

US EPA ARCHIVE DOCUMENT

REMEDY SELECTION PLAN FOR THE CENTRAL IMPACT AREA

July 2011

The United States Environmental Protection Agency (EPA) seeks your feedback on this Remedy Selection Plan for the Central Impact Area site located on the Camp Edwards portion of the Massachusetts Military Reservation (MMR). The Remedy Selection Plan explains the cleanup alternatives considered for the site, which alternative is proposed, and why.

The U.S. Army's Impact Area Groundwater Study Program (IAGWSP), under the oversight of EPA and the Massachusetts Department of Environmental Protection (MassDEP), has investigated potential soil and groundwater contamination at the site and has issued reports on those investigations, along with a feasibility study presenting alternatives for addressing the contamination at the site.

The Army's work at the site was conducted under the authority of EPA's Safe Drinking Water Act Administrative Orders (SDWA 1-97-1019 and SDWA 1-2000-0014), and in consideration of the substantive cleanup standards of the Massachusetts Contingency Plan (MCP).

EPA wants your feedback and is seeking public comment during the 30 day comment period from July 25 through August 25, 2011. Please review this Remedy Selection Plan, and send your comments to us. After the comment period ends, EPA will consider the public comments, consult with MassDEP, and issue a Decision Document providing the details of the remedial actions selected for the site. With the Decision Document, EPA will include a Responsiveness Summary that provides responses to comments received during the public comment period. MassDEP will issue its official position in a comment letter after the public comment period has ended.

HOW TO PARTICIPATE

You can provide written comments on this Remedy Selection Plan from July 25, 2011 through August 25, 2011, and you are invited to a public informational meeting on Wednesday, July 27, 2011 at 5:30 p.m. in Building 1805 (at the water tower rotary) on Camp Edwards, MA to learn more about the soil and groundwater contamination and source areas at the Central Impact Area, and the proposed remedy. You can also provide oral comments at a public hearing that will immediately follow the public meeting. EPA, MassDEP and Army representatives will be available at the meeting or by phone (see page 13 for contact information) to respond to questions regarding the site and proposed remedies. A summary of comments and the responses to those comments will be provided as part of the Decision Document.

Public Comment Period for the Remedy Selection Plan

July 25, 2011 through August 25, 2011

Oral comments may be offered at the Public Hearing or written comments may be submitted by U.S. mail or email no later than August 25, 2011.

Public Information Meeting/Public Hearing

July 27, 2011 at 5:30 p.m.
Building 1805 (at the water tower rotary)
Camp Edwards, MA

Written comments should be mailed to:

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Or sent by:

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CENTRAL IMPACT AREA REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

The Central Impact Area is a 330 acre area within the 2,200 acre Impact Area at MMR. The Central Impact Area contained the majority of the targets used for munitions training and is believed to be the primary source area for groundwater contamination for this portion of MMR. The sources of contamination include soil contamination and unexploded ordnance (UXO). Some actions have been taken to address the currently known sources of contamination and these actions are described in the Central Impact Area Source Investigation Summary Report. The groundwater at the Central Impact Area has been contaminated by RDX and perchlorate. These chemicals are associated with use and disposal of military munitions. The Feasibility Study (FS) report for the Central Impact Area contains an evaluation of a range of alternatives developed to address the groundwater contamination migrating from the Central Impact Area and its remaining sources.

The cleanup objectives for the site are to restore the useable groundwater to its beneficial use wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent ingestion and inhalation of groundwater containing the contaminants of concern (RDX and perchlorate), in excess of federal maximum contaminant levels, Health Advisories, drinking water equivalent levels, applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

The groundwater cleanup levels used in the Feasibility Study are 2 parts per billion (ppb) for perchlorate, which is the Massachusetts drinking water standard, and 0.6 ppb for RDX, which is the concentration in drinking water that would be expected to cause an increased lifetime cancer risk of one in a million (sometimes called the 10^{-6} cancer risk level). These cleanup levels are more protective than the EPA Lifetime Health Advisories (concentrations that are not expected to cause any adverse non-cancer effects for a lifetime of exposure) for perchlorate (15 ppb) and RDX (2 ppb).

As discussed in the FS and in the Source Area Summary Investigation Report, approximately 20,845 tons of contaminated soil has been excavated and treated on-site, disposed of off-site or is awaiting final disposition. In addition, varying amounts of unexploded ordnance have also been removed within 56 acres of the Central Impact Area. It is estimated that there are approximately 4,000 to 9,000 munitions items containing high explosives remaining in the Central Impact Area. These remaining munitions pose a potential long term threat to the groundwater.

The Feasibility Study evaluated alternatives for achieving the groundwater cleanup objectives: No Further Action, Monitored Natural Attenuation and Land-use Controls, and alternatives with Focused Extraction. For more details on the alternatives see the Feasibility Study report for the site. (A web link is provided on page 13.) The alternatives considered in the FS also include a long term response action to address UXO items that may pose a threat to the groundwater.

The Army developed conceptual designs for the groundwater alternatives, including:

- Number and location of extraction and injection wells, and estimated groundwater extraction flow rates;
- Type, size, and location of treatment facilities;
- Preliminary schedule for construction and operation; and
- Preliminary cost estimate.

The conceptual designs for the groundwater alternatives are based on the following information:

- Plume extent and concentrations as delineated based on the most up to date groundwater analytical data;
- Predictions of groundwater flow and contaminant fate and transport as estimated by groundwater modeling;
- Use of treatment systems with ion exchange resin and/or granular activated carbon vessels (similar to those previously used by the IAGWSP);
- Use of the existing Demolition Area 1 Treatment System and/or modular treatment systems; and
- Continuation of groundwater monitoring (where applicable) for several years after cleanup objectives are achieved.

Preliminary cost estimates were prepared for each groundwater alternative. Each estimate includes the following components:

- Capital costs, which are expenditures required to initiate and install a remedial action;
- Operation and maintenance (O&M) and land-use control costs, which are post-implementation costs, such as monitoring, labor, reporting and electricity, costs, equipment replacement, and disposal of treatment residuals, necessary to ensure the continued effectiveness of the remedial action.
- Present worth analyses; and
- Indirect costs, including engineering services.

All alternatives outlined in this Remedy Selection Plan, except Alternative 1 (No Further Action), include land-use controls and long-term monitoring. Land-use controls consist of measures that would prevent human exposure to plume contaminants and prevent actions that would interfere with the remedy. In this case, the land-use controls would restrict well drilling or other activities that could expose individuals to contaminated groundwater and to areas containing unexploded ordnance. Land-use controls would be monitored to ensure effectiveness and currently a land-use control report is required on an annual basis. The long-term monitoring would consist of groundwater monitoring to determine if the remedy is performing as planned and when contaminant concentrations reach cleanup levels. Reporting on monitoring results and periodic updating of the sampling plan also are included. All alternatives except Alternative 1 also include a long-term plan for the removal of UXO.

CRITERIA FOR EVALUATING THE CLEANUP REMEDY

As documented in the feasibility study, a detailed analysis was performed on all of the alternatives presented for the Central Impact Area. The evaluation used the EPA evaluation criteria listed below to select the proposed response action for the site. These nine criteria are summarized as follows:

1. Overall protection of human health and the environment; which includes prevention of the movement of contaminants into the aquifer and its preservation as a public drinking water supply: Will the remedy protect human health? Will it restore the aquifer?
2. Compliance with regulations: Does the remedy meet all applicable federal and state standards?
3. Long-term effectiveness and permanence: What are the remaining risks after completion of the remedial action? What is the adequacy and suitability of controls, if any, that are used to manage untreated contaminants remaining at the site?
4. Reduction of toxicity, mobility, and volume through treatment: What is the expected reduction in toxicity, mobility or volume? What are the type and quantity of treatment residuals that will remain following treatment?
5. Short-term effectiveness: Is the community protected during the remedial action? Are workers protected during the remedial action? What are the environmental impacts to natural resources? How long will it be before remedial response objectives are achieved?
6. Implementability: Is it technically and administratively feasible to design and construct the technology? How reliable is it? Can effectiveness be monitored? Are the services and materials available?
7. Cost: What are the capital costs of the remedy? What are the operations and maintenance costs? What is the net present value of the costs?
8. State Acceptance: What issues and concerns might the State have regarding each alternative? This criterion will be evaluated throughout the development, screening and evaluation of alternatives based on comments and input received from MassDEP, in fulfillment of the substantive requirements of the Massachusetts Contingency Plan (MCP), the state regulation governing the cleanup of oil and hazardous materials.
9. Community Acceptance: What issues and concerns might the public have regarding each alternative? This criterion will be evaluated based on public feedback, such as comments made at the public hearing, or written comments submitted during the public comment period or at the public hearing.

A summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria is included.

BACKGROUND

The Central Impact Area is a 330-acre portion of the 2,200-acre Impact Area, located near the center of the installation where many known targets were located. The delineation of the 330 acres was based on historical site use, a review of historical aerial photographs, airborne magnetometer results, firing fans and unexploded ordnance discoveries, groundwater plumes and particle backtracks, and explosives detections in soil.

The Central Impact Area is considered the primary target area for artillery, mortar and other firing activities from the 1930s until firing ceased in 1997. Various types of munitions have been fired into the Central Impact Area. The munitions include high explosive rounds designed to explode upon impact, practice and "inert" rounds, which do not contain an explosives charge but might contain a spotting charge designed to emit smoke upon impact. Explosive munitions that did not explode or that partially functioned have accumulated within the Central Impact Area.

Historical information indicates that in the past, several portions of the Central Impact Area have undergone a variety of uses and, in some cases, have been mechanically cleared of vegetation. Among the previously developed areas within the Central Impact Area are the following:

- Sub Caliber Aircraft Rocket (SCAR) sites – two approximately 10-acre sites used by Naval aircraft in the 1940s for target practice
- Eastern Test Site – an area in the northern portion of the Central impact Area believed to have been used for artillery and mortar targeting.
- Tank Alley – a cleared area developed around 1965 and afterward used extensively to locate tanks and other targets.

INVESTIGATIONS AND FINDINGS

Investigations in the Central Impact Area began in 1997 and have included soil sampling, geophysical surveys, groundwater sampling, and a robotics technology demonstration.

As part of an extensive source investigation, approximately 3,800 soil samples were analyzed for explosives and 700 for perchlorate. Detections of RDX and other explosives and perchlorate in soils were found to be scattered throughout most of the areas sampled with some of the highest densities of detections found near Turpentine Road and Tank Alley. Explosives detections predominantly consisted of RDX and TNT.

Some of the groundwater underlying and downgradient of the Central Impact Area is contaminated by RDX and perchlorate. RDX is the most widespread groundwater contaminant. The RDX plume, which is comprised of multiple parallel and overlapping plumelets, is oriented in a southeast to northwest direction consistent with the regional groundwater flow direction. Many of the plumelets appear to be detached from historic source areas, while others correlate to continuing shallow detections. The furthest downgradient extent of the main plume is located about two miles from its presumed origin. Most of the plume remains on the installation. There is a narrow RDX plume that originated in the Central Impact Area and now passes under the Northwest Corner and has migrated off the installation. There is currently no exposure to this plume.

This narrow RDX plume is monitored as part of the Northwest Corner Decision Document (2010). However, since the Central Impact Area is the source of this contamination, the effectiveness of source control actions on this plume will continue to be evaluated as part of the Central Impact Area remedy.

RDX within the groundwater plume has been reported up to a maximum concentration of 45 ppb in 2005. The 2010 maximum concentration was 21 ppb. Most values are below 10 ppb and the overall average of the detectable concentrations in 2010 was 3 ppb. (The cleanup level for RDX is 0.6 ppb.)

The perchlorate plume is significantly less extensive than that of the RDX contamination. The highest concentration was 10 ppb, detected in 2010, and the average was approximately 1 ppb.

Because of the inconsistencies of soil detections, potential source areas were identified through water table detections. These source areas determined from water table detections are consistent with other potential source area indicators such as target locations, UXO density, cratering on aerial photographs and particle backtracks from wells with explosives detections. More recent (post-2007) RDX water table data shows declining concentrations. These data suggest that the source area response actions conducted to date have had a positive effect on the groundwater. However, a significant amount of UXO items still remain in the Central Impact Area and the long term impacts of these items to groundwater as they corrode are difficult to predict.

RESPONSE ACTIONS

Several soil response actions have been undertaken in the Central Impact Area to reduce levels of contamination from certain areas. These include soil removals at the following areas:

- Armored Personnel Carrier (Target 25) – Approximately 300 tons of contaminated soil was removed and treated in September 2000.
- Mortar Target 9 – 465 tons of contaminated soil was excavated in August 2001. Several unexploded ordnance items also were discovered and there were elevated levels of explosives contamination at these locations. Therefore, an additional 112 tons of contaminated soil was excavated. Excavated soil at Mortar Target 9 was treated on site using soil washing.
- Targets 23 and Target 42 – 885 and 1,100 tons of soil was excavated and treated on site using low-temperature thermal desorption.
- In 2009 the Air Force Research Laboratory (AFRL) conducted a technology demonstration at the Central Impact Area. This was done to evaluate several methods to clear potential unexploded ordnance from the ranges using remotely controlled equipment. During this demonstration, UXO was removed from approximately seven acres.
- In 2010 a second technology demonstration was conducted by AFRL. Contaminated Soil was excavated from a 3 acre area and approximately 12,300 tons of soil was removed.

In summary, soil removal actions have been conducted at several locations and approximately 20,845 tons of contaminated soil has been excavated and treated on-site, disposed of off-site, or is awaiting final disposition.

Major geophysical investigations were also conducted and include an AIRMAG survey, the Sub-caliber Aircraft Rocket site, the Eastern Test site, the High Use Target Area Phases 1 and 2, unexploded ordnance density estimation test plots, and the robotics technology demonstrations.

During the soil removal actions, munitions were nearly completely removed from approximately 5.5 acres. In addition, munitions were removed from an area of approximately 4.3 acres during the above-listed geophysical investigations. Thus, near complete munitions removal has been completed over an area that is approximately 10 acres.

Further investigations were also conducted over an area approximately 14 acres in size, with plans for an additional 8 acres to be completed. These areas have been surface cleared and major magnetic anomalies have been removed. When completed, approximately 75% of munitions will have been removed from an area of approximately 22 acres.

Approximately 85% of munitions have been cleared from 16 acres for drill pad sites, roads, buffers around removal actions, and support areas for vehicle traffic.

Surface clearance has been performed on approximately eight acres along Tank Alley and Turpentine Road. This surface clearance resulted in approximately 25% munitions removal from these acres.

In summary, some degree of UXO removal has been completed in approximately 56 acres. As of 2007, approximately 520 known or suspected UXO items containing high explosives had been removed. Approximately 250 to 300 additional items have been recovered during more recent investigations, including the robotics work. However, it is estimated that there are approximately 4,000 to 9,000 UXO items still remaining in the Central Impact Area.

DEVELOPMENT OF ALTERNATIVES

The remedies evaluated for groundwater in the Central Impact Area Feasibility Study are monitored natural attenuation and focused extraction. These remedies include technologies already in place and functioning effectively at the Massachusetts Military Reservation. The technology selected for the alternatives is groundwater extraction, treatment with granular activated carbon (GAC) for RDX and ion exchange resin for perchlorate contaminated groundwater, and return of treated water back into the aquifer via reinjection wells or infiltration galleries.

All the alternatives, except Alternative 1 - No Further Action, include a long term plan to address the UXO that remain in the CIA. Due to a number of uncertainties, the details and costs of this source area remedy are somewhat difficult to determine but an approximate cost to address UXO is \$570,000/acre. This component is intended to optimize the groundwater treatment alternatives while achieving source reduction for long term protectiveness.

CENTRAL IMPACT AREA PLUME ALTERNATIVES

Alternative 1 – No Further Action

Capital cost	\$	0
O&M Costs	\$	0
Site closeout documentation	\$	<u>325,000</u>
TOTAL	\$	325,000

Alternative 1 provides for no further action to address groundwater contamination associated with the Central Impact Area plume. Under this alternative:

- Model predictions could not be confirmed due to abandonment of existing monitoring wells.
- Land-use controls would not be implemented and so would not ensure against exposure until cleanup is achieved.
- Site close-out documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk based level of 6 ppb by 2030, the HA of 2 ppb by 2053, the 10^{-6} risk-based level after 2090.

Central Impact Area Plume Alternative 2 – Monitored Natural Attenuation (MNA) and Land-use Controls (LUCs)

Capital cost	\$	1,712,500
O&M Costs	\$	6,150,000
Site closeout documentation	\$	<u>38,400</u>
TOTAL	\$	7,860,000

Alternative 2 would provide optimized monitoring of the Central Impact Area groundwater until concentrations of contaminants within the plume reach risk-based levels. Under this alternative:

- Long-term monitoring would continue.
- Land-use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site close-out documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk based level of 6 ppb by 2030, the HA of 2 ppb by 2053, the 10^{-6} risk-based level after 2090.
- Groundwater modeling results also predict that natural attenuation processes would limit RDX plume concentrations exceeding the 2 ppb RDX Health Advisory to areas within the MMR boundary.

Alternative 3 – Focused Extraction with One Well, MNA and LUCs

Capital cost	\$	5,720,000
O&M Costs	\$	17,100,000
Site closeout documentation	\$	<u>60,200</u>
TOTAL	\$	22,900,000

Alternative 3 would provide for extraction and treatment of the groundwater. Under this alternative:

- A 300-gallon-per-minute (gpm) pump and treat system would be installed that would include:
 - One extraction well pumping at 300 gpm.
 - Two mobile treatment units.
 - Infiltration of the treated water via an infiltration trench.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site-closeout documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk based level of 6 ppb by 2027, the HA of 2 ppb by 2056, the 10^{-6} risk-based level by 2084 and background by 2110.

Alternative 4 – Focused Extraction with Two Wells, MNA and LUCs

Capital cost	\$ 4,600,000
O&M Costs	\$ 12,500,000
Site closeout documentation	\$ 55,000
TOTAL	\$ 17,200,000

Alternative 4 would provide for extraction and treatment of the groundwater. Under this alternative:

- Two extraction wells with a cumulative pumping rate of 550 gpm would be installed along Burgoyne Road
- Contaminated water would be piped to the Demolition Area 1 treatment facility:
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site-closeout documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk-based level of 6 ppb by 2027, the HA of 2 ppb by 2049, the 10^{-6} risk-based level by 2077 and background by 2110.

Alternative 4 (Modified) – Focused Extraction with Three Wells, MNA and LUCs

Capital cost	\$ 5,200,000
O&M Costs	\$ 12,900,000
Site closeout documentation	\$ 100,000
TOTAL	\$ 18,200,000

Alternative 4 (Modified) would provide for extraction and treatment of the groundwater. Under this alternative:

- Two extraction wells with a cumulative pumping rate of 550 gpm would be installed along Burgoyne Road.
- The southern well would be turned off in 2035, at which time a third northern well would begin operation.
- Contaminated water would be piped to the Demolition Area 1 treatment facility.
- A long-term groundwater monitoring plan would be implemented and optimized as required.

- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site-closeout documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk-based level of 6 ppb by 2027, the HA of 2 ppb by 2047 the 10^{-6} risk-based level by 2055 and background by 2110.

Alternative 5 – Focused Extraction with Three Wells, MNA and LUCs

Capital cost	\$ 8,000,000
O&M Costs	\$ 27,900,000
Site closeout documentation	\$ 131,000
TOTAL	\$ 36,000,000

Alternative 5 would provide for extraction and treatment of the groundwater. Under this alternative:

- Two extraction wells would be installed along Burgoyne Road; one extraction well would be installed along Spruce Swamp Road. The cumulative pumping rate of the three extraction wells would be 700 gpm.
- Contaminated water from Burgoyne Road wells would be piped to the Demolition Area 1 treatment facility. Water from the Spruce Swamp Road well would be treated at two mobile treatment units.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site-closeout documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk-based level of 6 ppb by 2027, the HA of 2 ppb by 2049 the 10^{-6} risk-based level by 2055 and background by 2110.

Alternative 6 - Focused Extraction with Thirty One Wells, MNA and LUCs

Capital cost	\$ 76,000,000
O&M Costs	\$ 31,900,000
Site closeout documentation	<u>\$ 970,000</u>
TOTAL	\$ 108,900,000

Alternative 6 would provide for extraction and treatment to achieve the 10^{-6} risk level for RDX (0.6 ppb) throughout the groundwater plume within 10 years. Under this alternative:

- A pump and treat system would be installed that would include:
 - o Thirty-one extraction wells with a combined pumping rate of 6,500 gpm.
 - o Treatment with granular activated carbon at three treatment facilities and one mobile treatment unit.
 - o Infiltration of the treated water via infiltration trenches.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and prevent actions that would interfere with the remedy.
- Monitoring, reporting and site-closeout documentation would be completed.
- RDX concentrations are expected to decrease below the 10^{-5} risk-based level of 6 ppb by 2015, the HA of 2 ppb by 2019, the 10^{-6} risk-based level by 2020 and background by 2036.

EVALUATION OF ALTERNATIVES FOR THE CENTRAL IMPACT AREA

Below is a summary of how the alternatives were evaluated in the Feasibility Study.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 2 through 6 would be protective of human health and the environment. Alternative 1, however, offers no monitoring or confirmation of existing land-use controls to ensure that future exposures do not occur. Alternative 2 adds provisions for plume monitoring and land-use controls to help prevent future exposure to contaminated groundwater. Alternatives 3 through 6 add extraction and treatment components and achieve risk-based concentrations earlier than Alternatives 1 and 2.

COMPLIANCE WITH REGULATIONS

All alternatives are eventually expected to result in compliance with applicable regulations. Alternatives 1 and 2 allow for continued migration of the plume. Because these alternatives involve no active remediation, chemical-specific regulations would be met only when contaminant concentrations decrease below the cleanup standards by natural attenuation. Alternative 2 includes monitoring to confirm this occurs; Alternative 1 does not. Alternatives 3, 4, 4 (Modified), 5, and 6 include active treatment to ensure that applicable standards are met.

LONG-TERM EFFECTIVENESS AND PERMANENCE

A significant portion of the source area has been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed. All of the alternatives would permanently achieve the cleanup goals; however, time to cleanup would vary. Moreover, Alternatives 3, 4, 4 (Modified), 5, and 6, which include active treatment of the plume, may result in fewer uncertainties over the long term regarding the fate and transport of the plume.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternatives 3, 4, 4 (Modified), 5, and 6 reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. Alternative 3 through 6 would extract various amounts of RDX mass (relative to Alternative 2). Alternative 3 – 5.5 Kg of RDX; Alternative 4 – 7.0 Kg of RDX; Alternative 4 (Modified) – 7.1 Kg of RDX; Alternative 5 – 8.5 Kg of RDX; Alternative 6 – 16 Kg of RDX.

SHORT-TERM EFFECTIVENESS

Alternative 1 would have the least impact on workers because construction is minimal. Alternative 6 would have the greatest impact because of the large amount of construction and additional source removal involved. Alternatives 3 through 6 would have the additional risks to workers associated with construction in an Impact Area containing unexploded ordnance.

Alternative 6 would cause the greatest environmental impact to natural resources and includes expanded source removal, the installation of 31 extraction wells, piping, four MTUs, and infiltration trenches. Alternatives 3, 4, 4 (Modified), and 5 would also have some environmental impacts due to construction. Alternative 2 through 6 would have environmental impacts from monitoring well installation, monitoring, and well abandonment. The only environmental impact of Alternative 1 would be from abandonment of the current monitoring-well system.

EVALUATION OF ALTERNATIVES FOR THE CENTRAL IMPACT AREA PLUME (CONT.)

IMPLEMENTABILITY

Alternatives 1 to 5 are not limited by administrative feasibility. Alternative 1 is the most easily implemented alternative since it requires no further action other than abandoning groundwater monitoring wells and preparing close out documentation and it does not address the potential remaining source. Alternative 2 is the next most easily implemented alternative with groundwater monitoring and land-use controls implemented. Alternatives 3, 4, 4 (Modified), and 5 include the installation of extraction well(s), MTU(s), new piping/power lines, and/or infiltration trench(es). These alternatives are somewhat more difficult to implement due to the presence of UXO in the area.

Operation of treatment systems for Alternatives 3 and 5 would be in an environment with the potential for munitions and maintenance of systems down range from small arms firing ranges.

Alternative 6 has significant administrative and technical implementability issues due to the extensive source removal, the large multi-facility treatment plant construction, and extensive land clearance required (up to 30 acres). Alternative 6 would be the most difficult alternative to implement technically to obtain the cleanup in ten years.

COST

Alternative 1 and Alternative 2 would be the least costly, with most of the Alternative 2 cost associated with long-term monitoring. Costs for Alternative 3, Alternative 4, and Alternative 4 (Modified) are similar with differences primarily reflecting the fact that for Alternative 4 and 4 (Modified), all water would be piped to the Demolition Area 1 facility. Alternative 5 would be significantly more costly than either Alternative 3 or Alternative 4. Alternative 6 is by far the most costly alternative. The primary driver of the costs for Alternative 6 is the capital cost for the very large scale extraction, treatment and discharge facilities required for this alternative.

Alternative 1 – total estimated cost of \$ 325,000

Alternative 2 – total estimated cost of \$7,860,000

Alternative 3 – total estimated cost of \$22,900,000

Alternative 4 – total estimated cost of \$17,200,000

Alternative 4 Modified – total estimated cost of \$ 18,200,000

Alternative 5 – total estimated cost of \$ 36,000,000

Alternative 6 – total estimated cost of \$ 108,900,000

STATE ACCEPTANCE

This criterion is continually evaluated as MassDEP participates in all aspects of the evaluation and selection of a remedy. MassDEP will issue its official position in a comment letter after the public comment period has ended and comments have been reviewed along with the substantive requirements of state regulations.

COMMUNITY ACCEPTANCE

This criterion will be evaluated based on all public comments received on the Remedy Selection Plan.

PROPOSED REMEDY FOR THE CENTRAL IMPACT AREA PLUME

Alternative 4 (Modified)

Focused Extraction with Monitored Natural Attenuation, Source Controls, and Land-use controls

Focused Extraction with Three Wells, Monitored Natural Attenuation and Land-use Controls provides the best balance of the criteria used to evaluate the cleanup alternatives. The proposed remedy consists of in-plume extraction along Burgoyne Road for the purposes of containing the plume along this road. The contaminated water will be piped to the Demolition Area 1 treatment facility. Based on current modeling and assumptions, three wells pumping a total of 550 gpm can contain the groundwater plume at this point. The southern and central wells will operate until 2035, at which time the southernmost well would be shutdown and the northern well would commence operation. Active treatment of the plume would remove RDX from the extracted groundwater and return the treated water to the aquifer. This system will also serve to prevent migration of future contamination until the source control work is completed. Downgradient of Burgoyne Road, the plume is expected to naturally attenuate to acceptable levels prior to reaching the base boundary. This alternative includes an enhancement of the existing monitoring well network and the option to modify the extraction and treatment system if necessary to optimize the system performance and/or maintain containment. The pipeline to the Demo 1 treatment plant will be constructed with extra capacity to address future contamination, if detected. The groundwater remedy is expected to achieve an RDX level of 0.6 ppb by 2055 and 2 ppb by 2047. The estimated cost of the proposed groundwater remedy is approximately \$18,200,000.

The response actions taken to date to have addressed known areas of soil contamination and varying degrees of UXO removal have occurred over a 56 acre area. However, there is an estimated 4,000 to 9,000 UXO items remaining within Central Impact Area. A long term response plan will be developed and implemented in a phased approach to address these items. The first phase will consist of UXO clearance of an additional 30 acres over a 3 year period followed by a second phase consisting of an additional 20 acres. The plan will employ techniques to minimize habitat destruction while maximizing the reduction of UXO. The first phase is estimated to cost \$18,000,000 and assumes a roughly 75%-95% reduction of UXO. A work plan will be developed for each phase and the effectiveness of each phase will be evaluated on an ongoing basis. This component is intended to optimize the groundwater treatment alternatives while achieving source reduction for long term protectiveness.

Human health is protected through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are correct and that any remaining contamination remains below risk-based levels. Groundwater monitoring will also provide information on potential impacts from the remaining UXO and whether additional actions are needed to minimize those impacts.

Human health will be further protected through the implementation and verification of land-use controls. Although the plume remains in a military munitions impact area, these controls will further prevent use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk-based levels.

This remedy will be evaluated every five years to determine if the groundwater treatment system is still protective and achieving the goals established. The long term plan for UXO removal will also be evaluated at this time to determine if additional actions and/or more expedited actions are needed to protect groundwater or if improved technologies are available.

The estimated total cost of the proposed remedy is approximately \$36,000,000.

This alternative is proposed because it achieves permanent cleanup of RDX in groundwater in the Central Impact Area economically and in a reasonable timeframe without excessive environmental and worker impacts. Through continued monitoring and enforcement of land-use controls that would prevent exposure to contaminated groundwater, the proposed remedy ensures protection of human health and the environment. In this proposed plan, EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the site.

GLOSSARY OF TERMS AND ACRONYMS

Background	Background level is the concentration of a hazardous substance that represents the level of the substance in an undisturbed environmental setting at or near the site.
Decision Document	Document that summarizes the response action selected to address contamination.
Feasibility Study	Document presenting and evaluating a range of alternatives for addressing contamination.
Granular activated carbon	A treatment medium used to remove contaminants, such as explosives from groundwater.
Lifetime Health Advisory (HA)	Guideline established by EPA that represents the concentration of a chemical in drinking water that, given a lifetime of exposure, is not expected to cause adverse, non-cancerous effects.
Federal Maximum Contaminant Level (MCL)	Federal maximum contaminant level for drinking water.
Massachusetts Maximum Contaminant Level (MMCL)	Maximum contaminant level for drinking water in the Commonwealth of Massachusetts.
Munitions and Explosives of Concern (MEC)	This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance (UXO), as defined in 10 U.S.C 101(e)(5); (B) Discarded military munitions (DMM), as defined in 10 U.S.C 2710(e)(2); or (C) Munitions constituents (e.g. TNT, RDX), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.
Perchlorate	An oxidizer used in some munitions, fireworks, flares, pyrotechnics and other items.
ppb	Parts per billion; used interchangeably with micrograms per liter (µg/L).
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, a high explosive.
Rapid Response Action	An interim cleanup action taken to reduce contamination while the investigation and selection of a response action is completed.
Remedial Investigation	Document that provides a summary of activities conducted and a synthesis of data gathered for the characterization of soil and groundwater associated with the site.
Remedy Selection Plan	The document outlining the cleanup alternatives and the proposed remedy.
Unexploded Ordnance (UXO)	Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)(A) through (C)))

NEXT STEPS/UPCOMING ACTIVITIES

Following presentation of the Remedy Selection Plan for the Central Impact Area, EPA is holding a 30-day public comment period to provide an opportunity for public input on the Remedy Selection Plan. After consideration of public comments and in consultation with MassDEP, EPA will issue a Decision Document that will detail the selected remedy. MassDEP will issue its official position in a comment letter after the public comment period has ended. A public informational meeting and public hearing is scheduled for July 27, 2011 at 5:30 p.m. in Building 1805 (at the water tower rotary) on Camp Edwards, MA.

FOR MORE INFORMATION

Contact the following individuals for more information:

Lori Boghdan – Impact Area Groundwater Study Program
(508) 968-5635

Ellie Donovan – Massachusetts Department of Environmental Protection
(508) 946-2866

Jeanethe Falvey – U.S. Environmental Protection Agency
(617) 918-1020

Or visit the EPA Web site at:

<http://www.epa.gov/region1/mmr/>

Or the IAGWSP Web site at:

<http://groundwaterprogram.army.mil/cleanup/areas/central.html>

Information repositories have been established at the public libraries in Bourne, Sandwich, and Falmouth to make information on the program available to the public. The repositories are updated to ensure that all necessary documents are available. A complete repository of documents, including copies of work plans, sampling results, site reports, fact sheets, meeting minutes, and other materials, are available at the Jonathan Bourne Library in Bourne. Recent documents are available at the other two libraries and all documents are available on the CLAMS (Cape) Library automated system.

Key documents related to the Central Impact Area site include:

- *Final Central Impact Area Remedial Investigation and Feasibility Study, July 2011*
- *Final Central Impact Area Source Area Summary Report, July 2011*
- *Draft UXO Source Investigation Report for the Central Impact Area, January 2008*

Note: These key documents will be available on the IAGWSP web site beginning July 25, 2011.

OPPORTUNITIES FOR PUBLIC COMMENT

The 30-day public comment period for the Remedy Selection Plan will be July 25, 2011 through August 25, 2011. During the public comment period, comments can be submitted as follows:

By fax to:

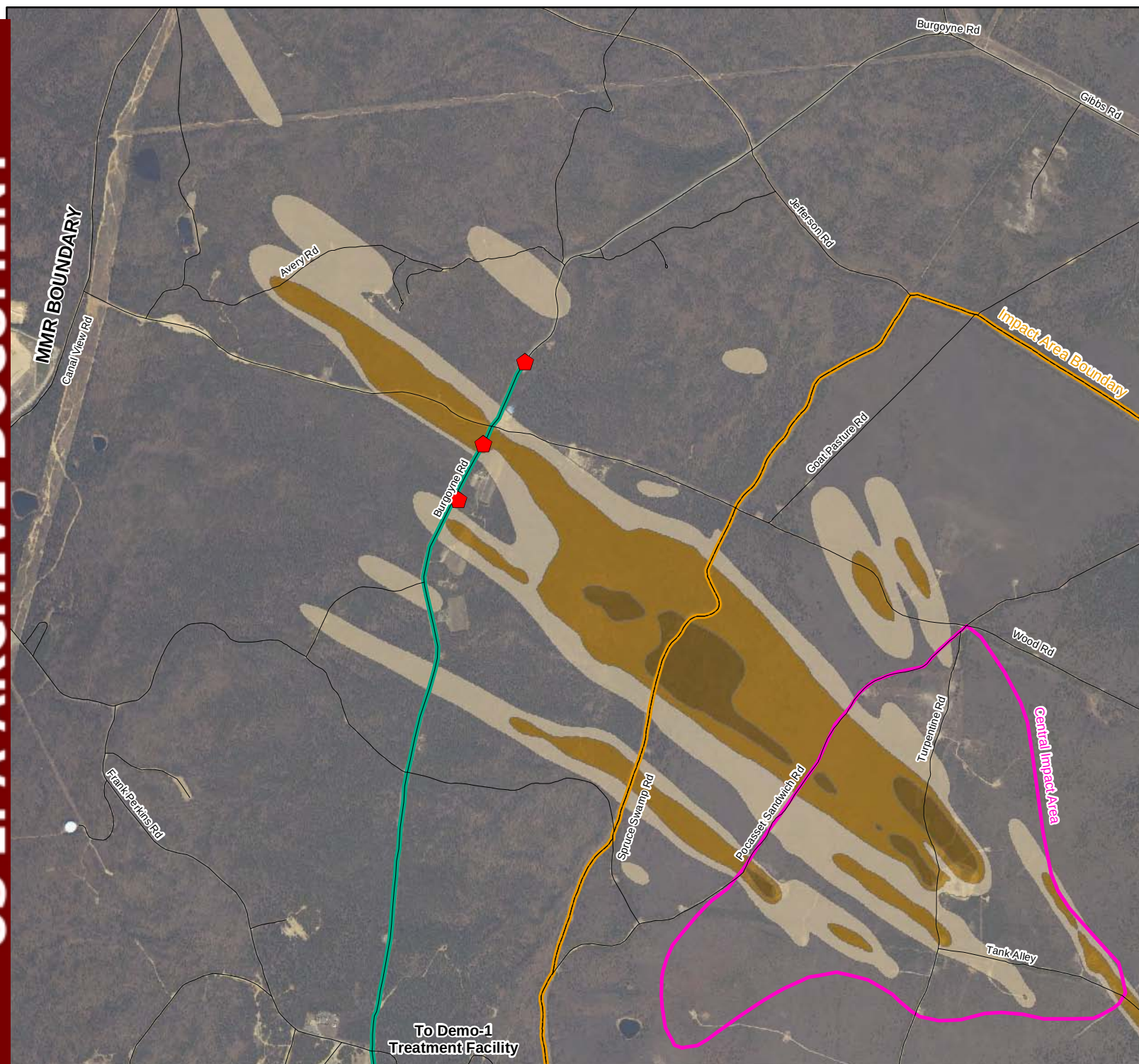
(617) 918-0020

By mail to:

**Jeanethe Falvey
US EPA Region 1
5 Post Office Square - Suite 100
Boston, MA 02109-3912**

By email to:

falvey.jeanethe@epa.gov

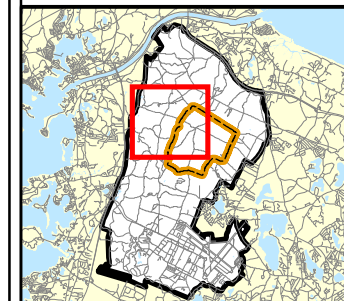


Impact Area Groundwater Study Program

LEGEND

- ◆ Extraction Well
- Underground Piping
- 2010 RDX Plume Outline
 - 0.6 - 2 ppb
 - 2 - 6 ppb
 - > 6 ppb
- Central Impact Area
- Impact Area Boundary
- Road

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
 Basemap data from US Geological Survey 7 1/2 minute
 Topographic Map Source: MassGIS
 Orthos: MassGIS April, 2005

TITLE

Configuration of Alternative 4
 (Modified)
 Treatment at
 Burgoyne Road



DRAFT

AMEC Earth & Environmental, Inc.
 Westford, Massachusetts

File: P:\Terc-JV\TO4\Restricted Files\GIS\Spatial\MXDs\RM\MXD_Verification_073109\CIAM\XDs\Figure_3-4_Alt4_Mod.mxd
 Prepared By: william.scales
 Coordinate System: NAD 1983 UTM Zone 19N

FIGURE

8-4