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Noise Mitigation for Training Ranges

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An Army Blast Noise Warning and Monitoring System

For Reference

by
Paul D. Schomer
Aaron J. Averbuch
Lester M. Lendrum

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Testing and training noise is a major adverse environmental factor at Army installations. The purpose of this study was to develop the noise warning and monitoring system (NWS) and to test its use, installation, operation, and maintenance in typical Army environments. The purpose of the noise warning and monitoring system is to alert the range control office when operational blast noise levels in a community exceed those established by the range control office and to monitor the overall blast noise produced by the installation.

The warning system consists of a microphone and a "smart" controller located in an area subject to noise problems. The microphone and controller will detect and record the noise levels. This information can be accessed by personnel at the range office via the telephone; alternatively, the controller can be programmed from range control via the telephone to send range control a warning whenever a predetermined noise level has been reached.

Installations can readily install, operate, and maintain the system with only modest training, and the system produces data with which the installation can better understand and manage its noise problems. The system is reliable, easily tailored, and useful in documenting compliance with applicable standards. The system also indicates when the installation is quiet and thus is not the source of complaints.

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noise levels. This information can be accessed by personnel at the range office via the telephone; alternatively, the controller can be programmed from range control via the telephone to send range control a warning whenever a predetermined noise level has been reached.

The results are positive and the system has proved successful. Installations can readily install, operate, and maintain the system with only modest training, and the system produces data with which the installation can better understand and manage its noise problems. Three results stand out: (1) the system is extremely reliable and easily tailored to specific installation needs; (2) the data show times when the installation is quiet, thus any complaints for those times are due to noise from off-post sources; and (3) the system is useful in documenting compliance with applicable standards.

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FOREWORD

This study was performed for the U.S. Army Engineering and Housing Support Center (EHSC) under Facilities Technology Applications Test (FTAT) Work Unit "Noise Mitigation for Training Ranges." The EHSC Technical Monitor was LTC James Stratta, CEHSC-EP.

This study was conducted by the Environmental (EN) Division of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). Dr. R. K. Jain is Chief of USA-CERL-EN.

COL Norman C. Hintz is the Commander and Director of USA-CERL and Dr. L. R. Shaffer is the Technical Director.

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AN ARMY BLAST NOISE WARNING AND MONITORING SYSTEM

1 INTRODUCTION

Background

Testing and training noise is a major adverse environmental factor at Army installations worldwide. The primary sources of noise are helicopters and large weapons. This report is concerned with the blast noise generated by large weapons, a noise which is virtually unique to the Army and one which is especially bothersome to communities because it can cause structures to shake and rattle. The adverse impact of this noise is eroding the Army's operational capability, and at several installations it is severe enough to threaten the Army's ability to operate and train.

In the Army, noise is assessed in accordance with the procedures of Army Regulation (AR) 200-1, Chapter 7.¹ Basically these assessment procedures mirror the more general procedures developed by the U.S. Environmental Protection Agency (USEPA) and the Department of Defense (DOD). They use the recommendations of the National Academy of Science and applicable American National Standards Institute standards. The assessment procedure uses the total noise energy produced and transmitted to a site as its measure. Since the measure is total energy, louder sounds have more energy and contribute more to the total measure of impact. All else being equal, nearer sources contribute more energy at a given site than do more distant sources.

Community annoyance is the basic psychoacoustical factor used by DOD and the Army to describe community response, and this is the factor that correlates with average sound energy. Complaints do not correlate with average noise energy and are not used as a measure in AR 200-1 because of their lack of correlation with an objective measure of the noise. In fact, it has been shown² that complaints occur primarily when a sound is unusual (for example, when it is new, different, or louder than normal). A noise warning and monitoring system can help an installation mitigate both complaints and community annoyance.

Blast sounds travel over long distances from the firing position or impact area to the receiving community. Weather conditions can greatly influence the sound energy received for a given source, such as a 155 mm howitzer. Sometimes the received sound in the community can be very loud (very energetic) and other times it will be inaudible; it all depends on the weather. Because of this large variation of sound energy with weather conditions, perhaps 10 percent of the firings produce 90 percent of the noise energy. So if the few very noisy and energetic events can be eliminated, nearly all of the noise impact as defined in AR 200-1 can be eliminated, while at the same time complaints which are generated by the loud or unusual events are also reduced or eliminated.

¹Army Regulation (AR) 200-1, *Environmental Protection and Enhancement* (Department of the Army, 15 June 1982).

²George A. Lux, Richard Raspet, and Paul D. Schomer, "An Analysis of Community Complaints to Army Aircraft and Weapons Noise," *Journal of the Acoustical Society of America*, Vol 73, No. 4, (April 1983), pp 1229-1235.

A noise warning system (NWS) can serve this purpose for the Army. Field monitors are placed at various locations in and around an installation, usually where there are communities which may be annoyed by the noise generated from on-base testing and training with large weapons (Figure 1). When a blast noise event becomes especially loud at a given field site, the monitor calls the computer at range control so that personnel are immediately warned of the high noise levels. Thus, the system provides more information to the installation so that it can better manage its testing and training function.

Not all installations need an NWS. Sometimes, just long-term noise monitoring is required. In fact, by making routine noise monitoring possible, the monitors are good for public relations. The community is pleased to see the base take an interest in the problem. The improved public relations can be "worth" a few decibels of quieting. Also, under the Installation Compatible Use Zone Program (ICUZ), installations with a Zone III off-post are required to perform monitoring. An NWS can also be configured as a noise monitoring system. In this configuration, the noise data can be accumulated in the monitor and periodically transferred by telephone to the base station.

Use of noise warning and noise monitoring systems is consistent with national and worldwide experience at public and military airfields. For example, some commercial airports use measurement systems (aircraft noise warning systems) to limit the maximum noise that an individual aircraft can produce. Many other airports have installed area monitoring systems as part of their program to mitigate noise and work constructively with the off-airport community.

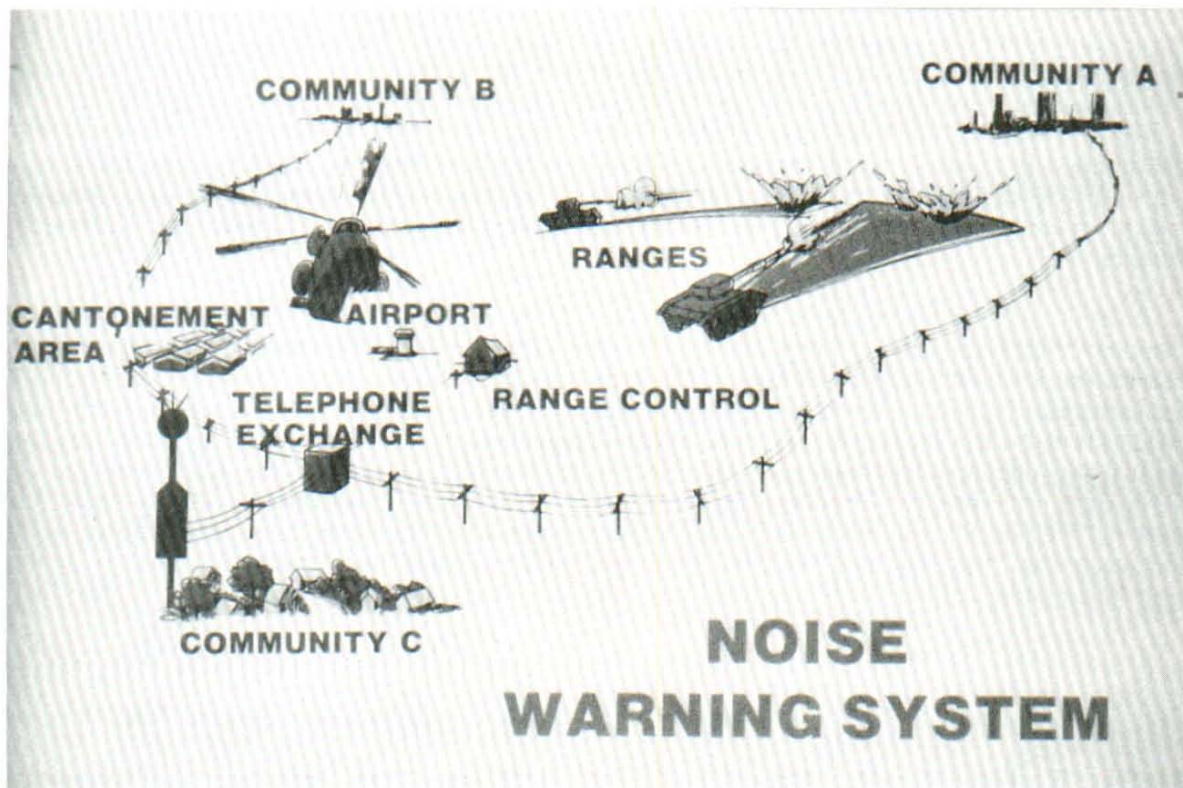


Figure 1. Schematic layout of the noise warning and monitoring system.

The Army's noise monitoring and warning needs are similar to civilian needs in the United States and other Western nations. A monitoring system can warn of especially loud individual events and it can serve as an area monitor. However, blast noise is unique to the Army; it requires special hardware in the field units which is not available in commercial instruments used at airports. And the operations of a range control office and the tracking of noise-producing events are not the same as the operation of an airfield and the tracking of aircraft, so the base station also is unique to the type of activity which occurs at Army installations.

Not only is the blast noise and range operation unique to the Army, but each installation has unique requirements requiring a degree of customizing. For example, the two installations initially chosen for the demonstration described in this report each had a different type of telephone system requiring major differences in software and hardware. Again, this situation mirrors the airport situation where monitoring systems are customized for a given airport. In response to these unique needs, a noise warning and monitoring system was developed as a Facilities Technology Application Test (FTAT). This test built on 10 years of U.S. Army Construction Engineering Research Laboratory (USA-CERL) experience and research in the measurement and monitoring of Army blast noise.

Purpose

The purpose of this FTAT project was to develop the NWS and to test its use, installation, operation and maintenance in typical Army environments. The test addressed two questions: Can the system be installed, run, and maintained by installation personnel? Can the system deliver useful data which can be correlated with operations and complaints and used to develop noise mitigation strategies?

Approach

The approach to this development project consisted of four phases, two that were preliminary to the main purposes of the test outlined above and two that dealt directly with the main purpose of the test:

1. Site selection
2. Equipment development
3. Physical installation and testing
4. Operational testing.

One site had to be a location where normal Army training was performed, where noise was a problem, and where the system could be installed and operated successfully with limited monitoring locations in order to minimize hardware expenditures. Fort Richardson, AK was chosen as the training installation site and three monitors were installed as a part of their system. Because the Army Materiel Command (AMC) was able to cost share on this test, the second site was an AMC location: Aberdeen Proving Ground (APG). Sixteen monitors were ultimately installed. APG was an especially useful site because previously they had attempted to install a monitoring system using commercial hardware, but the contractor had been unable to make it operate.

The choice of these two installations presented some unique technical challenges. In general, the system is designed to work using commercial telephones. A monitor calls the base station by dialing its commercial telephone number. This is in contrast to some systems at airports which use dedicated phone lines and have constant communications between the base station and the field locations. The commercial system which APG had attempted to use was designed using private dedicated telephone lines in a tree structure where all the units are "on the line" at the same time. So the NWS for APG, at their request, was designed to operate in the existing private line environment.

Commercial hardware and existing airport monitoring systems were reviewed and analyzed for their applicability to the Army system. None could properly measure the high-amplitude, impulsive noise created by Army testing and training activities, and none could communicate between the field stations and the base using the combination of telephone systems described above. Thus it was necessary to design and build the systems at USA-CERL.

Since commercial hardware was not available, commercially available components and modules were used wherever possible. For example, the basic chassis and many of the modules are made by National Semiconductor as part of their industrial products, the uninterruptable power supply comes from a specialty manufacturer in Wisconsin, the modem is a standard Hayes model, and the basic enclosure is a standard Hoffman model, etc. Only those parts not commercially available were made by USA-CERL. These primarily were the modules required to implement the proper measurement and analysis of the large-amplitude impulsive noise, the capability lacking in commercial instruments.

Ease of operation, flexibility, and reliability were design goals. USA-CERL developed the software to run with the different telephone systems and gave it the capability to interact with and be operated by the normal military personnel in the range control environment. It was felt that ease of operation by the military personnel assigned to range control, simply performed maintenance, and reliability were basic keys to success of the system. Thus the emphasis in overall development was on these factors and not on cost. For example, the enclosure is stainless steel, the temperature range is -40 to +113 °F (-40 to +45 °C), the layout is spacious, and subassemblies are easy to reach and replace.

The last two phases of the study were the installation and running of the systems at Fort Richardson and APG and the operational testing described above. In each case, installation was planned and accomplished in conjunction with installation personnel, and training was performed at the time of installation. Complete documentation was developed on the design, operation, installation and maintenance of the system. This documentation was customized for the installation and provided with the system. The operational testing has centered on the Fort Richardson site, and Chapter 3 of this report details the operational test and its results.

Flexibility is the final requirement in our approach. It is a key point necessary for success of the system. Flexibility means the system can accommodate a range of options so it can be customized and changed to meet the needs of a particular installation and its unique problems. This flexibility has already facilitated the installation of customized systems at Picatinny Arsenal in Dover, NJ and Naval Air Station (NAS) Fallon in Fallon, NV, where the Navy uses it to monitor sonic booms. Flexibility includes such options as using private or commercial telephone lines, alternative measures of the peak noise level (the Navy uses flat, the Army uses "C"), one or two-channel operation, and standard or

enhanced dynamic range. Like commercial airports, each installation requires customizing. Finally, flexibility means the system can be enhanced to use new to accommodate new requirement and to reflect the result of new research. For example, current research at USA-CERL is showing that wind induced noise can be reduced by using a special two-microphone array. Any field unit can be upgraded to two microphones. Also, the NWS will form a portion of a total, PC-based installation noise management system, the Firing Information and Range Execution (FIRE) system. In the future, the base station of the NWS will be upgraded to a more powerful machine that will operate the NWS and at the same time accomplish many of the functions of this total noise management system.

Mode of Technology Transfer

The system is complete, and technology transfer has been accomplished by development of hardware, full plans and specifications, operations and maintenance manuals, and software. APG doubled their system from 8 to 16 units during the development and initial operation. The U.S. Army Environmental Hygiene Agency (USAEHA), the group whose mission is to provide assistance to installations with noise problems, recommended the system to several installations including Picatinny Arsenal. Picatinny now has an operational system. The Navy is using the system to monitor sonic booms at NAS Fallon, and at least three other Army installations--one U.S. Army Forces Command (FORSCOM), one U.S. Army Training and Doctrine Command (TRADOC), and one AMC installation--are actively considering installation of systems. Along with the system, USA-CERL supplies a customized instruction manual to an installation in looseleaf form, again for flexibility. The APG instructions manual deals with their private telephone system, and the Navy instructions manual speaks of sonic-booms rather than blasts and uses flat-weighted rather than C-weighted peak levels.

Training is provided during system installation. With this training and the instruction manual no difficulties have been experienced in running the system or in moving and relocating field sites.

2 PHYSICAL INSTALLATION, TESTING, AND MAINTENANCE

Theory of Operation

The USA-CERL NWS is designed to inform the installation (typically range control) when impulse noise levels in the community or in other critical areas are exceeding thresholds established by the installation. The system consists of two types of units: a base station and multiple field units. The base station is located at a central point--typically the range control office, and the field units are situated at noise sensitive locations (on or off base) selected by the installation.

The base station is presently an Apple IIe microcomputer with a printer, a Hayes modem to interface to the telephone lines, and an audio system for monitoring remote microphone signals. The base station is designed for indoor use at range control or another location chosen by the installation, and it is the overall controller of the system. Figure 2 shows a base station being operated by range control personnel at Fort Richardson. Through the base station, the operator is able to obtain acoustical data from the field units. Further, the base station is used to set various functional parameters of itself and the field units and perform various intermittent functions, such as:

- Setting the time of day
- Setting the sound threshold above which data will be gathered
- Setting the sound threshold above which the data will be immediately printed at the base station
- Setting the wind threshold above which data will not be gathered (to minimize wind gusts being processed as blast noise)
- Sampling the noise level at a particular field unit on demand
- Turning on the internal calibrator at a particular unit on demand
- Listening to the unprocessed audio signal from a particular unit.

A field unit consists of an outdoor microphone system and an anemometer coupled to a microprocessor-based system capable of processing and storing acoustic data and determining if a preset threshold has been exceeded. Figure 3 shows a typical installation at Fort Richardson. When the threshold is exceeded, the field units use telephone lines to call the base station and inform it of the exceedence. The field units require connection to telephone lines and 120 V ac primary power but are otherwise self contained and designed for unattended exterior use. Except for a power switch, they contain no controls to be manipulated by the user; rather, all control of the field units is accomplished by the base station. The field units are designed to operate continuously through short periods of power outage by incorporation of an internal battery. Should the field unit lose contact with the base station for any reason, the field unit will continue to operate, storing any data it acquires until communication with the base station is restored. An anemometer is incorporated into the field unit so that it can sense wind speed and eliminate data or warn of data gathered during high wind conditions (such data which may result from the wind and may not actually be true blast noise).



Figure 2. The base station being operated by enlisted personnel in the range control office at Fort Richardson.

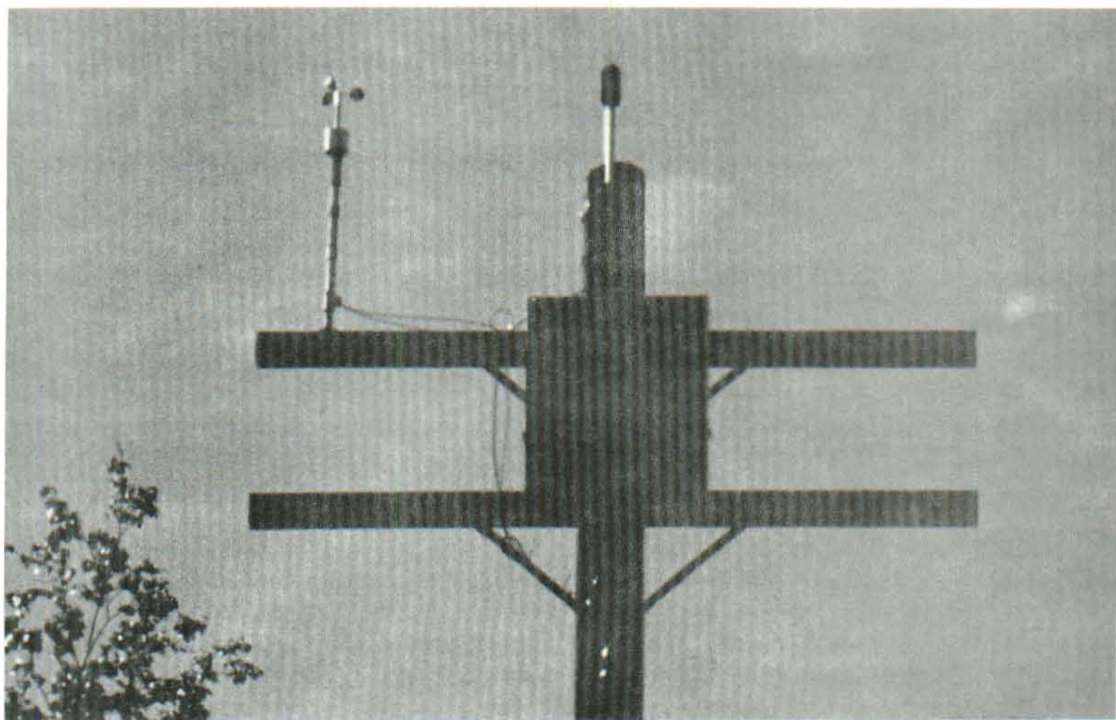


Figure 3. A typical field unit installation including commercial outdoor microphone system, anemometer, and controller.

Two versions of the system have been designed for different installation requirements: (1) a version using commercial dial-up telephone lines (Public Switched Telephone Network [PSTN]), and (2) a version using dedicated (direct connect) telephone lines. Using the PSTN system, the field units dial the base station when they have data to report and the base station dials the field unit when the operator requests a special function as outlined above. Using direct private line systems, the base station constantly and sequentially polls the field units for data and may address any particular field unit for special functions.

Various other options are available in the field unit hardware and software, and in the base station software. One option is dynamic range. While most monitoring applications can be accommodated by a 70 dB dynamic range, a 90 dB range is available for special requirements. Two other options are choice of filters and number of channels. The typical Army installation uses one channel and measures both the C-weighted peak level and the C-weighted sound exposure level (CSEL). As an option, the unit can have two channels, each with a different frequency weighting. Navy units measure CSEL with one channel and flat-weighted peak level with the other channel. With changes to software, the hardware can also support A-weighting on one or both channels.

In summary, the theory is to deploy a very rugged outdoor monitor which is completely self-supporting and yet completely controlled from the base station. The outdoor components of the system are unaffected by power failure, telephone line failure, and interruptions of base station operation. These components are completely weatherproof and designed to operate over a temperature range of -40 to +113 °F (-40 to +45 °C).

Installation, Operation, Maintenance, and Training

Details of installation, operation, and maintenance are contained in the installation's customized instruction manual. Training has been successfully accomplished by having designated installation maintenance personnel work with USA-CERL personnel to install the system. Typically, the maintenance personnel are civilians who work as technicians maintaining target and target controls, alarms and other sensors, or range communications equipment and aircraft sensors. With the training during system installation, the instructions manual, and a set of maintenance tools and instruments (supplied by USA-CERL as a repair kit with the system), three of the NWS installations have already successfully moved and reinstalled field monitors on their own, without any assistance from USA-CERL.

Chapters 2 and 3 of the instruction manual deal with base station operation. None of the four installations presently operating systems have experienced any significant difficulty in learning to operate the base station. Basically, the base station operation consists of using a small set of simple menus which are presented on the computer display. The cursor keys are used to highlight the selected operation or response.

All of the troubleshooting procedures, adjustment procedures, and periodic maintenance are described in Chapter 4 of the instruction manual. Periodic maintenance consists only of checking a few voltages, cleaning the air filters, inspecting the cables, and testing the power-out standby batteries. The manual also contains a complete list of parts, layouts, dimensions, and schematic diagrams. (This represents an advantage over many commercial systems where the manufacturer will not supply this type of information.)

The NWS is designed for reliable, continuous operation. However, as with all electronic equipment, occasional failures can be expected. The base station has been designed using only commercial components for which local service should be available anywhere in the United States or Europe. The field units have been designed as a collection of easily replaceable modules to facilitate repair. It is expected that any installation operating an NWS will maintain a complete set of spare modules for use in troubleshooting and repair of field units. Repair of all commercially available modules such as the Hayes Smartmodem and the National Semiconductor CIMBUS printed circuit cards usually can be handled through local distributors or dealers for these companies. Alternatively, USA-CERL can act as a central clearinghouse for repair of the commercial products as well as for repair of any of the custom modules designed and built at USA-CERL. It is estimated that the repair of any circuit card, board, or module will be about \$350 to \$550 (1987 dollars).

The units installed so far have had no failures of USA-CERL-designed parts, so there is little information on repairs. At Fort Richardson the units have operated for 18 months without failure, and at Picatinny Arsenal they have operated since installation (about 9 months) without failure. Two modems and the Central Processing Unit (CPU) in one National Semiconductor module failed; all were within warranty and all were easily replaced. The biggest problems have been reliable electric power and telephone communications at some of the remote desert monitor locations at NAS Fallon in Nevada, and reliable telephone communications using the unusual private line telephone system at APG. (Out of the 30 dB dynamic range available to a Hayes modem by Federal Communications Commission (FCC) regulation, the private line system at APG loses 20 dB by design. The resulting 10 dB dynamic range is insufficient to operate all of the time through the base telephone wiring and communications typically are lost once or twice a day, usually for just a few minutes.) In contrast, where the power and telephones are reasonably reliable, the system operates reliably.

In summary, the experience shows that with minimal training, the installation personnel can install, operate, and maintain the system, and that very reliable operation has been achieved.

3 OPERATIONAL TESTING

Purpose

The NWS is designed to warn an installation when noise levels are becoming too high at various communities or locations. The data are designed to help an installation operate by providing needed information. A central question at many installations might be: "What is the noise level at which we get complaints?" This level is expected to vary from installation to installation and site to site because, as noted in Chapter 1, complaints do not correlate directly with noise level but are more a function of the "unusual." Another question typically might be: "What weapons or what firing points cause the problems?" This chapter reports on the operational test, which examined whether the NWS could develop data which were useful to the installation and could help the installation better manage its operations. Fort Richardson was used for this test.

Data Sources

There are three primary sources of data one can use to analyze noise and its relation to range operations. These are (1) the NWS field measurements of individual events, (2) actual range operations (i.e., weapons used, their location, their target, their type of ammunition, the time of day, etc.), and (3) citizen complaints about blast noise. Figure 4 is a map of Fort Richardson and the surrounding area. The major firing ranges, the impact area, and the monitor locations are explicitly shown on this figure. Table A1 (see Appendix) lists what appear to be valid data measured during times when large weapons were being fired on the ranges at Fort Richardson during calendar year 1986. Continuous noise such as nearby helicopter noise can also exceed the threshold set in the monitor. These continuous noises have been excluded from Table A1. Table A2 (see Appendix) summarizes all the complaints received by Fort Richardson during 1986 which dealt with blast noise (other complaints dealt with helicopters). This table also shows the weapons being fired and the monitor measured data during the period of the complaint.

Analysis

The analysis can be split into two parts: (1) complaints related to training operations at Fort Richardson, and (2) complaints not related to training operations at Fort Richardson. Examples of the latter occurred primarily during preliminary testing during 1985. During a major field training exercise (FTX), many complaints were received, but during times when no actual firing was underway and the monitors registered nothing. It turned out that the news of the FTX had been published in the local newspaper and so Fort Richardson was assumed to be the source of the blast noise. It is thought that the actual source was highway blasting at the south end of Anchorage. A few similar occurrences are noted during the analysis of the 1986 data below. Thus one major finding is that many of the complaints received by an installation may not be related to installation operations, and the actual source may be off-post and entirely different. (A similar result has been found at Picatinny Arsenal, where it appears that fully half of their blast noise complaints relate to off-post highway construction and quarry operations and not to testing at Picatinny.)

Examination of the weapons and times of day in the Appendix (Tables A1 and A2) indicates four potential sources of noise complaints at Fort Richardson. These are (1) small demolition (under 10 lb [4.53 kg]), (2) large demolition (over 10 lb), (3) artillery at night, and (4) artillery during the day. The large demolition includes both combat

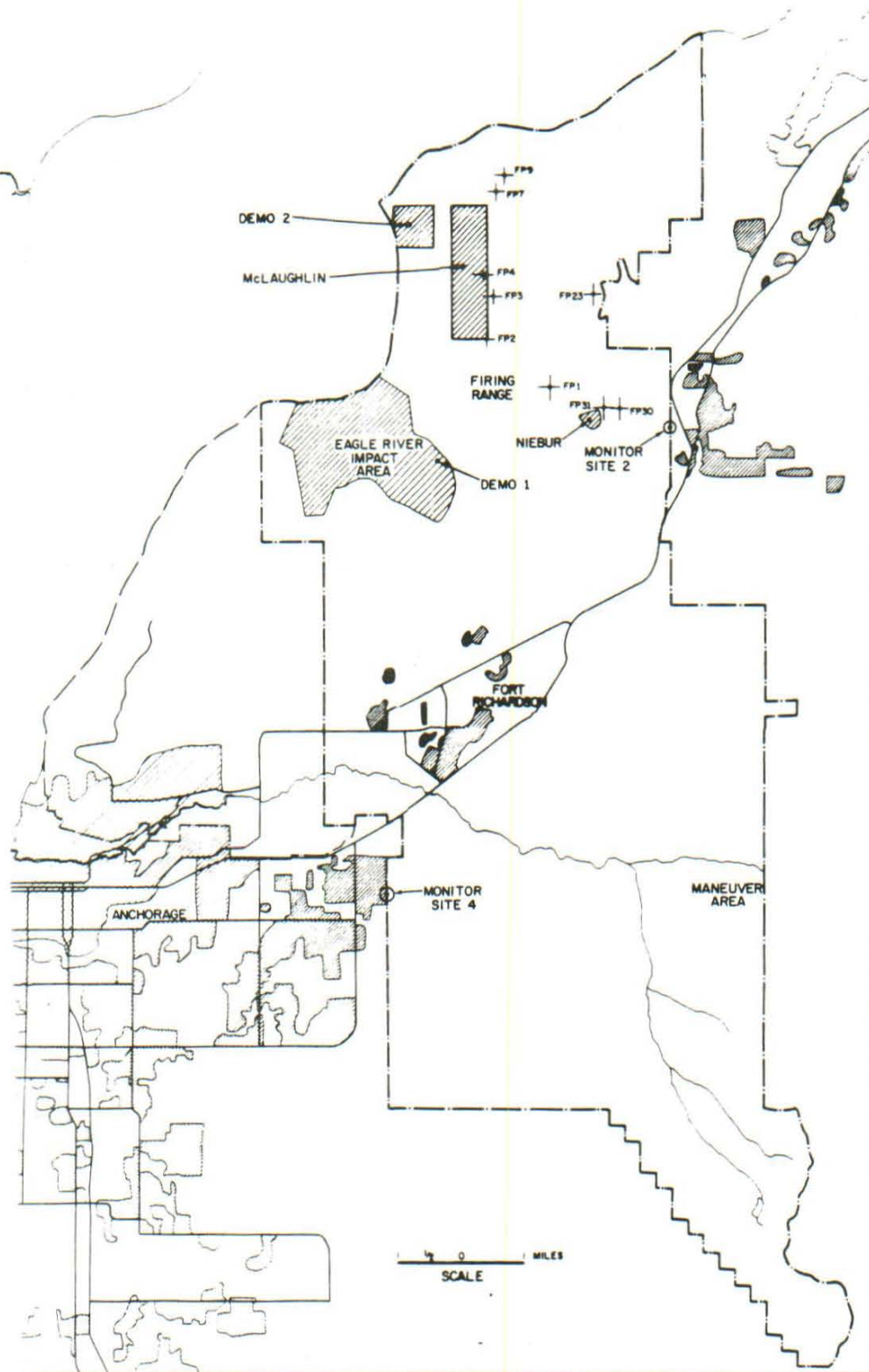


Figure 4. Map of Fort Richardson and surrounding area.

engineer training and explosive ordnance demolition (EOD). No other, smaller weapons at Fort Richardson ever caused the monitors to register or caused complaints. Therefore, the four weapons listed above are the only significant noise sources. In particular, the data do not indicate mortars to be a significant source of problems. The data for the four source categories are given in Tables 1 through 4, respectively. Each table gives each date when that source operated at Fort Richardson during 1986. For example, Table 2 lists large demolition for 1986. Each table includes the hours of operation, the firing location, any monitor measured data by monitor site and time, and any complaints received by location and time.

Examination of Tables 1 through 4 yields several interesting results and conclusions. Table 1 shows that small demolition never resulted in complaints although high peak levels were measured a couple of times during the year. Table 2, large demolition, shows that complaints related to large demolition are correlated with the noise measure at the monitor located at the Fort Richardson boundary near Eagle River (monitor number 4). Whenever the C-weighted peak level goes over about 118 dB (117 dB on one day), complaints are likely. Complaints never occurred during 1986 when the level did not exceed about 118 dB except for 1 day. The complaint for this day is considered invalid since it is for a time when no firing was occurring and the monitors measured nothing. The complaint is for the evening, but the demo was fired during early morning.

Tables 3 and 4 deal with artillery. These tables must be examined as a set--day and night together. Table 3 deals with nighttime. Here, unlike for the large demolition, complaints do not correlate with the measured noise. It appears that a main problem with the artillery is all-night training, particularly when it is part of a major FTX. No level could be found which correlated with a presence or absence of complaints. Rather, it appears that whenever the noise lasts through the night, is late in the evening, or is early in the morning, and it is audible and clearly noticeable, then some complaints can be expected. However, the peak levels do not appear to be particularly high and frequently are below a reasonable level for measurability at the monitor locations. In other words, the monitor cannot reliably detect the blasts in the presence of modest wind and/or other noises without the aid of an onsite human observer.

It is known that weather conditions can focus the sound and result in high levels at distant locations when nearer locations measure little or no sound, and it is possible that this is occurring during the night at Fort Richardson. However, focuses, especially in the extreme, are usually short-lived. The complaints speak of "all day and night." This would seem to indicate that the problem is indeed just audibility and detectability and not high levels that are somehow missing the monitor sites.

Artillery noise that occurs only during the daytime does not appear to be a major problem. Complaints for daytime artillery usually come during the 3-day FTXs and usually relate to day and night operation. In total, the evidence indicates that daytime artillery operations are not a source of significant complaints. Table 4 shows only 3 days with valid noise complaints related to daytime firings, and these complaints appear to be minor, because there is only one complainant each day. Unlike the FTX at night or the large demolition, both of which generate relatively large groups of complaints, the complaints for these days appear modest and isolated. One other day which had artillery firing only during the daytime had noise complaints. But like the invalid complaint for large demolitions, discussed earlier, this complaint also is considered invalid since it is for a time during the day when no one was firing and the monitors measured nothing.

Table 1

Complaints, Noise Levels, and Operations During 1986--Small Demolition

DATE	DAYS REGIS.	118DB PEAK	DAYS COMPL.	COMPL. CATEGORY	TIME COMPL.	LOCATION	UNIT	OTHER SOURCE
1/13/86	no	no	no					
1/23/86	yes	no	no					DEMO II
2/11/86	yes	no	yes *	DAY & EVEN	none	ANCHORAGE	12; 4, 2; 3, 1; 2	Artillery
2/12/86	yes	no	yes *	DAY & EVEN	none	ANCHORAGE	35; 4	Artillery
4/15/86	no	no	no					
5/21/86	no	no	no					
6/16/86	no	no	no					
6/24/86	yes	no	no					
7/8/86	no	no	no					
7/15/86	no	no	no					
7/22/86	no	no	no					
7/28/86	no	no	no					
8/11/86	no	no	no					
8/12/86	no	no	no					
8/14/86	yes	no	no	DEMO I				
8/19/86	no	no	no					
9/17/86	no	no	no					
10/1/86	no	no	no					
10/8/86	no	no	no					
10/22/86	yes	yes	no	Artillery				
10/27/86	no	no	no					
10/29/86	yes	no	no					
TOTAL								

22								

* Artillery firing on the 11th and 12th of Feb. '86 is believed to be the real source of this complaint.--A call to the mayor's office covering both days.

NOTE: The data in the unit column indicates the number of times each monitor (No. 4, 3, 2) registered an exceedance that day. For example "12; 4" means that monitor 4 registered 12 times.

Table 2

Complaints, Noise Levels, and Operations During 1986—Large Demolition

DATE; DESCRIPTION	TIME	C. TIME	LOCATION	UNIT	DAYS REGIS.	118DB PEAK	DAYS COMPL.
1/16/86 DEMO I	1326	afternoon	EAGLE R., MULDOON, ANCHORAGE	10;4, 4;3	yes	yes	yes *
1/23/86 DEMO II	2018				yes	no	no
1/26/86 Waldom Lake	1633-1949				yes	no	no
1/31/86 POW Comp.	2247	1030-1100	Muldoon		yes	yes	yes *
2/1/86 DEMO II	0551-0732	evening	Eagle River (Invalid)		yes	no	yes
2/5/86 DEMO II	1339-1803				yes	no	no
2/6/86 DEMO II	0853-1730				no	no	no
2/7/86 DEMO II	0932-1553				no	no	no
2/10/86 DEMO I	1140-1442		Eagle River S. Mt. area, Muldoon, Glen Highway, Big Lake	12; 4, 1; 3	yes	yes	yes *
2/12/86 Waldom Lake	1027-1415 1533-1728 0700-2049		(mayor's office) Anchorage: (NOTE: Artillery complaint for firings on Feb. 11 & 12)		yes	no	yes
2/13/86 DEMO II	0715-0952				yes	no	yes
2/20/86 Waldom Lake	1035-1246	1230	E. Peters Creek	3;4, 3;2, 1;3	yes	yes	yes *
4/8/86 DEMO II	0828-1603				yes	no	no
4/14/86 EOD, DEMO I	1148-1232				no	no	no
4/15/86 DEMO II	0930-1446				no	no	no
4/25/86 DEMO II	1204-1718				yes	no	no
5/5/86 DEMO I	1456				yes	no	no
6/9/86 DEMO I	1352-1422				yes	no	no
6/13/86 DEMO I	1126-1159				no	no	no
6/23/86 DEMO I	1035-1305				no	no	no
7/1/86 DEMO II	1241-1449				no	no	no
7/2/86 DEMO II	0959-1332				yes	no	no
8/4/86 DEMO II	1227-2046				no	no	no
8/5/86 DEMO II	1017-1820				yes	no	no
8/7/86 DEMO II	1007-1414				yes	no	no
8/12/86 McLaughlin	1751-1848				no	no	no
8/13/86 McLaughlin	1131-2400				yes	no	no
8/14/86 DEMO I	1732-1951				yes	no	no
8/18/86 DEMO I	1336-1505				yes	no	no
9/15/86 DEMO I	0916-1247 1412-1433	1250	E. AFB	7; 4	yes	yes	yes *
9/25/86 DEMO	0808-2054		E.R.;Midtown;Westchester lag-oon;Mt View; Anchorage (Note:Probably Demo & Artillery)	14; 4	yes	yes 117	yes *
9/26/86 DEMO II	0912-1242 1141-1750				yes	no	no
9/27/86 DEMO II	1101-1832				yes	no	no
9/28/86 DEMO II	1015-1126 1453-1949				no	no	no
10/18/86 DEMO II	1107-1552	Day & Night	7th&K, Turpin & Airport Heights 7; 4 (Note: Probably Artillery)		yes	yes	yes *
10/27/86 DEMO I	1342-1425				no	no	no

Table 2 (Cont'd)

DATE; DESCRIPTION	TIME	C. TIME	LOCATION	UNIT	DAYS REGIS.	118DB PEAK	DAYS COMPL.
11/3/86 DEMO I	1308-1436				yes	yes	no
11/15/86 DEMO II	1213-1348				no	no	no
11/20/86 Whitney Pt.	1008,1105 1130,1149 1206				yes	yes	no
11/21/86 DEMO II Whitney Pt.	1320-1420 1101-1646	AFT-0315	Big Lake	4; 4	yes	yes	yes *
TOTAL							
40							

* Valid Complaint day

NOTE: The data in the unit column indicates the number of times each monitor (# 4, 3, 2) registered an exceedence that day. For example "10; 4" means monitor 4 registered 10 times.

Table 3
Complaints, Noise Levels, and Operations During 1986
—Artillery During Nighttime

DATE	FPs	LOCATION	UNIT	TIME	C. TIME	COMPL. CAT.	DAYS REGIS.	112DB PEAK	DAYS COMPL.
*****	*****	*****	****	*****	*****	*****	*****	*****	*****
2/23/86	FP 2			E 1627-2206			no	no	no
	FP 3			E 1531-2306			"	"	"
2/24/86	FP 2			M 0557-0746			no	no	no
	FP 3			M 0630-0815			"	"	"
	Niebar			M 0830-0911			"	"	"
2/30/86	FP 31			E 1544-2344			no	no	no
4/23/86	2,3,9,31 33, Niebar	Central Eagle R.	5; 3	E 0848-2306	2300	Late Even.	yes	yes	yes
4/24/86	FP 2,3, Niebar	Westchester Lagoon	5; 3	M 0557-0815	0700-0730		yes	no	yes
4/29/86	FP 9			E 1702-2305			no	no	no
4/30/86	FP 9			E 0611-2344			yes	no	no
5/6/86	FP 31			E 1311-2326			yes	no	no
	FP 5			M 0559-1219			"	"	"
5/7/86	FP 9			E 1830-2228			yes	no	no
	FP 9			M 0631-0825					
5/8/86	FP 31			E 1240-2257			yes	no	no
8/20/86	FP 31,32			M 0625-2019			no	no	no
8/21/86	FP 31,33			M 0616-0800			yes	yes	no
8/26/86	FP 22			E 1343-2221			yes	yes	no
8/27/86	FP 3			M 0550-1308			yes	yes	no
	FP 5			M 0530-2418			"	"	"
9/9/86	FP 1,31	Turnagain Arm	1; 4	N 0001-0234	Evenings	Day & Night	yes	yes	yes
9/10/86	FP 2	Anchorage		E 1417-2400			no	no	yes
	FP 5			E 2122-2400			"	"	"
9/11/86	FP 5	E. Anchorage & Boniface		M 0537-1200	2300		no	no	yes
	FP 9			M 0537-1117			"	"	"
9/22/86	unk FP 2	E.R., Muldoon, Parkstrip Down&Mid Town	none	E 0600-2400	N; Evenings	Day & Night	no	no	yes
				E 1930-2016			"	"	"
9/23/86	FP 7,22,23	Anchorage, Down&Mid town West Lagoon, Muldoon, E.R.	9; 4	E 2018-2400	N; Evenings	Late Even.	yes	yes	yes
9/24/86	FP 7,22,23	Anchorage, Down&Mid town	8; 4	N 0001-1552	D; E; N	Day & Night	yes	yes	yes
	FP 1	E.R., West Lagoon, Muldoon		E 2331-2400			"	"	"
	FP 3			E 1158-2230			"	"	"
	FP 31			E 2322-2400			"	"	"
9/25/86	FP 1	Eagle River, Midtown	16;4	N 0001-1000	Night	Day & Night	yes	yes	yes
	FP 22	MT. View, Anchorage		E 1828-2400			"	"	"
	FP 31	West Lagoon		N 0001-1800			"	"	"
	FP 23			E 2246-2400			"	"	"
	FP 7			E 2303-2400			"	"	"

Table 3 (Cont'd)

DATE	FPs	LOCATION	UNIT	TIME	C. TIME	COMPL. CAT.	DAYS REGIS.	112DB PEAK	DAYS COMPL.
10/6/86	FP 31, 33			E 0929-2255			yes	yes	no
10/7/86	FP 23			E 1222-2305			yes	yes	no
	FP 1			M 0557-1239			"	"	"
	FP 31			M 0552-1410			"	"	"
	FP 33			M 0557-1218			"	"	"
10/18/86	FP 2	Turpin & Airport Heights	7; 4	E 1001-2001	Day & Night	Day & Night	yes	yes	yes
	FP 31			E 1001-2047			"	"	"
	FP 22			E 1551-2157			"	"	"
10/19/86	FP 1	City View, E.R., Muldoon	none	E 1159-2035	Day-Morning	Day & Night	no	no	yes
	FP 2	Turpin & Airport Heights		E 2231-2341			"	"	"
	FP 5			E 1630-2400			"	"	"
	FP 9			E 2019-2400			"	"	"
	FP 22			E 1100-2400			"	"	"
10/20/86	FP 5	Muldoon, E.R., Hillside	16; 4	N 0001-1054	Night & M.	Day & Night	yes	yes	yes
	FP 5	Turpin & Heights		E 1344-2102			"	"	"
	FP 31			E 2342-2400			"	"	"
	FP 33			E 2038-2340			"	"	"
10/21/86	FP 3	Turpin & Airport Heights		E 2334-2400			no	no	yes
	FP 23			E 2103-2400			"	"	"
11/6/86	FP 3			N 0001-1547			yes	yes	no
TOTAL									

28									

NOTE: The data in the unit column indicates the # of times each monitor (# 4, 3, 2) registered an exceedence that day. For example "10; 4" means monitor 4 registered 10 times.

Table 4

**Complaints, Noise Levels, and Operations During 1986
—Artillery During Daytime**

DATE & TIME *****	C. TIME *****	COMP. CAT. *****	FPs *****	LOCATION *****	UNIT *****	DAYS REGIS. *****	118DB PEAK *****	DAYS COMPL. *****
2/11/86, 1433-2233 0700-2049 0853-1730	none	VALID DAY -----	FP 1,31 FP 1,31	(mayor's office) Anchorage	12; 4, 2; 3 1; 2	yes	no	yes
2/12/86, 0700-2049	none	VALID DAY -----	FP 1,2,31	(mayor's office) Anchorage	35; 4	yes	no	yes
2/13/86, 0715-0952	DAY	Invalid	FP 1,31	Eagle River	6; 4	yes	no	yes
2/19/86, 1402-2211	D & E	VALID DAY -----	FP 31	Downtown Anchorage	16; 4	yes	no	yes
2/23/86, 1627-2206 1531-2306 0848-1320 0853-1025 1411-1500 1224-1307 1541-1552			FP 2 FP 3 FP 9 FP 31 FP33 Niebar Niebar			no " " " " " "	no " " " " " "	no " " " " " "
2/30/86, 0611-1412 1544-2344 1414-1543			FP 9 FP 31 Niebar			no " "	no " "	no " "
3/5/86, 0945-1747			FP 33			yes	no	no
3/6/86, 1018-1110 1111-1212			FP 2,5			no "	no "	no "
4/9/86, 1019-1936			FP 5			no	no	no
4/10/86, 1108-2400			FP 5			yes	no	no
4/23/86, 0848-2306	2300	Late Even.	2,3,9,31, 33, Niebar	Central Eagle R.	5; 3	yes	no	yes
4/24/86, 1001-2117 0830-0911	0700-0730	Early Morn.	FP 2, 3, 33, Niebar	Westchester Lagoon	5; 3	yes "	no "	yes "
4/29/86, 1702-2305			FP 9			no	no	no
5/5/86, 1509-2009 1232-1302			FP 5 Niebar			yes "	no "	no "
5/6/86, 1219-1308 1311-2326			Niebar FP 31			yes "	no "	no "
5/7/86, 1529-1632 1830-2228 1320-1434			Niebar FP 9 FP 31			yes " "	no " "	no " "
5/8/86, 1240-2257 1140-1239 0620-1126			FP 31 Niebar FP 9			yes " "	no " "	no " "
8/19/86, 1116-1959			FP 31,32			no	no	no

Table 4 (Cont'd)

DATE & TIME *****	C. TIME *****	COMP. CAT. *****	FPs *****	LOCATION *****	UNIT *****	DAYS REGIS. *****	118DB PEAK *****	DAYS COMPL. *****
8/26/86, 1343-2221			FP 22			yes	no	no
8/27/86, 1419-1941			FP 3			yes	no	no
1439-1941			FP 22			"	"	"
9/9/86, 0751-1036		Day & Night	FP 1	Turnagain Arm	1; 4	yes	no	yes
1129-1635			FP 5			"	"	"
1037-1635			FP 9			"	"	"
9/10/86, 1417-1804	E & N	Day & Night	FP 2	Anchorage, Turnagain Arm	none	no	no	yes
1636-1852			FP 1			"	"	"
1800-1852			FP 31			"	"	"
9/11/86, 1200-1346	2300	Day & Night	FP 2	E. Anchorage & Boniface	none	no	no	yes
1117-1203			FP 3			"	"	"
1203-1300			FP 30			"	"	"
9/22/86, 1158-1917	E & N	Day & Night	FP 3	Down&Midtown, E.R., Muldoon,	none	no	no	yes
1134-1924			FP 5,9	Parkstrip		"	"	"
1930-2016			FP 2			"	"	"
9/24/86, 0001-1552	D & N	Day & Night	FP 7,22,23	Down&Midtown, E.R., Muldoon,	3; 4	yes	no	yes
1158-2230			FP 3	Anchorage, Westchester Lagoon		"	"	"
1828-1930			FP 9			"	"	"
0016-1930			FP 33			"	"	"
9/25/86, 0001-1000	N	Day & Night	FP 1	E.R., Midtown, Westchester Lagoon, 16; 4	yes	yes 117		yes
1038-1211			FP 1	MT. View, Anchorage				
0001-1800			FP 31					
9/26/86, 0001-1035			FP 22,23			yes	no	no
9/29/86, 1507-2034			FP 31			no	no	no
1800-1930			FP 33			"	"	"
10/6/86, 0929-2255			FP 31,33			yes	no	no
10/7/86, 1222-2305			FP 23			yes	no	no
1240-1535			FP 3			"	"	"
1424-2305			FP 9			"	"	"
10/8/86, 0601-1631			FP 9,22,23			no	no	no
0756-2011			FP 1			"	"	"
10/18/86, 1001-1536	D & N	Day & Night	FP 1	7th&k, Turpin & Airport Heights	7; 4	yes	yes	yes
1001-2001			FP 2			"	"	"
1001-2047			FP 31			"	"	"
1551-2137			FP 22			"	"	"
1520-1550			MMDC			"	"	"
10/19/86, 1159-2035	D - M	Day & Night	FP 1	Muldoon, Turpin & Airport Heights, none	no	no	no	yes
1630-2400			FP 5	7th&k, City View, E.R.		"	"	"
1100-2400			FP 22			"	"	"
10/20/86, 0225-1300	N & M	Day & Night	FP 2	Turpin & Airport Heights, Muldoon, 16; 4	yes	yes	yes	yes
1344-2102			FP 5	E.R., Hillside		"	"	"

Table 4 (Cont'd)

DATE & TIME	C. TIME	COMP. CAT.	FPs	LOCATION	UNIT	DAYS REGIS.	118DB PEAK	DAYS COMPL.
0001-1809			FP 9			"	"	"
0001-1028			FP 22			"	"	"
1301-1343			MEDC			"	"	"
0001-1054								
10/21/86, 1359-1714	NONE	Day & Night	FP 5	Turpin & Airport Heights	none	no	no	yes
1133-1715			FP 9			"	"	"
0001-1132			FP 33			"	"	"
1139-1233			Niebar			"	"	"
10/22/86, 0001-1138			FP 3			yes	yes	no
0001-1212			FP 23					
11/6/86, 0923-1504			FP 3			yes	117.9	no
11/22/86, 0735-1605			FP 33			no	no	no
TOTAL								
38								

NOTE: The data in the unit column indicates the # of times each monitor (# 4, 3, 2) registered an exceedance that day. For example "10; 4" means monitor 4 registered 10 times.

Quantitatively, nighttime artillery training was the number one problem during 1986. Of the 28 nights on which firing occurred, about 50 percent resulted in complaints. In contrast, daytime artillery generated only three valid complaint days out of 38 days. During 1986, large demolition was a valid problem on 8 out of 40 days, and small demolition never generated complaints.

However, as indicated in the introduction, complaints do not correlate with noise levels, and the Army policy is based on noise levels and annoyance. Table 5 lists the measured yearly C-weighted day-night level, the measure described in AR 200-1, for artillery and for large demo at the two monitor sites which operated throughout the year. (The third site was turned off and taken out while the water company performed major construction at the site.) At the Eagle River monitor, which is on the Fort Richardson boundary, the monitored yearly C-weighted day-night level indicates that the area has a noise level which is still well below the level for the Zone II boundary. Table 5 shows that the primary source is large demo, and although the noise level is only barely approaching the Zone II boundary, the noise warning system can be used to mitigate the noise. At the other location (monitor 3) and even for artillery at the Eagle River monitor (4), the monitors demonstrate that Fort Richardson is not even approaching the limits established in AR 200-1. Rather, the complaints for artillery appear to be related more to just the audibility and detectability of the sound. Here, the NWS can serve no purpose in reducing the impact, because it cannot even measure it. But, perhaps more importantly, the NWS demonstrates that the noise levels are well below the applicable criteria and do not require mitigation.

In summary, a significant number of noise complaints do not relate to on-post activities and actually are the result of distant off-post sources. The Fort Richardson-generated blast noise complaints come primarily from large demolition activity and from nighttime artillery training. The demolition-generated complaints correlate with measured noise level and occur when the measured peak C-weighted level at the on-post

site by Eagle River exceeds about 118 dB. The corresponding yearly C-weighted day-night level (CDNL) shows that the noise is still well below the Zone II boundary as described in AR 200-1, but it is measurable. The artillery-generated complaints correlate with nighttime and appear to be based more on audibility and detectability than on a specific level. The artillery does not produce levels which approach applicable standards.

Table 5

Measured Yearly Levels (Day, Night, and CDNL) by Source and Monitor Site

	Monitor #3			Monitor #4		
	Day	Night*	CDNL	Day	Night*	CDNL
Large Demo	28.3	-	28.3	52.1	51.2	54.7
Artillery	26.4	21.1	27.5	43.7	41.1	45.6
Total			30.9			55.2

*Includes 10 dB nighttime adjustment. (Note that 10 dB is added to the nighttime levels when calculating CDNL in accordance with its formulation. The Zone II boundary is 62 CDNL, as defined in AR 200-1.)

4 CONCLUSIONS

It has been shown that an installation can readily install, operate, and maintain the NWS system with modest training. It has also been shown that the system can provide data an installation can use to understand its noise problems and potentially develop mitigation strategies.

Three results stand out. First, the system is more reliable and more easily tailored to a particular installation's needs than was originally hoped. Second, the data show times when the installation is quiet; thus any complaints for those times are due to noise from off-post sources. This is a totally unexpected result. Finally, the system is useful in documenting compliance with applicable standards as well as in mitigating Army noise problems.

APPENDIX:

BASIC MONITOR AND COMPLAINT DATA—1986

Table A1

**Valid 1986 Blast Noise Data Measured With the Monitors
During Times When the Firing Point Ranges Were in Operation**

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME	UNIT	HR	MIN	SEC	SEL	PEAK	DUR	NOTES	
***	***	*****	*****	*****	*****	***	***	***	***	***	*****	*****	*****	
12	7	Demo II	C-4	15lbs.	1522		4	15	25	17	97.9	104.3	0.3	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	54	58	113.6	125.3	0.7	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	1	94.6	104.4	0.1	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	19	113.8	124.7	1.2	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	22	112.4	124.3	0.8	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	24	94.5	105.5	0.1	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	34	112.6	124.2	0.6	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	36	95.4	105.1	0.2	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	40	112.0	109.5	1.3	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	55	46	112.3	121.6	1.2	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		4	11	56	13	111.6	123.1	1.3	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		3	13	41	43	91.3	110.5	0.1	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		3	13	41	53	90.9	106.7	0.1	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		3	13	42	11	91.4	105.9	0.2	0
1	16	Demo I	C-4	7@ 100lbs. , 6@ 80lbs.	1153-1336		3	13	42	27	90.2	110.6	0.1	0
1	23	Demo II	UNKNOWN	16.5lbs. (possibly Bangalor)	cont.		2	13	12	40	88.2	108.4	0.1	0
1	23	Demo II	Bangal	120lbs.	cont.		4	13	12	50	90.1	109.0	0.1	0
1	23	Demo II	Bangal	61lbs.	cont.		2	13	13	18	88.0	109.1	0.1	0
1	23	Demo II	TNT	11lbs.	2018		2	13	13	20	92.0	106.8	0.1	0
1	23	Demo II	C-4	12lbs.	1236-1622		2	13	13	23	90.0	107.2	0.1	0
1	23	Demo II	TNT	10lbs.	cont.		2	13	13	24	88.0	107.1	0.2	0
1	23	Demo II	TNT	24lbs.	cont.		4	13	13	27	90.4	109.2	0.1	0
1	23	Demo II	TNT	5lbs.	cont.		4	13	13	29	98.4	110.2	4.8	0
1	23	Demo II	cont.	cont.	cont.		4	13	13	38	93.9	107.4	1.1	0
1	23	Demo II	cont.	cont.	cont.		2	13	14	50	88.7	108.3	0.2	0
1	23	Demo II	cont.	cont.	cont.		4	13	15	0	90.4	110.1	0.1	0
1	23	Demo II	cont.	cont.	cont.		4	14	24	55	97.9	111.2	0.2	0
1	23	Demo II	cont.	cont.	cont.		4	14	28	2	102.3	115.4	0.2	0
1	23	Demo II	cont.	cont.	cont.		4	14	28	8	100.6	111.3	0.2	0
1	23	Demo II	cont.	cont.	cont.		4	20	15	18	96.5	107.9	2.6	two time zones
1	23	Demo II	cont.	cont.	cont.		4	20	15	23	90.7	104.6	0.1	for data
1	23	Demo II	cont.	cont.	cont.		4	20	15	48	92.9	104.7	0.8	0
1	26	N N Lake	C-4	4@ 12lbs.	1633-1949		4	17	1	27	90.1	104.3	0.1	0
1	26	cont.	cont.	cont.	1633-1949		4	18	36	20	88.2	109.0	0.1	0
1	26	cont.	cont.	cont.	1633-1949		4	18	36	26	82.9	104.5	0.1	0
1	26	cont.	cont.	cont.	1633-1949		4	18	37	35	88.1	109.2	0.1	0
1	31	POW Comp.	C-4	10lbs.	2247		4	22	47	17	116.2	131.5	1.2	poss. invalid
2	1	Demo II	C-4	30lbs.	0551-0732		4	7	7	31	96.2	108.2	0.2	0
2	5	Demo II	cont.	cont.	1339-1803		2	13	42	56	87.1	110.0	0.1	0
2	5	Demo II	C-4	85lbs.	1339-1803		3	14	1	22	94.7	104.9	0.1	0
2	5	Demo II	TNT	15lbs.	1339-1803		4	14	13	8	90.0	105.4	0.1	0
2	5	Demo II	cont.	cont.	1339-1803		4	15	8	48	86.1	104.2	0.1	0
2	5	Demo II	cont.	cont.	1339-1803		4	15	12	5	93.2	108.7	0.1	0
2	5	Demo II	cont.	cont.	1339-1803		4	16	10	0	99.0	111.1	0.4	0
2	5	Demo II	cont.	cont.	1339-1803		4	16	18	28	89.0	104.2	0.1	0
2	5	Demo II	cont.	cont.	1339-1803		4	17	22	20	98.2	110.1	0.2	0
2	10	Demo I	C-4	852lbs.	1140-1442		4	12	3	56	112.1	124.9	0.6	0
2	10	Demo I	cont.	cont.	cont.		4	12	4	2	112.6	125.3	0.7	0
2	10	Demo I	cont.	cont.	cont.		4	12	4	25	112.6	125.4	0.6	0
2	10	Demo I	cont.	cont.	cont.		4	12	4	41	113.7	126	0.6	0
2	10	Demo I	cont.	cont.	cont.		3	12	6	42	93.8	104.7	0.8	0
2	10	Demo I	cont.	cont.	cont.		4	13	30	13	112.6	123.3	0.7	0
2	10	Demo I	cont.	cont.	cont.		4	13	30	24	112.1	106.8	0.6	0
2	10	Demo I	cont.	cont.	cont.		4	13	30	31	112.8	123.1	0.7	0
2	10	Demo I	cont.	cont.	cont.		4	13	30	34	113.6	124.7	0.7	0
2	10	Demo I	cont.	cont.	cont.		4	13	30	37	94.5	104.4	0.1	0
2	10	Demo I	cont.	cont.	cont.		4	14	42	4	110.7	121.8	0.4	0
2	10	Demo I	cont.	cont.	cont.		4	14	42	29	115.8	124	0.7	0
2	10	Demo I	cont.	cont.	cont.		4	14	42	32	113.3	106.3	0.6	0
2	10	Demo I	cont.	cont.	cont.		4	14	42	34	96.4	104.3	0.1	0
2	11	7Ps&OPs	105MM	38HE, 81LL, 27HE, 91LL, 47HE, 41LL.	0700-2049		3	9	19	58	92.8	104.6	0.1	0
2	11	cont.	cont.	cont.	1433-2233		2	15	23	30	86.7	107.1	0.1	0
2	11	cont.	cont.	cont.	0853-1730		4	15	57	20	94.9	104.9	3.0	0
2	11	cont.	cont.	cont.	cont.		3	16	19	8	68.6	106.1	0.1	0

Table A1 (Cont'd)

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME UNIT	HR	MIN	SEC	SEL.	PEAK	DUR	NOTES	

2	11	cont.	cont.	cont.	cont.	4	18	5	16	93.4	105.6	0.6	0
2	11	cont.	cont.	cont.	cont.	4	19	7	19	89.6	108.2	0.1	0
2	11	cont.	cont.	cont.	cont.	4	19	10	54	89.3	108.5	0.2	0
2	11	cont.	cont.	cont.	cont.	4	20	5	50	97.3	112.4	0.6	0
2	11	cont.	cont.	cont.	cont.	4	20	23	26	87.0	104.5	0.1	0
2	11	cont.	cont.	cont.	cont.	4	20	31	17	95.0	110.8	0.3	0
2	11	cont.	cont.	cont.	cont.	4	20	31	56	92.3	105.9	1.0	0
2	11	cont.	cont.	cont.	cont.	4	20	32	55	95.0	111.0	0.5	0
2	11	cont.	cont.	cont.	cont.	4	20	33	59	97.1	115.4	0.4	0
2	11	cont.	cont.	cont.	cont.	4	20	34	41	91.8	105.0	0.1	0
2	11	cont.	cont.	cont.	cont.	4	20	34	59	95.3	112.2	0.3	0
2	12	Demo II	Bangalore	1027-1415	4	9	5	10	89.2	107.7	0.2	0	0
2	12	Demo II	TNT 11b.	1533-1728	4	9	9	37	90.7	104.3	0.2	0	0
2	12	FPs&OPs	105MM 50HE, 2ILL	0700-2049	4	9	12	2	89.2	108.4	0.1	0	0
2	12	N N LAKE	TNT 15lbs.	cont.	4	9	18	48	89.9	109.6	0.1	0	0
2	12	cont.	cont.	cont.	4	9	18	56	89.1	108.0	0.1	0	0
2	12	cont.	cont.	cont.	4	9	19	26	88.5	106.3	0.1	0	0
2	12	cont.	cont.	cont.	4	9	59	14	90.1	107.5	0.1	0	0
2	12	cont.	cont.	cont.	4	11	10	14	94.5	110.0	0.1	0	0
2	12	cont.	cont.	cont.	4	11	27	37	86.7	108.5	0.1	0	0
2	12	cont.	cont.	cont.	4	11	29	42	87.5	108.2	0.1	0	0
2	12	cont.	cont.	cont.	4	11	31	11	86.9	105.6	0.2	0	0
2	12	cont.	cont.	cont.	4	11	32	50	86.0	104.8	0.1	0	0
2	12	cont.	cont.	cont.	4	12	24	7	99.4	108.8	0.3	0	0
2	12	cont.	cont.	cont.	4	12	29	22	89.9	109.0	0.2	0	0
2	12	cont.	cont.	cont.	4	12	58	44	97.9	108.7	0.2	0	0
2	12	cont.	cont.	cont.	4	13	11	59	85.8	104.8	0.1	0	0
2	12	cont.	cont.	cont.	4	13	19	35	90.3	108.1	0.1	0	0
2	12	cont.	cont.	cont.	4	13	23	30	91.6	110.7	0.1	0	0
2	12	cont.	cont.	cont.	4	13	26	3	88.2	106.0	0.1	0	0
2	12	cont.	cont.	cont.	4	13	31	5	84.4	105.2	0.1	0	0
2	12	cont.	cont.	cont.	4	13	33	12	96.2	106.1	0.3	0	0
2	12	cont.	cont.	cont.	4	13	40	17	85.5	104.7	0.1	0	0
2	12	cont.	cont.	cont.	4	13	43	5	91.4	111.1	0.2	0	0
2	12	cont.	cont.	cont.	4	13	46	7	87.4	105.4	0.1	0	0
2	12	cont.	cont.	cont.	4	13	48	22	89.8	108.8	0.1	0	0
2	12	cont.	cont.	cont.	4	13	51	7	89.5	108.2	0.1	0	0
2	12	cont.	cont.	cont.	4	13	53	20	87.0	106.8	0.1	0	0
2	12	cont.	cont.	cont.	4	13	56	39	89.0	108.2	0.2	0	0
2	12	cont.	cont.	cont.	4	14	0	57	85.8	113.7	0.1	0	0
2	12	cont.	cont.	cont.	4	14	2	41	88.9	108.9	0.1	0	0
2	12	cont.	cont.	cont.	4	14	12	22	98.9	113.9	0.3	0	0
2	12	cont.	cont.	cont.	4	14	15	27	85.3	104.6	0.1	0	0
2	12	cont.	cont.	cont.	4	14	25	26	97.2	105.6	3.6	0	0
2	12	cont.	cont.	cont.	4	15	12	58	90.6	104.5	0.1	0	0
2	12	cont.	cont.	cont.	4	16	10	49	88.4	109.4	0.1	0	0
2	12	cont.	cont.	cont.	4	16	14	54	87.5	108.2	0.1	0	0
2	13	7p&OPs	conip 22lbs and TNT, 2lbs.	0715-0952	4	9	14	10	89.1	105.4	0.1	0	0
2	13	cont.	105MM 14HE, 21HE	0715-0840	4	9	17	37	95.9	106.6	0.7	0	0
2	13	cont.	cont.	cont.	4	9	27	29	97.4	110.8	0.7	0	0
2	13	cont.	cont.	cont.	4	9	36	18	90.8	105.4	0.2	0	0
2	13	cont.	cont.	cont.	4	9	36	50	89.8	107.7	0.1	0	0
2	13	cont.	cont.	cont.	4	9	37	19	90.6	108.7	0.1	0	0
2	19	FP's	105MM 12ILL, 74HE	1402-2211	3	15	41	47	85.0	104.7	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	16	11	33	86.3	104.9	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	16	15	39	86.5	105.2	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	16	15	58	86.7	105.4	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	16	24	6	86.4	104.5	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	16	30	15	86.1	105.0	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	25	14	87.8	107.6	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	28	33	86.5	105.3	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	32	59	92.4	105.2	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	40	58	92.7	104.7	0.7	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	41	0	87.9	104.4	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	18	46	58	93.0	104.6	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	57	48	86.9	107.4	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	57	58	86.6	106.7	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	58	14	86.1	105.3	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	58	24	86.3	107.2	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	58	39	86.2	106.1	0.1	0	0
2	19	cont.	cont. 12ILL, 74HE	cont.	4	21	58	48	86.5	105.8	0.1	0	0

Table A1 (Cont'd)

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME	UNIT	HR	MIN	SEC	SEL	PEAK	DUR	NOTES	

2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	3	88.1	105.9	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	11	86.9	105.8	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	24	86.3	107.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	38	86.4	105.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	42	87.9	108.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	21	59	55	86.7	106.3	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	0	5	86.4	105.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	0	17	88.6	106.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	0	33	86.5	105.5	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	0	44	86.2	104.4	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	0	56	89.8	105.6	1.5	poss. invalid
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	9	87.1	106.1	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	12	91.0	108.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	19	87.2	106.8	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	35	86.8	105.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	37	92.7	110.4	0.2	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	1	48	88.8	107.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	2	13	92.0	106.4	0.6	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	2	27	84.9	105.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	2	36	86.2	106.5	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	2	48	86.3	107.1	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	2	55	85.3	105.1	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	5	86.7	107.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	15	89.8	104.7	1.2	poss. invalid
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	22	84.7	105.5	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	28	86.3	105.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	32	86.2	106.3	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	43	88.3	107.3	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	3	53	85.1	106.9	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	5	85.9	106.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	21	84.4	105.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	23	87.9	104.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	33	85.5	104.4	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	38	85.9	104.4	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	43	84.7	105.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	44	88.1	106.8	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	4	56	86.2	105.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	5	12	86.7	105.0	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	5	16	85.9	105.2	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	6	27	88.1	105.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	5	35	88.7	104.7	0.1	0
2	19	cont.	cont.	12ILL, 74HE	cont.		4	22	5	56	88.6	104.9	0.1	0
2	20	Waldom	Bangalexpedient bangalor, ice		1035-1246		2	11	16	26	97.7	110.1	0.2	0
2	20	cont.	cont.	cont.	cont.		4	11	16	31	106.4	121	0.4	0
2	20	cont.	TNT	38lbs.	cont.		2	12	14	29	93.1	108.1	0.2	0
2	20	N N Lake	TNT	35lbs.	cont.		4	12	14	35	107.1	121.7	0.4	0
2	20	cont.	cont.	cont.	cont.		2	12	38	56	92.2	111.0	0.1	0
2	20	cont.	C-4	36lbs.	cont.		4	12	39	2	103.2	119.0	0.3	0
2	20	cont.	cont.	cont.	cont.		3	13	47	46	90.7	104.8	0.2	0
3	5	F.P. 33	105MM40HE		0945-1747		4	11	4	32	87.8	107.0	0.1	poss. invalid
3	24	DEMO II	C-4	40lbs.	0852-1614		3	9	15	58	93	104.6	0.3	0
3	24	cont.	cont.	cont.	cont.		3	10	10	50	88.7	104.5	0.3	0
3	24	cont.	cont.	cont.	cont.		4	13	3	45	94.6	108.5	0.1	0
3	24	cont.	cont.	cont.	cont.		4	13	4	7	93.8	107.5	0.2	0
3	24	cont.	cont.	cont.	cont.		4	13	5	11	92.5	106.5	0.1	0
3	24	cont.	cont.	cont.	cont.		4	13	15	6	91.7	105.0	0.4	0
4	8	DEMO II	CLAYMO	42	0828-1603		4	11	27	11	76.2	105.7	0.1	0
4	8	cont.	TNT	47lbs.	cont.		4	11	35	27	95.0	106.3	0.9	0
4	8	cont.	cont.	cont.	cont.		4	11	35	32	94.1	105.3	0.7	0
4	8	cont.	cont.	cont.	cont.		4	11	35	43	93.5	105.6	0.7	0
4	8	cont.	cont.	cont.	cont.		4	11	35	49	92.0	104.9	0.5	0
4	8	cont.	cont.	cont.	cont.		4	13	35	20	93.5	104.6	0.1	0
4	8	cont.	cont.	cont.	cont.		4	13	39	57	98.6	104.4	1.5	0
4	8	cont.	cont.	cont.	cont.		4	14	10	36	94.6	104.3	1.6	0
4	8	cont.	cont.	cont.	cont.		3	14	49	58	94.9	104.7	1.5	0
4	8	cont.	cont.	cont.	cont.		4	14	58	3	96.3	104.9	0.2	0
4	8	cont.	cont.	cont.	cont.		4	15	5	39	94.9	105.5	0.1	0
4	8	cont.	cont.	cont.	cont.		4	15	46	52	94.9	105.5	0.1	0
4	8	cont.	cont.	cont.	cont.		4	15	46	59	97.9	104.4	0.2	0
4	8	cont.	cont.	cont.	cont.		4	15	56	16	98.9	107.7	0.3	0
4	8	cont.	cont.	cont.	cont.		4	15	56	22	101.1	106.3	0.6	0

Table A1 (Cont'd)

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME	UNIT	HR	MIN	SEC	SEL	PEAK	DUR	NOTES
4	10	FP's	105MM	28 HE	1019-1936	4	13	7	13	75.5	107.6	0.6	0
4	10	cont.	cont.	cont.	cont.	4	13	47	4	94.5	104.8	0.1	0
4	23	FIRE POINT	105MM	26ILL, 24HE, 10HEPD, 5HE	0848-2306	3	18	31	18	92.4	109.5	0.2	0
4	23	cont.	cont.	7HEquick, 232HE, 2WP, 89HE	cont.	3	18	42	15	86.5	105.0	0.1	0
4	23	cont.	cont.	12HEVP	cont.	3	18	44	30	91.0	111.5	0.1	0
4	23	cont.	cont.	cont.	cont.	3	18	44	51	91.0	112.7	0.1	0
4	23	cont.	cont.	cont.	cont.	3	18	45	7	89.2	108.9	0.1	0
4	24	NIEBAR	105MM	38HE, 1WP, 26HE	cont.	3	6	49	41	86.1	105.5	0.1	0
4	24	FP 2,3	cont.	cont.	1001-2117	3	7	23	55	90.6	105.1	0.4	0
4	24	NIEBAR	cont.	cont.	0830-0911	3	7	27	48	85.8	106.3	0.1	0
4	24	FP 2,3	cont.	cont.	0557-0815	3	7	42	22	91.9	108.4	0.6	0
4	24	cont.	cont.	cont.	cont.	3	18	47	45	92.5	106.9	0.4	0
4	25	FP's	105MM	7HE, 6HE, 7ILL, 14HE	0007-1000	4	2	6	12	86.0	105.4	0.1	0
4	25	DEMO II	cont.	12 1/2lb. TNT 181b. C-4	1204-1718	4	2	9	22	91.1	106.2	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	9	29	87.4	108.8	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	26	30	86.3	106.1	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	30	24	89.1	110.9	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	32	26	87.5	108.2	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	33	16	85.4	105.4	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	33	23	86.2	105.1	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	33	33	87.7	109.8	0.1	0
4	25	cont.	cont.	cont.	cont.	4	7	33	41	88.8	107.0	0.2	0
4	30	FP 9	105MM	61HE, 4ILL, 7HE, 56HE	0611-2344	4	9	8	36	92.8	109.0	0.4	0
4	30	cont.	cont.	cont.	cont.	4	9	8	39	94.3	111.4	0.9	0
4	30	cont.	cont.	cont.	cont.	4	14	29	49	92.1	104.5	0.2	0
4	30	cont.	cont.	cont.	cont.	4	16	33	1	98.9	105.3	0.2	0
4	30	cont.	cont.	cont.	cont.	4	20	11	12	93.6	104.6	0.1	0
5	5	DEMO I	FLEXEX	251b. C-4 551b.	1456	4	14	54	53	98.3	112.4	0.2	0
5	5	FP 5	105MM	unknown	cont.	4	14	55	2	93.7	108.5	0.1	0
5	6	FP NIEBAR	105MM	10HE	1219-1308	4	7	30	45	86.4	104.2	0.1	unit b 1/37
5	6	FP 31	cont.	cont.	1311-2326	3	8	59	9	87.4	107.4	0.1	0
5	6	FP 5	105MM	40HE, 2HE, 3WP	0559-1219	3	9	0	41	86.9	106.0	0.2	0
5	6	cont.	cont.	cont.	cont.	3	9	5	53	84.1	104.4	0.1	0
5	6	cont.	cont.	cont.	cont.	4	10	1	28	93.4	105.3	0.6	0
5	7	FP 9	105MM	33HE	1830-2228	4	18	41	35	94.9	105.2	0.1	unit a 1/37
5	7	FP 9	cont.	cont.	0631-0825	4	19	7	41	96.9	105.1	0.1	0
5	7	FP 31	cont.	8HE	1320-1434	4	19	56	21	94.2	105.9	0.1	0
5	7	NIEBAR	cont.	19HE	1529-1632	4	20	40	18	93.7	104.8	0.2	0
5	7	cont.	cont.	cont.	cont.	4	21	9	47	95.6	105.2	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	9	50	95.2	105.1	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	25	18	93.6	104.3	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	25	35	94.6	107.2	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	26	38	91.9	104.4	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	35	8	96.2	105.2	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	35	11	92.9	104.3	0.1	0
5	7	cont.	cont.	cont.	cont.	4	21	36	53	98.4	108.6	0.2	0
5	7	cont.	cont.	cont.	cont.	4	22	31	25	99.2	109.7	0.2	0
5	8	FP NIEBAR	105MM	7HE	1140-1239	4	11	57	47	98.5	104.7	0.7	unit a 1/37
5	8	FP 31	105MM	35HE, 10ILL	1240-2257	4	15	45	31	93.6	105.3	0.7	0
5	8	FP 9	cont.	cont.	0620-1126	4	16	48	23	82.3	109.7	0.1	0
5	8	cont.	cont.	cont.	cont.	4	21	49	46	77.1	104.4	0.1	0
6	9	DEMO I	C-4	801bs.	1352-1422	4	14	20	13	89.5	104.3	0.4	0
6	24	DEMO II	C-4	6 1/4lbs.	0746-1234	4	7	41	59	93.6	104.9	1.1	0
6	24	cont.	TNT	5 3/4lbs.	cont.	4	9	24	34	93.4	104.2	0.7	0
6	24	cont.	cont.	cont.	cont.	4	9	24	41	91.1	104.4	0.1	0
6	24	cont.	cont.	cont.	cont.	4	10	11	43	95.4	104.5	1.3	0
6	24	cont.	cont.	cont.	cont.	4	10	43	31	95.6	104.1	1.3	0
6	24	cont.	cont.	cont.	cont.	4	11	30	0	93.6	105.5	1.3	0
7	2	DEMO II	TNT	581bs.	0959-1532	3	10	23	49	95.9	104.6	0.1	0
7	2	cont.	D.CORD	358ft	cont.								0
7	2	cont.	B.TRAP	400	cont.								0
7	2	cont.	F.CORD	510ft	cont.								0
7	2	cont.	C-4	1/4 stick 200	cont.								0
8	5	DEMO II	CLAYMO	97 total; 9-14 in sequence	1017-1820	4	14	6	45	92.5	104.6	0.9	0
8	5	cont.	cont.	cont.	cont.	4	14	15	52	94.3	105.1	1.4	0
8	5	cont.	cont.	cont.	cont.	4	14	16	1	90.8	104.1	0.1	0
8	5	cont.	cont.	cont.	cont.	4	15	12	53	90.8	104.8	0.4	0
8	5	cont.	cont.	cont.	cont.	4	15	12	56	93.3	104.8	0.4	0
8	7	DEMO II	CLAYMO	70 total; 6-10 in sequence	1007-1414	4	10	10	32	91.7	105.5	0.8	0
8	7	cont.	cont.	cont.	cont.	4	11	53	57	93.4	104.5	0.5	0

Table A1 (Cont'd)

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME	UNIT	HR	MIN	SEC	SEL.	PEAK	DUR	NOTES	
8	13	McLaughlin	CLAYMO	unknown	1131-2400		4	12	1	41	95.6	108.1	0.1	0
8	13	cont.	cont.	cont.	cont.		4	12	22	36	93.9	104.6	0.1	0
8	13	cont.	cont.	cont.	cont.		4	12	22	52	96.9	106.4	0.1	0
8	13	cont.	cont.	cont.	cont.		4	12	22	54	98.7	107.5	0.4	0
8	13	cont.	cont.	cont.	cont.		4	12	38	40	96.9	105.5	0.1	0
8	13	cont.	cont.	cont.	cont.		4	12	38	43	99.7	104	0.9	0
8	13	cont.	cont.	cont.	cont.		4	12	40	42	98.9	104.3	1.4	0
8	13	cont.	cont.	cont.	cont.		4	13	4	36	98.7	105.3	0.2	0
8	13	cont.	cont.	cont.	cont.		4	13	11	24	95.6	104.7	0.2	0
8	13	cont.	cont.	cont.	cont.		4	14	22	53	103.9	110.1	0.3	0
8	13	cont.	cont.	cont.	cont.		4	15	15	37	95.6	104.7	0.2	0
8	13	cont.	cont.	cont.	cont.		4	23	38	17	92.5	104.2	0.1	0
8	14	DEMO	C-4	51b, 121b	1427-1619		4	14	45	45	92.7	105.7	0.2	0
8	14	cont.	cont.	cont.	cont.		4	16	18	7	89.6	105.3	0.2	0
8	18	DEMO	C-4	1001b	1336-1505		4	14	24	18	93.0	104.3	0.1	0
8	18	cont.	cont.	cont.	cont.		4	14	35	7	93.3	107.3	0.1	0
8	18	cont.	cont.	cont.	cont.		4	15	0	30	94.6	107.5	0.1	0
8	18	cont.	cont.	cont.	cont.		4	15	1	27	97.9	111.1	0.2	0
8	21	FP 31,33	105MM	18HE, 3HC, 3WP	0616-0800		4	7	59	7	85.9	113.4	0.1	0
8	21	cont.	cont.	cont.	cont.		4	18	23	53	98.0	111.9	0.4	0
8	26	FP 22	105MM	24HE, 25HE	1343-2221		4	14	26	8	103.9	112.9	0.2	0
8	26	cont.	cont.	cont.	cont.		4	14	31	52	101.2	112.4	0.2	0
8	26	cont.	cont.	cont.	cont.		4	14	42	13	99.3	111.1	0.1	0
8	27	FP 3	105MM	60HE, 51HE, 6WP, 55HE, 6smoke, 65HE	1419-1941		4	9	51	7	97.0	116.3	0.1	0
8	27	FP 3	cont.	cont.	0550-1308		4	9	51	18	94.0	112.1	0.1	0
8	27	FP 22	cont.	cont.	1439-1941		4	9	51	20	97.7	116.3	0.1	0
8	27	FP 5	cont.	cont.	0530-2418									0
9	9	FP 1	105MM	12HE	0751-1036		4	9	44	24	90.9	114.7	0.1	likely no Art
9	9	FP 1,31	cont.	50HE	0001-0234		4							0
9	9	FP 9	cont.	cont.	1037-1635		4							0
9	9	FP 5	cont.	cont.	1129-1635		4							0
9	15	DEMO I	cont.	8-75lbs.	0916-1247		4	10	37	31	101.4	117.0	0.2	0
9	15	cont.	cont.	cont.	cont.		4	10	38	45	105.5	119.3	0.3	0
9	15	cont.	cont.	cont.	cont.		4	10	39	30	102.0	116.8	0.2	0
9	15	cont.	cont.	cont.	cont.		4	10	40	35	98.8	112.9	0.1	0
9	15	cont.	cont.	cont.	cont.		4	11	51	38	97.6	111.6	0.1	0
9	15	cont.	cont.	cont.	cont.		4	11	52	39	99.9	112.9	0.1	0
9	15	cont.	cont.	cont.	cont.		4	12	46	10	98.2	111.4	0.1	0
9	23	FP 7,22,23	105MM	14HE, 2HC, 2WP, 40HE, 20HE	2018-2400		4	8	12	39	101.6	111.4	0.1	0
9	23	cont.	cont.	cont.	cont.		4	8	12	42	105.6	115.2	0.6	0
9	23	cont.	cont.	cont.	cont.		4	8	12	44	104.5	111.6	0.1	0
9	23	cont.	cont.	cont.	cont.		4	8	58	55	97.6	111.7	0.3	0
9	23	cont.	cont.	cont.	cont.		4	14	52	1	101	111.7	0.1	0
9	23	cont.	cont.	cont.	cont.		4	14	55	49	102.6	111.6	0.1	0
9	23	cont.	cont.	cont.	cont.		4	14	55	54	112.4	120.6	0.8	0
9	24	FP 7,22,23	105MM	20HE, 6HE, 5HE, 15HE, 5HE, 4WP, 3HE, 30	0001-1552		4	10	41	35	93.6	112.1	0.2	0
9	24	FP 1	cont.	cont.	2331-2400		4	14	16	31	93.5	111.5	0.1	0
9	24	FP 31	cont.	cont.	2322-2400		4	17	15	24	99.7	112	0.2	0
9	24	FP 3	cont.	cont.	1158-2230		4							0
9	24	FP 33	cont.	cont.	0016-1930		4							0
9	24	FP 9	cont.	cont.	1828-1930		4							0
9	25	DEMO	C-4	13-40LBS.	0808-2054		4	14	44	29	99.1	111.5	0.2	poss. Artillery
9	25	105MM	HE	15, 15, 15, 5	0001-1000		4	14	48	32	100.7	112.2	0.2	0
9	25	cont.	cont.	cont.	1038-1211		4	17	6	10	106.3	112.9	2.5	0
9	25	cont.	cont.	cont.	0001-1800		4	18	19	3	101.8	114.4	0.1	0
9	25	cont.	cont.	cont.	1828-2400		4	18	19	14	103.1	115.1	0.1	0
9	25	cont.	cont.	cont.	2246-2400		4	18	20	27	103	115.4	0.3	0
9	25	cont.	cont.	cont.	2303-2400		4	18	20	52	105.6	117	0.4	0
9	25	cont.	cont.	cont.	cont.		4	18	21	50	101.8	113.4	0.2	0
9	25	cont.	cont.	cont.	cont.		4	18	22	4	102	113.9	0.1	0
9	25	cont.	cont.	cont.	cont.		4	18	22	32	100.9	112	0.2	0
9	25	cont.	cont.	cont.	cont.		4	18	24	36	100.3	111.6	0.2	0
9	25	cont.	cont.	cont.	cont.		4	18	26	38	100.8	111.3	0.1	0
9	25	cont.	cont.	cont.	cont.		4	20	24	18	101.6	112.8	0.2	0
9	25	cont.	cont.	cont.	cont.		4	20	25	43	102	114.1	0.1	0
9	26	FP 22,23	105MM	unk	0001-1035		4	10	48	0	98.8	112.6	0.1	0
9	26	DEMO II	C-4	6 1/4	0921-1242		4	16	35	31	99.1	112.2	0.1	0
9	26	cont.	TNT	281b.	cont.		4	17	21	36	100.9	113.9	0.2	0
9	26	cont.	bangal	13	1141-1750		4							0
9	26	cont.	C-4	18 3/4	cont.		4							0

Table A1 (Cont'd)

MON	DAY	LOCATION	WEAPON	DESCRIPTION	FIRING TIME	UNIT	HR	MIN	SEC	SEL	PEAK	DUR	NOTES
9	27	DEMO II	4-40lbs.	crater,2-mis tank mines(more)	1101-1832	4	16	57	11	103.0	115.4	0.2	0
9	27	cont.		cont. 8 blocks tnt, 2-40lb. shapes	cont.	4	18	0	1	99.3	111.5	0.1	0
10	6	FP 31,33	105MM	83HE, 2WP, 28HE, 2WP, 37HE	0929-2255	4	20	17	46	87.1	116.1	0.1	0
10	6	cont.		cont. cont.	cont.	4	21	16	32	86.8	113.0	0.1	0
10	6	cont.		cont. cont.	cont.	4	21	17	33	86.0	111.8	0.1	0
10	6	cont.		cont. cont.	cont.	4	22	11	6	89.7	117.3	0.1	0
10	6	cont.		cont. cont.	cont.	4	22	12	8	91.3	113.3	0.1	0
10	6	cont.		cont. cont.	cont.	4	22	14	56	88.4	111.6	0.1	0
10	7	FP 23	105MM	35MK, 35HE, 20HE, 27HE, 54HE(more)	0557-2305	4	8	50	1	92.7	111.3	0.1	0
10	7	FP 3		cont. 2WP, 7HE, 24HE, 12HE, 23HE	1240-1535	4	9	19	47	89.0	114.6	0.1	0
10	7	FP 9		cont. 46HE	1424-2305	4	9	20	9	88.7	114.1	0.1	0
10	7	FP 1		cont. cont.	0557-1239	4	13	4	0	97.9	111.3	0.3	0
10	7	FP 31		cont. cont.	0552-1410	4	19	51	4	90.7	113.5	0.1	0
10	7	FP 33		cont. cont.	0557-1218	4	19	51	35	93.0	115.6	0.1	0
10	7	cont.		cont. cont.	cont.	4	19	54	56	90.4	111.8	0.1	0
10	7	cont.		cont. cont.	cont.	4	20	5	0	89.6	112.6	0.1	0
10	7	cont.		cont. cont.	cont.	4	20	5	23	92.1	112.0	0.1	0
10	7	cont.		cont. cont.	cont.	4	20	5	36	92.6	112.3	0.1	0
10	7	cont.		cont. cont.	cont.	4	20	4	47	89.1	112.2	0.1	0
10	18	DEMO II		Bangalore; C-4, 16 1/2; SC 6-15lbs.	1107-1552	4	13	12	21	100.1	112.4	0.1	0
10	18	cont.		TNT 18lbs.	cont.	4	13	14	9	101.0	113.3	0.1	0
10	18	FP 1	105MM	unk	1001-1536	4	13	53	44	103.6	116.0	0.2	0
10	18	FP 2		cont. cont.	1001-2001	4	13	59	36	105.7	119.1	0.2	0
10	18	FP 31		cont. cont.	1001-2047	4	14	2	17	103.2	116.4	0.2	0
10	18	FP 22		cont. cont.	1551-2137	4	14	19	10	103.8	116.8	0.3	0
10	18	MMDC		cont. cont.	1520-1550	4	15	28	32	98.0	113.2	0.5	0
10	20	FP 2	HE	103; 29; 50; 8; 40	0225-1300	4	15	14	13	79.8	120.6	0.1	0
10	20	FP 5		cont. cont.	1344-2102	4	15	17	15	79.0	120.6	0.1	0
10	20	FP 22		cont. cont.	0001-1028	4	15	20	16	75.6	113.8	0.1	0
10	20	MMDC		cont. cont.	1301-1343	4	15	23	18	89.0	118.8	0.1	0
10	20	FP 5		cont. cont.	0001-1054	4	15	32	30	85.3	112.4	0.1	0
10	20	FP 31		cont. cont.	2342-2400	4	15	35	32	76.4	115.3	0.1	0
10	20	FP 33		cont. cont.	2038-2340	4	15	38	34	82.5	124.1	0.1	0
10	20	cont.		cont. cont.	cont.	4	16	39	43	96.6	111.2	0.1	0
10	20	cont.		cont. cont.	cont.	4	17	15	16	100.2	108.8	1.1	0
10	20	cont.		cont. cont.	cont.	4	17	35	8	86.8	109.8	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	28	42	90.3	113.6	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	31	9	89.2	113.6	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	33	26	88.9	113.5	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	35	9	88.5	114.4	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	39	33	90.7	121.9	0.1	0
10	20	cont.		cont. cont.	cont.	4	22	45	6	93.1	113.6	0.4	0
10	22	DEMO	C-4	9lbs.	1243-1523	4	10	28	24	92.7	111.8	0.1	0
10	22	105MM	FP 3	cont.	0001-1138	4	10	34	28	80.7	119.6	0.1	0
10	22	cont.	FP 23	cont.	0001-1212	4	10	37	30	83.3	125.5	0.1	0
10	22	cont.		cont. cont.	cont.	4	10	40	32	93.4	124.5	0.1	0
10	22	cont.		cont. cont.	cont.	4	10	43	34	84.2	120.3	0.1	0
10	22	cont.		cont. cont.	cont.	4	10	49	38	79.6	117.6	0.1	0
10	22	cont.		cont. cont.	cont.	4	10	55	42	85.3	123.7	0.1	0
10	29	DEMO	TNT	3lbs.	1250-1533	4	12	35	43	80.4	116.1	0.1	0
10	29	cont.	C-4	9lbs.	cont.	4	12	54	55	83.7	111.5	0.1	0
11	3	DEMO I		Flexite 50lbs.	1308-1436	4	14	18	51	103.0	117.8	0.2	0
11	3	cont.	C-4	cont.	cont.	4	14	19	7	111.7	124.8	0.3	0
11	3	cont.		cont. cont.	cont.	4	14	19	17	112.0	124.5	0.2	0
11	6	FP 3	105MM	50HE	0001-1547	4	13	57	46	93.9	112.9	0.3	0
11	6	cont.		cont. cont.	0923-1504	4	13	57	50	92.5	111.8	0.1	0
11	6	cont.		cont. cont.	0001-1547	4	14	39	32	91.0	111.1	0.1	0
11	6	cont.		cont. cont.	cont.	4	14	53	53	95.8	117.9	0.2	0
11	6	cont.		cont. cont.	cont.	4	14	53	57	93.6	112.4	0.2	0
11	6	cont.		cont. cont.	cont.	4	15	36	49	96.6	117.0	0.1	0
11	20	Whitney point		4 40lb shapes and 1 12lb. shape	1008	4	10	8	49	110.9	131.9	0.2	0
11	20	cont.		cont. cont.	1105	4	11	12	34	99.6	118.4	0.2	0
11	20	cont.		cont. cont.	1130	4	11	35	6	106.3	121.2	0.2	0
11	20	cont.		cont. cont.	1149	4	11	52	32	102.3	123.5	0.2	0
11	20	cont.		cont. cont.	1206	4	12	8	57	105.3	117.8	0.2	0
11	21	EOD	TNT	8 sticks	1320-1420	4	13	38	25	101.7	115.3	0.2	0
11	21	cont.	Pmines	14	cont.	4	13	38	31	102.2	115.3	0.2	0
11	21	cont.	D cord	50'	cont.	4	13	40	8	112.4	126.0	0.3	0
11	21	cont.	Tmines	2	cont.	4	13	40	10	97.2	113.7	0.1	0

Table A2

Complaints Received During 1986 Related to Blast Noise

DATE	TIME	S.TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAK	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
10/21/85	1120-1154	1500-1600	DEMO I	176th EOD; one 201b.	--	/	/	/	Shots were harder than usual.	Up. Eagle Rock Loop;	Ahrens
11/7/85	--	PM	ARTILLERY		--	/	/	/	Noise shook windows and lamps.	Anchorage; Boniface, Debarr	area
1/16/86	1153-1336	Noon	DEMO I	C-4; 7@ 100lbs., 6@ 80lbs.	4	113.6	125.3	0.7	Noise	Muldoon; Mardock	
1/16/86	cont.	Noon	DEMO I	cont.	4	94.6	104.4	0.1	Shook windows, plants; well water gets murky.	Hillside, Eagle R.; Resso	
1/16/86	cont.		DEMO I	cont.	4	113.8	124.7	1.2	Noise	Eagle R. rd.; Rush	
1/16/86	cont.	Noon	DEMO I	cont.	4	112.4	124.3	0.8	Felt like an earthquake;	Eagle R.; Anderson.	
1/16/86	cont.	Noon&1345	DEMO I	cont.	4	94.5	105.5	0.1	house rattled badly and animals got upset.		
1/16/86	cont.	1155-1345	DEMO I	cont.	4	112.6	124.2	0.6	Feels like an earthquake; building shook.	Eagle R. loop rd.; Kent	
1/16/86	cont.	--	DEMO I	cont.	4	95.4	105.1	0.2	Scared kids, shook house and rattled dishes.	Eagle R.; Anthony	
1/16/86	cont.	--	DEMO I	cont.	4	112	109.5	1.3			
1/16/86	cont.	--	DEMO I	cont.	4	112.3	121.6	1.2			
1/16/86	cont.	--	DEMO I	cont.	4	111.6	123.1	1.3			
1/16/86	cont.	--	DEMO I	cont.	3	91.3	110.5	0.1			
1/16/86	cont.	--	DEMO I	cont.	3	90.9	106.7	0.1			
1/16/86	cont.	--	DEMO I	cont.	3	91.4	105.9	0.2			
1/16/86	cont.	--	DEMO I	cont.	3	90.2	110.6	0.1			
1/21/86	--	1400-1500	DEMO II	401b charges.	--	/	/	/	Knocked pictures off wall thought it was an earthquake.	Muldoon; Miner	
1/31/86	2247	1030-1100	POW Comp.	C-4; 101bs.	4	116.2	131.5	1.2	Big boom; shook house badly and he noticed a crack in new basement [poss. invalid data]	Eagle R.; Marquardt	
2/1/86	0551-0732	evening	DEMO II	C-4; 301bs 31 ton Special Forces demo at pow camp	4	96.2	108.2	0.2	Shaking house, scaring pets, and could see flaming debris near Eagle River camp ground.	Eagle R.; Archey	**[a]
2/10/86	1140-1442	evening	DEMO I	C-4; 852 lbs.	4	112.1	124.9	0.6	Things fell, kids scared, and windows shook.	Up. Eagle R. rd.; Ahrens.	
2/10/86	cont.	1455	DEMO I		4	112.6	125.3	0.7	Noise	Eagle R.; unk.	
2/10/86	cont.	1325-1335	DEMO I		4	112.6	125.4	0.6	The putty fell out of window, causing it to break.	Big Lake; Connelly	
2/10/86	cont.	12-1230PM	DEMO I		4	113.7	126	0.6	Trailer rocked.	Muldoon&Glen Highway; unk.	
2/10/86	cont.	1430	DEMO I		3	93.8	104.7	0.8	The house shook.	South Mountain area; Lee.	
2/10/86	cont.	1200-1300	DEMO I		4	112.6	123.3	0.7	unknown	unknown	
2/10/86	cont.	1200-1230	DEMO I		4	112.1	106.8	0.6	Afraid vibrations might collapse his well.	Eagle R.; Craig	
2/10/86	cont.	--	cont.		4	112.8	123.1	0.7			
2/10/86	cont.	--	cont.		4	113.6	124.7	0.7			
2/10/86	cont.	--	cont.		4	94.5	104.4	0.1			
2/10/86	cont.	--	cont.		4	110.7	121.8	0.4			
2/10/86	cont.	--	cont.		4	115.8	124	0.7			
2/10/86	cont.	--	cont.		4	113.3	106.3	0.6			
2/10/86	cont.	--	cont.		4	96.4	104.3	0.1			
2/11/86	0700-2049	--	FP 1,31	105MM; 38HE, 81LL, 27HE,	3	92.8	104.6	0.1	Anchorage residents complained of noise.	Anchorage; residents	
2/11/86	0853-1730	--	cont.	91LL, 47HE, 41LL.	2	86.7	107.1	0.1			
2/11/86	1433-2233	--	cont.		4	94.9	104.9	3			
2/11/86	cont.	--	cont.		3	68.6	106.1	0.1			
2/11/86	cont.	--	cont.		4	93.4	105.6	0.6			
2/11/86	cont.	--	cont.		4	89.6	108.2	0.1			
2/11/86	cont.	--	cont.		4	89.3	108.5	0.2			
2/11/86	cont.	--	cont.		4	97.3	112.4	0.6			
2/11/86	cont.	--	cont.		4	87	104.5	0.1			

Table A2 (Cont'd)

DATE	TIME	S. TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAR	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
2/11/86	cont.	--	cont.		4	95	110.8	0.3			
2/11/86	cont.	--	cont.		4	95	111	0.5			
2/11/86	cont.	--	cont.		4	92.3	105.9	1			
2/11/86	cont.	--	cont.		4	97.1	115.4	0.4			
2/11/86	cont.	--	cont.		4	91.8	105	0.1			
2/11/86	cont.	--	cont.		4	95.3	112.2	0.3			
2/12/86	1027-1415	--	DEMO II	Bangalore, TNT 11lbs.	4	89.2	107.7	0.2	Anchorage residents complained of noise.	Anchorage; residents	
2/12/86	0700-2049	--	FP 1,2,31	81MM and 105MM; 50HE, 21LL	4	90.7	104.3	0.2			
2/12/86	1231-1406	--	FP JOHN	81MM; 10HE	4	89.2	108.4	0.1			
2/12/86	1533-1728	--	N N LAKE	TNT; 15lbs.	4	89.9	109.6	0.1			
2/12/86	cont.	--	cont.	(note; firing time is diff. from data)	4	89.1	108	0.1			
2/12/86	cont.	--	cont.	(note; this is an artillery complaint)	4	88.5	106.3	0.1			
2/12/86	cont.	--	cont.		4	90.1	107.5	0.1			
2/12/86	cont.	--	cont.		4	94.5	110	0.1			
2/12/86	cont.	--	cont.		4	86.7	108.5	0.1			
2/12/86	cont.	--	cont.		4	87.5	108.2	0.1			
2/12/86	cont.	--	cont.		4	86.9	105.6	0.2			
2/12/86	cont.	--	cont.		4	86	104.8	0.1			
2/12/86	cont.	--	cont.		4	99.4	108.8	0.3			
2/12/86	cont.	--	cont.		4	89.9	109	0.2			
2/12/86	cont.	--	cont.		4	97.9	108.7	0.2			
2/12/86	cont.	--	cont.		4	85.8	104.8	0.1			
2/12/86	cont.	--	cont.		4	90.3	108.1	0.1			
2/12/86	cont.	--	cont.		4	91.6	110.7	0.1			
2/12/86	cont.	--	cont.		4	88.2	106	0.1			
2/12/86	cont.	--	cont.		4	84.4	105.2	0.1			
2/12/86	cont.	--	cont.		4	96.2	106.1	0.3			
2/12/86	cont.	--	cont.		4	85.5	104.7	0.1			
2/12/86	cont.	--	cont.		4	91.4	111.1	0.2			
2/12/86	cont.	--	cont.		4	87.4	105.4	0.1			
2/12/86	cont.	--	cont.		4	89.8	108.8	0.1			
2/12/86	cont.	--	cont.		4	89.5	108.2	0.1			
2/12/86	cont.	--	cont.		4	87	106.8	0.1			
2/12/86	cont.	--	cont.		4	89	108.2	0.1			
2/12/86	cont.	--	cont.		4	88.9	108.9	0.1			
2/12/86	cont.	--	cont.		4	98.9	113.9	0.3			
2/12/86	cont.	--	cont.		4	85.3	104.6	0.1			
2/12/86	cont.	--	cont.		4	97.2	105.6	3.6			
2/12/86	cont.	--	cont.		4	90.6	104.5	0.1			
2/12/86	cont.	--	cont.		4	85.8	113.7	0.1			
2/12/86	cont.	--	cont.		4	88.4	109.4	0.1			
2/12/86	cont.	--	cont.		4	87.5	108.2	0.1			
2/13/86	0715-0952	All Day	FP 1,31	Conip; 22lbs. TNT; 2lbs.	4	89.1	105.4	0.1		Eagle R.; Archey	**[a2]
2/13/86	0715-0840	--	cont.	105MM; 14HE, 21HE.	4	95.9	106.6	0.7			
2/13/86	cont.	--	cont.		4	97.4	110.8	0.7			
2/13/86	cont.	--	cont.		4	90.8	105.4	0.2			
2/13/86	cont.	--	cont.		4	89.8	107.7	0.1			
2/13/86	cont.	--	cont.		4	90.6	108.7	0.1			
2/19/86	1402-2211	Day&Evening	FP 31	105MM; 12ILL, 74HE	4	86.3	104.9	0.1	Rattling windows.	Downtown Anchorage; unk.	
2/19/86	cont.	--	cont.		4	86.5	105.2	0.1	Loud explosions-thought it was an earthquake.	E. Peters Creek; unk.	**[a1]
2/19/86	cont.	--	cont.		4	86.7	105.4	0.1			
2/19/86	cont.	--	cont.		4	86.4	104.5	0.1			
2/19/86	cont.	--	cont.		4	86.1	105	0.1			

Table A2 (Cont'd)

DATE	TIME	S.TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAK	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
2/19/86	cont.	--	cont.		4	87.8	107.6	0.1			
2/19/86	cont.	--	cont.		4	86.5	105.3	0.1			
2/19/86	cont.	--	cont.		4	92.4	105.2	0.1			
2/19/86	cont.	--	cont.		4	92.7	104.7	0.1			
2/19/86	cont.	--	cont.		4	86.9	107.4	0.1			
2/19/86	cont.	--	cont.		4	86.6	106.7	0.1			
2/19/86	cont.	--	cont.		4	86.1	105.3	0.1			
2/19/86	cont.	--	cont.		4	86.3	107.2	0.1			
2/19/86	cont.	--	cont.		4	86.2	106.1	0.1			
2/19/86	cont.	--	cont.		4	86.5	105.8	0.1			
2/19/86	cont.	--	cont.		4	88.1	105.9	0.1			
2/19/86	cont.	--	cont.		4	86.9	105.8	0.1			
2/19/86	cont.	--	cont.		4	86.3	107.2	0.1			
2/19/86	cont.	--	cont.		4	86.4	105.2	0.1			
2/19/86	cont.	--	cont.		4	87.9	108	0.1			
2/19/86	cont.	--	cont.		4	86.7	106.3	0.1			
2/19/86	cont.	--	cont.		4	86.4	105.2	0.1			
2/19/86	cont.	--	cont.		4	88.6	106.2	0.1			
2/19/86	cont.	--	cont.		4	86.5	105.5	0.1			
2/19/86	cont.	--	cont.		4	86.2	104.4	0.1			
2/19/86	cont.	--	cont.		4	89.8	105.6	1.5			
2/19/86	cont.	--	cont.		4	87.1	106.1	0.1			
2/19/86	cont.	--	cont.		4	91	108.2	0.1			
2/19/86	cont.	--	cont.		4	87.2	106.8	0.1			
2/19/86	cont.	--	cont.		4	86.8	105.7	0.1			
2/19/86	cont.	--	cont.		4	92.7	110.4	0.2			
2/19/86	cont.	--	cont.		4	88.8	107	0.1			
2/19/86	cont.	--	cont.		4	92	106.4	0.6			
2/19/86	cont.	--	cont.		4	84.9	105	0.1			
2/19/86	cont.	--	cont.		4	86.2	106.5	0.1			
2/19/86	cont.	--	cont.		4	86.3	107.1	0.1			
2/19/86	cont.	--	cont.		4	85.3	105.1	0.1			
2/19/86	cont.	--	cont.		4	86.7	107	0.1			
2/19/86	cont.	--	cont.		4	89.8	104.7	1.2			
2/19/86	cont.	--	cont.		4	84.7	105.5	0.1			
2/19/86	cont.	--	cont.		4	86.3	105.7	0.1			
2/19/86	cont.	--	cont.		4	86.2	106.3	0.1			
2/19/86	cont.	--	cont.		4	88.3	107.3	0.1			
2/19/86	cont.	--	cont.		4	85.1	106.9	0.1			
2/19/86	cont.	--	cont.		4	85.9	106	0.1			
2/19/86	cont.	--	cont.		4	84.4	105.2	0.1			
2/19/86	cont.	--	cont.		4	87.9	104.7	0.1			
2/19/86	cont.	--	cont.		4	85.5	104.4	0.1			
2/19/86	cont.	--	cont.		4	85.9	104.4	0.1			
2/19/86	cont.	--	cont.		4	84.7	105.2	0.1			
2/19/86	cont.	--	cont.		4	88.1	106.8	0.1			
2/19/86	cont.	--	cont.		4	86.2	105.7	0.1			
2/19/86	cont.	--	cont.		4	86.7	105	0.1			
2/19/86	cont.	--	cont.		4	85.9	105.2	0.1			
2/19/86	cont.	--	cont.		4	88.7	104.7	0.1			
2/19/86	cont.	--	cont.		4	88.6	104.9	0.1			
2/19/86	cont.	--	cont.		3	85	104.7	0.1			
2/20/86	1039-1625	-1230	FOX/COLE	81MM; 83HE	4	106.4	121	0.4		E. Peters Creek; unk.	**[aa2]
2/20/86	cont.	--	N N LAKE	TNT; 35lbs.	2	97.7	110.1	0.2			
2/20/86	1035-1246	--	Waldom	Bangalor?; expedient bangalor, ice?	4	107.1	121.7	0.4			

Table A2 (Cont'd)

DATE	TIME	S.TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAK	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
2/20/86	cont.	--	cont.	TNT; 381bs., C-4; 401bs.	2	93.1	108.1	0.2			
2/20/86	cont.	--	cont.		4	103.2	119	0.3			
2/20/86	cont.	--	cont.		2	92.2	111	0.1			
2/20/86	cont.	--	cont.		3	90.7	104.8	0.2			
3/14/86	1900-2323,1	1045	ARTILLERY	81MM; 35HE,55WP,80ILL; 45HE,25WP	--	/	/	/	Noise wakes them up.	Central Eagle R.; Boyer.	
4/23/86	0848-2306	2300	Fire Point	105MM; 7HE quick, 232HE,	3	92.4	109.5	0.2	Their dog had to be taken to the vet	Eagle R.; Parker	
4/23/86	cont.	--		2,3,9,31 2WP, 89HE, 26ILL, 24HE, 10HEPD	3	86.5	105	0.1	for tranquilizers.		
4/23/86	cont.	--		33,NIEBAR 5HE, 12?	3	91	111.5	0.1			
4/23/86	cont.	--	cont.		3	91	112.7	0.1			
4/23/86	cont.	--	cont.		3	89.2	108.9	0.1			
4/24/86	0630-0815	0700-0730	FP 2, 3	105MM; 38HE, 1WP, 26HE	3	92.5	106.9	0.4	Booms scare dog and cause the windows to shake.	Westchester Lagoon,inlet;	Davies
4/24/86	0557-0746	--	NIEBAR		3	86.1	105.5	0.1			
4/24/86	1001-2117	--	cont.		3	90.6	105.1	0.4			
4/24/86	0830-0911	--	cont.		3	85.8	106.3	0.1			
4/24/86	cont.	--	cont.		3	91.9	108.4	0.6			
9/9/86	0751-2400	evenings	ARTILLERY	105MM; 12HE	4	90.9	114.7	0.1	Noise	Turnagain Arm; Ellington.	***[aaa1]
9/9/86	0715-1036		FP 1								
9/9/86	1129-1635		FP 5								
9/9/86	1037-1635		FP 9								
9/9/86	0001-0234		FP 1,31								
9/9/86	cont.										
9/10/86	1417-2400	evenings	FP 2	105MM; 7HE, 50	--	/	/	/		Turnagain Arm; Ellington	***[aaa2]
9/10/86	2122-2400	2100-0230	FP 5		--	/	/	/	Noise	ad; 241 condova; Aslund	
9/10/86	1417-1804		FP 2								
9/10/86	1636-1852		FP 1								
9/10/86	1800-1852		FP 31								
9/11/86	0537-1200	2300	FP 5	105MM; 8HE, 20HE, 20HE, 41HE	--	/	/	/		Turnagain Arm; Ellington	***[aaa3]
9/11/86	0537-1117		FP 9	81MM; 36HE							
9/11/86	1200-1346		FP 2								
9/11/86	1117-1203		FP 3								
9/11/86	1203-1300		FP 30								
9/14/86	--	1030	ARTILLERY	176th EOD; 751b.	--	/	/	/	Loud explosions that caused the windows to rattle and the house to shake	E. Anchorage&Boniface,	Hanson
9/15/86	0916-1247	1250	DEMO I	?; 8-751bs.	4	101.4	117	0.2	House shook and daughter was frightened.	E. AFB.; Knoblauch	
9/15/86	cont.	--	cont.		4	105.5	119.3	0.3			
9/15/86	cont.	--	cont.		4	102	116.8	0.2			
9/15/86	cont.	--	cont.		4	98.8	112.9	0.1			
9/15/86	cont.	--	cont.		4	97.6	111.6	0.1			
9/15/86	cont.	--	cont.		4	99.9	112.9	0.1			
9/15/86	cont.	--	cont.		4	98.2	111.4	0.1			
9/21/86	--	1500	ARTILLERY		--	/	/	/	Noise and vibrations knocked pictures off the wall.	Anchorage; Meyer	**[b1]
9/22/86	0600-2400	evening	ARTILLERY	105MM; 6HE, 34HE, 32HE, 45HE	--	/	/	/	Noise woke them up and dog went crazy.	Parkstrip; Scott	**[bb1]
9/22/86	1930-2016	All Night	FP 2		--	/	/	/	They could not sleep.	Muldoon; Bearden	***[bbb1]
9/22/86	1158-1917	evenings	FP 3		--	/	/	/	They could not sleep and the dog went crazy.	Downtown; Thompson	***[c1]
9/22/86	1134-1924	--	FP 5,9		--	/	/	/	Loud noise	Eagle R.; Coatney	***[cc1]

Table A2 (Cont'd)

DATE	TIME	S.TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAK	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
9/22/86	cont.	Night	cont.		--	/	/	/	Loud bangs and shaking of house.	Eagle R.; Deterra	***[ccc1]
9/22/86	cont.	10-1100PM	cont.		--	/	/	/	Cracks in seam lines of house plus everything on walls shook.	Midtown; Madigan	***[d1]
9/23/86	2018-2400	9PM-4AM	FP 7,22,23105MM	14HE, 2HC, 2WP, 4OHE, 2OHE.	4	101.6	111.4	0.1	Things fell, house shook, and it wakes up baby.	Eagle R.; Morrison	**[dd1]
9/23/86	cont.	Night	cont.		4	105.6	115.2	0.6	Rattling windows and dog goes crazy.	Westchester Lagoon; Davies	***[ddd1]
9/23/86	cont.	P.M.	cont.		4	104.5	111.6	0.1	Shaking windows.	Midtown; Aslund	**[e1]
9/23/86	cont.	All Night	cont.		4	97.6	111.7	0.3		Parkstrip; Scott	**[bb2]
9/23/86	cont.	All Night	cont.		4	101	111.7	0.1		Midtown; Madigan	***[d2]
9/23/86	cont.	Night	cont.		4	102.6	111.6	0.1		Eagle R.; Deterra	***[ccc2]
9/23/86	cont.	--	cont.		4	112.4	120.6	0.8		Eagle R.; Coatney	***[cc2]
9/23/86	cont.	evening	cont.		--	/	/	/		Downtown; Thompson	***[c2]
9/23/86	cont.	Night	cont.		--	/	/	/		Muldoon; Bearden	***[bbb2]
9/24/86	0001-1552	2300	FP 7,22,23105MM	2OHE, 6HE, 5HE,	4	93.6	112.1	0.2	He can't sleep and his dog can't either.	town; Plasse	
9/24/86	1158-2230	2100	FP 3	15HE, 5HE, 4WP, 3HE, 3OHE	4	93.5	111.5	0.1		Anchorage; Meyer	**[b2]
9/24/86	1828-1930	Night	FP 9		4	99.7	112	0.2		Westchester lagoon; Davies	***[ddd2]
9/24/86	0016-1930	9PM-4AM	FP 33		--	/	/	/		Eagle R.; Morrison	**[dd2]
9/24/86	cont.	early	cont.		--	/	/	/		Muldoon; Bearden	***[bbb3]
9/24/86	cont.	evening	cont.		--	/	/	/		Downtown; Thompson	***[c3]
9/24/86	cont.	--	cont.		--	/	/	/		Eagle R.; Coatney	***[cc3]
9/24/86	cont.	Night	cont.		--	/	/	/		Eagle R.; Deterra	***[ccc3]
9/24/86	cont.	Night	cont.		--	/	/	/		Midtown; Madigan	***[d3]
9/25/86	0808-2054	Mid-0600	DEMO	C-4; 13-40lbs. 21b TNT, 401b CRATER	4	99.1	111.5	0.2	Noise	Anchorage; Bauf	
9/25/86	0001-1000	0450	cont.	105MM, 15HE, 15HE, 15HE, 5HE	4	100.7	112.2	0.2	Loud noise shakes house and can't get any sleep.	MTN. View; Peterkin	
9/25/86	1038-1211	Night	cont.		4	106.3	112.9	2.5		Westchester lagoon; Davies	***[ddd3]
9/25/86	0001-1800	A.M.	cont.		4	101.8	114.4	0.1		Midtown; Aslund	**[e2]
9/25/86	1828-2400	Night	cont.		4	103.1	115.1	0.1		Midtown; Madigan	***[d4]
9/25/86	2246-2400	Night	cont.		4	103	115.4	0.3		Eagle R.; Deterra	***[ccc4]
9/25/86	2303-2400	1845	cont.		4	105.6	117	0.4		Eagle R.; Coatney	***[cc4]
9/25/86	cont.	--	cont.		4	101.8	113.4	0.2			
9/25/86	cont.	--	cont.		4	102	113.9	0.1			
9/25/86	cont.	--	cont.		4	100.9	112	0.2			
9/25/86	cont.	--	cont.		4	100.3	111.6	0.2			
9/25/86	cont.	--	cont.		4	100.8	111.3	0.1			
9/25/86	cont.	--	cont.		4	101.6	112.8	0.2			
9/25/86	cont.	--	cont.		4	102	114.1	0.1			
10/17/86	/	Day&Night	ARTILLERY		--	/	/	/	Dogs are going crazy and it also bothers her.	7th&k; Beverly	***[ee1]
10/18/86	1107-1552	Day&Night	DEMO II	Bangal torp. , C-4; 16 1/2,	4	100.1	112.4	0.1		7th&k; Beverly	***[ee2]
10/18/86	1001-1536	--	FP 1	SC 6-15lbs., TNT 181b.	4	101	113.3	0.1	NOISE; residents from the Turpin and	Turpin&Airport Heights; residents	***[eee1]
10/18/86	1001-2001	--	FP 2		4	103.6	116	0.2	Airport heights.		
10/18/86	1001-2047	--	FP 31		4	105.7	119.1	0.2			
10/18/86	1551-2137	--	FP 22		4	103.2	116.4	0.2			
10/18/86	1520-1550	--	MEDC		4	103.8	116.8	0.3			
10/18/86	cont.	--	cont.		4	98	113.2	0.5			
10/19/86	1159-2035	1235AM	FP 1	HE: 21, 52, 42, 25, 40, 42	--	/	/	/	Firing late at night.	? street; Oakes	
10/19/86	1630-2400	2030	FP 5		--	/	/	/	Firing late at night upsets his young son.	City View; Haldane	
10/19/86	1100-2400	Day&Night	FP 22		--	/	/	/		7th&k; Beverly	***[ee3]
10/19/86	2231-2341	--	FP 2		--	/	/	/		Turpin&Airport Heights; residents	***[eee2]
10/19/86	2019-2400	Night&Morn	FP 9		--	/	/	/	Rattling windows; dog goes berserk.	Eagle R. Sub.Div.; Archy	**[f1]
10/19/86	cont.	Night	cont.		--	/	/	/	House shakes and they can't sleep.	Muldoon; Bearden	**[ff1]
10/19/86	cont.	--	cont.		--	/	/	/			

Table A2 (Cont'd)

DATE	TIME	S. TIME	TYPE	DESCRIPTION	UNIT	SEL	PEAK	DUR	COMPLAINT & NOTES	LOCATION & PERSON	NOTES (*)
10/20/86	0025-1300	0330	FP 2	HE; 103, 29, 50, 8, 40.	4	79.8	120.6	0.1	Pets going crazy and so are they.	Airport Heights; Geistus	
10/20/86	0001-1054	0830-0930	FP 5		4	79	120.6	0.1	Windows shaking badly.	Hillside(Skyline Dr.);	Kent
10/20/86	1344-2102	0300	FP 5		4	75.6	113.8	0.1	Woke him and his wife up.	Muldoon; Ulmer	
10/20/86	0001-1809	Night&Morn	FP 9		4	89	118.8	0.1		Eagle R. Sub.Div.; Archy.	**[f2]
10/20/86	0001-1028	Night	FP 22		4	85.3	112.4	0.1		Muldoon; Bearden	**[ff2]
10/20/86	1301-1343	--	MEMC		4	76.4	115.3	0.1		Turpin&Airport Heights; residents	***[eee3]
10/20/86	2342-2400	--	FP 31		4	82.5	124.1	0.1			
10/20/86	2038-2340	--	FP 31		4	93.1	113.6	0.4			
10/20/86	unk	--	Whitney		4	86.8	109.8	0.1			
10/20/86	cont.	--	cont.		4	96.6	111.2	0.1			
10/20/86	cont.	--	cont.		4	90.3	113.6	0.1			
10/20/86	cont.	--	cont.		4	89.2	113.6	0.1			
10/20/86	cont.	--	cont.		4	88.9	113.5	0.1			
10/20/86	cont.	--	cont.		4	88.5	114.4	0.1			
10/20/86	cont.	--	cont.		4	90.7	121.9	0.1			
10/20/86	cont.	--	cont.		4	100.2	108.8	1.1			
10/21/86	1139-1233	--	NIEBAR	HE: 64, 2, 38, 2, 58, 8	--	/	/	/		Turpin&Airport Heights; residents	***[eee4]
10/21/86	1359-1714	--	FP 5								
10/21/86	1133-1715	--	FP 9								
10/21/86	0001-1132	--	FP 33								
10/21/86	2334-2400	--	FP 3								
10/21/86	2103-2400	--	FP 23								
11/21/86	1320-1420	afternoon	EOD	TNT; 8 sticks, P mines; 14,	4	101.7	115.3	0.2	Shock waves may cause house to fall from	Big Lake; Jurica	
11/21/86	cont.	-----	EOD	T mines; 2, D cord 50'	4	102.2	115.3	0.2	piles; awaiting new basement		
11/21/86	cont.	worst at	EOD		4	97.2	113.7	0.1			
11/21/86	cont.	0315	EOD		4	112.4	126	0.3			
All Year	--	--	ARTILLERY		--	/	/	/	complaint recieved; Oct. 20; The past months have been driving him crazy	City View; Holdane	

(*) In the Note column, symbols show that a person complained more than once in the year.

For example in ***[bbb] the asterisks show how many times the person complained in the year; letters represent the person's name; and the # after the last letter shows which complaint it is in the year.

e.g. *** 3 complaints
 [bbb Beardon
 3] Third complaint