Massachusetts Military Reservation Cleanup Team (MMRCT)
Building 1206
Camp Edwards, MA
October 13, 2010
6:00 – 8:15 p.m.

Meeting Minutes

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Action Items:

1. At a future meeting, AFCEE will present Crooked Pond sentry well sampling data and any additional plans and data for groundwater investigations associated with the leading edge of CS-20.

2. The IAGWSP will provide the regulators with a tungsten investigation XRF data table.

Handouts Distributed at Meeting:

1. Response to Action Item from the September 8, 2010 MMRCT Meeting
2. Presentation handout: Southwest Plumes Update
3. Packet of figures to accompany Southwest Plumes Update
4. Presentation handout: Military Munitions Response Program (MMRP) Overview
5. Presentation handout: Demolition Area I Groundwater Monitoring Update

6. Presentation handout: Demolition Area 2 Groundwater Monitoring Update
7. Presentation handout: Remediation & Investigation Update
8. MMR Cleanup Team Meeting Evaluation Form

Agenda Item #1. Introductions, Agenda Review, Action Item Review, Approval of September 8, 2010 MMRCT Meeting Minutes

Ms. Donovan convened the meeting at 6:05 p.m. and the Massachusetts Military Reservation Cleanup Team (MMRCT) members introduced themselves. Ms. Donovan reviewed the agenda and asked if there were any comments on the Response to the Action Item from the September 8, 2010 MMRCT meeting. No comments were offered. Ms. Donovan then asked if there were any changes or additions to the September 8, 2010 MMRCT meeting minutes. No changes were offered and the minutes were approved as written.

Agenda Item #2. Southwest Plumes Update/CS-4 Optimization

Mr. Davis displayed a map and pointed out the Southwest Plumes (Chemical Spill 4 [CS-4], CS-20, CS-21, and Fuel Spill 29 [FS-29]), Route 151, the Southwest Plumes remediation systems, the Coonamessett Reservation, and the Crane Wildlife Management Area. He reminded the group of the contaminants of concern (COCs) in the Southwest Plumes: tetrachloroethene (PCE), trichloroethene (TCE), 1,1,2,2-tetrachloroethane (1,1,2,2-TeCA), and ethylene dibromide (EDB) at CS-4; PCE at CS-20; TCE at CS-21; and EDB and tetrachloride ($CC1_4$) at FS-29. He also reviewed a chart that showed maximum contaminant concentrations during the recent reporting period (May 2009 through September 2010) and historical concentrations (since 1996) and noted that the COCs at FS-29 were both below their respective cleanup levels during the recent reporting period.

Mr. Davis noted that Phase I of the Southwest Plumes remedial system (CS-4/CS-20) started up in December 2005 and Phase II (CS-21/FS-29) started up in September 2006. He then reported that the Hunter Avenue Treatment Plant, where groundwater from the Southwest Plumes is treated, also began treating groundwater from the Landfill 1 (LF-1) and CS-23 plumes in December 2006. Mr. Davis showed a figure entitled "Southwest Plumes SPEIM (System Performance and Ecological Impact Monitoring) Chemical Network" and pointed out the monitoring wells (color-coded to indicate whether they are sampled triennially, annually, or semiannually), active extraction wells, extraction wells that have been shut off, active reinjection wells, reinjection wells that have been shut off, and the sentry wells associated with Falmouth's Crooked Pond public water supply well (which has wellhead treatment).

Mr. Davis then reviewed a slide pertaining to combined costs for all four Southwest Plumes: $2.27 million for fiscal year 2010, which includes an allocation to each plume for the new wind turbine project; $51.7 million for the years 1997 through 2010, which includes water hookups, easements, and the like; and $9.8 million in estimated costs from 2011 through 2038. It was also noted on the slide that the estimated costs assume that the CS-4 system operates until 2015 and is monitored until 2024, CS-20 operates until 2017 and is monitored until 2022, CS-21 operates until 2028 and is monitored until 2038, and FS-29 is monitored until 2019.

Mr. Davis then showed a "spider diagram" figure entitled "CS-20 PCE Concentration Trends at Selected Monitoring Locations." He noted that overall there is a decreasing trend in concentrations, although at the trailing edge of the plume concentrations had been going down, but seem to be coming back up. Mr. Davis also noted that the maximum contaminant level (MCL) for PCE is 5 micrograms per liter (µg/L). He then reminded the group that although there are two extraction wells operating at CS-20, the Record of Decision (ROD) called for three wells, but it was not possible to install the third extraction well (at the toe of the plume) because of access issues. The decision to forego construction and enhance monitoring in that area was documented in an Explanation of Significant Differences

(ESD), and modeling predicted that some concentrations would move through the area south of the last extraction well. Mr. Davis then pointed out a monitoring well where concentrations are now slightly less than 30 µg/L, and he pointed out another well at the end of Raspberry Path where concentrations are now slightly less than 20 µg/L. He also: noted that the plume outline was extended to include those concentrations; pointed out the farthest extent the contamination is expected to reach according to the groundwater model; reported that an additional monitoring well was installed last year to help track this uncaptured portion of the plume; and said that it's been reconfirmed that all of the homes in the toe area of CS-20 are on town water.

Mr. Saucier asked if Deep Pond is used for recreation and Mr. Davis confirmed that it is. Mr. Saucier then inquired about any type of warning that contamination is traveling toward the pond. Mr. Davis replied that the pond water is routinely sampled, with results being nondetect. He also noted that the cross-section figure of the toe of the plume includes a monitoring well near the pond, which, although it previously tested nondetect, in the latest sampling event showed a concentration of 9 µg/L. He further noted, however, that should that kind of concentration discharge into the pond, it would be undetectable as it would dilute immediately upon entering the pond.

Mr. Davis then showed the cross-section figure, pointed out the southern extraction well and the direction of groundwater flow, and noted that pieces of the uncaptured part of the plume are starting to show up in different monitoring well screens. He also said that it doesn't appear that the contamination in that area is continuous and that it's thought that the pumping of the southern extraction well pulled some of the contamination back into it.

Mr. Davis continued with his presentation by showing a figure entitled "CS-21 TCE Concentration Trends at Selected Monitoring Locations" and noting that the CS-21 plume is located under the Ballymeade area. He said that the toe of the plume, as it used to be depicted, no longer exists as concentrations there have dropped below the MCL. Consequently, the extraction well there has been shut off. Three extraction wells continue to operate, and there's evidence that the plume is beginning to break up. Mr. Davis also noted that in response to an increase in concentrations at the trailing edge of the plume, which was discussed at an MMRCT meeting a couple of years ago, drilling was conducted in about seven different upgradient locations and no widespread contamination was found.

Mr. Davis then showed a figure entitled "FS-29 EDB and $CC1_4$ Concentration Trends at Selected Monitoring Locations." He noted that one of the FS-29 extraction wells was shut off earlier this year, and the other was shut off a couple of weeks ago because the monitoring network was no longer showing any above-MCL contamination. He also explained, however, that the extraction wells have not been shut off permanently and so could easily begin operating again if monitoring results indicate the need for additional treatment. Mr. Davis then noted that even though the monitoring network shows no EDB concentrations above MCL, a plume continues to be depicted because of mass detected a year ago (at 0.08 µg/L) that's thought to still exist, but isn't currently located at a monitoring well.

Mr. Goddard asked if it's correct that no MCL exceedances of either EDB or $CC1_4$ are currently being seen upgradient of the extraction well that was recently shut off. Mr. Davis confirmed that that's correct. Mr. Goddard then asked what would happen if an MCL exceedance is detected beyond the area downgradient of the extraction well. Mr. Davis explained that sampling is conducted on a semiannual basis right at the well location, so any contamination that went by would be within the capture zone of the well (it would be pulled back by the well). Mr. Davis also mentioned that FS-29 will probably be the first plume to go through the 3-Step Process (the process for moving a groundwater area from system shutdown, through monitoring, and eventually to site closure).

Mr. Davis then showed a figure entitled "CS-4 PCE, TCE, and 1,1,2,2-TeCA Concentration Trends at Selected Monitoring Locations" and noted that two extraction wells are operating at CS-4. He also

reported that the Air Force Center for Engineering and the Environment (AFCEE) recently went through a CS-4 optimization analysis, which he would discuss in detail later in the presentation.

Mr. Davis then showed an "Overview of Remediation" slide for CS-4/CS-20, which noted that during the reporting period: at CS-4 two extraction wells operated at 170 gallons per minute (gpm); at CS-20 two extraction wells operated at 773 gpm; the system treated 530 million gallons of groundwater; and 12.5 pounds of PCE and 1.9 pounds of TCE were removed. It was also noted that since system startup 101.5 pounds of combined COCs were removed, which is enough PCE/TCE to put approximately 3,690 Olympic-sized swimming pools at the MCL of 5 µg/L. Mr. Davis also reviewed an "Overview of Remediation" slide for CS-21/FS-29, which noted that during the reporting period, before the toe extraction well was shut down: at CS-21 four extraction wells operated at 1,397 gpm; at FS-29 one extraction well operated at 224 gpm; the system treated 780 million gallons of groundwater; and 23.5 pounds of TCE and 1.1 pounds of $CC1_4$ were removed. Since system startup the 117 pounds of combined COCs were removed, or enough to put approximately 4,250 Olympic-sized swimming pools at the MCL of 5 µg/L.

Mr. Davis also displayed a figure entitled "Southwest Plumes Remedial Systems Electrical Consumption and Associated Air Emissions – Impact of Renewable Energy Use." He noted that for CO_2, as an example, 1,499 tons was estimated to be emitted during the reporting period. He then explained that because AFCEE has switched its portfolio to "Green Power" purchases, that number was reduced by 661 tons, and reduced further, by 111 tons, due to operation of the MMR wind turbine, bringing the actual number to 727 tons emitted. Mr. Davis stated that AFCEE's goal is to reduce that number to zero by obtaining its power from green sources and the new wind turbines that are going to be built.

Mr. Pinaud referred to Mr. Saucier's inquiry about Deep Pond and asked if it's correct that AFCEE provides this type of information at its annual briefings with the selectmen and Boards of Health. Mr. Davis confirms that it does. Mr. Pinaud asked if it's correct then that the towns are aware of the sampling results from the ponds. Mr. Davis confirmed that it is, but also noted that AFCEE's spot on the Falmouth Board of Health agenda has been put off about five times this year and so AFCEE is now looking into meeting with the Board of Health chairman directly. Mr. Pinaud noted that although there are always some scheduling conflicts, AFCEE does meet with these local groups every year. Mr. Davis confirmed that that's the case.

Mr. Davis then turned the group's attention to the CS-4 optimization analysis. He explained that while AFCEE always works collaboratively with the regulatory agencies, for the CS-4 optimization AFCEE worked collaboratively with the agencies to develop a documented, systematic approach to treatment system optimization. He also noted that the development of a documented approach was recommended by an Air Force peer-review team. Mr. Davis then reviewed the basic steps of system optimization: identify optimization opportunities; update assessment tools and determine whether additional data are needed; develop and compare alternative approaches; select an alternative; obtain approvals; and implement and observe.

Mr. Davis displayed a flow chart entitled "Collaborative Process for Optimizing Remedial Actions." He then mentioned that some "jump-out" points exist – for example, since the CS-4 toe extraction well was pulling in clean water, it was agreed that three months of testing was not necessary in order to determine that the well no longer needed to operate. Mr. Davis also pointed out that the flow chart includes information about the development of the Technical Memorandum that describes the optimization evaluation process.

Mr. Goddard asked if the documented optimization process and AFCEE's "green remediation" efforts are being shared across other Department of Defense (DoD) cleanup sites. Mr. Davis replied that AFCEE has briefed on the green remediation topic at about eight different conferences around the

country; DoD is including this information in its presentations; and he's seen information about the turbine on U.S. Environmental Protection Agency (EPA) websites. Mr. Davis also said that the optimization flow chart has been integrated into the Air Force's processes, and it's being shared with other branches of the military as well.

Mr. Davis continued discussing the CS-4 optimization by noting that AFCEE collected additional data (from direct-push locations and existing wells) and updated the groundwater model before evaluating multiple pumping schemes. He then showed some computer animations of the alternatives, beginning with the base-case alternative (extraction well 14 [EW-14] and EW-15 pumping), and pointed out that it appears that some clean water is being pumped. He also showed the Scenario 4 animation (the selected alternative), in which EW-14 and EW-15 continue to operate, but with the top of the well screens packered off in order to prevent pumping the clean portion of the aquifer. Mr. Davis noted that, like the base-case scenario, this scenario maintains capture and achieves cleanup in the 2015/2016 timeframe, but without having to pump as hard. He also showed the Scenario 5 animation, which he described as a stability analysis in which the entire system is shut off to determine whether the plume is stable. He noted that the animation shows that the plume migrates, which means that it is an unstable situation and the extraction wells must continue to operate in order to maintain capture. Finally, Mr. Davis showed another animation in which both extraction wells were shut off, the plume was allowed to migrate, and then the downgradient well was restarted, to see if this would improve the cleanup timeframe. Modeling indicated, however, that this approach would in fact extend the cleanup timeframe and re-contaminate areas that had already been cleaned up.

Mr. Davis said that it was beneficial to work with the regulatory agencies, look at the different scenarios, and come up with a selected optimization. He also said that the MMRCT can expect to hear about optimization every time there's a briefing on a set of plumes, as optimization is an ongoing iterative process. He then reminded the group that no extraction wells are currently operating at FS-29, but AFCEE is sampling the nearby monitoring wells on a more frequent basis in order to be ready to restart the wells if necessary. He also reviewed the "Recommendations/Next Steps" slide: optimize CS-20 and CS-21 (toe well already shut off); operate remedial systems at optimized flow rates and monitor performance; perform required plume monitoring, and closely watch the toe area at CS-20.

Ms. Rielinger referred to CS-20 and the shallow well near Deep Pond and asked if there are other shallow wells in that area, given that the plume historically has been deep. Mr. Davis replied that there are not, but noted that there might be room to fit one more well there, if necessary, based on whether there are repeated concentrations in the shallow well screen. Ms. Rielinger inquired about the sampling frequency for the shallow well there, and Mr. Davis replied that it's sampled annually. Ms. Rielinger asked if there's a plan to increase that frequency. Mr. Davis said that there is not at this time, and added that the next sampling round will occur in March 2011. Ms. Rielinger also asked how the model prediction compares with measured concentrations in the toe area. Mr. Davis replied that there are higher concentrations and the plume has migrated a little farther than the model predicted. Ms. Rielinger then asked if the model indicated that the contamination would become shallower in that area. Mr. Davis ran an animation for the CS-20 plume and said that it does not appear that the model predicted that. He also noted that the model predicted contaminant concentrations up to about 15 µg/L, while measured concentrations in the area are about 29 or 30 µg/L, and that the plume has traveled a couple hundred feet farther than predicted. Ms. Rielinger asked if the MMRCT would be briefed on monitoring results from the March sampling. Mr. Davis replied that he would make sure that the CS-20 sentry well sampling data would be shared with the team, when available.

Mr. Foster inquired about the CS-23 plume. Mr. Davis clarified that CS-23 is not one of the Southwest Plumes, but added that it will be discussed at the December MMRCT meeting as part of the LF-1/CS-23 plume update. Mr. Foster then asked if the Hunter Avenue Treatment Plant is operating efficiently. Mr. Davis replied that the plant runs very well. He also noted that – unlike water associated with the Ashumet Valley plume (wastewater) or the LF-1 plume (a landfill) – the water being treated in the

Hunter Avenue Treatment Plant is very clean and therefore doesn't require any pretreatment. He noted that the carbon lasts a long time at the plant and, with the optimizations, it was determined that the booster pumps (to help push water though the carbon vessels and out to the reinjection field) could be shut off, which increased energy savings.

Mr. Taylor asked, regarding CS-20, whether AFCEE had spoken to the chairman of the Falmouth Board of Health. Mr. Davis called on Mr. Karson to answer this question more thoroughly, but first clarified that the Board of Health is familiar with the fact that there's an uncaptured portion of the plume. Mr. Karson said that for several months he's been working with David Carrigan, Falmouth's health agent, to try to set up an appointment with the Board of Health, whose agendas have been full. He also noted that he recently sent an email to Mr. Carrigan requesting to meet with him one-on-one initially, but has not yet received a response. Mr. Karson added that he will follow up with a phone call to Mr. Carrigan and try again to set a date with the Board, at which time the CS-20 information will be presented, as well as any other issues related to Falmouth,

Mr. Taylor suggested emailing Ray Jack, Falmouth's director of Public Works, as it appears that the plume could be close to the Crooked Pond water supply well. Mr. Davis replied that the data reported at tonight's MMRCT meeting have already been shared (via the sentry well program) with the state, Mr. Jack, and his consultant. Mr. Davis also noted that AFCEE had funded more than $5 million for wellhead treatment at the Crooked Pond well, which is operating at this time.

Mr. Saucier said that according to the cross-section figure, it appears that Deep Pond is about 20 feet deep. Mr. Davis replied that that would be fairly accurate. Mr. Saucier also said that the cross-section figure indicates that the plume is about 30 feet deeper than the bottom of the pond. Mr. Saucier then referred to the CS-20 spider diagram and asked if Ms. Rielinger had been referring to the two monitoring wells at the toe of the plume when speaking about shallow wells. Mr. Davis showed the CS-20 toe cross-section figure and pointed out the two wells (MW-19A,B,C and MW-1507), which, he noted, are not labeled on the spider diagram. He also mentioned that the two deeper screens at MW-19 tested nondetect, while the shallow screen had a detection of 9 µg/L in the April 2010 sampling event. Mr. Dalrymple added that the shallow screen tested below-MCL the first time it was sampled, and he believes that the two deeper screens tested nondetect both times.

Mr. Saucier remarked that the detection in the shallow screen seems to indicate that the plume is rising in the aquifer. Mr. Dalrymple replied that it's thought that a piece of the plume may be splitting off, and he is curious whether it's traveling just above the middle well screen. He also said that he doesn't think that the majority of the plume is traveling toward the pond because he doesn't think the gradients are steep enough. Mr. Saucier said that in the animation it looked like the plume was going away from Deep Pond, but he wonders whether there's some sort of device to take a grab sample from the bottom of the pond if it turns out otherwise. Mr. Davis replied that it wouldn't be worthwhile to make a special effort to take grab samples from the pond bottom since even contaminant in the hundreds of parts per billion (ppb) dilutes so rapidly upon discharging to a pond that it can't be detected. He also said that while no one wants to see any concentrations in surface water, the ambient water quality standard is 1,000 ppb. Mr. Davis also acknowledged the psychological concern, however, and said that that is why routine pond sampling is conducted.

Mr. Saucier then said that he's surprised that AFCEE is having a hard time getting on the Falmouth Board of Health's agenda. Ms. Donovan asked if AFCEE has an update scheduled with the Board of Selectmen. Mr. Davis replied that it does not, and added that such updates are handled through the Environmental & Readiness Center (E&RC). Mr. Karson added that the E&RC's annual updates are not always environmentally-focused, so he is not always invited to participate. Ms. Donovan asked if Mr. Karson knows when the E&RC plans to update the Boards of Selectmen next. Mr. Karson replied that he does not. Mr. Davis mentioned the idea of MMRCT citizen members encouraging the Board of Health to schedule an AFCEE update. Mr. Karson noted that the Bourne and Mashpee Boards of

Health quickly accepted AFCEE's offer to provide an update, and the update to the Sandwich Board of Health is scheduled for next Monday.

Ms. Jennings referred to the CS-20 cross-section figure and noted that there really aren't any well screens between MW-18B (a 29 µg/L detection) and MW-19C (a 9 µg/L detection), so it seems to her that some artistic liberty was taken in terms of not drawing a connected plume between the two. Mr. Davis said that he had also asked about this and was told that the temporal data do not support continuous contamination in that area. Ms. Jennings questioned how the temporal data that are needed could be available if there's no well screen in front of the 29 µg/L detection, and she noted that the detection at MW-13A is deeper. Mr. Davis said that he thinks it has to do with travel time and there not having been any contamination above MCL in the deeper screen at MW-19. Ms. Jennings then inquired about the source of contamination seen at MW-18. Mr. Davis replied that it might have been a whiff of contamination that could have passed through before a sampling event, which would support the idea of blobs of contamination as opposed to continuous contamination. He also reminded the group that cross-section figures are exaggerated in the horizontal.

Mr. Taylor asked to see a plan view figure of the CS-20 plume. Mr. Davis showed the plan view and noted that the plume boundary line doesn't extend as far as the monitoring well with the 9 µg/L detection. He also noted that the plume depiction was drawn one year ago. Mr. Taylor said that he doesn't think the plume is truly defined because there aren't enough data points.

Mr. Pinaud said that he thinks it's fairly clear that some additional data points are needed at the leading edge of the plume, downgradient of MW-1507. He mentioned the idea of a new well with a shallow and a deeper screen in order to determine what's potentially coming up in the pond and what might be flowing under it. Mr. Pinaud also said that in plan view it appears that the plume might be skirting the outside edge of Deep Pond, and added that intuitively it doesn't seem that that shallow pond would have enough influence to pull the plume from that deep. Mr. Davis mentioned some potential access problems in that area. Mr. Pinaud acknowledged that access in that area has historically been "pretty tough," but he and Mr. Davis agreed that there might be some room for additional data points. Mr. Davis also indicated that he thinks it makes sense to see the next round of sampling data first, before adjusting the monitoring program.

Agenda Item #3. Military Munitions Response Program Overview

Mr. Davis stated that the purpose of the Military Munitions Response Program (MMRP) Overview presentation is to familiarize the MMRCT with the program, provide some background information, and set the stage for future public engagement as the MMRP involves a new set of sites undergoing investigation and potential cleanup and removal actions.

Mr. Davis explained that as a result of previous military training, DoD sites may contain unexploded ordnance (UXO), discarded military munitions (DMM), and/or munitions constituents (MC). He reported that in 2001, Congress and DoD, through statute, created the MMRP to address human health, safety, and environmental concerns at defense sites. He also noted that the MMRP is a program element of the Defense Environmental Restoration Program (DERP), as is the Installation Restoration Program (IRP) run by AFCEE, and that as IRP spending goes down in the future, DoD will be able to free up some of the DERP money and apply it to the newer program – the MMRP.

Mr. Davis then reviewed definitions of some MMRP terms: UXO – ordnance that was fired but didn't function properly and remains unexploded; DMM – munitions that have been improperly abandoned or disposed – usually buried; MC – chemical residues originating from UXO or DMM; munitions and explosives of concern (MEC) – includes UXO, DMM, and MC, at high enough concentrations to pose an explosive hazard; munitions response area (MRA) – a property known or suspected to contain MEC or MC; and a munitions response site (MRS) – a discrete location within an MRA requiring a response.

Mr. Davis noted that 12 MRAs have been identified at MMR and the next step is to determine if any of those MRAs will become MRSs.

Mr. Davis then reviewed a slide entitled "MMRP Policy," which noted these points: follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP); MMR's Federal Facility Agreement (FFA) applies; the program does not apply to operational ranges (such as nearly all of the northern 15,000 acres at MMR), operating storage/manufacturing facilities, or permitted treatment and disposal facilities; implements response alternatives to address unacceptable risks – both explosive safety and munitions constituent risks (while the purpose of the Impact Area Groundwater Study Program [IAGWSP] is to protect the groundwater); provides for meaningful stakeholder involvement (the IRP's Community Involvement Plan matrix will apply); provides for response actions consistent with reasonable anticipated future land use; and fosters and supports the development and application of improved and innovative technologies and methods.

Mr. Davis then began discussing activities to date by noting that from 2007 to 2009 the Army National Guard conducted an MMR-wide Historical Records Review (HRR), which involved examining multiple archives, reports, and aerial photographs, and resulted in the identification of nine MRAs at MMR. From 2008 to 2009 the Air National Guard conducted an HRR also, which was focused on Otis Air National Guard Base property. This effort resulted in the identification of three additional MRAs that were not identified by the Army National Guard.

Mr. Davis then showed a 1947 aerial photograph and pointed out a munitions storage area identified in both HRRs, which, he noted, is currently under pavement. He also pointed out what appears to be a shooting range, and he noted that the munitions storage area is not visible in a 1951 photograph of the same location. Ms. Donovan inquired about the other areas in the photo. Mr. Davis replied that those are aircraft parking areas, which were spread about in order to make the aircraft less susceptible to bombing.

Mr. Davis showed a figure from the Army National Guard's report that identified MRAs to be investigated further. He pointed out the Otis target butt, some bayonet training areas, and an old grenade court. He also showed a figure from the Air National Guard's report and pointed out the MRAs there, including the skeet range visible in the 1947 aerial photo and an ordnance area that will be dropped from the program because it's still being used for munitions storage.

Mr. Davis then stated that the MRAs will be rolled into what's called a Comprehensive Site Evaluation (CSE) Report. Phase I of the CSE is similar to a Preliminary Assessment (PA) and Phase II is similar to a Site Investigation (SI). He explained that Phase I involves a scoring protocol to prioritize the sites, the development of initial cost estimates, and essentially setting the stage for moving the sites forward through the process. He also noted that the draft CSE Report is expected to be submitted to the regulators in December, that a final report is expected to be issued in February 2011, and that accompanying news releases and fact sheets will be issued as appropriate.

Mr. Goddard asked if it's correct that the IRP is the lead on MMRP for the entire base. Mr. Davis confirmed that it is. Mr. Goddard then asked why these sites weren't addressed earlier, either by the IRP or the IAGWSP. Mr. Davis replied that the IAGWSP is dealing with operational ranges from the standpoint of the Safe Drinking Water Act (SDWA) Administrative Orders – to protect the groundwater from imminent and substantial endangerment; whereas the MMRP doesn't apply at operational ranges. Mr. Gonser added that traditionally munitions that happened to exist at a site where there was a release of a hazardous substance would be addressed as part of the cleanup, but there was no authority to remove the munitions for safety purposes. He explained that the creation of the MMRP program in 2001 gave DoD the authority to deal with the munitions themselves, rather than just as part of a hazardous substance cleanup.

Mr. Goddard said that it appears that there are some MMRP sites in the vicinity of the Impact Area, which is being addressed by the IAGWSP. Mr. Davis clarified that the IAGWSP is dealing with operational range, and those sites to which Mr. Goddard referred are on the outskirts, specifically on transmitter property.

Ms. Jennings further explained that originally the entire MMR, including the northern 15,000 acres, was listed in the definition of Superfund site. Then EPA identified contamination not only in the southern part of the base where the Air Force was conducting cleanup, but also in the northern part of the base. At that time, DoD put out "the range rule," which says that munitions cleanup under CERCLA would not occur at operational ranges. However, given the sole-source aquifer, EPA used SDWA to call for source and groundwater cleanup in the northern part of the base. Around the same time, DoD was dealing with the closing and transferring of other ranges across the country and recognizing that there was no mechanism in place to clean them of munitions, which resulted in the establishment of the MMRP. Then as the history of MMR continued to move forward, someone at DoD realized that MMRP applies at the base and had the Army National Guard conduct an inventory and develop a list of potentially eligible MMRP sites at MMR. The regulatory agencies, however, made a point of noting that there are also other authorities doing cleanup at MMR (under SDWA and Superfund), and questioned how all these overlays would work. Then the Air National Guard did its inventory of properties owned or leased by the Air Force and came up with three more potential MMRP sites. Ms. Jennings stated that today 15 MMRP sites "that kind of have overlapping authorities" have been identified, and an effort is under way to determine in which "box" they belong in order finish the cleanup. She noted that some of the sites that fit in MMRP are actually covered under the SDWA order, and so a type of dual authority exists. Ms. Jennings further noted that the MMRP sites are not high-priority munitions sites; there hasn't been much activity on them for years and it's likely that little will be found there. Nevertheless, it's necessary to go through the exercise, which begins with HRRs, and will perhaps include some sampling and geophysical work. Then anything that's found will be addressed, allowing for the sites to be officially closed and used for other purposes in the future if desired.

Mr. Goddard said that he's concerned about the possibility of finding new plumes and new source areas. Ms. Jennings replied that she thinks the chances of that happening are quite slim. Although it's possible that some soil contamination may have to be addressed, if it were enough to drive a groundwater plume it probably would have been seen by now.

Mr. Goddard then inquired about the Formerly Used Defense Site (FUDS) program. Mr. Gonser explained that sites in the FUDS program are actually MMRP sites as well, but they are handled under FUDS because they are no longer defense sites and DoD no longer owns the property. He further noted that some MMRP sites are addressed under the Base Closure program; that FUDS sites are handled by the Army Corps of Engineers; and that sites on an installation are generally handled by the IRP.

Mr. Goddard urged the cleanup programs to work with community involvement staff and come up with a way to present the MMRP information to the public such that it doesn't seem that there are a lot of major sites that no one's ever seen before.

Mr. Dinardo asked why the MMRP isn't being implemented at MMR until now, when it was established nine years ago, and whether that might have to do with having to wait to transfer funds. Ms. Jennings said that she thinks that bases that really had uses for their properties were a higher priority, and MMR is simply at the lower end of the queue. She also noted that there were no deadlines associated with the program when it was first created. More recently, however, Congress required deadlines for all the sites and called for inventories of every base by a particular date.

Mr. Dinardo asked if Ms. Jennings anticipates any funding conflict given the need to continue ongoing cleanup program activities and now the need to conduct MMRP activities. Ms. Jennings replied that

actually this was seen as an opportunity to get additional funding "that wouldn't always be around," another pot from which to draw. She also said that part of the reason why the MMRCT hadn't been briefed on MMRP until now is because it's taken a few years to figure out how to divvy up the work between the two DoD entities – Army and Air Force – and determine how that would relate to the other cleanup activities happening at the base. Ms. Jennings also said, with respect to Mr. Goddard's concern about a big new set of sources, that many of the MMRP sites were already known, but weren't high priorities in the queue. But now, with the pot of money that's available, it's time to move forward "and tell you how they unfold as we go." She further noted that in the IAGWSP program there are a number of little areas that haven't been thoroughly investigated yet and there's an effort to figure out the best way to approach them – either by sampling each and every one or perhaps by looking at them more as site types. She said that the project managers have been dealing with the major source areas, but those will be wrapped up in the next few years, and the next step is to stand back and look at all the other little areas where training occurred and munitions, or even disposal areas, might exist. She indicated that one question is what to do with them under SDWA, and another is what to with them if the goal is close and transfer the range.

Agenda Item #4. Demolition Area 1 Groundwater Monitoring Update

Mr. Gregson began his presentation with a discussion about the Demolition Area 1 (Demo 1) treatment system by reviewing a slide entitled "Treatment System Summary (through August 2010)," which noted the following: 1.76 billion gallons of groundwater has been treated; 96 pounds of perchlorate (81% of the original plume) has been removed; 42 pounds of RDX (70% of the original plume) has been removed; influent concentrations are steady at the Pew Road treatment system, which is near the toe of the plume; the Pew Road system operates at 103 gpm; the Pew Road system granular activated carbon (GAC) media had to be changed out only once in 2010, for RDX breakthrough; influent concentrations have decreased considerably at the Frank Perkins Road system, which can operate at upwards of 1,000 gpm; Phase I optimization of the Frank Perkins Road system extraction wells included cycling the three most upgradient wells (to try to move the plume out of stagnation zones between the wells); and because no breakthrough has occurred, there have been no media change-outs.

Mr. Gregson displayed a graph showing influent concentrations at the Frank Perkins Road treatment facility. He pointed out that perchlorate and RDX concentrations decreased steadily from 2007 to August 2009 and HMX has never been detected above the drinking water standard. He also reviewed Demo 1 groundwater sampling results, noting that the most recent sampling rounds showed 11 well screens with detections of perchlorate above the 2 ppb state MCL and 12 well screens with detections of RDX above the 0.6 ppb risk-based concentration. At the upgradient portion of the plume (from the source area to Frank Perkins Road): perchlorate is below detection limits at the source area, while RDX continues to be detected there; perchlorate and RDX concentrations are decreasing as expected and the plume has gotten smaller; and the highest RDX concentration seen in this part of the plume was 30 ppb, at MW-77. At the middle part of the plume (from Frank Perkins Road to Pew Road), perchlorate and RDX concentrations are decreasing as expected and the plume has gotten smaller, and the highest perchlorate concentration is 98 ppb, at MW-211M1 (at Pew Road). At the part of the plume downgradient of Pew Road: several new wells have been installed; the plume trajectory has been redefined to the north, which will be shown in new plume maps; and the highest perchlorate concentrations are approximately 7 ppb (at MW-532M2).

Mr. Gregson then showed a 2006 figure of the Demo 1 perchlorate plume and pointed out the source area, the treatment plants, and the downgradient portion of the plume. He also showed a 2007 figure and noted that the plume is a little narrower and the influence of the Frank Perkins Road extraction well can be seen, and he showed a 2008 figure and noted that the plume is broken up quite a bit and is detached from the source area in that depiction. He also showed a 2009 figure and noted that the plume is broken up even further, with areas of clean water between the extraction wells. He then showed a 2009 figure of the Demo 1 RDX plume and noted that RDX is still present at the source area and has

not migrated as far downgradient as perchlorate. Mr. Gregson then showed an April 2009 cross-section figure of the perchlorate contamination and pointed out the source area (a natural depression where munitions were disposed), which was removed about five years ago. He also showed an April 2009 cross-section figure of the RDX contamination.

Mr. Gregson displayed a figure of the downgradient portion of the plume and pointed out MW-532, where perchlorate was detected. He noted that some additional monitoring wells are being installed along the base boundary, with one have tested 0.5 ppb for perchlorate and the other testing nondetect. He added that the well where perchlorate was detected might not have been drilled deep enough so the plan is to drill it a bit deeper and then offset it to the north and the south. Mr. Gregson also reported that the model has been recalibrated using hydraulic data, which helps in visualizing groundwater flow patterns under natural conditions and pumping conditions and helps predict where the plume is going and when it will be cleaned up. He then displayed a figure of the toe of the plume that showed particle tracks from the downgradient wells, and another figure entitled "Modeled Particle Tracks/Capture 2009," which showed that the capture area extends beyond where the plume is located.

Mr. Gregson concluded his presentation by noting that the next Demo 1 monitoring report will include an updated plume depiction with the new wells and new data. That report is due to be issued in early 2011.

Mr. Saucier inquired about the property on the other side of the MMR boundary. Mr. Gregson replied that the boundary is with the town of Bourne. He then referred to a figure and pointed out Route 28, the Bourne rotary at the entrance to the base, a Mass Highway storage facility, and an area where there's a mix of commercial and residential properties. He also made a point of noting that all of the properties downgradient of the plume are on town water and there are no water supply wells there.

Ms. Jennings asked to see the particle track figure again in order to review concentrations detected in the monitoring wells. Mr. Gregson showed the figure and Mr. Nixon stated that MW-532 had a perchlorate detection of 7 or 8 ppb, and he recalls that the next well to the north was nondetect and the well to the south had essentially nothing. He then skipped over an area, indicating that there wasn't much to report there, and said that at D1-3 profile screening data showed perchlorate up to 0.54 ppb, below the cleanup goal. He also noted that the IAGWSP plans to go deeper at that location to punch through that lightly contaminated zone. Ms. Jennings inquired about concentrations at MW-353MW and MW-352M1, which Mr. Nixon had skipped over. Mr. Nixon stated that detections there were very low, between nondetect and 0.1 or 0.2 ppb, at the deepest settings. He also said that it appears that the plume is a little bit north of MW-352, and then reported that at D1-4, a profile boring near the base boundary, there was nothing greater than 0.11 ppb in the profile screening. In addition, Mr. Nixon noted that concentrations in well setting samples are generally lower than in profile samples. He also said that he thinks that the future trajectory of the plume might be somewhat closer to D1-3, if it even makes it that far. He then pointed out well 95-14 and reported that perchlorate was detected there at 1.24 ppb in the most recent sampling round.

Ms. Jennings inquired about the plan for remapping the plume footprint, and mentioned the 7 ppb detection at MW-352. Mr. Nixon replied that the new depiction will certainly show the plume around MW-352. Mr. Gregson added that the monitoring report, which is due early next year, will include an updated plume map, and by then results from all of the wells at the toe of the plume will be available. Mr. Nixon also stated that he thinks the only place downgradient of Pew Road where there are currently detections of perchlorate above the cleanup goal is at MW-352. Everything else in that area, including older existing wells a little farther upgradient, are all below the cleanup goal.

Mr. Pinaud inquired about the detection at MW-533. Mr. Nixon replied that even in the most recent sampling round the concentration there was below the state MCL of 2 ppb, by quite a bit. Mr. Pinaud asked how the plume would be connected then, since the groundwater contours have to be honored and

"they don't bend that way." He asked if Mr. Nixon thinks the contamination at MW-532 is coming from farther upgradient. Mr. Nixon replied that the distance between MW-532 and the adjacent wells is only about 150 feet, which is not "extremely different from what we've seen in the past." Mr. Pinaud asked if the perchlorate detected in MW-532 was found in the middle well screen. Mr. Nixon said that he believes it was. Mr. Pinaud said that it's probably a Demo 1 related source then. Mr. Nixon agreed. He also said that, especially in the profile samples, there's a small trace of RDX as well, which is very consistent with what's been seen at MW-255 a little bit farther upgradient, which was always assumed to be the center of mass of the plume. He also noted, however, that it's now thought that the center of mass might be 50 to 75 feet north of there, and by the time it reaches the new wells "150 feet is not outside the realm of possibility." Mr. Nixon clarified that it's believed that it's the same plume, and the same source, but it's traveling a little farther north than originally thought. He also noted that MW-240, which is north of MW-255, has been clean for a very long time. Mr. Pinaud said that he thinks Ms. Jennings's question was "how do you make the plume go there and still honor the data that you have." Mr. Nixon replied, "We haven't done it yet." Mr. Gonser added that the moraine may have created some preferential travel routes in that area.

Agenda Item #5. Demolition Area 2 Groundwater Monitoring Update

Mr. Gregson stated that groundwater sampling at Demo 2, which was conducted in October 2009, involved sampling 19 monitoring wells for explosives, five of which are sampled annually and 14 of which are sampled twice a year. He showed a map of the Demo 2 area, pointed out the direction of groundwater flow (to the north/northeast), and said that the site is similar to Demo 1, but not as much soil or groundwater contamination has been found. He also noted that RDX has been detected in groundwater, but no perchlorate has been detected. Mr. Gregson then showed a 2008 figure of the Demo 2 plume and said that the representation was based on the model and migrating forward previous monitoring well results. He also displayed a 2009 figure and noted that it shows further reduction in the extent of contamination, and the plume doesn't appear to be migrating beyond MW-435.

Mr. Gregson then displayed a figure entitled "Demolition Area 2 Groundwater Contaminant Trends" and pointed out a well (MW-404M2) that's currently nondetect, but had detections higher than 6 ppb a few years ago – the source of the migrated contaminant at MW-435. He also pointed out that there are a couple of monitoring wells near the source area that are hovering right around the cleanup level and that all the other wells have very low concentrations.

Mr. Gregson showed a table entitled "Demolition Area 2 – Groundwater Results for 2009" and noted that wells with concentrations above the 0.6 risk-based standard (2 ppb and 1.2 ppb) are highlighted in yellow (MW-160 and MW-161), by the source area. He also showed a table entitled "Demolition Area 2 – Model-Predicted versus Measured RDX Concentrations for Selected Monitoring Wells" and noted that "the model and the measured are tracking fairly well," with the model perhaps over-predicting just a bit. Mr. Goddard observed that at MW-16S the difference between predicted (0.02 ppb) and measured (0.25 ppb) is a factor of 10. Mr. Gregson replied that these are very low concentrations, below the 0.6 ppb risk-based standard.

Mr. Gregson reviewed the slide entitled "Groundwater Sampling Results – 2009 Reporting Period," which noted the following: seven out of 19 well screens had RDX detections during the reporting period; the highest RDX concentration was 2 ppb, at MW-160S; the highest detection at MW-435 (the most downgradient well) was 0.35 ppb; the plume is drawn using forward-migrated past detections, therefore spaces between clean wells show remaining RDX – this is probably conservative; two out of 19 wells screens had HMX detections during the reporting period; and wells downgradient of the former source area had HMX concentrations equal to the reporting limit (0.25 ppb).

Mr. Gregson displayed a table of the latest RDX results, from March 2010, and noted that the decreasing trend continues. He pointed out that only one well has a detection above 0.6 ppb – MW-

160S at the source area (1.2 ppb). Mr. Gregson stated that the plume seems to be dissipating as expected, especially the downgradient portions, and is on track to attenuate to below risk-based concentrations by 2013. He also said that the IAGWSP will continue sampling per the Environmental Monitoring Plan, particularly at the downgradient well (MW-435) to ensure that concentrations do not increase there. Results noted in the monitoring report will be evaluated in order to determine whether any additional monitoring wells are needed either downgradient or near MW-435.

Agenda Item #6. Remediation & Investigation Update

Former A Range Geophysics and Investigation Status

Mr. Gregson reported that approximately 2,500 cubic yards of soil (to a depth of 2 feet) was removed from Former A Range and run through a one-inch screen to remove munitions. Soil sampling was then conducted and no explosives were detected; other analytes were either nondetect or below screening levels. Mr. Gregson also mentioned that prior to excavation some TNT was detected in what is now a separate stockpile of soil that will be transported off site for disposal, although it tested nondetect after it was stockpiled. He also noted that the 2,500 cubic yards of soil was found to contain a lot of 50-caliber and 0.762 bullets, as the Former A Range was used for small arms training. He said that the IAGWSP will be discussing this matter with the regulators tomorrow.

Mr. Gregson stated that the geophysics work at Former A Range involved two different types of surveys – an EM-61 survey (a magnetometer mounted on a cart) and a meandering path survey of the range floor. He then showed a figure of the range, referred to a firing point, and explained that soldiers fired at targets that were mounted on a railroad track that rolled down a hill. He pointed out the areas where the targets were fired upon, the soil berms where munitions were found, and the area where the EM-61 survey was conducted. Mr. Gregson also noted that the yellow squiggly line on the figure represents the meandering path survey, which involved a UXO technician walking through the woods with a hand-held magnetometer and marking the ground where anomalies were detected.

Mr. Gregson then pointed out berms A, B, C, and D, investigated as part of the EM-61 survey, and reported the following: six 37 mm projectiles (each containing 1.5 ounces of RDX) were discovered among the 20 anomalies investigated at Berm A; one 75 mm shrapnel projectile (containing 3 ounces of black powder) was discovered among the 25 anomalies investigated at Berm B; no munitions items were discovered among the 25 anomalies investigated at Berm C; and one 37 mm projectile (containing 1.5 ounces of tetryl) was discovered among the 25 anomalies investigated at Berm D. He also clarified that the contaminants are just suspected to be contained in the munitions because their rusted condition makes it's difficult to make a positive identification. Once the munitions are blown-in-place it will be possible to determine if they did indeed contain explosives or if they were practice rounds.

Mr. Gregson also spoke about the meandering path survey, which identified 500 anomalies, all of which were intrusively investigated. He noted that nothing was found between the firing point and the target berms, and most items were discovered at the edges of the target area berms. He reported that the found items, all which will be blown-in-place, included ten 37 mm projectiles (seven containing RDX, two containing 1.6 ounces of tetryl, and one containing 1 ounce of tetryl), one 75mm shrapnel projectile (containing black powder); one 2.36-inch rocket (containing 4 ounces of TNT and 4 ounces of PETN), and one 3.5-inch rocket motor. Mr. Gregson then displayed a target area figure and pointed out where most of the items were discovered. Ms. Jennings pointed to a downrange location and asked what was found there. Mr. Gregson replied that one 2.36-inch rocket was found there. He also noted that this will be a topic at the Tech Meeting and next steps will be discussed.

Tungsten Speciation Findings

Mr. Gregson stated that the Army Corps of Engineers' Cold Regions Research & Engineering Laboratory (CRREL) conducted a study (2007 – 2009) on the different chemical species of tungsten and their mobility in the environment. He also reminded the group that between 1999 and 2006 tungsten-nylon bullets were used on small arms ranges at Camp Edwards as a substitute for lead, as tungsten was thought to be insoluble and therefore immobile in the environment. Around 2006, however, studies began to show tungsten detections in pore water and groundwater, and the Massachusetts Army National Guard stopped firing tungsten-nylon bullets. Mr. Gregson also noted that the U.S. Army's Center for Health Promotion and Preventive Medicine (CHPPM) has been conducting toxicity studies using sodium tungstate in order to try to relate data found on the ground with possible toxicity results.

Mr. Gregson then reviewed a slide entitled "Conceptual Site Model," which noted the following: tungsten-nylon breaks apart when it hits a hard target; over time tungsten metal oxidizes to soluble ions that are subject to leaching; the fate of the tungsten depends on the geochemistry of the soil and the tungsten, and the amount of time that the tungsten is in the environment; tungsten is subject to change, from tungsten oxide to tungstate to polytungstate to polyoxometallates; and the acid soil at Camp Edwards favors the polymerization of tungsten (the formation of polytungstate and polyoxometallates).

Mr. Gregson stated that the objective of the study was to improve the understanding of tungsten speciation in natural environments. The study looked at the different types of tungsten in soil at Camp Edwards and at two other sites, and the forms of tungsten were identified using a variety of laboratory equipment and techniques. The study involved the collection of pore water samples, groundwater samples, and soil samples up to a depth of 100 centimeters. Samples were analyzed in bulk to determine total tungsten and they were analyzed in detail using x-ray absorption spectroscopy and microprobe x-ray fluorescence (XRF). The study also looked at adsorption and desorption, and used geochemical computer models to help understand the data

Mr. Gregson reviewed the results/conclusions from the study: tungsten species found at MMR are tungstate, polytungstate, polyoxometallates, tungsten oxide, and tungsten metal; tungsten concentrations in soil decrease with depth; tungsten metal oxidizes readily, and oxidized tungsten dissolves rapidly to form tungstate, polytungstate, and polyoxometallates; different tungsten species aren't equally mobile in the environment – tungstate is more mobile than polytungstate, which is more mobile than polyoxometallates, which is more mobile than tungsten oxide, which is more mobile than metallic tungsten; the mobility of tungsten depends on how it reacts with the soil, specifically soil pH and the presence of calcium, iron, phosphorus, silicon, and organic carbon; the type of tungsten species changes with depth; tungsten is more mobile in soil at higher concentrations; tungsten mobility decreases over time; and mobility is a function of site geochemistry, and fate & transport behavior is highly variable.

Mr. Gregson showed a figure from the study report, which was entitled "Tungsten Species Concentrations with Depth." He noted that the data on the figure are from two soil sample locations – the berm at Bravo Range (Profile A) and the trough (Profile B). He pointed out that polyoxometallates and polytungstates are most prevalent at depths less than 20 centimeters, while they are less prevalent than tungstate at greater depths. He also mentioned that the soil samples were collected prior to the Guard's soil removal project, which removed some of those higher concentrations in surface soil. Now, tungsten concentrations are in the 0 to 100 part per million (ppm) range.

Current B Range Investigation

Mr. Gregson stated that the Guard's 2006 soil excavation project greatly reduced the amount of tungsten at the small arms ranges, removing contaminated soil from the bullet pockets on the face of the berms. He then noted that the IAGWSP conducted some additional XRF screening at B Range to

determine current concentrations. This effort included six in-berm soil sampling locations to a depth of 4 feet, two deep soil borings to the groundwater, and three wells with six groundwater samples (both filtered and unfiltered). Lysimeter sampling is not yet complete and the IAGWSP has proposed to install an additional lysimeter on B Range tomorrow.

Mr. Gregson reported that groundwater results for the new wells were nondetect for tungsten. He also said that based on results from the deep boring next to the berm, tungsten appears to have migrated less than 8 feet below the subsurface, and more borings are planned as part of the investigation. Mr. Gregson further noted that all soil and groundwater samples were tested for metals and tungsten.

Ms. Jennings asked if it's correct that tungstate is most prevalent species of tungsten being seen at MMR. Mr. Gregson referred to the previous slide, "Tungsten Speciation Concentrations with Depth," reminded Ms. Jennings that it represents a snapshot in time, and said at the time the dominant species in the more contaminated surface soil of the berm were tungstate, polytungstate, and polyoxometallate. He said that this leads one to believe that the snapshot was taken at a time when some of the tungstate had converted to polytungstate and polyoxometallate and some hadn't. He added that both species were seen in surface soil, but considerably less tungsten metal was observed there. Concentrations of tungstate, polytungstate, and polyoxometallate decrease beneath the berm. Mr. Gregson then said that he supposes there are no current data on the most prevalent species, but based on the samples in the snapshot, tungstates, polytungstates, polyoxometallates had about the same concentrations.

Mr. Gregson continued his presentation by displaying a figure that showed where groundwater samples were collected at B Range. He pointed out the new monitoring wells (MW-538, MW-537, and MW-539) and pointed out an existing well, MW-72S, which showed elevated tungsten concentrations about five years ago and is currently testing at about 2 ppb. He noted that the other wells tested nondetect. He also mentioned that MW-538 appears to have some construction issues, as the sample from that well contained a lot of sediments; the IAGWSP is going to try to clean out that well to get a good sample. Mr. Gregson also pointed out on the figure the existing lysimeters that were sampled as part of previous studies.

Mr. Gregson then displayed a figure that showed the XRF sampling results, noting that green dots represent nondetect, yellow dots represent concentrations up to 100 ppm, and red dots represent concentrations greater than 100 ppm (three locations – 100 ppm, 139 ppm, and 211 ppm). Based on the XRF results, shallow borings were drilled in the berm to a depth of about 4 feet. He showed a figure entitled "In-Berm Soil Boring Locations/Results" and noted that general trends for lead and tungstate at the five borings were a decrease with depth for all species, with some tungsten still showing up in the sample taken at 4 feet. He further noted that one of the borings was different, with higher tungsten concentrations at the 4-foot depth.

Mr. Gregson stated that soil samples were collected while drilling two of the monitoring wells: MW-539 (located a little farther downrange, and so considered background) and MW-538 (at the berm). He reported that at MW-539 lead detections range from 1.5 to 3.2 ppm and tungsten was very low – basically nondetect. At MW-538 lead was detected down to a depth of about 8 feet, at concentrations as high as 5 ppm, and tungsten was detected down to a depth of about 6 feet, at concentrations up to 80 ppm, after which a rapid drop-off was seen. He also noted that recent tungsten concentrations in groundwater at MW-72S are between 1 and 2 ppm.

Mr. Gregson reviewed slides that listed findings associated with XRF and in-berm samples, deep soil samples, and groundwater samples. For XRF and in-berm sampling: XRF results ranged from nondetect to 210 ppm; and soil sampling within the berm indicates that tungsten and lead concentrations generally decrease with depth. For deep soil samples: the background boring (MW-539) helps to determine naturally-occurring levels of metal, with average concentrations being 2 ppm for lead and 0.072 ppm for tungsten; soil sampling beneath the former berm indicates the presence of

tungsten at elevated concentrations similar to those within the berm to about 6 to 7 feet below grade (i.e. below the range floor), slightly elevated concentrates to 20 feet below grade, and then mostly nondetects (background) to the depth of the boring; and lead is present at somewhat elevated concentrations to 8 to 9 feet below grade, then background concentrations below that. For groundwater samples: tungsten was once again detected in MW-72S at concentrations similar to previous results; filtering removed almost half the concentration in the sample from MW-72S (from 2.7/2.5 ppm to 1.5 ppm), indicating that some of the tungsten is not in the dissolved phase; groundwater results for the new wells were nondetect for tungsten; and tungsten was not detected in cross-gradient or downgradient wells.

Mr. Gregson noted that the next steps are to drill two additional deep soil borings beneath the berm to confirm decreasing tungsten concentrations with depth and to sample the lysimeters and install a new lysimeter.

Mr. Goddard asked if tungsten-nylon bullets are being used anywhere. Mr. Gregson replied that they are not. Mr. Goddard then asked if it's correct that these studies aren't being conducted as part of an effort to resume the use of tungsten-nylon. Mr. Gregson confirmed that that's not the case, and noted that the purpose of the studies and investigation is to understand the impacts. Mr. Goddard asked if the University of New Hampshire (UNH) conducted the speciation studies. Mr. Gregson clarified that CRREL conducted the studies, and Mr. Gonser added that UNH sometimes works with CRREL. Mr. Goddard then remarked that it doesn't appear that a tungsten groundwater plume is forming. Mr. Gregson agreed and note that the levels that have been measured are quite low, with groundwater contamination being seen in only one well. He also reminded Mr. Goddard that the Guard removed about 30,000 cubic yards of tungsten-contaminated soil, excavating every single berm where tungsten had been used and transporting the soil off site. He said that the current work is being performed to confirm that that source removal was complete and determine whether tungsten concentrations up to the 200-ppm range are a concern.

Mr. Goddard also said that he's heard that copper is the new green munition, and asked whether studies have been done in order to ensure that there'll be no problems with copper bullets. Mr. Gonser replied that an environmental analysis is conducted with the development of any new weapons system, so someone in the acquisition/small arms community would have done an analysis of potential environmental impacts. Mr. Goddard then asked if the flaw associated with tungsten had to do with the testing being done in a lab rather than in the field. Mr. Gonser explained that tungsten was known to be insoluble so it was everyone's belief that that was the case. What wasn't known, however, is that in the environment and exposed to water, the tungsten chemically changed to tungstate and other forms that are soluble. He also noted that the tungsten in the tungsten-nylon bullets was very fine particles pressed together, and when the bullet struck a hard target it fell apart, becoming more exposed to the environment. At the time, however, looking at the books and doing the research, it was believed that tungsten would be immobile. Mr. Goddard then asked if there had been more real-world testing of copper bullets. Mr. Gonser replied that copper has been used as a jacket in virtually every round for a very long time, so the Army is returning to more benign metals such as copper and steel.

Ms. Jennings explained that the toxicity tests to determine a safe level of tungsten in groundwater are being done on a particular kind of tungsten – actually a tungstate. So, in order to figure out if the toxicity study results would apply at MMR, it became necessary to do the speciation study and determine what species of tungsten exists here. Ms. Jennings said that there appears to be some correlation; the tungstate used in the toxicity tests does match up to the kind of tungstate being seen at MMR, and therefore those test results could be used to set a cleanup number. She also explained that the Guard's tungsten removal project involved the use of an XRF gun to decide what would and wouldn't be removed. The Guard removed up to the detection limit of the gun, which she believes was 150 ppm, but really had nothing to do with whether it was a safe level that was left behind or something that could cause a long-term threat to groundwater. Ms. Jennings indicated that it's

important to understand how mobile tungsten is within the soil column, and if it becomes necessary to come up with a soil cleanup number, what that number would be. She also noted that although tungsten concentrations decrease with depth within the berm, traces of tungsten are still detected at 4 feet, and in one berm down to about 8 feet, which is why the regulators are asking for more borings to understand better how tungsten is moving within the soil column.

Ms. Jennings then referred to the figure showing XRF results and said that it's interesting to her that there are so many yellow dots (detections) on the left side of the berm and not so many on the right. Also, it seems peculiar to her that the highest detections occurred at the right bottom of the berm and not at the very upper part. She then asked if Mr. Gregson knows the actual readings associated with the yellow dots, which represent detections up to 100 ppm. Mr. Gregson said that he doesn't have that information now, but confirmed that it is available and will be provided. He also said that as far as the higher values go, it might just be a function of "this is more toward the middle of the range," which would have been used more. Mr. Nixon added that the area where the green dots (nondetect) are is very sandy, while the soil in the area with yellow dots tends to contain more organics. He suggested that perhaps the tungsten sorbed better to the organics. Mr. Gregson also said that the detections by the toe might be the result of some run-off from the face of the berm. Ms. Jennings said that the removal project was focused on the bullet pockets, and inquired about the lighter scars in the figure. Mr. Gregson replied that the aerial photo is pre-excavation so the bullet pockets can be seen. He also mentioned the idea of overlaying the photo with a newer post-excavation aerial photo.

Mr. Goddard asked if there are other sites where tungsten contamination is a concern. Ms. Jennings said that she knows that tungsten has been used elsewhere; however, the focus of the tungsten studies being discussed tonight is to figure out what needs to be done at MMR in particular. She also noted that the information that comes out of the studies would be helpful to other bases if it's determined that they require cleanup of tungsten. Mr. Goddard said that it's his understanding that there are bases in California that had used tungsten bullets, and he wonders whether EPA is watchful of what's happening at MMR as it might relate to the California bases. Ms. Jennings said that she knows that the information is being shared but she doesn't now how it's being used. She also said that her Region has been pushing for the establishment of a cleanup number for tungsten, and mentioned that it was at the front of the curve with regard to perchlorate as well.

Decision Document Update

Mr. Gregson reviewed a slide noting the status of IAGWSP decision documents: completed – BA-4 and Demo 1 (September 2009), Demo 2, Northwest Corner, and Western Boundary (June 2010), and L Range (September 2010); in process – J-1 Range (draft sent to regulators for review, expected to be finalized in October); upcoming – Former K Range, Former A Range, and Gun & Mortar Positions (draft investigation reports submitted and being reviewed/finalized), Central Impact Area and J-2 Range (feasibility studies to be submitted this winter), and Training Areas, J-3 Range, and Small Arms Ranges (investigation reports or feasibility study to be submitted this winter).

Agenda Item #7. Next Meeting Schedule and Adjourn

Ms. Donovan stated that the next MMRCT meeting is scheduled for *December 8, 2010. She then adjourned the meeting at 8:37 p.m.

***Please note:** The December MMRCT meeting has since been rescheduled to December 15, 2010, and will be a joint meeting with the Senior Management Board.*