DOE/IG--0285

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The Secretary of Energy
Washington, DC 20585

May 31, 1990

The Honorable John C. Layton
Inspector General
U.S. Department of Energy
1000 Independence Ave., S.W.
Washington, DC 20585

Dear Mr. Layton:

I have reviewed your report entitled "Drilling Operations at the Nevada Test Site." As a result, today I am tasking the Acting Assistant Secretary for Defense Programs to report to me with recommendations for corrective actions within 60 days. I will take appropriate actions promptly.

Thank you for your continuing efforts to ensure the Department's accountability.

Sincerely,

James D. Watkins
Admiral, U.S. Navy (Retired)

MASTER

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United States Government

Department of Energy

memorandum

DATE: May 29, 1990

REPLY TO
ATTN OF: IG-1

SUBJECT: INFORMATION: Report on "Drilling Operations at the Nevada Test Site"

TO: The Secretary

BACKGROUND:

This report is provided to inform you of the results of our review of the nuclear test hole drilling activity at the Nevada Test Site and to give you an opportunity to comment.

DISCUSSION:

The Nevada Operations Office (NV) is responsible for supporting the nuclear test programs of the Los Alamos and Lawrence Livermore National Laboratories. This support includes the drilling of test holes for nuclear device testing at the Nevada Test Site (NTS). The purpose of this audit was to assess the effectiveness of the Department of Energy's management of test hole inventories at the NTS.

Our audit disclosed that NV accumulated a large inventory of unused test holes and approved drilling additional holes for which neither laboratory (Los Alamos nor Livermore) had identified a need. The overdrilling of test holes occurred because NV did not comply with good inventory practices that would have had NV's approving official question the need for, and the timing of, the laboratories' drilling requests. Instead, NV gave perfunctory approval to the laboratories' work orders for drilling test holes, and emphasized keeping two drill rig crews busy and satisfying the laboratories' demands for dedicated drilling personnel.

Although NV did not agree that overdrilling had occurred, it has cut back its drilling activities and estimated that this will save about \$7.6 million annually. NV agreed with the recommendations in the report and has taken corrective actions.

John C. Layton
Inspector General

Attachment

cc: The Under Secretary
Assistant Secretary for Defense Programs
Manager, Nevada Operations Office
Controller, Office of Financial Management and Controller
Director, Audit Liaison Division

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL

DRILLING OPERATIONS AT THE NEVADA TEST SITE

Report No.: DOE/IG-0285
Date of Issue: May 29, 1990

Western Regional Office
Albuquerque, New Mexico

DRILLING OPERATIONS AT THE NEVADA TEST SITE

TABLE OF CONTENTS

	<u>Page</u>
Purpose and Scope of Audit	1
Background	1
Results of Audit	2
Recommendations	6
Management Reaction	7
Auditor Comments	9
NV's Inventory of 96-inch Diameter Holes ..	Exhibit A
NV 96-inch Diameter Test Holes Drilled and Planned Use	Exhibit B

OFFICE OF INSPECTOR GENERAL
WESTERN REGIONAL OFFICE
ALBUQUERQUE, NEW MEXICO 87115

DRILLING OPERATIONS AT THE NEVADA TEST SITE

Audit Report Number: DOE/IG-0285

PURPOSE AND SCOPE OF AUDIT

The audit assessed the effectiveness of the Department of Energy's (Department) management of nuclear test hole inventories at the Nevada Test Site (NTS).

Our review focused on the Nevada Operations Office's (NV) Fiscal Year (FY) 1987 and 1988 test hole drilling programs. We reviewed Department and NV policies, practices, and procedures for coordinating and managing NTS drilling operations. We examined the basis for the number of test holes required; reviewed evaluations of drilling operations by NV, Reynolds Electrical and Engineering Company (REECo), and others; inspected NTS drilling sites and support operations; interviewed Department and contractor program officials; and reviewed contractor records of test hole drilling histories and the status of the FY 1987 and 1988 inventory. We also reviewed test event plans through FY 1991.

We followed generally accepted Government auditing standards for performance audits, included tests of internal controls, and reviewed their compliance with laws and regulations as necessary to satisfy the audit objective. Since our review was limited, it would not necessarily have disclosed all material weaknesses. However, our findings relating to the management of the NTS drilling program showed internal control weaknesses which NV should consider when preparing its yearend assurance memorandum on internal control.

The firm of ADC, Ltd. participated with the Department's Office of Inspector General in conducting the audit. We discussed our findings with NV officials during an exit conference on March 16, 1990.

BACKGROUND

The NV Weapons Test Program supports the nuclear test programs of the Los Alamos National Laboratory (Los Alamos) and the Lawrence Livermore National Laboratory (Livermore). Since

May 1957, this support included drilling test, exploratory, and post-shot holes at NTS's Yucca Flat or Pahute Mesa locations. Depending on the expected kiloton yield, test hole diameter and depth of each hole varied depending on test requirements. Hole sizes ranged from 52 to 120 inches in diameter and from 826 to 2,250 feet in depth. Laboratories frequently requested 96-inch holes with depths averaging about 2,100 feet at Pahute Mesa and about 1,500 feet at Yucca Flat. This standard was usually used when NV drilled test holes for inventory purposes.

Several schedules governed drilling activities. Los Alamos and Livermore developed their own time cycle schedule for each nuclear test event. These laboratories' schedules identified the activities, including drilling the test hole, required to meet the test date and gave the approximate starting time for each activity. NV had a generic event schedule covering a 13-month preparation period. This schedule allowed about 45 days for drilling the test hole, with a start date of about 9.5 months before the actual detonation. While the generic schedule was generally applicable, the lead-time for some tests was as long as 24 months.

During the audit period, FYs 1987 and 1988, funding for the NTS drilling program was about \$64.9 million. From this funding, NV spent about \$38 million for 26 test holes and the remainder for other drilling activities such as drilling exploratory and post-shot holes, and tunnels.

As of February 1988, REECO's NTS drilling resources consisted of about 150 employees and 24 drill rigs. Of the 24 drill rigs, only four were capable of drilling deep, large-diameter test holes at either Pahute Mesa or Yucca Flat. REECO assigned two of these drill rigs and a dedicated drill rig crew to each laboratory. Drilling was done 24 hours a day by drill rig crews consisting of 24 persons, divided into 3 shifts, working 5 days a week.

RESULTS OF AUDIT

To avoid unnecessary expenditures, sound business principles require that NV drill nuclear test holes only when needed, that it use holes in inventory, to the extent possible, before drilling more holes, and that it closely time the drilling of any additional holes to the (1) scheduled test event or (2) principle of maintaining the smallest practical inventory of test holes. NV accumulated a large inventory of unused test holes and approved drilling additional holes for which neither laboratory (Los Alamos nor Livermore) had identified a need. The overdrilling of test holes occurred because NV did not comply

with good inventory practices that would have questioned the need for, and the timing of, the laboratories' drilling requests. NV routinely approved laboratory work orders for drilling test holes, and emphasized keeping two drill rig crews busy by satisfying the laboratories' demands for dedicated drilling personnel. By changing its drilling practices and reducing its drilling program NV could save at least \$7.6 million annually. If uneconomical drilling practices are continued, the Government will incur contractor's costs which are unreasonable.

Inventory Management Principles

The Department had not issued guidance directly addressing test hole inventories. However, the principles underlying the Department's Property Management Regulations (PMR) provided a guideline for managing inventories such as test holes. For example, PMR 109-27.50 stated that:

Necessary inventories shall be established and maintained at reasonable levels, consistent with program requirements. They shall be managed and controlled in the most practicable and economical manner consistent with program needs and the following objectives (emphasis added):

- o Maintain adequate quantity controls for effective management of overall inventories, including those not under financial controls.
- o Provide materials and supplies as needed to meet requirements.
- o Maintain reasonable inventory levels.
- o Ensure maximum efficient use and avoid waste.
- o Maintain an economical operation.

As incorporated into sound business principles, PMR requirements would link test hole drilling requests to short-term needs, to available inventory, and to precise specifications. Such linkages would have helped NV avoid accumulating a large test hole inventory that was expensive to drill and finance and that may have become unfit for use through deterioration and/or obsolescence.

Excessive and Premature Drilling

NV did not apply sound business principles for test hole drilling. Instead, NV drilled holes that exceeded established needs and that were completed far in advance of the time needed. For example, at the beginning of FY 1987, NV's inventory of test holes included 30 96-inch diameter holes. NV records and officials could not document the original intended purpose of these 30 holes, almost half of which were over 18 months old. The depth of the holes varied from 841 to 2,250 feet. (See Exhibit A for details.)

As of September 30, 1988, 21 of the holes still had no designated use. The remaining 9 were designated as primary or backup holes for use in tests planned for FYs 1989 and 1990.

Despite the large number of test holes in its beginning FY 1987 inventory, NV approved work requests for drilling 20 more 96-inch holes in FYs 1987 and 1988. At least 12 of the additional holes were drilled two or more years in advance of need, while 6 had no specific planned use. (See Exhibit B.)

Excessive and premature drilling also occurred with other size test holes, but to a lesser extent. Over 50 percent of the other size holes in the FY 1987 inventory were more than 18 months old. Further, 2 new holes drilled in FY 1987 were not scheduled for use until 1990, according to the laboratories' FY 1987 and 1988 drilling records.

As late as April 1988, NV was planning a high level of drilling support even though its total test hole inventory could meet most test requirements for FY 1989. NV's drilling program budget requests for FY 1989 through 1991 provided for dedicated rig crews for each laboratory. Although subject to change, preliminary nuclear test plans for FY 1989 showed the need for only 2 new test holes. In addition, NV's projected test hole inventory through FY 1991 showed only a slight decrease from the FY 1988 inventory. These plans indicated a continued high level of drilling activity.

NV did not agree that any excess emplacement holes were drilled. They contended that every test hole of a specific diameter could not meet the need for all planned test events requiring that size hole. In addition, program changes over a 2-or 3-year period may also cause a small, though unpredictable, increase in inventory.

NV's Oversight of the Test Hole Drilling Program

The Department's PMR (109-27.50) and NV's standard operating procedures for engineering, construction, and support services (NTS-SOP-6001) provided NV the basis for economically managing the test hole inventory as part of the drilling program. The PMRs required setting test hole inventories at reasonable levels, ensuring maximum resource use, avoiding waste, and managing and controlling necessary inventories. Under NTS-SOP-6001, NV had to approve all test hole work orders before drilling could begin and notify the laboratories of its approval or disapproval of drilling requests. NV could also have supplemented these Department guidelines with the laboratories' test event schedules which provided additional guidance on when to begin drilling holes for nuclear tests.

Rather than applying the principles underlying the PMR to its test hole drilling program, NV allowed the laboratories to control their own drilling operations as long as these activities did not exceed approved funding levels. NV did not question the drilling requests and made little or no attempt to determine the most economical way to meet test hole needs. This perfunctory approval process was further weakened by the absence of any requirement in NTS-SOP-6001 that NV perform an independent assessment of test hole need. Keeping drill rig crews busy became the important element in the drilling program.

In our opinion, the large number of test holes held in inventory also resulted from NV's practice of segregating the nuclear test programs of each laboratory. Thus, NV allowed REECo to not only assign drill rig crews dedicated to each laboratory but also drilled the test holes for the exclusive use of the requesting laboratory. Although NV officials said the laboratories occasionally shared test holes and drilling resources, NV made little attempt to pool the drilling equipment, drill rig crews, or test hole inventory to maximize their use and to operate the test program economically.

Future Savings

Better NV management and control procedures over the NTS drilling program could save the Department millions of dollars per year. In response to our Draft Report, NV stated that they had reduced their drilling operation from two 5-day drilling crews to one 7-day drilling crew. We were advised that this action will save the Department \$5.7 million in FY 1990 and \$7.6 million annually thereafter.

Conclusions

NV's practice of approving test hole work orders without considering the number of holes required to meet test requirements did not conform to the inventory management principles contained in the PMR or to the laboratories' event time cycle schedules. NV's lack of formal written criteria defining an optimum inventory level of test holes, the absence of a requirement for an independent assessment of need in NV's operating procedures, and the laboratories' insistence on separate support activities also contributed to an excessive test hole inventory. In our opinion, these practices detract from NV management's ability to follow sound business principles in its drilling program and to conduct the nuclear test program as economically as possible. Although many factors could affect future testing requirements, we believe that drilling holes to maintain inventory at a high level is risky because these holes may not match future needs and, thus, may become obsolete.

RECOMMENDATIONS

To the Manager, Nevada Operations Office:

1. Require that existing test holes be used, to the maximum extent practicable, before drilling additional holes for planned events.
2. Require that the laboratories jointly share the existing inventory of test holes and drilling resources when technical, logistic, and programmatic constraints allow.
3. Establish a criteria to limit the number of test holes in inventory for which no specific test event requirement exists.
4. Limit the drilling of test holes for specific events (to the extent practicable) to the time allowed in the event time cycle. If test holes are needed for inventory, limit the number drilled to the criteria established under recommendation 3.
5. Direct that future NTS drilling program budgets be based on the implementation of recommendations 1, 2, 3 and 4.

MANAGEMENT REACTION

NV did not agree that overdrilling had occurred. Subsequent to our fieldwork, NV provided some rationale for test holes drilled during FYs 1987 and 1988. However, our review of that rationale showed that the holes were for backup or stockpile. NV has agreed with our recommendations and has taken the following corrective actions.

Recommendation 1

NV implemented a general policy of using existing test holes before drilling additional test holes, consistent with the need for maintaining an emplacement hole inventory. Accordingly, NV has initiated the following interrelated actions:

- o Established a written policy to ensure that emplacement holes in inventory are used to the maximum extent practical before drilling additional similar holes.
- o Developed a Standard Operating Procedure (SOP) requiring justification of each emplacement hole when submitting drilling criteria; this will include reviewing the hole inventory to ensure that no suitable hole is available.

Recommendation 2

While the Laboratories have shared hole inventories in the past and will continue to do so, there are legitimate reasons for maintaining some separate hole resources. In cases where programmatic needs do not conflict, however, NV will require that the Laboratories share the existing inventory. In response to the OIG's recommendation, NV has initiated the following actions:

- o Formalized the requirement for joint sharing of "excess" inventory holes in the NTS SOP, and required an annual drilling needs request from each Laboratory;
- o Developed drilling plans for each Laboratory in sufficient detail to allow REEC0 to develop annual manpower plans for support of the anticipated drilling program; and
- o Required that REEC0 annually justify drilling manpower to ensure that adequate personnel will be available, but only to the level necessary to complete the program.

Recommendation 3

NV will continue to inventory some emplacement holes because of test plan changes or other extenuating circumstances. These inventoried holes may be perfectly acceptable for an event requiring less stringent design. In response to the recommendation, NV has initiated the following actions:

- o Established criteria consistent with Property Management Regulations (PMR 109-27.50) detailing the number and type of emplacement holes to be maintained in inventory;
- o Established formal criteria calling for test schedules for the ensuing 18 to 24 months and providing inventory limitations approximately as follows:
 - (a) One hole of the correct size and depth for each planned event.
 - (b) One backup hole of suitably completed dimensions for each deep test scheduled within the next 12 months.
 - (c) One backup hole of suitably completed dimensions for each two intermediate or shallow tests scheduled within the next 12 months.

This proposed inventory level will reasonably ensure that emplacement holes would be available to meet program needs. The inventory also provides flexibility to accommodate program direction changes; short time frame, one-point safety tests; and special projects (such as the recent unscheduled Joint Verification Experiment) without drastically affecting the scheduled test program. NV believes that variables, such as program direction changes and hardware and device design problems, when considered with the commitment to have test holes available when needed, sufficiently justify maintaining this level of inventory.

Recommendation 4

NV agreed that it would try to match test hole drilling schedules to event time cycles where practicable. NV also stated that any inventory holes drilled would be consistent with the criteria established under Recommendation 3.

Recommendation 5

NV said that future NTS drilling program budgets will continue to be based on programmatic needs. NV will also ensure careful consideration of inventory criteria and any other actions taken in response to the first four recommendations when developing drilling program budgets.

AUDITOR COMMENTS

NV's actions are responsive to our recommendations and will improve its oversight of the test hole drilling program. As mentioned earlier, NV has reduced the number of drill rig crews. However, NV's intention to develop a reasonable inventory of test holes -- one backup hole for every deep test and one backup hole for every two test holes at shallow depth -- continues to raise questions about the inventory level. The rationale for this quantity of backup holes remains unclear.

Office of Inspector General

EXHIBIT ANV's Inventory of 96-inch Diameter Holes
(As of October 1, 1986)

<u>Test Hole Number</u>	<u>Date Drilled</u>	<u>Depth (feet)</u>	<u>Age of Holes (months)</u>
9CT	06/11/81	1,710	63
10BH	05/10/82	925	52
9CV	05/25/82	1,426	51
2EY	09/27/82	826	48
2FG	12/13/82	1,604	45
4AN	01/20/83	1,592	44
1D	04/12/83	1,500	41
4AP	07/07/83	1,043	38
1E	07/07/83	1,200	38
4AQ	07/09/83	914	38
2EZ	11/23/83	1,297	34
2FH	02/10/84	1,397	31
2GC	04/23/84	1,204	29
2GD	10/12/84	841	24
4S	03/05/85	2,000	18
7BK	05/10/85	1,235	16
4T	06/11/85	2,020	14
20AP	09/10/85	2,140	12
7CA	11/14/85	1,800	10
3MG	11/27/85	1,500	10
3MI	01/24/86	1,200	8
7CB	02/21/86	1,850	7
3MH	03/20/86	1,500	6
20AS	04/16/86	2,100	5
2CTF	05/13/86	1,500	4
3MK	05/20/86	1,500	4
3LP	06/12/86	1,350	3
20AV	07/28/86	2,100	2
19AQ	08/27/86	2,250	1
3LL	09/09/86	1,300	1

EXHIBIT BNV 96-inch Diameter Test Holes Drilled and Planned UseFY 1987

<u>Test Hole Number</u>	<u>Date Drilled</u>	<u>Depth (feet)</u>	<u>Planned Use</u>	<u>Time from Drilling to Planned Use (months)</u>
3ML	12/23/86	1,200	After FY 1990	45+
2CU	02/06/87	1,515	After FY 1990	45+
4U *	02/24/87	2,100	FY 1989	19-31
2GE	02/28/87	1,920	FY 1988	7-19
3MF*	03/03/87	2,100	FY 1987	7
3MN	03/11/87	900	FY 1988	13
2GF	03/19/87	1,810	FY 1988	6-18
2CVF	04/03/87	1,340	After FY 1990	42+
4AG	04/09/87	1,481	After FY 1990	42+
4AT	04/16/87	1,521	FY 1989	17-29
19AU	06/04/87	2,250	FY 1988	16-28
20AY	06/17/87	2,100	FY 1988	15-27
19AX	08/03/87	2,250	FY 1988	13-25
4AU	09/23/87	1,750	FY 1988	12

FY 1988

19AY	11/20/87	2,250	FY 1989	10-22
7CC	01/12/88	1,600	FY 1989	9-21
2GG	01/25/88	1,821	FY 1989	8-20
20BC	06/03/88	2,000	FY 1990	16-28
2GH	07/31/88	1,801	After FY 1990	26+
2GI	08/14/88	1,373	After FY 1990	25+

- * NV officials stated that 74" liners had been placed in these two holes, and they could not be used as 96" test holes.

END

DATE FILMED

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