3.11 HAZARDOUS MATERIALS AND WASTE

3.11.1 Introduction/Region of Influence

The following section is an overview of the hazardous substances that may be used, stored, or encountered in the project ROI. Regulations that govern the use, transport, and disposal of these hazardous materials and wastes are discussed in Appendix A.

The project ROI for the MMR alternatives includes the boundaries of MMR and the trails (including buffer areas) that would be used for troop marches. Fences and mountain ranges cannot always confine or reduce impacts from hazardous materials and waste incidents; therefore, areas immediately adjacent to MMR and the trails also are considered part of the ROI.

The project ROI for the PTA alternative includes the boundaries of PTA and the areas immediately adjacent to PTA. It also includes the areas immediately adjacent to the main transportation routes from Kawaihae Harbor to the PTA Cantonment Area. This route is detailed in Section 2.4.3.

The public expressed concerns during the EIS scoping process regarding the impact of both existing and proposed military activities and training on the public and the environment. Specific issues include the following:

- Types, handling, and storage of ammunition;
- The presence of UXO;
- Potential contamination by various hazardous chemicals and materials, such as lead, depleted uranium (DU), pesticides, and polychlorinated biphenyls (PCBs);
- Radiation (radon); and
- Medical waste disposal procedures.

Lead-based paint (LBP) and asbestos are hazardous building materials that can create an impact on human health and safety if released to the environment. LBP and asbestos are often encountered when structures built prior to 1978 are remodeled or demolished. No structures containing LBP or asbestos would be remodeled or demolished on MMR or PTA as part of the proposed training, so there would be no effects related to LBP or asbestos.

Radon is a naturally occurring radionuclide found in the environment that affects air quality. If inhaled at large concentrations, radon is a carcinogen,
potentially producing a significant threat to human health and the environment. Radon, however, is found in low concentrations in Hawai‘i and is not considered a specific risk to this area. Additionally, no buildings would be built to potentially create radon-related effects.

A number of studies have been conducted to identify the types of materials that were used and disposed of at MMR, including materials that were burned in the OB/OD area. These findings are documented in the Hydrogeologic Investigation Report in Appendix G-1. No biomedical materials or infectious waste were discovered during these investigations (USACE 2006), and no such disposal or usage has been reported at MMR. Additionally, infectious waste has never been reported as being disposed of at MMR (Char 2003; Kim 2003). For these reasons, LBP, asbestos, radon, and biomedical waste are not included in the impact analysis.

In this section, contaminant concentrations are compared to EPA Region IX preliminary remediation goals (PRGs). The purpose of this comparison is to screen concentration values against conservative regulatory and health-based standards. PRGs are not promulgated cleanup standards, and higher or lower standards may be reasonably applied to sites based on site-specific risks and other conditions. The PRGs are goals and are designed to be protective of human health under a wide range of conditions. The guidelines for the use of PRGs allow users to adjust the exposure assumptions to better reflect site-specific conditions.

Because MMR is not an active or proposed remedial site, the Army is using the industrial soil PRGs and drinking water PRGs only as reference points for the concentrations of contaminants detected on the training ranges. However, these PRGs are based on exposure durations and assumptions that are substantially higher than those expected for military personnel using the MMR range areas. For example, industrial soil PRGs assume adult outdoor worker exposures for eight hours a day over 25 years. In fact, most military personnel use the training ranges for brief periods totaling days or weeks so that actual exposures are far lower than those assumed in the industrial PRGs.

3.11.2 Hazardous Materials Management

A hazardous material is defined as any material that, because of its concentration, physical, chemical, or infectious characteristics, can pose a substantial hazard to human health or safety or to the environment. Subcategories of hazardous materials include flammable, toxic, corrosive, and reactive materials. Typical hazardous materials used and stored on MMR and PTA include the following:
• Batteries and battery fluid;
• Aerosols;
• Petroleum, oils, and lubricants (POLs);
• Fuels (gasoline and diesel);
• Solvents;
• Fluorescent light bulbs;
• Paint products;
• Herbicides; and
• Munitions.

The Army follows strict SOPs for storing and using hazardous materials (MMR and PTA site-specific SOPs are kept at the respective range offices and are available upon request from the Army). All hazardous materials used by training units are stored at the Hazardous Materials Control Center (HMCC) on the Schofield Barracks East Range. When an Army unit requests a hazardous material, it is picked up from the HMCC and transferred by the unit to a temporary storage area for immediate use during training. No hazardous materials used by the troops are left on the range complex after completion of the training; materials are brought with the unit back for use in their respective motor pool or industrial facility. Material safety data sheets are continually kept on-site and updated for all hazardous materials used and stored on-site. In accordance with Army and federal regulations, all hazardous materials are kept in approved storage containers, and contractors who temporarily store materials on-site must also follow these SOPs and regulations.

3.11.3 Hazardous Waste Management

**Hazardous Waste**

The Resource Conservation and Recovery Act (RCRA) defines a hazardous waste as a solid waste (or combination of wastes) that, due to its quantity, concentration, or physical, chemical, or infectious characteristics, can cause or significantly contribute to an increase in mortality. RCRA further defines a hazardous waste as one that can increase serious, irreversible, or incapacitating reversible illness or pose a hazard to human health or the environment when improperly treated, stored, disposed of, or otherwise managed. A solid waste is considered hazardous if it is not excluded from regulation as a hazardous waste or if it exhibits any ignitable, corrosive, reactive, or toxic characteristics (EPA 1999).

The Army follows strict regulations and site-specific SOPs for collecting, storing, and turning in hazardous waste and non-regulated waste for MMR
3.11 Hazardous Materials and Waste

The Military Munitions Rule (62 FR 6621, 40 CFR 260, et seq.) identifies when military munitions become a hazardous waste under RCRA and guides safe storage and transport of such waste. This rule is discussed further below.

MMR is a conditionally exempt small quantity generator, in accordance with 40 CFR 261.5. Hazardous wastes generated on Army land are first collected at hazardous waste shop storage points (HWSSPs), which are designated areas at or near the point of waste generation. The only hazardous waste accumulated in the HWSSP on MMR is the burn pan residue, discussed in the ammunition section below. The MMR range office strictly follows MMR-specific SOPs for handling, storing, and disposing of hazardous waste. Once the HWSSP reaches full capacity (a 55-gallon limit), waste is sampled and profiled to determine the proper disposal method. Waste characterized as hazardous waste is picked up by a Defense Reutilization and Marketing Office, Hawai‘i (DRMO-HI) contractor and transported to a treatment, storage, and disposal facility (TSDF) for ultimate disposal (Akasaki 2003). The DRMO-HI uses a contractor that is authorized and certified to transport hazardous waste from the MMR HWSSP with a EPA transporter identification number. Other wastes generated by contractors (for example, grass waste) are handled and disposed of by the contractor in accordance with federal, state, and Army regulations and MMR-specific SOPs.

PTA is a small quantity generator in accordance with 40 CFR 261.5. PTA operates its own transfer accumulation point, where it consolidates and stores hazardous waste. A contractor picks up the hazardous and non-hazardous wastes and transports it to the DRMO or it is shipped off-island for permanent disposal at a certified hazardous waste disposal site (US Army and USACE 2004).

**Disposal of Ordnance Under RCRA**
The disposal of ordnance, such as ammunition, is regulated under RCRA. Section 107 of the Federal Facilities Compliance Act of 1992 requires EPA, in consultation with DoD and the states, to issue a rule identifying when conventional and chemical military munitions become hazardous waste under RCRA and to provide for protective storage and transportation of that waste. This rule explains what is considered a solid waste and the rules for handling that waste (i.e., permitting, labeling, storing, transporting, and disposal). The final rule also amends regulations regarding emergency responses involving both military and nonmilitary munitions and explosives (EPA 2002c).
This rule establishes the regulatory definition of solid waste as it applies to
the following three specific categories of military munitions:

- Unused munitions;
- Munitions being used for their intended purpose; and
- Used or fired munitions (which can then be termed either exploded
  ordnance [EXO] or UXO).

The rule conditionally exempts the following:

- From RCRA Manifest Requirements and Container Marking
  Requirements, nonchemical military munitions waste that is
  shipped from one military-owned or military-operated TSDF to
  another, in accordance with DoD military munitions shipping
  controls; and
- From RCRA Subtitle C storage regulations, nonchemical military
  munitions waste subject to the jurisdiction of the DoD Explosives
  Safety Board storage standards.

### 3.11.4 Specific Hazardous Materials and Wastes

The following sections address specific hazardous materials and wastes
that may be used, stored, transported, or encountered within MMR or
PTA. These hazardous substances could affect human health and the
environment and often have specific regulations that govern their use,
storage, and disposal. The hazardous materials and waste areas of interest
for MMR are identified on Figure 3.11-1.

#### Ammunition and Training

MMR was first used for training from 1941 to 1949. Between 1949 and
1951, unexploded bombs and shells were cleared from the range.
Approximately 11,000 rounds of artillery, mortars, and bombs, plus bulk
explosives, were reportedly detonated, either in place or in the OB/OD
area (USATHAMA 1984; Sox 1977). Range activities continued in the
early 1950s to prepare for the Korean Conflict. Ordnance was again
cleared in 1963. Ordnance was destroyed, and artillery, tanks, and infantry
assault weapons were used regularly during the 1960s. The site was used
extensively for training during the 1990s, until training was suspended in

The PTA range location (Alternative 4) is located entirely in the existing
impact area. The PTA training and impact areas were officially
established in 1955 and have been in use ever since. The combined impact
area on PTA, including dudded areas, comprises 51,000 acres (20,640
Figure 3.11-1  Hazardous Materials and Waste Areas of Interest, MMR
hectares). The impact area is off-limits to unauthorized personnel due to hazards from fired munitions. Since the range boundaries are located entirely in the existing impact area, UXO removal will have to take place prior to range construction.

The quantities of ammunition used depend on the training scenario being conducted. Table 2-3 summarizes the weapons and ammunition that are available for use during training at MMR and PTA. Table 2-5 presents the estimated quantities of munitions to be expended per year.

Ammunition to be used during each CALFEX is brought in by the user unit and is stored in a temporary ammunition holding area throughout the training exercise. At the completion of training, ammunition that was not used is returned to the ammunition supply point on WAAF used to store ordnance for all units of the USAG-HI or at the Navy magazines on Lualualei and West Loch.

Live-fire activities include artillery and mortar training. Bags filled with explosive propellant are required for artillery use, and similar explosive propellant charges are used for mortars. Propellant charges are explosive powders that propel the round of ammunition out of the gun barrel when ignited. Charges are transported to the firing point in the canisters they are received in. Each canister is transported with a maximum of three charges. If charges are removed from the originally packed canister prior to movement, the canister is resealed to prevent disturbance or damage from moisture or other influences.

The number of charges used generally determines how far an ammunition round travels. The exact number of bags of propellant required is not known prior to training because aligning a weapon toward its target requires adjustments to trajectory and distance (depending on the number of propellant bags). Accordingly, there is normally an excess of propellant as a result of the artillery and mortar training. Charges that are not used during training are burned in an approximately 50-square-foot (5-square-meter) metal burn pan with a 33-inch (84-centimeter) containment wall at the designated MMR burn site, shown in Figure 3.11-1. The burn sites for both MMR and PTA were selected and constructed in accordance with Section 17-5, Department of Army Pamphlet 385-64, Ammunition and Explosive Safety Standards. The burn sites are operated under the following restrictions:

- All burn sites have a means of collecting remnants produced by the burning operation;
• Propellants to be burned are unconfined and spread evenly over the burn pan. The depth of the propellant does not exceed 3 inches (8 centimeters); and

• The burn pan is used only once per 24-hour period.

The burnt propellant leaves an ash-like residue within the burn pan. The constituents of this residue change, but may contain chemicals such as lead, dinitrotoluene (DNT), benzene, and cyanide. After propellant burning is completed, a hazardous waste technician collects the residue. Management and disposal of burn pan residue is not required, but it is a best management practice (BMP) that is instituted to reduce the threat of uncontrolled wildland fires and minimize the potential for a release to the environment. The technician takes all hazardous waste precautions by wearing a protective Tyvek suit, gloves, and a respirator during collection. Propellants are burned separately according to artillery type. The residues created from burned propellant are temporarily stored at the range burn site in a designated HWSSP (see Figure 3.11-1). Each residue class is stored separately. Prior to disposal, the unit samples the residue and sends it out to be analyzed for chemical profiling and waste identification. When the HWSSP receptacle becomes full, it is properly disposed of by the DRMO-HI, or transported to a designated transfer and accumulation point (Husemann 2003d). Table 3.11-1 summarizes the specifications of the MMR and PTA burn sites and process.

### Table 3.11-1
Burn Site Specifications

<table>
<thead>
<tr>
<th>Burn Site</th>
<th>Est. Amount in Lbs./Burn</th>
<th>Est. Frequency of Burns/Week</th>
<th>Type of Propellants</th>
<th>Burn Pan Dimensions</th>
<th>Pan Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMR</td>
<td>5-10</td>
<td>0.5</td>
<td>M1, M8, M9, M10</td>
<td>5'9&quot; by 8'10&quot; by 33&quot;</td>
<td>1 unit</td>
</tr>
<tr>
<td>PTA</td>
<td>10-50</td>
<td>2</td>
<td>M1, M8, M9, M10</td>
<td>5'9&quot; by 8'10&quot; by 33&quot;</td>
<td>1 unit</td>
</tr>
</tbody>
</table>

Source: US Army 1999

During training, explosive munitions residues, fragments, or metal casings from munitions items, and projectiles (including lead-antimony alloy bullets) are deposited on the ranges. If they are left in place for long periods, the surfaces of metal fragments and projectiles may dissolve slowly and leach metals, including lead, antimony, iron, and nickel, into soil and water. Munitions contain a number of chemical constituents, depending on the types of munitions, including high explosives, propellants, fuse material, and other constituents. While most of the original chemicals are burned or vaporized when the munitions are fired or detonated, some of the material may not be fully destroyed, leaving residues that may be deposited in the soil.
Historical Open Burn/Open Detonation Use

Shown in Figure 3.11-1, the OB/OD area at MMR is an inactive RCRA treatment facility in delayed closure status from the HDOH, Solid and Hazardous Waste Branch. The area is downslope of the access road. Army, Air Force, Navy, and Marine Corps personnel used this area from the 1960s into the 1990s. This site was reportedly the only safe disposal site in Hawai‘i for hazardous materials. Ammunition was doused with large amounts of fuel and waste oils in the bottom of a trench and ignited using incendiary grenades, blasting caps, or time bombs (Char 1977). Larger munitions (such as mines) were buried in specially designed trenches and detonated. Trenches were used only once, and each detonation consumed approximately one ton (908 kilograms) of waste. Detonations could be sequenced in 15-second intervals (USATHAMA 1984). After destruction of the munitions, the trenches were inspected to ensure complete destruction and were backfilled with soil. No nuclear, radiological, chemical, or biological agents were disposed of at the OB/OD area (Geotechnical and Structures Laboratory 2002).

The OB/OD area had three primary purposes, including the mass destruction of unserviceable ordnance; engineer training with large demolition and mine munitions, such as bangalores; and the burning of excess propellant (Char 2003). Quantities of ordnance disposed of in the OB/OD area varied from year to year, but approximate total quantities disposed of per year included 12 tons (11 metric tons) by the Army, 6 tons (5 metric tons) by the Air Force, and 60 to 70 tons (54 to 64 metric tons) by the Navy.

The last time ammunition was destroyed by open burning was in the OB/OD area in 1992. Unserviceable munitions are now shipped back to ammunition depots in the CONUS for final disposition (Akasaki 2003).

Unexploded Ordnance

Following training, the units remove target equipment, gather brass casings from spent rounds, remove litter, and otherwise make every effort to restore the facility to its condition prior to use. The only weapons used at the site that can produce UXO are grenades, mortars, and artillery; all other ammunition projectiles are inert. Following each training event, a group of 30 to 40 people, including explosive ordnance disposal (EOD) specialists and Soldiers, conduct two surface sweeps of the ordnance impact area to identify UXO (Husemann 2003d). EOD specialists destroy all identified UXO where it is found, whether it is a result of the training just completed or from prior use of the range. No known unexploded rounds are left in place at the conclusion of a training exercise. These procedures ensure that training will not increase the amount of UXO on
3.11 Hazardous Materials and Waste

the site. There is one exception to these procedures: if UXO is found on or adjacent to a culturally sensitive site, it will be removed from the area prior to detonation, if possible. If it cannot be removed, the UXO will be shielded by plywood and sandbags in order to prevent damage to the cultural site.

During the week of October 28, 2002, the Army conducted a prescribed burn of Mākua Valley in the southern lobe to enable UXO clearance and to minimize the risk of fire outbreak by reducing the existing fuel load. This prescribed burn removed vegetation so that UXO could be cleared from suspect areas (US Army 2002a). An additional prescribed burn was conducted within the northern lobe on July 22, 2003, to reduce the vegetative fuel load and to locate UXO that could not be identified through ground clearance due to the terrain and heavy vegetation. EOD specialists detonated or removed surface UXO that did not discharge during the burn. A total of 172 pieces of UXO were identified and removed. Safe areas in the northern valley that were not culturally significant were identified for future troop marches, training, and maneuvers.

Improved conventional munitions (ICMs), also referred to as cluster bombs, are artillery munitions that contain multiple submunitions. Due to the extreme safety risk, ICMs are no longer used on Army training land, in accordance with HQDA Letter 385-01-1, Section 7a (HQDA 2001); traces of past use have been discovered at MMR. ICM areas near the CCAAC (shown on Figure 3.11-1) have been closed and are no longer accessible. There is a 16,800-acre (6,800-hectare) ICM impact area within the larger impact area on PTA. This area is closed and not accessible.

UXO has been identified within the northern valley of MMR, including a portion of the trail to be used by Soldiers marching between DMR and MMR (DEI 2002). While not conducted in the northern valley now, live-fire training may have been performed there in the past. EOD specialists have cleared the portion of the trail and valley used by troops, but UXO could be encountered in this region. No UXO has been reportedly discovered beyond the limits of MMR.

Soldiers are educated on identifying UXO and proper procedures for handling UXO. Soldiers are given a Skills Level 2 through 4 Manual, as well as a Field Manual 21-16, Unexploded Ordnance Procedures (HQDA 1994), detailing the types of UXO, safety guidelines, and handling procedures. Before they are deployed, Soldiers receive additional training in specific types of UXO in the deployment location. UXO classes are periodically given to Soldiers for further training on UXO management.
Finally, Soldiers who are chosen to assist EOD specialists with UXO clearance are given special training prior to range sweeps (Dunn 2003).

Range Division Maintenance maintains MMR. Long-term scheduling is conducted on O‘ahu by the Directorate of Plans, Training, and Mobilization (DPTM) Range Division–Hawai‘i Scheduling Office, using the Range Facility Management Support System (RFMSS) database. Units can access the RFMSS to check the schedules of specific ranges. Additionally, the RFMSS keeps material safety data sheets of all chemicals stored on-site and records of ordnance use and management in the range scheduling office (Sato and Associates 1996).

**Chemicals of Concern Used in Training**

Energetic materials, such as nitroglycerine, tetryl, RDX, HMX, TNT, 2,4- and DNT, are used in a number of industries and, among many other uses, are used to produce explosives, ammunition, and dyes. These substances have been found at hazardous waste sites that contain buried ammunition wastes and have been known to affect the soil, surface water, groundwater, and air. Exposure to high levels may affect the nervous system and the blood (USDOHHS 1999). Because energetics are used in training, they are being analyzed as part of the ongoing air and hydrogeologic field investigations at MMR. The hydrogeologic investigation showed concentrations of energetics in soils at the following locations:

- OB/OD area;
- Within berms at Objective Deer;
- Weather station burn pan area;
- In streambed sediments of Mākua Stream;
- Demo pit; and
- Objectives Wolf, Deeds, and Badger.

None of the findings showed concentrations of energetics above PRG levels (see Appendix G).

Due to various studies documenting the use and disposal of Agent Orange on military bases within the US, public concern prompted research to confirm that this material was not stored, used, or disposed of in Hawai‘i. Various Air Force studies document that in 1971, chemical agents stored in Okinawa were transported to Johnston Island and stored at the Chemical Storage Facility there. Public Law 91-672, passed in 1972, prohibited the transport of chemical agents from Okinawa to any of the 50 states and authorized destruction of Agent Orange outside these areas. In 1972, the
1.4 million-gallon (5.3 million-liter) stockpile of Agent Orange amassed during the Vietnam War was transported directly to Johnston Island and placed in storage there. In 1977, Agent Orange stored at Johnston Island, as well as in Mississippi, prior to Public Law 91-672, was destroyed by high-temperature incineration at sea in the South Pacific (USARHAW and 25th ID(L) 2001a). There is no record of Agent Orange being used, stored, or disposed of on O‘ahu.

**Depleted Uranium**

In August 2005, while conducting range clearance activities to modernize ranges for the new Stryker Brigade, an Army contractor discovered 15 tail assemblies from the M-101 spotting round body (SRB), a component of the Davy Crockett weapons system. The Davy Crockett was the name given to the M28 and M29 series of recoilless guns. This weapon system, which was produced from 1960 until 1968, was used in training until 1968. Although it could use several types of munitions, the munitions of interest were the M-101 SRB that contained DU. Unlike munitions that use DU in penetrators to defeat enemy armor, the DU in the M-101 was used to provide weight sufficient for the SRB to mirror the trajectory of the Davy Crockett’s nuclear warhead. The M-101 was a small (about 1-inch [2.5-centimeter] diameter) low speed projectile that contained about 6.7 ounces (0.19 kilograms) of a DU-alloy.

When the Davy Crockett was used, it was a classified weapon system and information concerning its deployment to SBMR and associated training activities was closely guarded.

In 2006, a scoping survey confirmed the presence of DU fragments from the M-101 on a portion of the SBMR impact area. After confirming the presence of DU, the Army disclosed that information to the public.

As a result of archive searches conducted by the USACE regarding the potential for contamination resulting from the firing of spotter rounds for the Davy Crockett weapons system at SBMR, suspicion arose that this weapons system may have been used at other firing ranges in the Hawaiian Islands. The suspected ranges include MMR on O‘ahu, PTA on the Island of Hawai‘i, and SBMR impact area on O‘ahu. For MMR and PTA, details of the archive searches were reported in “Archive Search Report On the Use of Cartridge, 20 mm Spotting M101 for Davy Crockett Light Weapon M28, Islands of Oahu and Hawaii” (Cabrera Services, 2008).

In August 2007 scoping surveys were performed at MMR and PTA. The surveys were performed to assess the presence of DU fragments that might have originated from past training activities involving Davy Crockett SRB.
The results of these survey activities will be used to develop the criteria and plans for a follow-on characterization survey of the potentially impacted areas.

The results of the MMR scoping survey were limited by accessibility issues. The aerial visual observations were obscured by vegetation and no radiological measurements were performed in the impact area. Entry to the impacted area was not allowed for safety reasons, and no samples of DU fragments were recovered or analyzed. The soil samples collected around the perimeter of the site did not identify any indications of DU (Cabrera Services, 2008).

The results of the PTA scoping survey confirmed several areas with launching pistons used to fire the Davy Crockett weapon system. Visual observations of these pistons, pistons, radiation measurements, and recovery of an intact Davy Crockett SRB all support that the Davy Crockett system was used at PTA. The soil samples collected around the perimeter of the site did not indicate the presence of DU, however, the Army will conduct a more thorough characterization survey and risk assessment in 2008 (Cabrera Services, 2008).

The Army does not have any plans to utilize DU at any range or other location in the state.

**Lead from Ammunition**

In addition to explosives residues deposited on the ranges at MMR and PTA during training, metals contained in various munitions may be deposited in the ranges. Among the metals present in some explosives are lead and mercury fulminate (an initiator for explosives). Lead is used in the manufacturing of ordnance/ammunition, such as those munitions used for small arms training listed in Table 2-3. Lead is used in the projectiles of small arms ammunition. Bullets are typically made up of an alloy of lead and antimony, which makes the bullet harder. Lead accumulating over the long term in backstops, range floors, and berms can leach into groundwater, be transported off-site by stormwater, be ingested by wildlife, or become airborne. Erosion can overload streams and rivers with sediments. The type and amount of ammunition used on the range along with its operational history greatly influences the risk of lead migration to groundwater. Different calibers of ammunition contain varying amounts of lead; therefore, when looking at the risk of lead migration, both the total number and type of rounds fired must be taken into consideration. Contamination risk is substantially reduced if regular maintenance has been performed on the backstop and apron areas to remove rounds and fragments from soil (USAEC 1998). The Army
implements general cleanup procedures following training events to remove shell casings and other munitions residue from the ranges. The permanent ammunition storage point located on WAAF requires that a certain percentage of weight of brass and links be returned to ensure the range area is returned to its original state to the extent possible.

The presence of lead can result in noncompliance with many environmental regulations, including the Clean Water Act, Safe Drinking Water Act, and Section 7003 of RCRA. Although these regulations and others can be applied to active small arms ranges, the law remains unresolved as to the extent to which federal and state agencies can directly regulate range activities. While the Army asserts that environmental authority does not reach active ranges, the Army’s position is that prevention is the best course of action in an uncertain regulatory climate (USAEC 1998). The US Army Environmental Center (USAEC) Range XXI Team and the Army Training Support Center (ATSC) developed the guidance document, Prevention of Lead Migration and Erosion from Small Arms Ranges (USAEC 1998), to give range managers and military and environmental personnel management practices that minimize adverse impacts on human health and the environment from small arms range operations.

Preliminary results of the current hydrogeologic investigation show concentrations of lead above industrial PRG levels in soil samples taken at MMR’s Objective Elk (see Appendix G). Based on the limited detection of lead on the range and the isolated areas where it was found, lead is less of a contaminant than expected. As lead does not appear to be a migrating contaminant, no mitigation or maintenance is necessary until the range is closed.

Based on the results of a 2002 soil study at PTA, the highest lead concentrations, two of which exceeded the industrial soil PRG, were detected in samples from Ranges 9, 10, and 11. These concentrations are likely due to human activities. The resulting combined risk is above the one in one million cancer risk threshold (which mainly results from lead), but is within the range of what is considered acceptable under some circumstances (US Army and USACE 2004).

**Pesticides**

The EPA defines a pesticide as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest (EPA 2002a). Pests can be insects, mice, and other animals, or unwanted plants (weeds), fungi, or microorganisms, such as bacteria and viruses. Though often misunderstood to refer only to insecticides, the term pesticide also
applies to herbicides, fungicides, avicides (bird agents), rodenticides, and various other substances used to control pests. A pesticide is also defined as any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant (EPA 2002a).

Pesticides can be applied only by someone who is certified to do so. There are three areas of pest management on MMR: herbicide treatment along the firebreak roads, alien weed species control, and building pests management. Herbicides are applied along the firebreak roads under contract every month or two, as needed. The DPW Environmental Division treats alien weed species. The DPW Pest Control Shop controls pests in the buildings. No pesticides are stored on MMR, as contractors are not allowed to store hazardous materials onsite. DPW personnel bring necessary materials to the site from SBMR. Pest management for MMR is covered under the USAG-HI Installation Pest Management Plan (USARHAW 2000), which conducts regular compliance inspections (Yamamoto 2002).

Hydrogeologic sampling being conducted by the Army includes testing for pesticides that may have been released to the environment through spills or disposal (Geotechnical and Structures Laboratory 2002). Preliminary results of the hydrogeologic studies found multiple areas within MMR that contain concentrations of pesticides below PRG levels. Heptachlor epoxide, a pesticide, was detected in MW-3C in the second round of sampling (but not in the first round) at a concentration of 0.039 µg/L, which is above the PRG of 0.007 µg/L but less than the MCL of 0.20 µg/L. On February 14, 2003, water samples were taken within MMR, and samples of water in both the Kaiahi Gulch and Punapōhaku streams contained concentrations of pesticides above PRG levels (see Appendix G).

There is one primary pesticide storage location on PTA, the DPW Natural Resources Department (Building T-93). This entity controls alien species and protects native threatened and endangered species with the use of herbicides and rodenticides on all training areas. Small volumes of pesticides are stored in plastic lockers, with closed plastic containers as secondary containment. Larger volumes are stored in plastic containers on secondary containment pallets. Pest management of the cantonment area is completed under contract. Contractors are not allowed to store hazardous materials, including pesticides, on site (US Army and USACE 2004).

According to site visits and interviews by outside consultants with PTA facility personnel during a 1997 hazardous waste inspection, a pesticide storage shed used to be located near the north side of Building T-31. In the
1980s, the pesticide storage shed was moved to the engineer’s storage yard along the northwestern side of the cantonment area. The ground surface around the former pesticide storage area may be contaminated from inadvertent spills of pesticides during the formulation and mixing process; however, installation personnel identified no specific instances of spillage (US Army and USACE 2004). Pesticide formulation and mixing was conducted at a potable water source equipped with a backflow-prevention device. Pesticide contaminated rinsates from the spray equipment and container rinsing were also reportedly disposed of by applying the rinsate to needed areas. Pesticides may also have spilled within the storage shed and seeped through a pervious wooden floor, contaminating the underlying soils. A gravel driveway now exists north of Building T-31, over the area that is believed to have been occupied by the pesticide storage shed. Later soil analysis in the area positively detected pesticide constituents in the soil, but average pesticide concentrations across the former pesticide storage area were well below the EPA Region IX PRG for pesticides of interest (PRC 1997, ES-3). As previously mentioned, pesticides are now stored in Building T-93 and are properly contained with an up-to-date spill plan (US Army and USACE 2004).

Field Investigations
The public has expressed concern about the impact on the environment of training operations throughout the Mākua Valley. Over the years, the area was used for military training with live ammunition. This resulted in a variety of ordnance and ammunition being distributed throughout Mākua Valley. Migration of compounds within and from MMR would likely be either through percolation into the deep groundwater or runoff and erosion of contaminated solid particles into surface water. Possible sources of groundwater contamination include metals, explosives, or explosives byproducts released into the environment. In addition to concerns about soil and water contamination, the public has expressed concerns about air pollution from military use of MMR. An overview of ongoing field investigations is discussed in the introduction to Chapter 3.

As mentioned previously, the MMR OB/OD area is a RCRA treatment facility and is undergoing delayed closure with the HDOH (Akasaki 2008). The quantities of ordnance detonated at the OB/OD area per year are discussed in the ammunition subsection in this report. There have been various studies conducted at MMR to evaluate the sources and the extent of contamination from military training. The potential for contamination from past training exercises and from the OB/OD area to migrate from the surface water to the groundwater pathway was considered in 1994 by Halliburton NUS. The monitoring well at the site, SP-7, was installed and sampled to investigate the possibility of surface water flow collecting...
contaminants then infiltrating through the streambed. Well SP-7 is shallow and adjacent to the streambed. Groundwater samples collected from this well were analyzed for energetics, semivolatile compounds, nitrates, nitrites, and total metals. None of the samples had detectable concentrations of energetics or semivolatile compounds. The nitrate and nitrite concentrations in the samples were below risk-based health criteria and drinking water standards. Detectable levels of barium, chromium, lead, mercury, and nickel were also below risk-based health criteria and drinking water standards (Halliburton NUS Corporation 1994). The conclusion from the results was that the basal aquifer at MMR was not contaminated. Therefore, the potential for contaminants from past training activities to migrate from the surface water to groundwater pathway to the installation boundary was considered low.

In 1999, the EPA and the HDOH performed an investigation of sediment samples from the *muliwai* west of Farrington Highway (Baylor 1999). Samples were collected from the pond bottom sediments and were analyzed for metals. The investigation found that cadmium, chromium, and copper exceeded the NOAA Effects Range-Low levels and that nickel exceeded the NOAA Effects Range-Medium level in both the MMR and reference *muliwai* samples. The NOAA Effects Range is a measure of the risk to ecological receptors and designates chemical concentrations as low, medium, or high. Because concentrations of some metals are naturally elevated in Hawaiian soils, and because elevated concentrations of these metals were found in the reference (background) *muliwai* location, the investigators could not determine whether the elevated metals concentrations originated from human activities or were naturally occurring.

From May 19 through 21, 2003, the Army collected 50 sediment samples from the three *muliwai* along Mākua Beach and the two background locations. Twenty-two samples were collected from the north *muliwai*, 18 from the south *muliwai*, 4 from the dry *muliwai*, and 3 each from the north background location and the south background location. All of the samples were analyzed for metals and explosives. Ten of the samples and two of the duplicates were subjected to an extended suite of analyses that included benzene, toluene, ethylbenzene, and xylenes (BTEX); organochlorine pesticides; chlorinated herbicides; semivolatile organic compounds (SVOCs); dioxins and furans; nitrate/nitrite; total organic carbon; and particle size.

Based on the field observations and the analytical results of the *muliwai* sediment sampling program, the following conclusions were made:
Concentrations of metals detected in the *muliwai* were within the ranges found in the background samples.

Arsenic and chromium were detected at concentrations above EPA Region IX soil PRGs but were within background concentration ranges.

Nearly all of the twelve samples that were analyzed for BTEX contained one or more of these compounds. All of the concentrations of the BTEX chemicals were far lower than EPA Region IX soil PRGs.

Six of twelve sediment samples analyzed for the full suite of organic compounds contained one or more of the chemicals of concern (with the exception of BTEX, which was detected more frequently). One sample contained one of the explosive compounds, and one sample contained one pesticide compound. Three herbicides and three SVOCs were found in four samples. The detected concentrations were far below EPA soil PRGs.

Trace concentrations of two dioxin isomers were detected in two of the twelve *muliwai* sediment samples analyzed for dioxins and furans. The 2,3,7,8-TCDD isomer was detected at a concentration above the EPA Region IX industrial soil PRG in one sample from the dry *muliwai*, collected at a depth of 2.5 feet. The toxicity equivalent of the octa-TCDD isomer found in the other sample, from the north *muliwai* did not exceed the Region IX industrial soil PRG.

The recent hydrogeologic sampling is discussed at the introduction of Chapter 3, and results are discussed for individual topic areas in Section 3.11.4.

**Nearshore Underwater Survey**

In December 2002, the Army’s 7th Dive Detachment conducted and videotaped a 12-diver, 3-day-long, nearshore dive survey of Mākua Beach that included all locations where metal globules were suspected to be on the ocean floor. The planned dive followed a 4,921-foot (1,500-meter) transect that ran parallel to the beach at a distance of 492 feet (150 meters) offshore, and five 984-foot (300-meter) transects that were spaced equidistant along the 4,921-foot (1,500-meter) transect and were oriented perpendicular to Mākua Beach (see Figure 3.11-2).

No metal globules were found in the ocean, but one metal globule, similar to the specimen presented during a public scoping meeting, was found on Mākua Beach.
Figure 3.11-2 December 2002 Near Shore Dive Survey Transects, MMR
Analysis of the metal globule for 24 different metals (including mercury) found that greater than 99.4 percent of the sample was composed of the following four metals:

- Aluminum: 976,000 milligrams per kilogram (mg/kg) (approximately 97.6 percent);
- Magnesium: 12,100 mg/kg (approximately 1.2 percent);
- Iron: 3,750 mg/kg (approximately 0.4 percent); and
- Copper: 2,340 mg/kg (approximately 0.2 percent).

The balance of the sample (approximately 0.6 percent) was composed of various trace elements, including calcium, chromium, and zinc. Based on this analysis and the physical appearance of the sample, it was likely an irregular mass of melted down aluminum cans since the chemical composition of aluminum alloys used in beverage cans closely resembles the sample results noted above. According to the USAEC, the University of California Berkeley, and the Alcoa Corporation, magnesium is added to beverage can aluminum alloys for corrosion resistance, and iron, copper, and zinc are added for structural strength.

**Polychlorinated Biphenyls**

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties, ranging from oily liquids to waxy solids. Due to their nonflammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications, including electrical, heat transfer, and hydraulic equipment (EPA 2002b). PCBs can be found in the cooling fluid of electrical equipment, including transformers and capacitors, particularly if such equipment was manufactured before the early 1970s. PCBs are also found in other manufactured items and as plasticizers and fire retardants in many solid materials (USCG 2002). No PCB-containing equipment or materials are located on MMR (Husemann 2003d).

Soil samples collected as part of the 1994 Halliburton NUS study contained PCBs in the soil above background concentrations. These contaminants were found in soils at the OB/OD area. The source of these chemicals is unknown; however, historic disposal of materials other than munitions in the OB/OD area was not uncommon. The concern was that these contaminants could be transported off-site by wind, surface water, or groundwater, as contaminants were found at depths ranging from between 6 inches (15 centimeters) below ground surface (bgs) to 12 feet (4 meters) bgs.
Because of the Halliburton NUS study results, historic site uses, historic records, and public concern regarding contaminants of interest (including PCBs), hydrogeologic investigations were initiated by the Army, including testing water and soil for a large number of different chemicals. PCBs are included to evaluate the potential disposal of transformer oils or other chlorinated oils. Results of the hydrogeologic investigation showed PCBs in two soil samples at the MMR OB/OD area. Concentrations were lower than industrial PRGs. PCBs were not detected in any other areas of MMR (see Appendix G-1).

PRC Environmental Management, Inc., conducted a preliminary assessment/site inspection of four potential contaminant sources (a former pesticide storage area, a fire training area, and two landfills) within the boundaries of PTA during March and April 1993. The analytical results for soil sampling in these areas indicated that PCB concentrations were all below the listed PRG. Devices that were found to contain regulated levels of PCB have been either removed and upgraded with non-PCB devices, or were retrofilled or removed, drained, packaged, and disposed of in accordance with 40CFR Part 761. No PCB-containing transformers remain at PTA.

**Electromagnetic Fields**

The production of weak electromagnetic fields (EMF) is associated with the generation, transmission, and use of electrical energy (NIEHS 2002). In 1992, Congress authorized the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMF-RAPID Program) in the Energy Policy Act (NIEHS 2002). The EMF-RAPID Program was funded jointly by federal and matching private funds, with substantial financial support from the utility industry. Congress instructed the National Institute of Environmental Health Sciences (NIEHS) and the Department of Energy (DOE) to direct and manage a program of research and analysis aimed at providing scientific evidence to clarify the potential for health risks from exposure to extremely low frequency-EMF (ELF-EMF). The NIEHS is one of 25 institutes and centers of the National Institutes of Health (NIH). The EMF-RAPID Program had the following three basic components:

- A research program focusing on health effects research;
- Information compilation and public outreach; and
- A health assessment for evaluating any potential hazards arising from exposure to ELF-EMF.
The NIEHS was directed to oversee the health effects research and evaluation (NIEHS 2002) and to provide a report outlining the possible human health risks associated with exposure to ELF-EMF. The document that responds to this requirement is the NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields (NIEHS 2002).

In its report, the NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In the opinion of the NIEHS,

“…this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern (NIEHS 2002).”

Based on the results of the NIEHS report discussed above, ELF-EMF are not addressed in this EIS as a potentially harmful issue of concern, but project activities involving EMF frequencies higher than ELF-EMF are addressed; this includes radio frequency EMF. Three remote automated weather stations (RAWS) are located on MMR (see Figure 3.11-1). These are typically set in remote wildland fire areas and are used to collect weather information to aid in determining the potential for wildfires (Shelley 2002). RAWS use radio frequencies to transmit weather data to a geostationary operational environmental satellite. The RAWS transmit information for approximately 15 seconds each hour. Exposure to any RAWS EMF is limited because they are typically located in remote locations, are unmanned, and transmit information for a short duration. These RAWS require personnel to be onsite only for maintenance and not for operations.

Equipment producing EMF that could pose a serious health risk is operated under strict constraints, in site-approved areas, and by qualified personnel per technical publications (Moreno 2002). Mobile radar equipment is owned by Division Artillery and consists of a radar set designed to detect incoming artillery and projectiles. It is operated and managed by the Forward Area Defense section.
Petroleum, Oils, and Lubricants
Mākua Military Reservation

The analytical results of the 1994 Halliburton NUS soil sampling showed that none of the soils used for past training exceeded the EPA’s conservative public health criteria for volatile organic compounds (VOCs), which are constituents associated with petroleum products. VOCs are commonly found in solvents used to wash shell casings or to clean other ordnance as part of the demilitarization process. A commonly found VOC is trichloroethylene, which has been found in the soil and groundwater at other military training areas. Another VOC, benzene, is often associated with motor fuels and fuel leaks and spills. VOC contamination is an ongoing concern, however, as training continues, and VOCs could be transported off-site by wind, surface water, or groundwater.

The introduction of Chapter 3 includes a discussion of the hydrogeologic sampling and analysis of surface and subsurface soil, stream sediment, surface water, and groundwater; analysis of these materials includes VOCs. Sampling results are summarized in Sections 3.7 and 3.8.

There are no underground or aboveground storage tanks containing POLs or hazardous materials and no oil/water separators on MMR. All industrial fueling and maintenance is conducted from the “super station” and unit motor pools on SBMR. Tankers transport needed petroleum to the reservation and leave after fueling vehicles and equipment. Only necessary quantities of fuels and oils needed during training exercises are temporarily staged onsite (for example, gasoline needed for a generator would be stored in a canister next to the equipment). Unused fuels and oils are removed from the reservation by the unit.

Pōhakuloa Training Area

PRC Environmental Management, Inc. conducted a preliminary assessment and site inspection of PTA in March and April 1993 (PRC 1997). Soil samples were obtained across the installation and were analyzed for various constituents, including petroleum products. The results indicated that subsurface soils and bedrock at the fire training area and two landfill areas were contaminated with low concentrations of petroleum-based substances (likely used motor oil and fuel oil, such as kerosene). The former burn pit was in the vicinity of the fire training area and was constructed of rubber plates covered with dirt and surrounded by an earthen berm. Flammable liquids were poured into the burn pit during fire training exercises and may have seeped into the underlying soil and bedrock along the unsealed plate seams. The former burn pit was
decommissioned after 1983, and a new fire training facility with a more suitable design was constructed in 1994 (US Army and USACE 2004).

Gross petroleum contamination was not apparent based on field observations and screening. Analytical results indicated that VOCs and SVOCs were below EPA Region IX PRGs. Site inspection data for soils in these areas indicate the presence of some contaminants of concern, but at concentrations that if left in place, would pose minimal, if any, threat to human health and the environment (PRC 1997) (US Army and USACE 2004).

The bulk storage facility, which was constructed in early 1982 at Building 343, has eight underground storage tanks (USTs). POL containers belonging to the bulk fuel facility are stored on a concrete pad with secondary containment.

One UST is included on the LUST list maintained by DPW. This tank was located at the dining facility in Building T-186 and was removed in May 1994. This site has been remediated, and the EPA issued a clean closure status in December 2001.