U.S. Department of

ENERGY

Nuclear Test Readiness

Report to Congress

May 2011

United States Department of Energy
Washington, DC 20585

Message from the Secretary

This report is submitted in response to section 3112 amended section 4208 of the Atomic Energy Defense Act for Fiscal Year 2008 (Pub. L. No. 110-181), which provides that "the Secretary of Energy shall submit to the congressional defense committees a report on the nuclear test readiness of the United States."

Pursuant to statutory requirements, this report is being provided to the following Members of Congress:

- **The Honorable Daniel K. Inouye**
  Chairman, Senate Committee on Appropriations

- **The Honorable Thad Cochran**
  Ranking Member, Senate Committee on Appropriations

- **The Honorable Dianne Feinstein**
  Chairman, Senate Subcommittee on Energy and Water Development, Committee on Appropriations

- **The Honorable Lamar Alexander**
  Ranking Member, Senate Subcommittee on Energy and Water Development, Committee on Appropriations

- **The Honorable Carl Levin**
  Chairman, Senate Committee on Armed Services

- **The Honorable John McCain**
  Ranking Member, Senate Committee on Armed Services

- **The Honorable Harold Rogers**
  Chairman, House Committee on Appropriations

- **The Honorable Norm Dicks**
  Ranking Member, House Committee on Appropriations

- **The Honorable Rodney Frelinghuysen**
  Chairman, House Subcommittee on Energy and Water Development, Committee on Appropriations

- **The Honorable Peter J. Visclosky**
  Ranking Member, House Subcommittee on Energy and Water Development, Committee on Appropriations

- **The Honorable Howard McKeon**
  Chairman, House Committee on Armed Services

- **The Honorable Adam Smith**
  Ranking Member, House Committee on Armed Services

- **The Honorable Mike Turner**
  Chairman, House Subcommittee on Strategic Forces, Committee on Armed Services

- **The Honorable Loretta Sanchez**
  Ranking Member, House Subcommittee on Strategic Forces, Committee on Armed Services

- **The Honorable Ben Nelson**
  Chairman, Senate Subcommittee on Strategic Forces, Committee on Armed Services

- **The Honorable Jeff Sessions**
  Ranking Member, Senate Subcommittee on Strategic Forces, Committee on Armed Services

If you have any questions or need additional information, please contact me or Jeff Lane, Assistant Secretary for Congressional and Intergovernmental Affairs, at (202) 586-5450.

Sincerely,

Steven Chu

Executive Summary

This report is submitted in response to section 3112 of the National Defense Authorization Act for Fiscal Year 2008 (Pub. L. No. 110-181), which provides that, "Not later than March 1, 2009, and every odd-numbered year thereafter, the Secretary of Energy shall submit to the congressional defense committees a report on the nuclear test readiness of the United States."

The Department of Energy (DOE) is required by Presidential Decision Directive (PDD-15, "Stockpile Stewardship") to maintain the capability to conduct an underground nuclear test within 24 to 36 months of direction by the President to do so. Achievement of any readiness response time is dependent on the specific details of the hypothetical nuclear test but more importantly on the manner in which it is to be conducted. Compliance with domestic laws and regulations relating to worker and public safety and the environment, as well as international treaties to which the United States is a party, could affect the desired schedule for execution of a nuclear test. Indeed, many of the regulations in place today did not exist at the time the last test was conducted, or were not applied to nuclear test execution. Consequently, there is little or no baseline for the activities required for "full compliance" with all current Federal, state and local regulations.

Funding for test readiness peaked in FY 2006. Subsequent cuts led to a general reduction in work specific to nuclear test readiness, resulting in some decline in readiness capabilities. Since FY 2010, there has been no funding specific to nuclear test readiness as a separate program. At present, all test readiness is supported either by funding under Readiness in Technical Base and Facilities (RTBF), or by the research and development conducted at the Nevada National Security Site (NNSS) and the national laboratories under the Science Campaigns and Directed Stockpile Work (DSW).

In response to the need for clarity on U.S. posture on test readiness, a special task force was convened by the United States Strategic Command, Strategic Advisory Group (SAG). Relative to the assessment of test readiness status, this group, which included the directors of all three National Nuclear Security Administration (NNSA) national laboratories, concluded that assessments of readiness should be made on a technical basis while assuming that a test would be conducted only when the President has declared a national emergency or other similar contingency and after any necessary waiver of applicable statutory and regulatory restrictions (e.g., relating to health, safety, and the environment). Furthermore, they assumed that additional funding would be available as necessary to achieve the technical ends. The validity of these assumptions was critical to the conclusions of the review.

On this basis, the group concluded that while a fully instrumented test to address a complex stockpile problem would take 24 to 36 months, and tests required for development of a new capability might take up to 60 months, in the supreme national interest and utilizing requirement waivers and simplified processes as stated above, a very simple test for political purposes could be conducted in as little as 6-10 months (noting that the Threshold Test Ban

Treaty requires a 200-day notification of a test).

NUCLEAR TEST READINESS

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Appendices

I. Legislative Language

This report is the seventh in a series of reports submitted to the Congress concerning the nuclear test readiness posture maintained by the DOE/NNSA. Prior reports were issued in 1998, 2001, 2003, 2005, 2007, and 2009. This report responds to section 3112, "Nuclear Test Readiness," of the National Defense Authorization Act for Fiscal Year 2008 (Pub. L. No. 110-181), which amended section 4208 of the Atomic Energy Defense Act (50 U.S.C. 2528) to require that:

... *"the Secretary of Energy shall submit to the congressional defense committees a report on the nuclear test readiness of the United States."*

Furthermore, section 4208 requires that this report is to contain the following information:

(1) An estimate of the period of time that would be necessary for the Secretary of Energy to conduct an underground test of a nuclear weapon once directed by the President to conduct such a test.

(2) A description of the level of test readiness that the Secretary of Energy, in consultation with the Secretary of Defense, determines to be appropriate.

(3) A list and description of the workforce skills and capabilities that are essential to carrying out an underground nuclear test at the Nevada Test Site.

(4) A list and description of the infrastructure and physical plant that are essential to carrying out an underground nuclear test at the Nevada Test Site.

(5) An assessment of the readiness status of the skills and capabilities described in (3) and the infrastructure and physical plant described in (4).

In accordance with the above-cited legislation, this report, with its appendices, describes the Department's approach to maintaining nuclear test readiness; the status of and the issues related to several test readiness postures; and the status of required equipment, facilities and personnel to conduct such tests.

II. The NNSA Approach to Test Readiness

The United States continues to observe the nuclear test moratorium established in 1992. The NNSA has maintained readiness to conduct an underground nuclear test if required to ensure the safety and reliability of the stockpile, or if otherwise directed by the President for defense policy reasons. The DOE/NNSA has maintained a 24- to 36-month nuclear test readiness posture (response time) pursuant to Presidential Decision Directive 15 (1993) during a period when readiness to test was funded as an active program. The NNSA evaluation of test readiness response time has changed over the years. There have also been changes to the fundamental approach taken to achieve test readiness.

Under NNSA policy, for a given test readiness posture, a single underground nuclear test would be conducted within the specified period. In establishing its posture for test readiness, the NNSA previously focused principally on a scenario that a test will be needed to resolve a technical problem discovered in the stockpile. Such a test would have to be highly diagnosed, and would fulfill all the same requirements that were in place in 1993. Aside from the uncertainty of these assumptions, it is possible that only one test may be needed to address and resolve a performance or safety issue with a U.S. nuclear weapon, but it is more likely that series of tests would be needed to isolate and resolve a specific problem. It is expected that these additional tests would be completed in a relatively short time span (one to two years). The NNSA does not currently have, nor does it have plans to acquire, the capability to resume a continuous, open-ended nuclear test program such as that conducted by the Department prior to the 1992 moratorium. It has also become increasingly clear over the past five years that this scenario is unlikely and it is unrealistic to maintain such conditions in order to conduct a test if called upon to do so by the President. Some tests employing simple scenarios with minimal diagnostics could be conducted in much shorter times. In contrast, some types of tests could not be conducted in less than 36 months from inception even prior to the test moratorium.

The NNSA strategy to remain ready for nuclear testing has been to maintain the sites, facilities, equipment, and skilled personnel needed for nuclear testing primarily through their use in the ongoing Stockpile Stewardship Program (SSP). The ability to conduct nuclear tests draws on the broad range of skills and capabilities at the Nevada Nuclear Security Site (NNSS) and at NNSA's national laboratories. Nuclear test readiness presumes the continuation of a robust SSP, including dynamic plutonium experiments (e.g., subcritical experiments), other high explosive-driven experiments, and high energy density experiments conducted with laser and pulsed-power machines. These activities are important to maintaining competency in a number of operational capabilities (e.g., underground operations and mining) and scientific equities (e.g., diagnostic development and deployment).

There are also a number of technologies unique to underground tests that are not exercised by stockpile stewardship. These are discussed in detail in the 2009 version of this report. Since that time, the equipment unique to test readiness has, for the most part, remained in storage with only minimal resources devoted to maintenance. The number of key personnel available for execution of an underground test has continued to decline as the staff who conducted tests retire. There is no funded program in place at this time to train replacements for these key positions, nor is there any way of completely evaluating their competence once trained. This situation cannot be avoided, but personnel can learn much of the operational readiness required for safely conducting nuclear operations at NNSS through the ongoing stockpile stewardship experimental activities.

Of the experimental activities relevant to nuclear test readiness, subcritical experiments most closely resemble nuclear tests in their operational aspects. They are conducted underground, utilize special nuclear material and high explosives in a dynamic environment, employ complex high-speed measurement, and require large coordinated teams of specialized technical personnel, including staff from the national laboratories, who exercise core competencies similar to those required for the conduct of an underground nuclear test. Twenty-six subcritical experiments have been conducted since 1997. In addition to test readiness benefits, subcritical experiments have provided important data on the dynamic behavior of plutonium that enhance our ability to evaluate the safety and reliability of the stockpile.

Currently, NNSA is planning to evaluate the benefit of performing "scaled" subcritical experiments at NNSA. These plutonium experiments are in convergent geometries designed to reach very high pressures approaching those of a weapon primary. The skills required to manufacture, assemble and field scaled experiments are similar in many ways to those required to build and field a nuclear test, but they are subcritical; hence, there is zero nuclear yield.

These and other stewardship experiments at the national laboratories, such as the complementary hydrodynamic experiments conducted at the Dual Axis Radiographic Hydrodynamic Test Facility using surrogates, help to maintain the up-to-date skills of the scientists, engineers, technicians, and operational personnel that would be needed if a nuclear test were required in the future. However, the primary goal of hydrodynamic and subcritical experiments is to provide data essential to stockpile stewardship and the benefit to test readiness is secondary. Additionally, efforts to plan and prepare life extension programs for major weapons systems and the conduct of production, maintenance and surveillance operations at the NNSA production plants have been important for maintaining the skills and facilities for handling and modifying a nuclear device for testing, if needed.

Any capability required for a nuclear test that is not utilized in other program work and that could not be reconstituted and implemented within the readiness response time window must also be maintained. Since the early 1990s, some facilities and equipment unique to underground nuclear testing (e.g., cranes, trailers, crew facilities at NNSS, roads, utilities, etc.) have not been maintained, based on the expectation they could be reconstituted within the mandated time window for test resumption.

With respect to personnel, there is, in addition to the training program for current staff, the expectation of having access to active and retired personnel with underground nuclear test-specific technical skills and expertise, should the need arise. However, this pool of experienced personnel is rapidly diminishing. Over the past decade, a program of exercises has been

conducted, sometimes in conjunction with non-nuclear experiments, in an effort to refresh expertise in some of the nuclear test-unique areas.

In addition, though not exclusively for nuclear test readiness, there are activities to maintain the physical infrastructure and experimental support facilities at the NNSS and North Las Vegas. These include the Device Assembly Facility, various equipment storage and staging sites, roads, power, communications, management, security, logistical support, and environmental, health and safety personnel, equipment and facilities. These would be important assets if a nuclear test must ever again be conducted.

The Nuclear Posture Review released in April 2010 reaffirmed and strengthened the commitment to maintaining the U.S. nuclear deterrent capability without nuclear testing. This clear policy statement makes it plain that the United States does not plan to ever return to nuclear testing, unless an unforeseen critical technical issue with the enduring stockpile is discovered. The only remaining purpose for test readiness remains response to another nation engaging in testing—to demonstrate that the U.S. deterrent capability is still effective. This scenario is among those considered in the table prepared by the SAG Special Task Force (see Appendix A).

III. Capability to Respond in 24 to 36 Months

As indicated above, in accordance with PDD-15, the NNSA is required to maintain a nuclear test readiness posture in which an underground test could be conducted within 24 to 36 months of a direction from the President. A complex test[1] might take 36 months to field and conduct, while a simpler test might be possible in a 24-month or shorter time interval.

In the years soon after nuclear testing ceased in 1992, test-skilled personnel, facilities and equipment were still in place and active, so confidence in asserting a 24- to 36-month test readiness posture was high. Subsequently, several reviews were conducted to evaluate the 24- to 36-month test readiness posture. These are cited and discussed in the 2003 edition of this report. From these reviews, it was concluded that, because of a loss of expertise (through personnel attrition) and degradation of some specific capabilities, the United States would more likely require 36 months to test, with less confidence in being able to achieve a 24-month response time, even for a test that was technically relatively simple. It was believed that as time passed, the 36-month posture would be increasingly difficult to achieve. Also of significance was the premise that test-experienced personnel, who had retired or moved to other fields, would be available for recall if required. While this was a reasonable planning basis a decade ago, the pool of available test-qualified personnel has been diminishing and, if a return to testing were required, would need to be replenished by hiring and training new personnel, preferably through other SSP activities.

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[1] A "complex test" is a fully-diagnosed test which fulfills all of the technical requirements of a pre-1993 test.

Beginning in 2003, the NNSA began to address the issues identified above with funds provided by Congress. For example, the NNSA made efforts to update test plans and procedures, including work to bring safety analyses up-to-date to meet new safety standards. Neutron generators that would be needed for nuclear testing were fabricated to replace those old units whose shelf lives had expired. Significant work was done to restore and update important diagnostic instrumentation and renew the skills of the scientists and technicians needed to use them.

In July 2006, the NNSA conducted the Unicorn subcritical experiment. Like previous subcritical experiments, Unicorn helped renew important nuclear test-related skills. However, this particular subcritical experiment was the first one conducted in a vertical geometry, more comparable to the emplacement of a nuclear test. In addition, many issues came to light and important lessons were learned from this experiment that would be valuable in the event a nuclear test were necessary someday. This work allowed the NNSA, by FY 2006, to regain a solid 24-month readiness capability, and a potentially shorter response time for a technically simpler test.

Since FY 2006, test readiness funding has decreased significantly. As of FY 2011, test readiness is no longer funded as a separate program and all test readiness-related activities are funded either under the Readiness in Technical Base Facilities (RTBF) Program or supported by the programmatic work conducted under Directed Stockpile Work (DSW) or the Science Campaign. Many activities that were implemented over the past decade purely for the sake of test readiness have been eliminated.

NNSA continues to identify the funding required to implement appropriate infrastructure closure processes and make strategic decisions to integrate activities supporting test readiness into the overall SSP at NNSS.

IV. Capability to Respond in 6 to 10 Months

Nuclear test readiness policy has consistently been based on readiness to respond to a technical problem with a stockpile weapon. The SAG Special Task Force, which included all three NNSA national laboratory directors, concluded in March 2010 that a very limited test to signal the readiness of the U.S. nuclear deterrent or respond to another nation's test, could be conducted in 6 to 10 months, but such a test is not a component of stockpile stewardship.

Historically, when the United States was engaged in a sustained nuclear testing program, it would normally take about 18 months to develop and field a nuclear test to obtain technical data. In many cases, particularly when a test had complex technical objectives, the time from test conception to execution could be much longer than 18 months. A test could be fielded in a shorter time interval only by interrupting and modifying a test already in process to fit a new set of technical objectives.

A test readiness posture as short as 6 months is substantially different in nature from an 18-month or 36-month test readiness posture. A 6-month test readiness posture would be most relevant if the President directed testing to resume for policy reasons, as President Kennedy did in 1961.

V. Personnel, Facility and Equipment Assets

In addition to requesting the above update on nuclear test readiness, section 3112 of the National Defense Authorization Act for Fiscal Year 2008 also requires information on specific nuclear test resources. This information is provided in Appendix B, which is a summary of nuclear test readiness resources, including key and critical personnel, facilities and equipment.

VI. Conclusion

While the essential requirements for readiness to test can be met in accordance with PDD-15, a number of elements on the critical path timeline to conduct a weapons physics test have eroded in the ensuing two decades. However, the capabilities of the SSP have improved significantly in the same time period.

Test readiness is no longer considered the backbone of stockpile stewardship. Recognizing the limited resources available for test readiness, a reduced set of capabilities is now considered in this analysis. In particular, the current assessment of test readiness assumes limited diagnostics. Most significantly, from the perspective of test readiness measured in months, the estimates of "readiness" have stabilized or even improved since 2009. This is not due to any actual improvement in the status of test readiness equipment or preparation. The current status differs from previous years due to a change in the underlying assumptions of the analysis; a return to testing by the United States is a low probability event which would only occur following a presidential decree of a national emergency. Hence, such a test would likely be conducted under waivers of most of the Federal laws, rules and regulations, compliance with which could affect the desired schedule. This analysis now assumes these waivers are in place when making estimates of "readiness." Test readiness capability is, therefore, determined solely on the basis of technical ability and not statutory and regulatory compliance.

Appendices

Appendix A

NUCLEAR TEST READINESS

Technological Aspects of Test Readiness Given Current State of Stockpile Stewardship

Reason for a Test	Complexity of the Test	Relative Contribution to a Solution*	Time to Conduct **(Technical Aspects)
Demonstrations (Single Test)			
Response to another nation's test	L		6 – 10 Months
Signal resolve	L		6 – 10 Months
Experiments			
New Military Characteristics	L to H	L to H	36 – 60 Months
SSP Confirmation	M to H	M	24 – 36 Months
Resolve Stockpile Problem	M to H	L	24 – 36 Months
Adversary Actions			
Technical Surprise	M to H	M	24 – 36 Months
Render Safe	M	M	24 – 36 Months
Effects/Survivability			
Effects	H	L	24 – 36 Months
Survivability	H	L	24 – 36 Months

L – Low, M – Medium, H – High *** Compared to SSP** **** Assuming waivers as needed**

Appendix B

NUCLEAR TEST READINESS

Nevada National Security Site Nuclear Test-Related Key and Critical Personnel and Physical Assets for FY 2011

This appendix presents a summary of the personnel and other resources necessary to conduct an underground nuclear test (UGT) at the Nevada Nuclear Security Site (NNSS). This appendix is based on prior years' data with some 2011 revisions.

1.0 UGT Personnel

Personnel data in this section covers the inventory of all Nuclear Test Organization (NTO) personnel and their individual skill sets that are available in the current NTO workforce for resumption of a UGT. In the case of National Security Technologies (NSTec), its UGT personnel database also contains the employees' skills sets.

1.1. NTO UGT Personnel

NSTec maintains and tracks NTO UGT key and critical position requirements and personnel assignments as provided by NTO member organizations. The last formal review[1] of the NTO UGT key and critical position requirements, completed in August 2006, concluded that there are 411 NTO (multi-organization) position requirements for the resumption of a UGT. Table 1 provides the details of the key and critical position requirements by NTO member.

The first column lists the following NTO organizations: ARL/SORD: Air Resources Laboratory, Special Operations and Research Division; NSTec; NNSA/Nevada Site Office (NSO); Desert Research Institute (DRI); Los Alamos National Laboratory (LANL); Lawrence Livermore National Laboratory (LLNL); Sandia National Laboratories (SNL); and Wackenhut Services Incorporated (WSI). Of the 411 total NTO key and critical position requirements, 59 position requirements have no personnel assigned. Each NTO member continues to assign experienced personnel to more than one position requirement. The 59 vacancies consisted of 5 key position requirements and 54 critical position requirements (see Table 2). The LANL vacancies shown in Table 2 resulted from the fact that the personnel assigned to these positions no longer appear in the LANL personnel directory. The NSTec vacancies are discussed in Section 1.2.

[1] Test readiness funding shortages for all test readiness activities have curtailed a number of activities including keeping related databases current.

Table 1 – NTO Key and Critical Position Requirements

NTO Organization	Key Position Requirements	Critical Position Requirements	Total
ARL/SORD	3	7	10
NSTec	14	167	181
NNSA/NSO	18	7	25
DRI	2	27	29
LANL[2]	19	50	69
LLNL	13	41	54
SNL	7	32	39
WSI	2	2	4
TOTAL	***78***	***333***	***411***

Table 2 – NTO Key and Critical Vacancies

NTO Organization	Key Personnel Vacancies	Critical Personnel Vacancies
ARL/SORD	2[3]	1
NSTec	1	25
NNSA/NSO	0	0
DRI	0	17[4]
LANL	1	8
LLNL	0	0
SNL	1	3
WSI	0	0
TOTAL	***5***	***54***

[2] LANL data reflects FY 2003 input because FY 2004 data was unavailable due to a security stand down at the laboratory.

[3] ARL/SORD personnel retired during FY08 have not been replaced at this time.

[4] Sixteen vacancies of the Desert Research Institute, University of Nevada (DRI) are for "field monitors." These vacancies continue to exist because of funding constraints. However, DRI has validated a strategy for using Federal Radiological Monitoring and Assessment Center (FRMAC) personnel to supplement DRI personnel and fill any field monitor vacancies for all phases of UGT.

1.2. NSTec UGT Personnel

The last formal review of NSTec key and critical position requirements was completed and validated in August 2006 by subject matter experts (SMEs), managers, and the personnel assigned to the NSTec Key Position of UGT Project Manager. The review determined that the number of key position requirements decreased slightly from 16 to 14 and the critical position requirements decreased from 185 to 167 due to continuing refinements to the defense support system functional area models.

A FY 2011 update found that NSTec has 128 personnel assigned to key and critical position requirements, leaving 26 critical position vacancies (see Table 3). Given NSTec's 181 key and critical position total requirements, plus 26 vacancies, NSTec has filled 155 position requirements with 128 personnel. This is possible because a single individual with extensive UGT experience can be qualified to fill more than one position requirement when scheduling allows.

Instituted in 1997 at the direction of DOE/NSO, the Retiree Corps enlists retirees and former employees with UGT experience and expertise. The UGT Retiree Corps offers a supplemental method for access to UGT experience and can be used for mentoring and training as well as consulting, archiving and advising on current UGT-related activities. With time, however, the success of this program is being tempered by a number of factors such as:

- The age of the retirees. It is now 19 years since the last nuclear test. As each year passes, the health of the retirees diminishes, as does the number available.
- The significant loss of ability to transition from once-used technologies to current practices to support ongoing stockpile activities and test readiness. Historic personnel skills are therefore of less utility in the modern technology environment.
- The lack of knowledge of current nuclear safety requirements limits their contributions.

The Retiree Corps currently consists of about 74 NNSS contractor and NNSA/Nevada Site Office retirees and former employees. Most of the retirees that continue to be involved in NSTec UGT-related activities are also members of the Retiree Corps. To date, at least 20 percent of the present and former Retiree Corps members have been or are being used for activities associated with the Test Readiness Program, but are not counted in key or critical skill positions.

Table 3 – NSTec UGT Position Vacancies

Position Title	Key or Critical	Number Required	Number Vacant
Project Management and Support - Project Manager	K	1	1
CAPTAIN-THREX, Scientist, THREX[5]	C	2	2
Electro-optics - Programmer, Application Support - Electronic Technician - Technical Advisor	 C C C	 1 4 1	 1 1 1
NUEX - Electronic Technician	C	6	1
Reaction History - Electronic Technician	C	6	2
Containment Diagnostics - Electronic Technician - Project Engineer	 C C	 2 1	 1 1
Control and Communication - Timing Station Technician - Technical Advisor	 C C	 2 1	 1 1
Detectors; Source Lab Technician	C	1	1
Data Analysis & Scientific Support - Technologist, Data Analysis - Programmer, Application Support - Data Analysis Manager	 C C C	 3 4 1	 2 3 1
Event Support - Event Support Manager	C	1	1
Event Engineering - Engineer, Civil	C	2	1
Event Construction - Cable Superintendent - Construction Manager - Electrical Superintendent - Mechanical Structures Superintendent	 C C C C	 1 1 1 1	 1 1 1 1

[5] Currently this position is not required due to the NTO management decision that CAPTAIN-THREX diagnostics are not needed in the most likely test scenarios.

2.0 Physical Assets

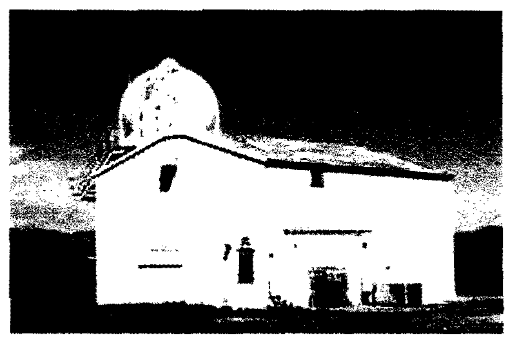
It has been 19 years since execution of the Los Alamos DIVIDER test, the last test before onset of the October 1992 moratorium on UGTs. The NNSS test readiness physical assets staff has continued to focus on identification and sponsoring minimal care efforts of UGT *unique* facilities, equipment and inventory. *Unique* encompass assets that represent a capability that must be available in order to successfully execute an underground nuclear test using the currently defined processes and is not readily available in the commercial sector.
For active mission-utilized assets, test readiness efforts have been limited to attempting to ensure that no modifications, use or ownership transfer occurs that would preclude an ability to perform the UGT mission if, and when, ordered.

The following sub-sections address specific physical assets or physical systems deemed critical to successful accomplishment of the test readiness mission. In particular, UGT critical facilities, equipment and inventory (other physical assets) are addressed.

2.1. Facilities

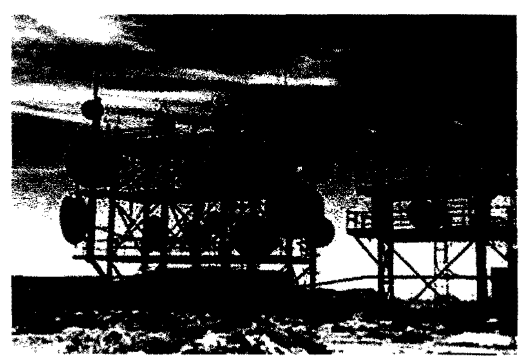
There are 81 NLV/NNSS facilities designated as readiness assets which provide some unique readiness capabilities, either built in or housed within. Thus far, the transfer and deactivation and decommissioning (D&D) actions have been cleared through the readiness staff when such actions would involve one of these facilities.

2.1.1. UGT Unique



There are 35 NLV/NNSS non-communications facilities designated as necessary for successful execution of a UGT or short series of tests. They must be maintained in a manner that will not jeopardize aspects of the structure or imbedded equipment needed for UGT readiness. They range from the NLV A-17 twin towers to lesser-known facilities such as the NNSS Area 6 CP-170 Yucca Lake Meteorology Station. Of the 35 facilities, many of these are active with other missions. Others are inactive, with only minimal maintenance periodically performed to prevent destructive deterioration.

2.1.2. UGT Communications Critical



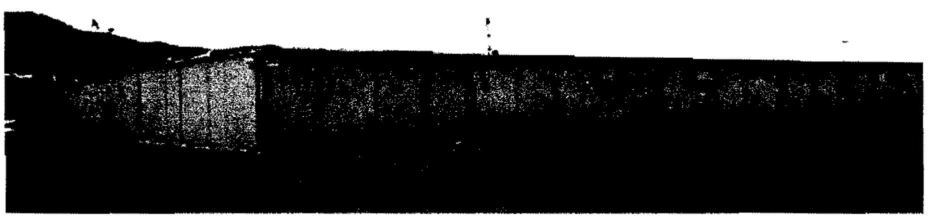
There are 39 communications structures deemed critical to successful UGT by SMEs. Because the overall communications systems (radio, telephone, and data) are comprised of interrelated and interdependent pieces, the readiness staff has relied on these SMEs to determine which are necessary to the UGT mission. This number may decrease over time as new communications technologies develop.

2.1.3. UGT JIT Capability Acquisition

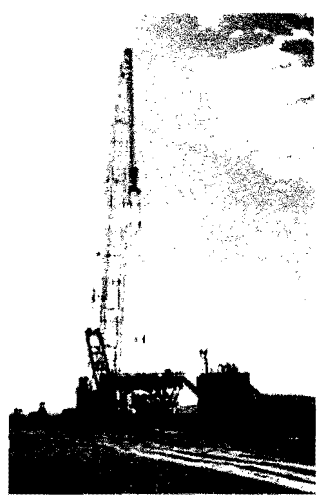
There are three facility capabilities that may have to be acquired in a just-in-time (JIT) manner. Three individual, now demolished, structures formerly within the Yucca Lake decontamination (DECON) area are illustrative. These were the equipment DECON building and immediately adjacent area, the DECON laundry, and the post-shot drill-back mud-motor DECON and repair buildings and equipment. These facilities would probably be needed if a series of tests were to be conducted, but probably would not be mandatory for a single test.

2.1.4. UGT Asset Storage

Four NNSS facilities are currently being used for storage of readiness assets: Building 6-CP65 for thousands of diagnostic equipment items, Building 6-903 for Radioactive Materials Area (RMA) storage of post-shot drilling system components, Building 6-911 for RMA storage of downhole logging assets, and Building 1-103 for storage of costly LLNL emplacement elevator system components.[6]



2.2. Equipment



The focus has been on equipment assets whose retention is deemed critical to the successful execution of a UGT. Some items are uniquely capable of supporting a UGT. Not only do the unique characteristics make them suited to UGT support but also these required characteristics often rule out new acquisition or leasing without arduous redesign and approval processes.

2.2.1. Device Emplacement and Handling, and Specialty Cranes

Design criteria and specifications for emplacement cranes were established through an exhaustive NNSS community crane study accomplished in the late 1970s. That effort resulted in a family of

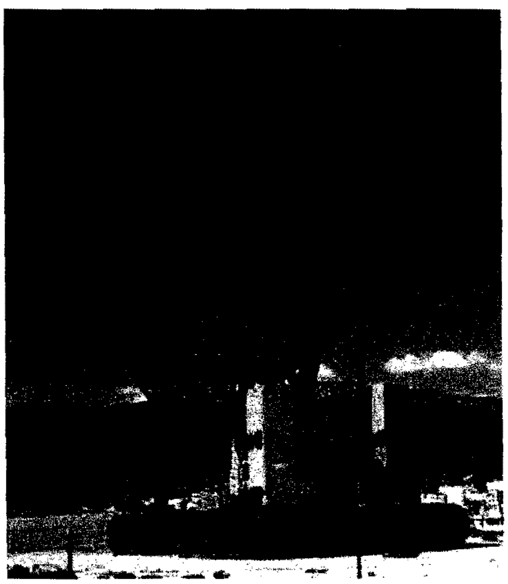
[6] An emplacement study completed by the Joint Nevada Project Office (JNPO) during FY08 recommended that only the wire-rope method for emplacement be used for the next test. The study also recommended that all LLNL equipment continued to be stored, but not maintained.

specially built units that has been reduced to three specific units. These cranes have special steel assemblies and fail-safe features specified as "must have" by the 1970s study.[7] In late 2010, a manufacturer's evaluation of the emplacement cranes was conducted to determine their condition and potential for continued use. The evaluation found the cranes to be in good overall condition, with minor adjustments and repairs recommended by the manufacturer, and assurance of continued availability of spare parts.

Manitowoc-4600T Emplacement Cranes and Equipment

There are two NNSS on-hand M-4600 cranes suitable for light UGT payload emplacement operations. Both are manufacturer-designated as 350-ton capacity. However, when outfitted with UGT appropriate booms and swinging in a UGT appropriate radius (180' and 50', respectively), they can handle loads up to approximately 100 tons. This is somewhat short of the weight of a complex test package. One was used on the Unicorn Event, and both have new tires replaced during the last five years.

Manitowoc-6000 Basic Emplacement Crane and Equipment



With the permanent transfer of the LANL-utilized M-4600 "Ringer" to the LLNL National Ignition Facility (NIF), then to the Oak Ridge National Laboratory, the M-6000 is the only crane available that has ever been nuclear-certified for envisioned test package weights. The basic crane (without the Lampson unit discussed below) can emplace packages weighing up to approximately 200 tons. This crane is located in the Yucca Lake Equipment Yard. The Joint NNSS Program Office (JNPO) emplacement study completed during FY08 specifically recommended, "Cranes to be used for emplacement and operator training should be put on a routine maintenance program assuring their viability long into the future and the ability to certify them for a nuclear test downhole operation in a time consistent with desired response for test execution."

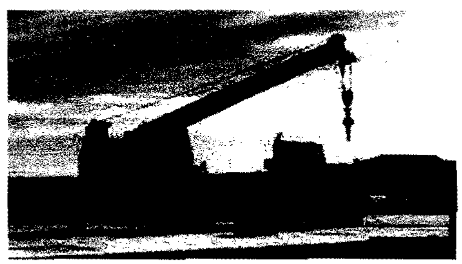
[7] These requirements were deemed effective and affordable in an era of continuous nuclear testing and have not been re-assessed for the test readiness situation of a possible single or sustained nuclear tests operating under modern safety standards. All such "requirements" described in this appendix should be viewed with this caveat: they may be either overly cautious or require exemptions to DOE safety orders today.

Manitowoc-6000/Lampson LTL-800 Heavy Lift Attachment Emplacement Crane Suite of Equipment

M-6000 capability can be increased threefold when the LTL-800 unit is attached. Emplacement capability then becomes in excess of 500 tons. These extreme weights were encountered with the later LLNL event packages. The various components for the LTL-800 are located within the Yucca Lake storage yards in Area 6.

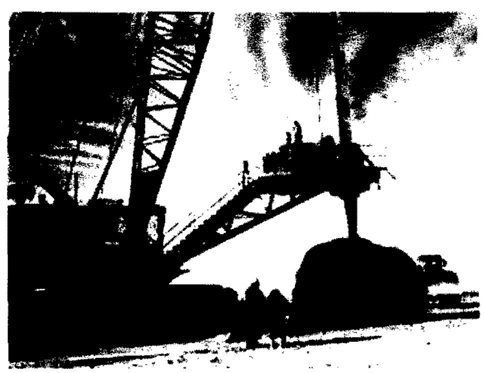
Grove 14.5 and 18 Ton Handling Cranes

Three on-hand hydraulic cranes are equipped with the nuclear certification-required safety features and remain operational and certifiable. These cranes are in active mission use and tend to remain continuously operational and nuclear-certifiable should the need arise.



Manitowoc-3950T

The Manitowoc-3950T is a general use crane that can be outfitted with a large Calweld Auger Attachment for drilling the surface holes needed for big-hole drilling operations. While present plans call for the use of existing emplacement holes, the retention of this crane and the associated attachments enables the NNSS to maintain a limited drilling capability.



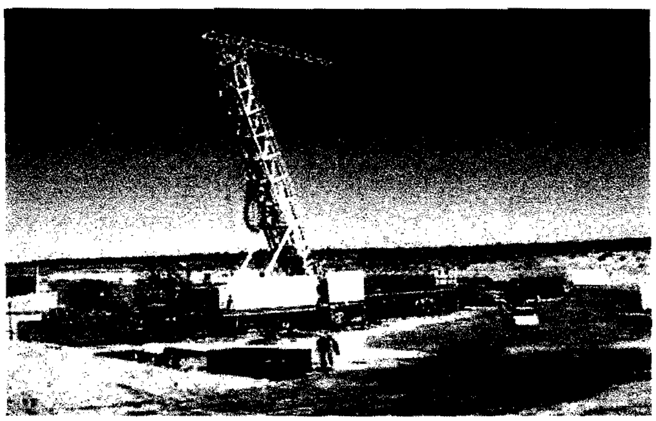
2.2.2. Retention and Potential Replacement of On-Hand Emplacement Cranes

There are "off-the-shelf" and in-use cranes capable of handling the requisite weights required for emplacement, but they have never been scrutinized for the historical (see footnote 7) UGT nuclear certification requirements. Existing NNSS cranes are operational and industrial-use certified, and almost certainly nuclear certifiable, but they are currently 27+ years old and their viability over the long-term future (10+ years) is uncertain.

2.3. Drilling Machines

Drilling operations at the NNSS have covered most of the spectrum of industrial drilling activities. They have ranged from small, shallow holes for cores and anchors through shallow and deep-water wells, to the very NNSS-unique device emplacement holes and post-shot drill-back and sampling holes. It is these last two that require the very specialized machines and component suites that have been the focus of test readiness. These operations can best be performed using on-hand rigs and equipment; hence, the continuing efforts to preserve this capability and a means to cost-effectively reconstitute them, if necessary. At this time, both the post-shot and big-hole rigs and their associated suites of subcomponents remain relatively intact and can be reconstituted. Subcontracting the drilling of emplacement holes using government-furnished equipment (which will require some refurbishment) is part of the baseline test readiness plan.

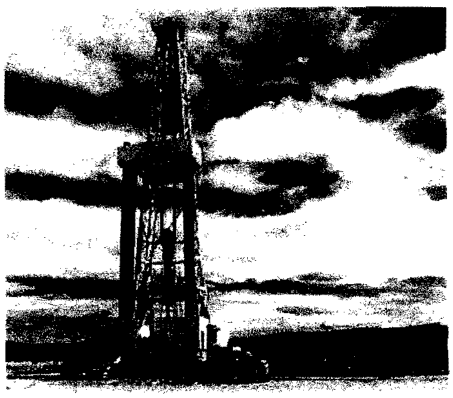
2.3.1. IRI-1100 Post-Shot Rig and Equipment



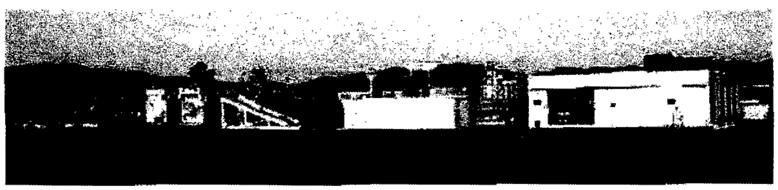
Post-shot acquisition of blast zone samples utilizes the IRI-1100 and associated equipment, which was specifically built for the NNSS post-shot mission. It operates from outside of the predicted zone of subsidence, drilling at an angle, and is therefore safer to operate than previous rigs. It was last utilized in actual drill-back operations during the summer of 2004. The Test Readiness Program funded an effort to "stack" (drillers' term for properly storing drill rigs between jobs) the IRI-1100 and all associated inactive equipment in a sequestered mode within the NNSS Area 1 Drilling Subdock. Subsequent semi-annual limited operation of basic rig systems and documented deferred necessary maintenance actions should enable successful and cost-effective reconstitution when necessary.

2.3.2. IDECO-3000 Big-Hole Rig and Equipment

The IDECO-3000 is a very large oil field type rig (30,000 foot class) that was designed specifically to accomplish drilling of UGT emplacement holes. NNSS engineering and drilling experts developed the particular method of drilling very large diameter, deep and very straight holes over the course of many years. The rig differs from those common to the oil and mining industry in that it was built to handle the very large flat bottom bits and the greater than 100 inch liner unique to the task. The mast, sub-base and drilling string are unique. The rig has been stored in the Area 6 Well #3 Casing Yard since the mid-90s. Drilling tools and various other subcomponents are also stored in the Area 1 Drilling Subdock.



An SME query indicates that two or three firms formerly capable of big-hole drilling no longer do so and the rigs utilized are no longer available. Predominant NTO opinion is that sufficient pre-drilled emplacement holes are available. Retention, at least through minimal maintenance actions, is prudent for the IDECO-3000 to protect this unique asset in case existing holes are damaged or inadequate. Should any cleaning, reaming or other repairs be required for an existing emplacement hole, the IDECO is the only known machine for this operation.



2.4. Forklifts

There are at present two nuclear-certifiable and four other special forklifts listed as readiness-specific assets. The two nuclear capable units are in active mission use at the Device Assembly Facility (DAF) and remain nuclear-certified. Two other non-nuclear certifiable units are equipped with special diagnostics cable-handling fork fixtures that have been certified for use by the forklift manufacturer. Two others, (capacity of 30 tons and 40 tons), are general-purpose units required for UGT and in regular mission use. There are some previously utilized forklift attachments, e.g., the post-shot Blow-Out Preventer positioning fixture that must have forklift manufacturer approval before they could be utilized, or must have specific approval to proceed without manufacturer approval.

2.5. Special Transport

2.5.1. Heavy and Outsized Loads

Readiness assets such as event site assembly towers, drilling machine masts, emplacement sub-bases, tower modules, etc., require the use of the Kenworth 100 ton tractor and Talbert 200 ton side-by-side trailer combination to enable onsite transport. The trailer has had all tires and the floor lagging replaced within the last seven years. The Kenworth 70 ton tractor is used to pull the IRI-1100 post-shot rig as the 100-ton unit hitch 5th wheel is too high to accommodate the rig hitch.

2.5.2. Special Materials

A unique transporter, the Device Transport Vehicle (DTV) is maintained in operational status for on-site transport of a special nuclear material event package. Obviously, safety and security considerations dictate maintaining the DTV in an operational status. Operational security requirements prohibit including a photo of the DTV.

2.6. Downhole Logging Equipment

Pre-moratorium UGT utilized 16 different log types during the course of day-to-day operations. A recent survey of the remaining UGT-experienced downhole logging SMEs led the Readiness staff to suggest retention of the three types described below. Other logging requirements can be satisfied utilizing outside contract sources. A considerable amount of effort will be required to relocate and store the three retained suites of logging equipment.

2.6.1. High Intensity GAMMA

Recent downhole logging experience utilizing industry-supplied instrumentation reinforced the logging SMEs' position that the more sensitive NNSS gamma logging capability be retained and maintained. The on-hand equipment has the requisite sensitivity threshold required for the UGT mission.

2.6.2. Big Hole Camera

Both the Big Hole Camera and the caliper tool described below are unique with respect to the diameter of the hole they are designed to log. Industry sources could probably accommodate these two requirements, but it would entail extensive fabrication and/or modification to their existing equipment. The camera module with the housing is currently on loan to the Las Vegas Atomic Testing

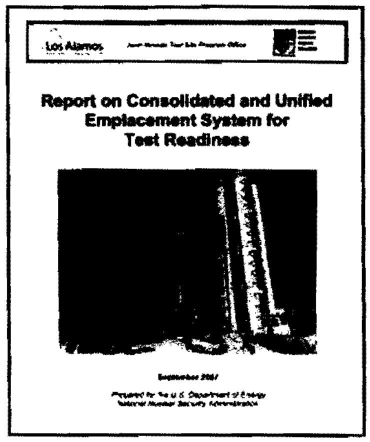
Museum, with the understanding that it can be retrieved and returned to active service should the need arise.

2.6.3. Big Hole Caliper

The sheer diameter of an emplacement hole makes this a unique logging operation. As with the camera suite, retention of the on-hand equipment is deemed cost effective when compared to the fabrication and/or modification that would be entailed with out-sourcing. This equipment is presently in minimal-care storage.

2.7. Emplacement

2.7.1. Emplacement System Study


Los Alamos

Report on Consolidated and Unified Emplacement System for Test Readiness

The NNSA tasked the JNPO with eliminating redundancies in test readiness from maintaining technologies for specific test operations developed separately by LLNL and LANL during the testing years. This emplacement study report specifically addresses the technologies for lowering the nuclear explosive and its diagnostics into a vertically drilled hole. Other test operations that carry unnecessary redundancies should be assessed in the future, including containment plans and material emplacement techniques, ground zero layout and operation sequences, etc. Tests in a test site tunnel complex should also be considered for similar analyses, as that may be a desirable test mode for technical reasons.

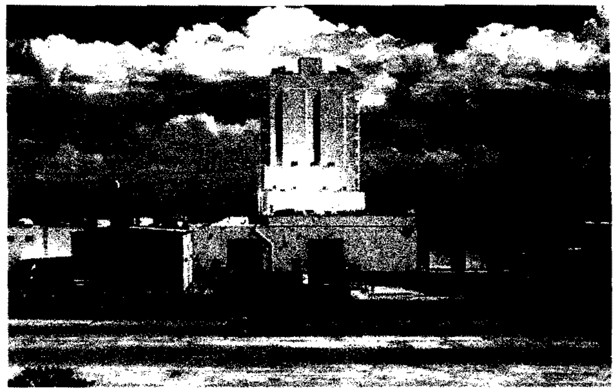
The NNSA's motivation was to reduce costs incurred by maintaining redundant technologies. In fact, more important than cost considerations – which are minimal in warehousing components – is narrowing the focus of the readiness community in its planning and exercise programs by reducing the breadth of potential concerns. That is, only one emplacement technique need be considered for maintenance, parts procurement, training, application to appropriate SSP experiments, etc.

The Test Readiness Program has implemented recommendations from the emplacement study:

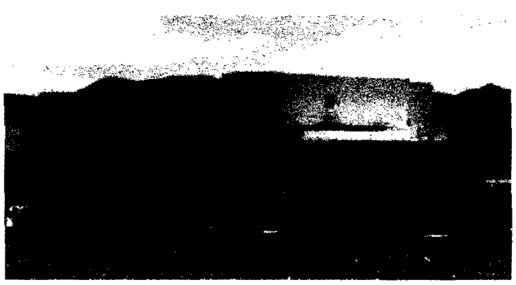
- The wire-rope harness medium used historically by LANL will be the single emplacement system maintained in readiness for future UGT events. As such, it will be the technique of choice for SSP experiments requiring vertical emplacement and will be specified for readiness exercises.
- The NNSA/NSO emphasized a Nevada Nuclear Test Infrastructure Program formalizing the responsibility to assure and maintain the centralized, non-redundant infrastructure for readiness for future tests. The Program will be responsible for infrastructure elements at the North Las Vegas Facility and the NNSS.
- All wire-rope expendable hardware and above ground emplacement technology hardware will be inventoried and maintained as critical readiness components.

2.7.2. ATLAS Facility in North Las Vegas

The ATLAS (Augmented Test Logistics and Support) Facility in North Las Vegas was conceived and developed to provide significant efficiencies to fielding practices then in place. This facility houses a large machine shop, detector manufacturing and electronics laboratory, a sheet metal fabrication shop, twin towers for rack assembly, and data trailer storage and instrumentation processes. The facility provides everything necessary to pre-stage all mechanical and electronic systems for a test so that minimal time and logistic support need be spent in the field. The NLVF provides machine shops and assembly spaces for building precision canister frame sections on the order of 40 feet in length and 68 to 96 inches in diameter.



2.7.3. Special Measurement Emplacement System equipment



There are several Special Measurement Emplacement System equipment assets located at the U-9ct event site. Readiness staff provides minimal maintenance of the line-tensioning modules and associated equipment that could be used to emplace sensing devices in an observation hole. The remaining equipment has been deemed unnecessary for Readiness.

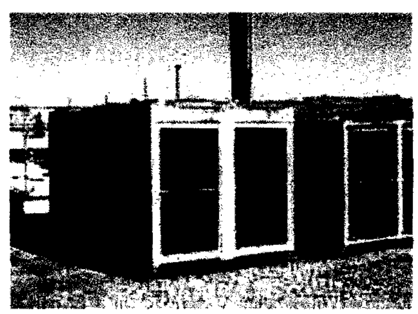
2.7.4. NWL Common Stemming Equipment

The Unicorn subcritical test employed stemming methodology and equipment that span the majority of assets needed for a UGT. Only the amount of material and depth of stemming would differ for UGT. Readiness staff has identified and maintains this equipment to support a future UGT.

2.7.5. Other Inventory Assets

2.7.5.1. Event Site Air Conditioners

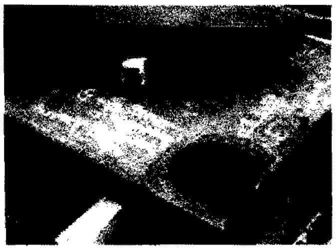
The large event site air conditioners are unique in several ways, including their ability to withstand post-detonation ground roll and still operate. It is likely that 24 or more of these units would be required for a complex scenario. Currently, there are enough operable and reparable units on hand at the NNSS to satisfy this level of requirement. Additionally, replacement units can be obtained from commercial sources and on-hand units can be



totally rebuilt to specification or repaired. Only occasional monitoring of these units is conducted by the NNSS air-conditioning SMEs.

2.7.6. Raw Materials

2.7.6.1. Special Steel



Fixtures and assemblies for handling UGT-related articles were most often constructed with special steel alloys such as HY-80, HY-100, A-537, etc. In the past, these alloys were often available only in large quantities and with fairly long lead-times. Currently, small lots can be acquired from regular materials suppliers with very short lead-times. A 2004 inventory constitutes the last action for on-hand materials. Therefore, test readiness staff will no longer track special steel stocks.

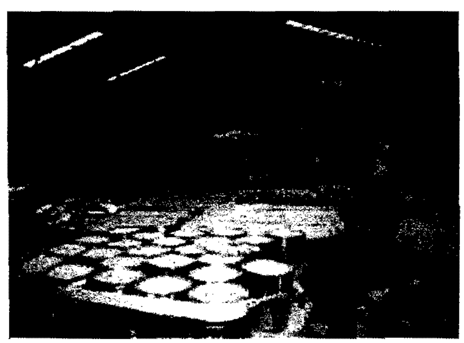
During the emplacement study, a number of items currently located at LANL were identified as possible candidates for relocation to the NNSS. Among those items were several hundred tons of special steel. No funding has been identified to accomplish this move and thus the material is currently still located at Los Alamos.

2.7.6.2. Big-Hole Liner

Sufficient stocks of 60-inch to 144-inch liner (casing) remain on hand to satisfy a small number of tests. Occasionally, another mission may need to use a piece or two. Readiness staff reviews and approves such use to ensure they do not jeopardize test readiness capabilities.

2.7.6.3. Shielding Materials

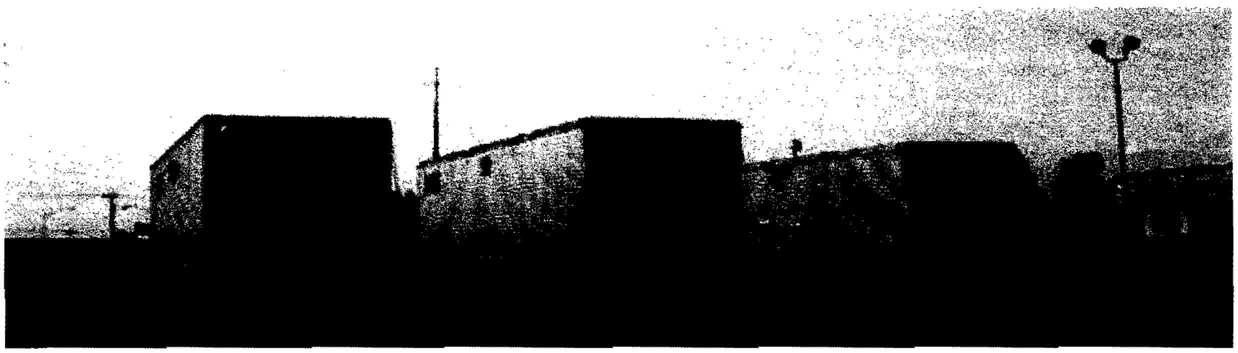
While some historic shielding materials are stored without maintenance in the Area 6 Building 6-907b, the Test readiness baseline assumes that any new shielding materials can be obtained just-in-time.



2.7.6.4. Downhole Data Cable

A large stock of unique and historically essential UGT radio-frequency (RF) data cable remains stored at the NNSS. The very specialized cable (e.g., RF-19 and RG-14) is no longer manufactured and it is unlikely that a vendor would refurbish the old tooling and re-establish a production line to support a small run for a single test. On-hand stocks are judged adequate for a single UGT scenario, with the caveats that the top two layers of spooled cable must be discarded and all cable would need to be discrete gas blocked. RF-44 and fiber optic cable is, for the most part, commercially available, but will require discrete gas blocks. Providing design and fabrication of discrete gas blocks for these fiber optic cables is a unique capability that must be maintained and is currently being exercised as part of the LANL subcritical experiments program. The cable fabrication capability is still operational and some of the SMEs working there have UGT experience. As time passes, downhole cabling will be an area of increasing concern.

2.7.7. Event Site Diagnostics Trailers



Twenty-eight of the specially manufactured event site diagnostic trailers have been individually identified as required for the readiness mission, some active and others not. A single test readiness methodology has been chosen for shock mounting using racks and Hexcel material. This was the preferred method of shock mounting utilized by LANL at the cessation of testing. A few of the LLNL trailers have already been modified to utilize this shock mounting system. There are sufficient numbers and types of these trailers, and they are serviceable for supporting UGT.

The diagnostics trailers identified and maintained as readiness assets are geographically split between LANL, LLNL, the North Las Vegas Complex, and at various places on the NNSS. Some of these trailers support active missions such as subcritical experiments at the NNSS U-1a Complex.

2.7.8. UGT Diagnostics Instrument Suites

The test readiness team continues to refine the database of over 34,000 diagnostics assets needed to execute a nuclear test. These assets and the post-shot drill back suite constitute the means of verifying weapons performance and therefore remain a top priority. The majority of inactive diagnostics equipment was co-located in the NNSS Building CP-65, which has been organized as a diagnostics warehouse facility. Within that facility, the equipment has been identified and co-located by type of diagnostic experiment, such as LLNL Reaction History, LANL Neutron Experiment (NUEX), and LLNL Special Measurements. Approximately half of these assets are non-expendable.