Massachusetts Military Reservation Cleanup Team (MMRCT)
Building 1805
Camp Edwards, MA
October 14, 2009
6:00 – 8:30 p.m.

Meeting Minutes

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Action Items:

1. Mr. Goddard requested an update on the plan for lead-contaminated soil, once that decision has been made.
2. Ms. Grillo requested information on the cost of the CS-10 ISCO project.
3. Mr. Taylor requested that future "Remediation & Investigation Update" presentations include cross-section figures for plumes.

Handouts Distributed at Meeting:

1. Responses to Action Items from the September 16, 2009 MMRCT/SMB Meeting
2. Presentation handout: Remediation & Investigation Update
3. Presentation handout: Chemical Spill 10 In Situ Chemical Oxidation (ISCO) Pilot Test
4. Info sheet: Contaminants of Concern
5. MMRCT Cleanup Team Meeting Evaluation form

Agenda Item #1. Introduction and Agenda Review

Mr. Field convened the meeting at 6:02 p.m. and reviewed the agenda. He confirmed that there were no questions or comments regarding the Responses to Action Items from the September 16, 2009 Massachusetts Military Reservation Cleanup Team (MMRCT)/Senior Management Board (SMB) meeting, and then asked if there were any changes or additions to the September 16, 2009 MMRCT/SMB meeting minutes. No changes were offered and the minutes were approved by the MMRCT. Ms. Wadsworth asked that the SMB also have the opportunity to approve the minutes before they are considered final.

Agenda Item #2. Final Discussion (if needed) on Western Boundary/Demolition Area 2/ Northwest Corner Remedy Selection Plan

Mr. Field said that three individual comments on the Western Boundary (WB)/Demolition Area 2 (DA-2)/Northwest Corner (NWC) Remedy Selection Plan (RSP) had been received – one was submitted through him and the other two were submitted directly to the Impact Area Groundwater Study Program (IAGWSP). He also invited team members to engage in any final discussion on the RSP at this time, if desired, as the public comment period closes tomorrow.

Ms. Grillo informed the group that Sierra Club representative David Dow has announced that he will no longer be attending and participating at MMRCT meetings. She noted that many of Mr. Dow's comments pertained to the Sierra Club's policy of not accepting monitored natural attenuation (MNA) as a remedy. She also said that Mr. Dow had been involved with the base cleanup programs for many years and will be sorely missed.

Mr. Reif mentioned that he had received an email from Mr. Dow about a comment he (Mr. Reif) had made at a previous MMRCT meeting, which Mr. Dow had interpreted as a remark that the plume dispersion models that are used to make cleanup decisions were inaccurate or ineffective. Mr. Reif then clarified that in fact he had simply asked whether the models had been validated, were in wide use, and had been accepted by the regulators. He noted that he had been satisfied with the answers he'd received at that meeting and hadn't asked for anyone to produce a validation.

Mr. Field reminded the group that any additional comments on the WB/DA-2/NWC RSP are due by close of business tomorrow (October 15, 2009).

Agenda Item #3. Remediation & Investigation Update

Mr. Gregson began his presentation by discussing the IAGWSP's ongoing groundwater actions, starting with Demolition Area 1 (Demo 1), a site for which a final decision has been implemented. He reported that last fall six drive-points were installed east and west of North Pond, based on low level perchlorate detections at monitoring well 352 (MW-352) and MW-353. Drive point results yielded one perchlorate detection of less than 2 parts per billion (ppb) near MW-258, and upgradient from there, in MW-225, perchlorate had been detected at concentrations as high as 20.7 ppb.

Mr. Gregson explained that in order to better understand conditions near the toe of the plume, the IAGWSP is planning to install four new monitoring wells near MW-258 and MW-352. He noted that during drilling profile samples will be collected every ten feet and information from their analysis will be used to select well screen and refine the model. He also reported that all monitoring wells downgradient of Pew Road are currently nondetect, although there might be some perchlorate between wells.

Mr. Gregson displayed a figure that showed drive-point and monitoring well perchlorate results at Demo 1. He pointed out the nondetect results in drive-points near the pond, the 0.5 ppb detection at MW-258, and the 0.4 ppb detection in MW-353, and noted that the new wells will better define that area. He also displayed a figure that showed a general overview of the Demo 1 plume and pointed out the source area, which has been removed. He also noted that the plume is traveling from east to west, and he pointed out the extraction wells at Frank Perkins Road and at Pew Road, where the plume has been "pinched in." Mr. Gregson also pointed out where the three new monitoring wells will be installed to help define previous detections at MW-258 and MW-352 and to ensure adequate monitoring as the contamination moves farther downgradient.

Ms. Jennings said that she doesn't think it's accurate to say that all monitoring wells downgradient of Pew Road are nondetect, given that it's believed that the plume still exists downgradient. Mr. Gregson agreed, but noted that currently there are no monitoring wells detecting it. Ms. Jennings said that she thinks that's a better way to describe the situation.

Mr. Gregson then displayed a figure that showed modeling results when the Pew Road treatment system was constructed. He noted that the extraction wells were predicted to continue to remove the perchlorate contamination and ten years after system startup there would be "a blob" remaining in the silt/clay layer between extraction well 2 (EW-2) and EW-3.

Mr. Gregson then reminded the team that Demo 2 was part of the RSP discussed at the last MMRCT meeting. He showed a map of Demo 2, mentioned the MNA with land-use controls (LUCs) remedy, and pointed out the monitoring wells being installed as part of the long-term monitoring program there, which will help validate modeling predictions. He also noted that the new well screens will be located along the particle track extending from MW-435.

Mr. Gregson continued with his presentation by noting that L Range, a 40mm grenade range located in the southeastern part of the base, is undergoing a fairly extensive unexploded ordnance (UXO) and RDX source removal project. He noted that the IAGWSP is planning to install two additional monitoring wells to ensure that the RDX detected in soil has not caused a negative impact to groundwater. He further noted that small detached plumes of perchlorate and RDX have been identified, but they appear to be attenuating and are located upgradient of the Air Force Center for Engineering and the Environment's (AFCEE's) Fuel Spill 12 (FS-12) treatment system. He also reported: that the contaminated soil has been excavated; that the new monitoring wells are being located downgradient of the mid-range area, where the explosives were detected; that the draft L Range Remedial Investigation (RI)/Feasibility Study (FS) document has been submitted to the regulatory agencies; and that the plan is to issue an RSP for public comment this winter. The information gained from the new wells will be fed into the RI/FS. Mr. Gregson also showed a figure entitled "L Range Proposed Well Locations" and pointed out the two new well locations, the range boundary, the soil removal area in the central part of the range, and groundwater flow direction (north/northeast to south/southwest).

Mr. Gregson then stated that the J-1 South plume is an RDX-only plume located in the southeast part of the range. The plume originates at the firing point of the J-1 Range and migrates from the northwest to southeast, into the Sandwich neighborhood of Forestdale. He reminded the group that J-1 South groundwater cleanup alternatives were presented to the MMRCT in July, and he noted that the purpose of the ongoing work is to ensure that the off-base portion of the plume is well defined.

Mr. Gregson stated that last year, as part of that work, a series of drive-points was installed to help refine the plume shape. RDX detections ranging from 1 ppb to 5.3 ppb were detected at Lady Slipper Lane, Little Acorn, Windsong, and Grand Oak Road, and some of the drive-points were nondetect. Now the IAGWSP is installing seven conventional groundwater monitoring wells in order to conduct monitoring into the future, and to provide a current snapshot of what the plume looks like. Mr. Gregson then explained that J-1 South, like the L Range, is in the middle of the RI/FS process. A draft report has been issued to the regulatory agencies, comments are being addressed, and the plan is to issue an RSP this winter.

Mr. Gregson displayed a figure entitled "J-1 Range South Proposed Well Locations" and pointed out the base boundary, the RDX plume outline (drawn to 0.6 ppb), the source area, groundwater flow direction, the drive-points, and the proposed monitoring wells. He also showed a zoomed-in figure of the proposed monitoring well locations as well as a photograph of the sonic drill rig that will be used. Mr. Gregson noted that the IAGWSP has coordinated with the Sandwich selectmen and the residents to keep them informed about drilling activities and the proper safety precautions.

Mr. Gregson then discussed the Former A Range, which was used in the 1940s and 1950s for anti-tank artillery and rocket firing. He noted that a new monitoring well is being installed north of the target area to try to characterize RDX levels in groundwater in the vicinity of Former A Range. He also stated that the IAGWSP will collect profile samples for explosives and perchlorate, and up to three well screens will be set based on profile sample results and the depths of other nearby detections.

Mr. Gregson displayed a figure of the Former A Range area and pointed out the proposed well location and the deeper RDX contamination, which he noted is from the Central Impact Area plume. He explained that the new well will be looking at whether there's some shallow explosive contamination from the Former A Range itself. He then noted that the investigation is also looking at whether the contamination at the range is in any way connected to the Northwest Corner RDX plume. Ms. Jennings asked Mr. Gregson to point out the range on the figure, which he did.

Mr. Gregson began discussing the tungsten investigation by reminding the group that tungsten has been found in some of the berms at the Small Arms Ranges. He noted that the IAGWSP is planning to conduct some additional investigation at Bravo Range, where tungsten was detected in groundwater at MW-72S at a concentration of 1.7 ppb. He also mentioned that the other 15 monitoring wells at the Small Arms Ranges had tested nondetect for tungsten. Mr. Gregson stated that the plan is to install three monitoring wells at Bravo Range to determine whether the contaminant has migrated from soil to groundwater. Also, soil samples will be collected as the borings are installed (particularly in the berm) to determine whether measurable tungsten concentrations have migrated vertically.

Mr. Gregson showed a figure of Bravo Range and pointed out the locations for the three proposed monitoring wells (next to MW-72S, in the target berm, and downgradient of MW-72S). He also reminded the group that years ago when tungsten was first identified as a groundwater problem, the Massachusetts National Guard proactively removed tungsten-contaminated soil from the berms down to a level of less than 150 parts per million (ppm). He explained that the IAGWSP is now trying to ascertain whether the residual tungsten contamination will be a potential future problem for groundwater.

Mr. Goddard referred to the photograph of the drill rig and asked how the IAGWSP is communicating with the residents about the J-1 South work. Ms. Curley replied that a neighborhood notice was mailed to 200 residents this week and the IAGWSP is also speaking directly with individuals whose homes are located right next to where the drilling will occur. Mr. Goddard spoke of the importance of applying lessons learned from AFCEE's construction work in the neighborhoods, and he mentioned that in similar situations AFCEE posted cleanup site signs that included a phone number to call for more information.

Mr. Taylor said that it would be helpful if presentations such as this included cross-section figures of the plume so that depth could be understood, rather than just two-dimensional figures. Mr. Gregson replied that that is a good point and acknowledged that cross-sections could have been provided. Mr. Gonser added that most of the plumes discussed this evening are located close to the water table, with the J-1 South plume being a little deeper.

Mr. Foster asked Mr. Gregson to explain how profile samples are used to determine well screen depths. Mr. Gregson explained that during drilling a device is used to collect a grab sample of groundwater every ten feet. Data from the profile samples, along with modeling information, which is also helpful in terms of providing an idea of where contamination might be expected, are used to determine where well screens should be set. Mr. Foster then asked how the IAGWSP deals with unexpected findings, as opposed to those that are anticipated. Mr. Gregson explained that the IAGWSP and project team work closely to discuss unexpected findings and perhaps install a well screen there to further evaluate them or propose additional wells to further delineate the area.

Mr. Reif inquired about the direction of groundwater flow at Bravo Range. Mr. Gregson replied that the groundwater there flows from east to west. Mr. Reif then asked Mr. Gregson to discuss the rationale for the locations of the three proposed wells. Mr. Gregson replied that the location near MW-72S was selected in order to confirm whether the contaminant detected in MW-72S was from leaching through the berm soil or from a short-circuiting problem associated with well construction that created a preferential pathway to the groundwater through the well itself. He also explained that the well to the right would be drilled through the bullet pocket of the berm in order to obtain a profile through the soil and determine whether there are changes in tungsten concentrations with depth, and whether there's a continuing impact to groundwater at that location. The purpose of the third well is to see if contamination detected at MW-72S has migrated toward MW-455S, where tungsten has not been detected.

Mr. Reif asked if the basis for clustering the new wells has something to do with elevated soil concentrations between MW-72S and MW-490S. Mr. Gregson replied that MW-490S, which tested nondetect, was installed to see whether there was a difference in tungsten concentrations in groundwater between the center of the berm and the end of the berm. Mr. Gonser added that because more firing occurs in the center of the firing range, it's expected that the center of the berm would have the most usage and the most tungsten. He also noted that all of the wells sampled have tested nondetect for tungsten, expect for MW-72S. And that is why the new wells are being clustered around that area, to see if those detections really reflect groundwater levels or if they reflect a problem with the well.

Mr. Saucier asked if any of the proposed wells at J-1 South would be used to extract water for treatment. Mr. Gregson replied that the proposed wells will be used just for monitoring, and added that extraction wells generally have a much larger diameter (eight inches versus two inches for a monitoring well). Mr. Gonser added that data from the monitoring wells would be used to help determine the best location for an extraction well.

Mr. Gregson continued his presentation by discussing ongoing or planned IAGWSP soil actions, which involve removal, screening, and stockpiling of soil. He mentioned the plan to conduct an alkaline hydrolysis treatment pilot project at L Range, and said that based on the success of that project, soils from Former K Range, the J-1 Range, the J-2 Ranges, and other ranges would also be candidates for alkaline hydrolysis treatment. He reported that 2,700 cubic yards of soil have been excavated from L Range and the IAGWSP and regulatory agencies are finalizing the work plan for the application of lime to treat the soil. That work is anticipated to begin later this month.

Mr. Gregson also reported that 123 cubic yards of soil will be excavated from the center of Former K Range later this week, and depending on results from the L Range pilot test, that soil may also be a candidate for alkaline hydrolysis. He further noted that the IAGWSP is also considering some limited excavation work at Former K Range's Area F, where some perchlorate has been detected. Mr. Gregson also mentioned 1,500 cubic yards of RDX-contaminated soil at J-1 Range and 555 cubic yards of soil at J-2 Range, to be excavated in early November and early December respectively, and considered for alkaline hydrolysis treatment.

Mr. Gregson then spoke about the Central Impact Area, where remote-controlled technology was used to remove soil from two areas (northern and southern). He noted that a one-foot lift was completed at the northern area and another one-foot lift is being conducted following the geophysical survey that indicated that more work needed to be done. A one-foot lift was also completed at the southern area, and another one- to two-foot lift is going to be conducted in response to the geophysical survey results there. He explained that additional soil will be removed based on confirmation sampling results, and the RDX-contaminated soil would be a candidate for alkaline hydrolysis treatment. Mr. Gregson showed a map of the Central Impact Area, pointed out the northern and southern areas, and explained that they were defined based on water table wells with continuing detections of explosives. He also showed several photos of the remote-controlled equipment, including a bulldozer, a screener, and a loader.

Mr. Gregson continued his presentation by noting that soil removal is planned for the target berm at Former A Range. Approximately 2,500 cubic yards of soil will be excavated, screened to remove munitions and metal fragments, and if the soil is found to contain explosives contamination, possibly subjected to alkaline hydrolysis treatment.

Mr. Gregson then discussed the ongoing work at Former B & D Ranges, which were used during the 1940s and 1950s for small arms training, but are no longer in use. He reported that to remove lead bullets from target berms at these ranges, the IAGWSP is clearing 0.3 acres at Former B Range and 0.9 acres at Former D Range. The sites were defined through a program of pre-excavation sampling using x-ray fluorescence and metal detectors and conventional lab analysis. It's estimated that 5,000 total cubic yards will be removed from the two sites, after which post-excavation sampling for lead will be conducted. The excavated soil will be screened to remove bullets and metal fragments, which will then be sent off site for recycling. Mr. Gregson also stated that the project is expected to be completed by mid-November of this year, and he displayed figures that showed the areas of excavation at the ranges.

Mr. Goddard inquired about the fate of the tungsten-contaminated soil that was previously stockpiled. Mr. Gregson replied that that those stockpiles have been characterized and will be shipped off site this month. Mr. Goddard also asked if it's correct that alkaline hydrolysis involves heat. Mr. Gregson clarified that alkaline hydrolysis is a chemical process in which lime and water are mixed with the soil to break down the explosives contamination. Mr. Goddard asked if it would involve an open-air mixture or some kind of container. Mr. Gregson confirmed that it would be an open-air mixture, and the process would break down the RDX molecule.

Mr. Goddard then asked if the lead-contaminated soil would be treated on site or shipped off site. Mr. Gregson replied that after the bullets are removed, the soil will be sampled, and based on results, a decision will be made. He also noted that one of the best things to do with soil that has some lead contamination is to reuse it on site at a target berm. Mr. Goddard asked what would be considered an acceptable level of lead contamination to reuse the soil in this manner. Mr. Gonser replied that many studies have shown that lead is not much of a leaching hazard. However, one wouldn't want an infinite amount of lead in the soil, which is why the bullets and fragments are going to be removed. Mr. Gonser also indicated that it's preferable to appropriately manage lead-contaminated soil than to leave it at an old, overgrown site. Mr. Goddard asked if the area where the soil would be reused would be monitored. Mr. Gonser confirmed that it would.

Mr. Goddard also asked if it's correct that there would be STAPP system in place at that area. Mr. Gonser replied that although that's possible, a STAPP system would not be appropriate for a location such as Sierra Range. Mr. Goddard then asked if it's correct that plans for some of the new ranges do not involve STAPP systems. Mr. Gonser confirmed that that's correct and explained that a STAPP system is not a viable alternative for certain ranges, such as those with pop-up targets, in which case other management practices would be sought.

Ms. Jennings stated that everyone thinks it's a good idea to get rid of the lead bullets themselves, which is the focus of the project. But with respect to residual lead contamination in soil, the best alternative and the correct level really haven't been decided. She also mentioned that she believes that the state has a residential standard, but discussions pertaining to an appropriate level for soil used at a berm have not taken place yet. Ms. Jennings further noted that although agreement on the best management practice for ranges such as Sierra Range hasn't been reached yet, if a soil berm ends up being the correct decision, it would make sense to use soil that's already contaminated with lead rather than leave that soil elsewhere on the base where it wouldn't be controlled and managed. She added that although those decisions haven't been made yet, everyone agrees that it makes a lot of sense to get rid of the lead bullets and fragments and then sample the soil that's left behind. Mr. Goddard asked if this topic could be a future agenda item. Ms. Jennings replied "absolutely," and noted that that would occur sometime after the Guard completes the alternatives analysis it's preparing for sites such as Sierra Range – although she's not certain whether that presentation would occur at an MMRCT meeting or at a public meeting that's focused on Small Arms Ranges.

Mr. Pinaud said that he agrees with Ms. Jennings comments about reuse of soil from which the lead bullets have been removed. He also added that the Massachusetts Department of Environmental Protection (MassDEP) has requested that the screened soil not be allowed to remain in stockpiles for any length of time, as the history of managing of soil stockpiles "has not been very good."

Mr. Reif noted that he has no objections to alkaline hydrolysis treatment or its byproducts, but is curious about its effectiveness and hopes that the IAGWSP would not try to treat 1,500 cubic yards of soil without first conducting a bench-scale pilot study. Mr. Gregson stated that alkaline hydrolysis has been successfully used to dissipate explosives at other sites, and although the IAGWSP had originally planned to conduct a bench-scale test, the soil that was collected at that time ended up being nondetect for explosives. At that point, it was decided to abandon the bench-scale test and instead move forward with a large-scale pilot test at L Range. Mr. Gregson explained that a treatment cell will be constructed to treat the L Range soils and fairly extensive sampling will be conducted to assess the effectiveness of the treatment. Based on that assessment, the IAGWSP will look at other sites with explosives contamination in soil to determine if alkaline hydrolysis treatment would be amenable. If the treatment fails at L Range, the program will come up with another approach for treating the soil at other sites.

Mr. Reif remarked that this does not seem like a very controlled study. Ms. Jennings indicated that she agrees with the IAGWSP's current proposal to go forward with a full-scale pilot test, and she noted that other lab studies have shown that alkaline hydrolysis does successfully treat RDX contamination in soil.

Mr. Dinardo inquired about alternatives in the event that alkaline hydrolysis doesn't work. Mr. Gregson replied that shipping the soil off site for disposal is one alternative. Mr. Gonser added that there are also other soil amendments that could be tried, including biological amendments. Mr. Dinardo remarked that although alkaline hydrolysis is the most cost-effective, it could be affected by weather conditions. He then inquired about the schedule for the L Range pilot test project. Mr. Gregson replied that a three-week treatment cycle is scheduled to begin in late October or early November.

Mr. Saucier said that he doesn't understand why lead bullets have to be removed if lead doesn't leach. Mr. Gregson explained that while it doesn't leach per se, infinite amounts are still undesirable, and so it makes sense to remove the lead bullets and manage the soil. Mr. Saucier noted that gun clubs across the state, which are required to remove lead, should be informed that lead does not leach to groundwater. Ms. Jennings said that the regulators' position is not that lead does not leach; although no lead plumes have been identified, it has been detected in groundwater in some instances. She further noted, however, that the regulators do believe that lead-contaminated soil can be used and managed. Mr. Pinaud mentioned the state's Lead Shot initiative, which requires best management practices that clean up lead projectiles. Mr. Saucier noted that it's commonly thought that type of cleanup has to do with groundwater protection. Mr. Pinaud replied that it's possible that having a wetland near a skeet range, for example, could be a problem.

Mr. Taylor said that it's his understanding that mixing lime with soil can be difficult. Ms. Jennings replied that such difficulty is not expected at the base because of the sandy soil there.

Agenda Item #4. Chemical Spill 10 In-Situ Chemical Oxidation Pilot Test

Ms. O'Reilly, the Chemical Spill 10 (CS-10) plume manager for AFCEE's System Performance and Ecological Impact Monitoring (SPEIM) program, noted that under the SPEIM program AFCEE is continually looking for ways to optimize remedial systems by improving system performance and reducing restoration timeframes and life-cycle costs. She then reported that AFCEE's review of in-situ remediation technologies that might be used to supplement the existing CS-10 treatment systems resulted in the selection of In-Situ Chemical Oxidation (ISCO) technology as a potentially viable technology – based on the contaminants to be treated and the high dissolved oxygen (DO) conditions at the site. She also noted that because the use of ISCO technology may be limited by site-specific hydrologic conditions and implementation costs, AFCEE completed a pilot test to further evaluate the potential application of the technology.

Ms. O'Reilly noted that her presentation on the CS-10 ISCO pilot test would include information on the following: CS-10 plume and treatment system, ISCO technology description, ISCO pilot test objectives, pilot test site selection, technical approach, results and evaluation, conclusions, and recommendations. She then showed an AFCEE Installation Restoration Program (IRP) plume map and pointed out the CS-10 plume, and then showed a map of the CS-10 plume and pointed out the plume's two primary source areas, the three treatment systems, and the leading edge lobes.

Ms. O'Reilly stated that the contaminants of concern (COCs) in the CS-10 plume are TCE and PCE, for which the maximum contaminant level (MCL) is 5 micrograms per liter (µ/L). She also reported that the current maximum TCE concentration in the plume is 1,600 µ/L and the current maximum PCE concentration is 159 µ/L. The historical maximum concentrations are 5,110 µ/L for TCE and 400 µ/L for PCE. Ms. O'Reilly further noted that the primary sources of the CS-10 plume are the former BOMARC missile site, which operated from 1960 to 1973, and the Unit Training Equipment Site (UTES), which has been in operation since 1978, although numerous other sources are believed to have also contributed to the plume. She then pointed out that: the plume is no longer delineated in the primary source areas; the main body of the plume is about 2.5 miles long and one mile wide; and the plume has three leading edge lobes (the northern lobe, the north-central lobe, and the southern lobe). She added that the length of the plume including the leading edge lobes is about 3.5 miles.

Ms. O'Reilly showed a table entitled "CS-10 Groundwater Treatment Systems": the CS-10 In-Plume system, which has a total flow of rate of 2,370 gallons per minute (gpm), has nine extraction wells, removed 349 pounds of contaminant mass in 2008, and removed 3,868 pounds from system startup to December 2008; the CS-10 Sandwich Road system, which has a total flow rate of 420 gpm, has five of nine extraction wells operating, removed 28 pounds of contaminant mass in 2008, and removed 1,001 pounds from system startup to December 2008; and the Northern Lobe extraction well system, which has a total flow rate of 175 gpm, has one extraction well, removed 20 pounds of contaminant mass in 2008, and removed 200 pounds since startup to December 2008. It was also noted in the table that the total contaminant mass estimated to be in the plume in December 2007 was 1,191 pounds. Ms. O'Reilly also mentioned that the north-central and southern lobes and the area east of Johns Pond are in long-term monitoring, and that the CS-10 Record of Decision (ROD) was signed on August 31, 2009.

Ms. O'Reilly showed a slide about the amount of electricity utilized by the CS-10 treatment plants (5,478 megawatt hours [MWh] in 2008 and 55,819 MWh since system startup) and noted that the amount of electricity used in one year to operate the CS-10 treatment plants is equivalent to the electricity used to supply 514 residents for one year. The slide included a table of air emissions associated with the production of this electricity. (The estimated air emissions since system startup, as noted on the slide, were: 93,791,465 pounds of carbon dioxide [CO_2]; 70,325 pounds of nitrogen oxide [NOx]; 56,947 pounds of sulfur dioxide [SO_2]; 3,293 pounds of volatile organic compounds [VOCs]; and 2,233 pounds of particulate matter 10 [PM-10].) Ms. O'Reilly stated that additional benefits to reducing life-cycle cost and restoration timeframes would be reduction in electrical costs to operate the systems and reduction in the production of air emissions. She then displayed a computer animation of the CS-10 TCE plume shell under Alternative 10 operating conditions and pointed out several higher concentration areas within the CS-10 plume. She also noted that although the system would likely be taken out of operation within 50 years, cleanup levels aren't predicted to be achieved until 2092 because of contamination located in low-conductivity zones. Ms. O'Reilly then pointed out the ISCO pilot test location, which she noted is upgradient of a CS-10 In-Plume extraction well, 03EW2109.

Mr. Taylor remarked that the year 2040 is only 30 years away. He also said that he thinks it would be beneficial to reduce the cleanup time. Ms. O'Reilly replied that that is what the IRP is trying to do, and one way is potentially to target the higher concentration zones, or areas where contamination is more persistent, with additional treatment like ISCO.

Ms. O'Reilly then stated that extraction/treatment/reinjection (ETR) technology is a technically appropriate technology for CS-10 because of the plume's large spatial extent and because of its potential mobility in the highly-transmissive aquifer, and the treatment plants are operating successfully and capturing the plume as designed. However, a preliminary screening of in-situ technologies was evaluated for use at CS-10 to determine whether the application of a supplemental treatment could reduce overall cleanup time and life-cycle costs. This effort resulted in the identification of ISCO as a potentially viable technology, based on the contaminants to be treated (TCE and PCE) and on the high DO conditions at the site.

Ms. O'Reilly then presented some background information to describe ISCO technology: ISCO involves the delivery of a strong oxidizing agent – sodium permanganate ($NaMnO_4$) – at the subsurface to transform groundwater contaminants (TCE and PCE) into less harmful chemical species; the oxidizer is consumed in the reaction; chemical oxidation of chlorinated organic compounds (TCE and PCE) occurs through direct electron transfer from the permanganate ion (MnO_4^-) to the electron acceptor (the chlorinated hydrocarbon). The chlorinated hydrocarbons are oxidized to carbon dioxide, chloride, and water; the application of an oxidant (permanganate) typically involves subsurface injection through a series of wells; the injection well spacing at a site depends significantly on the ability to distribute the oxidant from a given well; and the oxidant distribution will be affected by the geologic and hydrogeologic conditions and the natural oxidant demand (NOD).

Ms. O'Reilly then noted that the goal of the ISCO pilot test is to provide site-specific information necessary to further evaluate the potential application of ISCO technology at MMR and determine whether it can be a useful technology to supplement the existing pump-and-treat systems. She also reviewed the objectives of the pilot test: to determine if adequate injection flow rates and pressures could be achieved with small diameter wells; to determine whether injection wells could be installed using a direct-push rig or if existing wells could be used as injection wells, which would be cost-effective; to assess the migration of the injected oxidant (sodium permanganate); to determine the number of wells required to treat a specified area; to quantify the consumption of the permanganate by NOD (which was assumed to be low at MMR); and to assess the impacts on general geochemistry and dissolved metals concentrations, given that non-target analytes could also be oxidized by the injection. Ms. O'Reilly noted that AFCEE was successful in meeting the objectives of the pilot test.

Ms. O'Reilly continued her presentation by showing an aerial photograph of the CS-10 ISCO pilot test site area and pointing out the I Gate, Simpkins Road, the pilot test site, and the downgradient CS-10 extraction well, EW-9. She noted that the pilot test location was chosen because of the higher contaminant concentrations there (up to 600 µg/L of TCE), because it was a secure site (behind the I Gate) with a power supply nearby, and because it was easily accessible for equipment and personnel. She also noted that because of the low hydraulic conductivity material there, the contaminant concentrations at the pilot test site are predicted to persist throughout system operation and perhaps beyond. In addition Ms. O'Reilly reported that site characteristics in the area are generally consistent with other portions of the CS-10 plume (high DO and low NOD).

Ms. O'Reilly then showed a cross-section figure of the pilot test site and pointed out: well cluster 03MW1024, which is just upgradient of EW-9; two lobes of contamination with fairly high concentrations; the silty sand zone (with the highest concentrations); and the clean water between the two lobes. She also noted that the ISCO test targeted the shallower lobe of contamination, an area located about 50 feet or so below mean sea level.

Ms. O'Reilly stated that a groundwater flow zoom model was developed to support the design of the pilot test. Design details identified with the model included: the number and spacing of the oxidant injection points (5 feet apart); the volume of injected oxidant solution and injection concentrations; and the layout of the monitoring network. Ms. O'Reilly reported that: the design model was able to produce a permanganate plume that was 50 feet thick and corresponded to the depth interval of the upper TCE plume lobe; simulations were completed to predict the development and migration of the permanganate plume, which had a maximum width of 75 feet and a length of 145 feet; and simulation results were used to design a monitoring network that included 22 wells located upgradient, cross-gradient, and downgradient of the injection wells.

Ms. O'Reilly displayed a figure entitled "Oblique View of Simulated Permanganate Plume After Fourth Injection Cycle" and noted that it turned out that three, vertically-spaced injection wells (deep, mid-depth, and shallow) were needed to cover the 50-foot zone. She also displayed a figure entitled "ISCO Pilot Test Monitoring Locations" and pointed out the injection wells, the monitoring wells, and the drive-points that were installed to help determine the thickness of the permanganate plume.

Ms. O'Reilly then stated that sodium permanganate (at 5,000 mg/L) was chosen as the oxidant for the injection because it can be diluted as a liquid solution and was thought to be persistent, with good advection properties. It was also proposed to add a non-reactive tracer, bromide, to the injection since the permanganate may become used up by the TCE. Ms. O'Reilly noted that the plan was to inject at 10 gpm in each of the three well screens for 10 hours a day for four days, for a total injection volume of 72,000 gallons of permanganate. She also reported that the sodium permanganate was received as a 10% solution that was diluted to 5,000 milligrams per liter (mg/L) at the site using base hydrant water. The dilution was accomplished with in-line mixing, and there were valves and instrumentation to control the mixing and injection. A manifold was used to distribute the solution to each of the three injection wells so that the injection could occur in all three wells simultaneously. Ms. O'Reilly showed a figure entitled "CS-10 ISCO Pilot Test Injection Equipment Schematic" as well as several photographs of the test site, and pointed out the permanganate tanker, the injection equipment, a de-con area, the manifold, the three separate lines to the injection wells, and the injection wells.

Ms. O'Reilly then reviewed an "Injection Results" slide, which noted the following: the injection timeframe was extended to five days (November 13 – 17, 2007) due to a late start one day when the valve on the tanker couldn't be opened because of freezing weather conditions; flow rates of 10 gpm were achieved at each injection well for the first two days, but, because of the varying lithology at the different elevations, the flow rates at the two deeper wells were decreased to 7 and 8 gpm and the flow rate at the shallow well increased to 15 gpm for the last three days; and a steady-state sodium permanganate concentration of 5,000 mg/L could not be maintained, and instead concentrations varied from 500 to 14,000 mg/L throughout the injection. Ms. O'Reilly noted that lessons learned from the experience included that using a mixing tank instead of in-line mixing and using electric pumps rather than gas-powered pumps would have helped regulate the injection concentration, and that sample analysis could have been done in the field rather than back at the field services trailer.

Ms. O'Reilly went on to discuss the sampling program, noting that a baseline event was conducted to establish pre-treatment aquifer conditions. She also reported that performance monitoring was done to assess the distribution and persistence of the permanganate and to evaluate the impact of the injection on the general geochemistry. Analyses included sodium permanganate, total dissolved solids, (TDS), sodium, bromide, VOCs, select metals, and water quality parameters. In addition, soil samples were collected at each of the injection well screen elevations for NOD analysis, and water level measurements were taken to evaluate the hydraulic impact from the injection and serve as a calibration target for the flow model. Ms. O'Reilly also mentioned the direct-push drilling that was done to supplement the monitoring well results and she reported that field activities were completed between August 2007 and April 2009.

Mr. Goddard inquired about the breakdown products that were being sought. Ms. O'Reilly clarified that when TCE comes into contact with the permanganate, the reaction is pretty much instantaneous. Mr. Goddard asked, "To what?" and Ms. O'Reilly replied "to the carbon dioxide, chloride, and water." Mr. Goddard then asked if that is the same case for PCE. Ms. O'Reilly replied that it is, but also clarified that the pilot test occurred in an area where there is no PCE contamination.

Ms. O'Reilly then stated that the 22 monitoring wells and the three injection wells were sampled for sodium permanganate during the pilot test. The injection wells were screened at three different elevations – A screen was deep (in silty sand), B screen was mid-depth (at the top of silty sand), and C screen was shallow (in sand) – and it was found that the varying lithologic conditions at each elevation impacted the migration of the sodium permanganate in each zone.

Ms. O'Reilly noted that in the shallow zone, where the injection rates were higher (up to 17 gpm) and the injection well was situated within a sand unit, sodium permanganate was detected within one day of injection at a shallow monitoring well 25 feet downgradient. And there was significant advection, with sodium permanganate observed 100 feet downgradient after two months. Because of the high groundwater flow rates in the shallow zone, however, the sodium permanganate was less persistent. Ms. O'Reilly showed a figure entitled "ISCO Cross-Section A-A'" and pointed out the 03MW1024 well cluster and the three injection well screens.

Ms. O'Reilly then reported that in the mid zone, where achieved injection rates were 8 to 10 gpm and the injection well was situated on top of a silty sand unit, sodium permanganate traveled 65 feet in three months, which showed significant advection. Also, relatively long persistence was demonstrated by the presence of sodium permanganate in some of the mid-screen wells at the end of the pilot test (at 18 months). In the deep zone, where achieved injection rates were 7 to 10 gpm and the injection well was situated in a silty sand unit, the highest sodium permanganate concentrations were observed (greater than 8,000 mg/L), as was a long persistence. Advection, however, was significantly less, with the sodium permanganate having traveled only 35 feet in three months, and between 35 to 65 feet at the end of 18 months.

Ms. O'Reilly showed a time series plot of sodium permanganate concentrations at various depths in 03MW1024. She then described the progress of the sodium permanganate over time while showing a series of cross-section figures dated December 2007, January 2008, February 2008, March 2008, and November 2008. Ms. O'Reilly then reviewed a slide that noted the following: the maximum sodium permanganate concentrations (8,000 mg/L) were higher than the targeted injection concentration (5,000 mg/L) because higher concentrations were injected at various times throughout the injection period; sodium permanganate was not observed in monitoring wells located to the southeast, but high concentrations (greater than 5,000 mg/L) were observed in monitoring wells located to the southwest, indicating that groundwater flow direction was more southwesterly at the pilot test site than originally expected; significant distribution due to advection was observed, but the sodium permanganate did not extend as far laterally, which may be due to relatively low dispersion in the aquifer; vertical distribution of sodium permanganate was observed up to 14 feet below the deep injection well; and the sodium permanganate plume reached a thickness covering 53 feet, and was approximately 40 feet wide and 135 feet long, which is consistent with the design goal to produce a sodium permanganate plume approximately 50 feet thick, 75 feet wide, and 145 feet long. Ms. O'Reilly also showed a figure entitled "Distribution of Maximum Sodium Permanganate Concentrations."

Ms. O'Reilly then reported that soil samples from each of the injection well screen locations were collected and analyzed for NOD. Results showed very low concentrations – much lower than at other sites where ISCO technology has been used for remediation. Ms. O'Reilly explained that this was favorable for efficient in-situ chemical treatment of the contamination because the oxidant is not used by the NOD before the contaminant is treated.

Ms. O'Reilly reported that the metals sampling program for the ISCO pilot test involved sampling for sodium, chromium, hexavalent chromium, manganese, arsenic, and molybdenum. She noted that sodium, which is present in the sodium permanganate solution, was used to assist in monitoring the migration of the sodium permanganate. And the other metals were identified as having the potential to become more mobile because their valence state is changed to more soluble forms in an oxidizing environment.

Ms. O'Reilly stated that significant increases in sodium concentrations were observed in wells impacted by sodium permanganate, and this was expected because the sodium permanganate oxidizes into sodium and permanganate ions in solution. She also noted that sodium concentrations decreased with decreasing sodium permanganate concentrations and returned to background values after the sodium permanganate was no longer present in the well. Ms. O'Reilly said that normally one would expect to see sodium longer after sodium permanganate migrates downgradient, but this provides evidence of migration of upgradient groundwater into the treatment area. She also showed a line graph entitled "Sodium Permanganate and Sodium Concentrations at 03MW1024G" and pointed out the maximum sodium permanganate concentration (nearly 3,000 mg/L), which corresponded to the maximum sodium concentration (300 mg/L), and both of which occurred within a month or so of the injection.

Ms. O'Reilly then reviewed the TDS Results slide, which noted the following: the sodium permanganate compound ionizes into sodium and permanganate in solution, increasing the TDS concentration in the water; substantial increases in TDS (up to two orders of magnitude) were observed in the presence of sodium permanganate; TDS concentrations decreased with decreasing sodium permanganate concentrations; the trend provides evidence of migration of upgradient groundwater into the treatment area; and if a decrease in sodium permanganate was due to its consumption, the TDS and sodium concentrations would have remained high. Ms. O'Reilly then showed the line graph entitled "Sodium Permanganate and TDS Concentrations at 03MW1024G."

Ms. O'Reilly also reviewed the Manganese Results slide: significant increases in manganese concentrations were observed in wells impacted by sodium permanganate, as was expected since manganese is a byproduct of the degradation of permanganate; manganese concentrations decreased with decreasing sodium permanganate concentrations and returned to background values after sodium permanganate was no long present in the well; and manganese concentrations at other locations where sodium permanganate was still present in March 2008 were also expected to decrease readily as permanganate concentrations declined. Ms. O'Reilly then showed the line graph entitled "Sodium Permanganate and Manganese Concentrations at 02MW1024G."

Ms. O'Reilly continued by displaying the Chromium Results slide, which noted the following: increased total dissolved chromium concentrations were observed after the injection; chromium was detected in the presence of sodium permanganate or in wells where sodium permanganate had been observed previously; chromium concentrations appeared to attenuate when sodium permanganate was no longer present, although at a slower rate than other metals; hexavalent chromium was detected above the reporting limit in two shallow screened wells at a concentration of 14 µg/L (March 2008); and in a strong oxidizing environment, the valence state of a metal is changed to more soluble forms (trivalent chromium to hexavalent chromium.)

Ms. Jennings inquired about measuring for trivalent chromium, which she noted is "pretty toxic." Ms. O'Reilly replied that sampling had been done for total dissolved chromium, and it was assumed that the total dissolved chromium detected in wells where permanganate was observed was hexavalent chromium. She further noted that the plan was to analyze samples for hexavalent chromium as well as total dissolved chromium but unfortunately, the lab diluted the samples so much for the hexavalent chromium analysis if sodium permanganate was present in the sample, the reporting limits were so high (about 5,000 µg/L) that all the samples came back nondetect. After the sodium permanganate migrated past a well it was possible to analyze for hexavalent chromium and in two of the shallow wells hexavalent chromium was seen at a concentration of 14 ug/L, which was consistent with the concentration detected for total dissolved chromium in those two wells.

Ms. Jennings asked if it's correct then that there's no understanding for total dissolved chromium versus hexavalent chromium versus trivalent chromium. Ms. O'Reilly replied that there is an understanding for total dissolved chromium, and it's assumed, given the presence of the strong oxidant, that it would have been present as hexavalent chromium. Ms. Jennings asked if it's possible to do a re-analysis, and Ms. O'Reilly confirmed that it is.

Ms. O'Reilly then showed a line graph entitled "Sodium Permanganate and Chromium Concentrations at 03MW1024G." Ms. Jennings remarked again that trivalent chromium is "pretty toxic." Ms. Forbes clarified that in fact hexavalent chromium is more toxic than trivalent. Ms. Jennings asked why then Ms. O'Reilly thinks hexavalent chromium is "okay." Ms. O'Reilly explained that she isn't saying that it's okay; rather, she was just reporting that it was assumed that the total dissolved chromium was hexavalent chromium in the presence of the oxidant and this is expected with the injection of a strong oxidant. She also noted that the increase in chromium concentrations (around 325 ug/L) wasn't long-lived, decreasing down to 14 ug/L after the sodium permanganate went by

Mr. Field asked what would happen as hexavalent chromium "migrated down." Ms. O'Reilly replied that it would eventually switch back to a trivalent state. Ms. Forbes said that it's worth noting that this typically what happens with ISCO technology. Ms. O'Reilly agreed and reminded the group that she had mentioned earlier that AFCEE had wanted to try to determine the impact the injection of a strong oxidant would have on inorganic compounds that weren't being targeted. She added that chromium "was definitely one of the parameter that increased in mobility, because the hexavalent state is more mobile than the trivalent state, and that is the more toxic one."

Ms. O'Reilly then continued her presentation by noting that groundwater samples were not analyzed for TCE if sodium permanganate was present, because the TCE would have been completely deteriorated. After the sodium permanganate had migrated past the wells, however, it was found that TCE concentrations were fairly similar to what they were before the injection. Ms. O'Reilly explained that the apparent rebound is likely due to the influx of contaminated groundwater from upgradient, as indicated by the return of TDS and sodium values to baseline values after the sodium permanganate was no longer present. She stated that it wasn't possible to determine the reduction in TCE mass as a result of the injection because TCE-contaminated water kept coming in from upgradient.

Mr. Reif asked, given the rebound problem and that the objective is to reduce TCE, what other parameters provide confidence in the ISCO process. He also inquired about the possibility of reducing the 5,000 mg/L concentration of sodium permanganate, and the idea of optimizing the contact time of the contaminant with the oxidant. Regarding the contact time, Ms. O'Reilly explained that the more persistent contamination is in the lower-conductivity units, and sodium permanganate was still being detected in the silty sand 18 months after the injection. So, where contaminant concentrations are highest, the oxidant shows good persistence and long contact time. In response to Mr. Reif's question about the TCE rebound, Ms. O'Reilly stated that ISCO technology is usually used in a source area, where there's no concern about contamination coming back into the site, which is what was observed at this site. Mr. Gonser added that it might be helpful to compare TCE levels some distance downgradient from the injection site to what would be expected there. Ms O'Reilly stated that downgradient wells are being sampled for TCE as part of the SPEIM program, Ms. O'Reilly then showed a line graph entitled "TCE Concentrations at 03MW1033B and 03MW1034B" and noted that at both of these wells, TCE levels decreased to just slightly lower than baseline after the sodium permanganate had migrated past.

Ms. O'Reilly then reported that water quality parameters (specific conductivity [SpC], oxidation-reduction potential [ORP], pH, and temperature) were measured in the field to evaluate changes in the aquifer geochemistry. She also noted that increases in SpC and ORP are typically seen in the presence of a strong oxidizer. She further noted that in order to prevent damage to the probes, water quality measurements were not taken if sodium permanganate was present in a well; however, after the sodium permanganate had migrated past, no significant changes in water quality parameters were observed. Ms. O'Reilly said that this was likely related to the migration of upgradient groundwater flushing out the area, because normally changes in field parameters would be expected.

Ms. O'Reilly then reviewed the following conclusions: adequate flow rates (8 to 17 gpm) were achieved and maintained with small diameter wells: the distribution and persistence of the sodium permanganate was determined based on the results of the monitoring program – the sodium permanganate plume reached a thickness covering approximately 53 feet and was approximately 40 feet wide and 135 feet long; observed sodium permanganate plume dimensions were consistent with the pilot test design model estimates of 50 feet in thickness, 75 feet in width, and 145 feet in length, and indicates that the ISCO simulation model was a useful tool for designing the injection system for the pilot test; and significant sodium permanganate distribution, due primarily to advection, was observed, primarily in the shallower zones (100 feet within two months and 135 feet within six months of the injection) – in contrast, sodium permanganate only migrated between 35 and 65 feet downgradient of the injection wells in the deeper lower conductivity zone, 12 months after the injection.

Ms. O'Reilly continued her review of conclusions: sodium permanganate migrated relatively quickly through the shallower zone and was observed within days of injection but not detected in shallow screened wells five months after injection; substantial sodium permanganate persistence (eight to 18 months) was observed in wells screened in lower hydraulic-conductivity sediments at deeper intervals; NOD test results were also low in comparison to concentrations and mass of sodium permanganate injected during the pilot test – since the NOD was very low, the consumption of NOD by the sodium permanganate was assumed to be negligible and wasn't quantified; and significant increases in sodium, manganese, and TDS concentrations were observed in wells impacted by the sodium permanganate injection – concentrations decreased with decreasing sodium permanganate, indicating the migration of groundwater with low sodium, manganese, and TDS into the treatment area from upgradient. Ms. O'Reilly then completed her review of conclusions: increased total dissolved chromium concentrations were observed after the injection – it is believed that chromium, was likely present as hexavalent chromium at the locations where sodium permanganate was present – chromium concentrations appeared to attenuate when sodium permanganate was no longer present, but at a slower rate than other metals (sodium and manganese); and no significant changes in water quality parameters were observed after sodium permanganate migrated past a well and no significant changes were observed in the wells not impacted by the sodium permanganate – this was not expected and is likely related to the migration of upgradient groundwater flushing out the area

Ms. O'Reilly also reviewed a slide entitled "Path Forward": additional sampling for TDS, sodium, and manganese will be completed at several monitoring wells located downgradient of the pilot test site and at 03EW2109 to further evaluate the migration of the permanganate plume; and the potential for using ISCO technology for treatment in the CS-10 plume may be considered when evaluating future optimizations of the CS-10 In-Plume treatment system – the objective of implementing this technology at CS-10 would be to expedite aquifer restoration and reduce the total life-cycle cost of the remediation – cost estimates would need to be prepared to evaluate the cost benefit of using ISCO technology.

Mr. Goddard asked if the higher concentration contaminant in the silty sand is slowly being released or just remaining there. Ms. O'Reilly replied that it's possible that the contamination in the lower-conductivity units could act as secondary sources, slowly bleeding out over time and potentially extending the system operation timeframe.

Mr. Goddard then asked if it's correct that the point of the ISCO technology is to convert TCE into carbon dioxide, water, and chloride. Ms. O'Reilly confirmed that it is. Mr. Goddard then asked about measuring for chloride, since that would seem indicative of whether the TCE was being converted. Ms. O'Reilly replied that she doesn't know that that would be indicative. Ms. Forbes explained that generally there's already a great deal of chloride in the aquifer and the soils, so the background level is likely very high. She also confirmed that the test did not include measuring for chloride. Mr. Goddard questioned how ISCO technology could be useful if it isn't shown that the TCE mass was converted. Ms. Forbes explained that it's more a matter of the absence of TCE rather than the presence of carbon dioxide, water, or chloride. She also noted that AFCEE will be conducting additional sampling for TCE, and to address Ms. Jennings' concern, chromium can certainly be added as well.

Mr. Goddard noted that another concern he has is whether ISCO might create a new contamination problem. He also asked if it's correct that Ms. O'Reilly had spoken about measuring TCE downgradient. Ms. O'Reilly confirmed that starting next month AFCEE will be conducting additional sampling for TCE and other parameters downgradient. Mr. Goddard suggested that finding a gap in contaminant concentrations would indicate that "it's being scrubbed" by the ISCO process. Ms. O'Reilly agreed and noted that one of the problems with in-situ technologies is the lack of concrete measurements like those associated with pump-and-treat, where one can measure influent groundwater and calculate how much mass has been removed.

Mr. Goddard also asked whether reactive wall technology, like that previously tested at the CS-10 source area, might be applicable at a "hotspot" like the one at the ISCO pilot test site. Ms. O'Reilly replied that reactive wall technology, which is another in-situ technology that AFCEE evaluated, is very costly to install at the depths and dimensions needed to treat the CS-10 plume. Mr. Field added that it's his recollection that reactive wall technology would be more applicable for a narrow plume, while the IRP plumes are generally wide and spread out. Mr. Goddard noted that he's referring to the "hotspot" where the contamination is expected to reside in silty sand for the next 75 years or so. Ms. Forbes confirmed that reactive walls are very expensive to install. She also said that although a downgradient extraction well is capturing the entire plume upgradient plume, AFCEE is trying to get something into the lower-conductivity units (where contaminant is sorbed and slowly bleeding out) in order to reduce the cleanup time, and a reactive wall wouldn't attack that contamination within the silts.

Ms. Grillo said that it was mentioned that ISCO technology may be used in future optimizations; she then asked how often optimizations are scheduled. Ms. O'Reilly replied that AFCEE will be completing a data investigation at the In-Plume area, upgradient of some of the extraction wells where high concentrations have been detected, including EW-2, an upgradient well where steady influent concentrations of nearly 90 ug/L of TCE have been observed at a flow of 460 gpm. She noted that new data from that investigation would be used to create a new TCE plume shell and look at optimizing the system, trying to improve performance and reduce life-cycle costs and the aquifer restoration timeframe. She said that if a high-concentration pocket that's expected to migrate slowly is found, it might be effective to use ISCO treatment. She further noted, however, that modifications might be needed – such as doing more than one injection, or utilizing a recirculating injection scenario with ISCO in order to help increase efficiency. Ms. O'Reilly said that cost/benefit would be analyzed to determine whether that approach would be worthwhile.

Ms. Grillo then inquired about the cost of ISCO technology. Ms. Forbes said that she would have to look up that information and Mr. Field noted the request as an action item. Ms. Grillo then said that this was a very lengthy presentation and Ms. O'Reilly did a very good job; however, if it's unlikely that ISCO will be used in the future, she doesn't think such a long presentation was needed. Mr. Field remarked that a broader message might be that many different technologies are examined in order to see what might be effective in reducing cleanup times.

Mr. Gonser remarked that "in-situ treatment really is an excellent way to go" because it's a sustainable approach to cleanup in that it doesn't generate a lot of greenhouse gases, doesn't use a lot of energy, and doesn't create waste that has to be transported to a landfill. He also noted that the challenges associated with ISCO are the depth to the groundwater and the transmissivity of the aquifer, which requires such close spacing of injection wells, making the technology "pretty expensive." Mr. Gonser added that the IAGWSP is always looking at trying to use more in-situ treatment at MMR, and he thinks it makes good sense to pursue it, although challenges do exist.

Agenda Item #5. Community Involvement Updates

Membership Guidelines

Mr. Field said that because hard copies of the membership guidelines/groundrules were not provided at tonight's meeting, he recommends postponing the topic until the December MMRCT meeting. There were no objections to proceeding in this manner.

MMR Cleanup Update and Community Involvement Plans

Ms. Curley reported that the IAGWSP and IRP have updated their plumes for the groundwater findings map (also known as the all-plume map because it includes groundwater plumes associated with both cleanup programs). She said that the document, which is being called the Cleanup Update and includes the map as well as "wrap-around" information, is currently undergoing internal review, is expected to be provided to MMRCT members for their review sometime in November, and then issued by the end of the year. Ms. Curley also noted that the IAGWSP's Community Involvement Plan (CIP) is also in the works, but is not the program's highest priority at this time, given the ongoing work associated with remedy selection plans, decision documents, and so forth. She said that it's hoped that the CIP will be available for review sometime in the beginning of 2010 – probably in the spring at the latest.

Mr. Karson stated that the regulatory agencies have completed their review of what the IRP calls its CIP Addendum, and comments are being addressed. He explained that the document is an addendum to the CIP that was issued in 2003, and is currently just under 20 pages long. He also noted that the CIP Addendum outlines activities that the IRP currently conducts as part of its Community Involvement Program and those that it intends to conduct in the foreseeable future. The document does not, however, include much of the historical information from the 2003 version, but refers back to that version as the source for information about past public involvement activities, community interviews, and so forth. Mr. Karson also said that he expects that MMRCT members will be provided with the CIP Addendum for review and comment sometime in November, with a public comment period to be scheduled in December.

Mr. Goddard said that he thinks the Cleanup Update will be a very useful tool in many ways. He then suggested utilizing space on the back of the document so it could be folder over and used as a mailer. He also mentioned the idea of a PDF version that could be emailed and made available to local realtors, Boards of Health, and the like. He said that he thinks the document will be a "good one-pager" that describes ongoing cleanup activities (not just investigations). Ms. Curley clarified that the Cleanup Update will actually be eight pages, with the more detailed information being a wrap-around to the groundwater findings map. She also confirmed that self-mailer and PDF versions would be available, and that the PDF would be posted on both the IAGWSP and IRP websites.

Ms. Grillo said that the IAGWSP CIP is continually being postponed, and given that there are so many IAGWSP activities scheduled for next year, she thinks that the plan should be in place. She also said that she can't recall whether it was 2001 or 2003 when the last CIP version was issued, and added that the goal is not to produce "a 30-page document that sits on a shelf." She further noted that she herself has difficulty determining, for example, whether the appropriate documentation for a cleanup action is supposed to be an RSP or a Decision Document, or whether an investigation is being folded into a larger RI/FS – and therefore she's concerned about the general public having a good understanding of the process. Ms. Grillo stated that she does not advocate postponing the CIP until April or May, and she believes that it is something that could have been accomplished long ago. She also said that, at minimum, she thinks that every IAGWSP presentation should include information about "where we are in the process" and the public involvement opportunities that are available. Ms. Grillo also expressed frustration over having asked repeatedly for the IAGWSP to provide a CIP, and she's just wondering why that hasn't happened yet.

Mr. Taylor stated that 23 years ago, when local businesses expressed a great deal of concern about the MMR groundwater plumes, the public was told by the military that all the plumes were on base property, that the best minds were studying the situation, and not to worry about it. He then said that looking at the maps shows that that "certainly isn't where we came to." Mr. Taylor also noted that 15 years ago, he, Joel Feigenbaum, and James Kinney calculated that the migration of the plumes was degrading eight million gallons of water per day. He further stated that that degrading of groundwater continues now because "a whole lot of" the CS-10 plume, as well portions of other plumes, such as LF-1 and Ashumet Valley, have been left uncaptured. He then said that he thinks that the words *extremely limited* should be used before the term *cleanup*, since eight million gallons of groundwater per day continues to be degraded today. Mr. Taylor also implied that he thinks it's nonsense to provide real estate companies with a document "that says something about cleanup" since what's being done is "extremely limited" and "not a big deal."

Mr. Minior stated that the underlying message is that human health and the environment are being protected, even if a small of amount of degradation of the aquifer continues while those uncaptured portions of plumes migrate and attenuate naturally. He stressed that there is no threat to human health or the environment. People are not drinking the water and no one is at risk. Mr. Minior said that although Mr. Taylor may not prefer the methods that have been undertaken, AFCEE continues to work with the U.S. Environmental Protection Agency (EPA) and MassDEP to ensure protection of human health and the environment. Mr. Goddard said that, given the amount of money spent on investigation and cleanup activities, he thinks it's important that people understand "that something was done" and how that affects their health, families, drinking water, and property values. Therefore he is opposed to saying nothing or not sharing any positive news because pristine groundwater conditions haven't been achieved.

Mr. Goddard also said that he thinks that members of the public should be told whether or not they're in immediate danger of exposure – as this is primary in everyone's mind. He further noted that he believes that public attendance at cleanup meetings has decreased over the years because people are confident that the problems are being addressed. Mr. Goddard also mentioned that he read that water pipes have potentially brought more TCE to the area than anything from the base, and he thinks it's important for there to be some perspective on these kinds of issues.

Mr. Marchessault reminded Mr. Taylor that in 1994, when the eight-million-gallons-per-day calculation was done, only one treatment system was in place – the CS-4 system, "which didn't even operate very well." Now, however, there are many systems in place, most of which are located at the leading edges of the plumes, with the exception of LF-1 and a small portion of CS-10. Mr. Marchessault stated that the actual amount of water being contaminated is "significantly less than the number" Mr. Taylor mentioned. He also said that he thinks that a great deal of progress has been made over the years.

Agenda Item #6. Next Meeting Schedule and Adjourn

Mr. Field stated that the MMRCT would meet next on Wednesday, December 9, 2009. He then adjourned the meeting at 8:30 p.m.