Massachusetts Military Reservation

Impact Area Groundwater Study Program

Overview and Update

Fact Sheet No. 2002-03 **December 2002**

This fact sheet provides an overview of the environmental investigations and cleanup activities being performed by the Impact Area Groundwater Study Program at the Massachusetts Military Reservation (MMR) on Cape Cod. It was developed in collaboration with the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MADEP). This fact sheet updates information contained in the Groundwater Study Program fact sheet dated October 2001.

Groundwater Study Program

The goal of the Impact Area Groundwater Study Program is to protect public health and the environment by assessing and cleaning up soil and groundwater contamination due to historical uses at the Camp Edwards' Impact Area and training ranges.

The National Guard Bureau (NGB) established the Groundwater Study Program to respond to the EPA's Administrative Orders regarding the investigation of 90 years of military activities on the northern 15,000 acres of the MMR. This area, known as Camp Edwards, lies directly over the Sagamore Lens, the most productive part of the Cape Cod Aquifer, the layer of fresh groundwater located beneath the Cape. The program began in 1997 and is overseen by the EPA and MADEP.

Historic activities at Camp Edwards included:

- Small arms firing at several ranges involving the use of small caliber munitions
- Firing of artillery and mortars into the Impact Area from gun and mortar positions
- Burning of excess propellant bags at firing ranges and gun and mortar locations
- Demolition training with explosives at demolition ranges
- Disposal through detonation and/or burial of unexploded ordnance
- Training activities with other munitions including pyrotechnic devices, rockets, grenades and mines
- Packing, testing, development and disposal of weapons by military contractors

Administrative Orders

During the 1980's, environmental issues both nationwide and on Cape Cod received increased attention. The discovery of significant groundwater contamination flowing off the southern portion of MMR renewed community interest in the existing environmental program at MMR, now the Air Force Center for Environmental Excellence's (AFCEE's) Installation Restoration Program (IRP). The IRP is responsible for the investigation and treatment of groundwater plumes emanating from areas associated with the former Otis Air Force Base (now Otis Air National Guard Base), located on the lower 7,000 acres of MMR.

As interest and activity in the IRP grew, the citizens and local community organizations began to look at other MMR activities and voiced concern about the effects of historic and current training on Camp Edwards' northern 15,000 acres. This growing awareness of possible groundwater contamination led the EPA to issue the first of four Administrative Orders under the Safe Drinking Water Act. (*Continued on page 2)*

In February 1997, the EPA issued Administrative Order No. 1 for Camp Edwards to the NGB. As a result, the Groundwater Study Program was established. The order required the NGB to investigate the nature and extent of contamination at, and emanating from, the training ranges and Impact Area on Camp Edwards. It also required Groundwater Study Program activities be conducted with adequate public involvement. The Impact Area Review Team, a citizen advisory committee, was established by the EPA.

Once contamination was identified through Administrative Order No. 1 activities, Administrative Order No. 2 was issued to the NGB and the Massachusetts National Guard in April 1997. It required that activities using propellants, high explosives, and pyrotechnics, excluding small arms firing with non-lead munitions, cease, pending the completion of environmental investigations at the training ranges and Impact Area.

In September 1999, MADEP issue a Notice of Responsibility (NOR) based on investigative work required by EPA's Administrative Order No. 1. This NOR required remediation of soil and groundwater under requirements set by the Massachusetts Contingency Plan.

Based on the sites identified and the amount of contamination found, the EPA issued Administrative Order No. 3 in January 2000, which required the NGB and the Massachusetts National Guard to conduct response actions, feasibility studies, and remedial actions to address contamination in certain areas. It required a feasibility study to address unexploded ordnance (UXO) and munitions, which have been disposed of or fired at the training ranges and Impact Area. It also required the NGB to implement remedial measures.

Administrative Order No. 4 was issued to the NGB in January 2001 under the Resource Conservation and Recovery Act (RCRA). This order requires that munitions found subsurface or in burial pits be properly stored and disposed of in a Contained Detonation Chamber (CDC), or by other means, which prevent the release of explosives, metals and other contaminants into the environment. As of December 2002, over 5,000 items have been destroyed using the CDC and in excess of 13,500 are schedule to be destroyed in the coming months.

Massachusetts Contingency Plan

In addition to complying with the Administrative Orders, the Groundwater Study Program's investigations and remediation activities must meet the requirements of the Massachusetts Contingency Plan, or MCP, regulated by MADEP. The MCP is the state regulation that provides for the protection of health, safety, public welfare and the environment. It establishes regulations and procedures for the assessment of environmental contaminants, the evaluation of alternatives and the implementation of remedial actions to abate, prevent and remedy contamination. In addition, the MCP has requirements to address ecological risk issues.More information on the MCP can be found at **www.state.ma.us/dep/bwsc**.

Status of Investigations

To date, more than 240 monitoring wells have been installed throughout the 15,000-acres of Camp Edwards. The investigation has targeted several sites on the Impact Area and training ranges, as primary areas of concern. These sites are being examined closely to assess the nature and extent of contamination from historic activities. The major areas of concern are:

- Demolition Area 1
- Southeast Ranges
- Central Impact Area
- Gun and Mortar Firing Positions
- Chemical Spill-19

Following a site investigation to delineate the areas, type, and extent of contamination, a feasibility study evaluating potential groundwater and soil cleanup alternatives will be prepared for each of the areas of concern. The feasibility studies will evaluate technologies and alternatives to be used for the containment, treatment, and/or removal of contamination from the sites.

The following is a summary and update on the investigations at these sites and other surveys being conducted at Camp Edwards.

Soil and Groundwater Contaminants of Concern

***RDX -** Royal Dutch, Royal Demolition or Research Department Explosive is used as part of a composite explosive in military munitions and in explosive demolition charges

HMX - High Melting Explosive is a white crystalline solid used as a part of a composite explosive used in military munitions

TNT - 2,4,6-Trinitrotoluene is produced at military arsenals and commercial facilities and is used alone, or as part of a composite explosive in military munitions

2,4-DNT - 2,4-Dinitrotoluene is used to produce ammunition and explosives, and is a compound found in most propellants

***Perchlorate -** This compound provides oxygen in the chemical reaction, which produces a detonation. It is a component of many types of rockets, missiles, fireworks, artillery, and mortars

RDX is the explosive compound most frequently detected at Camp Edwards. It has been detected in groundwater at levels below and above the EPA Health Advisory of 2 parts per billions (ppb). The EPA currently classifies RDX as a possible human carcinogen.

*(*See the map on page 4 for more information.)*

Demolition Area 1

Demolition Area 1 (Demo Area 1) is a former military training area used from the mid 1970s to the late 1980s primarily for demolition training, including the open burning, detonation, and disposal by burying of explosives. The seven-acre area is a topographic depression, or kettle hole, 45 feet deep at its base.

Soil and groundwater investigations have identified the following contaminants of concern for soil and groundwater: The explosive compounds RDX, TNT, HMX, 2A-DNT, 4A-DNT, and 2,4-DNT, and perchlorate, a substance contained in some military propellants and munitions.

Of these, perchlorate has migrated the farthest in the groundwater. A plume of groundwater contamination extends more than 8,500 feet west (downgradient) of Demo Area 1. It is approximately 1,000 feet wide and 100 feet deep in the aquifer.

The highest contaminant concentrations measured to date in the Demo Area 1 plume are 370 parts per billion (ppb) for RDX and 300 ppb for perchlorate. The long-term health advisory for RDX in drinking water is 2 ppb. Currently, there is no federal or state drinking water standard for perchlorate. The New England region of the EPA provided a "relevant standard" of 1.5 ppb for the use in evaluating cleanup technologies for the Groundwater Study Program.

The groundwater contamination in the Demo Area 1 plume is almost fully defined with the exception of the plume's downgradient end or leading edge. Drilling and installation of monitoring wells are ongoing to define the leading edge of the plume. The Groundwater Study Program expects to fully define the plume in the coming months.

The Groundwater Study Program and the regulatory agencies recently introduced plans to address Demo Area 1 soil and groundwater contamination. These actions are designed to reduce the impacts of the contamination and fast track cleanup until comprehensive cleanup measures are identified through the feasibility study process.

The plans, called Rapid Response Actions/Release Abatement Measures (RRA/RAM), to address groundwater contamination include extraction, treatment and reinjection, or ETR, in two areas of the plume: one along Frank Perkins Road (the middle of the plume) and another in an area near the plume's leading edge. The ETR at Frank Perkins Road will address the highest levels of contamination, while the ETR near the leading edge will limit further downgradient contamination of the aquifer and potential off-base migration.

The feasibility study process, to identify and evaluate comprehensive cleanup alternatives for addressing contamination at the entire site, will continue while the RRA/RAM is intended to remediate areas of known contamination.

Soil contamination at Demo Area 1 will be addressed under a RRA/RAM action, involving the excavation of approximately 15,000 cubic yards of contaminated soil thought to be acting as an ongoing source of groundwater contamination.

MAP PAGE

Central Impact Area

The Central Impact Area covers over 300 acres of the 2,200-acre Impact Area in the middle of Camp Edwards' training ranges. It was the main target for artillery and mortar firing for more than 90 years and it also was a site for small arms, gun, hand grenade and rocket training.

Ongoing groundwater and soil investigations to identify the nature and extent of contamination in this historic training area indicate a broad area of RDX and HMX contamination. The highest concentration of RDX detected in the groundwater beneath the Central Impact Area was 29 ppb. The highest concentration of HMX was 9.7 ppb.

Perchlorate is another contaminant being discovered within the Central Impact Area. To date, the highest level of perchlorate detected in the groundwater at this location is 5 ppb.

There are multiple sources for the explosives present in Central Impact Area groundwater. These explosives also are being found in soil, indicating explosive compounds present in groundwater are related to past training activities, such as firing at targets with artillery and mortars.

The Groundwater Study Program has drilled more than 120 monitoring wells in the Central Impact Area to ensure the extent of contamination is adequately defined.

In addition, soil samples have been collected from a number of former military target areas. The data obtained from the groundwater and soil samples is helping the regulatory agencies and the Groundwater Study Program determine the best way to clean up the explosives and perchlorate. A schedule for a cleanup plan is being developed. It will include control of contamination migration, groundwater treatment, soil removal and removal of ordnance from selected areas within the Impact Area.

Detections of Perchlorate in Bourne

Detections of less than 1 ppb of perchlorate were found in three of four Monument Beach Wellfield production wells in Bourne. Prior to the detections, the Bourne Water District shut down two of these wells as a precaution and the third well was shut down as soon as the detection was found in a weekly sampling.

There is no perchlorate at any level being pumped throughout the Bourne water delivery system. However, as a precaution, MADEP issued an interim drinking water advisory for Bourne recommending sensitive populations – pregnant women, infants, children under 12, and people with hypothyroidism – not consume water with perchlorate levels above 1 ppb. To date, all detections in the wellfield have been below 1 ppb.

The Groundwater Study Program is working closely with the Bourne Water District. On a weekly basis, they are sampling water supply wells, and wells that are located immediately upgradient. Studies are underway to identify the perchlorate's source.

Southeast Ranges

Explosives have been detected in groundwater and soil southeast of the Impact Area and north of Snake Pond. This area lies at the highest point of the groundwater mound of the Sagamore Lens of Cape Cod's sole source aquifer, and groundwater flows out radially from this area. This area contains three former defense contractor test ranges (the "J" Ranges) and several Massachusetts Army National Guard training ranges (the "L" Ranges). The U.S. Army – from the 1930s to the 1950s – extensively used this entire area for training. Existing documentation on defense contractor activities at the J Ranges suggests that explosive contaminated wastewater was disposed of to the ground surface, as well as below ground into holding tanks. Open burn/open detonation/disposal of munitions and other materials also occurred at numerous locations throughout the J Ranges.

To date, impacts to groundwater quality have been observed at a number of locations in the Southeast Ranges. The Groundwater Study Program continues to investigate the extent of soil and groundwater contamination and is working to further delineate several plume areas identified in this location. The plumes vary in composition, but are generally a mixture of RDX, HMX and perchlorate. Investigations are proceeding to gather additional information on contamination in this area. The Southeast Ranges also are being inspected under the Munitions Survey Project.

Munitions Survey Project

In December 1997, 1,100 buried 81-millimeter mortar rounds were discovered on the now-inactive J-1 Range at Camp Edwards. As a result, the EPA modified an Administrative Order to require the Groundwater Study Program to begin a Munitions Survey Project (MSP) to look for munitions disposed of through burial or other means.

The primary goal of the MSP is to locate disposed or buried munitions that might present a threat to human health because of their potential to contaminate groundwater. The MSP selects investigation sites identified by historical records, site surveys or other investigations as training areas or potential disposal sites. The project is looking at areas conveniently located for disposal activities. The NGB has contacted people who worked and trained on Camp Edwards to obtain information about training and disposal activities.

Locating buried munitions and other items requires a combination of technologies designed to locate subsurface metal objects. The airborne magnetometer is mounted to a helicopter and flown over large areas to map out "anomalies," (magnetic interference on or below the ground surface), that could indicate buried munitions. Contractors use an electromagnetic tool, called an EM-61, to locate metal objects beneath the ground surface. They then can excavate some of these sites to determine if they contain munitions or other military items.

The MSP has located approximately 30,000 items, including mortars, projectiles, small arms ammunition, and a variety of other munitions or cartridge casings.

Approximately 75% of these were considered spent or inert (not capable of exploding). A number of these sites had detectable concentrations of contaminants.

In addition to clearing UXO to prevent soil and groundwater contamination, the Groundwater Study Program is clearing UXO from the surface of selected sites so that the work involved with the soil and groundwater investigations is easier and safer. UXO is removed from the areas designated for monitoring well installation and soil sampling.

Potentially dangerous munitions encountered during the investigations that are unsafe to move are detonated where they are discovered or "blown in place". Other items that are safe to move and contain explosives are destroyed in the Contained Detonation Chamber. The majority of the ordnance found to date were inert.

Technologies such as the air magnetometer, the ground-based detection tools, and the CDC aid the Groundwater Study Program in their quest to safely, effectively, and efficiently remove UXO that might pose a potential threat to public safety and the groundwater.

Notification Protocols

Because of the potential dangers posed by UXO, the Groundwater Study Program makes it a priority to keep citizens and officials informed about the discovery and disposition of UXO close to their town's border.

If field technicians detect military munitions, they map out a potential "fragmentation radius," which conservatively estimates the farthest a fragment from an exploded item might travel. If the estimated radius falls outside of MMR boundaries, a notification protocol is activated. It may require notifying a neighborhood, schools, local officials and/or authorities, and the local media. All work is coordinated closely with EPA and MADEP.

Chemical Spill-19

The Chemical Spill-19 (CS-19) site is a small area in the west-central region of the Impact Area. CS-19 was used for the burial and burning of ordnance. Groundwater contamination extends approximately 5,000 feet to the west. This site currently is being addressed by the Air Force under the Installation Restoration Program through a Remedial Investigation and Feasibility Study pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as "Superfund".

Investigations indicate the presence of RDX in CS-19 groundwater. The highest detected concentration of RDX was 20 ppb. The highest level of perchlorate was 2.09 ppb. Elevated levels of explosives, metals and semi-volatile organic compounds also have been found in the soil. Approximately 1,100 cubic yards of contaminated soil were removed. Soil exceeding cleanup levels for lead, dioxin/furans, explosives, and other compounds, was transported to a licensed off-site facility. Additional cleanup activities currently are being planned.

Gun and Mortar Firing Positions

Approximately 36 current and former firing positions for artillery and mortar practice are located at Camp Edwards. Detailed evaluations of these positions are underway based on elevated soil detections of the propellant and explosive compound 2,4-DNT. Other contaminants including several metals, semi-volatile organic compounds, and pesticides have been detected at these sites. The Groundwater Study Program is evaluating this contamination and will begin developing remedial alternatives for soil cleanup in the near future.

Natural Resources

Camp Edwards is home to at least 876 species of animals and 545 plant species. Thirty-seven of these species are on the Commonwealth of Massachusetts Endangered, Threatened or Special Concern Listing.

The Groundwater Study Program's Natural Resource Specialist oversees areas disturbed by the environmental investigations and makes sure that these areas are returned to their natural states, to protect the habitat of these plant and animal species. Before any fieldwork activities begin, rare species and habitat evaluations are conducted.

In addition to complying with all applicable state and federal endangered species regulations of habitat and wildlife, Camp Edwards' Integrated Natural Resources Management Plan's objective is to coordinate management of natural resources with military training and cleanup activities.

Cultural Resources

Cultural resources include archaeological sites, historic buildings, structures (e.g., bridges), and objects (e.g., tanks, planes, ships); artifact and document collections; historic landscapes; and Native American sacred sites and properties of traditional, religious, and cultural significance.

A Cultural Resources Manager maintains an inventory of all cultural resources present on lands owned or leased by the Massachusetts Army National Guard. All actions that might impact those resources occur in compliance with federal and state legislation. There is a balance with the needs of preservation with those of the investigation and military training.

The Impact Area Review Team's goal is to serve as a technical advisory resource to assist EPA and MADEP in ensuring a thorough and timely investigation and cleanup at Camp Edwards. Public meetings of the team are held on the fourth Tuesday of each month to discuss recent Groundwater Study Program findings and activities. Meetings are rotated among the four Upper Cape towns neighboring Camp Edwards. For meeting agendas and summaries, visit the Groundwater Study Program web site at www.groundwaterprogram.org/impact.htm.

Activities to Identify and Clean Up Contamination

Feasibility Study – used to evaluate cleanup technologies and alternatives to be used for the containment, treatment, or removal of contamination from a site

Remedial Design – the engineering design necessary to complete the remediation or cleanup of the contamination

Remedial Action – the construction of the remediation or cleanup alternative and its operation

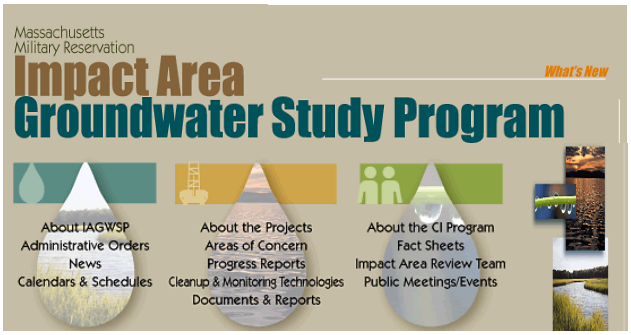
The remedy selection process for each area of concern is as follows: A draft feasibility study will be developed outlining alternatives and technologies being considered for the cleanup process. After all input is received, a proposed remedy selection plan, which details the recommended approach for the cleanup, will be written. This plan will be developed by the Groundwater Study Program under the review of the EPA, the MADEP, and the Impact Area Review Team, prior to being released for a public comment period.

Upon the evaluation of any comments received during the public comment period, NGB will prepare a decision document for approval by the EPA and MA DEP describing the cleanup remedy that will be performed. Upon selection of the remedy by EPA, the cleanup phase of the project begins. A Remedial Design document, that describes the design of the system to be used for the cleanup, will be reviewed by the EPA and the MADEP. The design then will be reviewed by the regulatory agencies when it is 60% designed and again at 95% design. This plan will detail the actual construction phase of the project.

For More Information

There are several ways to get more information on the Groundwater Study Program.

Visit the Groundwater Study Program web site at: **www.groundwaterprogram.org.**



Information repositories have been established in five local libraries to make information on the program available to the public. The repositories provide access to all necessary documents including copies of work plans, sampling results, site reports, fact sheets, meeting minutes and other materials are available. The repositories are located at:

Falmouth Public Library
123 Katharine Lee Bates Road
Falmouth, MA 02540

Jonathan Bourne Library
19 Sandwich Road
Bourne, MA 02532

Mashpee Public Library
Steeple Street, Mashpee Commons
Mashpee, MA 02649

Sandwich Public Library
142 Main Street
Sandwich, MA 02563

U.S. Coast Guard Library
Building 5205, Ent Street
Otis ANGB, MA 02542

For additional information, please contact the following individuals:

Kris Curley – Groundwater Study Program at 508-968-5626

Ellie Grillo – MA Department of Environmental Protection Community Involvement at 508-946-2866

Jim Murphy – US Environmental Protection Agency at 617-918-1028