysis Laboratory for analysis of ^{90}Sr and $^{238,239+240}\text{Pu}$. Cattle liver samples were also analyzed for these radionuclides. Mule deer muscle, liver, lung, and rumen contents were analyzed for $^{238,239+240}\text{Pu}$. Cattle blood and kidney, mule deer combined or selected tissues, and bighorn sheep kidney samples were analyzed for tritium. Other tissue samples, as available, were analyzed for gamma emitters and selected radionuclides. Analytical results are available for the first three quarters of the year. They show values consistent with those reported in the past. No abnormally high values were detected from any samples collected during FY 1993.

Internal Dosimetry ■ The Off-Site Internal Dosimetry Network is composed of residents living in the immediate vicinity of the NTS and the families of the CRMS managers. During FY 1993,

62 individuals from the area surrounding the NTS were examined as part of this program. In addition, 112 individuals subject to potential occupational exposure, two members of the general public with exposure concerns, and one special study participant were analyzed. The special study participant was a member of the U.S. Army. This individual was scanned to determine if embedded shrapnel received in the Desert Storm conflict contained depleted uranium (DU) and if there was a detectable uranium lung burden. The occupational workers included employees of EPA and other organizations. In all cases, analysis consisted of a whole-body count using a single high-purity intrinsic germanium coaxial detector, a lung count with six high-purity intrinsic germanium semiplanar detectors, and urinalysis for tritium. The whole-body count detects radionuclides over the range of 0.1 to 2.0 MeV; the lung count detects radionuclides with energies between 10 and 300 keV.

Whole-body and lung counts of civilians did not reveal any gamma emitting radionuclides except naturally occurring ^{40}K at activities greater than the MDC. The soldier participating in the special study noted above was found to have pieces of DU as well as other shrapnel metal. No DU was found in this individual's lungs above the MDC of 120 pCi for ^{235}U . Bioassay results for tritium were not complete, but all available results were near or below MDC levels.

Long-Term Hydrological Monitoring Program ■ In addition to sampling wells on and near the NTS on a monthly and semiannual basis, water samples were collected at other sites in the United States where nuclear tests were conducted during the 1960s and 1970s. These sample collections are completed annually, except for biannual samples at Amchitka, Alaska. In FY 1993, sample collections were completed as follow:

February 1993	--	Project SHOAL (Nevada)
March 1993	--	Project FAULTLESS (Nevada)
April 1993	--	Project DRIBBLE (Salmon Site, Mississippi)
June 1993	--	Project RULISON (Colorado)
June 1993	--	Project RIO BLANCO (Colorado)
June 1993	--	Project GASBUGGY (New Mexico)
June 1993	--	Project GNOME (New Mexico)
July 1993	--	Projects MILROW/CANNIKIN/LONGSHOT (Alaska)
August 1993	--	Projects MILROW/CANNIKIN/LONGSHOT (Alaska)

The 3.8-l (1-gal) samples collected at each sampling location are preserved with nitric acid and analyzed by high-resolution gamma spectrometry. For the semiannual on-site collections and all off-site collections, one of the two 500-ml samples from one collection period is analyzed for tritium by the conventional method, and the other is used either as a duplicate or replacement sample. One of the 500-ml samples from each of the monthly on-site collections and from the other collection period for the semiannual on-site and off-site locations is analyzed for tritium by an enrichment method (EPA, 1979). The MDC for this method is less than 10 pCi/l, and is generally in the range from 5 to 6 pCi/l.

At the time the sample is collected, the specific conductivity, pH, and temperature are recorded for inclusion in the data base along with the water level and depth of sampling for those wells on which the sampler was used. Also, the first time a new location is sampled, an analysis for $^{89,90}\text{Sr}$, $^{234,235,238}\text{U}$, and $^{238,239} + ^{240}\text{Pu}$ is performed.

PROJECT SHOAL ■ The Project SHOAL (a test-detection experiment) samples were collected near Frenchman Station, Nevada, on February 24 and 25, 1993. Five of the six routine sampling locations were sampled. No sample was collected from the Spring Windmill Well because the

equipment had been removed. Well H-2 will be sampled next year following receipt of additional information from DRI. A tritium result of 62 ± 4.2 pCi/l was detected in the water sample from Smith/James Spring, which is within the range of results obtained in previous years. The remaining samples yielded results less than the MDC.

PROJECT FAULTLESS ■ Five samples were collected in the vicinity of Blue Jay, Nevada, on March 16 and 17, 1993, for analysis of tritium potentially arising from the Project FAULTLESS (seismic calibration) test cavity. No samples were collected from Wells HTH-1 and HTH-2 because of the impassable snowy road conditions. Samples were collected from these wells a week later. No sample was collected from Six Mile Well due to failure of the pump motor (belt missing). No tritium results greater than the MDC were detected in any of the water samples.

PROJECT DRIBBLE (SALMON SITE) ■ Sampling in Mississippi and in the vicinity of the Tatum Salt Dome was conducted during the period April 18-22, 1993. One hundred thirty of the 137 scheduled samples were collected. Four samples at Baxterville Well HMH-7 could not be collected because the wellhead was under water. The Ascot-2 Well in Baxterville was inaccessible. The Regina Anderson Well in Baxterville was inoperable. The John Hudson Quail House Well, also in Baxterville, could not be sampled because the owner declined to participate in the sampling program.

Of the 130 samples collected in the vicinity of the Salmon Site, 104 contained tritium at concentrations greater than the MDC. Of those greater than the MDC, the highest was 7790 ± 305 pCi/l in the water sample collected from the Well on the Salmon Site. All of the off-site samples yielded tritium concentrations less than 24 pCi/l. Off-site city water supplies contained less than 10 pCi/l of tritium. Neither strontium, ^{238}U , nor plutonium were detected in any of these samples. Results of sampling related to Project DRIBBLE are discussed in the report by Thomé and Chaloud (see Sec. 10.4).

PROJECTS RULISON AND RIO BLANCO ■ Sampling in the area of Project RULISON (gas stimulation experiment) was completed on June 16, 1993. Nine samples were collected in Grand Valley and Rulison, Colorado. Tritium results were greater than the MDC for all Project RULISON-related samples except for Grand Valley City Springs. The highest tritium concentration was 116 ± 5.2 pCi/l in the water sample collected from Lee Hayward Ranch, which is less than one percent of the Interim Primary Drinking Water Regulation maximum permissible tritium concentration of 20,000 pCi/l.

Sampling in the area of Project RIO BLANCO was completed on June 17, 1993. Fourteen samples were collected in Rio Blanco, Colorado. Nine of these yielded tritium results greater than the MDC of about 6 pCi/l. The highest was 58 ± 5.0 pCi/l measured at CER #1-Black Sulphur. The six sites located on Fawn Creek yielded tritium results ranging from 28 to 75 pCi/l, indicating no difference between sites located upstream and downstream of surface GZ.

EPA completed in-situ gamma counting and core sampling at both the RULISON and RIO BLANCO locations. Preliminary results show no gamma emitters above levels encountered from global fallout.

PROJECT GASBUGGY ■ Twelve samples were collected in the vicinity of Gobernador, New Mexico, site of Project GASBUGGY (gas stimulation experiment), during the period June 20-21, 1993. Well 30.3.32.343 (North Windmill) was inoperative and the windmill had been removed. All other scheduled samples were collected. Ten samples yielded tritium results greater than the MDC of approximately 5.6 pCi/l. The highest tritium result was 20 ± 3.8 pCi/l in Cave Springs.

Well EPNG 10-36, which yielded a tritium result of 364 ± 7.9 pCi/l in 1992, had a result of 327 ± 7.1 pCi/l.

Preliminary results of in-situ gamma counting and soil core sampling at the Project GASBUGGY site indicated no gamma emitters above levels encountered from global fallout.

PROJECT GNOME ■ Sixteen samples were collected in the area of Project GNOME (multipurpose PLOWSHARE experiment) during the period June 26-27, 1993. A total of 16 samples were collected. During FY 1993, the Pecos Pumping Station was deleted as a routine sampling location. Well DD-1 had only a tritium sample collected. The monument at GZ had tilted due to erosion. A new sampling location, the J. Mobley Ranch (3.5 miles from GZ), was established during FY 1993. Routine samples were taken in Carlsbad, Loving, and Malaga, New Mexico. Wells USGS-4 and USGS-8 are known to contain radioactivity as a result of a tracer study performed by USGS subsequent to the PLOWSHARE test. In addition, wells DD-1 and LRL-7 intercept the explosion cavity and associated side drift. Tritium results greater than the MDC were observed in seven of the nine sites near sampling locations. The highest tritium value was 7330 ± 296 pCi/l in the water collected from Well LRL-7. This well penetrates the GNOME cavity. Three samples from Wells USGS-4 and USGS-8 were found to contain ^{90}Sr , reflecting the intentional addition of this isotope during tracer study experiments. The greatest activity detected by gamma spectroscopy was $8.2 \times 10^5 \pm 7.97 \times 10^4$ pCi/l of ^{137}Cs in Well DD-1. Wells LRL-7 and USGS-8 also showed detectable amounts of ^{137}Cs .

PROJECTS MILROW/CANNIKIN/LONGSHOT ■ Samples were collected during the period July 28-August 9, 1993. Three EPA representatives and one IT Corporation representative visited Amchitka Island. No evidence of vandalism or tampering was noted at the CANNIKIN, MILROW, or LONGSHOT GZ areas. The wells listed in Table 13 were not sampled for the reasons indicated.

Due to the site closing, no Navy support or Piquini Management Corporation support will be available after September 15, 1993. After that date, only Wildlife Fish and Game personnel will remain on the site.

A total of 1 vegetation and 127 water samples were collected. All samples were received at EPA/EMSL-LV without loss or breakage.

TABLE 13. AMCHITKA, ALASKA, SAMPLING EXCEPTIONS FOR FY 1993

SAMPLE SITE	REASON NOT SAMPLED IN FY 1993
D + E Hydro Explore Holes	Sampling location discontinued
Army Well #3	Sampling location discontinued
Decon Pond	Sampling location discontinued
Decon Sump	Sampling location discontinued
Milrow Well W-4, Dry Wells W-8, W-12, W-16, W-17, & W-19	In deep water or completely under water
TX-Site 77,000-Gallon Water Tank	Tank dry; generator servicing tank had been disconnected and removed

As in the past, the highest concentration of tritium was detected at the LONGSHOT GZ Well #1. For the sample taken August 1, 1993, this value was 1355 ± 262 pCi/l. Of the remaining water samples, 29 showed detectable tritium levels over the range of 4.5 ± 2.5 to 152 ± 4.1 pCi/l. Detectable tritium in samples other than LONGSHOT GZ #1 averaged 32.2 ± 3.2 pCi/l.

Gamma spectral analysis of samples collected from Amchitka in FY 1993 showed no detectable gamma-emitting radionuclides.

NTS AND ENVIRONS ■ A total of 32 off-site sampling locations surrounding the NTS in California and Nevada are sampled on a monthly basis. In addition, two locations in Rachel, Nevada, (Penoyer Farms Well 13 and Wells 7 and 8) are sampled in the months the wells are operational. In FY 1993, Wells 7 and 8 were sampled in April. Well 13 was sampled in May, and all three wells were sampled in October. Of the available results for the sampling locations around the NTS, tritium results greater than the MDC were found in water samples from the January 1993 sampling at Adaven, Nevada.

Eighteen locations on the NTS are sampled monthly. Well 20, where the pump failed in April 1991, was repaired and returned to routine sampling in April 1992. No samples were obtained from Wells 20 and UE-19C after December 1992, because the wells were inaccessible due to snow and icy conditions and because the pipelines were drained and the power shut off. Well 20 was last sampled in July 1993. By September 1993, the pump for this well was again inoperable. Well UE-19C remains out of service. Detectable tritium levels of 5 ± 3.4 pCi/l were obtained from Well UE-19C in December 1992. Well 8 and Wells C and B were tested throughout the year. The range of tritium results for Well C was 6.1 to 25 pCi/l and for Well B 90 to 111 pCi/l.

Another 17 locations on the NTS are sampled semiannually. Well 5B was reactivated in August 1992, after having been shut down since 1988. Wells HTH-1, UE-16F, C-1, PM-1, and UE-18T all showed detectable levels of tritium in at least one sample. These ranged from 6 ± 2.9 pCi/l in Well 16F in May 1993 to a high of 317 pCi/l in May from Well UE-7NS.

Thermoluminescent Dosimetry Network ■ Thermoluminescent dosimeters and automated readers used in this network are manufactured by Panasonic. Each dosimeter has four elements containing various thermoluminescent phosphors behind specified attenuators. The model UD-802 dosimeter is used for monitoring off-site personnel. This dosimeter contains two elements of $\text{Li}_2\text{B}_4\text{O}_7\text{:Cu}$ and two of $\text{CaSO}_4\text{:Tm}$ phosphors behind 14, 300, 300, and 1000 mg/cm^2 of filtration, respectively. The model UD-814 dosimeter is used for fixed environmental station monitoring. This dosimeter contains three replicate $\text{CaSO}_4\text{:Tm}$ elements filtered by 1000 mg/cm^2 of plastic and lead. A fourth element of $\text{Li}_2\text{B}_4\text{O}_7\text{:Cu}$ filtered by 14 mg/cm^2 of plastic is not used for purposes of environmental monitoring. About 124 fixed locations around the NTS are equipped with two UD-814 dosimeters deployed in specially designed holders. About 57 citizens living in the off-site area participate in the off-site resident personnel monitoring program and are issued single UD-802 dosimeters in standard holders. The dosimeters are deployed and processed on a quarterly exchange frequency to locations in Nevada, California, Utah, and Arizona and to individuals living in Nevada, California, and Utah.

During FY 1993, original research was completed in collaboration with the U.S. Army Primary Standards Laboratory which characterized the angular response of the Panasonic UD-802 Dosimeter ISA-820 Holder combination to irradiation categories ^{137}Cs , H-150, and M-150. Results, presented and published at the Panasonic International Thermoluminescent Dosimeter (TLD) User's Symposium, enable dosimetry processors utilizing this dosimeter/holder combination to demonstrate compliance with Section 3.3 of the DOE Laboratory Accreditation Program and with

comparable sections of the DOE Laboratory Accreditation Program and National Voluntary Laboratory Accreditation Program Personnel Dosimetry Performance Standards.

Data results for FY 1993 are not yet available.

Pressurized Ion Chamber Network ■ The Pressurized Ion Chamber (PIC) Network consists of 27 instruments deployed around the NTS. Ten additional PICs are located at the Bureau of Land Management's Remote Automatic Weather Stations; beginning in 1993, data from these instruments were incorporated into the PIC network data base. Most of the network uses commercial power, but several PICs receive power from batteries charged by solar power units. The detector is an 8-l spherical aluminum chamber filled with high purity argon compressed to 25 times standard atmospheric pressure. The Rustrak paper and cassette tapes are changed biweekly. The data are transmitted every four hours via Geostationary Orbiting Environmental Satellite directly to CP-1 and from there to EPA/EMSL-LV by dedicated telephone lines. If the gamma exposure exceeds the site-specific alarm threshold for two consecutive one-minute measurements, the system transmits a string of nine consecutive one-minute values on an average of every three minutes (typically varies between 2 and 15 minutes). The site-specific alarm thresholds are set at twice the normal background exposure.

The unit is sensitive enough to pick up increases in terrestrial radiation due to meteorological low-pressure fronts passing over the sensor, to detect the decrease in rate due to snow cover in the winter, and occasionally to detect passage of trucks carrying low-level waste to the disposal site near Beatty, Nevada. The data are evaluated and reported weekly at EPA/EMSL-LV as part of routine quality assurance procedures to denote trends and anomalies. Copies of the reports are sent to CRMS Station Managers for posting at the station. These reports display the current weekly average gamma exposure rate, the previous week's and previous year's average, and the maximum and minimum backgrounds in the United States. In addition to being posted at each CRMS, report copies are sent to appropriate federal and state personnel in California, Nevada, and Utah.

In February 1993, the PIC at the Las Vegas, Nevada, station was moved from one side of the building to the other. This resulted in an increase of approximately $3 \mu\text{R/hr}$ in the indicated ambient gamma exposure rate.

10.3.5 Community Information

As the primary purpose of EPA's off-site surveillance program is protection of the health and safety of the off-site population, community involvement is an integral component of the EPA programs. Radiation monitoring technicians maintain frequent contact with the off-site residents during sample collection visits. In addition, during past test series, in the days prior to each nuclear weapons test, population counts were taken and the whereabouts of residents on test day were ascertained. This was to facilitate implementation of protective actions, had they been necessary.

CRMSs are located in 19 communities in Nevada and Utah. The CRMS program is a collaborative effort of the DOE, EPA, DRI, and the University of Utah. All of these CRMSs contain a barometer, PIC, TLD, and air sampler. Noble gas and tritium-in-air samplers are also located at most of the CRMSs, operated either routinely or on standby status. In each community, a local resident serves as a station manager and a second resident acts as the alternate station manager. A station manager's training course is held annually; in FY 1993, this training session was held in Brianhead, Utah, April 1–6, 1993. Station managers received specific training on the theory and operation of instrumentation and heard presentations on radiation safety and other radiation-related topics.

Town hall meetings and overview presentations provide a forum to educate the public regarding radiation safety and nuclear weapons testing effects, address public concerns, and disseminate monitoring results. The following meetings were conducted by EPA in FY 1993:

October 12, 1992 - Cedar City, Utah - American Legion - 19 attendees
October 13, 1992 - Cedar City, Utah - Cedar City High School - 122 attendees
October 13, 1992 - Cedar City, Utah - Cedar City Women in Business - 30 attendees
May 7, 1993 - Beatty, Nevada - High School Career Day
July 13, 1993 - Tonopah, Nevada - Rotary Club - 22 attendees

The October and July meetings addressed the topic, "Consumer Electronic Radiation."

10.4 REPORTS

Each year, EPA prepares a data summary report for the off-site surveillance networks and a separate report for the Tatum Dome study. These reports are published as EPA documents. Preparation of journal articles and conference presentations is encouraged. Additionally, EPA coauthors contribute to the annual DOE/NV Annual Site Environmental Report and the Environmental Monitoring Plan; REECO has prime responsibility for these documents.

Reports, journal articles, and conference presentations published or in press in FY 1993 include:

- Dicey, B. B., and W. S. Harris, *Angular Response of a Modified Personnel TLD Holder with Panasonic UD-802 Dosimeters*, Proc. 12th Annual International Panasonic TLD Symposium, June, 1993.
- Dicey, B. B., *Environmental Radiation Monitoring of Areas Surrounding the Nevada Test Site*. Presentation at STI (Harshaw) TLD User Symposium, November 1992.
- Faller, S. A., *Gamma-Ray Surface Characterization of the Gnome Test Site in Eddy County, New Mexico*.
- Grossman, R. F., and C. B. Thompson, *Creation of a Data Base of Survey Meter Readings in the Western United States After Nuclear Tests*, February 1993.
- Holloway, R. W., *Tritium in Surface Waters of the Western United States*, Radiochemica Acta (In press).
- Holloway, R. W., "Quality Assurance in a Radiochemical Laboratory," Presentation at 39th Annual Conference on Bioassay, Analytical and Environmental Chemistry, October 11-15, 1993, Colorado Springs, CO.
- Thomé, D. J., and D. J. Chaloud, *Environmental Monitoring Report - Radiation Monitoring On and Around the Tatum Dome Test Area, Lamar County, Mississippi*, April 1992.
- Thomé, D. J., "Off-Site Radiological Monitoring and Emergency Response," Presentation to the Defense Nuclear Facility Safety Board, April 1993.

11.0 SAFETY

11.1 PROGRAM IMPLEMENTATION

11.1.1 Mission Statement

The DOE/NV Safety Division develops and administers evaluation of safety in programs for assigned functional areas which include activities involving aviation, tunneling, construction, drilling, nonnuclear explosives, fire protection, firearms, and occupational safety. The Division conducts investigations of accidents occurring in DOE/NV, DOE/NV contractor's, and NTS user's operations and implements procedures to ensure compliance with quality assurance and environmental safety policies and standards as they relate to assigned activities.

11.1.2 Program Oversight

The Division's oversight activities include functional and managerial compliance inspection, accident investigations, program appraisals, employee complaint investigations, and review of engineering drawings. These activities ensure that programs are developed and administered in accordance with existing policy, standards, and codes.

11.1.3 Functional Responsibilities

The Safety and Health Division's responsibilities are to:

- Recommend to the Assistant Manager for Environment, Safety, Security, and Health staffing policies and procedures required to carry out the safety functions.
- Oversee DOE/NV, DOE/NV contractor(s), and NTS users development and implementation of DOE/NV programs and policies in assigned functional areas.
- Manage a Federal Employees Occupational Safety and Health program in cooperation with the Health Protection Division; establish and support the FEOSH committee at DOE/NV.
- Recommend policies and practices to the DOE/NV Manager to ensure that operations will have a minimal and acceptable safety impact on federal and contractor employees and members of the public.
- Provide DOE/NV expertise for policies, standards, and codes in assigned functional areas.
- Maintain a continuous awareness of political, social, media, public, and scientific activities in the safety area which could adversely affect the DOE/NV mission.
- Provide DOE/NV expertise for statutes, regulations, standards, and DOE/HQ or DOE/NV policy in the functional areas assigned.
- Support accident investigation boards for Class A and B investigations.
- Develop and implement an internal control system and a quality assurance program to ensure that safety and health objectives are met in a timely and efficient manner.

11.2 ONGOING ACTIVITIES

11.2.1 Occupational Safety

Ongoing occupational safety activities revolve around a vigorous oversight program designed to identify both outstanding and deficient safety and health related areas in the operation of the NTS. The Division has actively supported the implementation of a behavior-based safety process within the DOE/NV contractor community and has initiated an Annual Occupational Safety and Health

Symposium to address current trends and issues facing the safety and health community within DOE/NV. The Division coordinated the DOE and contractor participation in the Environmental, Safety, and Health (ES&H) five year planning process that identifies and prioritizes the activities necessary for a successful safety and health program at NV. The occupational safety staff works closely with contractor management and other DOE/NV organizations to identify and correct facilities and/or equipment codes or standards violations and programmatic policy findings that have the potential to adversely impact the safety of contractor or federal employees and the public. The Division generates contractor cost-plus-award-fee input based on contractor performance regarding safety programs.

11.2.2 Appraisals, Surveys, Inspections, and Reviews

The Division has continued to aggressively pursue the closeout of the many findings generated during both previous years and this year's compliance assessment activities. Over 3300 findings have been dispositioned, and the closeout of the remaining ones is being actively pursued.

An integrated, cost-effective approach for performing functional appraisals of contractor and user ES&H programs was instituted during this period.

11.2.3 Nuclear Explosive Safety

To assure the DOE/NV Manager that all nuclear explosive operations are carried out in a safe manner, Nuclear Explosive Safety (NES) reviews of LANL and LLNL operations are conducted by the Nuclear Explosive Safety Division. DOE/NV reviews include NES studies and surveys, as-built reviews, field follow-up, and annual appraisals of laboratory and contractor operations at the NTS.

Objectives and responsibilities for the NES program are outlined in DOE/HQ Orders 5610.10 and 5610.11 and DOE/NV Orders 5610.10 and 5610.11A. These Orders are designed to ensure that all nuclear explosive and nuclear weapon operations by DOE/NV contractors are conducted safely. All NES items associated with these operations are studied and include hardware such as assembly and handling fixtures; electrical test meters; trucks, forklifts, cranes, and lifting slings; electrical and electronic components; and safety equipment.

The DOE/NV Nuclear Explosive Safety Division schedules and chairs all NES studies and surveys for nuclear explosive operations conducted at the NTS. The review groups include members from the national laboratories (LANL, LLNL, and SNL), DOE/HQ, DOE/NV, DOE/AL and DOE Oakland. No operations may be conducted on any nuclear explosive at the NTS prior to NES review and approval of the review report by the DOE/NV Manager (for NES surveys) and the DASMA (for NES studies).

12.0 ENVIRONMENTAL PROTECTION

12.1 PROGRAM IMPLEMENTATION

12.1.1 Mission Statement

The policy of DOE is to conduct its operations safely and to minimize the impact on the environment. Protection of the public, the environment, and the employees at DOE facilities is the responsibility of paramount importance.

The policy of DOE/NV is to conduct all of its field activities in compliance with the letter and spirit of both national and international agreements, environmental statutes, regulations, and standards. In addition, DOE/NV is committed to excellence in environmental management of all programs and to identifying and correcting existing problems before they pose a threat to the public or the environment.

12.1.2 Program Oversight

The environmental oversight program within DOE/NV is implemented by the Environmental Protection Division (EPD) primarily through various DOE/HQ and DOE/NV 5400-series orders. Specific directions are given in the EPD SOPs.

EPD routinely conducts functional appraisals, audits, and surveys of DOE/NV contractor and NTS user activities to ensure compliance with all applicable environmental protection regulations. For example, as part of EPD's ongoing functional appraisal program, RSN and EG&G/EM activities were examined in detail during FY 1993. The EG&G/EM activities at the Remote Sensing Laboratory, North Las Vegas Facility, Santa Barbara Operations, and Special Technology Laboratory, as well as the operational procedures and conceptual design reports of RSN, were reviewed for compliance with National Environmental Policy Act (NEPA) and DOE NEPA Regulations (10 CFR Part 1021).

A DOE Tiger Team Compliance Assessment inspection of the NTS was conducted in the fall of 1989, and a DOE/NV audit was conducted of the EG&G/EM Las Vegas Area Operations facilities at both North Las Vegas locations in 1991. The DOE/NV Compliance Assessment Action Plan identified 149 concerns/findings from the Tiger Team/Safety Appraisal of 1989, 45 of which were determined to be environmentally-related but none reflected situations with an immediate risk to public health or the environment. Of the 149 original deficiencies, 140 (94 percent) were fully closed at the end of FY 1993 and the official closure process was nearly completed on 3 of the remaining 9 issues.

12.1.3 Memorandums of Understanding, Agreements in Principle, et cetera

Agreements covering DOE/NV activities include a Memorandum of Understanding between DOE and the state of Nevada, covering radiological releases; Agreements in Principle with the states of Nevada and Mississippi, covering oversight of environment, safety, and health activities; a Programmatic Agreement with the state of Nevada, covering archeological and historic preservation activities; and a Settlement Agreement with the state of Nevada to manage mixed transuranic waste.

12.1.4 Functional Responsibilities

EPD ensures that all of DOE/NV's nuclear test-related programs are conducted in accordance with applicable environmental guides and standards. Important environmental compliance activities at the NTS during FY 1993 included hazardous waste management associated with Resource Conservation and Recovery Act (RCRA) requirements; sampling and reporting of asbestos renovation projects in compliance with the Clean Air Act and state of Nevada air quality permit renewals and reporting; and compliance with the Endangered Species Act. Compliance actions also included field surveys and consultation with the Nevada State Historic Preservation Officer (SHPO) to protect historic properties in accordance with the requirements of the National Historic Preservation Act.

12.2 ONGOING ACTIVITIES

12.2.1 Radiation Protection

Environmental Monitoring ■ Results of environmental monitoring on the NTS during FY 1992—the latest year for which complete data analyses are available—showed full compliance with the Radiation Exposure Guidelines; DOE Order 5400.5, *Radiation Protection of the Public and the Environment*; DOE Order 5480.11, *Radiation Protection for Occupational Workers*; and 40 CFR 141, *National Primary Drinking Water Regulations*.

On-site air monitoring results showed the following sitewide, annual average concentrations as a percentage of DOE Order 5480.11 guidelines: ^3H , 0.046; ^{85}Kr , 0.0088; $^{239} + ^{240}\text{Pu}$, 3.0.

Drinking water supplies on the NTS contained the following average concentrations as a percentage of the DOE Order 5400.5 guidelines: ^3H , 0.012; ^{90}Sr , 0.32; ^{238}Pu , 1.9; $^{239} + ^{240}\text{Pu}$, 1.7.

Radioactive Emissions ■ NTS operations continue to be conducted in compliance with the radioactive emissions standards of 10 CFR 41, *National Emission Standards for Hazardous Air Pollutants (NESHAP)*. NTS operations are subject to Subpart H of NESHAP. In compliance with EPA reporting requirements, DOE/NV provides reports on radioactive effluents to DOE/HQ for formal submission to EPA.

Radioactive air emissions may occur from permanent stacks at three locations on the NTS. These include air ventilation exhaust stacks (1) on the tunnels in Rainier Mesa, (2) on clothes dryers for the anticontamination clothing laundry facility in Area 6 (although most of the radioactivity removed from this clothing is in the wash water), and (3) for the analytical laboratory hoods in Mercury.

Sources that are difficult to monitor include increases in seepage of noble gases from underground tests through the ground to the atmosphere caused by meteorological changes, evaporation of tritiated water from containment ponds, and wind-blown resuspension of plutonium-contaminated soil from safety-test sites.

Other air emissions occur from operational activities such as drillbacks into underground nuclear test cavities (to obtain diagnostic and other data) and purging of tunnel systems after nuclear effects tests (to facilitate reentry activities). The NTS user laboratories that conduct NTS nuclear tests have developed effluent monitoring procedures accurate within a factor of two for such operational activities. Considering the low levels of maximum off-site exposures reported in the recent past, this accuracy is considered acceptable. For example, using best estimates of air

emissions in 1992 as input to CAP-88-PC (the EPA-prescribed computerized model for calculating population exposures to airborne radioactive emissions), the maximum individual effective dose equivalent was 0.012 mrem, much less than the 10 mrem/yr specified in 40 CFR 61.

Discussions with EPA Region IX personnel continue to indicate that the present effluent monitoring for NTS potential operational releases are in full compliance with 40 CFR 61 requirements.

12.2.2 Resource Conservation and Recovery Act Activities

In addition to routine environmental sampling, important RCRA activities for FY 1993 at the NTS included the following:

- Underground storage tank upgrades, closures, and removals.
- Implementation of waste minimization and pollution awareness plans.
- Submittal of a revised RCRA Part B Permit Application to the state of Nevada for disposal of RCRA-regulated waste in Area 5, and completion of groundwater characterization wells for the Area 5 waste disposal facility.
- Negotiation of a low-level mixed-waste storage agreement with the state of Nevada for environmental remediation and case-by-case operational waste.
- Negotiation of settlement agreements for two events violating the state of Nevada's hazardous waste laws.

12.2.3 Solid/Sanitary Waste

In 1993, EPA promulgated new regulations for the construction, operation, and closure of municipal solid waste landfills. Pursuant to these new regulations, DOE/NV began evaluating options for the continued operation of solid waste landfills at the NTS. The Area 23 municipal landfill was temporarily closed, and a Class III landfill for the disposal of hydrocarbon-burdened materials was constructed, approved, and opened in Area 6. At this time, multiple alternatives are being evaluated including the closure of the Area 9 landfill (10-C), the expansion of the Area 23 municipal waste landfill, and the construction of several small construction landfills.

12.2.4 Clean Air Act

Activities conducted to ensure compliance with the Clean Air Act included NESHAP asbestos abatement projects at the NTS as well as radiological reporting and monitoring for compliance with ambient air quality standards, as reported in Section 12.2.1. In addition, air quality permit issues were addressed at various NTS and off-site locations.

Air Quality Permits ■ NTS air quality regulatory compliance activities during this reporting period involved state of Nevada air quality permit reporting and renewals. The 1992 annual report for Nevada air quality permits was submitted to the state on March 17, 1993. Common air pollution sources at the NTS included aggregate production, drilled-hole stemming activities, surface disturbances, fugitive dust from unpaved roads, concrete batch plants, fuel storage facilities, fuel-burning equipment, open burning, and incineration.

Representatives of the state of Nevada conducted no sitewide air quality inspections at the NTS during 1993; however, the state conducted two separate inspections of specific operating equipment. Inspections revealed total compliance.

Visible emission opacity readings from air pollution sources were obtained to determine compliance with the state-regulated plume opacity limit. Certification to perform visible emissions evaluations is required by the state of Nevada, with recertification every six months. During FY 1993, twenty-five REECO personnel were certified or recertified—ten in November 1992 and fifteen in May 1993.

National Emission Standards for Hazardous Air Pollutants Asbestos Compliance ■ In January 1990, the Nevada Division of Occupational Safety and Health issued regulations (Nevada Revised Statutes 618.760-805) requiring that all contractors intending to engage in asbestos abatement projects in Nevada (involving friable asbestos in quantities greater than or equal to 3 ft² or 3 linear ft) submit a Notification Form. A completed form must be submitted ten days before beginning any work at an asbestos abatement project site. EPA Region IX is also notified in accordance with 40 CFR 61.145-146.

The Nevada Division of Occupational Safety and Health requests that information copies of all notifications of NESHAP (asbestos abatement) actions be provided for its files. During 1993, notice on four abatement actions was provided. An estimate of abatement actions contemplated for 1993 was sent to EPA Region IX in January 1993, and the final action report for abatement actions completed in 1992 was sent to EPA in June 1993. These notifications were for asbestos renovation and abatement projects in accordance with the requirements of 40 CFR 61.145-146 and NRS 618.760-805. REECO collected and analyzed bulk, occupational, environmental, and clearance samples for these projects.

For the first time Nevada Bureau of Health Services representatives conducted an inspection at the NTS. Food preparation facilities, vending machines, swimming pool, and housing were inspected. In addition, they inspected septic tank pumping contractors and water hauling operations at the NTS. These inspections determined that the swimming pool and the cafeteria kitchen did not have required operating permits. The inspectors also determined that the Mercury recreational vehicle park was not up to code. REECO is addressing all of these issues.

12.2.5 Clean Water Act

All NTS wastewater is discharged to on-site lagoons and ponds under state permits; however, some off-site facilities have permits to discharge wastewater to local publicly owned treatment works. DOE/NV's monitoring and reporting activities were limited to the requirements of applicable state and local permits.

12.2.6 Safe Drinking Water Act

A REECO employee has become certified as a Water Distribution System Operator II. In this capacity, he is responsible for the operation of all NTS potable water systems.

Laboratory analysis determined that no volatile organic compounds have been found in the NTS potable water system for the previous three years. Therefore, a waiver of the Safe Drinking Water Act (SDWA) quarterly volatile organic compounds sampling requirement was requested.

An NTS potable water systems Operations and Maintenance Manual was prepared by REECO, and copies have been delivered to the state of Nevada, Bureau of Health Protection Services.

During FY 1993, Nevada Bureau of Health Services staff conducted a complete survey of the NTS potable water systems. The systems were determined to be in compliance with all major Nevada state requirements.

Water from Well 5B was found to exceed SDWA pH standards. The Nevada Bureau of Health Protection Services stated that the water could be used only if a notice warning users of high pH levels was posted or delivered water at distribution points is within SDWA pH limits by blending Well 5B water with waters of lower pH. To achieve compliance, the DOE/NV NTS Office decided to blend water from Wells 5B and 5C with water from Army Well #1.

New Water Well 4A was inspected by the Nevada Bureau of Health Protection Services and allowed to be placed into the Area 6 potable water system. Redesign of the Area 6 potable water/water hauling truck fill stand was approved by the Nevada Bureau of Health Protection Services. The fill stand will be part of a "Closed Loop" water system in which each water hauling truck will be individually permitted as a public water system.

The Nevada Department of Human Resources, Radiological Health Section, analyzed waters from the NTS for gross alpha, gross beta, and tritium contamination. All of the determinations were below SDWA levels.

Design and planning work continues on the NTS potable water systems revitalization project.

12.2.7 Historic Preservation, American Indian Programs

The National Historic Preservation Act requires federal agencies to take into account the effect of their actions on properties listed in, or eligible for, the National Register of Historic Places. DOE/NV conducts cultural resource surveys and other investigations to assess the effects DOE/NV operations may have on historic properties at the NTS. When required, data recovery plans are prepared to mitigate the adverse effects of DOE/NV's field operations. These plans are reviewed and approved by the Nevada SHPO and the state's Advisory Council on Historic Preservation (ACHP).

During FY 1993, 52 cultural resource surveys were conducted, reports were prepared, and consultation with the SHPO was completed. Fifty new sites were identified, with 36 being eligible for the National Register of Historic Places. Data recovery, which was initiated in FY 1992, at two sites has been completed and technical reports were sent to both the SHPO and the ACHP. In addition, fourteen technical reports covering prior data recovery efforts were finalized and resubmitted to the SHPO.

After extensive discussion, DOE/NV agreed to prepare a retrospective report and descriptive summary of the past twelve years of archeological work on Pahute and Rainier Mesas. This agreement was finalized with the SHPO and ACHP as an attachment to the Programmatic Agreement between the state and DOE/NV. A chapter outline for each document has been prepared and submitted to the SHPO, the ACHP, and a peer review panel for comment.

American Indian Religious Freedom Act ■ The American Indian Religious Freedom Act Compliance Program was initiated at the NTS in 1989. This EPD-administered program includes:

- A literature review and evaluation.
- Preparation of a baseline document.
- Preparation of a study design.
- Consultation with Native Americans.
- Preparation of a draft report.
- Native American, DOE/NV, and SHPO review of the draft report.
- Preparation of final report.

EPD spent most of FY 1993 researching and preparing the draft report and obtaining the tribal group's respective reviews. Two separate meetings were held with the tribal groups

12.2.8 Endangered Species Act

The Endangered Species Act requires federal agencies to ensure that their actions do not jeopardize the continued existence of listed species or modify or destroy critical habitats. DOE/NV conducts biological surveys and other investigations and studies to ensure the protection and conservation of threatened, endangered, and candidate species.

During FY 1993, 38 biological surveys were completed to determine the presence of listed and candidate plant and animal species. Currently, 19 species found on the NTS are candidates for listing as threatened or endangered— 10 plant species, 2 mammal species, 6 bird species, and 1 reptilian species.

The desert tortoise, *Gopherus agassizii*, is listed as a threatened species in the southern one-third of the NTS. On-site biologists were provided for 11 projects to observe tortoise habitats but no tortoises were seen. A total of 106 tortoises were seen on or adjacent to NTS roadways.

Work on the Nevada Bell Fibre Optic Cable project was completed, and a report of actions taken under the Biological Opinion for this project was submitted to the U.S. Fish & Wildlife Service (FWS).

The final report on the status of *Astragalus beatleyae* on the NTS has been completed and submitted to the FWS with a request to downlist the plant from Category 1 to Category 3c.

12.2.9 National Environmental Policy Act Activities

Commencing in January 1993, a DOE/NV NEPA training course was implemented for DOE/NV and contractor employees. The course consists of eight hours of training and covers such areas as the Council of Environmental Quality Regulations, the DOE/NV NEPA process, and DOE NEPA Regulations and Procedures.

Volume III of the DOE/NV NEPA Compliance Guide was assembled by EPD. Volume III is to be used with DOE/HQ Volumes I and II and provides a quick reference handbook containing procedures, formats, and guidelines for personnel responsible for DOE/NV's NEPA compliance activities. This Compliance Guide serves as a reference book for the NEPA training course; 57 copies of the Guide have been distributed and maintained.

A complementary course on the preparation of Environmental Assessments and Environmental Impact Statements is currently being prepared by the EPD staff. The prerequisite for this new course will be the basic NEPA training course.

DOE/NV approved 60 Categorical Exclusion Determinations during FY 1993, and 10 Environmental Assessments are pending.

12.2.10 Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act

In 1987, the locations of underground nuclear tests became CERCLA sites. Each additional nuclear test would be reported to the National Response Center. DOE/NV will continue to report all future

underground tests, should there be any, to the state of Nevada, Emergency Management Division, as part of the reporting procedure.

12.2.11 Toxic Substances Control Act

The NTS polychlorinated biphenyl (PCB) annual report was submitted to both EPA Region IX and the Nevada Division of Environmental Protection in June 1993. The report included the quantity and status of PCB and PCB-contaminated transformers and electrical equipment at the NTS. Also reported were the number of shipments of PCBs and PCB-contaminated items from the NTS to an EPA-approved disposal facility.

12.3 PERMIT ACTIVITIES

Federal, state, and local regulatory authorities have granted permits to contractors providing operational support at DOE/NV-administered facilities, both on the NTS and at other off-site locations. The numbers of different types of permits that were in effect during Operation KLAXON are shown in Table 14.

Throughout all of FY 1993, there were no noncompliance issues of permit requirements under the jurisdiction of DOE/NV.

All disposal, treatment, and storage of hazardous wastes on the NTS are consolidated under one EPA RCRA generator identification number. Initial technical comments from the state of Nevada, Department of Environmental Protection, on the NTS's revised RCRA Part B application were received in July 1993 and these comments are being incorporated. Work is also progressing towards the preparation of permit applications for new disposal units.

TABLE 14. ENVIRONMENTAL PERMITS DURING OPERATION KLAXON

Type	NTS	TTR	NLV	Woburn	Amador	So.Cal.	LV	Total
Water Hauling	1							1
Sewage System	4							4
Septage Hauling	8							8
Construction Permit, Air Quality	20	1	1					22
Operating Permit, Air Quality	23	5	28	1		1		58
RCRA	1	1						2
ARPA	1							1
Endangered Species	1							1
Scientific Collection	1							1
Borrow Pit		1						1
Public Water System	6	4						10
Transportation of Hazardous Materials			1	1				2
Wastewater Discharge	1		2	1	1	3	1	9
Hazardous Material Storage	2	1	2	1	1	1		8
PCB Notification	1							1
Notification of Hazardous Waste Generation	1	2	1	1	1	2		8
TOTAL	71	15	35	5	3	7	1	137

13.0 GEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS

13.1 PROGRAM IMPLEMENTATION

13.1.1 Mission Statement

The principal responsibility of the USGS to the Weapons Program is the definition of the geologic and hydrologic environment of underground nuclear explosions.

13.1.2 Program Oversight

The USGS mission is formalized by means of Interagency Agreement DE-AI08-91NV11040 between the USGS and DOE/NV. Funds to support the effort of the USGS, in addition to those of DOE/NV, are provided by LANL and LLNL.

13.1.3 Functional Responsibilities

Annually, or otherwise as required, DOE and USGS agree on specific work plans for tasks to be performed by the USGS within the following general guidelines:

- Provide information and interpretations describing the geologic, geophysical, and hydrologic environment of the NTS and other sites where nuclear explosions have occurred.
- Document and analyze the effects of nuclear explosions on the geologic and hydrologic environment.
- Provide two senior geologists as member and alternate member of the CEP.
- Provide the designated testing laboratories with geologic, geophysical, and hydrologic data pertaining to each proposed event site.
- Provide general consultative services to DOE/NV in the disciplines of geology, hydrology, geophysics, and scientific instrumentation.
- Coordinate with DOE/NV and DOE/NV contractors in development of plans for DOE programs.
- Conduct research in the fields of geology, geophysics, and hydrology.
- Provide topographic mapping services as requested by DOE.

13.2 ONGOING ACTIVITIES

13.2.1 Mapping

Revisions of the Pahute Mesa 1:24,000 geologic quadrangle maps continued during Operation KLAXON. Field work and office compilation continue to add detail to the current maps while improving our understanding of the geology. In addition, revisions were completed in geologic map symbology for the current maps. These data will eventually be incorporated with other data in the NTS Geologic Information System (GIS). The main part of the revision will come from the 1:100,000 Geologic Map of Pahute Mesa (see Minor and others in Reports). In addition, the digital versions of the geologic maps of the 1:100,000 geologic maps of Beatty and Indian Springs will be integrated into the NTS geologic map in the near future.

A program to digitize all test-related fractures at the NTS continued during Operation KLAXON. The pilot program, for fractures on Pahute Mesa, began during Operation SCULPIN and was completed during Operation KLAXON. The initial product of this mapping project will be a revised Pahute Mesa composite fracture map, scale 1:48,000. The map will show postnuclear test

fractures from the advent of Pahute Mesa testing in 1966 to the most recent test. Highlighted will be surface effects of tests during the interval January 1984 to September 1992 to bring previous editions of the map up to date. The first draft of the text is complete, and map compilation began during Operation KLAXON.

The USGS distributed the most recent compilation map of underground nuclear-test-induced ground surface fractures and sinks on Yucca Flat, scale 1:12,000. This version of the map brings surface effects documentation on Yucca Flat up to date through March 1992.

13.2.2 Topical Studies

Structural Framework of the Yucca Flat Basin ■ Field reconnaissance and some detailed mapping were completed during the year in areas of critical structural relations within the Paleozoic formations. The Tippinip fault zone, exposed on the west side of the Climax stock north of Yucca Flat, was examined in detail. Local relations show that this fault zone may have a significant component of left-lateral strike-slip displacement, in addition to forming the structural boundary between the Mississippian Eleana Formation and older parts of the section to the east.

Detailed mapping and fault-slip studies in the Mine Mountain area and on the east flank of Rainier Mesa in connection with drill hole ER-12-1 indicate that significant east-west to northeast-southwest extensional faulting occurred in the NTS area prior to the onset of Miocene volcanism. Stratigraphic relations in the area indicate that some faulting was pre-late Oligocene (pre-Monotony Tuff), and suggestive evidence indicates that the faulting may be as old as pre-middle Cretaceous in age (prior to Climax stock intrusion). Reconnaissance mapping, fault-surface studies, and limited stratigraphic work in the CP Hills area confirm the presence of significant westward-vergent overturned folding in the Mississippian and Pennsylvanian rocks. This contractional strain appears to result from westward-vergent thrusting of Eocambrian and Cambrian rocks, but relations are highly complex due to widespread overprinting by prevolcanic extensional faulting.

Rock Magnetic Properties of Tertiary Volcanic Rocks ■ Acquisition of rock magnetic information for studies of structural and stratigraphic problems of the southwestern Nevada volcanic field continued during Operation KLAXON. Directions of remanent magnetization have aided identification and correlation of volcanic rocks within the revised stratigraphic hierarchy. During Operation KLAXON, these data were used to assess the influence of Walker Lane strike-slip faulting in the NTS area, provide magnetostratigraphic information for many volcanic units, and constrain rock magnetic properties of a newly acquired aeromagnetic survey. The information is described in the publications of Hudson et al., Minor et al., and Grauch et al. (see Reports). Additionally, numerous fault-slip data that give evidence for a period of prevolcanic extension in the Mine Mountain area of the NTS were summarized by Hudson and Cole (see Reports).

Acquisition and compilation of remanent magnetization and magnetic susceptibility data for rocks continue for studies of structural and stratigraphic problems of the southwest Nevada volcanic field in the NTS region. Directions of remanent magnetizations have aided identification and correlation of volcanic rocks within the revised stratigraphic hierarchy.

Stratigraphy of the Nevada Test Site ■ Revision of the stratigraphy of the southwest Nevada volcanic field at the NTS continues to be jointly conducted by USGS and LANL. During Operation KLAXON, advanced isotopic techniques were used to accurately date southwest Nevada volcanic field units. A paper by Sawyer et al. summarizing the new dates awaits publication in the Bulletin of the Geological Society of America. Petrographic, chemical, and synthesis studies continue for

publication in a report summarizing the geochronologic and stratigraphic revisions of the southwest Nevada volcanic field.

Geographic Information Systems Project ■ The USGS Denver Geographic Information System (GIS) facility now includes computer hardware and software necessary for GIS work.

Digital Elevation Models and all of the Digital Line Graph files for the four 1:100,000 quadrangles that cover NTS have been received and are being put into forms accessible by all of the owned software systems. The Digital Line Graph files have been used to supply road nets as overlays on preliminary maps and will be used for this on final map products.

A pilot data base for the Pahute Mesa area is in the planning stage. This data base will encompass the drill hole data and similar information at first. Later, the data base will be expanded to include the Digital Elevation Models, the Digital Line Graph data, various image data sets, and the surface geologic and geophysical information.

Paleostress Studies of Yucca Flat Basin ■ The project is complete. Paleostress data are summarized in the paper by Minor.

13.2.3 Geologic Data Center and Core Library

The Geologic Data Center and Core Library is a DOE/NV support facility managed by USGS. The facility receives support funding from the Weapons Testing, Environmental Restoration, and Yucca Mountain Site Characterization Projects. Drill-bit cuttings, drill core, and other rock samples collected from the weapons test areas and groundwater monitoring sites are systematically processed, cataloged, and stored in the Core Library. A reference library of reports, maps, aerial photographs, and geophysical logs is maintained in the Geologic Data Center. This facility is a field headquarters and logistical center for the USGS geoscientists and technical staff. These USGS and other earth scientists are provided with work and meeting space along with access to all in-house reference materials and office support.

An accumulated total of 51,484 sample storage boxes are currently stored within this facility. These samples, which are valuable assets available to the entire NTS community, represent 864,634 m of drill hole.

During Operation KLAXON, 223 boxes, representing 4,201 m of drill hole samples, were added to storage. The breakdown by user agency is shown in Table 15.

TABLE 15. DRILL SAMPLE TOTALS FOR OPERATION KLAXON

<u>User</u>	<u>No. Holes</u>	<u>Feet</u>	<u>Meters</u>	<u>Boxes</u>
LANL	2	899.0	274.0	8
LLNL	6	730.0	222.5	7
DNA	3	795.3	242.4	91
DNA/TTBT	15	61.6	18.8	13
DOE/ER	8	11,298.0	3,443.6	104
Total	34	13,783.9	4,201.3	223

13.2.4 Support to National Laboratories

Support to the national laboratories continued during Operation KLAXON in the disciplines of geology, geophysics, and hydrology. Operational support to the laboratories for tests in Yucca Flat and Pahute Mesa involved predrill analysis, and postconstruction review. Review, prior to CEP presentation, involved two sites on Yucca Flat—one for LLNL and one for LANL.

Yucca Flat ■ Two predrill expanded geologic data summaries were prepared under authority of DOE/NTS SOP-5417, *Protection of Groundwater at Nuclear Test Locations*. Both were prepared for LLNL. One site is a new location, and the other is a deepening of a previously drilled site. After review by LLNL, summaries were sent to USGS/Water Resources Division for generation of hydrologic information summaries. Hydrologic summaries were sent to LLNL for review and incorporation into site packages for review within the DOE system prior to drilling.

The USGS computer siting program is under review, as time permits, to correct faulty data and to bring the program up to date.

Two sites were reviewed postconstruction—one each for LANL and LLNL. Samples, geophysical logs, site characterization reports, and geology of surrounding drill holes were reviewed for each.

Analysis of the Paleozoic rock surface, using surface gravity data, aided LANL's geologic structure interpretation. A field check of the site revealed some renewed surface fracturing, caused by nearby underground tests, well removed from the new test location.

Downhole photography, samples, and geophysical logs from the LLNL site suggested a geologic setting in disagreement with that of LLNL. Detailed results of the USGS investigation were sent to the laboratory, and differences of opinion were discussed.

Pahute Mesa ■ USGS activities on Pahute Mesa, in support of LANL, include review and revision of an expanded predrill geologic data summary for one site; completion of cuttings log for one site; and completion of downhole movie log for one site. USGS activities on Pahute Mesa, in support of LLNL, include compilation of an expanded predrill geologic data summary for one site; revision of cuttings log for one site; and completion of downhole movie log for one site.

Surface Effects ■ Documentation of ground-surface breakage from buried nuclear tests is a fundamental aspect of containment study. Surface fracturing reveals the presence of concealed faults, their trends, sensitivity, and sense of movement, as well as orientation of near-surface stress fields. Surface fracture maps are used in the location of new sites and in site evaluation.

Draft composite fracture maps of Pahute Mesa were compiled for USGS review and edit of the digital data base. Status evaluation and preliminary examination of all Areas 19 and 20 digital files began the concluding stage of data preparation. Documentation of surface fracturing on Pahute Mesa continues with digitization of sites expended during previous years. In addition, a status evaluation of all digital files was completed and a first review of all digital files was completed. A draft text to accompany the Pahute Mesa digital fracture map awaits review.

USGS canceled plans to digitize Yucca Flat surface effects. The Pahute Mesa pilot project taught a valuable lesson: original data must be used in construction of digital files. Initial research of Yucca Flat sites shows conclusively that far too much original-site data has been lost to make a Yucca Flat digital project practical. Therefore, the Yucca Flat composite fracture map will be redrafted for cosmetic improvement. Redrafting will begin as time permits during FY 1994.

Due to the testing moratorium, no new surface effects data were compiled during Operation KLAXON.

13.2.5 Verification and Control Technology

USGS participates in DOE/NV Verification Management Division projects for Verification and Control Technology to establish the technology and means for detecting and verifying nuclear explosions at remote sites. USGS assists the Division in the planning and execution of future verification activities under the current Protocols of the TTBT and Peaceful Nuclear Explosions Treaty. A USGS representative is a member of the DOE/NV Verification Working Group.

During Operation KLAXON, USGS attended meetings to assist in organization of field teams and equipment for verification activities both at the NTS and in Russia. The meetings encompassed the following topics: DRY RUN RED exercise, deployment of equipment and cadre to Russia, Moscow Coordinating Group for PRILIV, security plan for handling cores and geologic data for the PRILIV event, U.S. verification representatives familiarization visit to Novaya Zemlya, and TTBT implementation during the current moratorium.

USGS participated in DRY RUN RED, a mock Coordinating Group exercise held at the Marriott-Dulles Hotel, Chantilly, Virginia, from January 11-15, 1993. Both the Red and Blue Teams prepared mock annexes covering logging, coring, geodetic measurements, and void detection. Responsibilities for specific annexes were discussed, debated, and assigned to either or both teams. The exercise telescoped the first 15 days of the proposed Moscow, Russia, Coordinating Group meeting into just five days.

Equipment was ordered and received for use by the Logging, Coring, and Surveying (LCS) Team for shipping core samples from the Russian test site to the United States. USGS assisted in the inventory of LCS equipment prior to shipment to Russia. Additionally, USGS attended and participated in meetings and training sessions concerning LCS Team readiness to deploy to the Russian test site.

Using stations surveyed by RSN surveyors, USGS personnel developed seismic and radar void-detection methods and procedures at the Colorado School of Mines experimental mine near Idaho Springs, Colorado. During the DNA exercise at that location, USGS continued field testing of void-detection equipment in the Miami tunnel. Numerous personnel, on site for the DNA exercise, visited the void-detection trials and were given firsthand explanations and hands-on experience using the equipment. Representatives from DNA, DOE, EG&G/EM, ENSCO, LANL, LLNL, OSIA, and RSN were present.

USGS participated as a U.S. (DOE) member of the TTBT Coordinating Group for the verification of the PRILIV event. A coordinated schedule to carry out activities related to verification of the PRILIV test was developed and agreed upon by both parties (American/Russian) in Moscow, Russia.

On July 19, 1993, the U.S. government received notification through the Nuclear Risk Reduction Center that the Russian government had postponed all activities associated with the PRILIV event. All LCS equipment was returned to the United States, and all LCS personnel are in a maintenance-of-capability mode.

13.2.6 Environmental Restoration Program

USGS continued work under the DOE/NV ERP during Operation KLAXON by supporting the Ground Water Characterization Project in five main areas:

- Technical planning
- Summaries of existing data
- Conceptual framework and analysis of structure and stratigraphy
- New field investigations
- Airborne geophysical surveys

At DOE request—following the considerable cost overruns in the drilling program to date—USGS participated in an extensive reassessment of the Groundwater Characterization Project drilling plans for FY 1994. This change of DOE program focus from scientific investigation, characterization, and data collection to cost containment resulted in time-consuming reconsideration of the geology and hydrology of numerous new (and reprioritized) target drilling locations.

Work was largely completed on composited aeromagnetic data for the NTS region. This combined and merged data set was assembled from more than 15 individual prior surveys, and allowed the production of derivative data maps for total-field magnetization, reduced-to-pole magnetization, and magnetic-body boundary enhancements. USGS obtained and provided to DOE digital 1:100,000-scale topographic and cultural data for the four 30-minute by 1-degree sheets that enclose the NTS. Revision of the digital geologic map coverage for the NTS area was also largely completed during Operation KLAXON.

In collaboration with the Water Resources Division, a summary report was prepared for the ERP that evaluates the current state of knowledge about the hydrogeologic controls on groundwater flow at the NTS. The concepts, new structural findings, and limitations of geologic and hydrologic data were discussed at length with DOE program officials and Groundwater Characterization Project participating organizations.

New field investigations were completed in two areas along critical flow-paths of groundwater movement between contaminated underground test areas and points of water discharge. Mapping in the Thirsty Canyon southwest quadrangle will enhance understanding of the distribution of aquifers that carry groundwater from Pahute Mesa to the Oasis Valley springs. Detailed fault studies and stratigraphic refinement in the French Peak area help to evaluate the significant pathways for water migration from the Yucca Flat basin into Frenchman Flat and thence down gradient to Ash Meadows and Death Valley.

In concert with the field mapping in Oasis Valley, USGS flew a detailed aeromagnetic and electrical survey of western Pahute Mesa, Oasis Valley, and the down-gradient areas south of the Bullfrog Hills. These data provide important information about the structural configuration of major rock bodies in the subsurface and establish critical controls on the units that form the principal aquifers down gradient from the contaminated Pahute Mesa underground test areas.

13.3 SPECIAL STUDIES/ACTIVITIES

Special studies and activities include general consultation to the Assistant Manager for Operations, participation on special DOE/NV panels, land use studies, and data requests from other federal agencies and private industry. Special tasks are unplanned, topical subjects that occur throughout the year, and normally are of short duration.

Containment Evaluation Panel ■ During Operation KLAXON, USGS provided a senior geology consultant and an alternate member to the CEP with duties to review, evaluate, and categorize containment plans for each nuclear test. USGS also provided official observers, as required, to obtain, analyze, and present information and data relating to media properties, geology, and hydrology. Two panel meetings were attended, at which LANL and LLNL each presented containment plans for evaluation. All containment documents were reviewed prior to Panel meetings, and comments were transmitted to the appropriate laboratory.

Volunteer for Science Program ■ During Operation KLAXON, the USGS volunteer for science program candidate completed his Ph.D. from Johns Hopkins University. Data obtained at the NTS will be summarized in the paper by Resmini and Marsh.

Project CHARIOT ■ Discussions regarding tracer studies performed in 1962, in relation to prediction of possible environmental effects of Project CHARIOT, continue between USGS and DOE/NV Assistant Manager for Environment, Safety, Security, and Health.

Quality Assurance ■ USGS continues to participate in the DOE Family Quality Forum to discuss uniformity of quality practices among DOE, other federal agencies, and private contractors.

NTS Lithologic/Stratigraphic Log Data ■ Development began on a data base of lithologic and stratigraphic logs of vertical drill holes in and near the NTS. During Operation KLAXON, reviews and revisions were made to the data base, and the accompanying text was completed. In addition, the text and data base were submitted for USGS peer review.

Mima Mound Studies ■ Preliminary field studies and office reviews were completed during Operation KLAXON. In addition, abstracts were prepared and approved for presentation at the Seventh Symposium on Containment of Underground Nuclear Weapons and the Eleventh Annual Classification Symposium. Field investigations of the mounds continue on selected parts of Pahute Mesa as does a review of the scientific literature related to the mounds.

Groundwater Protection Policy ■ Two sites were considered under DOE/NTS-SOP 5417, *Protection of Groundwater at Nuclear Test Locations*, and work on a third site began during Operation KLAXON. The USGS role under the policy is to generate a model, prior to drilling, of the geology and hydrology of each site proposed by a testing laboratory. The laboratory, after review and concordance, sends the site model to a DOE Environmental Restoration and Waste Management Division panel for review of compliance to SOP-5417. This panel sends its recommendation to the DOE/NV Assistant Manager for Operations who accepts or rejects site construction.

USGS reviewed a companion DOE/NTS-SOP 5413, *Characterization of Event Sites*, and sent comments to the USGS Contract Officer Technical Representative.

Seventh Symposium on Containment of Underground Nuclear Explosions ■ Members of USGS attended the Seventh Symposium on Containment of Underground Nuclear Explosions, Boeing Space Center East, Kent, Washington, September 14-17, 1993. Two USGS papers were presented (Garcia and Covington, see Reports; Hale, G. S., and D. A. Trudeau, 1993, *Groundwater Levels From Well and Test-Hole Data, Yucca Flat, Nevada Test Site, Nye County, Nevada*. Unpublished).

USGS served on the Symposium Program Committee to review abstracts and combine related papers into topical sessions for presentation.

Data and Information Request ■ USGS received requests from DOE/NV and DOE/NTS contractor organizations for data, information, references, or other assistance in contemporary projects. During Operation KLAXON, examples of the type of information provided by USGS include NTS lithologic data for the IT Corporation, geologic data pertaining to surface water percolation to the regional aquifer for REECo, a fault map of the NTS for DOE/NV TOD, references and data relating to the chemical element composition of Frenchman Flat soils for EG&G/EM, and a listing of Pahute Mesa tests that had collapsed to the surface and were at least 100 m above the static water level for the LLNL environmental group.

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14.0 HYDROLOGICAL INVESTIGATIONS

14.1 U.S. GEOLOGICAL SURVEY PROGRAM IMPLEMENTATION

14.1.1 Mission Statement

USGS provides hydrologic expertise and assistance to DOE/NV in support of the Weapons Testing Program and Environmental Restoration Program (ERP) at the NTS. The USGS mission is described in Interagency Agreement DE-AI08-91NV11040.

14.1.2 Program Oversight

The USGS Hydrology Program provides hydrologic expertise and support to the Hydrologic Resources Management Program (HRMP) and the ERP. The HRMP is conducted under the general management of the DOE/NV Assistant Manager for Environment, Safety, Security and Health. The ERP is conducted under the general management of the DOE/NV Assistant Manager for Environmental Restoration and Waste Management.

14.1.3 Functional Responsibilities

USGS is responsible for conducting geohydrologic investigations, collecting hydrologic information on and adjacent to the NTS, and maintaining this information in a centralized data base for various DOE/NV programs. The purpose of the HRMP, operated by representatives from USGS, DOE/NV, DRI, LANL, and LLNL, is to provide operational support, perform groundwater monitoring, assist in groundwater protection activities, and conduct long-range research for the Weapons Testing Program. The purpose of the ERP is to support DOE Environmental Restoration and Waste Management Program efforts in identifying and restoring inactive waste sites and ensuring compliance with applicable laws and regulations. A key element of the ERP is the Underground Test Area Remedial Investigation/Feasibility Study. Project goals are to determine the magnitude and extent of contamination, define groundwater flow paths, identify receptors along these flow paths, and provide site-specific and regional groundwater data that can be used to meet data requirements set forth by regulatory authorities. USGS provides technical support and expertise in hydrology and groundwater hydraulics for planning, implementing, interpreting, and reviewing DOE-funded projects. Technical support includes general consultations with DOE and its contractor personnel, participation on standing and ad hoc committees, preparation and review of specific reports for inclusion in DOE documents, and completion of unprogrammed tasks to assist in the solution of unforeseen problems or concerns.

14.2 U.S. GEOLOGICAL SURVEY ACTIVITIES

14.2.1 Operational Support

Hydrologic expertise during Operation KLAXON was provided to DOE in support of operations at the NTS. Water-level data were collected and analyzed to support weapons testing in the Tuff Pile area of Yucca Flat. Problems have been experienced in constructing emplacement holes in this part of the NTS due to shallow depths to water and high fluid pressures. USGS continued to collect continuous and intermittent depth-to-water measurements in three piezometers at Well UE-3e 4, in two piezometers at UE-4t, and at postshot Hole U-4u PS 2a. Additional data were collected during Operation KLAXON at emplacement Hole U-7cd and the U-7cd 1 satellite hole using transducers to monitor fluid-level rises.

Support to the CEP continued to be provided by USGS as part of the operational support efforts of the HRMP. Specifically, this support included providing hydrologic expertise in the siting of proposed underground nuclear tests, reviewing containment document packages, participating in the CEP meetings, evaluating geohydrologic data, and conducting site-specific hydrologic investigations at the NTS. Water-table altitude maps of the testing areas were maintained to aid in estimating the depth to water at proposed weapons testing sites.

The computerized Groundwater Site Inventory data base, established and maintained by USGS, continued to be used for the storage and retrieval of geohydrologic data collected from selected test holes, wells, and emplacement holes at and adjacent to the NTS. Historical and current geohydrologic data are being compiled, verified, and stored in the data base. These data represent the foundation for most hydrologic investigations at the NTS to support operations and will aid in improving understanding of groundwater flow rates and paths and the mechanisms of radionuclide migration. Historical water-quality data continued to be compiled and stored in the data base.

14.2.2 Groundwater Monitoring/Protection

Measurements of groundwater data are needed to characterize the groundwater flow system underlying the NTS. The configuration of the water table and distribution of hydraulic head beneath the water table must be defined to determine groundwater flow paths and rates. Groundwater levels continued to be monitored by USGS by making depth-to-water measurements in a network of 53 selected wells, test holes, and emplacement holes at the NTS and at 60 wells and test holes in areas adjacent to the NTS. This network is used to monitor fluctuations in groundwater levels by intermittently or continuously measuring the depth to water in accessible wells and test holes. Water-level data collected from weapons testing and ERP/GCP wells and test holes were used specifically in site selection, and in containment and groundwater protection evaluation. Many of the weapons testing holes were accessible only for very short periods of time. Depth-to-water measurements were made frequently in these holes until a near static water-level condition was achieved. Measurements were then made at a decreasing frequency until the holes were no longer accessible. These measurements provided data to aid in evaluating the location and containment of proposed weapons tests, in ensuring compliance with DOE SOP-5417 regarding groundwater protection, and in evaluating the location for new ERP/GCP wells and workover sites.

Water-level data collected from wells at radionuclide-migration study sites aided in characterizing local groundwater flow systems, which in turn will aid in determining flow rates and potential travel paths for radioactive materials deposited at these sites. For this purpose, continuous data reflecting water-level fluctuation were collected intermittently at UE-2ce, UE-7nS, U-7cd, U-7cd sat 1, UE-4t #1 and #2, and PM-2.

Water samples were collected from holes penetrating saturated sediments and delivered to the EPA/EMSL-LV for tritium analysis. During Operation KLAXON, 13 water samples were collected. The results of the analysis by EPA were provided to DOE/NV for evaluation as part of the HRMP activities. Water samples also were collected (U19-bh) for other agencies (DRI) for use in studies concerning radionuclide migration.

Water-use data for the NTS were compiled and stored in the USGS database. During Operation KLAXON, water-use data were collected from 13 wells on the NTS. The flowmeter and data logger installed at Well J-12 continued to provide continuous data until May 1993. Planning began for the installation of additional flowmeters and data loggers at all water-use wells.

During Operation KLAXON, USGS provided support to DOE for groundwater protection activities. Hydrologic assessments for two planned events were prepared as part of DOE/NTS-SOP 5417.

14.2.3 Special Studies/Activities

Special studies and activities conducted during operation KLAXON included the maintenance of a GIS, analysis of water-level fluctuations to determine aquifer properties, and the continued investigation of the suitability of transducer systems in measuring water-level fluctuations in deep wells and test holes under nonstressed conditions.

The GIS capabilities were used to analyze data collection at and adjacent to the NTS, for management efforts of both HRMP and ERP activities, and to facilitate well-siting activities at the NTS.

During Operation KLAXON, an analysis was begun of the frequency response of water levels in wells and test holes to earth tides, atmospheric loading, and seismic events. Data collected at wells equipped with transducers were analyzed to determine if hydrologic properties of the geohydrologic units at the NTS and vicinity could be determined by means other than conventional aquifer tests. Equipment modifications were undertaken to improve the chances of measuring water-level response, in wells and test holes, caused by the dilation of the geohydrologic units. Methods were investigated to develop techniques for defining hydraulic properties based on the analysis of water-level fluctuations resulting from underground detonations. Techniques were investigated to determine if directional properties of hydraulic conductivity can be defined from differences in the frequency response of water levels in wells in a fractured rock area.

14.2.4 Environmental Restoration

USGS provides independent technical review of plans, documents, and reports prepared by DOE, IT Corporation, and other contractors working on the underground test areas Remedial Investigations and Feasibility Study (RI/FS). Reviews are performed as part of the underground test areas RI/FS planning task. Documents reviewed included sampling and analysis plans, data-quality objectives, well drilling criteria, and predrilling predictive reports. Written, as well as oral, comments were provided to DOE. USGS also provided support in selecting sites and developing scientific objectives for individual underground test areas RI/FS wells.

A regional water-level network consisting primarily of off site wells is maintained by USGS as part of the underground test areas RI/FS data collection task. Water levels were measured twice in each of the 60 or so wells during the fiscal year. Timely release of the measurements was provided through the USGS's monthly status letter. The network continues to be reevaluated and modified. New wells are continually being added as they become available, and a few wells were deleted in cases where another program began equivalent or more frequent monitoring activities at a site. Measurements made at network wells, along with other hydrologic data of local interest, are maintained in the USGS's National Water Information System and are released officially in the USGS's annual data report as part of the underground test areas RI/FS database management task.

A study of evapotranspiration was initiated at Ash Meadows to help quantify discharge from the ground-water flow system at the NTS as part of the underground test areas RI/FS data analysis task. In support of this and planned future activities concerning discharge, satellite imagery was acquired for both the Ash Meadows and Oasis Valley areas, gaging stations were installed on Carson Slough and the Amargosa River near Beatty, water samples were collected and analyzed from major springs in the vicinity, and a local water-level monitoring network was established.

Sites were selected and equipment was ordered for measuring evapotranspiration rates throughout the Ash Meadows region. All activities have been coordinated and approved by the Fish and Wildlife Service.

14.2.5 Reports

The following abstract was presented and published at the 7th Symposium on Containment of Underground Nuclear Explosions:

- *Groundwater Levels From Well and Test-Hole Data, Yucca Flat, Nevada Test Site, Nye County Nevada.*

The following reports received colleague and DOE reviews and will be submitted to the USGS for approval:

- "Water-Level Data from Wells and Test Holes and Potentiometric Contours at Yucca Flat, Nevada Test Site, Nye County, Nevada, 1991."
- "A Summary Description of the Hydrologic Controls on Ground-Water Flow to Support Environmental Restoration at the Nevada Test Site, Nye County, Nevada."

Drafts of the following reports were processed in preparation for colleague review prior to being submitted to USGS and DOE for approval:

- "Water Levels in Eastern Pahute Mesa, Nevada Test Site and Vicinity, Nye County, Nevada."
- "Ground-Water Data Collected at the Nevada Test Site and Vicinity, Nye County, Nevada, Water Years 1990-91."
- "Ground-Water Data Collected at the Nevada Test Site During Water Year 1992 and Adjacent Areas From 1952 Through Water Year 1992, Clark and Nye Counties, Nevada."

A memorandum listing all groundwater levels measured each month in selected test holes, wells, and emplacement holes at and adjacent to the NTS was distributed monthly to DOE/NV, LANL, DNA, REEC Co, RSN, LLNL, and DRI for their information.

A memorandum listing all compiled water use at the NTS was distributed quarterly to DOE/NV, LANL, DNA, REEC Co, RSN, LLNL, and DRI for their information.

A memorandum detailing the status of the evaluation and testing of transducers at the NTS was submitted to DOE in June 1993.

14.3 DESERT RESEARCH INSTITUTE PROGRAM IMPLEMENTATION

14.3.1 Mission Statement

The main focus of the DRI weapons-related geohydrology program is the assessment of prospects for containment of underground nuclear explosions at the NTS and characterization of the resultant radionuclide movement through unsaturated and saturated zones to the subsurface.

14.3.2 Program Oversight

DRI's geohydrology research is performed through a variety of projects ranging from regional and local groundwater studies to statistical and data management support for large quantities of hydrologic and other data collected, stored, and retrieved. An additional task has been to investigate testing problems such as elevated water levels, and other tasks in support of weapons testing. Another new area of support has been to assist DOE in compliance with several DOE Orders related to groundwater protection and monitoring to comply with other regulations, such as the SDWA.

14.3.3 Functional Responsibilities

DRI is responsible for a variety of research, administrative, and program support functions for DOE/NV's HRMP, formerly the Hydrology/Radionuclide Migration Program. Research functions include sampling, analysis, modeling, and prediction of the chemistry and flow of both surface water and groundwater throughout the NTS. The primary focus is on water transport of radionuclides resulting from underground nuclear tests. Program support includes the procedures for security, radiation safety, quality assurance, computer security, and classification for all appropriate HRMP activities. DRI is also responsible for writing a history of the HRMP, from its beginnings with the Radionuclide Migration Program to the early 1990s.

Surface water studies include investigation of precipitation patterns on the NTS and determination of recharge and runoff relationships, which are now part of the NTS Groundwater Characterization Project.

DRI supports drilling and testing activities for the HRMP by selecting drill sites, developing drilling plans, conducting tests, collecting samples, and analyzing results. The Institute also develops and implements procedures to examine water movement in wells so that samples for chemical analyses may be collected at appropriate locations; the samples are analyzed to determine how radionuclides may be transported in groundwater, particularly near underground sites. Samples containing radionuclides are analyzed for other elements and organic compounds. Numerical models are developed to describe water movement around underground test sites.

DRI is responsible for investigating pretest and posttest hydrologic response and radionuclide migration at specific sites on the NTS. With site-specific information, containment prospects and groundwater impacts for all proposed underground nuclear tests are evaluated and reported from a hydrologic perspective.

Another large area of DRI's responsibility is the management and utilization of existing data; this function extends to the development, testing, calibration, and running of flow models for groundwater within and around the NTS. DRI reviews existing hydrologic data bases, adds historical data, and develops a comprehensive program for adding new data when collected. Past and present data from various data bases are integrated into a geographic information system, and

DRI is charged with initiating the development of a system that is compatible with the systems used by other DOE/NV contractors.

14.4 DESERT RESEARCH INSTITUTE ACTIVITIES

Reorganization of DRI programs during FY 1993 resulted in realignment, for reporting purposes, of several tasks. Tasks formerly reported herein but which are now components of the Groundwater Characterization Project (which will no longer be reported herein) include:

- Recharge and Runoff Studies (Pahute Mesa Recharge)
- Well Validation Program
- Hydrologic Data Management
- Drilling and Testing Support

Tasks reported in prior years but not funded during FY 1993 include:

- Radionuclide Migration—Cambric Ditch
- Geochemical and Isotopic Models
- Radionuclide Geochemistry Studies
- Nonradionuclide Geochemistry Studies
- Free Versus Bound Water Studies

14.4.1 Saturated Zone Studies

Yucca Flat Hydrology ■ The high hydraulic pressure observed in Yucca Flat continues to be a problem with respect to nuclear testing, increasing the engineering and material cost for drill-hole construction and causing concern for radionuclide migration. The long-term goal of this project was to collect the hydraulic information necessary to understand and mitigate the high-pressure zone at Yucca Flat.

During FY 1993, research concentrated on the development of a three-dimensional graphical representation of a conceptual model for overpressure development at the Faultless site in central Nevada. This site is being considered as a simplified analog for the overpressure phenomenon observed at Yucca Flat. Several reports on the progress and results of this work are in review.

Radionuclide Distribution Studies (Tritium Exchange) ■ This project was designed to experimentally explore the possibility of using isotopic exchange between liquid and water vapor to reduce elevated levels of tritium in waters. The determination of the fundamental factors of isotopic exchange will significantly advance the theory of isotopic fractionation, and will have direct application to cleaning water with elevated levels of tritium on the NTS and other DOE sites.

The alternative to the method of isotopic exchange is to either simply evaporate the water or to chemically precipitate the tritium out of the water. Both of these methods may produce radioactive solids (depending on the presence of other radioactive components and other complex factors) which must be shipped to a disposal facility.

The effect that the volume and surface area of water bodies have on the rate of isotopic exchange has been determined, and research into the effects of an "active" exchange system (involving bubbling tritium-free water vapor through water of elevated tritium) and the effect of elevated temperature to augment isotopic exchange is continuing.

14.4.2 Radionuclide Transport Investigations

Near-Field Hydrologic Study ■ The nature of hydrologic flow and radionuclide transport in the near-field environments of shot cavities strongly affects the potential for regional or off-site migration of radionuclides in groundwater. DRI is examining the general features of this near-field hydrologic flow and the primary factors that influence it. Studies of near-field flow are limited by a lack of hydrologic and radionuclide data, so numerical models are being developed to help explain water and radionuclide movement.

In FY 1993, sensitivity analysis and other secondary modeling activities were carried out for the study of the impacts of Pahute Mesa emplacement hole drilling fluid. These results continue to indicate that observed standing water in Pahute Mesa emplacement holes is unlikely to be returned drilling fluids, despite the huge volumes of water injected into the formation during drilling. Preliminary work was completed and a draft report written on the development of a conceptual model and estimates of potential tritium migration from the BENHAM (U20c) site on Pahute Mesa.

14.4.3 Special Studies/Activities

Hydrologic Resources Management Program ■ The major focus of the DRI HRMP (formerly Hydrology/Radionuclide Migration Program) is to attain a better understanding of the NTS hydrology, including groundwater protection and groundwater monitoring. The program focus is on long-range hydrologic studies, site-specific and posttest studies, as well as studies related to solving environmental aspects of the ongoing and future operations of the NTS. These projects are reported on in other sections of this report.

DRI also provides programmatic support to individual HRMP projects, as well as to activities such as developing work plans; writing, editing, and reviewing proposals and project reports; conducting security briefings and radiation safety training; and participating in planning review and coordination meetings. General field and laboratory support is also provided.

In FY 1993, program planning meetings were attended and work plans for FY 1993 and FY 1994 were compiled. Technical aspects of the HRMP projects were discussed, and efforts continued on report review and revision.

General programmatic, budget, field, and laboratory support continued to be provided throughout FY 1993; security briefings and radiation training was also given to DRI personnel involved with NTS activities.

Containment Evaluation Panel ■ The CEP evaluates the containment design of each proposed underground nuclear test and advises DOE of the technical adequacy of such design. The objective of this effort is the containment of all nuclear tests considered by the Panel. DRI's primary activity for the CEP continues to be the assessment of the hydrologic implications of each test.

In FY 1993, two CEP meetings were attended by the DRI member and/or alternate, who also attended the containment symposium held in Seattle, Washington.

History of the Hydrology/Radionuclide Migration Program at the Nevada Test Site ■ Scientific research has been conducted for the past approximately 28 years on the effects of underground nuclear testing on the subsurface environment of the NTS. With the advent of underground testing

at the NTS in 1962, groundwater contamination concerns became a focus for a series of studies. Today, groundwater studies continue as part of the HRMP.

The objective of this project is to research the HRMP, previously the Radionuclide Migration Program, from its beginnings to about 1990, document the events and people that led to its creation and continuation, and provide highlights of significant activities.

During FY 1993, research continued and a draft of the final project report was written and is currently in peer review.

14.4.4 Reports

- Andricevic, R., 1993, *Transport of Sorbing Solutes in Randomly Heterogeneous Formations: Spatial Moments, Macrodistribution, and Parameter Uncertainty*, WRC Pub. #45108.
- Brikowski, T., 1993, *Predicted Fate of Tritium Residuum from Groundwater Tracer Experiments in the Amargosa Desert, Southern Nevada*, WRC Pub. #45103, DOE/NV/10845-19.
- Chapman, J., and B. Lyles, 1993, *Groundwater Chemistry at the Nevada Test Site: Data and Preliminary Interpretations*, WRC Pub. #45100, DOE/NV/10745-16.
- Chapman, J., et al., 1993, *Hydrologic Database User's Manual*, WRC Pub. #45115, DOE/NV/10845-31 (final report).
- Ingraham, N., 1993, *Final Report on the Exchange of Tritium Between Water and Vapor*, (letter report).
- Ingraham, N., and R. Criss, *The Effects of Surface Area and Volume on the Rate of Isotopic Exchange Between Water and Water Vapor*, (manuscript accepted by Journal of Geophysical Research [Atmospheric]).
- Lyles, B., 1993, *Tritium Activities in Selected Wells on the Nevada Test Site*, WRC Pub. #45104, DOE/NV/10845-20.
- Slattery, M. W., and N. L. Ingraham, *Detritiation of Water by Isotopic Exchange: Experimental Results*, submitted to Environmental Science and Technology.
- Slattery, M. W., and N. L. Ingraham, 1993, *Reducing Tritium Levels in Water by Low-Temperature Isotopic Exchange Between Water and Water Vapor*, DRI Publication #45110.
- Slattery, M. W., 1993, *Isotopic Exchange Between Water Vapor and Water in Closed Systems*, Master's Thesis, University of Nevada, Las Vegas, May 1993.

15.0 SEISMOLOGICAL INVESTIGATIONS

15.1 PROGRAM IMPLEMENTATION

15.1.1 Mission Statement

Seismological investigations for the nuclear weapons testing program are a function of URS/JAB. URS/JAB provides the necessary and appropriate studies, measurements, investigations, and experiments to assess, quantify, and predict the character and magnitude of the ground motion, and response of structures to ground motion, induced by underground nuclear explosions and natural environmental forces.

15.1.2 Program Oversight

The URS/JAB contract work is monitored in accordance with DOE/NV directives and policies and as set forth in SEN-20-90. The designated duties and responsibilities of the Contracting Officer's Representative are outlined in the DOE/NV letter describing those activities.

All contract modifications including revisions to the scope of work and terms and conditions of the URS/JAB contract are the responsibility of the Contracting Officer under DOE/NV Contracts Division. The Contracting Officer's Representative, under DOE/NV Test Operations Division, interacts with the Contracting Officer to resolve all technical matters pertaining to the contract.

15.1.3 Close-Out Activities

During Operation KLAXON, URS/JAB's representatives were directed to close out their contract. URS/JAB has been associated with the DOE/NV Seismic Safety Support Program for the last 29 years. Close-out activities included removal of strong-motion seismometers from 100 high-rise buildings in Las Vegas and Laughlin, as well as dismantling the 34 seismic ground stations surrounding the NTS. The seismometer systems were then transferred to the SNL/EG&G seismic weapons program.

A major effort was categorizing and archiving event and earthquake data which have been collected for the last 30 years. Most of the data is stored on 8-mm magnetic tape, but a representative sample of events was transferred for long-term storage on optical disks. The seismic library and archival data have been transferred to the Test Operations Division for maintenance of files. Responsibility for these records may be assigned to another DOE contractor.

One complaint of alleged property damage resulting from a previous large NTS event was investigated and a report was filed.

15.2 REPORTS

Seven reports on large local and regional earthquakes felt in the Las Vegas Valley and surrounding communities were completed and published. Also, a history of the program, which covers the last 30 years, was published.

JAB-10733-TM6 Processed Seismic Motion Records From Little Skull Mountain, Nevada, Earthquake of June 29, 1992, Recorded at Stations in Southern Nevada, December 1992.

- JAB-10733-TM7** Processed Seismic Motion Records From Desert Hot Springs, California, Earthquake of April 22, 1992, Recorded at Stations in Southern Nevada, April 1993.
- JAB-10733-TM8** Processed Seismic Motion Records From Little Skull Mountain, Nevada, Earthquake Aftershocks of July 5, 1992 and September 13, 1992, Recorded at Stations in Southern Nevada, April 1993.
- JAB-10733-TM9** Processed Seismic Motion Records From Landers, California, Earthquake of June 28, 1992, Recorded at Stations in Southern Nevada, April 1993.
- JAB-10733-TM10** Processed Seismic Motion Records From Big Bear, California, Earthquake of June 28, 1992, Recorded at Stations in Southern Nevada, April 1993.
- JAB-10733-TM11** Processed Seismic Motion Records From St. George, Utah, Earthquake of September 2, 1992, Recorded at Stations in Southern Nevada, April 1993.
- JAB-10733-TM12** Processed Seismic Motion Records from Earthquakes (1982 Through 1993) Recorded at Scotty's Castle, California.
- JAB-10733-2** Seismic Safety Program: Ground Motion and Structural Response.

16.0 RADIOECOLOGY INVESTIGATIONS

16.1 PROGRAM IMPLEMENTATION

16.1.1 Mission Statement

The Statistics and Data Management Group of DRI provides statistical and data management support to DOE/NV environmental projects.

16.1.2 Program Oversight

The work performed by this group in FY 1993 consisted of activities for the Basic Environmental Compliance and Monitoring Program (BECAMP) and the Off-Site Radiation Exposure Review Project (ORERP).

16.1.3 Functional Responsibilities

DRI's Statistics and Data Management Group performed the following tasks during Operation KLAXON:

- Prepared BECAMP data files and associated documentation for archiving.
- Prepared ORERP data files and associated documentation for archiving, and prepared a review draft of the report on the Town Data Base.

16.2 ONGOING ACTIVITIES

16.2.1 Basic Environmental Compliance and Monitoring Program Data Base

The purpose of the BECAMP is to assess changes in the radiological and ecological condition of the NTS and surrounding areas and to provide information needed for compliance with applicable environmental laws.

Due to further reductions in funding, work on the computerized archival system started in FY 1992 was canceled. Efforts were directed toward long-term storage of the BECAMP data files and documentation in DRI's custody. These materials are being transferred to the Coordination and Information Center maintained by REECO in Las Vegas.

16.2.2 Off-Site Radiation Exposure Review Project

The ORERP was established to review the possible exposure of off-site populations to radiation from NTS activities and to collect pertinent historical weapons-testing information and data. The project's charter assures that state-of-the-art methods and the best and most complete information available will be used to assess radiation doses to people living near the NTS.

The Town Data Base contains the ORERP's best estimates of exposure rates and times of fallout arrival for locations near the NTS. DRI completed the final updating, documenting, and archiving of computer files related to the Town Data Base.

The report on the Town Data Base was completed in draft form and sent out for review.

No radioecology special studies or activities were conducted by DRI during Operation KLAXON.

16.3 REPORTS

Thompson, C. B., R. D. McArthur, and S. W. Hutchinson, *Estimates of Exposure Rates and Fallout Arrival Times Near the Nevada Test Site* (tentative title), NVO-322, (currently in review).

17.0 CULTURAL RESOURCES INVESTIGATIONS

17.1 PROGRAM IMPLEMENTATION

17.1.1 Mission Statement

The NTS Cultural Resources Program is focused on assisting DOE/NV in its compliance with various stipulations and regulations of the National Historic Preservation Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, and the cultural resource components of the National Environmental Policy Act.

17.1.2 Program Oversight

Cultural Resources Program assistance is provided by DRI through several interrelated components.

The BECAMP component provides overall management and administrative support for the NTS Cultural Resources Program; addresses the identification, evaluation, and limited mitigation of potential effects of DOE/NV activities on cultural resources throughout the NTS area; conducts data recovery programs on historic properties; and addresses the archival requirements of DOE/NV and the National Historic Preservation Act by providing a curation facility for artifacts and associated documents and record-keeping services.

The Pahute-Rainier Mesa Long-Range Study Plan component was designed as a comprehensive data recovery project focused on the mitigation of potential adverse impacts from weapons testing to archaeological resources on Pahute and Rainier Mesas (parts of NTS Areas 12, 19, and 20) as specified in a Programmatic Agreement between DOE/NV, the Advisory Council on Historic Preservation, and the Nevada Division of Historic Preservation. In FY 1993, the Programmatic Agreement was modified by Attachment A, which instituted a three-year program that requires data analysis and interpretation of the known archaeological resources on Pahute and Rainier Mesas.

The other major component is a multiphase program to consult with Native American tribes, to assist DOE/NV in complying with the American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act, and to assess the effects of DOE/NV activities on Native Americans.

17.1.3 Functional Responsibilities

For the NTS Cultural Resources Program, DRI manages all activities necessary to provide ongoing, on-call assistance to DOE/NV concerning its Cultural Resources Management Program. Activities include procurement and administration of staff; preparation of management objectives, documents, and cultural resource management reports and recommendations; assistance in the development of Programmatic Agreements and Memoranda of Understanding; response to on-call requests from DOE/NV for information and support documents, meeting attendance, and consultation assistance with other federal, state, and private agencies; and public relations and communication assistance concerning the NTS Cultural Resources Program.

Additional NTS Cultural Resources Program responsibilities include the following:

- Conduct and document on-call preconstruction surveys prior to project activities.
- Conduct limited test excavations, as necessary, at selected archaeological sites to fully evaluate their scientific significance, and establish suitable plans for data recovery.
- Prepare and conduct data recovery plans for those cultural resources which cannot be avoided by proposed activities, and conduct those data recovery studies at historic properties scheduled for disturbance by DOE/NV activities.
- Provide curatorial and other record-keeping services for the NTS Cultural Resources Program. Specific activities include the maintenance and updating of cultural resources inventory files and site record maps and the curation of artifacts and associated records in accordance with 36 CFR 79.
- Solicit, on behalf of DOE/NV, comments from Native Americans regarding the effects of DOE/NV activities on historic properties and artifacts of value to Native Americans and to their expression and exercise of traditional Native American religions.

17.2 ONGOING ACTIVITIES

17.2.1 Preconstruction Surveys

Since the NTS Cultural Resources Program began in 1978, a total of 3,192 separate cultural resources sites have been identified through 541 separate surveys conducted on lands managed by DOE/NV. Of those resources, 552 occur on the Tonopah Test Range and surrounding Nellis Air Force Range, 741 occur on lands being studied under the YMP, and the remaining 1,899 occur on the NTS proper. Thirty-two separate data recovery projects have been conducted on the NTS to mitigate the potential adverse effects on historic properties through scientific study.

Surveys for cultural resources were conducted at 30 locations in FY 1993:

- Area 1 U1a.01 Event Site.
- Area 3 U3mq Access Road and Fiber-Optic Corridor, Northern Leg of the Nevada Bell Fiber-Optic Line.
- Area 4 U4aq Drill Hole, Access Road, Drill and Utility Corridors; U4T-PS3a Postshot Drillback and North-South Access Road Restoration Area, LLNL Land Mine Detection.
- Area 5 Phase II Science Borehole Project.
- Area 6 Northern Leg of the Nevada Bell Fiber-Optic Line, Tower Module Storage Area, Tweezer Road Complex Fiber-Optic Link, U6c Drill Hole, Access Roads and Utility Corridor, Sanitary Sewer System for the Decontamination Facility.
- Area 7 Northern Leg of the Nevada Bell Fiber-Optic Line, U7cd Fiber-Optic Link, Skid Trail U7cd to Emplacement U3ml, U7cd Ground Motion Corridor, U7ba-PS1a Postshot Drillback and Utility Corridor.
- Area 9 Northern Leg of the Nevada Bell Fiber-Optic Line.
- Area 10 Northern Leg of the Nevada Bell Fiber-Optic Line.
- Area 11 Northern Leg of the Nevada Bell Fiber-Optic Line.
- Area 12 Dining Car U12e.18, 32 LANL Seismic Stations, N Tunnel.
- Area 15 Northern Leg of the Nevada Bell Fiber-Optic Line.
- Area 19 Drill Hole U19bh Postshot Pad and Perimeter Fence; U19bl Bypass Road; U19bk Drill Hole, Borrow Pit, and Utility Corridor.

- Area 20 Sample Units SU20-06 and SU20-12, U20ax Drill Pad and Utility Corridor.
- Area 22 ASOS Near the Desert Rock Airstrip.
- Area 23 Overwinter Tortoise Site, Borrow Pit/RCRA Closure, Fire Training Facility, WSI Parking Lot Expansion.

17.2.2 Field Data Recovery

Three monitors chosen by the Native American tribes were in attendance during these data recovery projects. Field work was completed at Sample Units U19ao and SU19-25. Draft technical reports for these two sample units were completed in FY 1993.

17.2.3 Data Archives

The inventory, data entry, and analysis of the artifacts from Sample Units U19ao and SU19-25 were completed. The cultural resources inventory files and site record maps were updated to include the information from the completed projects. Twenty-three surveys, ten new sites, and twelve isolated artifacts were put into the inventory files and site record maps.

17.3 SPECIAL STUDIES/ACTIVITIES

A preliminary inventory of the historic structures at the NTS which were associated with the development of nuclear testing was completed in FY 1993 with the assistance of an architectural historian.

The Long-Range Study Plan Peer Review Committee met with the Nevada Division of Historic Preservation, the Advisory Council on Historic Preservation, DRI, and the DOE/NV and provided recommendations for the implementation of Attachment A to the Programmatic Agreement.

In FY 1992, the basic retagging and reboxing of the entire NTS collection was completed as the first phase of a multiphase program for the upgrade of DOE/NV artifact curation activities to comply with 36 CFR 79. In FY 1993, an item-by-item inventory was initiated and will continue into FY 1994. The ethnobotanical and ethnoarchaeological study with the Native Americans which began in FY 1992 was completed in FY 1993 by conducting a mail survey of the adults on the tribal rolls of 17 tribes in Nevada, California, Arizona, and Utah. A meeting of representatives of the 17 tribes produced a series of tribal recommendations regarding the ethnobotanical and ethnoarchaeological resources on Pahute and Rainier Mesas, which were incorporated into the draft technical report on this project.

17.4 REPORTS

This list is limited to reports of work performed under the Defense Programs budget. The report number is the start date of field work; all reports were completed in FY 1993.

SHORT REPORTS:

- SR063092-1 A Class III Cultural Resources Reconnaissance of the Postshot Pad and Perimeter Fence for Drill Hole U19bh, Area 19, Pahute Mesa, Nevada Test Site, Nye County, Nevada.
- SR070192-2 A Class III Cultural Resources Reconnaissance for Seismic Activities at Dining Car U12e.18, Nevada Test Site, Area 12, Nye County, Nevada.

- SR072092-1 A Class III Cultural Resources Reconnaissance of Sample Unit SU20-12 and Testing of Sites 26NY1915, 26NY1917, and 26NY1920 on Pahute Mesa, Nevada Test Site, Nye County, Nevada.
- SR072992-1 A Class III Cultural Resources Reconnaissance of Sample Unit SU20-06 on Pahute Mesa, Nevada Test Site, Nye County, Nevada.
- SR082492-2 A Class III Cultural Resources Reconnaissance of the N Tunnel Seismic Stations and Trailer Locations, Nevada Test Site, Nye County, Nevada.
- SR090792-1 A Class III Cultural Resources Reconnaissance of the U7cd Fiber-Optic Link, Yucca Flat, Area 7, Nevada Test Site, Nye County, Nevada.
- SR090792-2 A Class III Cultural Resources Reconnaissance of the Proposed Skid Trail from Emplacement Site U7cd to Emplacement Site U3ml, Yucca Flat, Areas 3 and 7, Nevada Test Site, Nye County, Nevada.
- SR091592-1 A Class III Cultural Resources Reconnaissance of the Northern Leg of the Nevada Bell Fiber-Optic Line, Areas 3, 6, 7, 9, 10, 11, and 15, Nevada Test Site, Nye County, Nevada.
- SR091692-1 A Class III Cultural Resources Reconnaissance of the Proposed U19bl By-Pass Road, Pahute Mesa, Nevada Test Site, Nye County, Nevada.
- SR110492-1 A Class III Cultural Resources Reconnaissance of 32 LANL Seismic Stations Associated with the Hunter's Trophy Event, Nevada Test Site, Area 12, Nye County, Nevada.
- SR120192-1 A Class III Cultural Resources Reconnaissance of the Proposed Overwinter Tortoise Site, Mercury, Area 23, Nevada Test Site, Nye County, Nevada.
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18.0 INSTRUMENTATION AND ENERGY MEASUREMENTS SERVICES

18.1 PROGRAM IMPLEMENTATION

18.1.1 Mission Statement

EG&G/EM is a management and operating contractor for DOE. Work done under the contract is controlled administratively by DOE/NV. Technical direction and oversight of work related to the underground test program is the responsibility of three DOE laboratories which use the NTS and the DoD.

In connection with testing of nuclear devices in support of the nuclear weapons test and defense programs at the NTS, EG&G/EM plans, designs, fabricates, installs, tests, operates, and maintains the following:

- Timing, firing, control, and related equipment and facilities.
- Equipment and related systems and facilities for the measurement, recording, reduction, analysis, and interpretation of weapons diagnostic information.
- Seismic equipment, geophysical equipment, and related systems for diagnostic and safety-related measurements.
- Device and diagnostic mechanical structures and systems associated with the emplacement and diagnostics of underground scientific experiments.

Because the procedures and operations of the various test site users are different, EG&G/EM has chosen to organize its management of the work into three large elements called "programs." Each program is dedicated to the support of a single DOE national laboratory.

Because SNL and DoD testing elements frequently involve the same tests, EG&G/EM combines DoD work with SNL work. The SNL Program provides engineering and operational support to DNA, and several DoD research and development organizations, for effects testing of nuclear weapons components and assemblies.

18.1.2 Program Oversight

All work performed by EG&G/EM is approved by DOE/NV. Funding approval is provided by the DOE Financial Plan.

EG&G/EM accepts work from the national laboratories through test schedules, event definitions, project task statements, and work orders. With DOE approval, DoD and other federal agencies use Military Interdepartmental Purchase Requests or Interagency Cost Reimbursable Orders to task and fund their requirements.

Work performed by the programs is delegated to the operations by the program managers. Technical oversight for projects is provided by DOE national laboratories and DoD.

18.1.3 Functional Responsibilities

Functional responsibilities are presented below as descriptions of individual programs.

Lawrence Livermore National Laboratory Program ■ The LLNL Program is organized into a program office and two operations offices. The managers of the two operations offices report to the program manager. The operations offices are Amador Valley Operations (AVO)—located in Pleasanton, California—and Las Vegas Operations (LVO)—located in North Las Vegas, Nevada. In addition to these two locations, work is also performed at the NTS.

The line of communications from LLNL scientists and engineers to LLNL Program staff is through a system of technical contacts. For each area of support, a designated technical contact provides the technical direction and coordination to the LLNL Program.

AMADOR VALLEY OPERATIONS ■ AVO is the primary design and engineering organization in the LLNL Program. Under the direction of LLNL, AVO mechanical engineers design diagnostic canisters and related equipment, and electronics engineers design data-recording systems for monitoring nuclear device performance.

LAS VEGAS OPERATIONS ■ LVO is the field support organization for LLNL Program activities conducted at the North Las Vegas facility and the NTS. LVO designs, fabricates, assembles, and fields equipment for the measurement, recording, analysis, and interpretation of weapons diagnostic experiment data. LVO operates and maintains timing, firing, control, and related equipment and facilities and provides software development and data reduction and analysis for device performance and containment phenomenology.

Los Alamos National Laboratory Program ■ The LANL Program is composed of two geographically separate operations: Las Vegas Support Operations (LSO) located at the EG&G/EM facility at North Las Vegas, Nevada, and Los Alamos Operations (LAO) located at Los Alamos, New Mexico. The LANL Program is also supported by the EG&G/EM Science, Research, and Development Program; specifically the Science, Research, and Development Program's Woburn Cathode-Ray Tube Operations (WCO) located in Woburn, Massachusetts, which almost exclusively supports the LANL Program.

The line of communications from LANL scientists to the LANL Program staff is through a system of technical contacts. All areas of support have a designated contact who provides technical direction and coordination to the LANL Program.

LAS VEGAS SUPPORT OPERATIONS ■ LSO provides data acquisition system fabrication and fielding support for LANL Program activities conducted at the North Las Vegas facility and the NTS. LSO installs and operates field equipment and systems that transmit timing commands and engineering information and receive monitor signals. LSO sets up and operates arming, timing, and firing systems and command, communication, and control systems. LSO also reads and evaluates event film and digital data and documents event design and reaction data.

LOS ALAMOS OPERATIONS ■ LAO provides data acquisition system design, fielding, and analysis for weapons diagnostic experiments. LAO develops, installs, and operates data acquisition instruments and systems. LAO provides calibration, evaluation, and property and parameter determination for baseline acceptability of various hardware components, systems, and associated software as well as data analysis and archival information for event-related diagnostics.

WOBURN CATHODE-RAY TUBE OPERATIONS ■ WCO develops and manufactures specialized cathode-ray tube designs and assembles cathode-ray tubes and other electron-beam devices for LANL. The work of WCO includes research and development for new designs, fabrication of newly designed cathode-ray tubes, and refurbishing of existing instruments.

Sandia National Laboratories Program ■ The SNL Program is organized into two operations offices. The managers of the two operations offices report to the program manager. The operations offices are Sandia and DoD/Las Vegas Operations (SDO)—located at Las Vegas, Nevada—and Kirtland Operations (KO) located at Albuquerque, New Mexico.

SANDIA AND DOD OPERATIONS ■ SDO provides engineering, technical, and operational support for tunnel events (and some vertical events). Technical personnel provide alcove and computer system operation, equipment repair, and seismic and geophone operations. Engineering and software personnel maintain continuous software development and electronic engineering capability for the specification, selection, and/or design of computer hardware/firmware.

SDO designs, prototypes, fabricates, installs, and maintains data acquisition and transmission systems and operates and maintains systems used in monitoring and recording event activities. Electrical and mechanical support is provided by SDO to complete button-up of the tunnel in preparation for an underground test and reentry activities after a test is executed.

KIRTLAND OPERATIONS ■ KO provides scientific and engineering support for weapons testing at the NTS in a variety of areas. Activities include the development of analog and digital data acquisition and recording systems, components, and software.

Projects directly involved with weapons testing include the Sandia Digital Underground System, shown in Figure 13, which supports SNL in the operation of digital data acquisition systems at the NTS. Another major project is the development of the Sandia Transient Acquisition and Recording System. This is a state-of-the-art data acquisition and recording system being developed by SNL. KO also provides support to SNL weapons test divisions by fabricating and fielding strain gauges for use on NTS events.

18.2 ONGOING ACTIVITIES

18.2.1 Lawrence Livermore National Laboratory Program

Nonproliferation Experiment ■ The Field Operations Division and the Mechanical Engineering Division participated in the NPE, formerly called Chemical Kiloton, with installation of cavity pressure and residual stress experiments. The cavity pressure measurement system deployed on this experiment was successfully fielded. While still being analyzed, much meaningful data was received. The electronics packages functioned properly through zero time, but cable shield damage at shock arrival time precluded the collection of meaningful plus-time cavity pressure data. The cable severed during the test was reconnected upon reentry. Cavity pressure data was obtained until approximately plus 600 milliseconds when the tunnel ducting fell on the cable. The residual stress measurement survived shock arrival time, and one channel continued to report data until October 14 when LLNL Containment Physics directed an experiment shutdown to secure the tunnel. Upon N Tunnel reentry, postshot status photos were taken of the instrumentation installations. The cavity pressure and residual stress experiments final engineering report is currently being written.

BISCUIT ■ The BISCUIT exercise was successfully supported through execution (simulated shot). The Communications, Command, and Control and Instrumentation sections actively participated in this exercise. This exercise included taking simulated data on new diagnostic systems and on standard diagnostic systems simultaneously. The data will be analyzed as if this were a normal event, and the results from different systems will be compared. A formal review with LLNL is

Figure 13. N Tunnel, N25 Nonproliferation Experiment:
View of SANDUS 505 Rack in Slow Alcove

scheduled. The purpose of this exercise was to establish the acceptability of the new digital systems for future events.

Planning Committees ■ Field Operations personnel are actively participating on committees formed by LLNL and are providing input to develop techniques and approaches for fielding future "permitted experiments." Included in the approaches are utilization of the ATLAS concept and the "campaign mode" concept with an emphasis to minimize the infrastructure support required at the NTS.

GABBS ■ The GABBS electronic project engineer asked LLNL Program personnel to discontinue work on the GABBS event. However, Program personnel feel that several subsystems being built up on GABBS should be completed because these systems can be used on future events. EG&G/EM prepared a list of these tasks which was tentatively approved by the GABBS electronic project engineer. Personnel in the Defense Sciences Engineering Division (DSED) at LLNL are prioritizing these tasks. Due to the continuation of the moratorium, the GABBS diagnostic canisters are being prepared for long-term storage. The earliest readiness date is now October 1994.

NORITE ■ The diagnostic engineering and mechanical assembly work for the NORITE readiness exercise were completed. This work included preparing engineering reports and readying the empty DOLOMITE upper canister frame for fielding and emplacement. However, the NORITE exercise was placed on indefinite hold before the DOLOMITE frame was shipped to NTS.

Nuclear Chemistry Exercise ■ Plans for participating in the Joint Test Operations reentry drillback exercise are in progress. LLNL Nuclear Chemistry has requested EG&G/EM and LLNL Field Operations Division's participation with a full complement of gas sampling trailers.

18.2.2 Los Alamos National Laboratory Program

ICECAP ■ Preparations for this event were begun and continued on schedule until announcement of the moratorium currently being observed. EG&G/EM control and diagnostic systems setup was placed on hold pending announcement of an event execution date.

Aboveground Experiment ■ Diagnostic systems support, in the form of set up and operation of recording digitizers, was provided on a series of ten Pegasus aboveground experiments at Los Alamos. An imaging system was set up and used to record data on four Pegasus experiments.

18.2.3 Sandia National Laboratories Program

Nonproliferation ■ EG&G/EM's SNL and DoD Las Vegas Operations participated in the NPE conducted at the NTS. Continuous ground-motion data were provided using the permanent 13-station geophone array and additional portable data acquisition units from two hours before the event until the system was released by DOE after the event. The five-station seismic network also successfully recorded seismic data during the event for use in yield studies. This data will be provided to LLNL for inclusion in their discrimination study database. All fifty Sandia data channels were successfully recorded in N Tunnel. Data was recorded from accelerometers which measured shock wave propagation throughout the tunnel, pressure transducers which measured energy coupling and stress, and current measurements for gauge survivability experiments. This data will be used in seismic and containment studies.

The Remote Equipment Monitoring System and the Facilities Monitor and Control System were also fielded during the experiment with a total of 280 monitors and commands that supplied information relevant to experiment readiness and facilities functions such as power and cooling. All monitor and command transducers survived the zero time ground shock and continued to operate until tunnel power was shut off after the event. In addition, prior to the event, mechanical and electrical button-up checklists were prepared. These checklists were used to verify that power switches were in the appropriate position and to prepare entrances for closure (buttonup). On D-1, a successful buttonup operation was performed.

SENTINEL ■ EG&G/EM is supporting SNL's efforts to conduct a simulated series of dry runs, culminating in a scaled, realistic, system-wide, simulated underground test that will demonstrate readiness. This event, named SENTINEL, is scheduled for December 1993. EG&G/EM will employ core personnel who have supported the underground effects test program in the past to develop and simulate a gauge matrix (modeled after the experimental array for the next scheduled underground test) that will support underground test resumption, identify and implement data acquisition system requirements necessary to implement the simulated test, exercise the monitor and control systems, coordinate line-of-sight (LOS) closure needs, and operate seismic and geophone ground-motion arrays.

The design of the high-frequency recording system for SENTINEL is currently in progress. Two Sandia Digital Underground Systems are being configured to the new requirements, and the timing, firing, manual commands, and monitor systems are being designed. Discussions are also continuing on cable and connector requirements for this event, and the cable plant is currently being designed. Personnel supporting this program are attending weekly update meetings.

18.3 SPECIAL STUDIES/ACTIVITIES

18.3.1 Lawrence Livermore National Laboratory Program

Dual-Use Project Support ■ Under the direction of LLNL, and with the concurrence of DOE, support is being provided to dual-use projects. Dual-use projects allow for the maintenance and expansion of EG&G/EM and LANL technical expertise and for development of new hardware for the weapons test program, as well as new organizations.

Automatic Fiber Pigtailling Machine ■ L-Division Physics asked the LLNL Program to provide optical engineering support to develop an automated technique to attach fiber-optic pigtails to lithium-niobate crystals used for Mach-Zehnder interferometers. This is a difficult and tedious process to perform by hand. If this work is successful, it could significantly reduce the cost of these and other electro-optic devices that use fiber-optic pigtails.

Nuclear Ignition Facility ■ Engineering and design support is being provided to the Nuclear Ignition Facility diagnostics effort through the support of an engineer and three drafters. An additional engineer has been assigned to support the independent cost validation for the Nuclear Ignition Facility project. The need for additional engineering, coordination support, and drafting is anticipated.

B-Division Support ■ One engineer has started work to develop a conceptual design of a multi-position, multiview radiographic facility for B-Division. This is in support of the Heavy Ion Fusion Physics Group that is part of the Inertial Confinement Fusion Program. This facility would be much smaller than the Nuclear Ignition Facility, but may ultimately be located at NTS.

A meeting was held with the LLNL head of B-Division and several B-Division Group Leaders to determine any areas where EG&G/EM and LANL weapons test systems and skills could be of benefit. Four projects were identified, and work is scheduled to begin on two of them in November. One project is a data analysis effort using EG&G/EM and LANL film reading and analysis capabilities to analyze velocity measurements from Fabry-Perot interferometers. The other project is an imaging fielding effort assisting in tuning the FXR linear accelerator at Site 300. These projects are in support of the nonnuclear testing effort which supports nuclear design. They are also in support of testing efforts nearly identical (but on a smaller scale) to those that LLNL is proposing for NTS in the future.

Sharpe's Gun Project ■ Participation began on a project at Site 300 at LLNL referred to as the "Sharpe's Gun Project." Two 128 X 128 Reticon imaging cameras are used to take pictures of a projectile and to measure the speed of a projectile shot from a gun at ten times the speed of sound. The initial schedule was one shot a week for four weeks. By modifying the systems to deal with the unexpected, the results were such that the project has been funded to continue for a year. The systems and procedures used are the same used on a nuclear test. Since the object of this test is to obtain high-resolution images of a very fast-moving projectile, a gated micro-channel-plate film camera was suggested to supplement the 512 X 512 camera. The physicists enthusiastically accepted the suggestion. The camera was assembled from spare streak camera parts with new or modified bits and pieces. The camera has been delivered and is being checked out.

China Lake ■ Time-domain recordings of ultrahigh bandwidth (4.2 GHz) radar signals were made on an LLNL experiment at China Lake. The equipment, personnel, and methods used had been under development for nuclear test applications. The data will be reviewed with other participants, including EG&G/EM Special Projects, in November 1993.

High Explosive Test Facility ■ LLNL's High Explosive Test Facility physicists have requested setup and operation of two Photo-metrics charge-coupled device cameras to record their streak cameras' data in two of their test chambers. The first camera is being shipped from the North Las Vegas Facility. A delivery date for the second camera has not been determined.

Defense Sciences Engineering Division Support ■ The Electronic Engineering Division has been asked by our technical contact at DSED to participate in the development of the HR 16 Series Mini-Cam project. This project is the development of a high-resolution, large-format (1242 X 1152), miniature, charge-coupled device camera system. DSED, formerly the Field Test Support Division, submitted the specification and design work for the next-generation data handling device for digital recording hardware to the LLNL Program. This will be an Intel-based smart controller. DSED was unable to do this work because the LLNL people who were to be assigned to the project were allocated to nonweapons test work.

Crypto Support ■ In November 1993, Communications, Command, and Control personnel assumed support of the crypto equipment located in CP-9.

Communications Security Support ■ LLNL/NV has asked EG&G/EM to take over the communications security work at the NTS. This work has been done jointly by LLNL/NV and EG&G/EM under a Memorandum of Understanding. A new Memorandum of Understanding will be prepared, defining the specific tasks to be done by each EG&G/EM organization and the cost of doing this extra work.

Papers Presented ■ Two EG&G/EM employees attended the Seventh Symposium on Containment of Underground Nuclear Explosions held in Kent, Washington, September 13-17. They were coauthors of a paper entitled "GALENA Cavity Pressure Measurement and a Proposed Sensor for Residual Stress." One of them chaired Session #1, Stemming Particles and Performance. The other also coauthored another paper, "A Summary of LLNL Sanded Gypsum Concrete Plug Performance."

18.3.2 Los Alamos National Laboratory Program

Joint Recording Trailers ■ EG&G/EM participated in the design coordination of two joint digital recording trailers that will be used on both LANL- and LLNL-sponsored events. The joint experimental trailers were designed for use on alternate occurring events by the two laboratories. One of the trailers will house two LANL/EG&G-designed digital alpha systems as well as a digital front-end system to provide prenuclear and reaction-history measurements. Both trailers will allow the national laboratories access to state-of-the-art digital systems that would not otherwise be available to them.

Control Room Consolidation ■ An implementation plan was prepared which addresses the issue of "consolidating" LANL and LLNL Control. The plan, presented to LANL and LLNL personnel, addresses Control Room signal equipment and includes one-line drawings, CP-9 CADAC building floor plans, and equipment rack layout drawings.

Optical Fiber Coating ■ A partial antireflection optical coating for the ends of an optical fiber was successfully developed and deposited. This work is part of a project whose goal is to construct a CORTEX-type Optical Time Domain Reflectometer system which employs a continuous-wave laser source.

PINEX Cameras ■ Five Model 601 prototype video cameras were produced. The cameras are a new generation of high-frame-rate vidicon cameras designed for use in PINEX experiments. The camera's frame rate is 8 times faster than that of a normal video camera.

Aboveground Experiment Recording ■ EG&G/EM provided engineering and technical support in Los Alamos for a series of high-energy capacitor bank experiments. P-15 invited EG&G's participation less than two weeks before the test series began. The PEGASUS experiment involved a number of fast video cameras and digitizers viewing experimental data during a high-energy capacitor discharge. Strong electromagnetic fields, generated by the discharge system, required careful design of the recording system to prevent electromagnetic interference. Despite these conditions, and the short time frame at a remote location, EG&G/EM obtained quality data from the test series.

Artificial Intelligence ■ EG&G/EM developed a neural network, as part of its continuing studies of Artificial Intelligence, to predict key characteristics of the underground sources generating accelerometer data. The neural network performance surpassed that of the current technique, with enhanced performance at the lower end of the source parameter range—an area deemed to be the critical region of interest. This advance is significant in that neural networks are amenable to being implemented in either hardware or software. They can be used to select the data to be recorded during the collection process instead of collecting all data and then postprocessing it to select the data to be further analyzed. Storage requirements are also reduced as only significant data is actually recorded and stored.

CAMAC List Sequencer ■ The first production run of the EG&G/EM-designed CAMAC List Sequencer was completed. The List Sequencer is an autonomous, CAMAC, single-width controller

which replaces four modules costing \$7K and requiring five slots in the CAMAC crate. The new List Sequencer was designed with technologies that allow significant assembly cost savings. This unit is EG&G/EM's first CAMAC design using Surface Mount Technology components throughout, and the printed-circuit layout was optimized for automatic parts placement by an outside vendor. The final price is \$900 for a completed unit (\$50,400 for 56 units). Comparing the costs of this approach to those of assembling, by hand, through-board hole-printed circuit boards (the previous EG&G/EM CAMAC design standard), a savings of \$61,600 is realized.

Pulse Calibration System ■ A personal-computer-based system was developed to automate characterizing active components, such as fiber-optic links. The system's software provides instrument control, rudimentary data analysis, and a standard data format output capability. The software can characterize the entire measurement system. The system was proven to be an invaluable time-saver in its first application characterizing the new 350-MHz fiber-optic link.

Microwave Transient Analyzer ■ A patent was granted to EG&G/EM and LANL personnel for their invention of a "Microwave Transient Analyzer." This unique instrument uses a Bragg cell to deflect a laser beam. As the deflection is proportional to the frequency of a radio frequency signal applied to the Bragg cell, the frequency spectrum of the applied signal can be determined.

Fiber Link Calibrator ■ A new calibration pulser was developed for a new fiber-optic link. The pulser will be located in the downhole box with the fiber transmitters. The pulser has a high-fidelity output which can be used for testing each link's transfer function (gain), time skew between links, and rise time.

X-Ray Fluorescence Instrument ■ Data reduction and analysis software for the X-ray fluorescence instrument were completed and delivered to LANL. The purpose of the instrument and software is to monitor the amount of plutonium and uranium stored in drums for Special Nuclear Material control and inventory purposes.

Cable Processing ■ ICECAP rack prestaging was very cost effective. Detector signal-cable lengths, measured at Los Alamos, were used to provide precise downhole signal-length information for the manufacture of required downhole signal cables at reduced electrician manpower levels. This approach eliminated the need for in-field signal-cable tailoring.

Digital Alpha Redesign ■ A conceptual redesign of the P-14 digital alpha system resulted in an overall system cost reduction by using design-for-manufacturing techniques. The original system uses modular, CAMAC-based time-interval meters and separate ladder-attenuator chassis. The cost of this system is approximately \$263K per detector channel. The new system combines the ladder-attenuator printed circuit board with two twelve-channel, time-interval meter boards in a single chassis. The estimated cost for this new digital alpha system is \$55K per detector channel.

18.3.3 Sandia National Laboratories Program

High-Frequency Seismic Data ■ The new seismic data collection system was installed at all remote stations in the Sandia Leo Brady Seismic System during FY 1993. The system has already proven to be very sensitive by collecting data from seismic events one-fourth the magnitude of the smallest events detected by previous systems. In the past, the system recorded events from the four states surrounding the NTS. The new system has recorded events as far away as India. The new system provides a second form of data which is sampled at a rate of 250 samples/second and is 16 bits wide with the capability for upgrading to 24 bits in the future. This type of data is sought after in many seismic circles but is difficult to find.

After the new systems were installed in April 1993, SNL requested that EG&G/EM perform an upgrade on the analog board to improve its performance characteristics. The board was modified, and testing revealed that the linearity was improved from 96 dB to 120 dB. This performance increase in the amplifiers results in a marked increase in the quality of the signal presented to the analog-to-digital converter on the analog board. Preliminary tests showed that the output of the analog board is now linear to over 114 dB. This upgrade allows the analog-to-digital converter to accurately handle extremely small seismic signals, which greatly enhances the current system capabilities and enhances the attractiveness to potential seismic customers.

Device Assembly Facility Instrumented ■ Ten portable data acquisition systems and thirty FBA-11 strong-motion accelerometers were calibrated, cabled, configured, and used to collect seismic data for a seismicity study at the Device Assembly Facility located at NTS. Future requests for this type of instrumentation are anticipated because of a new DOE Order requiring all critical structures to have seismic instrumentation and structural response studies.

Modular Advanced Recording System ■ As a result of the short time available before fielding the HUNTERS TROPHY underground test in FY 1992, many of the verifications normally carried out on a new system were accomplished after the event during FY 1993. Efforts consisted primarily of characterization, testing, and careful measurement of specifications and performance for the individual modules and the modular advanced recording system as a whole. In addition, a major effort to clean up and finalize all the documentation was performed.

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18.4.3 Sandia National Laboratories Program

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19.0 ARCHITECTURAL AND ENGINEERING SERVICES

19.1 PROGRAM IMPLEMENTATION

19.1.1 Mission Statement

RSN provided architecture and engineering for both surface and subsurface support to Operation KLAXON on a variety of engineering, scientific, technical, administrative, and maintenance functions to meet the goals of DOE, DoD, and DNA.

19.1.2 Program Oversight

RSN management provides direction to the program through line managers and supervisors who were familiar with the objectives of the overall program.

19.1.3 Functional Responsibilities

RSN was responsible for engineering, design, construction inspection, surveying, drilling and mining, vulnerability analysis, postshot damage reporting, aerial photography coordination, materials testing, nondestructive testing, direct optical downhole surveying, cost estimating, micro-filming, procurement, in-plant inspections, alarm design, test structure design, frequency management, and a multitude of small projects.

The Project Management Engineering & Construction, Project Management Test Construction, and the Technical Support Departments provided direct support of special services to the scientific laboratories at the NTS to include technical liaison and project engineering, preparation of stemming plans, logging of stemming and emplacement operations, and compilation of reports and studies to support the Scientific Advisory Group representing the CEP.

19.2 ONGOING ACTIVITIES

19.2.1 Engineering Services

General Plant Projects (GPP) included:

GENERAL: Well Housings - Wells C1 and 5B, Well 4A Water Distribution system.

AREA 1: Postshot Equipment Maintenance Facility.

AREA 5: Mercury PA System, Underground Munitions Magazine.

AREA 6: Device Transport Vehicle Facility, Decontamination Pond, CP-1 Cafeteria Renovations, Upgrade Tweezer Road, Quality Assurance Building Addition, Cable Facility and Office Modifications, Cementing Services Building 351, Underground Storage Tank Upgrades/Replacements, Building 6-900 Parking Area, Sanitary Sewer Connections.

AREA 12: SNL Assembly Building, Bus Driver's Lounge and Office, Dormitory 12-45, Power Loop Pahute Mesa-Rainier Mesa (Areas 12, 19 and 20), Underground Storage Tank Upgrades/Replacements.

AREA 22: Underground Storage Tank Upgrades/Replacements.

AREA 23: Underground Storage Tank Upgrades/Replacements, Building 1010 Addition, 40-mm High-Explosive Grenade Range, Warehouse 8 Addition, Firing Range Upgrades, Communications Upgrades, Addition to Building 1103, NTSO Office Building 139,

Physical Wellness Center, Fire Training Facility, Mercury Cafeteria Renovations, Building 300, Expansion/Upgrade Building 1001, Remodel NTS Badge Office, Site Maintenance Office Addition, Mercury Garbage Facility, Consolidate HS-12 to Building 600, Shooting House.

DEVICE ASSEMBLY FACILITY:

- Provided project support including criteria development, design review coordination and documentation, design integration, scheduling, cost and progress reporting, and Title III services.
- Provided engineering design effort for Improvements to Land, Support Facilities, and Security Systems.
- Completed DAF Alarm Control System installation and initial check-out.
- Continued an information request process with which to document and answer REECO questions on security system construction.
- Continued a submittal process to monitor REECO Security Systems procurement and construction.
- Continued to support the DOE Special Door procurement action.
- Initiated REECO Work Orders to correct construction discrepancies.
- Toured, consulted with, and instructed laboratory and REECO maintenance personnel concerning DAF systems.
- Continued preparing the DAF Final Safety Analysis Report.
- Completed recommendations for approximately 50 percent of over 400 DAF backfit items assigned to RSN.

19.2.2 Support Facilities and Services

The RSN Information Services Department completed the following activities in support of Operation KLAXON:

- RSN planned, installed, and made operational a new computer center at Summerlin. This consolidated the administrative processing resources, enabling a reduction in associated outside maintenance charges. The result was a reduction in overhead expenditures for large computer system support.
- A centralized, updated network management center was installed at the Summerlin facility. This operation provides better control over the RSN-controlled NTS network resources, assuring better up-time and availability of the NTS RSN network resources.
- RSN has successfully exchanged X.400 mail with DOE/NV. This provides for better communications between DOE/NV and RSN Weapons Program Managers.
- A Budget Tracking System was developed which provides planning estimates and actual costs to RSN Program Managers. The Budget Tracking System provides current monthly information to the RSN Weapons Program Managers, thus enhancing their ability to manage weapons resources assigned to RSN.

19.2 3 Communications - Electronics Services

RSN Communications-Electronics (C-E) provided engineering design of telecommunications and electronic systems, project management for special projects, and radio frequency management in support of Operation KLAXON. C-E general plant project support is provided to Engineering Services; those projects are not addressed in this section.

Telecommunications ■ Operation KLAXON support provided by the Telecommunications Engineering Section in FY 1993 includes:

- Completion and submittal to DOE/NV of a partial set of Plant-In-Place records and drawings for radio system repeater sites for Echo Peak, Area 12, Shoshone, Atlas, DOE/NV, and Skull Mountain.
- A set of design standards to provide design consistency for DOE/NV operations.

Telecommunications developed and provided the following proposals:

- An NTS Water Management System proposal. This system proposal replaces existing antiquated high-maintenance equipment with a state-of-the-art central station control and monitoring system.
- A Communications Consolidation proposal. Consolidation will provide a cost savings due to the reduction of redundant systems maintained by various contractors and agencies.
- A Station 900/Fire Dispatch Consolidation proposal. Consolidation will result in a decrease in maintenance costs associated with the maintenance of similar systems located at different facilities.

Other miscellaneous tasks were these: rewritten TEMPEST plans; an Idaho ORPS System Evaluation; a DOE/NV NSF building communications estimate; REECO 1995-1999 Budget submission; 11 DOECA Inspections and Acceptances; Engineering Change tracking, approximately 24 drawing reviews; and routed a DOE cabling proposal for comment. Communications-Electronics also provided pertinent technical support during the Telephone Provider's Contract Renewal Review.

Title II tasks were:

- A Two Site/Three Channel simulcast trunking (an Atlas single site EDACS trunking Phase I of prototype is installed). The trunking system, when fully implemented, will consolidate all current net operations into the trunking system. Excess frequencies will be freed up and user net availability will increase. Individual groups will be invisible to other group users on the same trunked radios. Again, the system will reduce DOE equipment maintenance and operating costs.
- A UHF simulcast system alignment. The system has also been installed.
- A Large alarm system upgrade.
- A WSI Nets Modification.
- A video teleconferencing switch (installed), and acceptance package. Implementation will result in travel cost savings for DOE and its contractors and provide better communication between DOE and contractor facilities throughout the DOE family.
- A Wiltel/REECO consolidation, Phase I.
- A DAF radio frequency system.

Electronics ■ The Electronics Engineering Section supported FY 1993 programs through design and installation engineering, acceptance testing, and as-installed documentation of various facilities and systems.

- The FiberSenSys evaluation, prototype installation at REECO Highland, and acceptance test. DOE has experienced numerous thefts, and this system addresses those concerns by providing a new exterior and interior sensor technology for cost-effective facility protection.

- The RSN Summerlin Security Titles II and III. The automated access control system design provides a cost-effective solution to access control for the facility and has since been used as a model for other DOE facilities.
- Other facilities completed and documentation submitted to DOE include: the REECO Waste Management, RSN Graphics, and 3721 S. Highland Alarm System Title III; the CSC Alarm System Title II and Title III; the EG&G Duress Alarm System Title II and Title III; the DOE Mailroom Alarm System Modification Engineering Change; the Las Vegas WSI Alarm System Title II and Title III; the IT Corp Alarm System Title II (installation) and acceptance.

The systems completed and documentation submitted to DOE include:

- The Mobile Intruder Reconnaissance Vehicle Title II, procurement, and equipment installation. The Mobile Intruder Reconnaissance Vehicle system includes radar, closed-circuit television, imaging infrared cameras, and radio on a mobile platform. This system is to be used in the detection and apprehension of intruders at the NTS. Future enhancements are currently being devised to integrate the systems to reduce operator fatigue and workload.
- Supported the P Tunnel alarm and evacuation system. The system was designed to satisfy the findings of an ES&H Tiger Team inspection. This system will enable personnel underground to initiate either an evacuation or general alarm condition. The old system did not have electronic supervision so an inoperable section was not detectable. The new system provides the required electronic supervision and numerous other personnel location features which increases their safety.
- A Strategic Sensor System Proposal. This proposal recommended upgrading the system to a bi-directional alarm system so that controls could be operated remotely by a central station. The project was well accepted by DOE but is on hold awaiting funding.
- A WA-450C review, comments, and a Security Monitoring System noncompliance survey, review, and report; a Security Tape investigation; Engineering Change tracking.
- An Alarm Assessment evaluation report. This system would provide DOE with the capability to verify the cause of isolated alarms on NTS. Cost savings would be realized in the more efficient use of WSI manpower. The guard force would be used only if a perpetrator is in the vicinity. The system could also be used to determine which sensors need service.
- Miscellaneous tasks: Security Monitoring System periodic inspections; NTS Security Monitoring System Upgrades as-installed drawings; and DAF access control post-Title II design additions.

Spectrum Management ■ The Spectrum Management Section FY 1993 activities included radio frequency coordination with the USAF and other federal, state, and local governmental agencies on use and noninterference of the radio spectrum. RSN filed applications with the Interdepartmental Radio Advisory Committee using locally developed frequency applications software, processed incoming DOE/HQ frequency actions, and wrote action letters for DOE/NV concerning radio frequency assignments, special studies, and telecommunications proposals.

19.2.4 Field Operations

DoD/DNA/SNL ■ DoD/DNA reentry work on DIAMOND FORTUNE and HUNTER'S TROPHY events was completed. Mining on the MIGHTY UNCLE event has progressed in the LOS and Bypass drifts to a mining cutoff as directed by DNA. Work is continuing in preparation for placement of LOS pipe and other underground facilities. A schedule for issue of drawings for MIGHTY UNCLE, which is tied to the actual operations schedule, was developed and approved; preparation and issue of drawings follow this schedule.

For the NPE event, RSN provided engineering design, project engineering, and construction inspection support in Civil, Mining, Mechanical, Electrical, Cabling, and Electronic Engineering disciplines, as dictated by requirements, from cavity excavation through test completion.

Other work for DNA supported their environmental programs for monitoring of effluent water from the Area 12 tunnels, closures and mothballing of inactive tunnels, monitoring and documenting spill clean-up, the plugback of drill holes on Rainier Mesa, preparation of documentation for use in the application for various environmental permits required from the state of Nevada, and for issuing a procedure for monitoring lead movement for maintaining an overall lead inventory.

The P Tunnel Electrical Compliance Project has been completed with issue of 92 drawings and a final report. A list of materials was compiled and submitted to DNA for procurement through the DNA purchasing system which should result in a significant saving to DNA. Work continued on the P Tunnel Ventilation Drift with RSN providing engineering and inspection for the completion of the mining, pregrouting of the drift protection plug and gas seal plug, forming of the drift protection plug and installation of the trainway, postgrouting of the drift protection plug, and forming of the gas seal plug. The main ventilation fans to be installed in the ventilation drift were ordered and received on site, the design for the fan station was completed, and the air-actuated air doors for the fan station were ordered.

Construction Summary Reports for the DISTANT ZENITH and DIAMOND FORTUNE events were compiled and issued. The reentry reports were issued. Preliminary engineering work for a project at the White Sands Missile Range has started and is expected to continue on through Title II design and Title III inspection of construction on the project.

Work at the A-12 Batch Plant has involved design of a new mixing arrangement and the design, field engineering, and inspection for a hood on the loading and mixing facilities to trap the fugitive dust created during mixing. Work packages were generated for all active projects and have been updated and maintained as a means of monitoring costs to stay within budget. One engineer actively participates in DNA's Universal Grout Working Group which reviews requirements for grouts developed for use on DNA projects. One engineer works with the YMP group on electrical matters, and one mining engineer works for the LANL Support Group on the U1A Project. RSN implemented a concentrated effort to cross-train inspection personnel for better utilization of the reduced number of inspection personnel resulting from reductions in the DNA program; manpower has been adjusted downward as required to stay within DNA budget constraints.

Sandia National Laboratories Program ■ SNL activities include only a minor amount of accounting work and reporting related to subcontracts.

Survey ■ Survey support for the DOE, DoD/DNA, and three national laboratories for event-related construction and NTS support construction was provided by RSN. This support consisted of survey for vertical and horizontal drilling, topography surveys to provide information for environmental work, underground survey for control of mining and for location of items being constructed, ground control for aerial photography, and topographic survey for a project at the White Sands Missile Range.

LANL/LLNL Program ■ The LANL/LLNL Program department provided project management, design engineering, inspection, drilling, survey, and other engineering support for LANL testing programs. LANL support was for the ICECAP and MEXIA events. In addition, support was provided for two postshot drillbacks, an emplacement exercise, the LYNER project, a GEONET project, and several special projects. The design, survey, and inspection services for U1g, and the U7cd Satellite Hole

drill sites were also provided during the fiscal year. LLNL support was for preparation for GABBS, the NORITE exercise, the Electro-Optic Mine Detection project, and special projects.

To maintain readiness and expertise, project engineers completed review of all pertinent DOE Orders, LANL manuals, and RSN procedures. All department procedures were updated and flowcharts were added for each procedure to incorporate Conduct of Operations requirements. Project engineers reviewed and provided comments on the draft revisions of the LLNL/NTOD Quality Assurance Manual and LLNL/NTED Design Guide.

The LANL/LLNL Program Manager was selected as a member of the Nuclear Explosive Testing Readiness Committee. The committee, comprised of DOE, national laboratories, and DOE contractor personnel, is to determine the present state of readiness, and the process needed to maintain readiness to successfully conduct nuclear explosive tests at the NTS. The evaluation may be instrumental in the strategic planning process to maintain readiness.

RSN participated with LANL, LLNL, and REECO, in the Downhole Nuclear Emplacement Readiness Review Committee. The review of standards, criteria, procedures, and training related to emplacement activities is of vital importance in maintaining readiness and to assure compliance with environmental and safety requirements.

RSN continues to take proactive measures to make the NTS safe and environmentally healthy. Environmental baseline assessments were conducted for all buildings in RSN's purview. Cleanup of Building T-101 in Area 2 was accomplished. All the materials were identified and disposed of properly. The clean facility has been turned over to DOE. Trash and hazardous materials have been removed from all shacks, block houses, field offices, and transportainers. REECO picked up 69 gallons of hazardous waste from these facilities. RSN prepared a work plan and a cost estimate for remediation of a fuel storage facility and coordinated removal of excavated hydrocarbon-contaminated dirt from an event site and a yard.

All required environmental and radiation safety clearances were obtained in a timely manner. All clearance requests for practice postshot drillback, emplacement exercises, and special projects were made properly and timely to ensure implementation of the DOE Orders, as well as effectively support the program.

Project engineers supported the Containment Evaluation Data Base project being compiled and maintained by the Office of Scientific and Technical Information for the DOE/NV. Bound copies of the Emplacement and Containment Reports for 300 events were provided.

Project engineers and survey personnel provided support for a water vapor experiment at Lake Mead for the GEONET project. This effort helped the LANL project scientists study differences in vaporization at the shore and interior areas, and provided, during the moratorium, an opportunity to use and maintain expertise of our technical personnel.

RSN provided project management and design engineering support for the Electro-Optic Mine Detection Project. The effort included budget estimating, survey, inspection, working drawings, and project engineering.

Project Engineers reviewed all design documentation for emplacement hardware in support of the NTOD Insertion and Emplacement Master Study. The study is a part of the DOE nuclear safety requirements. The data will assist LLNL in assuring the quality of the wide array of hardware used during downhole operation.

Project management and design engineering support was provided for modification of the Special Measurements Emplacement System. The use of sheaves instead of a drum, and other changes, will facilitate cable handling and minimize the possibility of cable damage. RSN provided direct coordination support between J-Division at Los Alamos and LYNER Project field operations at the NTS. The complexities, lack of total definition, and construction schedule of the project necessitated this effort.

In an effort to provide common support to the two laboratories, engineers prepared and submitted for review common event drawings to DOE, LANL, and LLNL. The drawings were accepted by all the reviewers. The drawings, along with common methods of constructing and operating event sites, will expedite schedules and help reduce costs.

19.2.5 Drilling

RSN's reorganization during Operation KLAXON resulted in expanded duties as the Subcontract Coordination, Reports and CEP Groups were incorporated under the Drilling Section. The resulting personnel reductions resulted in more cost-efficient operations. All previous duties or responsibilities were reassigned in accord with the reduced level of weapons testing activity.

Sixty-one active drill holes were monitored or inspected during Operation KLAXON. New construction accounted for 180 m of Emplacement hole, 792 m of Post Shot hole, 268 m of Instrument/Cable hole and 12 m of Rack Assembly hole. Casing installed accounted for 675 m in postshot holes, 1104 m in existing instrument/cable holes, and 12 m in a rack assembly hole. Cement used amounted to 62 m³ in postshot holes and 62 m³ in instrument/cable holes. By the end of Operation KLAXON, 31 emplacement holes were in inventory .

The RSN Drilling section provided geophysical, directional survey, directional drilling, and other miscellaneous services to the weapons testing program through its Subcontract Coordination Group. The group also ordered, coordinated deliveries, maintained inventories, and maintained costs for all cementing materials used by the weapons testing program.

The RSN Drilling Section, Reports and CEP Group, provided: Daily Drilling and Mining Reports, Monthly Drilling Summaries, Quarterly Status Reports, NTS Drilling and Mining Summary Update, hole histories, hole history updates, CEP Preliminary Data Summary packages, and D-1 Data Summary Updates in support of Operation KLAXON. The group also provided subcontract services for three DOE/DNA-requested consulting members to the CEP and Containment Advisory Team. The group Principal Engineer served as advisor to the CEP and briefed the Event Scientific Advisor for the D-1 Containment Briefings.

19.2.6 Environment, Safety, and Health Activities

RSN emphasized environment, safety, and health in operational as well as design functions. RSN created a separate ES&H Office, including safety, industrial hygiene, health physics, and environmental protection functions. This structure has enabled close federal, state, and local monitoring of environmental regulations

The RSN ES&H Office has taken the lead for RSN on the DOE Order Compliance Program and has made this a major RSN initiative.

The Environmental Protection Program Implementation Plan (EPPIP - August 1991) was completely revised, then reissued as the Environmental Protection Program Management Plan - NV Operations (October 1993). Included in this Plan are the other RSN plans:

- Waste Minimization and Pollution Prevention Awareness Plan
- Process Waste Assessment Plan
- Hazardous Materials Management Plan
- Operational Area Monitoring Plan
- Environment, Safety and Health Area Representative Program Plan

RSN personnel reviewed NEPA requirements for every project. RSN Environmental personnel reviewed every Title III drawing prior to delivery to the respective DOE project manager to assure compliance with all regulatory standards. Environmental reviews were provided for conceptual design reports and other preliminary design efforts. Continuing environmental restoration activities were completed at the Atlas Wireline Facility in Area 6 during FY 1993.

RSN established and maintains Satellite Accumulation Areas at RSN facilities. On-the-job training was provided to the Satellite Accumulation Area coordinators and other affected personnel. The NTS Spill Incident Report Procedure was implemented at RSN facilities, and the required posting and training was completed.

RSN followed an aggressive schedule of inspections, audits, surveillances, and assessments by trained ES&H personnel to assure compliance of RSN operations with all applicable environmental, safety, and health standards.

A special effort was completed to conduct a Health Hazards Inventory of all RSN-custody facilities. RSN is developing and implementing a Behavior-Based Safety Program as a major element of its Environment, Safety and Health Area Representative's Program.

19.2.7 Quality Assurance

Through the performance of assessments, surveillances, design and procurement document reviews, source verification and receipt verification activities, and maintenance of the Management Quality Assurance Program and the combined efforts of Independent Assessment, Commitment to Excellence, NTS Quality Engineering, and NTS Operations Quality Representatives in the various line organizations, RSN ensured and maintained an effective Quality Assurance Program during FY 1993, in support of NTS activities.

The RSN Management Quality Assurance Program was revised to reflect extensive organizational and responsibility restructuring. This revision was approved and issued April 8, 1993. At the beginning of FY 1993 the Quality Assurance Division was discontinued as an organization with personnel being dispersed to; Independent Assessment, Commitment to Excellence, NTS Operations, and various line organizations. Under the direction of the Manager, NTS Operations Division, an NTS Quality & Inspection Department was formed to include: NTS Quality Engineering, Nondestructive Testing (NDT) Laboratory, Materials Testing Laboratory (MTL), and Inspection Sections.

Direct quality assurance support was provided to LLNL in developing their Quality Assurance Program in compliance with DOE Order 5700.6C, leading and participating in audits, preparing procedures, and performing procedure reviews. Also, direct assistance was provided to DNA in developing procedures for and participating in supplier surveys and source inspections.

Assessment and Surveillance ■ Assessment and surveillance schedules were prepared and issued. Eight Independent Assessments were performed resulting in forty-six findings. Seventeen NTS Operations Assessments/Surveillances were performed resulting in thirteen deficiencies.

Quality Engineering ■ Quality Engineering support was provided by reviewing/approving quality-affecting documents in the form of procedures, drawings, specifications, and procurement documents. Additional support was performed by preparing source verification plans and conducting source verifications. Significant activities were: 36", 42" & 48" Tube Turn Closure; 180,000 cubic-feet-per-minute Vent Fans; LOS Front End Hardware; TAPS Inlet Assembly.

Title III inspection efforts generated thirty-seven nonconformance reports.

NTS Inspection ■ NTS Inspection personnel provided facilities inspection for the DOE/NV on lump-sum contracts, cost-plus-fixed-fee work orders for plant and capital equipment facilities, and reimbursable projects at the NTS. NTS Inspection support services included on-site construction inspections, project documentation, and technical liaison among users, craft personnel, architect/engineers, and DOE/NV.

NTS Inspection personnel performed field testing and provided photographic support and as-built drawings. Test data sheets, inspection plan documents, daily inspection logs, checklists, field memos, discrepancy report, and design clarification requirements were maintained. Also, the NTS Inspection Section performed Nevada state inspections of sewage disposal systems, prepared and issued four RSN Quality and Inspection procedures, and began the process of developing a Backflow Prevention Program for NTS operations.

Nondestructive Testing Section ■ The NDT Section provided support to all NTS contractors. Testing included hoisting, lifting, and handling equipment as well as trailers, tankers, low boys, and bucket trucks.

NDT personnel received training and took examinations on the Dielectric Testing of high voltage bucket and pole-setting trucks. This was part of their RSN recertification on Dielectric Certification.

At the request of LANL, NDT presented an "NDT Overview Update" to J-6 and J-7 personnel from NTS and Los Alamos.

NDT continued providing the staging of industrial radiography accidents for REECO training as part of their Radiological Emergency Response Operation and Transportation Emergency Training for Radiological Assistance.

Work continues on the implementation of the site-specific Radiological Control Manual. Procedures were revised and training was accomplished to this end.

The NDT Section implemented a Visual Inspection procedure; personnel were trained and certified in this discipline.

NDT work is ongoing in the LYNER project. The 48"-diameter vent shaft had all circumferential welds radiographed, and handling equipment tested.

Materials Testing Laboratory ■ The MTL Section support for DOE/NV activities includes: quality assurance testing for physical properties of numerous materials as listed below for use in the

DoD/DNA tunnel event; designing and testing grout mixes used for all events; and characterization of rock core properties for LANL's containment work for use in their computer models. The lab tested shock mounting materials, and conducted impact tests on special foam samples. The MTL received, prepared and tested approximately 5,000 samples and numerous analyses of many samples during FY 1993.

The Geotechnical Group of the MTL was involved in testing for the YMP, P Tunnel, U1A, and General NTS support. (YMP and GCP activities are not included here.)

P Tunnel Support activities included:

- Shotcrete material testing
- Hydro-Plus material testing

U1A Support activities included:

- Permeability testing of shotcrete core samples
- Shotcrete material property testing

General NTS Support activities included:

- Dust guard chemical analysis.
- JIT suspect counterfeit fasteners testing, including tension, mechanical, and chemical analysis.
- Hydrostatic testing of fire protection valves.
- Testing of steel weld coupons, wire rope with sockets, and elemental analysis of stainless steel samples utilizing the arc/spark Optical Emission Spectrometer and the Atomic Absorption Spectrometer.
- Soil property testing for the Area 6 Decontamination Facility.
- Ladder testing for the NTS Fire Department.
- Printer cartridge destruction.
- pH and alkalinity testing of solutions.

The preceding is a compilation of the major activities of the Geotechnical Section but does not include the many smaller projects.

The Soils, Concrete, and Asphalt Group of the MTL was involved in testing for the YMP, P Tunnel, U1A, GPP, REEC0, and DAF. MTL tests common to most projects include nuclear densities, concrete strengths (beams, cubes, cylinders, etc.), sieve analyses, proctors, gradations, coring and testing shotcrete, compactions, soil classifications, and other tests.

REEC0 Support activities included the following tests not common to other projects:

- Foaming Agent for Air Drilling testing.
- New Concrete Mix Designs with Air.
- Aggregate Studies.
- Quality Assurance/Quality Control of Magnetite, Portland Cement, Concrete Sand, Type II Aggregate, and 3/4" Aggregate.
- Percolation Tests at Test Cell "A".
- Area 5 Pit #3 Soils Direct Shear and Triaxial Tests.

A Senior Engineer from the MTL attended the 7th Symposium on Containment of Underground Nuclear Explosions (Seattle, Washington) and a Senior Specialist attended a course at the University of Nevada Las Vegas on Concrete Problems—Investigative Techniques, Causes, and Solutions.

The MTL is now in compliance with obtaining all material safety data sheets for all chemicals, labeling all chemicals, establishing a central area for all material safety data sheets, testing procedures, etc., locating eye wash stations throughout the lab, and conducting monthly general and safety meetings.

19.2.8 Geologic Support

General ■ The RSN Geology/Hydrology Section moved from Building 155 to Building 117. Geology/Hydrology also completed a revision of its procedures manual. RSN geologists continue to maintain and expand the capabilities of the Intergraph Computer-Aided Design and Drawing system on which base maps and drill hole data are compiled.

Defense Nuclear Agency Support ■ Most of the field work performed by RSN/DNA geologists was in support of construction for the U12n.25 NPE and the U12p.06 test bed.

RSN/DNA support geologists mapped geology in approximately 1985 m of newly mined drift in P-tunnel and 91 m of new drift and the cavity for the NPE in N Tunnel (U12n.25); logged approximately 232 m of core from, and conducted resistivity and sonic velocity measurements in, two holes drilled in the U12p.06 test bed; conducted a seismic refraction survey in the U12p.06 Bypass drift; performed a borehole camera inspection in one drill hole; provided geologic correlation information for placement of gages in drill holes for the NPE; and mapped postevent underground effects from the NPE.

An RSN geologist continued to perform as consultant to the DNA's Containment Advisory Team, attending five meetings in FY 1993. Presentations to update the Team on current geologic studies were made at most meetings. The consultant was also invited to address the Containment Advisory Team's Modeling and Material Properties Working Group on geologic perspectives on containment and on geologic aspects of treaty verification issues.

RSN/DNA support geologists completed a geologic map and cross sections of the N Tunnel pond area at the request of the DNA Technical Compliance Branch.

Los Alamos National Laboratory Support ■ The majority of the RSN/LANL geologists field effort was directed toward mapping the U-1a access drift. Geologists prepared predictive studies prior to the beginning of mining, mapped 472 m of new drift, and prepared a preliminary report on this phase of mining.

RSN/LANL geologists also monitored drilling activities at a "practice" postshot hole; prepared a report on the expected geology at one emplacement hole; prepared geologic data packages for one emplacement hole, one satellite hole, and the "practice" postshot hole; and prepared geologic data for and attended one meeting of the CEP in support of a proposed LANL event.

RSN geologists completed a study on natural concentrations of 12 metals (specified by the State of Nevada) in geologic formations likely to be penetrated in proposed emplacement hole U-19bL.

LANL-support geologists updated subsurface geologic maps for LANL-use areas of Yucca Flat and continued transferring geologic data to the computer-aided design and drawing system. LANL-support geologists continued to update and document various geologic data bases that are resident on a personal computer, and continued preparations for interfacing the data bases with the computer-aided design system.

19.2.9 Geophysical Logging Services

Thirty-five logging services for NDT weapons-related drill holes were conducted by Atlas Wireline Services and four directional surveys were furnished by Scientific Drilling International and Baker-Hughes. One logging test and 124 services were conducted by Atlas Wireline Services for the underground test areas RI/FS, 177 services were conducted for System Construction. The RSN Logging Group coordinated and directed equipment and personnel for geophysical logging and directional surveys at the NTS. In addition, the RSN Logging Group procured the off-site services of Barbour Well Surveying, Halliburton Logging Services, and Schlumberger Logging Systems for a total of 19 services.

Cost savings of \$8,800 was realized by outfitting a government-owned logging truck and further savings will be realized during the coming year by the use of the Logging Group for running the TAM international sliding sleeve shifting tool as opposed to procurement of subcontractor labor. System Construction with 85 services incurred no lost time by the RSN Logging subcontractor, thereby saving the government rig costs. Time and cost savings were achieved by streamlining procurement of off-site subcontractors ensuring backup equipment (when available) and proper documentation before arrival at the NTS. A cost savings of over \$34,000 resulted from the continued use of an in-house floppy disk duplicator machine as opposed to subcontractor procurement.

Computerized geophysical log mapping applications were developed for in-house personnel and user laboratories or agencies. These applications enable more expedient query processing, retrieval, and reports on geophysical logging data base information.

The transition to in-house computer systems management of the Logging VAX 4000 computer system eliminated the need for on-site support by the RSN Information Systems Department.

19.2.10 Scientific Cable

The Scientific Cable Group developed conversion kits which permitted the use of "in stock, corrugated RF-14 connectors" on smooth-wall RF-44 cable. This eliminated the need to purchase RF-44 connectors and made use of inventory that would otherwise have been excessed. The use of the kits resulted in an initial cost saving of approximately \$20,000.

This Group developed and fabricated high temperature, high pressure test chamber for fiber-optic cable gas-block testing.

RSN engineers developed and fabricated a working model of a cable preparation tool to be used in preparing 7/8-inch, corrugated 50 ohm cable for the installation of connectors. Cable preparation time when using the new tool is about one minute, where previously the preparation time ranged between 20 and 30 minutes. An average shot would require approximately 300 connector installations. The calculated cost savings using loaded electrician labor rates using the new tool versus the regular preparation methods would amount to a minimum of \$18,000.

The Group issued a final report concerning the potting-compound study. One compound was selected from several potential candidates. This compound was further investigated for gas block suitability and a report issued.

The Scientific Cable Group also:

- Prepared cable specifications for DoD/DNA, Kirtland Air Force Base and DOE.
- Conducted in-plant product evaluation of 1,455,135 m of copper cables, 24,000 m of fiber-optic cables and 7,130 connectors.
- Developed new fiber-optic gas blocking procedures to ensure protection of the environment and the scientific data transmitted.
- Conducted an investigation of CORTEX sensor assembly failures for EG&G.
- Performed frequency characterization comparison study between DOE-NV-RF-19 (corrugated outer conductor, 7/8-inch, 50-ohm coaxial cable) and RF-49 (smooth-wall outer conductor, 7/8-inch, 50-ohm coaxial cable). Tests included attenuation, velocity of propagation, characteristic impedance and shield effectiveness. This study was conducted to investigate the interchangeability between the two cables. Full interchangeability would result in more vendors bidding on future procurements, ending sole source procurement which would result in substantial cost savings.

19.2.11 Threshold Test Ban Treaty Verification

DNA TTBT Verification Activities ■ RSN geologists supported the DNA's verification efforts as follows: planned, participated in, and documented a week-long exercise for LCS equipment and personnel at N Tunnel; planned, participated in, and documented a month-long LCS exercise at the Colorado School of Mines Army Tunnel in Idaho Springs, CO; and prepared a draft of a manual of LCS procedures which included instructions and guidance for surveying, drilling, geology, and borehole logging activities conducted during TTBT verification of horizontal events.

DOE TTBT Verification Activity ■ Two RSN geologists were selected as members of the LCS Team for deployment to Russia. Although the deployment was canceled shortly before the planned departure date, the geologists participated in the selection and preparation of equipment for the deployment and prepared detailed written procedures for geologic deployment activities.

19.3 SPECIAL STUDIES/ACTIVITIES

The RSN Logging Group conducted a surface logging test to determine optimum logging sonde selection and spacing for cement or other material emplaced in drilled boreholes. This modification will greatly enhance the ability of drilling engineers to determine the depth of cement, sand, gravel, etc., placed down hole. The logging sonde will give an accurate interpretation even when looking through the several strings of tubing and/or casing.

Analysis of computer maintenance contracts revealed that approximately \$710 per month was being paid out for excessed or unneeded computer equipment. Corrective action resulted in a cost savings of over \$3,500 during the last two quarters in FY 1993. Other cost savings have been achieved by modification of subcontractor-owned percussion core guns to permit firing in dry holes. Increasing the firing rate from 49 percent to 98 percent, resulted in reduced rig costs.

20.0 CONSTRUCTION AND SUPPORT SERVICES

20.1 PROGRAM IMPLEMENTATION

20.1.1 Mission Statement

REECo's mission is to provide DOE/NV with maintenance, operation, management, technical, support, and construction services in support of the NTS, the Nevada Research and Development Area, and the Tonopah Test Range.

20.1.2 Program Oversight

The General Manager is appointed by the President, EG&G, Inc., to execute and manage the contract with the DOE. Authority to act for the General Manager is delegated to the Deputy General Manager. Oversight of REECo programs is administered by the managers of the divisions and departments reported in the following sections.

20.2 ONGOING ACTIVITIES

20.2.1 General Construction Activities

Field Operations Support ■ REECo continued construction and support services to the NTS throughout FY 1993. Major projects completed included construction of the NTSO Building (Building 111) expansion at Mercury, construction of the SNL Cable Assembly Building (CP-215), construction of the building extension to WSI training offices (Building 1103), construction of the mezzanine floor for REECo Site Maintenance engineering offices at Mercury (Building 710), construction of the new carpenter/painter/laborer shop in Area 6, construction of the new operator/teamster building in Area 6, construction of the new vehicle maintenance shop in Area 6, construction of the new field engineering building in Area 6, and construction of hazardous waste landfill closure in Area 23. Other formidable project accomplishments included the installation of fiber-optic cable service from Area 23 to Area 6 for Nevada Bell, construction of computerized remote fuel tank gauging/monitoring/inventory reporting systems for bulk fuel storage on site, construction of a tower storage site at Area 6, and construction of spill containment structures at the Area 6 bulk fuel storage tank site. Additional completed project efforts included the renovation/reconfiguration of Building 5-6 in Area 5, numerous underground tank removals and associated restoration, various sewerage facility upgrades, replacement of well house buildings, upgrading of sleeping quarters fire separations at the fire stations, and numerous minor building facility upgrades.

Department activities continued to involve a number of long-term capital improvement efforts. These projects extended through several years and manifest construction performance in terms of yearly progress (as opposed to a single completion). Several major efforts at the DAF fall into this category and appear in department reports for more than one year.

In addition to capital improvement projects, considerable effort was expended in on-demand support of other agencies' NTS activities, including support for event operations in the form of cementing services, concrete production, and aggregate supply. In FY 1993, these services were extended to the YMP operations, where the growing demand for support resources has also involved this department's support efforts on over 30 ordered support tasks. The department continued to provide requested support as needed for waste management operations, the Area

5 spill test operations, and the DoD. Progress on major projects throughout the reporting period amounted to \$13.4 million in accomplished work. Work requests resulted in approximately 300 additional construction and support efforts throughout the reporting period.

Field Operations Department ■ This department furnished support for test operation preparation in Yucca Flats during this period. This effort, put forth before the extended moratorium, consisted of site preparation for drilling and emplacement; moving in drill rigs; mobilizing and demobilizing diagnostic buildings, service towers, and associated construction facilities; and prefabrication, installation, termination, and testing of downhole, surface, coaxial, and signal cables. The construction budget was approximately \$20 million for the LANL project and \$12 million for the LLNL project.

Work continued on the new construction facility in Area 6. The carpenter/painter/laborer shop, a 1587 m² rigid-frame structure, and the field engineering office (laboratories), a 668.9 m² rigid-frame structure, are 100 percent complete and occupied. The operator/teamster shop, a 371.6 m² rigid-frame structure, is 100 percent complete and will be occupied early in FY 1994. The vehicle maintenance shop, a 371.6 m² rigid-frame structure, is 100 percent complete and ready for occupancy. The work on these buildings was performed by a REEC Co subcontractor.

In an effort to further reduce overhead costs, this department has continued a very stringent equipment control process. Forty-five additional units of equipment were turned in, for a net savings of \$45,000 per month. Using the daily records of crane usage as a method of payment, cost of this equipment was reduced by \$679,228 this fiscal year. Utilization of the fleet operations Area 3 holding yard has continued which has reduced costs by \$235,602 for this fiscal year. These units have been used by other departments to satisfy their requirements at a reduced cost. Additionally, 10 heavy duty and 45 light duty vehicles were turned in for further savings. This department has also reduced radio communication counts by 90 units, realizing savings of approximately \$5,000 per month. All equipment requirements for this department have been coordinated with on-site laboratory personnel. The Operations Equipment Department places equipment in excess under criteria established by DOE.

This department's environmental compliance coordinator was instrumental in the planning and preparation of the Areas 2 and 3 compound closure plan. REEC Co staff knew that the disposition of a large number of buildings and equipment was going to be a complex project. Using the concept of Total Quality Management, a Building Disposition Committee was formed. Toward the completion of the project, this department expects to: define and resolve all conflicts in responsibilities and authority; collect all documentation pertaining to the subject; establish a clear flow of tasks; develop a Company procedure or family of procedures defining the process; and develop checklists and a signature tree to ensure quality.

The elevator mechanics maintained and certified the elevators and personnel hoists for the entire NTS. Personnel hoists were erected and dismantled for the mobile service towers. Mechanics also supported television and logging runs and the operation of the Bare Reactor Experiment-Nevada tower elevator.

Diagnostic trailers, canisters, and cable were transported between the NTS and the Atlas Facility in North Las Vegas in support of LANL and LLNL programs.

Manpower and equipment were used efficiently in the recovery of a strongback on a LANL expended event site. A recovery procedure was developed to minimize the number of personnel

exposed during the recovery process. Savings in reuse of strongbacks are anticipated in excess of \$50,000 on each event should testing be resumed.

Through scheduling meetings and administrative planning, customer milestones were accomplished and schedules maintained on three event sites, one future site, and the overhead power project in Area 19. These projects were performed to specifications and requirements as mandated by both laboratories. Due to the continued moratorium, the three events and subsequent exercises, NORITE and REX, have been canceled at various stages of construction; however, this department has maintained a cadre of personnel capable of resuming testing operations as required in compliance with a presidential mandate.

The LANL U1a event utilized an existing head frame. To adapt the head frame for this event, changeout of structural members to include new sheave and ladderway was required. Destemming was performed on the lower 2,294 m and shaft rehabilitation was completed with the destemming advancement. The Ottomwa hoist was changed out for a Vulcan/Denver hoist and the hoist room revisions were completed. The AM-50 Alpine miner was lowered to the bottom of the shaft where the following cavities and chambers were excavated.

	Dimensions (m)		
	Height	Width	Length
Shop Drift	4.14	4.57	19.91
Connecting Drift	3.05	3.05	21.34
Secondary Containment	3.96	3.96	84.12
Containment Plugs (2@)	3.96	3.96	12.9
Vent Drift	3.05	3.05	231.0
Vent Drift	3.96	5.18	42.7
Users Alcove	3.05	3.05	61.0

The vent drift and users alcove were fibercreted. This department mined pillar to U1g, lowered 301 m of 1.22 meter casing, poured the vent drift, users alcoves, J-8 alcove, and main drift.

The U2gj (LLNL) event required the use of the 15.24 m Atlas and the 30.48 m CAT service towers. The hole is 2.49 m in diameter and 503.35 m deep. The emplacement package is not complete; therefore, the weight is unknown. A 317.51 metric ton crane is currently on location.

The U7cd (LANL) event required the use of 47.55 m and 15.55 m service towers. The holes are 1.88 m and 2.18 m in diameter and 30.49 m and 505.36 m deep. The emplacement package is not complete; therefore, the weight is unknown. A 453.59 metric ton crane is currently on location. Shock mitigation is required in the Alpha Park.

20.2.2 Field Operations Department/Drilling

In support of the weapons program, this department completed the drilling of two emplacement shafts at drill locations U2gk and U1g. Shaft U2gk was 2.44 m and shaft U1g was 2.74 m in diameter. One of the referenced shafts was initiated during the previous fiscal year, but was completed during this reporting period. The holes had a total drilling depth of 857 m and required the excavation of approximately 4743 m³ of material. One postshot reentry hole at U4t was drilled for a total depth of 766 m. The postshot operation at U3ml, initiated during FY 1992, was completed during this reporting period. This postshot reentry hole was drilled to review operational readiness and equipment operational viability under a joint test operations configuration.

Additionally, lowering of hydrodynamic diagnostic equipment in satellite hole U7cd was completed during this reporting period.

In support of the ERP/GCP, drilling was performed on five holes. Holes ranged from 25 to 51 cm in diameter and utilized a variety of circulation systems such as direct, dual string reverse with air assist, and dip stick methods. Total drilling depth for GCP holes was 4290 m. Three wells were completed and an additional four wells received clean out and/or hole conditioning services.

In support of work for others, drilling was performed for environmental assessment, workover of NTS wells, and the REECO Systems Construction Department in support of the U.S. Air Force. This work was scheduled and performed on a noninterference basis with the Environmental Restoration and Weapons Programs.

A proposal was developed and implemented to eliminate the use of the vacuum truck subcontractor, JCI Environmental Services, for the transportation of drilling fluids. This department took over the established responsibilities which utilized existing personnel. An estimated operational savings of \$657,000 could be realized over the next three years from this recommendation. The JCI contract was terminated on November 25, 1992.

Postshot reentry operations were targeted for enhanced environmental and safety performance in accomplishing the following: reduce or eliminate the incidence of radioactive exposure to skin and personal clothing, thus increasing safety and reducing reportable incidents; and controlling work area inventories of hazardous material to assure that RCRA materials do not intermix with low-level radioactive waste (LLW), forming a mixed waste. This was an aggressive operation that involved aspects of management controls and personnel commitment and ownership of environmental and safety programs. During the completion of postshot U3ml and throughout postshot U4t, the following measures were implemented to reduce or eliminate the incidence of exposure: the utilization of special clothing; tight controls on personal and work activities; and special care during donning of protective clothing. To control work area inventories of hazardous materials required the development of a list of allowable materials and area control to assure that only authorized material entered the radiation exposure (RADEX) area. Not a single incident occurred during these postshots.

A geophone that had been lost during operations in approximately 1965 was economically recovered from Well UE-10j. The recovery of this geophone allowed for continued operations ahead of scheduled requirements. Recovery operations required the removal of fill material above the geophone and utilization of a core barrel to drill around and hold the fish for removal.

20.2.3 Field Operations - Tunnels

Major environmental remediation projects have been undertaken and completed at U12E Tunnel, U16 Tunnel, and on Rainier Mesa. Procedures have been authored, and other requirements have been met, resulting in the issuance of a water discharge permit by the Nevada Department of Environmental Protection for the U12N Tunnel discharge water. A formal environmental inspection schedule was implemented in Area 12 for all facilities and work operations.

The N.24 project reentry and recovery operations were completed. The N.25 OSSY No. 3 calibration shot was completed. Initial preparations for mothballing the tunnel were begun. Mining for the N.25 project was completed. The N.25 experiment cavity was completed and turned over to the laboratory for explosives emplacement. The N.25 project was stemmed, buttoned up, and

successfully completed in September 1993. Buttonup for the event did not require the normal nuclear event containment features.

P Tunnel was operational on a three-shift basis until January 1993, a two-shift basis from February until August 1993, and then a one-shift basis until the end of the fiscal year. Mining began on the LOS and Bypass Drifts (Figures 14 and 15) for the P.06 event. Reentry and recovery operations in P.04 and P.05 were completed. Completed mining in the Ventilation Drift and started plug construction.

Mothballing of the T Tunnel complex (Figure 16) began with the removal of useable equipment and closure of the main plugs. The surface facilities have also been shut down and their functions transferred to other facilities.

Shop fabrication and construction activities were provided for N and P Tunnel activities, including processing 4175 metric tons of cementing materials and the drilling of 707 m of specialized drill holes (core and large diameter holes). Support was provided to the department environmental group on remediation and reclamation operations in Area 12 and on Rainier Mesa.

The program for equipment maintenance, repair, and interface with the Operations Equipment Department continued; however, usage of Building 12-929 for that function was discontinued. Heavy equipment in support of the tunnel mining and construction efforts was maintained at Building 12-929 until May 1993, at which time the maintenance function moved to U12P Tunnel.

20.2.4 Communications and Electronics

In support of the weapons testing program, the Communications and Electronics Department provided communications systems, alarm systems, industrial electronics systems, video systems, data communications, and minicomputer and peripheral maintenance, which included the following specific activities:

- Took the necessary steps to consolidate all laboratory radio nets to Net 5 to reduce radio frequency spectrum usage and the number of radio units in service.
- Completed the radio net changeout of EG&G Nets 1 and 2 to Net 8, which eliminated the requirement for two separate radios for communication with the laboratories.
- Implemented the new AIRS Security System at the NTS.
- Decreased the number of two-way radios used at the NTS by approximately 750.
- Completed six security system installations.
- Provided one Mobile Intruder Reconnaissance Vehicle to be used for interdiction purposes.
- Completed the installation of a multi-point control unit for video teleconferencing.
- Completed the installation of the KG By-Pass switch for video teleconferencing.
- Completed the exchange of three personnel radios for new models without cost to the government.
- Completed the realignment of all mountaintop UHF antenna systems.

20.2.5 Occupational Safety

The Occupational Safety & Fire Protection (OS&FP) Department adapted its operations to the new Company system of reporting and tracking the correction of identified hazards, using the System Deficiency Report and the Automated Deficiency Tracking System (ADTS).

Figure 14. U12P.06 LOS Drift View Towards Work Point

Figure 15. U12P.06 Bypass Drift, Intersection at MAC Crosscut

Figure 16. U12T Work Point Side of Gas Seal Door, Door Closed for Tunnel Mothball

The Safety and Health Committees continue to be a strong contributor to the success of REEC's Occupational Safety and Health efforts. Procedures were revised to improve the program. Subcommittees dealing with issues such as electrical, transportation, hoisting, and rigging have proven to be very effective.

REEC continues its accomplishments in the reduction of occupational injuries and illnesses. Compared to a baseline established in FY 1990, the Lost Workday Case rate was reduced by 66 percent, and the Total Recordable Case rate was reduced by 55 percent.

REEC is awaiting the announcement of DOE's version of the Voluntary Protection Program so that an application can be filed.

The Manager of the OS&FP Department and a Safety Professional participated as planners and controllers for the P Tunnel Underground Emergency Exercise. The purpose of this exercise was to evaluate multiple emergency units responding to an accident with mass casualties. The exercise evaluated Medical, Fire Protection, and Mine Rescue Teams as emergency responding units, and also evaluate management's response and coordination of such an event.

The Manager of the OS&FP Department, a Safety Professional, and the Fire Chief supported FOD/DoD in the NPE. Safety personnel reviewed, analyzed, and submitted comments on the Safety Analysis Report and the Operational Safety Procedure. Occupational Safety followed the experiment through the planning stages, monitored the emplacement and button up activities, and were present at detonation.

A Compliance & Monitoring Safety Specialist was appointed to be a participant in the Environmental Observers Program. The purpose of this program is to train participants in the recognition of environmental hazards/violations. Participants are expected to conduct monthly environmental inspections in their department, document findings, and track corrective action to closure.

A Compliance & Monitoring Safety Specialist was appointed to participate as a member of the Transportation, Rigging, and Equipment Safety Subcommittee. This group's purpose is to identify, discuss, and resolve safety issues involving transportation, rigging, and equipment. The group meets twice a month and is comprised of both craft and management with appropriate expertise. The results of their work is reported to the Blue Safety and Health Committee.

A Safety Professional and a member of the Budgeting Department have concluded their monitoring, tracking, and oversight of deficiencies identified during the DOE Compliance Assessment Program. The remaining 29 deficiencies have been assigned to the Finance & Management Control Department for further tracking. Status on the remaining items has been checked as of the end of FY 1993, and all documentation associated with this program can be found in the Finance Management & Control Department Office.

The Compliance & Monitoring Section has made a complete transition to the Phase IV enhancements of the ADTS. This system is virtually paper free and is developing a "key word" system that will assist in trending of deficiencies throughout the Company.

The Compliance & Monitoring Section is in the process of updating its schedules and listings for prioritizing inspections. Facility lists and facility managers will also be updated to reflect the Company's most recent reorganization efforts. This section will also attempt to incorporate a new

system for tracking facility data introduced at the Second Annual DOE Occupational Safety Conference. The update to inspection scheduling and facility data is scheduled to be completed in January 1994.

The Compliance & Monitoring Section has met its goal for inspections conducted in FY 1993. New goals for FY 1994 include a number of departmental assessments to be conducted in addition to compliance inspections.

20.2.6 Occupational Medicine

Occupational Medicine, Emergency Medical Services, Nonoccupational Medicine, Employee Assistance, Wellness, and Environmental Health Services were provided to all personnel at NTS, and to the Las Vegas branch personnel. The Area 23 medical facility was the focal point of Occupational Medicine activities. This facility was supported by four medical aid stations located throughout the NTS and another branch in Las Vegas.

The outpatient work load consisted of 1,971 occupational treatments; 7,936 nonoccupational treatments; 4,529 physical examinations; and 529 immunizations.

20.2.7 Industrial Hygiene

Field monitoring was provided for all phases of construction, respiratory protection devices, recommended engineering controls, ventilation measurements, audits for compliance with health and environmental standards, and consultation on all occupational health factors concerning personnel connected with NTS activities.

Industrial Hygiene conducted non-radiation health activities associated with tunnel minebacks and drillbacks, including extensive monitoring of tunnel air for toxic and explosive gases and for required air quantities. Specifications were provided for precautions to be taken in handling toxic substances in tunnels. Support was provided for the mining phases of underground tests, postevent reentries, and postevent minebacks and drillbacks. Surveillance was provided to drillback sites for nuclear tests outside the tunnel areas, at high-explosive tests, and in shops, laboratories, and warehouses.

Engineering drawings were reviewed for construction and modification projects to ensure inclusion of health hazard controls.

Hazardous substances requisitioning, purchasing, and shipping were monitored in coordination with the Supply Department. Material Safety Data Sheets for hazardous substances were obtained, computerized, and forwarded to users. Assistance was provided to Information Systems in establishing a computerized hazardous material program.

Heavy equipment specifications were reviewed for health hazard engineering controls, such as noise and dust suppressors. Upon equipment delivery, measurements were made for hazard controls.

Support services were regularly provided to EG&G, LANL-NTS, SNL-NTS, EPA/EMSL-LV, USGS, WSI, RSN, and other DOE Contractors. Services included consultations, respirator fittings and training, trade name chemical compositions, hazard potential evaluations, and sample analyses.

20.2.8 Fire Protection Engineering

Engineering & Analysis ■ Fire Protection Engineers attended all preliminary and Title II design review meetings pertaining to major NTS construction and modification projects.

In support of Contract Administration, Occupational Safety Professionals and Fire Protection Engineers attended subcontractor prebid and postaward conferences to provide safety and fire protection guidance.

The Fire Protection Engineering Survey List was updated to include new facilities which have a high-monetary loss potential, are programmatically important, or are a significant life safety risk.

The Major NTS Construction and Modifications List is an internal report to assist Safety and Fire Protection personnel in maintaining an awareness of NTS facility new construction/major modifications. This list was periodically updated and the projects were monitored appropriately.

The computer program, "Hydraulic Calculation," purchased in 1990 and since updated, is continually used to verify pipe schedule fire sprinkler systems and to check fire sprinkler contractor submittals for accuracy.

Fire Protection Engineers conducted specific fire protection evaluations and prepared written reports as required. These specific evaluations included pre-lease inspections, inspections of new construction/modifications, welding/cutting location surveys, and fire barrier evaluations.

Fire Protection Engineers reviewed and commented on 119 engineering design drawings, specifications, and material evaluations.

Fire Protection Engineers conducted fire protection assessments of 98 NTS facilities.

Fire Protection Engineers assured that all fire protection systems and equipment (including suppression systems, detection systems, fire pumps, etc.) were inspected, tested, maintained, and documented according to National Fire Protection Association (NFPA) codes and standards.

SIGNIFICANT ACCOMPLISHMENTS ■ Automatic fire sprinkler and/or alarm systems were installed in the following new facilities:

- Area 6 - SNL Cable Assembly Building, CP-215
- Area 6 - LANL/LLNL Operator/Teamster Office, Building 6-901
- Area 6 - LANL/LLNL Field Engineering, Building 6-902
- Area 6 - LANL/LLNL Vehicle Maintenance Shop, Building 6-903
- Area 6 - FOD/LANL/LLNL Painters/ Carpenter Shop, Building 6-906
- Area 12 - Dormitory, Building 12-45
- Area 23 - NTSO, New Addition, Building 111

The following facilities were retrofitted with automatic sprinkler and/or alarm systems to comply with previous fire protection surveys and/or 1986 Factory Mutual Survey recommendations:

- Area 23 - NTSO, Building 111
- Area 25 - Cafeteria, Building 3127

The following facility was retrofitted with a backflow check valve to comply with state requirements:

- Area 23 - Craft Workshop, Building 710

The following facilities were retrofitted with fire separations between the Sleeping Quarters and Engine Bay areas to comply with NFPA 1500 requirements.

- Area 6 - Fire Station, Building CP-70
- Area 23 - Fire Station, Building 425

Safe Driver Awards were earned by 124 REECO professional drivers (85 percent) who had operated vehicles during the year without a preventable vehicle accident. Together, these drivers have a total of 1,119 years of awarded safe driving, which averages nine years per driver. Thirteen drivers were recognized for achieving 10 years of safe driving, and five earned their 20-year awards.

OS&FP Department responded to a request from DOE/NV to have all Computerized Accident Incident Reporting System reports from January 1, 1990, through the request date separated by operations (NTS, Tonopah Test Range, Systems, and YMP) and appropriate information submitted to Idaho Falls so that the Safety Performance summary reports of occupational injuries and property damage would reflect the experience rates for each individual operation.

OS&FP Department personnel conducted nine safety assessments of operational departments, which included identifying deficiencies and recommending corrective actions to assist management in improving their safety programs.

A Safety Professional served on a DOE/NV-directed committee to assess the hoisting and rigging program at the NTS and EG&G/EM Atlas facility according to the request of DOE/HQ.

Four Safety Professionals received initial or refresher MORT/AI training so they could be available to serve on Class A and Class B investigation boards.

A Safety Professional served on the DOE/HQ committee charged with revising and distributing the DOE Hoisting and Rigging Manual. The manual was approved as a guidance document and copies have been distributed throughout the Company.

An extensive review was conducted of the Company Safety Manual to develop a plan to revise and update REECO's Safety Codes into Safety Procedures. As a consequence, 41 of the 160 original safety codes were rewritten into safety procedures, transferred to another department, or deleted. Those of special significance include:

- A-5, Safety Meetings.
- A-6, Supervisor & Employee Safety & Fire Protection Inspections & Reports.
- A-7, Occupational Safety & Health Complaints.
- A-8, OSHA Logs and Posters.
- A-10, Accident/Illness/Near Miss Incident Notification, Investigation & Reporting.
- C-8, Lockout/Tagout.
- C-9, Centralized Control of Hazardous Energy for the NTS Power System.
- C-11, Confined Space.
- E-1, Explosive Safety.

■ H-16, Load Binders & Chains, Wire Rope, Synthetic Web & Fiber Rope Slings.

Another 62 safety codes are currently under revision. On the average, these codes are approximately 50 percent complete.

OS&FP Department initiated the effort to develop a DOE/NV Confined Space Guidance Document. A Safety Professional was instrumental in developing the guidance document for all organizations under DOE/NV who are responsible for confined space entries. As a result, all organizations will follow the same procedure and all employees will be provided the same level of protection when they enter confined spaces. This was the first effort of its kind, and now DOE/NV is considering a similar project for lockout/tagout.

A Safety Professional participated on a Root Cause Analysis Team formed to investigate the circumstances involving four separate occurrences involving heavy equipment under the operational control of the REECo Waste Management Department. Upon request, copies of the report were sent to DOE/HQ and DOE/NV.

A Safety Professional was the chairman of a task group formed to conduct an assessment of the Company's forklift training and operator qualification program.

An Occupational Injury/Illness Reporting and Recordkeeping Audit was performed by Internal Audit. No discrepancies were noted.

A Fire Protection Engineer participated on a Root Cause Analysis Team formed by the Environment Safety & Health Division Manager to determine the root cause(s) for numerous environmental discrepancies.

OS&FP Department provided Company Compliance Oversight Organization safety and fire protection support to the Site Maintenance Department by reviewing and commenting on new work packages each week.

OS&FP provided the Executive Office information/documentation for the closure of eight outstanding fire protection deficiencies resulting from a 1986 Factory Mutual Survey of the NTS.

Emergency Medical Service Program ■ Upon request, Firefighter/Emergency Medical Technicians provided ambulance driver support to REECo Occupational Medicine Department.

Twenty-three of the 38 firefighters are certified by the state of Nevada as Emergency Medical Technicians.

Firefighting Equipment Tests ■ Annual fire hose service tests were conducted on all fire hoses with the exception of cabinet hoses. A combined total of 20,000 ft of 1-1/2-in, 2-1/2-in, and 3-in hose was tested and the proper documentation prepared. All fire hose test records continue to be maintained on a computerized database for easy access.

All firefighting units were vacuum tested and the booster tanks were flushed.

Annual fire apparatus pump tests were conducted on all Fire Protection Services fire pumps. All units satisfied NFPA requirements and the proper documentation was prepared and entered into the computerized database.

Annual flow tests of fire hydrants on the NTS were conducted and documented. On-duty firefighters conducted the tests on weekends to avoid interference with pedestrian and vehicular traffic. Problems encountered were reported and repaired by the Sprinkler Fitters assigned to the NTS General & Support Department.

Responses ■ Types and numbers of responses were:

Vehicle	19
Range fires	7
Automatic Signals	119
Other Responses	26
Off-site Incidents	6
Total Responses	177
Loss of Government Property	\$10,210
Nonfire Government Loss	36
Total Government Loss	\$10,246

Other ■ Controlled burns were conducted until June 1993. All burns were scheduled through and approved by the Environmental Compliance Office. The field training facility was closed in June 1993 because of the identification of the burn pit as a potential RCRA closure site due to historical hydrocarbon fuel contamination. Field training was suspended pending completion of a new field training facility.

Progress has been made on review and corrections to present station instructions guiding operations in the event of an emergency. The first area of response to be completed was firefighter support to Desert Rock Airport. A comprehensive station operating procedure book with more than 70 procedures is in effect.

A Fire Awareness Field Day was conducted by firefighters for the NTSO to familiarize them with firefighter tools and techniques and give the participants "hands-on" experience using the basic tools such as fire extinguishers and breathing apparatus.

Firefighters provided standby support for the loading and unloading of locomotive batteries in Area 6.

Fire Protection Services developed a comprehensive plan to meet NFPA 1500 *Standards for Firefighters Health and Safety*. The NFPA 1500 plan has been reviewed by DOE as well as the 1992 Technical Safety Appraisal Team, and both have given it high acclaim.

Significant training activities and recertifications occurred during 1993 including: a 40-hour aircraft crash/rescue course leading to certification of airport firefighters, 16-hour fire prevention-inspection course for all firefighters, a bloodborne pathogens course, a HAZCOM training program, and recertifications in Emergency Medical Technician and Cardiopulmonary Resuscitation. In addition, selected firefighters completed train-the-trainer courses in HAZMAT Technician, Emergency Medical Services Instructor, Fire Instructor, and Cardiopulmonary Resuscitation Instructor.

Area 12 fire station was closed. Three out of 12 firefighters were retained to reduce overtime costs in Area 23 and Area 6 Fire Stations.

20.2.9 Property Management

Property Management did not supply direct support to Operation KLAXON.

20.2.10 Environmental Protection

One of the Environmental Compliance Department's responsibilities was to ensure that REECo operations were in compliance with all applicable environmental laws and regulations. The equipment used in preparing stemming material and all equipment used in the stemming operation had all of the required environmental permits. Emissions from some of this equipment, however exceeded permit requirements. Where these problems existed, efforts were made during the year to either modify the equipment or the methods of operation to comply with state regulations.

20.2.11 Site Maintenance Department

Department personnel oiled and chipped 24.04 km of the Stockade Wash Road, NTS streets, the airport road in Area 18, as well as various sections of the Area 12 complex.

All roads were maintained and kept open to drilling and mining operations during inclement weather and adverse conditions.

During this period, the following facilities were activated and are now included in the department's maintenance responsibilities: FOD/LANL-LLNL Shop Buildings 6-902, 6-906, and 6-907 (totaling 2248 m²) and CP-215 (totaling 408 m²).

All CP facilities were maintained in operational readiness.

The Department provided support to the Groundwater Characterization Program on test wells 19-C and UE-10j, and supported Radionuclide Migration Project on test wells RNM-1 and RNM-25. Maintained and upgraded all water wells and pumping equipment throughout the NTS.

A dedicated maintenance crew was continued for the 12,077 m² DAF. This crew will be instrumental in the final DAF startup.

During this period, the majority of the facilities in Area 12 were deactivated. Facilities that were totally shut down amounted to 9106 m², while mothballed units amounted to 3921 m². A total of 12,027 m² of facilities were removed from active use.

Maintenance personnel performed new roof coating applications for Building 425, 750, 517, and 681 in Mercury, as well as CP-9 and CP-40.

Supervisory and craft support was provided to the NPE.

20.2.12 Operation Equipment

Heavy equipment was maintained throughout FY 1993. Mechanics and electricians inspected all equipment periodically, and provided servicing and repairing as needed. Cranes, hoists, and forklifts associated with downhole operations received special monthly inspections by qualified equipment inspectors. At fixed intervals, those equipment units were thoroughly tested and certified. Drilling air compressors in use were inspected weekly, and drilling rigs were inspected monthly, to ensure their safe operation.

A joint LANL and REEC Co committee recommended that operating parameters associated with downhole operations should be recorded to ensure that the downhole crane is operated according to established procedures. The electrical section installed a "black box" on a 200-ton Manitowoc 4600 crane to satisfy this recommendation. Information to be recorded will include boom angle, line speed, engine speed, hook load, throttle position, and fuel flow. Laboratory and REEC Co personnel will evaluate the recorded data to ensure that the crane is operated properly during each event.

A crane preventive maintenance program was instituted and is presently in operation. Critical components are inspected and/or tested every three or six months, rather than every 18 months under the requirements of the crane certification program. The more frequent inspections should result in less downtime and ensure enhanced operation of the cranes.

This department was closely involved with the removal of the existing hoist at the U1a shaft and the installation of the rebuilt 400-hp Vulcan-Denver originally intended for use by the YMP. The Lilly controller and depth indicator had to be refurbished, as well as the entire operator station.

The Drilling Support Section reconstructed the Wilson 38 drill rig from what was essentially a mine rescue rig. The entire rig, from crown to ground level, was rehabilitated, rebuilt, or replaced to meet national codes and standards.

A clutch-brake interlock system was installed on all heavy duty downhole cranes. This system provides a safety feature that automatically applies brakes when the clutch is disengaged. This reduces the probability of an operator error that would allow a load to descend without control.

The Equipment Control Section identified, inspected, and processed over 200 items of equipment for excess during this period.

Twelve-hundred items of heavy equipment maintained by this department have been entered into the maintenance tracking computer program. This will facilitate compliance with DOE Order 4330.4A.

Results of biannual exhaust emissions testing on underground equipment were tracked and analyzed for a two-year period. The analysis showed a 97 percent compliance with Mine Safety and Health Administration standards. Testing was discontinued, saving approximately 480 man hours per year.

A comprehensive survey of equipment custodians and the laboratories was initiated to determine the current status and future requirements for over 3900 pieces of heavy equipment under REEC Co control.

20.2.13 Fleet Operations

This department provided vehicular support to DOE, other government agencies, and to all contractors at the NTS. A broad spectrum of fleet management activities during this period included specification writing, procurement, quality control, dispatching, fiscal and physical control, preventive maintenance, mechanical repair, body repair, painting, fueling, lubrication, tire and wash service, welding and machine tool fabrication, engine rebuilding, teamster driver support, and associated record keeping and reporting.

Fleet initiated a cost study aimed at reducing maintenance and fuel costs. The results of the study indicate premature wear resulting in replacement and repair of engine and drivetrain components. A large portion of this maintenance has been attributed to driver error, due to the lack of education and training in regard to modern engine operations and progressive shifting techniques. Fleet initiated an aggressive truck driver training program aimed at reducing or eliminating these costs. The estimated annual savings are \$500,000. In January 1993, this program was implemented with the train-the-trainer concept, which further reduces costs associated with sending personnel off site to be trained.

Initial projections regarding the closure of the Area 12 shop indicated a need for an Area 23 swing shift to maintain the existing level of service. Several options were explored to reorganize the operation. Innovative actions were taken to achieve a cost-effective transition with minimal disruption of service. The Area 23 machine shop operation was eliminated and this area was converted to additional mechanic's stalls. Some personnel were utilized as field mechanics and others were assimilated into the Area 6 and 23 shops. The closure and relocation was achieved in a timely and organized manner due to excellent planning and cooperation from all employees. The end result was a day-shift-only operation which will handle the present fleet size. This saves approximately \$300,000 over going to a swing shift operation.

Executive Order 12759 requires government fleets to reduce their fuel consumption 10 percent by 1995 as compared to the FY 1991 base year. The NTS fleet has achieved a 5.25 percent reduction in the first year (FY 1992). This was achieved through several mechanisms. The biggest gain was made by switching to gasohol blends for the full year. Also contributing were an increase in miles per gallon, from 13.4 to 13.6, and a reduction in miles operated, from 24,002,000 to 23,800,000. The 10 percent goal is easily achievable barring major programmatic change. The replacement of older vehicles with new, fuel-efficient ones will increase the miles-per-gallon ratio.

A computerized maintenance tracking system has been purchased and installed. In addition to meeting the requirements of DOE Order 4330.4A, this system will result in greater productivity, reduce maintenance costs, and provide an effective tool for better fleet management.

The goal of less than the average vehicle fleet service costs-per-mile for federally-owned fleets, as published in the General Services Administration Federal Motor Vehicle Report, has been achieved. Despite aging of the fleet due to budgetary constraints, the FY 1992 cost per mile was 24.7 cents. This compares with 38.1 cents for the latest federal fleet data. This lower cost means that the NTS fleet is maintained annually for \$3,190,272 less than the average federal fleet.

Fleet interfaced with DOE/NV Security and Safeguards Division personnel to provide a procedure, training manual, and training in compliance with DOE Order 5610.11, Nuclear Explosives Safety, for drivers designated to drive the Device Transport Vehicle.

At the request of DOE, fleet personnel provided an outstanding presentation on commercial driver's license requirements to the Interagency Motor Equipment and Advisory Council in Scottsdale, Arizona. Information presented was shared with and utilized by SNL, Albuquerque, New Mexico, and General Services Administration, San Francisco, California.

As a result of an excellent presentation given to NV contractors, the department has been tasked with ensuring that the Company's transportation program meets all the applicable Department of Transportation (DOT) requirements, which includes program development and DOT compliance (driver qualification requirements, accident reporting, and transportation safety).

Fleet successfully dedicated one person with the primary responsibility for development, implementation, and maintenance of the commercial driver's license program. The program encompasses such functional areas as licensing, records management, training, and compliance to DOT regulations.

Fleet achieved, developed, and implemented a truck driver training program that meets both DOT Hazardous Material and Federal Motor Carrier Safety regulations. Due to the success of this program, EG&G/EM, requested assistance in the development of a truck driver training program for use by their drivers.

A one-day training seminar with the NDT group was coordinated to train six Fleet personnel in Insulated Boom Truck Testing, along with RSN personnel, according to ANSI A92.2 - 1990, *Vehicle-Mounted Elevating and Rotating Aerial Devices*.

20.2.14 Quality Assurance

DOE and NV Orders 5700.6C, *Quality Assurance Program Implementation*, serve as the guidelines for on-site quality assurance operations, with DASMA QC-2 acting as additional supplements. In summary, these standards require cohesive efforts for implementing quality activities by stressing three principal areas; management, performance, and assessment.

Toward these ends, the Quality Management Plan coordinating DOE and NV Order 5700.6C implementation activities was produced and implemented.

The ADTS was upgraded with a Phase IV enhancement to consolidate all external and internal assessments into a common tracking and trending system, and to make the system as "paperless" as possible.

The current internal and independent assessment programs were expanded to further cover Environmental, Health, Radiological, Safety, Quality, Emergency Management, and Property activities as pertain to the protection and well being of NTS employees.

Work continued on the on-going revision to the NTS Welding Manual to provide consolidated, recognizable standards for all NTS welding and welder certification.

Procurement documentation was reviewed for inclusion of quality requirements. Vendors, as applicable, were surveyed/qualified for providing goods and services to the NTS.

Support and guidance was provided to the NTS Quality Family Forum to assist in the establishment of common methods, procedures, and processes for accomplishing quality activities among the numerous NTS affiliated organizations.

In addition, normal NTS levels of activity also continued in the areas of program and procedure development, personnel training and qualification, quality improvement, documents and records, work processes, design, procurement, inspection and acceptance testing, and internal audit, surveillance, and assessment.

20.2.15 Awards

REECo received the DOE/HQ, Office of Military Application Award of Excellence for significant contributions to the Nuclear Weapons Program; "In recognition of significant improvements in the Occupational Safety and Health Program during the last three years."

20.3 EMERGENCY MANAGEMENT OFFICE

The REECo Emergency Management Office coordinated the planning, preparation, execution, and follow-up of the P Tunnel Mass Casualty Exercise conducted June 2, 1993. The primary goal of this exercise was to develop, maintain, and demonstrate skills, expertise, and response capability to an underground emergency.

Exercise planners used as much realism as possible to ensure maximum exercise benefit. Simulations were designed to evoke responses and actions close to those resulting from a real situation (Figure 17).

An emergency is stressful because of the representation of an inherent threat to human life and property. This exercise simulated an emergency and proposed to evoke emergency response through the simulation of stress. To counterbalance stress and realism, planners highlighted safety as a critical element of the exercise.

The scenario-driven exercise was triggered by a simulated incident in the main drift of the tunnel that results in power failure, fire, and casualties (all simulated).

Evaluation of this exercise resulted in the issuance of seven deficiencies (failure to comply with formal direction), and 23 observations (deviation from best management practice).

20.4 REPORTS

The following reports were produced during FY 1993:

DOE/NV Numbered Reports

- *Operational Air Sampling Report July through December 1991*, DOE/NV/10630-37.
- *Operational Air Sampling Report January 1 - June 30, 1992*, DOE/NV/10630-65.
- *Operational Air Sampling July 1 through December 31, 1992*, DOE/NV/10630-37.
- *The Environmental Monitoring Plan - Nevada Test Site and Support Facilities*, DOE/NV/10630-28 Addendum.
- *Environmental Monitoring Plan for Nevada Test Site and Support Facilities*, DOE/NV/10630-28 Addendum 2.
- *DOE Nevada Field Office Environmental Protection Implementation Plan*, November 1992, DOE/NV-361.
- *Underground Radionuclide Migration at the Nevada Test Site*, November 1992, DOE/NV-346.
- *CASCADER: An M-Chain Gas-Phase Radionuclide Transport and Fate Model. Vol 2-User's Manual*, DOE/NV/10630-57.
- *CASCADER: An M-Chain Gas-Phase Radionuclide Transport and Fate Model. Vol 4-User's Guide to CASCADER 9*, DOE/NV/10630-63.
- *A Simulation of the Transport and Fate of Radon-222 Derived From Thorium-230, Low-Level Waste in the Near Surface Zone*, DOE/NV/10630-58.
- *A Simulation of the Transport and Fate of Radon-220 Derived From Thorium-232 Low-Level Waste in the Near-Surface Zone of the Radioactive Waste Management Site in Area 5 of the Nevada Test Site*, DOE/NV/10630-58.
- *A Modeling Study of the Effect of Depth of Burial of Depleted Uranium and Thorium on Radon Gas Flux at a Dry Desert Alluvial Soil Radioactive Waste Management Site (RWMS)*, DOE/NV/10630-85.
- *Technical Basis for Internal Dosimetry at the Nevada Test Site*, DOE/NV/10630-64
- *Radiological Effluents Released from U.S. Continental Tests 1961-1989*, DOE/NV-317C.
- *U.S. DOE/NV Annual Site Environmental Report 1992*, Volumes I and II, DOE/NV-359.
- *NV/YMP Radiological Control Manual*, DOE/NV/10630-59.
- *NV/YMP Radiological Control Manual Implementation Plan*, DOE/NV/10630-60.

Technical/Scientific Reports ■ Seven abstracts, seven papers, and eight presentations were reviewed by the Administrative Services Department, Information Products section and DOE/NV.

Emergency Management Hazards Assessment reports were prepared for the following facilities:

- REEC Co Administration Building, Las Vegas, Nevada.
- REEC Co Building 111, Area 23, Mercury, Nevada NTS.
- REEC Co Special Projects Compound, Area 1, NTS.
- Area 23 Building 1010.
- Area 23 Site Maintenance Department Office (Building 620).
- Area 23 Site Maintenance Department Facility.
- Area 23 Warehouse 3.
- Area 25 Site Maintenance Department Facility.
- Area 6 Site Maintenance Department Facility.
- Area 6 Linemen Facility.
- Building 1002.
- 2753 South Highland-LV.

- 2805B Westwood-LV.
- 3068 South Highland-LV.
- Building 725-Mercury.
- Support Services - Building 113-Mercury.
- REEC Co YMP Facility - 4460 So. Arville St. Suite 6 - Las Vegas.
- REEC Co YMP Building 101 - Convention Center Drive Las Vegas.
- REEC Co Bulk Fuel Storage Facility - Area 6 NTS.
- Warehouse "C" Area 6 NTS.
- REEC Co Bulk Fuel Storage Facility in Area 23 NTS.
- Building 1014 (Inspection Station) Area 23 NTS.
- Powder Magazine in Area 12 NTS.
- Warehouses 777, 776, 775 in Area 23 NTS.
- Warehouse 160 in Area 23 NTS.
- Building 101 in Area 23 NTS.
- Building 155 - Mercury.
- Occupational Medicine Department - Las Vegas and NTS.
- Dorm C - Area 23 - NTS.
- Building 127 - Area 23 - NTS.
- Building 5-6, Area 5, NTS.
- Building 653 - Mercury.
- Dorm B, Area 23, NTS.
- Dorm D, Area 23, NTS.
- Building 3, 2340 Paseo Del Prado - Las Vegas.

Other Reports

- Treatability Test Facility Test Plan.
- Numeric Forms Index.
- Alphabetic Forms Index.
- Conduct of Operations Manual.
- NV/YMP Radiological Control Manual.
- Glossary of Terms - Volumes I & II.
- Acronyms.
- EG&G Corporate Radiological Control Manual.
- Electronic Company Forms Index.
- General Plant Project Plan.
- Evaluation Report for the P Tunnel Underground Emergency Exercise.
- Training Package for the Containment and Effects Training Event at the Tualatin Valley Fire and Rescue Regional Training Center 07/28 - 08/05/93.
- Descriptions of the REEC Co Integrated Medical & Employee Assistance Programs and the OMD Emergency Management Plan.
- REEC Co Training Manual.
- Hazardous Material On-Site Transportation Safety Booklet.
- REEC Co Affirmative Action Plan October 1992 through September 1993.
- The DOE/NV Radiological Assistance Team Notification Procedure, Rev. 18.
- Evaluation Report for Containment and Effects Training Event at the Tualatin Valley Fire and Rescue Regional Training Center 07/28-08/05/93.

21.0 DEPARTMENT OF DEFENSE ACTIVITIES

21.1 PROGRAM IMPLEMENTATION

21.1.1 Mission Statement

The DNA is responsible for fielding underground nuclear weapons reliability tests at the NTS in support of DoD programs. Under the direction of the DNA, these tests are supported in part by the DoD and DOE laboratories and DoD and DNA contractors. DNA also maintains the capability to verify the yield of Russian nonstandard configuration underground nuclear tests.

21.1.2 Program Oversight

Logistical and engineering support of the DNA portion of Operation KLAXON are coordinated and supervised by the FCDNA. Within this organization, Nevada Operations support included inventory control, procurement, and transportation of DNA test equipment, and logistic support of the DoD and DNA contract agencies. Comptroller support of the test program is provided by the Financial Management Division, Comptroller Directorate.

21.1.3 Functional Responsibilities

FCDNA headquartered at Kirtland Air Force Base (Albuquerque, New Mexico) is responsible for the DNA nuclear weapons and conventional weapons reliability test program and is under the direction of DNA Test Directorate in Alexandria, Virginia. The organizations within FCDNA with specific responsibilities in fielding the DoD nuclear tests are as follows:

NEVADA OPERATIONS ■ Nevada Operations is the fielding element for DoD participation. Organized under FCDNA, Nevada Operations is a joint service organization responsible for integrating and managing the underground nuclear weapons reliability testing program at the NTS. The program is designed to determine the survivability and effectiveness of United States and North Atlantic Treaty Organization forces in a nuclear environment. Responsibilities include, but are not limited to:

- Coordinating and managing the engineering, logistical, and administrative support for all DoD- and DNA-sponsored agencies involved in weapons reliability test operations and exercises at the NTS and for DNA/FCDNA operations and exercises off NTS, as directed.
- Exercising administrative control over all DoD/DNA/FCDNA personnel assigned or attached to Nevada Operations or functioning in a DoD capacity at NTS.
- Acting as the Nevada representative for the Director, Test Directorate and FCDNA.
- Maintaining liaison with all other federal and civil agencies at NTS.
- Supervising the management, maintenance, and utilization of DNA facilities and equipment in Nevada.
- Supervising the coordination of DNA Nevada Operations with the DOE/NV and all other participants.
- Providing safety engineer services for Nevada Operations.
- Participating in the review of stemming and containment studies for DOE panels.
- Providing test verification support in acquiring, maintaining, and fielding DNA's Test Verification Deployment System.

- Providing Contract Officer Technical Representatives to perform technical management duties as appropriate, to monitor contracts and contractor performance on a wide range of contracts in support of DNA activities in Nevada.
- Providing liaison to Headquarters DNA/FCDNA for visiting personnel to include transportation, housing, and conference area reservations at DOE/NV.
- Maintaining a liaison office to provide support services for official DoD and DOE/NV visitors.

These services included travel coordination, accommodation, briefings, and other miscellaneous requirements including support for DOE's general public tour program. Special tours of the NTS are also conducted for distinguished DoD visitors.

ENGINEERING DIVISION ■ The Engineering Division, located at Mercury, Nevada, is responsible for engineering and construction furnished by DNA and DoD contract agencies at the NTS. This division provides direct engineering and construction support to each test group staff and serves as the principal point of contact between the DoD participants, NTSO, and the DOE/NV architectural engineering and construction contractors. The division plans for and coordinates the allocation of assets for new and improved testing concepts and coordinates the design, fabrication, and installation of the LOS pipe systems and closures. The division also coordinates the work accomplished in support of DoD events by the US Army Corps of Engineers' Waterways Experiment Station and supervises reentry operations of DoD events executed in previous years. A test group engineer and a structural engineer from the Engineering Division staff are provided to the Test Group staff for each test.

TEST OPERATIONS DIVISION ■ The Test Operations Division provides administrative and logistic services for the DoD testing activities in Las Vegas and at the NTS, and supplies the TGD and Program Directors who administer the DoD nuclear tests. The Test Group Director is responsible for overall management of the assigned test, from conception of the test through the fielding, execution, and recovery phases, to the completion of final test reports. The Test Group Director monitors construction activities, reviews proposals submitted by experimenter agencies, manages DNA funds allocated to each event, supervises installation and checkout of experiments, manages security functions, and logistic requirements, coordinates and plans verification and non-proliferation support activities, arranges for logistic support, and directs those field operations not assigned to others.

Other responsibilities include:

- Planning for and managing resources and staff to develop, procure, maintain, and operate equipment and systems for the program.
- Providing administrative and logistical support, training programs, and safety support necessary to conduct verification operations.
- Coordinating verification planning and execution with other elements of DNA, the OSIA, the DOE, and the Department of State.
- Supervising the management, maintenance, and utilization of DNA verification systems.
- Performing contract technical manager duties as appropriate to monitor contracts and contractor performance in support of verification operations.
- Developing and revising long-range program goals, plans, and objectives to verify that the yield of nonstandard nuclear weapon tests do not exceed treaty limitations.

TECHNICAL COMPLIANCE DIVISION ■ The Technical Compliance Division evaluates the impact of federal and state regulations, DoD and DNA instructions and DOE Orders on the FCDNA mission. Responsibilities include, but are not limited to:

- Developing policy and guidance for implementation of environmental protection, safety and health, quality assurance, emergency preparedness, and training compliance programs.
- Monitoring FCNV and contractor operations at NTS to ensure implementation of established compliance policies.
- Reviewing test plans and identifying and responding to compliance programs.
- Advising and preparing compliance documents and reviews of compliance documents.
- Responding to audits and assessments of FCNV compliance programs.

TEST SCIENCE AND TECHNOLOGY OFFICE ■ The Test Science and Technology Division, located at Kirtland Air Force Base, New Mexico, formulates and executes the technical (scientific) experiment program for individual events of the DoD nuclear weapons reliability test program, prepares and reviews postevent reports, and provides technical directors for appointment to specific test events. The technical director for each event is responsible for formulation of all technical and scientific aspects of the event, and preparation of postevent reports. He coordinates closely with the Test Group Director on all technical aspects of the event.

TEST MANAGEMENT DIVISION ■ Management services provided by the Test Management Division, located at Kirtland Air Force Base, New Mexico, include the preparation of detailed cost estimates and schedules, and monthly status reports for each event. Additionally, this division prepares the master test schedule essential for coordination and control of the overall DoD nuclear weapons reliability test program.

21.2 ONGOING ACTIVITIES

No nuclear weapons reliability tests were conducted at the NTS during FY 1993, in compliance with the test moratorium. In July 1993, the original 10-month moratorium was extended another 15 months. In concert with this action, DNA operations at the test site were significantly reduced. Prime contractor manpower shrank from 537 to 100 with concomitant reductions in other contractors. During the months of October, November, December, and January, successful tunnel reentry and experiment recovery and analysis occurred for the HUNTERS TROPHY event. Deemed one of the most complex and ambitious DNA tests, HUNTERS TROPHY boasted a 97 percent data recovery rate.

A major reorganization of the DNA Nevada Operations offices occurred on 1 July 1993. The following changes were made:

- The Instrumentation Branch, formerly CEIE, was combined with its counterpart at Kirtland Air Force Base to form a new instrumentation group capable of supporting aboveground testing and underground testing operations.
- The Mechanical Systems Branch, formerly CEMS, was absorbed by the Technical Services Branch, leaving the engineering division with two branches, namely, Technical Services and Field Engineering. Duties remained the same.
- The Containment and Geotechnical Division was disestablished with all personnel placed in other divisions.

With the extension of the moratorium and cancellation of the MIGHTY UNCLE event, construction of the MIGHTY UNCLE testbed was stopped. Mining in the LOS drift was suspended at the end of stemming, and the bypass drift was halted at CS15 + 50. Rock bolting, shotcreting, and other finish preparations will be completed to preserve the tunnel for future use. Installation of the power systems in the RUPS alcove was complete. Additional tunnel stabilization work is in progress.

Construction support was also provided in support of the CHEMICAL KILOTON test event which used a mixture of ammonium nitrate and fuel oil blasting agent. This was the first test using this explosive in an underground facility at the NTS.

The Technical Compliance Division increased the scope of effort to include ES&H surveillance of DNA's radiation simulators and high explosive testing activities. Compliance with federal and local ES&H regulations by several facilities was documented for DNA management review and action. This effort also included identifying and developing required ES&H documentation to support these missions. The Technical Compliance Division's LLW application was accepted and DNA became the first approved LLW generator to dispose of waste on the NTS. Technical Compliance also began negotiations with the state of Nevada covering environmental remediation of DNA sites on NTS.

A major accomplishment in the Supply and Transportation Branch was the refurbishment of the warehouse which took over 600 man-hours. Over 12,000 ft² of warehouse floor was cleared, cleaned, painted, sealed, equipment inventoried, repackaged, new shelves constructed, 20 long tons of equipment relocated, plus excess property was turned in to DRMO, Nellis Air Force Base, including the old shelving (over one ton). This in-house project had a direct savings to DNA of over \$50,000.

Prior to its dissolution, major accomplishments for DNA Test Verification Operations Division during this period include five training exercises for deployment teams and one full-length remote deployment exercise for the Site Characterization Team. All exercises were conducted successfully and with the joint participation of the OSIA. Three Hydro-Plus systems have been completed in full deployment configuration, inventoried as such, and new equipment was deployed on FAM IV. The division provided one tunnel specialist to the PRILIV Coordinating Group that met in Moscow, Russia, and two representatives that participated in the familiarization trip to Novaya Zemlya, the northern Russian Test Site. The DNA Test Verification Operations Division was disbanded 1 July 1993 with personnel dispersed into other divisions. The DNA Hydro-Plus warehouse facilities and offices were also vacated and personnel and equipment relocated to other facilities and offices as a cost saving measure. Future verification missions will be coordinated by Test Operations with participation from all divisions within DNA.

With reduced weapons reliability test workload, DNA operations in Nevada have shifted in large measure to environmental remediation, and testing in support of moratorium and treaty verification.

Efforts to use NTS assets to destroy rocket motors, high-explosive components from nuclear warheads, as well as other munitions declared excess by various DoD and DOE agencies following DoD force reductions were discussed and shelved as the sponsors are pursuing other disposal techniques.

21.3 REPORTS

Formal reports generated by the Las Vegas DNA office were the Environmental Safety and Health Assessment of DNA Simulators, Environmental Assessment for Seismic Hardrock On-Site Source Test (SHIST), and the HUNTERS TROPHY Test Execution Report.

Distribution

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