Massachusetts Military Reservation Cleanup Team (MMRCT)
Building 1805, Camp Edwards, MA
January 13, 2010
6:00 – 8:30 p.m.

Meeting Minutes

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Action Items:

1. Mr. Dinardo requested a future MMRCT agenda item on the effect of the wind turbine on electrical cost savings.

Handouts Distributed at Meeting:

1. Presentation handout: Pyrotechnics Use at Camp Edwards
2. Presentation handout: EPA's Position on Pyrotechnics at MMR
3. Presentation handout: Environmental Management Commission's Review of Proposed Simulated Grenade Use
4. Presentation handout: Remediation & Investigation Update
5. Presentation handout: J-1 Range Source Area Update – Part II
6. Presentation handout: Fuel Spill 12 Plume Update
7. Info sheet: Contaminants of Concern
8. MMRCT Cleanup Team Meeting Evaluation form

Agenda Item #1. Introduction and Agenda Review, and Approval of December 9, 2009 MMRCT Meeting Minutes

Mr. Karson convened the meeting at 6:03 p.m. and informed the Massachusetts Military Reservation Cleanup Team (MMRCT) that Gary Bostwick had resigned from the team. He also noted that the Installation Restoration Program's (IRP's) Community Involvement Plan (CIP) Addendum has been sent to MMRCT members for review and comment. He then reviewed the meeting agenda and asked if there were any additions or corrections to the December 9, 2009 MMRCT meeting minutes. No changes were offered and the minutes were approved as written.

Agenda Item #2. Pyrotechnics Update

From the Environmental & Readiness Center (E&RC)

Ms. Palmer stated that at Camp Edwards on the MMR, the use of pyrotechnics, which are an important training tool at military facilities throughout the country, was suspended by the U.S. Environmental Protection Agency (EPA) because of concerns about potential environmental impacts to groundwater. In 2008, with reformulated pyrotechnics simulators being developed by the Department of the Army, the Massachusetts Army National Guard (the Guard) announced its intent to pursue the use of pyrotechnics simulators at Camp Edwards. Ms. Palmer reported that two new pyrotechnics devices were developed: a grenade simulator, and a ground-burst simulator.

Ms. Palmer then reviewed the constituents in the old version of the simulators: black powder, sodium salicylate, red gum, aluminum, potassium chlorate (a match head is about 50% potassium chlorate), potassium chloride, dextrin (a starch breakdown product), potassium nitrate (a fertilizer), and perchlorate. The new versions contain all of the same constituents, but only 1 gram of perchlorate in the ground-burst simulator rather than the 17 grams in the old version (a 93% reduction), and no perchlorate at all in the grenade simulator.

Ms. Palmer noted that EPA, the Massachusetts Department of Environmental Protection (MassDEP) and the Environmental Management Commission (EMC) were all involved in the ground-burst simulator field tests done at MMR. She explained that the tests, which were conducted in a metal shipping container to minimize dispersion, allowed testing for a worst-case scenario, and concentrated the residue for sampling. She noted that 20 ground-burst simulators were used, and after visually determining how much soil was displaced during the process of deflagration, soil samples were collected at a depth of 0 to 3 inches and tested for perchlorate, nitrates, and metals.

Ms. Palmer explained that the testing was conducted with the ground-burst simulator, for a worst-case scenario, because it does contain some amount of perchlorate. Test results showed perchlorate concentrations in soil ranging from 3 parts per million (ppm) to 78 ppm, and perchlorate concentrations in the cardboard scrap after combustion ranging from 2.8 ppm to 8.7 ppm. Based on these results, the Guard decided that further research was required before proposing use of the ground-burst simulators for training at Camp Edwards. However, because the grenade simulator contains no perchlorate, the Guard has moved forward with its proposal to use the simulators for training as soon as they are available.

Ms. Palmer displayed a slide showing metals sampling results and noted that no increase in metals was seen after the field test. She also reported that EMC's Science Advisory Council (SAC) had asked the Guard to look more closely at potassium chlorate, whose use in a simulator is similar to striking a match. She noted that one grenade simulator has the same amount of potassium chlorate as three to four safety matches, with match heads being 45% to 55% potassium chlorate. She also explained the calculations that were done in order to determine potassium chlorate mass per grenade simulator, noting that there are 41 milligrams (mg) of potassium chlorate in the ignition of each simulator, which is 88% of the entire weight of the ignition. The molecular weight of each of the substances was considered, and the amount of potassium chlorate ion was calculated to be 25 mg per simulator. Then, a "very artificial" worst-case loading scenario was established, which assumed use of 1,000 simulators per year, no photo-degradation (although studies have shown that potassium chlorate does photo-degrade), and a 0% combustion efficiency (although there's some evidence of much higher combustion efficiency). Calculations based on this worst-case loading scenario led to 25 grams as the amount of potential mass loading of potassium chlorate per year.

Ms. Palmer further noted that calculations for the worst-case groundwater estimate for potassium chlorate, based on the use of 1,000 simulators per year, concentrated in an approximately one-acre area, with 0% combustion efficiency, and a recharge rate of 27 inches per year, resulted in an estimated groundwater concentration of 0.009 milligrams per liter (mg/L). She also reported that although there are no EPA or MassDEP drinking water standards for potassium chlorate, guidelines do exist, which include: the World Health Organization's drinking water guideline of 0.7 mg/L; California's notification level of 0.8 mg/L for drinking water; and EPA's herbicide land-application guidelines (6 pounds per acre in agricultural use, and 0.9 pounds per 100 square feet in non-agricultural use.) Ms. Palmer pointed out that even the artificially exaggerated worst-case groundwater concentration is well below any of the potassium chlorate guidelines.

Ms. Palmer then began discussing the approval process for use of the newly-formulated grenade simulators at Camp Edwards. She noted that there are several layers of oversight, including the EMC and the Environmental Performance Standards (EPSs) that were developed out of Chapter 47 of Massachusetts General Law (M.G.L.), as well as the EPA Administrative Order (AO) process. Ms. Palmer noted the Guard has petitioned EPA for its approval. She also reported that M.G.L. Chapter 47 requires that the simulator devices are protective of drinking water supply and wildlife habitat, and the Guard's expert technical review concurs that training with the simulators can be done while being completely protective of the unique drinking water supply and wildlife habitat at Camp Edwards.

Ms. Palmer also reported that on November 18, 2009, the SAC voted unanimously to support use of the grenade simulators and recommended an update and review after two years. On December 3, 2009, the EMC's Community Advisory Council (CAC) unanimously concurred with the SAC. And on December 9, 2009, the EMC unanimously voted to support the use of the devices.

Ms. Palmer then reviewed the general regulatory requirements (contained in the EPSs and Range Regulations) by noting that grenade simulators cannot be used in wetland buffers, in water supply Zone I areas, in noise-sensitive areas, near the fence-line, or when conditions indicate a fire hazard. Also, soldier must police up debris as required by regulation and policy.

Ms. Palmer then reviewed the reasons why pyrotechnic training at Camp Edwards is so valuable: improvised explosive devices (IEDs) cause 80% of the casualties in Afghanistan; many required training activities prior to soldiers' deployment are focused on reacting to contact; combat usually takes the form of an explosion from either indirect fire or an IED; factors that create realism, smoke, dust, noise, and pressure all help create the confusion associated with realistic battle conditions; and soldiers can meet more training requirements closer to home, with less time spent away from their families and their civilian jobs. Ms. Palmer mentioned that the grenade simulators are expected to be available for training at Camp Edwards this summer. She also remarked that Massachusetts' deploying soldiers deserve the best training that can be provided, and the hope is that proper training, along with environmental stewardship, will save lives.

Mr. Dinardo asked why the small amount of perchlorate in the reformulated ground-burst simulator can't be eliminated completely. Dr. Ciaranca explained there's a whistle in the ground-burst simulator and the 1 gram of perchlorate is the oxidizer that allows that whistle to blow. Ms. Palmer added that research is being done to see if the perchlorate can be eliminated entirely.

Mr. Reif asked if the grenade simulators are currently in production. Ms. Palmer replied that approval has been given for production of a batch of the devices for training this summer. Mr. Reif then asked if the simulators are in use at other military bases. Ms. Palmer replied that the old formulations of the devices are in use throughout the world, but the newly-formulated devices aren't yet available anywhere. She added that the pilot batch was used for the field tests at Camp Edwards.

From EPA

Ms. Jennings clarified that the testing of the perchlorate-containing ground-burst simulator raised questions that still need to be evaluated, and tonight's discussion is focused on the non-perchlorate-containing grenade simulator. She then reminded the group that in 1997 EPA issued AOs governing activities at MMR, which required the investigation of the base and cleanup of contaminants related to training activities, and Administrative Order #2 (AO2) included the suspension of certain training activities (including those involving the use of pyrotechnics and of lead bullets). She also noted, however, that AO2 had contemplated the resumption of certain training activities at the base, as happened recently with the return to use of lead bullets. Ms. Jennings then said that although the AOs included provisions to allow amendments to an order to permit certain training to occur, they can't be modified without some kind of demonstration that the items to be used won't cause an impact to the environment or to the aquifer. Ms. Jennings noted that the demonstration (field test) that Ms. Palmer had described was primarily geared toward the perchlorate-containing item, which has been tabled.

Ms. Jennings then reported that on October 26, 2009, the Guard submitted its petition to EPA requesting approval to use the grenade simulators. The petition included information on the chemical makeup of the devices, as well as how and where they would be used, and the amount that would be used. EPA reviewed the information and determined that use of the items will not pose a threat to the environment (given their chemical makeup and that no more than 1,000 would be used in an area one acre in size).

Ms. Jennings noted that EPA issued a response to the Guard's petition in the form of a letter that contains the agency's findings and authorizes use of the grenade simulator devices. EPA's authorization is limited to two years, however, mostly because of concerns raised by the SAC and because EPA generally operates in a "crawl mode" when it comes to authorizing use of different training devices at the base. Ms. Jennings also mentioned that she expects EPA's role in such matters to decrease once the investigation and cleanup work being led by the Impact Area Groundwater Study Program (IAGWSP) has been completed, at which time EPA would defer to the EMC on such approval matters. She then reviewed the conditions of EPA's two-year authorization: the Guard must comply with all requirements established by the EMC in its approval; and prior to the end of the two-year

period the Guard must provide a summary report of details about the items that were used (the amount, locations, etc.) as well as sampling and analysis data to demonstrate that use of the items is not an issue.

Ms. Jennings reported that as a next step EPA is conducting a 30-day public comment period (from January 14 through February 16, 2010) on its draft response and the information provided by the Guard. Once comments have been received, EPA will issue its final position (including responses to comments) in March 2010. Ms. Jennings then concluded her portion of the Pyrotechnics Update by displaying a slide with her contact information.

Mr. Goddard asked if the petition to use the ground-burst simulator would be submitted separately. Ms. Jennings replied that it would, if the Guard decides it wants to petition for its use. Mr. Goddard also inquired about inventory control associated with the use of the grenade simulators. LTC Bertone, the deputy base commander at Camp Edwards, replied that the simulators would be handled using Range Control's standard operating procedures, in which all materiel and munitions are stored at the Ammunition Supply Point (ASP), and the items need to be on base for a certain period of time before the unit arrives, with key-and-control entry for all products. Ms. Jennings added that her experience with the firing of lead bullets has taught her that "it's pretty tightly controlled and documented."

Mr. Dinardo asked if the Guard is restricted to using no more than 1,000 grenade simulators per year. He also said that he realizes that the calculations were done based on 1,000 items concentrated in a one-acre area. Ms. Jennings replied that the EPA letter focused on the number of devices over a particular area, although a calculation would have to be done if the Guard suddenly wanted to use something like 10,000 of the items. She also said that it is "tricky to put an upper limit on it" because there are many other factors to consider, such as cumulative effects. She added that EPA tried to structure its letter without being too restrictive, but at the same time having enough information to do a calculation "on what its actual impacts would be."

From EMC

Mr. Begley reminded the group of the 2001 Memorandum of Agreement (MOA) between the Army, the Commonwealth of Massachusetts, the Air Force, and others, on the future oversight and joint management of the northern 15,000 acres of MMR. He explained that one of the recommendations in the MOA was for the Commonwealth to put that agreement into legislation, which led to Chapter 47 of the Acts of 2002. He then reported that the EMC is made up of three commissioners (MassDEP, Fish & Game, and Conservation & Recreation), and one staff person (himself). He also noted that the EMC gets input from MassDEP's Lakeville office on various projects, and from Mr. Pinaud of MassDEP and others involved with the Small Arms Ranges (SAR) Working Group. Mr. Begley then stated that the EMC monitors and oversees training and similar activities required to follow the EPSs, but cleanup does not come under the EMC's purview.

Mr. Begley reported that the EPSs, which were initially crafted as part of the Massachusetts Environmental Protection Act (MEPA) process, state that activities must be protective of the groundwater and wildlife habitat, and that "All actions, at any location within the Camp Edwards training areas, must preserve and maintain groundwater quality…" He further noted that it was determined that a procedure to modify the EPSs (such as establishing a way to allow the return of the use of lead bullets) should be developed and that a review process for munitions, such as the simulated munitions being discussed tonight, should be established.

Mr. Begley stated that, as Ms. Palmer reported, the EMC's two advisory councils (the SAC and the CAC) made their recommendations, and the EMC Commissioners voted unanimously to allow use of the grenade simulator devices. The EMC also called for him to write an approval letter that contains conditions pertaining to how the munitions devices would be used, including best management practices (BMPs). Mr. Begley noted that the Guard has already proposed a number of BMPs (no

grenade simulator use in wetland buffers, water supply Zone I areas, noise-sensitive area, or when conditions indicate a fire hazard, and soldiers will police up debris), including that Camp Edwards will track the number of devices that are used.

Mr. Begley stated that EMC plans to issue its approval letter after the conclusion of the EPA comment period, around the same time that EPA issues its approval letter. He explained that as members of the SAR Working Group, the EMC and EPA, as well as the Guard, try to work together in terms of what makes sense in approval letters. Mr. Begley noted that once the approvals have been given, the grenade simulator will be added to the list of approved munitions in the EPSs and, after the two-year period EMC will review the simulated munitions use and monitoring information. Mr. Begley concluded his portion of the presentation by displaying a slide that showed his contact information.

Mr. Pinaud said that, as Mr. Begley stated, MassDEP's role in this issue is as an advisor to the MassDEP Commissioner, one of three commissioners on the EMC. In addition, MassDEP operates in an advisory capacity on the SAR Working Group by reviewing and commenting on each of the items discussed by that group. Mr. Pinaud then noted that with regard to the grenade simulator issue, MassDEP agrees with the conclusions and recommendations made by EPA and through the EMC, and believes that if used as proposed the devices will likely not cause any harm to human health and the environment.

Mr. Goddard asked if units coming to the base from out of state for training with pyrotechnic devices would be briefed on the sensitivity of the habitat at Camp Edwards. MAJ Koski replied that all units coming into a training area have to be certified in order to use the training area and they are thoroughly briefed on all environmental regulations and performance standards that are followed at the base, regardless of where the units come from.

Mr. Dinardo asked if there's a timeline for approval of the ground-burst simulator, which, he understands, is currently off the table. Ms. Jennings replied that a timeline will begin when, and if, the Guard petitions EPA for approval. She also noted that the preliminary demonstration with the ground-burst simulator was "a little surprising" as a fair amount of perchlorate was left behind in the soil, even though the devices contain only 1 gram of perchlorate. She said that as soon as the field test results came back, the Guard made the decision to take the device off the table. She added that it will be up to the Guard to say whether or not (or when) it plans to resume pursuing use of the ground-burst simulator.

Mr. Foster inquired about the type of information that will be reviewed at the end of the two-year period. Mr. Begley replied that he expects that the SAR Working Group members will consult with each other to come up with a format that makes sense in terms of validating the conceptual site model and ensuring that there's really no impact to groundwater. He said that this may include some soil sampling, as well as groundwater sampling at existing monitoring wells. Ms. Jennings added that she thinks the amount of information will depend on how many items are used, but it will probably include both some soil and some groundwater sampling.

Agenda Item #3. Remediation & Investigation Update

Mr. Gregson displayed a map and pointed out the various areas where the IAGWSP has been conducting soil work. He reported that soil containing explosives has been removed, screened, and stockpiled from L Range, Former K Range, J-1 Range, J-2 Range, Former A Range, and the Central Impact Area.

Mr. Gregson noted the following about L Range: 2,700 cubic yards of soil was excavated and subjected to alkaline hydrolysis treatment (mixing lime with the soil to raise the pH and destroy the RDX contamination); soil was excavated to a depth of 6 inches; the target cleanup level was less than 1 ppm; the excavated soil was screened through a one-inch mesh to remove the 40-mm grenades suspected to

exist in the soil, stockpiled, and then run through a pugmill to add lime and placed in a treatment cell; soil samples collected from the treatment cell tested nondetect for explosives; the IAGWSP is proposing to use the treated soil to backfill the excavated area at L Range; and the source removal action will be included as part of the Remedy Selection Plan (RSP) to be presented for public comment in March 2010. Mr. Gregson also showed a figure of L Range, which is located at the southeast corner of the ranges. He pointed out the excavated areas and noted that the grids are 100 feet by 100 feet in size. He also pointed out an excavated area where blow-in-place (BIP) activities had occurred, and noted that once the L Range soil is removed from the treatment cell, it will be used again to treat more soil, probably in March when the weather gets warmer.

Mr. Reif asked if all of the stockpiled soil was treated. Mr. Gregson replied that all of the excavated L Range soil is currently in the treatment cell. Mr. Reif said that he was going to ask how the soil was being stored. Mr. Gregson said that prior to treatment the soil is placed on and covered with polyethylene sheeting.

Mr. Gregson then reported that at Former K Range: 123 cubic yards of soil was removed from Area E; the soil was excavated to a depth of 18 inches; and post-excavation sampling results indicate that no additional excavation is needed. He also noted that about 1,500 cubic yards of soil is being removed from the southern portion of J-1 Range, and about 925 cubic yards of soil will be excavated from the J-2 Extension area at the J-2 Range (three grids will be excavated to six inches, and one grid to one foot). Mr. Gregson also showed figures of the Former K Range, J-1 Range, and J-2 Range and pointed out the areas of excavation, including the 2,000-meter berm at the J-1 Range, and a portion of the Impact Area at the J-2 Extension area. He noted that some high levels of HMX in soil will be removed as part of the work at the J-2 Range.

Mr. Gregson also reported that the approximately 2,500 cubic yards of soil that was removed from Former A Range has been screened and stockpiled and is currently being sampled to determine if it's a candidate for alkaline hydrolysis treatment, as it is possible the soil may contain elevated levels of lead that would preclude such treatment. He then noted that the IAGWSP has been working in two locations at the Central Impact Area – a northern two-acre site where soil was removed to a depth of two feet at most of the location, and a southern site where soil was removed to a depth of one foot. Depending on sampling results, the Central Impact Area soil might undergo alkaline hydrolysis treatment. Mr. Gregson also mentioned that some additional excavation work will be done at the southern site, and once the work has been completed, these source removal actions will be considered in the RSP to be presented for public comment later this year. He then showed a figure of Former A Range and pointed out the railroad/target and excavation areas at the backstop berms, and he showed a figure of the Central Impact Area and pointed the northern and southern excavation locations there.

Mr. Gregson continued his presentation by reporting that 5,000 cubic yards of soil was excavated from Former B Range (North & South), Former D Range, and the M-2 Range in order to remove lead concentrations at these inactive ranges. He then noted the following: the goal to remove soil with lead contamination at concentrations greater than 300 ppm was achieved in most areas, although some additional work is needed; the soil was screened to separate spent bullets/fragments/metal for recycling and to reduce lead levels so it could be reused as a berm on an active range; the IAGWSP is currently looking at alternatives to separate the lead from rocks; and the post-screening results from the soil pile were between 300 and 700 ppm, with most results between 300 and 500 ppm. Mr. Gregson also showed figures of Former B & D Ranges and pointed out the excavation areas there, including a hillside berm at Former D Range. He also showed a figure of M-2 Range and pointed out an excavation area at a target berm, noted that lead levels behind the berm measured between 300 and 465 ppm, and added that the IAGWSP is currently assessing whether some additional excavation work is needed there.

Mr. Dinardo asked if there's a contamination component to the "screen-outs" or if they just undergo normal recycling. Mr. Gregson mentioned the use of a half-inch screen and noted that the current challenge is to develop an economical method of separating metal fragments from rocks so that the metal can be recycled. He noted that one possible method is soil washing, which uses water to separate materials by density. Another possibility is a pneumatic process that uses air instead of water.

Mr. Goddard asked how alkaline hydrolysis works. Mr. Gregson explained that it is a chemical process in which the explosive molecule is broken apart into small chemical components. Mr. Goddard asked if alkaline hydrolysis can be used to treat perchlorate. Mr. Gregson replied that it cannot; rather, it treats explosive compounds such as RDX and HMX, and perhaps TNT and DNT. Mr. Goddard asked if the breakdown products are a problem. Mr. Gregson replied that there hasn't been any concern about the breakdown products.

Mr. Goddard also asked if the soil with lead contamination less than 300 ppm will be reused at the base or transported off site. Mr. Gregson replied that that soil will be used on site to build berms. He explained that reusing the soil for this purpose means that the lead-contaminated soil will be located where BMPs for target berms containing lead are being implemented. Mr. Goddard asked if this applies just to berms that have STAPP bullet-capture systems on them. Mr. Gregson replied that the soil could be used at either STAPP berms or normal target berms, as testing and investigation have shown that lead is unlikely to migrate at the concentrations that are in the soil that's to be reused. Mr. Goddard then asked if it's correct that perchlorate-contaminated soils must be transported off site. Mr. Gregson replied that soil containing perchlorate is typically sent off site, unless there's enough to warrant bringing in a thermal treatment unit to handle the soil. Mr. Goddard then asked if there are other contaminants that can't be treated using alkaline hydrolysis. Mr. Gregson replied that soil from some gun and mortar positions contains 2,4-DNT, which is bound up in nitrocellulose, and it's unclear at this point whether alkaline hydrolysis will be effective at breaking down the nitrocellulose to get to the 2,4-DNT.

Mr. Gregson continued his presentation by discussing groundwater investigations, beginning with the J-1 South plume, an RDX plume that originated at the southern end of the J-1 Range and is migrating southeast into the Forestdale section of Sandwich. He reported that seven permanent monitoring wells are being installed at drive-point sites to help define the location and extent of the southern J-1 Range plume before making a final decision on a remedy. Two of the wells will be installed on Lady Slipper Lane, one on Lichen Lane, three on Grandwood Drive, and one on Grand Oak Road. Mr. Gregson then reviewed profile results from the new wells, which were noted on the slide as follows: RDX detections in the Lady Slipper Lane and Lichen Lane area were lower than in the drive-point (0.17 to 2.5 parts per billion [ppb] compared to 1 to 5.3 ppb in 2008); the detection at Grand Oak Road was slightly higher (1.6 ppb versus 1 ppb in 2008); low-level detections (0.16 to 0.38 ppb) occurred at one of three previously nondetect locations at Grandwood Drive; and the results at the other two Grandwood Drive locations remain nondetect. Mr. Gregson stated that monitoring well screens are being set to correspond to profile results. He also reported that an additional monitoring well was drilled on base, upgradient of the treatment system (near drive-point 389 [DP-389]), in order to obtain more information about the plume. He then showed a figure entitled "J-1 Range New Well Locations" and reminded the group that the plume currently has an extraction well operating at 75 gallons per minute (gpm) to clean up the upgradient portion of the plume. He also displayed another J-1 Range figure with color-coded sampling points showing RDX concentrations less than 0.6 ppb, concentrations from 0.6 to 2.5 ppb, and nondetect.

Ms. Grillo questioned how data from the new well near DP-389 will help in the assessment of plume remediation, when most of the plume is downgradient of it. Mr. Gregson explained that the purpose of that well is to gather additional data on the upgradient portion of the plume, where a treatment system is operating. He also showed a cross-section figure of the J-1 South plume and pointed out the extraction well and the base boundary.

Mr. Gregson then spoke about J-1 North, where two new monitoring wells are being installed at the downgradient edge of the plume in order to understand perchlorate concentrations between some existing wells. He noted that one of the wells has been completed, and Mr. Hill said that he believes that profile results from that well were 0.07 ppb in one interval and a lesser concentration of perchlorate in another interval. Mr. Gregson stated that well screens will be set based on profile results and modeling, and results from those well screens will be used to determine the exact location of the monitoring well to the west. He also noted that results from wells being installed for both J-1 Range plumes will be considered in the RSP to be presented for public comment this March. Mr. Gregson then showed a figure of the J-1 North plume and pointed out its source at the Interberm Area (IBA), Wood Road, and the locations of the two new monitoring wells. He also showed a cross-section figure of the plume and pointed out the source area, Wood Road, and the toe of the plume.

Mr. Gregson then reported that a monitoring well (MW-536) was installed downgradient of Former A Range to assess whether explosives are migrating to groundwater from the Former A Range target area. Profile samples from the well showed RDX detections of less than 0.6 ppb at depths of 198 to 218 feet below ground surface (bgs), which indicates an upgradient source, probably in the Central Impact Area. In addition, perchlorate detections less than the 0.2 ppb reporting limit were seen in several intervals, including those where RDX was detected. Mr. Gregson noted that well screens were set based on these results, particle tracks, and depths of other nearby detections. He also said that this information will be included in the investigation report scheduled to be issued this spring. He then displayed a figure of Former A Range and pointed out the railroad tracks, the new monitoring well, and some existing wells to the east and west.

Mr. Gregson also stated that two monitoring wells are going to be installed this month at L Range to see whether RDX is migrating to groundwater, potentially from the soil area that was excavated. At Bravo Range, three monitoring wells will be drilled this month to determine current groundwater conditions, and soil samples are being collected from the berms to help determine the vertical extent of tungsten contamination beneath the berms. Mr. Gregson showed a figure of L Range and pointed out the two new monitoring well locations, existing downgradient wells, and an existing well in the southern part of the range. He then showed a Bravo Range figure and pointed out the locations of the three new monitoring wells to be installed there.

Mr. Gregson also reported that four new monitoring wells are being installed at Demolition Area 1 (Demo 1), near MW-258 and MW-352, to refine the model and verify plume migration predictions. Findings from the new wells will be included in an annual report. In addition, two new monitoring wells will be installed at Demo 2 to verify that contamination has not crossed the base boundary at significant concentrations. This information will also be included in an annual report. Mr. Gregson also showed a figure of the Demo 1 plume and pointed out the 2-ppb perchlorate contour, and he showed a cross-section figure of Demo 1 and noted that the extraction wells are breaking up the plume. He also showed a figure of Demo 2 and pointed out the source area, the proposed monitoring well locations, and the anticipated plume migration path.

Mr. Reif referred to the Demo 1 cross-section figure, remarked on the resolution that's achieved under ground, and inquired about profile sampling intervals. Mr. Gregson informed him that the IAGWSP takes profile samples at 10-foot intervals for all of its monitoring wells. He also explained that anywhere from one to five 10-foot screens are set in a permanent well, with the depth of the screen based on higher detections or where modeling indicates higher detections would be found. Mr. Reif then asked how the program decides that sampling has been done to an adequate depth to ensure that the full depth of contamination has been identified. Mr. Gregson replied that drilling is done to a depth greater than indicated by the model, profile samples are taken at 10-foot intervals, and generally clean water is detected beneath the plume. If, however, there continue to be detections in the deepest sample, a second well would be drilled or some other measure taken to investigate the deeper portions of the

plume. Mr. Gonser added that in many cases the wells are drilled all the way down to bedrock. Mr. Gregson then showed a cross-section figure of the Demo 2 plume.

Mr. Goddard requested that the IAGWSP include labels for Former A Range and Bravo Range on future plume maps. He also asked if there's a possibility of installing a system to treat the downgradient portion of the J-1 South plume. Mr. Gregson replied that this is a possibility, and he noted that some of the alternatives for the J-1 South plume that were presented last July included active treatment in that part of the plume. He further noted that the purpose of the ongoing investigation is to confirm that the modeling is correct and that the IAGWSP has a good understanding of the contamination that's there. Mr. Goddard asked when results would be available. Mr. Gregson replied that the updated information would be included in the J-1 Range Remedial Investigation/Feasibility Study (RI/FS).

Mr. Goddard asked Mr. Gregson to show a base-wide plume map and then inquired about the status of the perchlorate contamination that led to the Bourne Water District hookup to the Upper Cape Water Cooperative supply. Mr. Gregson said that if that plume still exists, it's currently between two monitoring wells "in this location." He also pointed out the Monument Beach wellfield and reminded the group that the contamination that had been there was a wide area of relatively low perchlorate concentrations (less than the state's 2 ppb standard). Mr. Goddard asked if the IAGWSP had ever pinpointed the source. Mr. Gregson replied that a point source was never identified. He also said that the source area is believed to be gone and what's left of the contamination is very diffuse. Ms. Jennings added that the final decision documents (DDs) for Demo 2, the Northwest Corner, and the Western Boundary (the area about which Mr. Goddard had inquired) are due to be issued very soon. She also noted that a proposed plan for the Western Boundary has been put forth already, and that is monitored natural attenuation (MNA). She further noted that the public comment period on that plan generated a fair amount of comments. She added that responses to comments are being written and the final DD is being tweaked and should be complete by the next MMRCT meeting.

Ms. Jennings also said that she wants to make it clear to the team that EPA has in mind a one- or two-well system for J-1 South and a two-well system for J-1 North, and much of the ongoing investigation work is "trying to hone in on that." She noted that the alternatives will be reviewed at the February MMRCT meeting, and the goal is to present the RSP for both of these plumes at the combined MMRCT/Senior Management Board (SMB) meeting in March.

Mr. Foster asked if it's problematic to drill wells in the winter months of January and February. Mr. Gregson indicated that it is not.

Agenda Item #4. J-1 Range Source Area Update

Mr. Gregson reminded the group that at the December MMRCT meeting he had spoken about the two most important source areas at the J-1 Range: the Firing Point Area and the Interberm Area. The three remaining areas, which he'll be discussing tonight, have no plumes emanating from them. Mr. Gregson also reminded the group that the J-1 Range, which is located in the southeast portion of the base, was used from the 1940s until the late 1980s, first as an anti-tank training range, and later as a contractor munitions testing range, which involved disposal of munitions and other materials by burial and burning. He noted that soil investigations yielded detections of explosives and propellants believed to be the sources of groundwater contamination, with burial and burning activities the most likely and most problematic sources of groundwater contamination found in the J-1 area.

Mr. Gregson stated that the J-1 North plume, which contains RDX and perchlorate, is migrating to the northwest through the Impact Area. The J-1 South plume, which contains RDX only, is migrating off base to the southeast. Mr. Gregson also reported that the IAGWSP has rewritten several sections of the draft J-1 Range RI/FS that was issued in May 2009, the results of which he'll be discussing today and over the next couple of MMRCT meetings.

Mr. Gregson stated that the three J-1 Range areas he'll be discussing tonight are the Southern Flyover Area, the Northern Flyover Area, and the 2000-Meter Berm Area. He also explained that a flyover area is the area on a range between the firing points and the target. He then reported that the Southern Flyover Area was found to contain a tunnel barrier, a mortar disposal area, and a burial site known as Polygon 6.

Mr. Gregson reviewed the Southern Flyover Area findings slide, which noted the following: all large geophysical anomalies were investigated and removed; some large anomalies that remain are associated with steel plates; most anomalies were related to munitions debris and other debris; no live munitions burials were identified in this portion of the range; a few anomalies were inert munitions in disposal pits; and no significant soil contamination was identified. The slide also noted that: some small to medium-sized anomalies remain; single impacted 60mm and 81mm mortars may remain; based on discoveries, it's highly likely that any residual rounds would be inert or inert with live fuzing; and no groundwater contamination is known to exist beneath this portion of the range. Mr. Gregson also showed a figure of the J-1 Range Southern Flyover Area and pointed out the lack of magnetic clutter, the tunnel berm, the mortar disposal area, Polygon 6, and the cleared road area. He also noted that some BIP data were collected at the range, at areas where soil was removed following a BIP activity.

Mr. Gregson also reviewed the Northern Flyover Area findings slide, which noted the following: all large anomalies in this portion of the range were investigated and found to be munitions debris and miscellaneous debris; smaller items identified in this area included inert rounds with live fuzes, and a few unexploded ordnance (UXO) items; and it is likely that additional 60mm mortars and perhaps other ordnance items would be present in the northern portion of the flyover area of the J-1 Range, as the entire portion of the range beyond Row 49 lies within the Impact Area. Mr. Gregson explained that the testing that was done on the J-1 Range overlays with the rounds used for training activities that impacted that general vicinity, which can be seen quite clearly on the geophysical signature. He also noted that some low levels of RDX were found in the Northern Flyover Area, but nothing even close to cleanup standards. He further noted that some soil was removed from BIP locations.

Mr. Gregson then discussed the 2000-Meter Berm Area, which he described as two large soil target berms (A & B) situated at the northwestern portion of the range, used as a primary target for the J-1 Range and also as a target for firing from some gun and mortar positions. He also mentioned that samples were taken at a small topographical depression in this area, as well as at the locations of some old army tanks that were used as targets. Mr. Gregson then reviewed the 2,000-Meter Berm Area findings: no disposal areas were found during investigations; the majority of items recovered were munitions debris and other debris; several inert items with live fuzes were recovered; explosives contamination was found in soils around tank targets, and is being removed; and the Air Force Robotics Laboratory technology demonstration removed soil and munitions from the impact (uprange) faces of the berm. Mr. Gregson noted that the 2,000-Meter Berm Area is entirely within the Impact Area. Geophysical data indicate that the area is heavily saturated with metallic items, and although it's possible that individual munitions items remain in this portion of the range, no concentrations of munitions in burial or burn pits were found. He also said that it's likely that the tank targets were fired upon from multiple firing positions, not just from the J-1 Range. Mr. Gregson then showed a figure of the 2,000-Meter Berm Area and pointed out a tank target location that had RDX concentrations up to 3.4 ppm (which are being removed) and some BIP activity locations.

Mr. Gregson stated that no sources to groundwater were found at the three J-1 Range areas discussed tonight; the main problem areas at the range are believed to the Firing Point Area and the Interberm Area. He also said that all of this information, and cleanup alternatives for the groundwater, will be included in the J-1 Range RI/FS document. The plan is to review the alternatives at the February

MMRCT meeting, present the RSP at the March meeting, hold a public comment period on the document, and then prepare a final DD and Response to Comments.

Agenda Item #5. FS-12 Update

Ms. Forbes stated that the Fuel Spill 12 (FS-12) plume, which is located near Snake Pond in the town of Sandwich, was defined by exceedances of two contaminants of concern (COCs): ethylene dibromide (EDB), which has a maximum contaminant level (MCL) of 0.02 micrograms per liter (µg/L); and benzene, which has an MCL of 5 µg/L. The historical maximum EDB concentration was 890 µg/L and the historical maximum benzene concentration was 2,700 µg/L, and these detections occurred in extraction well 14 (EW-14) when it was being installed in November 1996. In 2009, the maximum EDB concentration was 23.1 µg/L (at MW-55, near the southern toe extraction fence), and the maximum benzene concentration was below the MCL, at 1.1 µg/L (at a well near the source area). Ms. Forbes said that because of its remediation and natural degradation, benzene is no longer an issue at FS-12.

Ms. Forbes reported that the FS-12 source area is located on base, at the site of a fuel release from an underground pipeline. The release, which, based on calculations, is estimated to have been 72,000 gallons, and is thought to have occurred between 1969 and 1970, was a mixture of aviation gasoline (AVGAS) and JP-4 (jet fuel). Ms. Forbes noted that AVGAS contains EDB, although jet fuel does not. She also mentioned that the plume, which migrated off base in Sandwich, is detached from its source area.

Ms. Forbes showed a 1996 aerial photograph of the FS-12 source area and pointed out the air sparging (AS)/soil vapor extraction (SVE) treatment system that operated there between 1995 and 1998 to clean up the source area soils near the water table. She explained that AS/SVE treatment involves pumping air into the ground to encourage biodegradation and help volatilize hydrocarbons entrained within the soil matrix and at the water table, and then extracting and treating those vapors by carbon and a catalytic oxidizer. She pointed out on an aerial photo: where the woods were cut to lay lines for the AS/SVE system; the source area; Greenway Road; the fuel release location; and the fence line at the base boundary. She also reported that over the lifetime of its operation, the AS/SVE system remediated about 45,000 pounds of product.

Ms. Forbes then displayed a figure entitled "Temporal Changes of EDB Concentrations at FS-12," which showed plume depictions from 1996/1997, from 2000, from 2005, and from 2009. She pointed out EW-14 and MW-55, noted that the plume is no longer defined in the source area, and said that source area remediation, natural attenuation, and the pump-and-treat system have done a good job cleaning up the plume.

Ms. Forbes reported that at startup, in September 1997, the treatment system was operating 25 extraction wells and 23 reinjection wells, and was pumping at 772 gpm. Over the years several optimizations of the system have been conducted, including modifying flow rates, packering off extraction well screens, and converting a reinjection well into an extraction well. By December 2009, the system was operating four extraction wells and 20 reinjection wells, and pumping at 360 gpm. Ms. Forbes then showed a figure entitled "FS-12 Plume 1997 and 2008 Comparison" and pointed out on the 1997 portion three extraction wells that the Air Force Center for Engineering & the Environment (AFCEE) had begun to install but never used because additional investigation had shown that there wasn't enough mass in that area to justify hooking up the wells. She noted that the IAGWSP ended up using one of those wells for its J-3 Range plume treatment system, which includes two additional extraction wells. She also pointed out the FS-12 treatment plant, where the groundwater is treated using carbon and then returned to the aquifer via reinjection wells.

Ms. Forbes also showed a photo of the FS-12 treatment plant, as well as a "Process Flow Diagram." She pointed out where the water enters the plant, the equalization tank, the pre-filters, the carbon

filters, the effluent holding tank, and where the water exits the plant to go the reinjection wells. She also pointed out the IAGWSP's J-3 system components that are housed in the FS-12 treatment plant, and explained that the J-3 treated groundwater ends up in same effluent holding tank as the FS-12 treated groundwater, and is returned to the aquifer via the FS-12 reinjection wells. Ms. Forbes described this arrangement as a "great reuse of an existing system" that saved taxpayer money.

Ms. Forbes stated that since startup through September 2009, the FS-12 treatment system has treated approximately 4 billion gallons of groundwater and removed nearly 135 pounds of EDB and nearly 218 pounds of benzene (or enough EDB to put 1.2 million Olympic-sized swimming pools at the 0.02 ppb EDB MCL). She also noted that approximately 27,000 gallons of AVGAS would have contained 135 pounds of EDB. Ms. Forbes further noted that model projections indicate that EDB exceedances in groundwater will persist beyond 2048. However, there is uncertainty associated with models (which are always being refined based on actual field data), and AFCEE's aggressive optimization program is always looking to expedite cleanup and/or reduce the cost of cleanup and its impact on the environment.

Mr. Reif asked if the 27,000 gallon number Ms. Forbes mentioned means that 45,000 gallons of AVGAS remains, based on the estimated 72,000-gallon release. Ms. Forbes pointed out that it's important to remember that some of the contamination was removed by the source area remediation and some has naturally attenuated. She also said that AFCEE has never really done the kind of mass balance to say that a certain amount still has to be remediated. She further noted that if there was that much free product AVGAS left, "we would be seeing it all over the place." Mr. Reif remarked that the monitoring wells aren't showing that that level still exists. Ms. Forbes agreed and emphasized that the amount of the release was an estimate, as good records are not available.

Ms. Jennings asked for an explanation of how AFCEE arrived at the 72,000 number as its estimate. Mr. Davis replied that it was based in part on what could be seen of free product at the time – its depth, how far it had spread. And that included AVGAS and JP-4, although it's unknown how much of that was AVGAS and how much was JP-4. He also said that a literature search yielded a number for how much EDB was in a gallon or liter of AVGAS.

Ms. Forbes continued with her presentation by reporting that the FS-12 plume poses no current risk of exposure, as the residences in the immediate vicinity of the plume were connected to municipal water. She also mentioned AFCEE's Private Well Verification Program, which is part of the Land-Use Controls (LUCs) Program, and said that AFCEE will be looking at the FS-12 area at the end of this year. Ms. Forbes further noted that no COCs have ever been detected in Snake Pond surface water, which is sampled twice a year. She also briefly reviewed FS-12 costs: approximately $1 million for fiscal year 2009; approximately $37 million for 1997 through 2009; and approximately $18 million projected from 2009 through 2038 (which is the extent to which the budget is done).

Ms. Forbes then discussed a remedial system optimization that came about after relatively high concentrations of EDB (about 55 µg/L) were being found between two axial extraction wells, in what appeared to be a hydraulic stagnation zone. To try to eliminate hydraulic stagnation zones, Mark Hilyard, CH2M Hill's FS-12 plume manager for AFCEE, recommended turning off some of the northern axial wells (EW-14, EW-15, EW-17, and EW-18), thereby allowing the plume to migrate freely to downgradient EW-19 where it would be captured, and possibly expedite cleanup time. Another recommendation was to turn off southern toe fence extraction wells EW-24 and EW-27, as they were no longer contributing to capture of the plume. The two recommendations, which were implemented in July 2008, resulted in a reduced total flow from 545 gpm to 360 gpm. Ms. Forbes also mentioned EW-31, the reinjection well that was converted to an extraction well in order to handle some unexpected mass found in 2000. She then explained that influent concentrations are expected to increase when less clean water is being pumped, and she showed a graph depicting FS-12 treatment

plant influent concentration trends from January 2002 to February 2009 and pointed out the effect of optimization scenarios implemented in 2005, 2006, and 2008.

Ms. Forbes then displayed a slide entitled "FS-12 Treatment System Summary" and reported that from May 2008 through May 2009, the FS-12 system treated nearly 200 million gallons of groundwater, removed 0.8 pounds of EDB, and underwent two carbon exchanges, with most extraction wells operating at 95% to 99% design rates. She also noted that the system used 939 megawatt hours of electricity, and pointed out on the slide the list of emissions related to the use of that electricity.

Ms. Forbes then showed a figure of the FS-12 monitoring network and pointed out the upgradient, downgradient, and side-gradient monitoring wells, which are sampled for EDB and volatile organic compounds (VOCs). She also pointed out the two surface water sampling locations at Snake Pond – near the two beach areas. She noted that surface water sampling, which occurs twice a year (in April/May and in July), has never yielded any detections of FS-12 COCs.

Ms. Forbes then showed a figure entitled "EDB Concentration Trends in Selected FS-12 Monitoring and Extraction Wells" and said that concentrations are decreasing overall. She also noted that any increases are not unexpected, but are just contaminant mass migrating downgradient toward extraction wells were it will be captured. Mr. Reif inquired about monitoring wells downgradient of extraction wells where concentrations might be increasing. Ms. Forbes clarified that those monitoring wells are located to ensure that nothing is migrating beyond the southern toe extraction fence. She noted that those monitoring wells always test clean, which indicates that the extraction fence is operating properly.

Ms. Forbes then showed a cross-section figure of the plume and pointed out the extraction well screens that were packered off in order to prevent extracting clean water, and instead extract water right from the plume itself, thereby increasing the efficiency of cleanup. She also mentioned that, like the IAGWSP, AFCEE also collects profile samples at 10-foot intervals in order to gain a good understanding of a plume's location.

Ms. Forbes also informed the group about the University of Massachusetts, Amherst (UMass) microcosm study to investigate the biodegradation of EDB under ambient and enhanced conditions. She said that the study involves evaluating kinetic data and the biodegradation activity within the plume, whether aerobic or anaerobic. If UMass determines that biodegradation is occurring, that information could be used to refine AFCEE's fate-and-transport models. If it's found not to be occurring, however, the study will look at whether biodegradation can be made to happen, by adding nutrients or substrate food sources. Ms. Forbes stated that AFCEE signed an agreement with UMass in August 2009, at which time UMass began its literature review. In October 2009, AFCEE provided soil cores; then UMass created microcosms, using actual site soil and groundwater in order to be as representative as possible. UMass is providing quarterly progress reports on this one-year project and will provide a final report at the end. Ms. Forbes also showed several photographs of the soil cores being obtained from the FS-12 plume area in October 2009.

Ms. Forbes then reviewed the "Conclusions" slide, which noted the following: the FS-12 plume is being contained by the treatment system, which is very effective at removing EDB; concentrations are declining and groundwater monitoring data show the plume to be collapsing horizontally and vertically; there are no reportable detections of EBD at monitoring wells located north of EW-14; concentrations of EDB at monitoring wells located between EW-31 and the axial fence continue to decrease, primarily due to operation of EW-31; no EDB is detected south of the southern toe extraction fence; no EDB is detected in Snake Pond surface water; benzene concentrations have been below MCL since 2006; and benzene was detected at one source area well, with concentrations continuing to be below the MCL.

Ms. Forbes also reviewed the "Recommendations/Next Steps' slide, which noted the following: continue operating the treatment system and optimize when opportunities are identified; continue monitoring under the System Performance and Ecological Impact Monitoring (SPEIM) program and optimizing the monitoring network; update the EDB plume shell and the outline; continue the Private Well Verification Program; and continue conducting the microcosm tests at UMass to study EDB biodegradation under both ambient and enhanced conditions.

Mr. Dinardo requested an update on the wind turbine and its effect on the budget. Ms. Forbes replied that a wind turbine update could be scheduled for a future MMRCT meeting.

Mr. Davis noted that last year AFCEE purchased approximately 19% of its electricity from green sources, which still needs to be rolled into the emissions number. He also asked for confirmation that the UMass microcosm study is being conducted under refrigerated conditions. Ms. Forbes confirmed that it is.

Agenda Item #6. Next Meeting Schedule and Adjourn

Mr. Goddard asked if it's correct that the March meeting will be a joint MMRCT/SMB meeting. Mr. Karson replied that that is the plan. Mr. Goddard also said that he believes that Selectmen Mealy of Bourne had mentioned that the SMB is dissolving as a board. He then asked if a discussion on the future of the SMB could be included as an agenda item at the March meeting. Ms. Jennings explained that the regulators, AFCEE, and the IAGWSP scope out the technical agenda items for the meeting, which the SMB will review at its planning meeting. She also said that she thinks that a discussion about the SMB's future could be included on the agenda, as it is "kind of an ongoing topic."

Mr. Karson stated that the MMRCT would meet next on Wednesday, February 10, 2010. He then adjourned the meeting at 8:14 p.m.