From: John Isaacson [mailto:isaacson@lanl.gov]
Sent: Thursday, June 02, 2005 2:24 PM
To: KIRK.W.OWENS@saic.com
Cc: ewithers@doeal.gov; torig@lanl.gov; sradz@lanl.gov; janecky@lanl.gov
Subject: Fwd: HE Testing NEPA Document

Kirk, this time with the document attached.

JI

Date: Thu, 2 Jun 2005 11:38:52 -0600
To: Kirk
From: John Isaacson <isaacson@lanl.gov>

Subject: HE Testing NEPA Document

Cc: Withers,torig-lanl.gov,sradz-lanl.gov,janecky-lanl.gov
Bcc:
X-Attachments:

Kirk, attached is the HE Testing NEPA Determination Document updates.

JI

--

John Isaacson
S-SWEIS Project Leader
ENV Division M887
(505) 667-2276 (phone)
(505) 667-0731 (fax)

LA-UR-01-3040

Title: ESH-20 NEPA Determination Document 10
High Explosives Testing Facility

Los Alamos
NATIONAL LABORATORY

Table of Contents

Tables

Figures

1.0 Introduction

This document describes the *National Environmental Policy Act of 1969* (NEPA) operational envelope for operations, capabilities, and parameters analyzed for High Explosives Testing Facilities, a key facility in the *Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory* (SWEIS; DOE 1999a). The principal buildings and structures for this key facility are shown in Table 1. The purpose of this document is to determine whether a proposed project for this facility has NEPA coverage in the SWEIS as implemented by the Department of Energy (DOE) in the Record of Decision (ROD) for the SWEIS. As long as the High Explosives Testing Facility operates within the bounds of the impacts projected by the SWEIS, the facility is in compliance with NEPA. If there is potential to exceed projected impacts, further NEPA review would be required.

Under the Laboratory Implementation Requirement (LIR) entitled "NEPA, Cultural Resources, and Biological Resources (NCB) Process," (LANL 2000a) proposed projects are screened by the authorized facility NCB reviewer as part of the NCB assessment. The screening requires the facility NCB reviewer to decide

- if the project is new or modified from a previous determination and
- if DOE has already made a determination that covers the proposed project.

The Facility NCB Reviewer uses the Facility NEPA Determination Document (LANL 2000b) for screening. Table 2 summarizes the capabilities, and the operations examples for the capabilities, that were published in the SWEIS to estimate the impacts. If the facility NCB reviewer finds that the proposed activity is one of the capabilities in the SWEIS and is within one of the operations examples for that capability as shown by Table 2, the reviewer could determine that the proposed activity is covered by the SWEIS and does not require further NEPA analysis.

However, a proposal that does not match a capability description in Table 2 or that is not included with one of the operations examples for that capability in Table 2 could still be covered by the SWEIS. The SWEIS analysis is based on information in background documents prepared for each of the key facilities; these background documents provide more detailed descriptions of the ongoing and potential operations for each key facility. In addition, the levels of activity called the "operations examples" for each of the capabilities reflects scenarios that were developed for each capability to provide an estimate for calculating potential impacts. The SWEIS was not intended to set stringent limits on the level of activity for a particular capability. In most facilities the operations examples for every capability would not be reached at one time because of the ebb-and-flow-like nature of the work at LANL. Thus it would be possible to exceed the operations examples for one capability and still be within the parameter limits for the facility or the LANL operations limit. If the proposal reviewer can demonstrate this, the proposal would still have NEPA coverage through the SWEIS. This document presents the procedure for a more detailed review and supporting information from the SWEIS and background documents.

2.0 Procedure

A proposed project can be screened by the Facility NCB reviewer or ESH-20 reviewer to determine if it is included in the descriptions in Table 2. Under that procedure, if a proposal does not clearly fit those descriptions of capabilities and operations examples, it will be referred to

ESH-20 for review under this procedure, which requires more familiarity with SWEIS supporting documentation and projected additive impacts of other proposed work at LANL. The ESH-20 reviewer will use the data on High-Explosives testing facilities and capabilities from the

Table 1. Principal Buildings and Structures of the High Explosives Testing Facility

Technical Area	Principal Buildings and Structures
TA-14 (Q-Site)	Warehouse: 14-6 Magazines: 14-22, 24 Control Room, Make-Up Room, Laboratory: 14-23
TA-15 (R-Site)	Firing Areas:TA-15-306, 312 Note: PHERMEX 15-184, 185, 310 has been disabled. Scheduled for D&D 06' Weapons Testing Backup Facilities: 15-280 Note: 44 45 on D&D list! Weapons Storage and Preparation: 15-41 Magazines: 15-42, 43, 241, 243 Make-Up Building, Short-Term Storage: 15-242 Machine Shops:,285, 313 Warehouse, 565 Pulsed-Power Laboratory and Shop: 15-203 Office Buildings: 15-40, 183, 305, 446, 484, 494 Vessel Preparation Facility: 15-534 Carpenter Shop: 15-563 X-Ray Calibration: 15-564 Oil Tanks: 15-435, 436, 461, 462
TA-36 (Lower Slobbovia)	Storage: 36-48 Control Buildings: 107 Firing Areas: 36-3, 6, 8, 12 Preparation Buildings: 36-4, 5, 7 11, 78, 82 Magazines: 36-9, 10, 83 PIXY Facility: 36-86 Oil Tanks: 36-141, 142
TA-39 (Ancho Canyon Site)	Main Office, Laboratories, Shops: 39-2 Magazines: 39-3, 5, 77 Trim Building: 39-4 Firing Areas: 39-6, 57, 88 Gas Gun Facility: 39-56 Storage and Assembly Building: 39-62 Note: non-DX activities takin gplace in TA-39-62. DX is landlord to ISR personnel. Gun Room, Instrument Room: 39-69 Gas Gun Support Building: 39-89 Shop: 39-98 Pulsed-Power Building: 39-111 Storage: 39-137, 138

	Bunkers: 39-56, 95, 97 Experiments: 39-67
TA-40 (DF-Site)	Offices, Laboratories: 40-1 Machine Shops: 40-23 Gas Gun Facility: 40-9 Firing Sites: 40-5, 8, 9, 15 Note: TA-40-4 scheduled for D&D Preparation Rooms: 40-3, 6, 11, 12, 14 Magazines: 40-2, 7, 10, 13, 36, 37, 38, 39, 40 Laboratory Building: 40-41

No changes necessary for Table 2, Franco

Table 2. High Explosives Testing Facility [a]

Capability	Operational Examples[b]
1. Hydrodynamic Tests	1.1 Conduct up to 100 hydrodynamic tests/year. 1.2 Develop containment technology 1.3 Conduct baseline and code development tests of weapons configuration. 1.4 Depleted uranium use of 6900 lb/year (over all activities).
2. Dynamic Experiments	2.1 Conduct dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons including some experiments with SNM.
3. Explosives Research and Testing	3.1 Conduct high explosives tests to characterize explosive materials.
4. Munitions Experiments	4.1 Continued support of Department of Defense in conventional munitions. 4.2 Conduct experiments with projectiles and study other effects on munitions.
5. High-Explosives Pulsed-Power Experiments	5.1 Conduct experiments and development tests.
6. Calibration, Development, and Maintenance Testing.	6.1 Conduct tests to provide calibration data, instrumentation development, and maintenance of image processing.
7. Other Explosives Testing	7.1 Develop advanced high explosives or weapons evaluation techniques.

a: Source: Modified from SWEIS 1998 Yearbook (LANL 1999).

SWEIS document and the background documentation. The supporting documentation on the High Explosives testing facilities and capabilities is presented in Sections 3 and 4 below.

A flow chart that summarizes the procedure for the ESH-20 reviewer to use in screening a proposal is presented in Attachment 1. Upon receiving a proposal, the reviewer should answer the following:

1. Is this a new capability? Review the detailed descriptions of the tritium facilities and capabilities from the SWEIS (Section 3 of this document) and from the background documents (Section 4 of this document).
   a. If this is a new capability, go to 4.
   b. If this is not a new capability, go to 2.
2. Does the proposal fit within one of the operations levels for that capability in the SWEIS? Compare description to second column of Table 2.
   a. If the proposal is within the operations levels for that capability, go to 5.
   b. If the proposal is not within the operations examples, go to 3.

3. Is the proposal within the facility operations data envelope? Work with the facility manager and other Environment, Safety, and Health subject matter experts (SMEs) to calculate if the proposal is within the envelope of facility operations data (Table 3).
   a. If the proposal is within the facility operations data envelope, go to 5.
   b. If the proposal is not within the facility operations data envelope, go to 4.
4. ESH-20 will prepare a NERF to complete the NEPA process.
5. Proposal is covered by the SWEIS. Attach explanation/calculations to NCB Screening Checklist (Attachment 2) to complete the NEPA process.

Table 3. High Explosives Testing Facility Operations Data

Parameter	Units [a]	SWEIS ROD
Radioactive Air Emissions:		
• Depleted Uranium	Ci/yr	1.5×10^{-1} [c]
Chemical Usage [d]		
• Aluminum[e]	kg/yr	45,450
• Beryllium	kg/yr	90
• Copper[e]	kg/yr	45,630
• Depleted Uranium	kg/yr	3930
• Lead	kg/yr	240
• Tantalum	kg/yr	300
• Tungsten	kg/yr	300
NPDES Discharges:[b]		
• Number of outfalls		14
• Total Discharges	MGY	3.6
• 03A-028 (TA-15)	MGY	2.2
• 03A-185 (TA-15)	MGY	0.73
• 04A-101 (TA-40)	MGY	0.0
• 04A-139 (TA-15)	MGY	None
• 04A-141 (TA-39)	MGY	0.0
• 04A-143 (TA-15)	MGY	0.018
• 04A-156 (TA-39)	MGY	0.0
• 06A-079 (TA-40)	MGY	0.54
• 06A-080 (TA-40)	MGY	0.03
• 06A-081 (TA-40)	MGY	0.03
• 06A-082 (TA-40)	MGY	0.0
• 06A-099 (TA-40)	MGY	0.0
• 06A-100 (TA-40)	MGY	0.04
• 06A-123 (TA-15)	MGY	0.0
Wastes:		
• Chemical	kg/yr	35,300
• Low-level waste	m^3/yr	940
• Mixed low-level waste	m^3/yr	0.9
• TRU waste/Mixed transuranic waste	m^3/yr	0.2

a: Ci/yr = curies per year; MGY = million gallons per year.
b: NPDES is National Pollutant Discharge Elimination System.

c: The isotopic composition of depleted uranium is approximately 99.7% uranium-238, approximately 0.3% uranium-235, and approximately 0.002% uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.
d: Usage listed for the SWEIS ROD includes projections for expanded operations at DARHT as well as the other TA-15 firing sites, consistent with the SWEIS Expanded Operations Alternative description (the highest foreseeable level of such activities that could be supported by the LANL infrastructure).
e: The quantities of aluminum and copper involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosives tests, and thus, do not contribute to air emissions.

3.0 SWEIS Data for HE Testing Facility

This section provides information directly from the SWEIS. Section 3.1 is a description of the high explosive testing facilities from Chapter 2 of the SWEIS. Section 3.2 is a description of the capabilities at these facilities at the time the SWEIS was written, while Section 3.3 is a description of the capabilities under the preferred alternative as selected under the Record of Decision.

3.1 SWEIS Description of Facilities

The facilities that make up the explosives testing operations are used primarily for research, development, test operations, and detonator development and testing related to DOE's stockpile stewardship and management programs (Figures 1 through 7). The firing sites specialize in experimental studies of the dynamic properties of materials under conditions of high pressure and temperature. The firing site facilities, occupying approximately 22 square miles (57 square kilometers) of land area, represent at least half of the total land area occupied by LANL (see Table 1).

Various radioactive and nonradioactive materials are used in the firing sites operations. Depleted uranium and plutonium metal are used in some of the operations (plutonium in such operations is contained to prevent release). Nonradioactive toxic or hazardous materials may include beryllium, copper, aluminum, and heavy metals. Other materials used are solvents such as acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1–trichloroethane. Sulfur hexafluoride is used as an insulating gas in specialized high-voltage equipment.

There are 13 permitted NPDES outfalls located at the firing site operations. DOE plans to eliminate one of these outfalls as described in the *Environmental Assessment for Effluent Reduction* (DOE 1996).

An ongoing construction project related to the TA–15 firing site operations is the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, analyzed in the *Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement* (DOE 1995). The first axis for this facility is currently being installed and is expected to be operational by the end of 1999. The second axis is expected to be operational by the end of 2002.

HE testing activities are conducted in five TAs, having a total of 13 associated firing sites. (This number can change slightly over time.) All of the firing areas are located in remote locations on the Pajarito Plateau or within canyons of the plateau. Four of the areas are located on or just below Threemile Mesa. The nearest private residences to these four firing areas are in the Royal Crest Trailer Park north of Sandia Canyon located approximately 2 miles (3.2 kilometers) to the north, and White Rock, approximately 4 to 6 miles (6.4 to 9.7 kilometers) to the southeast. The following paragraphs contain descriptions of the five firing areas.

The major use of the TA-14, Q-Site, firing area is testing quantities of energetic materials (such as HE) that exceed the safety limits for these materials indoors at TA-9. Two firing sites are available at the Q-Site firing area. Up to 100 pounds (45.4 kilograms) of HE per test may be fired at this area. Characterization tests to determine the chemical and physical properties of energetic materials used to model weapons behavior are conducted at this site. DOE has applied for a RCRA permit for the disposal of explosives and explosives-contaminated materials at Q-Site by either detonation or by burning. Currently, waste disposal is performed under RCRA interim status requirements by either detonation or by burning.

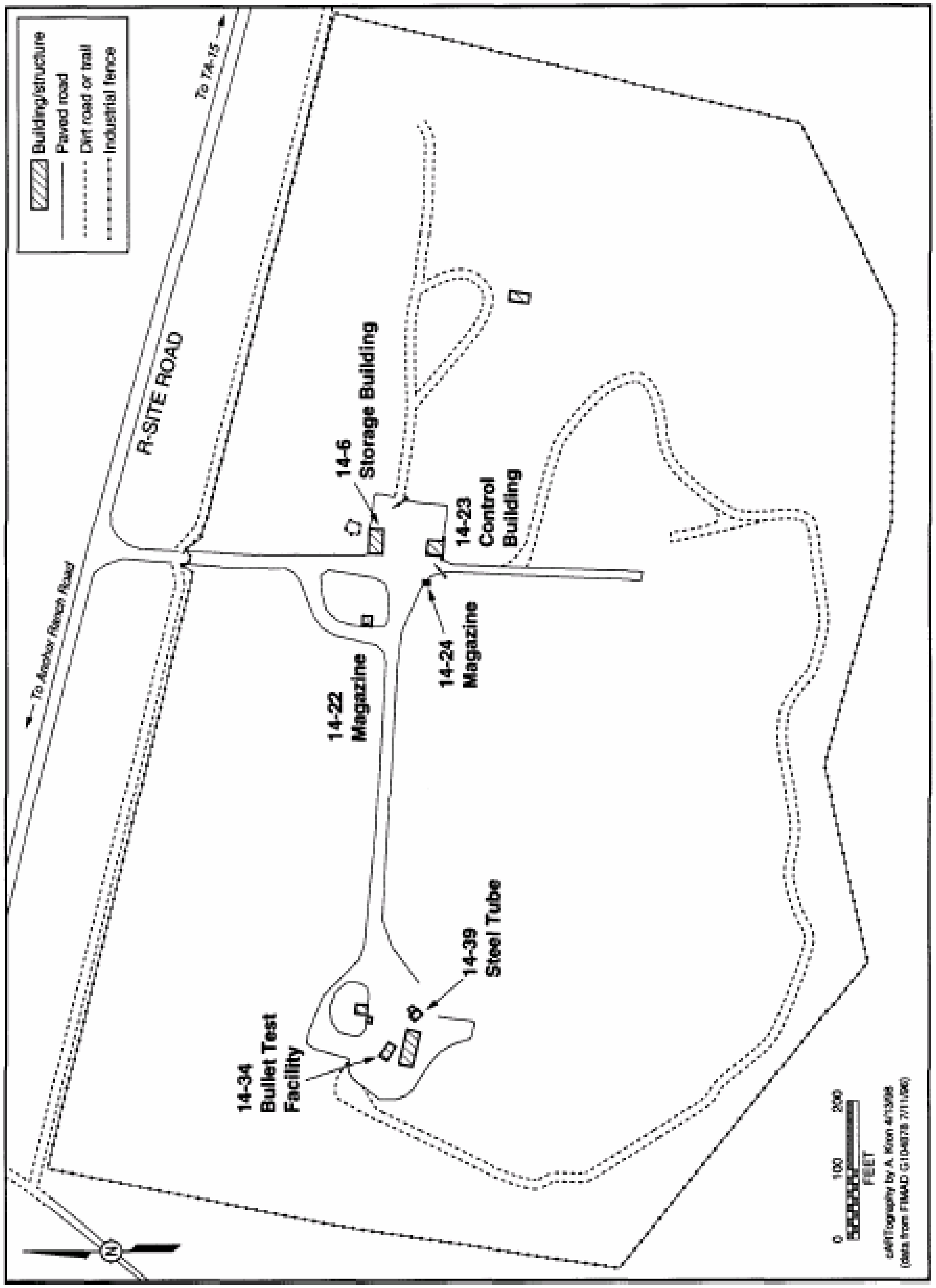


Figure 1. TA-14 High Explosives Testing

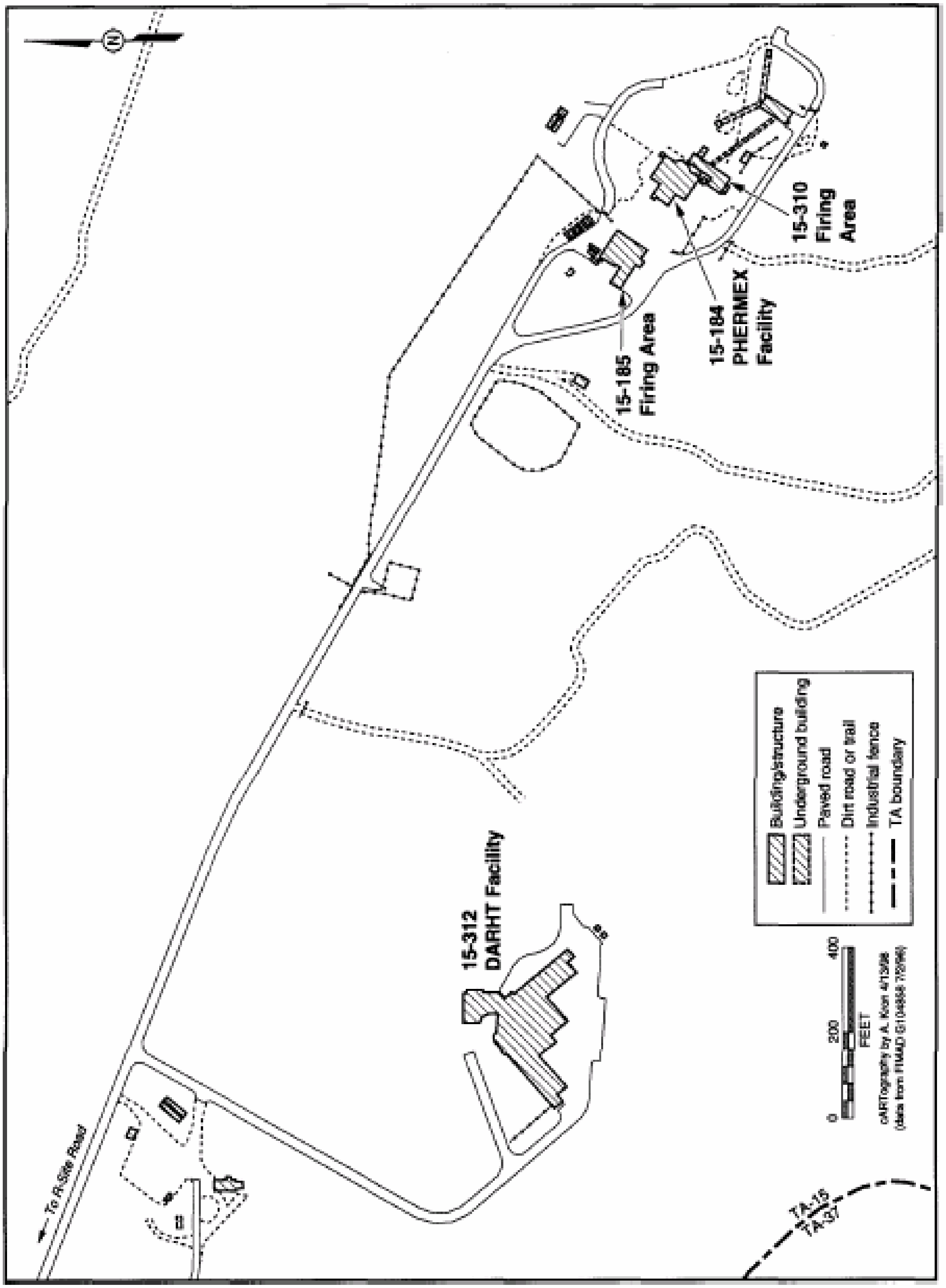


Figure 2. TA-15 West High Explosives Testing

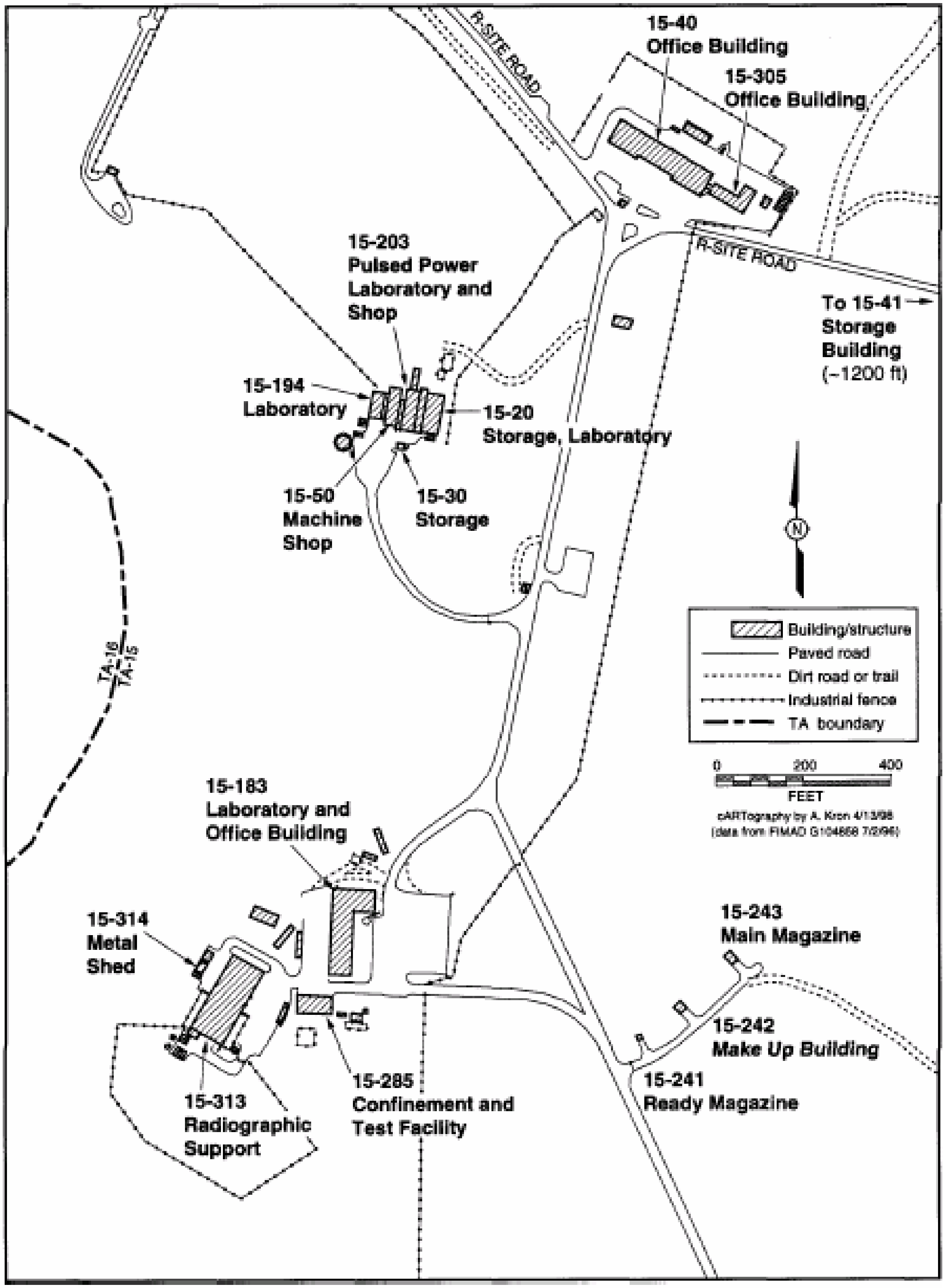


Figure 3. TA-15 Central High Explosives Testing

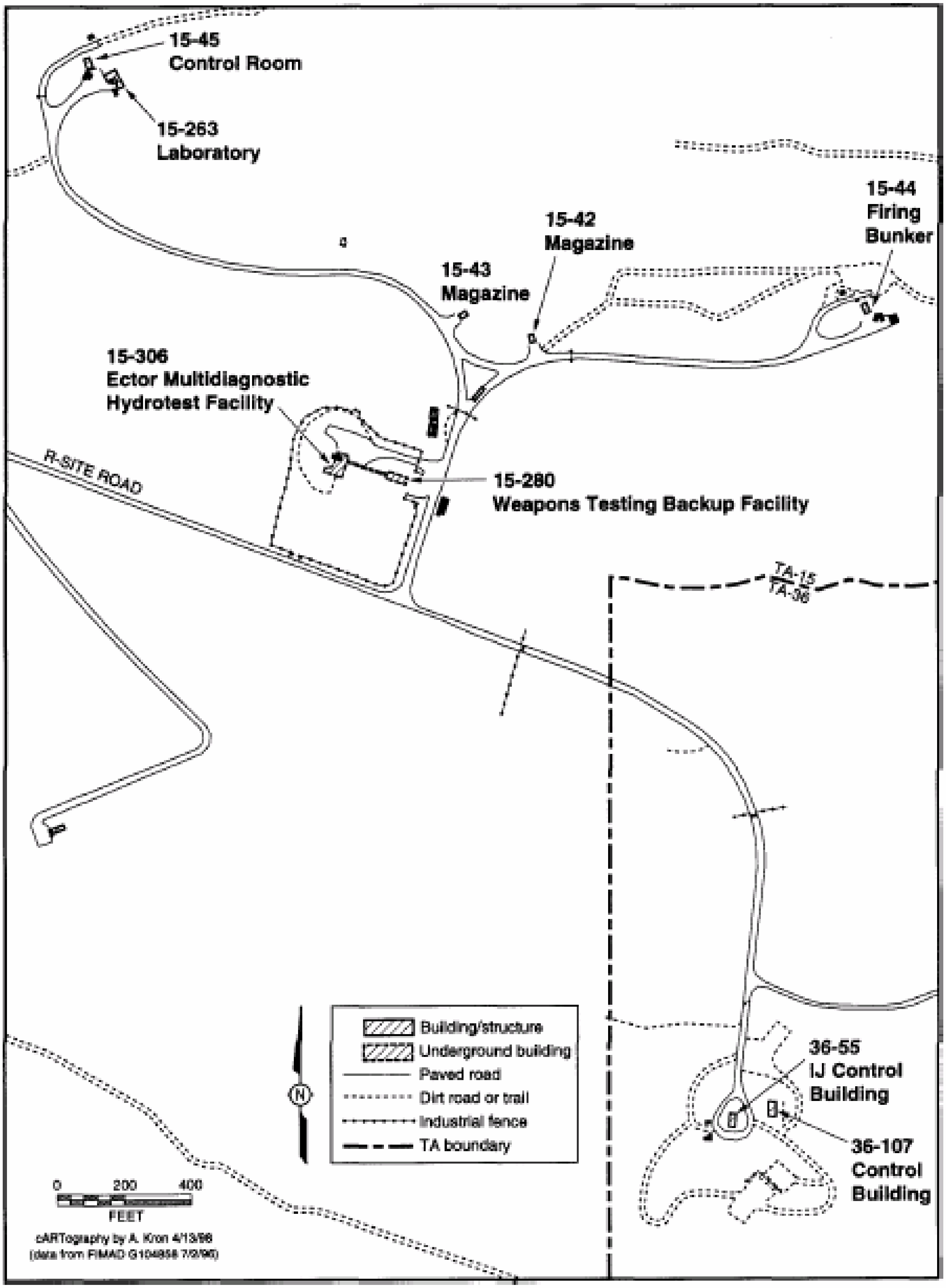


Figure 4. TA-15 East and TA-36 West High Explosives Testing

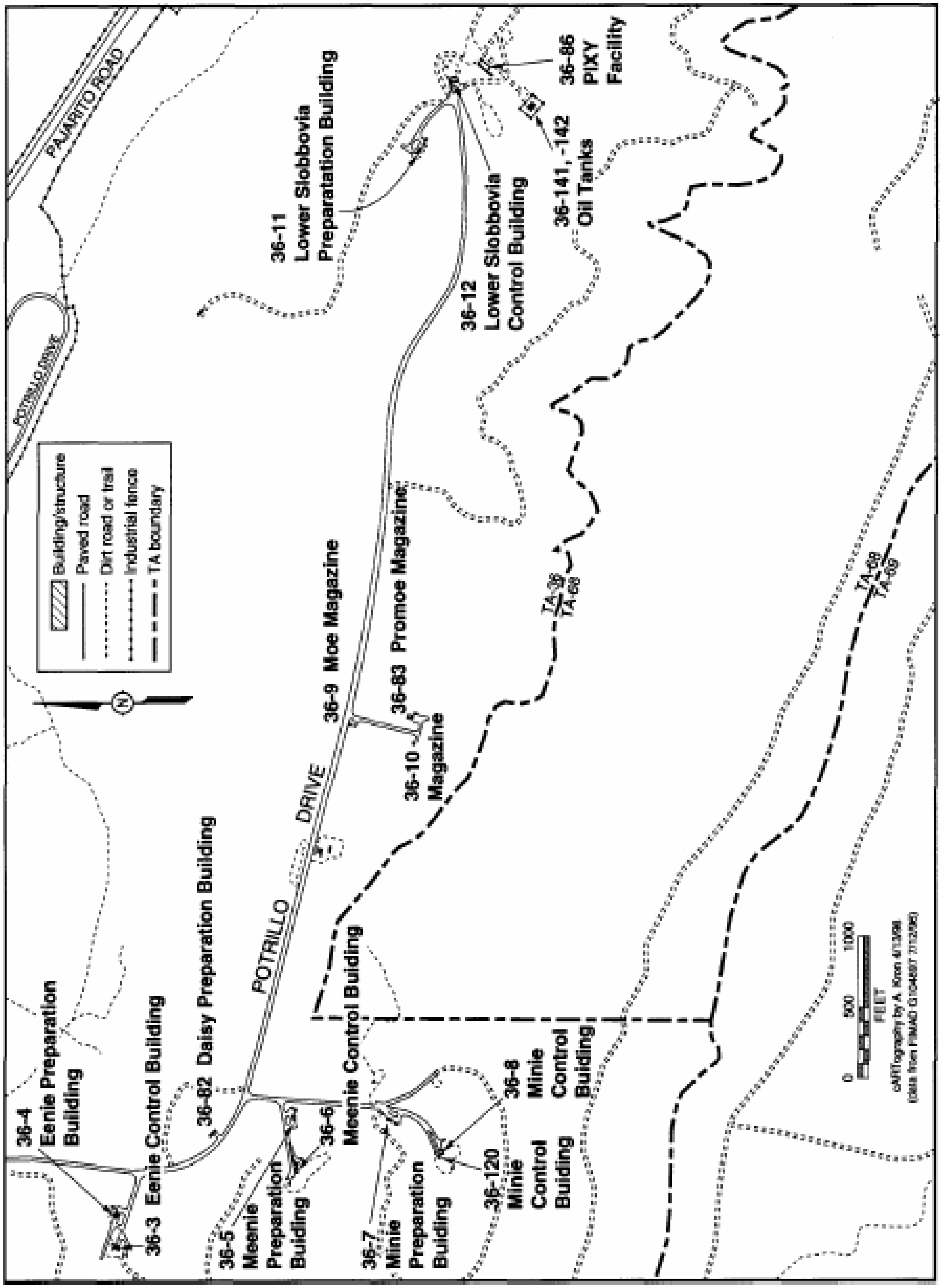


Figure 5. TA-36 East High Explosives Testing

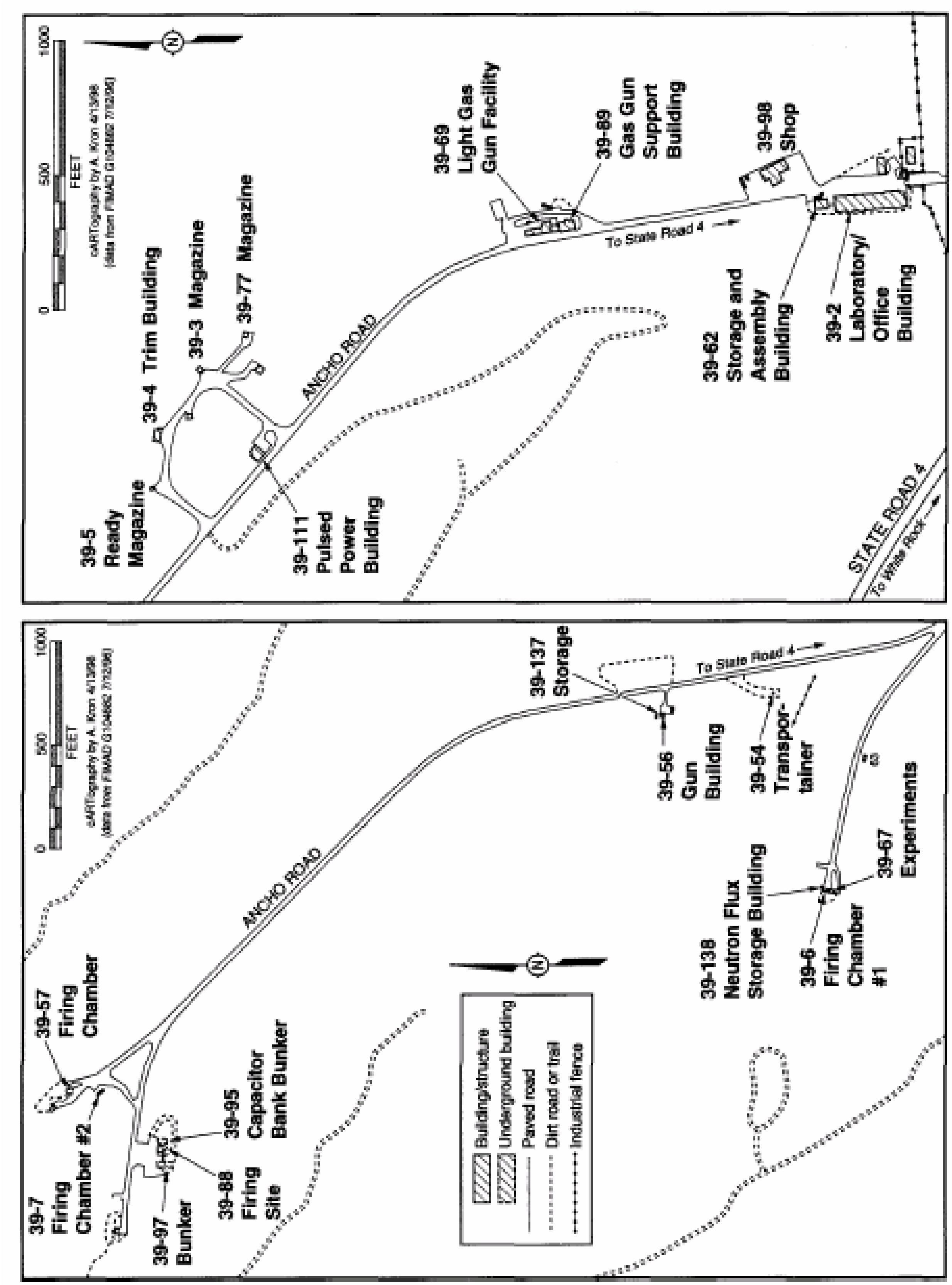


Figure 6. TA-39 High Explosives Testing

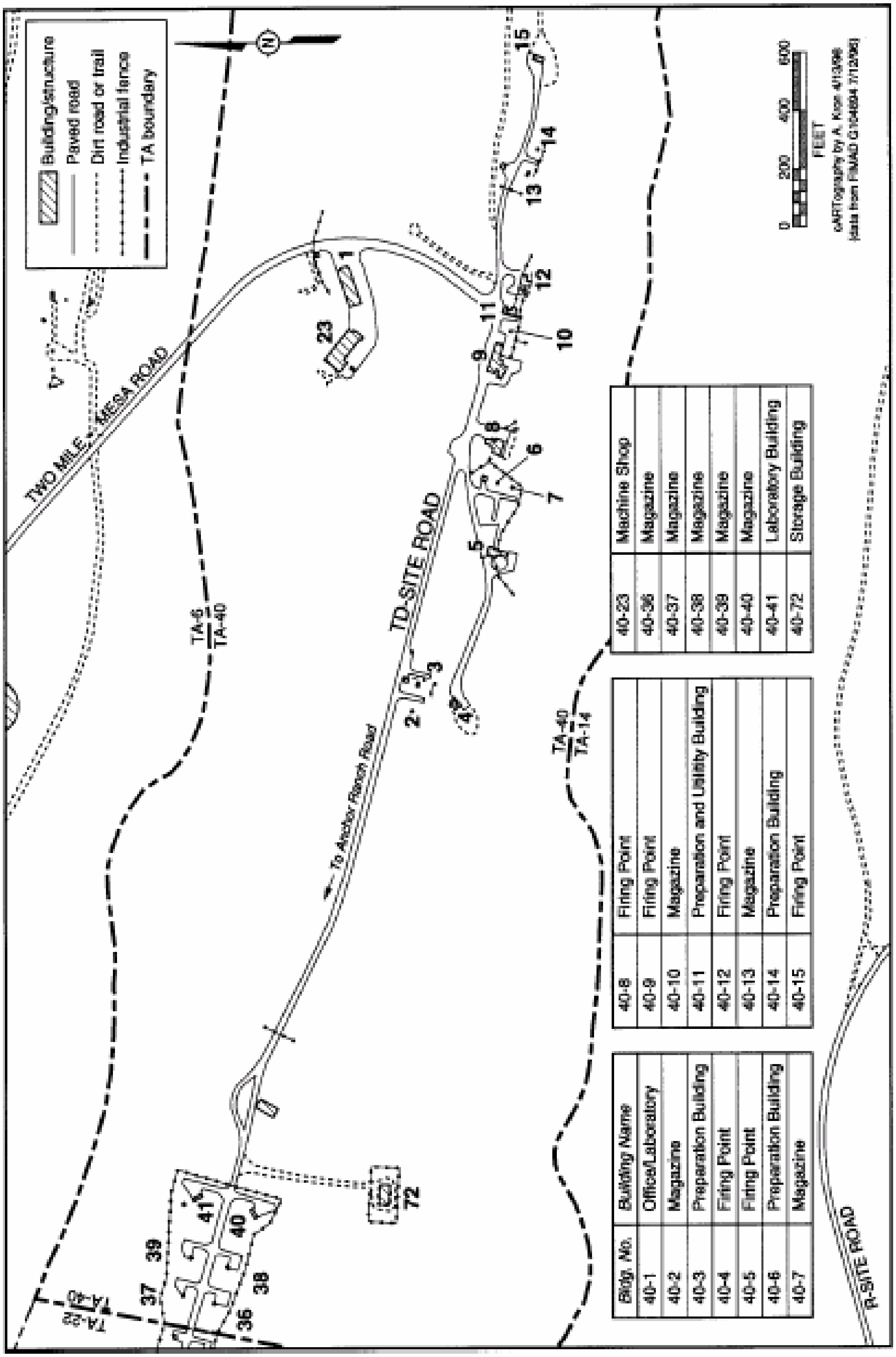


Figure 7. TA-40 East High Explosives Testing

TA-15, R-Site, contains three firing sites: Pulsed High-Energy Radiation Machine Emitting X-Rays (PHERMEX) facility, DARHT Facility, and R306, a general purpose firing site. The PHERMEX facility is capable of producing high-resolution x-ray pictures of very dense, fast-moving materials and is used primarily for weapons studies. The PHERMEX firing site is used for full-scale, multidiagnostic hydrodynamic tests and for smaller scale experiments, such as the study of HE or materials driven by HE that might require fast, high-resolution, high-intensity radiography. The firing site can handle up to 154 pounds (70 kilograms) of explosives on the firing runway in front of machines. Charges up to 1,600 pounds (730 kilograms) or more of explosives may be detonated at points east of the runway (at greater distance from the PHERMEX machine). All of the buildings adjacent to the firing site are constructed of heavily reinforced concrete.

The DARHT facility is currently under construction near the PHERMEX firing site. When completed, the DARHT facility will provide dual axis, multiple exposure radiographs at the highest penetration and resolution available for the study of devices and materials under hydrodynamic conditions. This facility will be used primarily in support of DOE's Stockpile Stewardship and Management Programs.

The third firing site at TA-15 is located at building R306. Currently, the R306 firing site is used for nonradiographic studies. This firing site and the nearby IJ firing site are current candidates for redevelopment and would probably continue to be used only for electrical, mechanical, and optical studies in the future. The IJ site is currently in safe standby.

Both open-air and contained explosives tests are performed at TA-15 as described in the DARHT EIS (DOE 1995) and record of decision (60 FR 53588).

TA-36, Kappa-Site, contains four active firing sites. A variety of diagnostic equipment is available at the four firing sites. A number of 2.3-million electron volts, 600-kiloelectronvolts, 450-kiloelectronvolts, and 150-kiloelectronvolts flash radiographic systems are also available. (These radiographic systems may also be used at other firing sites.) In addition to providing support for DOE nuclear weapons programs, the explosives testing and firing facilities at TA-36 are often used for a wide variety of nonnuclear ordnance testing for the U.S. Department of Defense (DoD). These tests may include warhead development, armor and armor-defeating mechanisms, explosives vulnerability to projectile and shaped-charge attack, warhead lethality studies, and the safety implication of shock waves on explosives and propellants. A total of 700 to 1,200 experimental firings are performed annually, using up to 5,000 pounds (2,270 kilograms) of explosives in a single test.

The Ancho Canyon Site, TA-39, is used for studying high-energy-density properties in experiments using explosives-driven pulsed power. Various phenomenological aspects of explosives, interactions of explosives, and explosions acting on other materials are also investigated. Gas guns are located at Ancho Canyon for the testing of inert materials. Typically, open air detonation is used, and up to 4,400 pounds (2,000 kilograms) of explosives may be used in a single test. In the past, contained testing involving plutonium was performed here. DOE may perform such testing again in the future.

Firing sites TA-39-6 and TA-39-88 typically support high-explosives-driven, pulsed-power experiments to study high-energy-density and high magnetic fields for stockpile stewardship, basic research, or other applications. These firing sites also can be used for other HE experiments in materials phenomenology. The pulsed-power experiments usually involve HE detonations and high-voltage, energy-storage capacitor bank discharges. Currently, for operational efficiency TA-39-6 is the principal firing site used for HE experiments for the National High Magnetic Field Laboratory, though both sites can be used for such experiments. The firing sites at TA-39 and the gas guns are used to measure the characteristics of weapons materials driving by HEs. Tests associated with proliferation control and verification activities are performed here also. Equation-of-state experiments may also be carried out at TA-39 to determine the properties of materials at extreme conditions.

Three separate firing sites at TA-40, DF Site, are used for general testing of explosives or other materials and in the development of special detonators to initiate HE systems. One site is used for the characterization of energetic materials using two gas guns normally located at TA-40. Another site employs a containment system in the study of small-scale experiments (less than 22 pounds [10 kilograms] of HE). The third site includes a laboratory for growth of long HE crystals used to study the properties of explosives. The TA-40 Facility has been used for many years for the testing of HE and physics experiments related to the nuclear weapons programs.

Some experiments at TA-40 include detonation of assemblies and configurations contributed by other groups at LANL. Experimental assemblies containing up to 55 pounds (25 kilograms) of explosives in various diagnostic configurations are routinely constructed and fired, while detonation of charges of up to 110 pounds (50 kilograms) can be studied.

3.2 SWEIS Description of Capabilities (Baseline)

The major categories of HE testing activities across the firing sites are described below

3.2.1 Hydrodynamic Tests

A hydrodynamic test is a dynamic, integrated systems test of a mock-up nuclear package during which the high explosives are detonated and the resulting motions and reactions of materials and components are observed and measured. The explosively generated high pressures and temperatures cause some of the materials to behave hydraulically (like a fluid). Surrogate materials are used to replace the actual weapons materials in the mock-up nuclear weapons package, to ensure that there is no potential for a nuclear yield. Most hydrodynamic tests will be conducted at TA-15, with some being conducted at TA-36.

Dynamic Experiments. A dynamic experiment is an experiment to provide information regarding the basic physics of materials or characterize the physical changes or motion of materials under the influence of HE detonations. Some dynamic experiments involve special nuclear material (SNM). Most dynamic experiments will be conducted at TA-15 and TA-36, with some experiments being conducted at TA-39 and TA-40. In the past, DOE has conducted dynamic experiments using plutonium metal. DOE may perform such studies again in the future at PHERMEX, DARHT, and other facilities. As a matter of policy, dynamic experiments involving plutonium would always be conducted inside containment vessels.

Explosives Research and Testing. Explosives research and testing activities are conducted primarily to study the properties of the explosives themselves as opposed to explosive effects on other materials. Examples include tests to determine the effects of aging on explosives, the safety and reliability of explosives from a quality assurance point of view, and fire resistance of explosives. Select explosive research and testing activities may be performed at any of the HE testing sites.

Munitions Experiments. Munitions experiments are those tests conducted to study the influence of external stimuli on explosives (i.e., projectiles or other impacts). These studies include work on conventional munitions for DoD. Most of the munitions experiments are expected be performed at TA–36, yet any of the other firing sites may be used as required.

High Explosives Pulsed-Power Experiments. High explosives pulsed-power experiments are those tests conducted to develop and study new concepts based on the use of explosively driven electromagnetic power systems. These experiments will be conducted primarily at TA–39.

Calibration, Development, and Maintenance Testing. Calibration, development, and maintenance testing are those experiments conducted primarily to prepare for more elaborate tests, and include tests to develop, evaluate, and calibrate diagnostic instrumentation or other systems. The calibration, development, and maintenance testing activities will be concentrated at TA–15 and TA–36, but may involve any of the HE testing sites.

Other Explosives Testing. Other explosives testing includes such activities as development of advanced HE and/or work to improve weapons evaluation techniques. Any of the HE testing sites may be used for select testing activities.

3.3 SWEIS Description of Capabilities (Preferred Alternative)

High explosives testing is described in the previous section. This alternative includes about 1,800 experiments per year, 100 of which would be characterized as major hydrodynamic tests. In addition to smaller quantities of other materials, up to 6,900 pounds (3,130 kilograms) of depleted uranium would be expended in experiments annually. As these numbers indicate, overall high explosives test activity would be about three times that under the No Action Alternative. The operation of the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility is included in all alternatives using phased contaminants as described in the Final DARHT EIS (DOE 1995).

Under the Expanded Operations Alternative, the following activities would occur.

Hydrodynamic Tests. LANL would increase the number of hydrodynamic tests (over the No Action Alternative), develop containment technology, and conduct tests of weapons configurations. These would include up to 100 major hydrodynamic tests per year.

Dynamic Experiments. LANL would increase these experiments by approximately 50 percent (over No Action Alternative levels) the number of dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons, including some experiments with SNMs.

Explosives Research and Testing. Up to twice as many high explosives tests would be conducted as under the No Action Alternative to characterize explosive materials.

Munitions Experiments. As under the No Action Alternative, LANL would continue to support DoD in conventional munitions, conducting experiments with projectiles and studying other effects of munitions.

High Explosives Pulsed-Power Experiments. LANL would conduct up to twice as many high explosives pulsed-power experiments and development tests.

Calibration, Development, and Maintenance Testing. LANL would conduct up to twice as many tests to provide calibration data, instrumentation development, and maintenance of image processing capability.

Other Explosives Testing. LANL would conduct 50 percent more advanced high explosives or weapons evaluation studies than under the No Action Alternative.

The operation of the DARHT facility is included in all alternatives.

4.0 Background Document Information for HE Testing

This section presents information from the "Background Information for the High Explosives Firing Sites" (LANL 1996).

4.1 Description of Facilities

This chapter contains a description of the five firing areas (14 firing sites) and the associated systems and facilities operated by the Dynamic Experimentation (DX) Division for the Los Alamos National Laboratory (LANL). The facilities described here are used primarily for research, development, and test operations related to stockpile stewardship and maintenance activities and for production operations related to the weapons mission of the division and the Laboratory operating under contract to the Department of Energy (DOE). The facilities are also used to support other government agencies and private industrial groups as time is available.

The firing sites specialize in experimental studies of the dynamic properties of materials under conditions of high pressure and temperature. These conditions are typically produced during the detonation of high explosive that is in contact with the materials or in the immediate vicinity of the materials. Studies typically involve the mapping of the explosive or hydrodynamic behavior of the materials at a specific time or over a period of time for use in comparison with mathematical models intended to predict the physical nature of the processes of interest. Diagnostic tools used to record the experimental data include fast-time-sequencing data collection and recording systems; flash x-ray radiography; and various microwave, laser, and other optical data recording systems. Tests performed as part of a production task provide the basis for qualification of the items as produced under the quality assurance and control programs of the Laboratory.

The DX Division is one of the largest divisions in the Laboratory in terms of both land area and personnel. The division occupies approximately 22 mi^2 of land area representing at least half of the total land area occupied by the-Laboratory. The organization employs approximately 350 personnel, including 144 technical staff, 127 technicians, 41 support personnel, 25 graduate and undergraduate students, 8 laboratory associates, and several service academy research assistants. In addition, the division uses the skills and experience of a large number of contract personnel involved in nuclear test readiness activities at the Nevada Test Site (NTS) and other Laboratory resources in the areas of environment, safety, and health, engineering, procurement, etc. In addition to the division office, the organizational structure of the division consists of 7 operating groups, a test office (to coordinate NTS work and other off-site projects), and a construction office for the Dual-Axis Radiographic-Hydrodynamic Test (DARHT) Project.

The core capabilities of the division are concentrated in areas related to nuclear weapons research: dynamic experimentation, explosive materials and devices, field engineering, and shock wave physics. These major capabilities require a host of attendant support capabilities from diagnostics design and development to image analysis, environmental monitoring, and deployment of sophisticated, portable command and control systems. Using these capabilities, the division contributes to related national programs such as the Nuclear Emergency Search Team, the Accident Response Group, the National High Magnetic Field Laboratory, and the Neighborhood Environmental Watch Network.

The division executes its responsibilities at five major firing areas which can be discussed in terms of the standard firing site components: firing pad, support structures, and bunkers. In addition to the standard firing site structures, the division provides a unique set of additional facilities. Some of these facilities are portable and can be moved from site to site, but most are located permanently as a single site location. These facilities include

- a contained firing facility,
- single- and two-stage light gas guns and large-bore powder guns,
- three flash x-ray systems,
- multistate, satellite-coupled environmental monitoring system,
- large pilot plant for chemical development, and
- underground subcritical test complex at NTS.

DX Division uses high-velocity gas and powder guns at several locations for a variety of programmatic needs that spread across a spectrum of technical disciplines. The guns are used for equation-of-state studies of both engineering and geological materials, explosive characterization and research, macroscopic and microscopic metallurgical studies, and penetration and armor mechanics Gas guns are also used as high-velocity injection devices for other projectile devices. It is expected that the armor and penetration studies for which these guns are used will increase as military organizations seek more effective and less costly techniques of engagement. Gun facilities deliver a projectile in a prescribed and well-controlled manner**.** The use of explosives to achieve the same projectile profile requires either outdoor firing or a vessel that contains the effects of a relatively large explosive charge as well as the metal projectiles and fragments.

Sections 4.1.1 through 4.1.5 of this chapter contain descriptions of the 5 firing areas (technical areas) 14 associated firing sites along with the specialized facilities and systems which may be employed.

- TA-14: Q Site/Outdoor Chemistry Laboratory (two firing sites),

- TA-15: R Site (three firing sites),
- TA-36: Kappa (four active firing sites),
- TA-39: Ancho Canyon (two firing sites), and
- TA-40: DF (three firing sites).

All of the firing areas are located in remote locations on the Pajarito Plateau or in canyons of the plateau. Four of the areas are located on or just below Three Mile Mesa. The nearest private residences to these four firing areas are the trailer court in the Los Alamos townsite, approximately 2 mi to the north, and White Rock, approximately 4 to 6 mi to the southeast. The TA-39 firing area is located in Ancho Canyon. The nearest private residences to this firing area are located in the trailer court in the Los Alamos townsite, above the canyon and approximately 5 mi to the northwest, and White Rock, approximately 3 mi to the northeast.

Each subsection of this chapter includes a description of the site facilities, primary program missions (including major funding sources), activities, facilities and equipment (including accident mitigation methods and systems), operating limits, permits, and releases.

Section 4.2 contains a description of the baseline use and the anticipated or proposed use of the firing site facilities under Expanded Operations Alternative.

4.1.1 TA-14: Q Site

The Q Site firing areas are known as the Outdoor Chemical Laboratory. Its major use is related to high explosives testing for quantities of materials which exceed the safety limits for indoor laboratories. Two firing sites are available at the Q Site firing area (see Figure 1). Both have a standard firing pad and bunkers. One site is used by Group DX-2, HE Science and Technology, to perform preliminary testing of high explosives and explosive formulations. This testing does not require sophisticated instrumentation, and there is none at TA-14. The site is also used by DX-2 to conduct processing operations that are not suitable for the process buildings at TA-9. The firing sites at Q Site are used primarily in support of the Stockpile Stewardship and Maintenance Program and various conventional weapons programs for the DOE. This area has been used for various training exercises in the past and may be used in this manner again. Up to 100 lb. of high explosive may be fired at this area.

Q Site has also been granted a state permit for the disposal of explosives and explosive contaminated materials. The permit allows the disposal of wastes at this facility by either detonation or by burning. The permit is broad in scope and allows for the disposal of materials that would be difficult to handle in any other way. This capability is expected to remain an important near-term requirement for the division.

No significant releases are expected from the work performed at Q Site. The byproducts of high explosive detonation consist of water, N_2, CO, and CO_2. None of these compounds represents a hazard to workers or the off-site population. The greatest hazard consists of the premature detonation of explosives, which could result in injury or death for personnel in the immediate vicinity of the detonation.

4.1.2 TA-15: R Site (Three Firing Sites)

TA-15, R Site, is the home of three firing sites, the Pulsed High Energy Radiation Machine Emitting X-Rays (PHERMEX) Facility, the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, and Building R 306; a general-purpose firing site (Figure 8). The PHERMEX facility (Figure 9) is a multiple-cavity electron accelerator capable of producing an intense, highly penetrating beam of x-rays of very short duration. The facility is capable of producing high-resolution x-ray pictures of very dense, fast-moving materials and is used primarily for weapons studies. The PHERMEX firing site is used for the investigation of weapons functions and systems behavior for nonnuclear tests. The firing site is used for full-scale, multidiagnostic hydrodynamic tests and for smaller scale experiments, such as the study of high explosives or materials driven by high explosives that might require fast, high resolution, high intensity radiography.

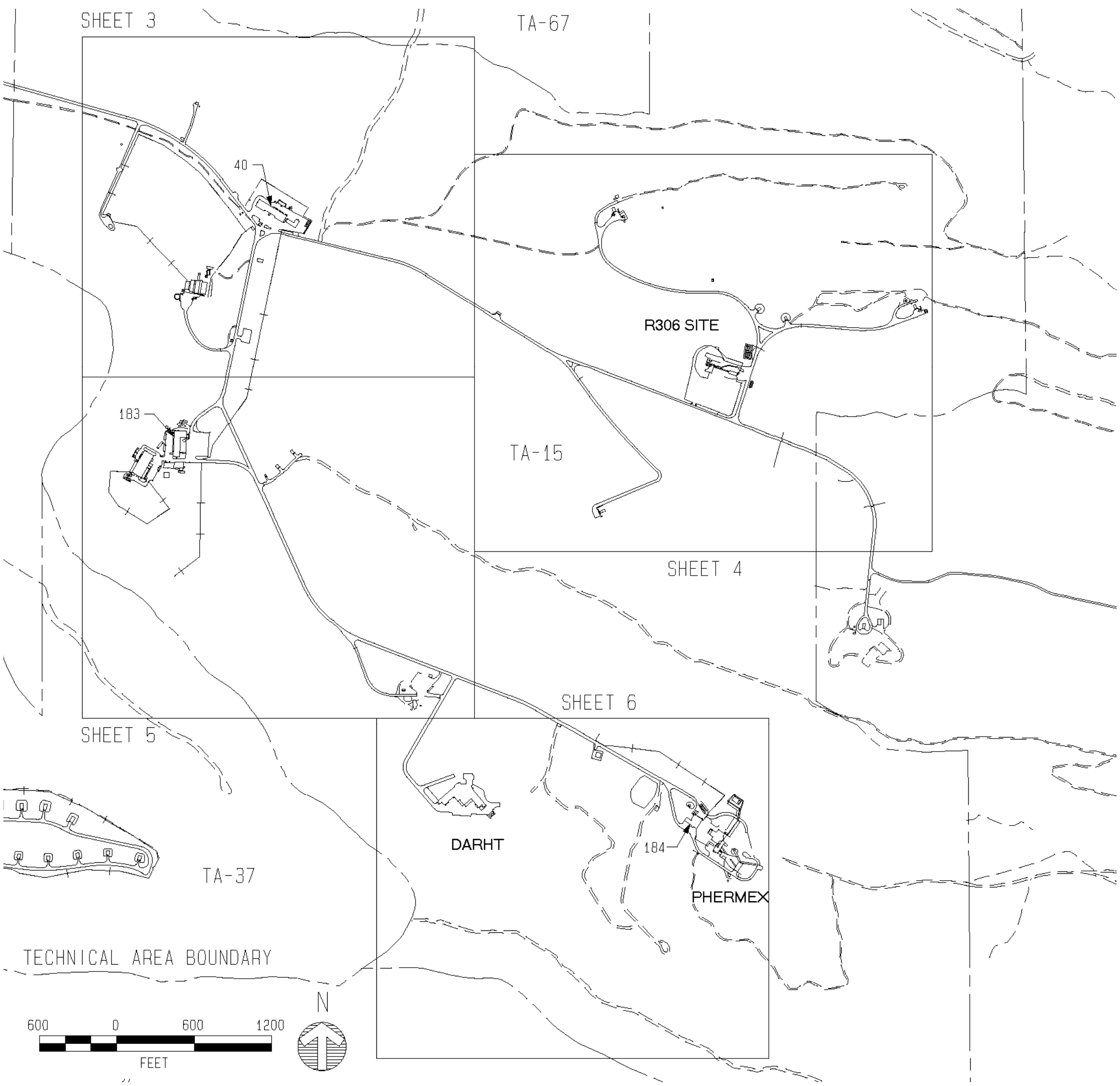


Figure 8. TA-14, R-Site

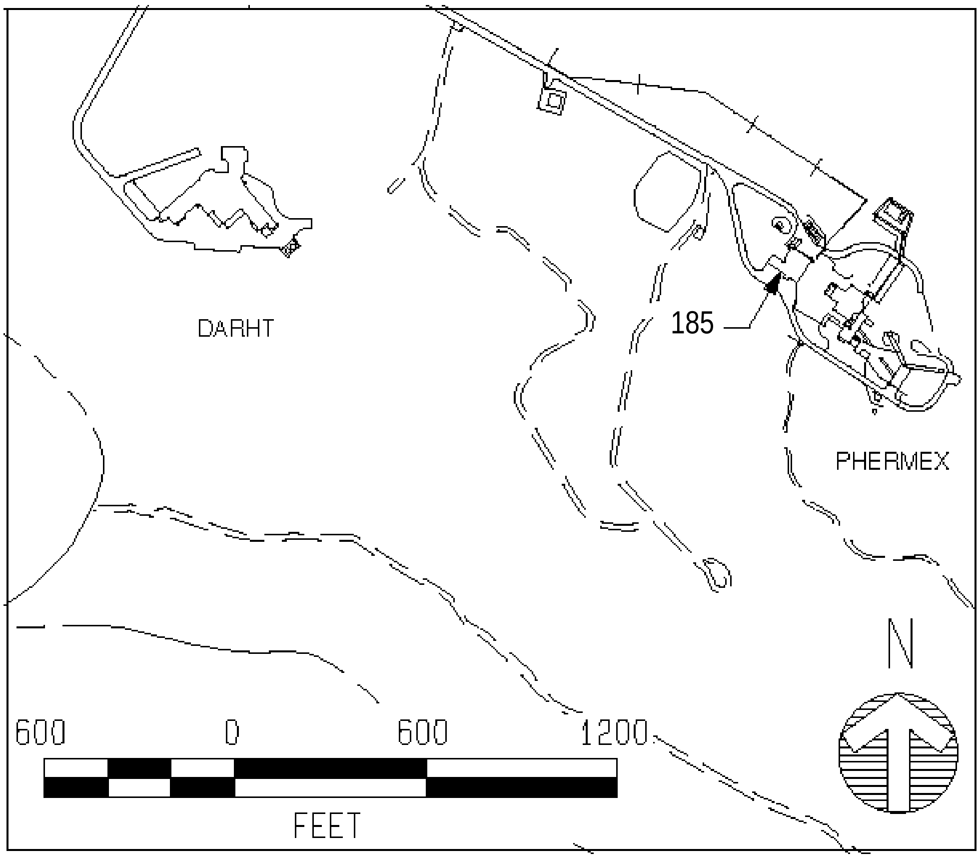


Figure 9. PHERMEX Firing Site

In 1997, a second x-ray machine, Ector, will also be relocated at the PHERMEX firing site and will have its beam axis oriented at 90 degrees to that of PHERMEX. It will be installed on tracks so that the machine can be pulled back from the firing site and held in protected reserve when not in use. The Ector controls, diagnostics, utilities, and the MARX tanks will also be moved. Diagnostics include a full quadrant of optical access to the runway and houses microwave and laser interferometers as well as fast cameras. The Ector controls will be linked to the firing runway through high-frequency signal cables. The PHERMEX facility has, and the Ector machine will have special environmental protection features in the form of spill control barriers for the large amounts of mineral oil in use at both facilities. When operating in conjunction with PHERMEX, the Ector machine will be controlled in tandem with PHERMEX from Building R185. Both an expansion and modernization of the safety interlock network is planned as part of the relocation effort. After the move, Ector will still be used in single axis studies of devices for which medium resolution, less penetrating radiographs are required. The combined PHERMEX-Ector facility, when operational, will be used to produce two x-ray pictures of a single test device; one high resolution and one medium resolution radiograph. Ector is a diode-type, pulsed power, x-ray machine.

The PHERMEX beam is produced by a radiofrequency linear accelerator and is the intense x-ray source of choice when high-resolution flash radiography is a principal diagnostic goal, especially when the test involves dense, fast moving materials such as explosively collapsed pit mockups. The 30-MeV electron accelerator is housed in a blast-proof structure at Building R184 and is controlled from the adjacent two-story building, R185. As the premier weapons hydrotesting area at TA-15, the PHERMEX firing site can handle up to 70 kg of explosives on the firing runway in front of machines. A so-called bull nose of blast shielding material protects the x-ray converter target of tungsten at the output end of the accelerator. Charge masses up to 400 kg and more can be detonated at points east of the runway. Immediately to the south of the runway is the MOC (Multidiagnostic Operations Center), building R310, a blast-proof structure offering protected space for a variety of fast diagnostics, featuring signal recording equipment such as transient waveform digitizers and time interval meters, and serving as the timing and firing control room. During testing, only R185, 186, and R310 are occupied. All of the buildings adjacent to the firing site are constructed of heavily reinforced concrete.

The second firing site at TA-15 is a new radiographic facility. The Dual Axis Radiographic Hydrodynamic Test Facility is currently under construction near the PHERMEX firing site. The environmental impacts and alternatives to the DARHT facility have been addressed separately in a final Environmental Impact Statement (EIS). The DARHT EIS also contains an appendix with complete baseline information on current operations at PHERMEX. When completed, the DARHT facility will provide dual axis, multiple exposure radiographs at the highest penetration and resolution available for the study of devices and materials under hydrodynamic conditions. The facility will be used primarily in support of the Stockpile Stewardship and Management Program of the DOE (DOE 1995; Record of Decision for DARHT, FR 60, 199, October, 1995).

The emphasis of the experiments conducted at the TA-15 firing area is on complex tests and detailed measurements of full-scale, explosively driven, warhead mock-ups in direct support of DOE nuclear weapons program, and less frequently for DoD conventional ordnance R&D. The tests are performed using both explosively driven device configurations and with any of the portable gas or powder gun systems. With the current moratorium on nuclear testing, these kinds of tests have become a vital component in the annual certification process for the safety and reliability of the enduring nuclear weapons stockpile. The typical experimental test involves a combination of diagnostic controls and numerous ultra fast techniques such as flash radiography, electrical and optical pins studies, particle or impulse detectors, rotating mirror or electro-optic cameras, holography, laser interferometry (point or line), and microwave interferometry. Both open-air and contained explosives tests are performed at TA-15. Most tests are performed on explosively driven device configurations. However, tests may also be performed using one of the portable gas or powder gun systems. These tests may involve materials such as beryllium, lead, and depleted uranium. Each experiment is designed with a specific set of diagnostics to enhance the observation of the material and time frame of interest so it can be assessed in great detail**.** Most of the tests are conducted in the open air; a few are fired in containment.

A strong effort to ally the explosives-testing program with supporting technologies is also maintained at TA-15: accelerator design, pulsed power, electron beam transport, electron gun development, computerized controls and monitoring,. The support groups also specialize in image analysis, and numerical modeling. The experimental design and installation support groups maintain expertise in diagnostics installation and adaptation, including precision assembly capabilities, calibrations, development of special electronics equipment, optics installation, x-ray film packaging and processing, storage phosphors methodologies, and lasers and microwave analysis techniques. Similarly, the ability to service or prepare firing areas, move portable structures, field heavy hardware, and to position and recover special shielding or detector elements has resulted in refined ability to develop and manage resident mobile crane capabilities for hoisting and rigging operations that are tailored to specialized testing programs in staging areas as well as at the firing sites. The ability to operate and maintain a cadre of monorail, gantry and jib cranes, plus forklift trucks and a tractor complete the spectrum of motorized lifting equipment that is in routine use at the firing sites. The third firing site at TA-15 is located at Building R306, the former Ector firing site (Figure 10).

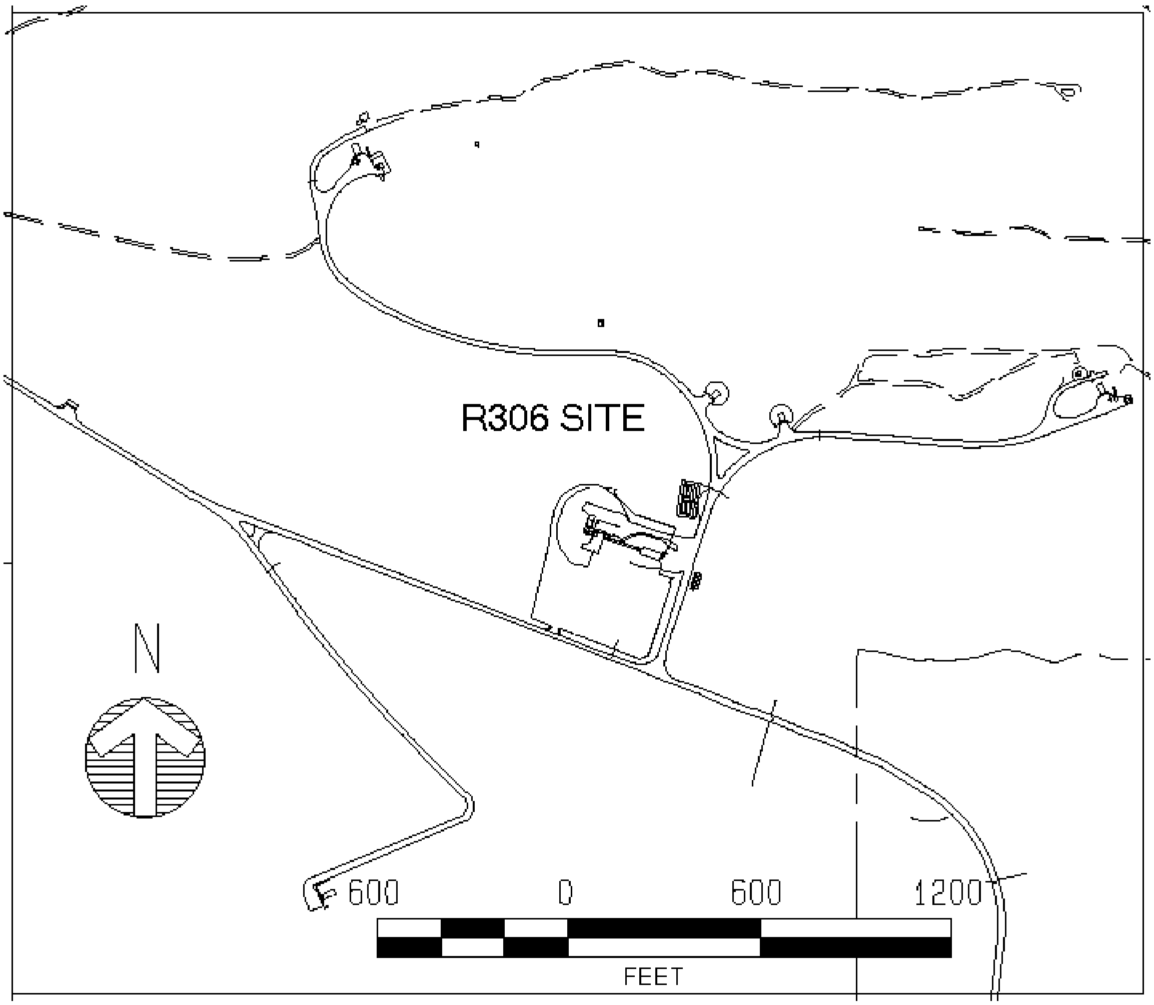


Figure 10. TA-15, R306 Site

The curved diagnostic room at this firing site provides nearly a full quadrant of optical access to the runway and houses microwave and laser interferometers as well as fast cameras. Like R310, the R306 control room currently has a full complement of digital signal recording instruments and is the focus for timing and firing controls plus machine monitors. Also like R310, the control room is linked to the firing runway through 1,000 high-frequency signal cables primarily for electrical pin instrumentation. An equipment room houses an uninterruptible power supply (UPS) conditioning all instrumentation power, and a bank of lead-acid batteries in nearby Bldg. R280 provides 15-min. reserve power for critical functions. The R306 firing site building has special environmental protection features in the form of spill control barriers for the large amounts of mineral oil that were in use when the Ector machine was in use there. Also like

R184, the HE limit is 70 kg. on the firing runway, with larger amounts possible away from the x-ray machine.

Currently, the R306 firing site is used for nonradiographic studies. This firing site and the nearby IJ firing site are current candidates for re-development and will probably continue to be used for electrical, mechanical, and optical studies in the future.

4.1.3 TA- 36: Kappa Site (Four Active Firing Sites)

The Dynamic Experimentation Division operates four explosives testing and firing facilities in support of the Laboratory and DOE nuclear and conventional weapons programs at TA-36. The facilities are often used for a wide variety of non-nuclear ordinance tests for the U. S. Department of Defense, including warhead development, armor and armor-defeating mechanisms, explosives vulnerability to projectile and shaped-charge attack, warhead lethality studies, and the safety implication of shock waves on explosives and propellants. A total of 700 to 1200 experimental firings are performed annually.

A variety of diagnostic equipment is available at the four firing sites: Four 2.3-MeV, six 600-keV, four 450-keV, and 12 150-keV flash radiographic systems are available. Rotating-mirror streak cameras with 20 mm/μs writing speed, image-intensifier cameras with 10 ns. shutter times, a combination streak and 2 million frame/sec. framing camera, other framing cameras, and high-speed digitizers are available for use at all firing sites. Nanosecond resolution, time-interval meters and digital delay units are installed at each firing site.

Eenie Site. The Eenie Site has the only aboveground bunker. This bunker allows the use of a variety of optical and electronic diagnostics. Below-grade bunkers at TA-36 are limited to the use of 35 mm. streak cameras which must observe the test device through a periscope. The image-intensifier cameras, a 70 mm streak camera, a combination streak camera with a two million frames/sec. framing camera, and a laser velocimeter are routinely available at this site for ready application for specific tests. The Eenie Site primarily performs small-bore (less than 100 mm) gun tests against conventional, ceramic, and reactive armors; shaped-charge jet tests against conventional, ceramic, and reactive armors; diagnostic experiments to determine shaped-charge jet physics; deflagration-to-detonation experiments; detonation physics experiments; and studies in explosives vulnerability to projectile and shaped-charge attach. The site has a load limit of 2000 lb of HE.

Meenie Site. Meenie Site is a general-purpose firing site. It is usually configured to perform large-bore (105 mm, 120 mm, 5 in, and 7 in) gun tests. Numerous diagnostic experiments are performed to help define the characteristics of shaped-charge jet physics, deflagration-to-detonation experiments, and explosives vulnerability to projectile and shaped-charge attack. Primary diagnostics include portable, low-resolution flash radiography and electrical timing and pressure measurements rather than optical observations. Meenie Site is the primary site for weapons components tests that require the use of the 35 mm smear camera. The site has a load limit of 2,000 lb of HE. Minie Site has also been granted a permit for treatment of explosive and explosive-contaminated material.

Minie Site. The Minie Site is also a general purpose firing site used primarily for shaped-charge jet tests against conventional, ceramic, and reactive armors. Some deflagration-to-detonation experiments and studies to determine explosives vulnerability to projectile and shaped-charge attach are performed at Minie Site when the primary diagnostics required by the customer are low-resolution flash radiography or electrical timing and pressure measurements rather than optical systems. Minie Site also serves as the backup site when scheduling conflicts preclude the use of the Meenie Site. Explosive and chemical destruct tests are also performed the Minie Site. The site has a load limit of 2000 lb. of HE.

Lower Slobbovia. Lower Slobbovia is a multipurpose site. It contains an upper firing site with instrumentation that is virtually identical to that found at the Minie Site. The primary diagnostics used here are optical, electrical timing, and pressure. The explosive load limit for the upper site is 5000 lb. The sled track is also located at Lower Slobbovia. This facility currently has a 1000 ft track. In this configuration and with the present sled design, the facility is capable of developing payloads of up to 100 lb. to velocities slightly above mach one. With a moderately redesigned sled, velocities approaching mach two or sled weights up to 1000 lb. should be possible. It is also possible to increase the track length to 2000 ft. At this length, payloads of several hundred pounds could be accelerated above mach two using multirocket motor sleds. The use of large rocket motors, greater than the current 5 in diameter is anticipated. The diagnostics currently available at the target end of the sled track include flash x-ray, time interval meters, digital delay modules, high-speed movie capability, four independent capacitive discharge units, rotating-mirror combination streak and framing camera, and image intensifier camera.

The PIXY, 8-MeV flash radiographic facility is also located at Lower Slobbovia adjacent to the target end of the sled track. The PIXY machine enables low-to-medium resolution, deep penetration radiography to be performed on a variety of conventional, ceramic, and reactive targets. PIXY will be fully integrated with the sled track and with the large-bore gun range located parallel and adjacent to the sled track enabling deep-penetration radiography to be performed in a variety of dynamic experiments.

4.1.4 TA-39: Ancho Canyon (Two Firing Sites)

TA-39, Ancho Canyon Site, is the home of the PT-88 firing site. This site is used to study high-energy-density properties in experiments using explosive driven pulsed power. The primary diagnostic techniques are the use of photographic methodologies and electrical measurements. Various phenomenological aspects of explosives, interactions of explosives, and explosions acting on other materials are also investigated. In some cases, the explosion is contained, however, for most tests, open detonation is used.

Firing Site PT-6 is the firing site for the National High Magnetic Field Laboratory (NHMFL), a consortium of Los Alamos, the University of Florida, and Florida State University. Experiments for NHMFL are carried out to produce extremely intense magnetic fields and electromagnetic pulses. These experiments usually involve HE detonations and high-voltage, energy-storage capacitor-bank discharges. The experiments are supported by operations involving HE storage and handling, machine shops, heavy equipment, laboratory preparations, data analyses, and administrative support. These support organizations are located at TA-39.

The characteristics of new weapons materials driven by high explosives are studied at TA-39. Tests associated with proliferation control and verification activities are performed here also. This is a relatively new area of research and development for the Laboratory and for DOE, and the level of activity in these areas is difficult to anticipate. However it is not unreasonable to expect new activity as global concerns for proliferation increases. Growth in this area is expected but is not well defined at present. The study of advanced techniques for hydrodynamic studies is expected to continue and some of the research and development effort related to these activities will be performed at TA-39. The study of radiation sources in the range of 10 MJ at 175 eV which may be powered by high explosives at a cost far less than that associated with equivalent high-energy capacitor-bank facilities, may be developed at TA-39. The vulnerability of sophisticated guidance systems to kinetic energy pulses was exposed during the Persian Gulf War. Eventually, as electromagnetic, beam, and laser weapons are better developed, explosive flux compressors will be required to power the devices. These are all research and development activities. The extent to which these programs will grow or decline in the future is difficult to anticipate.

Equation-of-state experiments are also carried out at TA-39 to determine the properties of materials at extreme conditions using a Two-Stage Gas-Gun in Bldg. 69 and the single stage gas gun in Bldg. 56. There are several supporting facilities for these activities including building 98, a machine shop.

4.1.5 TA-40: DF (Three Firing Sites)

TA-40, DF Site, is used in the development of special detonators to initiate high-explosives systems. Fundamental and applied research conducted at this site includes investigating phenomena associated with initiating high explosives and research in rapid shock-induced reactions. The TA-40 facility has been used for many years for the testing of high explosives used in the nuclear weapons programs. LANL also does research in the physics and chemistry of detonations and shock wave propagation.

Three widely separated individual firing sites with differing experimental assemblies containing up to 25 kg of explosives in various diagnostic configurations are routinely constructed and fired, while detonation of charges of up to 50 kg can be studied. Optical and mechanical diagnostics are performed at the firing sites to characterize each explosion in detail. The operations conducted at TA-40 are funded approximately 85% weapons program work and 15% reimbursable or work for others.

Specific measurements and experiments of importance to the weapons community include measurements of time required for emergence of detonation at a given input pressure by streak camera photography of detonating wedges. Measurements of the detonation velocity of pure compounds and of plastic-bonded (PBX) explosives are made by point-contact measurements along detonating cylinders (rate sticks). Failure diameter experiments provide a simple initial estimate of geometrical and size constraints on detonation. Fabry-Perot and VISAR interferometry uses laser fringes to measure the particle velocity in the detonating material.

Corner-turning, a measure of the vigor of the detonation reaction, is measured in a mushroom-shaped test. Plane wave lenses of explosive provide a driving shock for these various configurations, imposing a well-known impulse on the sample. These driving lenses account for most of the explosive in a given configuration. Reliability and reproducibility of detonator function is also tested exhaustively at TA-40. The gas guns are another method of producing very planar shock waves, which are better characterized in time than waves from lenses. This property allows tracking of the shock wave, the particle velocity, and the material response as the shock moves through the target sample, by in-material gauges, providing data at a level which is not attainable outside this facility. Spectroscopy of detonating and shocked materials is studied at TA-40.

Special experiments are done to examine topics such as hydrodynamic flow in detonation and factors affecting detonation wave shape. Other experiments at TA-40 include detonation of assemblies and configurations contributed by other groups in the Laboratory.

Protection of the on-site personnel, the public, and the environment has dictated the design of the explosives test facilities. Firing sites and firing procedures are carefully designed to protect the local personnel and the facilities from explosions. To assure that blasts do not disturb TA-40 workers or the public, firing sites are located at an appreciable distance from each other and from roads, and are located inside a very large preserve inaccessible to the public. Open-air firing of modern explosives reliably produces N_2, CO_2, CO, and water, rather than explosive fragments or firebrands, and thus has a negligible effect on the environment outside the immediate firing pad.

4.2 Discussion of Missions/Programs Under the Expanded Operations Alternative

The following discussion does not consider the use or effects of the following facilities that have been proposed to augment the LANL capability but are at an early stage in their proposal cycle

- The Advanced Hydrotest Facility
- The Explosive Pulsed Power Facility

The Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility has been examined in its own EIS. Major elements of the Contained Explosives Test Complex (CETC) have also been addressed in the DARHT EIS. Since the DOE record of decision has identified the phased containment alternative as the preferred alternative for DARHT, it is expected that elements of CETC will both become functional during the time interval addressed by the SWEIS, and hence, have been included in the following discussion

Many of the firing site missions/programs have the goal of maintaining a small but viable nuclear weapons stockpile without the historical benefit of new designs or nuclear tests. As a result of these circumstances many activities need to be enhanced from their historical level in order to maintain the operational capabilities necessary to meet the new needs of the programs.

4.2.1 Physics, Stockpile Stewardship

The goal of this program is to maintain high confidence in the safety, reliability, and performance of the weapons in the stockpile. This program has relied on underground nuclear tests as an essential element. These tests were supplemented by laboratory explosive and other tests to provide valuable data. To achieve this goal without underground nuclear testing is a significant technical challenge. It requires a new approach, one of science based stockpile stewardship. It is based on advances in supercomputing and numerical simulation, coupled with improved fundamental understanding of weapons-related science and appropriate experimental capabilities to address aspects of weapons behavior without a nuclear explosion. A weapon's safety, reliability, and performance must be predictable according to changes observed as the weapon ages. System safety and reliability must also be predicted with a high degree of accuracy and confidence. The Science-Based Stewardship Program uses past nuclear test data in conjunction with non-nuclear test data, modeling and simulation, and advanced experimental facility data to add to the body of understanding of nuclear weapons. The ability to perform major hydrodynamic tests is essential to satisfying the needs of this program. This program will also require strong support functions including on-going machine and diagnostics development and the development of advanced containment technology in order to satisfy the phased containment option which was the preferred option identified for the implementation of the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility.

Under the No Action Alternative, this program will require about 15 to 30 major hydrodynamic tests per year. These tests are likely to vary widely in their make up and complexity. In addition, each test may consist of up to 30 individual shots. Several of these tests will represent baseline tests of stockpile systems. Should concern arise about the performance of a stockpile system, the number of tests could increase significantly. The program will also require about 200 dynamic experiments per year including a small number involving special nuclear material.

Under the Expanded Operations Alternative, this program would support about 30 to 100 major hydrodynamic tests per year (each test may consist of up to 30 individual firings), about 300 dynamic experiments per year, and would significantly increase experiments to enhance the fundamental data on special nuclear material.

4.2.2 Surety

Surety of nuclear weapons includes their safety, security, and use control. LANL evaluates weapons for these qualities by various assessment modeling and testing techniques. The Laboratory develops new technologies for enhancing such qualities in the nation's stockpiled nuclear weapons. The Surety Technology Program conducts studies and assessments in collaboration with DoD users, supports the activities of DOE and DOE/DoD surety oversight groups, develops the data needed for surety assessments, and develops surety technology. Such technology programs are continually examined to ensure that they strike a proper balance between preparing for the future and obtaining data for the present. An important programmatic direction for the next few years will be the benchmarking of the surety performance of the stockpiled systems to provide a standard against which to compare proposed new features.

Under the No Action Alternative, this program will require about 30 to 50 major safety or reliability tests per year with supporting minor tests. These tests will vary widely, for example from major full weapon mock-up hydrodynamic tests to behavior tests of aged High Explosive. This program will require development of advanced surety technology, particularly in the fields of Assessment (nuclear explosive safety and joint DOE/DoD evaluations), R&D (HE behavior, multi-point safety, and fire resistance) and Technology (security systems and detonator system development).

Under the Expanded Operations Alternative, the number of safety/reliability tests would increase to about 50 to 100. Tests to advance the development of Surety Technology would be increased. The effort in High Explosives Science would be increased significantly.

4.2.2.1 NTS/Subcritical Experiments/Test Readiness

This program requires the development of experiments to be conducted at the subcritical test complex at NTS. This complex permits subcritical experiments with special nuclear material to be performed. Approximately two to four subcritical NTS tests per year are needed. The operations considered in this study are only those conducted at LANL to prepare for the final experiment at NTS. The NTS activities will be considered in the NTS studies. Many of the activities associated with this program and others permit the retention of that expertise that would be necessary should a decision be made to resume nuclear testing.

Under the Expanded Operations Alternative, there would be an increase to about 4 to 6 tests per year.

4.2.2.2 High Energy Density Experiments

The High Energy Density Physics program consists of weapon physics, technology development, and basic high energy density science.

The weapons physics experiments advance the development of the predictive capability required for Science Based Stockpile Stewardship. Primary and secondary experiments produce data used to improve and refine the physics models in weapon design codes, which are the primary tool for assessing the health of the stockpile.

Technology development pushes the envelope in experimental weapons physics in order to realize the full potential of future experiments. Hydrodynamic driver development explores the production of high energy density environments using magnetic energy, usually by imploding heavy solid liners. This includes the development of explosive pulsed power systems specifically designed for hydrodynamic and dynamic material property experiments.

The effort in basic science provides the underlying scientific knowledge and experience needed to extend current experimental techniques and open the door to new approaches. A major goal of the basic science element is engaging world-class researchers from outside the weapons program in high energy density experiments with the aim of both invigorating our approach and validating the historically high quality of our on-going efforts.

Under the No Action Alternative, this program requires about 6 to 12 major high explosive Pulsed Power experiments per year. In addition, about 10 to 30 development tests are required.

Under the Expanded Operations Alternative, this program could expand to about 12 to 24 High Explosive Pulsed Power experiments and about 10 to 50 development tests per year.

4.2.2.3 Stockpile Management

The goal of this program is to develop and carry out those activities required to dismantle, maintain, evaluate, and repair or replace nuclear weapons in the existing stockpile.

The Stockpile Management Program builds on the technologies developed in the Stewardship Program to extend stockpile lifetimes beyond those originally planned. In particular the program will establish the capability to manufacture replacements for fixed-life components as well as for components judged to require replacement due to unacceptable aging effects. The program will also provide needed parts for the surveillance program as well as for other activities that require destructive testing.

This program requires a significant number of tests of high explosive parts in order to satisfy the quality control standard for rebuilt parts in order to replace items destructively analyzed as a part of the stockpile surveillance program. In addition, the program requires about 2 to 5 complete hydrodynamic tests in order to continue the certification of existing stockpile weapons systems.

Under the Expanded Operations Alternative, this program could increase the number of quality assurance tests of high explosive parts in order to satisfy an increased production rate for rebuilt or new parts. The program could conduct about 6 to 10 complete hydrodynamic tests to maintain the certification of existing stockpile weapons systems.

4.2.6 Other Explosive Experiments

LANL has applied much of its unique expertise to assist the Department of Defense with a variety of studies applied to the properties of conventional munitions.

As a part of the evaluation of properties of materials under the effects of high explosives, LANL has developed an extensive image processing capability. This expertise has been applied to the locally conducted explosive experiments and the resulting images. In addition, this expertise has been exploited by the DOE emergency response elements, to examine and evaluate unusual systems under severe field conditions.

In support of nuclear nonproliferation goals, the LANL explosive testing expertise has developed special disablement capabilities that may be effective at safely disarming improvised nuclear devices that might be assembled by terrorist organizations.

Under the Expanded Operations Alternative, the program could significantly increase the number of experiments to study and evaluate explosive systems

4.3 Discussion of Operational Capabilities in Support of Programs

4.3.1 Hydrodynamic Tests

4.3.1.1 Description

A hydrodynamic test is a dynamic, integrated systems test of a mock-up nuclear package during which the high explosives are detonated and the resulting motions and reactions of materials and components are observed and measured. The explosively generated high pressures and temperatures cause some of the materials to behave hydraulically (like a fluid). Surrogate materials are used to replace the actual weapons materials in the mock-up nuclear weapons package.

4.3.1.2 Programs Supported

Hydrodynamic testing at the LANL firing sites is used to support Physics Research, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.1.3 Radioactive Materials

The principal radioactive material used in these operations is depleted uranium. Because of its low specific activity, depleted uranium is of little environmental concern from the point of view of radiation exposure or contamination. In addition to the depleted uranium, some amounts of tritium will be used in the hydrodynamic tests.

The DOE has identified the Phased Containment Option to the Enhanced Containment Alternative as its preferred alternative for the implementation of the DARHT facility. The Phased Containment Option would be phased in over 10 years. To mitigate potential adverse environmental impacts, this option establishes materials release goals that would be met by using containment vessels and augmented cleanup of debris from shots that necessarily must be uncontained. This will finally result in containment of up to 75 percent of the experimental material. The potential impacts from depleted uranium contamination to soils and surface water would be substantially reduced under this alternative. There is a projected increase in the estimated worker dose from radioactive material under this alternative. This is as a result of a potential increase in worker exposure to radiation as a result of clean out operations.

4.3.1.4 Nonradioactive, Toxic, or Hazardous Substances

Non-radioactive toxic/hazardous materials used in this operation may include beryllium and heavy metals (e.g. lead). Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane. Sulfur hexafluoride is used as an insulating material.

4.3.1.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment. Access is controlled to ensure that no personnel are within the hazard area for each test. Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

4.3.2 Dynamic Experiments

4.3.2.1 Description

A Dynamic Experiment is an experiment to provide information regarding the basic physics of materials or characterize the physical changes or motions of materials under the influence of high explosive detonations. These experiments are also performed to study the response of materials to the shock produced by high explosives.

This category covers those dynamic experiments conducted with other than a complete nuclear weapons mock-up. A significant number of these experiments will support research and development, calibration, diagnostic development and component verification directly related to companion hydrodynamic tests and dynamic experiments. These experiments may also include the study of shaped charges and possible disablement techniques for improvised nuclear devices.

4.3.2.2 Programs Supported

Dynamic experiments at the LANL firing sites are used to support Physics, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, High Energy Density Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.2.3 Radioactive Materials

Some dynamic experiments will be conducted with plutonium metal. As a matter of policy, dynamic experiments involving plutonium would always be conducted inside double-walled steel containment vessels. All experiments would be arranged and conducted in a manner such that a nuclear explosion could not result.

The only other radioactive material used in these operations is depleted uranium. Because of its low specific activity, depleted uranium is of little environmental concern from the point of view of radiation exposure or contamination.

The DOE has identified the Phased Containment Option to the Enhanced Containment Alternative as its preferred alternative for the implementation of the DARHT facility. The Phased Containment Option would be phased in over 10 years. To mitigate potential adverse environmental impacts, this option establishes materials release goals that would be met by using containment vessels and augmented cleanup of debris from shots that necessarily must be uncontained. This could finally result in containment of up to 75 percent of the experimental material. The potential impacts from depleted uranium contamination to soils and surface water would be substantially reduced under this alternative. There is a projected increase in the estimated worker dose from radioactive materials under this alternative. This is as a result of a potential increase in worker exposure to radiation as a result of clean out operations.

4.3.2.4 Nonradioactive, Toxic, or Hazardous Substances

Non-radioactive toxic/hazardous materials used in this operation may include beryllium, heavy metals (e.g. lead). Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane. Sulfur hexafluoride is used as an insulating material.

4.3.2.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment and the mitigation used. Access is controlled to ensure that no personnel are within the hazard area for each shot.

Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

4.3.3 Explosive Research and Testing

4.3.3.1 Description

Explosive Research and Testing are those experiments conducted to primarily study the properties of the explosives themselves as opposed to explosive effects on other materials as was the interest above in hydrodynamic testing and dynamic experiments. Examples include those tests to determine the effects of aging on explosives, the safety and reliability of explosive from a quality assurance point of view, and fire resistance of explosives.

4.3.3.2 Programs Supported

Explosives research and testing at the LANL firing sites is used to support Physics, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.3.3 Radioactive Materials

Radioactive materials are not normally involved in explosive research studies.

4.3.3.4 Nonradioactive, Toxic, or Hazardous Substances

Non-radioactive toxic/hazardous materials used in this operation may include beryllium or heavy metals (e.g. lead). Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane. Sulfur hexafluoride is used as an insulating material.

4.3.3.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment. Access is controlled to ensure that no personnel are within the hazard area for each test.

Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

4.3.4 Munitions Experiments

4.3.4.1 Description

Munitions experiments are those tests conducted to study the influence of external stimuli on explosives, for example, projectiles or other impacts. These studies also include work on conventional munitions for the DoD.

4.3.4.2 Programs Supported

Munitions experiments at the LANL firing sites are used to support Physics, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.4.3 Radioactive Materials

The only radioactive material used in these operations is depleted uranium. This depleted uranium is usually in the form of armor-piercing projectiles. Because of its low specific activity, depleted uranium is of little environmental concern from the point of view of radiation exposure or contamination.

4.3.4.4 Nonradioactive, Toxic, or Hazardous Substances

Non-radioactive toxic/hazardous materials used in this operation may include heavy metals (e.g. lead). Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane.

4.3.4.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment. Access is controlled to ensure that no personnel are within the hazard area for each test.

Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

4.3.5 Explosive Pulsed Power Experiments

4.3.5.1 Description

This operational capability involves conducting Pulsed Power experiments driven by High Explosives in support of nuclear weapons issues. Explosive pulsed power experiments are those tests conducted to develop new weapons concepts based on the use of explosively-driven electromagnetic power systems.

4.3.5.2 Programs Supported

Explosive pulsed power experiments at the LANL firing sites are used to support Physics, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, High Energy Density Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.5.3 Radioactive Materials

There are no radioactive materials used in these operations.

4.3.5.4 Nonradioactive, Toxic, or Hazardous Substances

Nonradioactive toxic/hazardous materials used in this operation may include copper and aluminum. Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane. Sulfur hexafluoride is used as an insulating material.

4.3.4.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment. Access is controlled to ensure that no personnel are within the hazard area for each test.

Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

4.3.6 Calibration, Development, Maintenance Testing

4.3.6.1 Description

Calibration, development, maintenance testing are those experiments conducted primarily to prepare components or other systems for more elaborate tests, i.e. dry runs. Tests to develop, evaluate, and calibrate diagnostic instrumentation or other systems are also included.

4.3.6.2 Programs Supported

As indicated in the matrix of missions and operational capabilities in Table 2-2, Calibration, development, maintenance testing at the LANL firing sites is used to support Physics, Stockpile Stewardship, Surety, NTS/Subcritical Experiments, High Energy Density Experiments, Stockpile Management, and Other Explosive Experiments programs.

4.3.6.3 Radioactive Materials

Limited amounts of radioactive materials as depleted uranium may be used in some of the calibration and/or development tests. Because of its low specific activity, depleted uranium is of little environmental concern from the point of view of radiation exposure or contamination.

4.3.6.4 Nonradioactive, Toxic, or Hazardous Substances

Non-radioactive toxic/hazardous materials used in this operation may include beryllium, heavy metals (e.g. lead). Cleaning chemicals are not used on a scale large enough to produce measurable releases. Materials used are rags dampened with acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1-trichloroethane. Sulfur hexafluoride is used as an insulating material.

4.3.6.5 Hazardous Energy Sources

The most serious hazard to operation personnel is from firing high explosives during the experiments. Hazards involved with handling explosives are well recognized and are based on long experience. Only experienced, trained personnel are allowed to perform the operations at the firing site. The hazard radius around the firing site varies from test to test depending on the energetic materials content of the experiment. Access is controlled to ensure that no personnel are within the hazard area for each test.

Potential accident scenarios include personnel contact with power supplies, charged capacitor banks or laser power supplies. Controls and barriers associated with electrical energy hazards are designed into each facility.

5.0 References

DOE 1995: “Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement,” U.S. Department of Energy, DOE/EA-1100 and Finding of No Significant Impact, Los Alamos, New Mexico. August 1995.

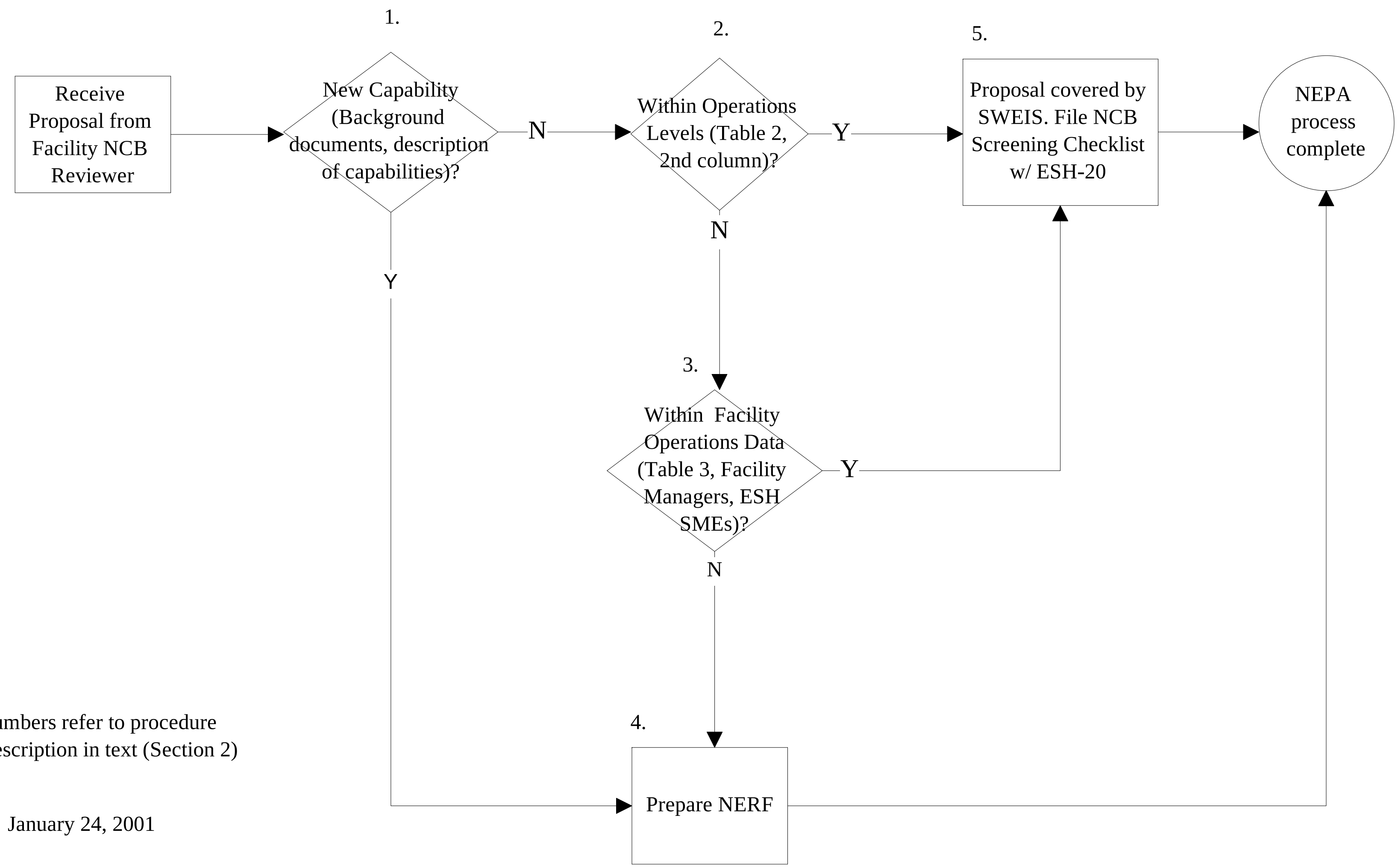
DOE 1996: “Environmental Assessment for Effluent Reduction,” U.S. Department of Energy, Los Alamos Area Office. DOE/EA-1156. Los Alamos, New Mexico, July 3, 1996

LANL 1996: “Background Information for the High Explosives Firing Sites,” Los Alamos National Laboratory, transmitted to Mr. Thomas Anderson, GRAM, Inc., by Doris Garvey, Project Leader, on December 2, 1996.

LANL 2000a: “NEPA, Cultural Resources, and Biological Resources (NCB) Process Laboratory Implementation Requirement,” Los Alamos National Laboratory LIR 404-30-02.0, January 20, 2000.

LANL 2000b: Facility NCB Reviewer Determination Document 10: High Explosives Testing, LA-UR-01-1273, March 6, 2001.

Attachment 1: ESH-20 Screening Flow Chart



Numbers refer to procedure description in text (Section 2)

January 24, 2001

Attachment 2: NCB Screening Checklist

REVIEWER: DATE:

PROJECT TITLE:

PROJECT IDENTIFIER/Reference No:

DESCRIPTION/Comments:

Air or water emissions to environment: Yes ☐ No ☐
Describe issue or resolution:

LOCATION: FMU No: FMU No:

TA:__ Building:_____ TA:__ Building:_____ TA:__ Building:_____
TA:__ Building:_____ TA:__ Building:_____ TA:__ Building:_____
Other: _____

CRITERIA:

2a. 1. Schedule or location modified to avoid T&E concerns?	Yes ☐	No ☐
2. After project modification is there an unresolved T&E issue?:	Yes ☐	No ☐
3. For T&E buffer areas, map of project footprint is attached or has been sent to ESH-20?	Yes ☐	No ☐
2b. Floodplain issue:	Yes ☐	No ☐
2c. Wetland issue:	Yes ☐	No ☐
Wetland BMPs implemented?	Yes ☐	No ☐
2d. Modifications to a historic building:	Yes ☐	No ☐
2e. Archaeological resources affected:	Yes ☐	No ☐
Sites within project area were avoided (notify ESH-20 and provide map):	Yes ☐	No ☐

3a. NEPA Documentation:

CX (specify): LAN-__-_____ LAN-__-_____
Site-wide EIS (specify): Facility NCB Document No.: _____ Operations Level (Use Table 2): _____

3b. Conditions that preclude a cx or SWEIS reference:		
Connected action:	Yes ☐	No ☐
Extraordinary circumstances	Yes ☐	No ☐
Siting/expansion - Treatment, Storage, Disposal facility?	Yes ☐	No ☐
Uncontrolled releases of contaminants	Yes ☐	No ☐

Reviewed by ESH-20 NCB staff:

NEPA:	Name	Date	Comment:
Biological Resources:	Name	Date	Comment:
Cultural Resources:	Name	Date	Comment:
Other:	Name	Date	Comment: