Impact Area Review Team
Bourne Best Western
July 25, 2006
6:00 – 9:00 p.m.

Meeting Minutes

Members:	**Organization:**
Ben Gregson	IAGWSP
Mike Minior	AFCEE/MMR
Lynne Jennings	US EPA
Bill Walsh-Rogalski	US EPA
Ron Fein	US EPA
Len Pinaud	MassDEP
Earl Lantery	IART/Sandwich
Edward Webb	IART/Sandwich
Richard Conron	IART/Bourne
Bob Mullennix	IART/Bourne

Facilitator:	**Organization:**
Jim Murphy	US EPA

Attendees:	**Organization:**
Kris Curley	IAGWSP
Bill Gallagher	IAGWSP
Lori Boghdan	IAGWSP
Pam Richardson	IAGWSP
Paul Nixon	IAGWSP
COL Bill FitzPatrick	E&RC
Larry Cain	USACE
Jane Dolan	US EPA
Desiree Moyer	US EPA
Mark Panni	MassDEP
Elliott Jacobs	MassDEP
Mark Begley	EMC
Kevin Hood	UCONN/TOSC
Jim Pierce	Citizen of Sandwich
David Dow	Sierra Club
Amanda Lehmert	Cape Cod Times
Diane Short	Ellis/DSA
Jane Shea Moran	e^2M

Agenda Item #1. Welcome, Agenda Review, Approval of 6/27/06 IART Meeting Minutes

Mr. Murphy convened the meeting at 6:04 p.m. and noted that Jim Pierce, a new member of the Plume Cleanup Team (PCT), who is also interested in joining the Impact Area Review Team (IART), is at the table. The IART members introduced themselves, and Mr. Murphy reviewed the agenda and then asked if there were any changes to the June 27, 2006 IART meeting minutes. No changes were offered and the minutes were approved as written.

Agenda Item #2. Responses to Action Items, Late-Breaking News

Mr. Murphy confirmed that there were no questions or comments on the responses to action items from the June 27, 2006 IART meeting.

Mr. Gregson reported that tungsten was recently detected at 560 parts per billion (ppb) in a well at B Range, one of the Small Arms Ranges. Previous tungsten sampling results at the well were 16 ppb and 22 ppb. The result from sampling subsequent to the 560-ppb detection was 5.6 ppb, and therefore the U. S. Army Environmental Center (AEC) is trying to find an explanation for the spike in the data – whether it was due to a pulse of contamination or whether it was an error of some kind having to do with the way the sample was collected or analyzed.

Mr. Gregson also noted that as part of the ongoing soil and groundwater investigations at the Small Arms Ranges, some drive-point work and the installation of some monitoring wells is planned for B Range, which should be valuable in terms of understanding the 560-ppb tungsten detection there. In addition, the Impact Area Groundwater Study Program (IAGWSP) has been working with the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Army Corps of Engineers (USACE) to collect another sample from the monitoring well where the 560-ppb occurred and to sample some of the wells in the area between the Upper Cape Water Cooperative supply wells and the Sierra East/Sierra and Tango Ranges, which had

previously tested nondetect. Mr. Gregson then stated that a written report on the data is expected to be issued later this week or early next week.

Mr. Mullennix asked if a duplicate sample had been held for the well where tungsten was detected at 560 ppb. Mr. Gregson replied that he isn't sure, but would check on the status of that.

Mr. Dow inquired about the possibility that the higher contaminant levels in the soil pore water could have somehow been introduced into the sample. Mr. Gregson replied that while he's not sure about that, lysimeter results beneath the berm near the monitoring well show high levels of tungsten (in the part per million [ppm] range), so the possibility that some runoff from the berm might have gotten into the well is being considered. He also noted, however, that the integrity of the well looks okay, but it's not absolutely certain whether some kind of short-circuiting could have occurred.

Mr. Dow mentioned the idea that rainfall events could wash high levels of contaminant out of the soil such that concentrations in soil pore water could vary from parts per million to some lower value, depending on how recently the rain had occurred. Mr. Gregson replied that the idea that it's been a relatively rainy year that might be causing contaminants to reach the groundwater faster than normal is being factored into the assessment.

Agenda Item #3. Risk Assessment 101

The group watched a 10-minute U.S. Environmental Protection Agency (EPA) video presentation that outlined and explained the four parts of the Superfund risk assessment process: data collection and evaluation, exposure assessment, toxicity assessment, and risk characterization.

Mr. Gregson introduced Larry Cain, the USACE risk assessor working with the IAGWSP. Mr. Cain stated that the purpose of his presentation is to provide the team with information about what risk assessment is, how it's applied, and how it supports the decision-making process for environmental problems at sites. He noted that making risk-based decisions involves: gathering data, conducting a risk assessment and writing a report; putting the report out for review and comment; considering other factors beyond risk, such as fate and transport; determining whether there's a need for remedial action; and then taking the remedial action, if warranted.

Mr. Mullennix asked Mr. Cain to identify the actual decision-makers. Mr. Cain recommended coming back to this question at the end of his presentation. He then continued by noting that a great deal of the risk assessment process involves assessing exposure – in terms of receptors, intensity, and frequency. He also said that because some of the chemicals evaluated at a typical site might be encountered elsewhere, incremental risk to health is considered as part of risk assessments. He further noted that risk assessment involves looking at both current and future conditions.

Mr. Cain then said that he considers the conceptual site model (CSM) the centerpiece of each risk assessment, as it provides the framework to focus the assessment by identifying complete exposure pathways and by distinguishing critical data needs from "not-so-critical" data needs. He also noted that the CSM shows the contaminant path from its source to the receptor, if one exists. He displayed a sample "cartoon-like" CSM and pointed out the various sources of contamination and pathways. He then displayed a cross-section figure and noted that what keeps it from being a CSM is that it doesn't include any indication of a source. Mr. Cain also showed a summary diagram of a CSM and noted that it identifies the source, transport mechanisms, exposure media, exposure routes, and potential receptors.

Mr. Cain continued by speaking about the application of risk assessments to "easy" sites, which require a fairly simple screening assessment that involves comparing sampling results to established generic criteria and determining whether there are any exceedances. He noted that

these easy sites generally pertain to small real estate transactions and the like. He also spoke about "not-so-easy" sites, which usually involve some kind of a baseline risk assessment, and pertain to more contaminated sites that might entail multi-media (such as soil, water, air, food).

Mr. Cain noted that an example of a typical "not-so-easy" site would be a rocket range at the Massachusetts Military Reservation (MMR), where there's potential for human contact with contaminated soil, although not generally with vapors or contaminated surface waters. With respect to contact through household use of groundwater, the concern would pertain to future users at MMR (as no current residents are using on-site groundwater) and to the possibility that the groundwater might be used by off-site residents, if it has traveled that far. Mr. Cain also noted that for a human health risk assessment at MMR, trespassers, recreational visitors, military workers, construction workers, and (hypothetical) future residents would be considered with respect to the various potential exposure routes, depending on the chemical (ingestion, dermal contact, and inhalation.)

Mr. Cain then noted that the first step of a human health risk assessment, which is data collection and evaluation, includes grouping the data by location, type of media (soil, water, air), and depth (with respect to soil data). The second step, the exposure assessment, involves looking at: current and likely future land uses; individuals at the site, the frequency that they're there, and the likelihood and intensity of exposure; and because of the sandy soil at MMR, the potential for leaching to groundwater, which is a major concern.

Mr. Cain then spoke about the third step of a human health risk assessment, the toxicity assessment, which is usually based on animal studies conducted in a laboratory. He explained that the toxicity assessment is a way of quantifying exposure versus effect, with increased dose being proportional to increased effect. He also noted that the toxicity assessment distinguishes between cancer and non-cancer effects.

Mr. Cain then discussed the fourth step, risk characterization, which involves looking at the results of the three previous steps in order to estimate cancer risk and non-cancer hazards. He also explained that the risk characterization, which accounts for total site risk (including any multiple chemicals or multiple exposures), looks at whether established limits are being exceeded.

Mr. Cain then reported that other considerations associated with a risk assessment are data quality issues (whether there are any data gaps) and whether background concentrations are important. He noted that background concentrations of metals, for example, could be naturally-occurring, although that is not the case for explosives. He further noted that various man-made chlorine byproducts from water treatment systems and the like are commonly detected at MMR and the question of whether that contamination is site-related needs to be answered as part of the risk assessment.

Mr. Cain also referred to challenges associated with groundwater risk assessment and noted that contamination from guns is deposited not only where the shells hit and explode, but also at the end of the gun barrel. If there's enough contamination and it's soluble, precipitation events could transport the contaminant from the soil to the groundwater – the question is how likely that is to occur. And if groundwater sampling shows no contamination, the question might be whether the contamination hasn't reached that location or has already traveled beyond it. Mr. Cain noted that theoretical transport models can be helpful in determining whether contamination has peaked or if it's likely to reach a location later on.

Mr. Cain continued by noting that an obvious concern about munitions, or unexploded ordnance (UXO), is that they are a risk to safety, which, however, is not being quantified at this point because it's extremely difficult to do. Nevertheless, access restrictions are in place at MMR and the IAGWSP is working on estimates of munitions as a source of contaminant leaching to

groundwater. He also mentioned the issue of the existence of UXO that might leak in the future, as they do corrode over time.

Mr. Cain then stated that the use of risk-based information can lead to a range of outcomes, including: a no-further-action determination (no cleanup is needed and existing institutional controls are adequate); a determination to continue monitoring to see if a cleanup action might be required in the future; and a determination for active remediation (cleanup and the implementation of institutional controls). In the last instance, the risk assessment process can be used to back-calculate acceptable cleanup goals and help define institutional goals.

Mr. Cain also discussed a hypothetical example of a risk assessment pertaining to a site where explosives were found in soil, some of those explosives were also found in groundwater, nobody's using the groundwater, the groundwater is staying on the site, toxicity values were available, a risk characterization could be conducted, and uncertainties and data gaps were being addressed.

Mr. Cain then reviewed the range of risk estimates for the hypothetical site. He noted that 1 is the non-cancer risk threshold, and because the values for chemicals added up to less than 1, the non-cancer effects were deemed acceptable. He also noted that non-cancer effects at or near 1 might be considered generally acceptable, and that if the value were greater than 1, a cleanup may or may not be warranted, depending on the toxic effects of the individual chemicals – the higher the number, however, the greater the indication that an action should be taken.

Mr. Cain referred to a double-pointed-arrow graphic and went on to explain that cancer risk is based on a probability scale, with a value of $1x10^{-6}$ at the "less risk" end of the scale, $1x10^{-5}$ in the middle, and $1x10^{-4}$ near the "more risk" end. He also noted that EPA has defined a 2-order of magnitude cancer risk range where the green "less risk" range requires no action, the yellow middle range requires consideration of whether action is needed, and the red "more risk" range dictates that action be taken. The state of Massachusetts, however, has picked a single threshold at $1x10^{-5}$, which makes things easier, especially for smaller risk assessments. Mr. Cain concluded his presentation by saying that it's typical to end up in the mid-range, where other site-specific factors need to be considered in order to reach a decision about cleanup, which is why he thinks it's worthwhile to come back to Mr. Mullennix's question about who the decision-makers are.

Mr. Conron asked how risk assessment is quantified in terms of MMR, and noted, for example, that his cholesterol level is meaningful to him with respect to whether or not he's at risk. Mr. Cain replied that just as Mr. Conron's cholesterol level may differ from his neighbor's, risk would differ for individual users of MMR – whether they are just visitors, residents, are drinking the water, have contact with the soil, and so forth. Mr. Conron asked if Mr. Cain could provide a number for groundwater risk at the L Range. Mr. Cain replied that Mr. Gregson will cover that question in his presentation. Mr. Conron then asked if the risk number for each area on the base could be rolled into one risk number for all of MMR. Mr. Cain replied that that would be a site-wide risk estimate. He also said that it would be possible to weave together more than one risk estimate for an individual who spends time at two areas of the base, for example; however, the norm is to see individual site-by-site risk estimates, and this is because decisions need to be made on a site-by-site basis.

Mr. Conron inquired as to the number of risk assessments that the IAGWSP has completed so far. Mr. Gregson replied that the risk assessment process is really just beginning. He also mentioned that the Demolition Area 1 risk assessment has been completed, and that a number of risk assessments for other sites are in the early stages. Mr. Conron asked Mr. Gregson to estimate the percentage of risk assessments that have been completed. Mr. Gregson replied that that number would probably be about 10%. Mr. Conron asked to be provided with copies of the risk assessment reports that the IAGWSP has completed thus far and Mr. Gregson agreed to do so.

Mr. Minior noted that the Air Force Center for Environmental Excellence (AFCEE) has completed risk assessments for about 30 of the 80 sites it identified at MMR, and the individuals who generate and interpret the risk estimate numbers "do it quite well." He also made a point of noting that it's much easier to come to agreement about risk when there are standards for the compounds that exist at the sites. He further noted, however, that AFCEE has always been able to reach agreement with the regulatory agencies on what the impacts are, what the risks are, and how to address the soil and groundwater. Mr. Minior also mentioned that currently the Air Force, which started its cleanup program at MMR decades before the IAGWSP started its program and therefore is in its infancy in terms of risk assessments, is pumping nearly 16 million gallons of groundwater per day.

Mr. Webb asked if the risk assessment model that Mr. Cain presented this evening is static or dynamic. Mr. Cain asked if Mr. Webb meant "dynamic" in terms of time trends, and Mr. Webb confirmed that he did. Mr. Cain said that the "different doses because of different behavior over time" could be taken into consideration; however, the limitation is on the environmental sampling data, and generally the most current data available are used. For example, there isn't much of a time trend for soil or groundwater data, because the sampling effort is intended to determine what's happening currently and then projecting into the future. Mr. Cain also said that "by changing the exposure assumptions you could change the concentrations", but "usually it's based on the baseline conditions," before any remediation has been done. Mr. Webb asked if it would be fair to assume that as the MMR model changes over time, "the determination and solution of what's going on at MMR will change over time." Mr. Cain replied, "Particularly in the context of groundwater transport, yes."

Ms. Jennings said that she thinks the answer to Mr. Webb's question is that the risk assessment model is both static and dynamic. She explained that parts of the risk assessment are fixed equations, well-understood assumptions (some of which are site-specific), and rule-of-thumb assumptions (when there are no site-specific data). However, there's also a dynamic component in that toxicity information is always being updated, such that today's "no-action" decision could be changed five years now as part of the regular five-year review process.

Mr. Fein referred to the presentation slide that showed the arrow graphic and noted that it pertains less to risk assessment and more to risk management, which is "an issue of values and law." He also noted that the context in which risk is considered is important – for example, a 1 in 100,000 chance that a tunnel ceiling would collapse and kill someone driving through it would be considered fairly unacceptable, while shuttle astronauts face a risk of death more in line with a 1 in 100 chance. Mr. Fein again referred to the arrow graphic and confirmed that EPA deems the yellow middle range as an area where site-specific factors need to be considered. He also noted that Superfund law calls for taking into account cumulative exposures when looking at risk between 1 in 1,000,000 and 1 in 10,000. However, for a Safe Drinking Water Act (SDWA) corrective action order issued by EPA and pertaining to a sole-source aquifer, "those regulations that define that risk range don't apply" and in the case of MMR, the agency has selected 1 in 1,000,000 as the cutoff point, such that the yellow range would essentially be red for the purposes of the IAGWSP cleanup. Mr. Cain replied, "For soil," and Mr. Fein clarified that he was thinking of groundwater, for the purposes of the SDWA cleanup.

Mr. Cain suggested that there might be two different targets. Mr. Fein agreed and noted that the state, which is overseeing part of the cleanup, has its own separate standards. He added that "it all depends on the context" and the risk range that's acceptable "depends on the particular program and the particular law, and who's making the decision."

Mr. Dow referred to cumulative effects and asked how cumulative exposures from multiple sources of perchlorate, for example (such as military training, fireworks, leafy vegetables) are

incorporated into a risk assessment based on military activities when there's so much uncertainty associated with those other relative contributions. Mr. Cain replied that perchlorate is a good example since there's a significant dietary component associated with perchlorate in lettuce in some areas of South America. He then explained that in such a situation, a site-related risk assessment would be conducted, but added onto that would be an additional analysis that takes into account that dietary component. Mr. Cain also noted that there's been some ongoing discussion about adding a generic factor into risk estimates, but it remains to be seen whether or not that becomes promulgated. However, it would be one way of dealing with the issue of "site-related versus coming from other sources."

Mr. Dow also inquired about the making of risk management decisions when the regulatory oversight agencies have different standards for the same contaminant. Mr. Gregson replied that while it would be nice if all the numbers were the same, that's not always the case. He noted, for example, that MassDEP is expected to come out with a 2-ppb perchlorate standard soon, and the IAGWSP will roll that promulgated standard into its risk assessments. He also mentioned that once that standard is promulgated, the IAGWSP will revise its recently issued Northwest Corner Remedial Investigation (RI) report to consider that 2-ppb standard.

Mr. Conron asked if remedial actions are ever taken before a risk assessment number is generated. Mr. Gregson replied that for sites where published cleanup goals are clearly exceeded, the IAGWSP has been conducting Rapid Response Actions to address the contamination. However, for sites where contaminant concentrations are lower or perhaps a little more complicated, full-blown risk assessments are undertaken before decisions about cleanup are made. He noted, for example, that soil removal actions at the J Ranges were conducted and a risk assessment hasn't yet been done.

Mr. Conron remarked that that seems to him to be "like taking drugs without a diagnosis." He also asked if updated risk assessment numbers are provided on an annual basis to the towns that surround the base. Ms. Jennings explained that risk assessments are not conducted annually but are the process to reach decisions about cleanup. She also said that it takes a certain amount of time to gather enough data and understanding of the contaminants and their concentrations before a risk assessment can be done, which is why AFCEE's Installation Restoration Program (IRP) is further along than the IAGWSP in its cleanup program. Ms. Jennings then noted that she agrees that the risk assessment process is at about 10% at this time; however, a considerable number of risk assessments are planned for the next year, which will lead to many decisions and actions taken. She further stated that she thinks it's important to keep in mind that much of the risk being evaluated is potential, future risk, and that risk assessments are used as a decision-making tool, after which the process moves on to the next phase, which is usually remediation.

Mr. Conron asked how he would then know that progress is being made. Mr. Gregson replied that he thinks the best way to keep track is to compare the number of sites identified for cleanup to the number where cleanup is either under way or has been completed. Mr. Conron recommended that the IAGWSP develop some sort of cleanup progress "measuring stick" or metrics that can be easily understood by average citizens and can be presented at town selectmen's meetings. Mr. Murphy noted that the IRP Annual Reports included this sort of information, which he thinks would be very useful for the IAGWSP as well.

Mr. Minior asked Mr. Fein if he could provide the IART with the documentation in which EPA made the determination of 10^{-6} (1 in 1,000,000), due to the sole-source aquifer, for the SDWA administrative orders being enforced at MMR. Mr. Fein replied that the January 2000 administrative order documents how that number was determined. Mr. Minior said that he'd like a copy of that order, and then recommended addressing Mr. Mullennix's question about who the decision-makers are.

Ms. Jennings stated that in her view a risk assessment is no different than any other phase of investigation and cleanup work, in that like RI reports, feasibility study reports, and the like, a risk assessment report is subject to regulatory review and approval. She also noted that, depending on the authority under which the work is being done, the law lays out fairly specific markers in terms of what is and what isn't acceptable, which govern how decisions are being made and who has the authority to make them. Ms. Jennings further stated that, as Mr. Minior mentioned, the regulators have worked very successfully with AFCEE in coming to agreement on a number of risk assessments. She added that she views the process as a "collective decision-making exercise, although the law is clear in terms of who has certain authorities…"

Mr. Gregson emphasized the importance of community input on the process, noting that the next step for many of the sites is a feasibility study and evaluation of cleanup alternatives, including consideration of tradeoffs such as cost. He noted that ultimately, once the regulators and IAGWSP are finished with the cleanup, the residents of Cape Cod will be left with that outcome, which is why he believes that community input is so important now and during the feasibility study phase.

Mr. Pinaud said that he agrees with Mr. Gregson. He also said that while the regulators can determine what does and doesn't need to be cleaned up, the ultimate risk decision is made by individuals in terms of how much risk they want to assume – based on their activity in the area, whether they drink the water, eat the lettuce, and so forth.

Mr. Mullennix said that although it seems he's looking for a simple answer to a complicated question, he'd like to know if EPA and MassDEP are the ultimate decision-makers with respect to how risk assessments are interpreted and which of the agencies would take precedence in the event that they disagree. Ms. Jennings replied that it would depend on the part of the site and the part of the risk assessment, and noted that she believes that groundwater is fully governed by the SDWA, while MassDEP's guidance is sought with respect to soil issues. Nevertheless, even with the different authorities, the group is trying to be consistent and reach decisions that make sense not only for the IAGWSP cleanup but also for the AFCEE sites that are within the Impact Area.

Mr. Pinaud added that EPA and MassDEP have individual authorities, coming from federal and state law. He said that if MassDEP thought that a decision didn't go far enough or that a cleanup wasn't complete enough, the state could act independently to get more cleanup if it chose to do so, but would otherwise be a satisfied with a joint decision.

Agenda Item #4. L Range Groundwater Risk Assessment

Mr. Gregson noted that a draft L Range Groundwater Risk Assessment report was issued on May 15, 2006 and the IAGWSP is awaiting the regulators' comments. He then reminded the group that the L Range, which is part of the Southeast Ranges at MMR, was used primarily for military training (grenades) from about 1968 up until the 1990s. He also showed two photographs of the site, and then a figure depicting the L Range study area and the perchlorate and RDX contamination there. He further noted that in order to assess all potential future risk in the study area, AFCEE's Fuel Spill 12 (FS-12) plume, whose source area is located on Greenway Road, was also considered as part of the risk assessment. Mr. Gregson made a point of noting that the FS-12 plume is currently undergoing active treatment and cleanup is progressing.

Mr. Gregson stated that the goals of the L Range human health risk assessment are: to determine if individuals could be exposed to site contaminants; to estimate risks based on L Range and FS-12 plumes, independently and combined; and to summarize cumulative risks from potential future exposure to soil and groundwater. He also said that the overall analysis was designed to be conservative and account for uncertainties.

Mr. Gregson showed the bar graph for the L Range risk assessment CSM and pointed out: the sources - L Range site soils and FS-12; the pathway – leaching to groundwater; exposure routes: ingestion, dermal contact, and inhalation; and potentially exposed populations – hypothetical on-site and off-site future residents, as there's currently no one drinking the water. He also noted that no risk from volatilization to indoor air was identified.

Mr. Gregson then showed a list of contaminants of potential concern (COPCs) identified at the study area (i.e. a hazard identification list). He also noted that the toxicity assessment looked at human health effects from the COPCs, the exposure assessment looked at the doses individuals were getting and how they were getting it, and the risk characterization integrated information from the toxicity and exposure assessments in order to assess the risk. Mr. Gregson also noted that an important part of risk characterization is to understand and evaluate uncertainties in the assessment. He further noted that the L Range risk assessment looked at cumulative risks from soil and groundwater.

Mr. Gregson reported that sampling at the L Range study area was conducted for 240 target analytes, 90 of which were detected and underwent a screening process whereby those whose maximum concentration was under established standards were dropped from the analysis. The remaining compounds were carried through the risk assessment process. He then mentioned perchlorate, RDX, DNX, some metals, some semi-volatile organic compounds (SVOCs), and the compounds of concern at FS-12 (benzene, ethylene dibromide [EDB], and arsenic).

Mr. Gregson noted that the toxicity assessment looked at both cancer and non-cancer effects. The sources for information about toxicity, in the order of preference, were: EPA's Integrated Risk Information System (IRIS), EPA's Provisional Peer Reviewed Toxicity Values, and other potential sources of toxicity information. The exposure assessment looked at the exposure setting – military training on base and mixed residential and recreational use off base, and as there are no known current users of the groundwater, future residents in the study area were identified as potential future users of the groundwater. Exposure point concentrations were calculated using the maximum average concentration for a particular exposure point, a particular well, or particular COPC within the study area. Then sampling results from wells from different areas were examined and the maximum concentrations were used to build a hypothetical well, after which exposure models were used to establish dose frequency and ingestion rates.

Mr. Gregson stated that risk characterization determines both cancer and non-cancer risks. He noted that cancer risk equals the lifetime average dose times the cancer slope factor, and that for non-cancer health effects, the hazard quotient equals the average daily dose divided by the reference dose. Mr. Gregson also reported that the following L Range compounds had exceeded the $1x10^{-6}$ risk level for cancer risk: BEHP (bis-2-ethylhexyl phthalate), 1,2-dichloroethane, 2,6-DNT, RDX, DNX, and tetrachloroethene, adding up to a cumulative risk number of $1.6x10^{-4}$. Non-cancer risk at the L Range pertained to metals thallium (4.3) and vanadium (1.3), adding up to a cumulative risk number of 5.6. The risk characterization also looked at FS-12 compounds having to do with cancer risk (benzene, EDB, and arsenic) and those having to do with non-cancer risk (methyl naphthalene, naphthalene, and arsenic). Mr. Gregson also said that he thinks that xylenes were recently added as a potential non-cancer risk at FS-12.

Mr. Gregson showed a list of the uncertainties that were considered as part of the risk characterization. He then reviewed the following L Range risk assessment summary statements: cancer risks above the risk range were for PCE, 1,2-DCA and BEHP; thallium and vanadium were the majority of the hazard index exceedances; FS-12 contaminant concerns pertained to benzene, EDB, and other fuel components; lead detections were of low risk and were dropped out of the analysis; the cumulative risk exceeded EPA's recommended range, but still left to do is take a closer look at possible explanations for each compound – for example, BEHP is thought to

be a lab contaminant; and some compounds that were carried through the analysis were infrequently detected and therefore might not drive a cleanup decision.

Mr. Conron noted that he's interested in seeing some conclusions in a presentation such as this. He then asked if the toxicity assessment, for example, would be considered high, medium, or low. Mr. Gregson replied that it would be considered medium, and some compounds need to be examined further. Mr. Conron then inquired about the exposure assessment. Mr. Gregson replied that there's no current exposure; however, potential future exposures were considered, although it's difficult to predict whether residential scenarios will occur in the future.

Mr. Conron asked if only cancer risks are assessed. Mr. Gregson clarified that non-cancer risks are also assessed, and mentioned thallium and vanadium. Mr. Conron asked what is meant by non-cancer risk. Mr. Cain replied that non-cancer risk pertains to other toxic effects – on the liver, kidneys, or central nervous system, for example. Mr. Conron then asked what is meant by "1.64E-04," as noted on the slide entitled "Risk Results." Mr. Gregson explained that that refers to a 1 in 10,000 risk, which needs to be assessed further. Mr. Conron remarked that use of terms such as "high, medium, or low" would make the information more understandable.

Ms. Jennings noted that EPA plans to submit its comments on the L Range Groundwater Risk Assessment document soon and will request a revision of the report that might change some of the conclusions that are presented. She then reviewed some of EPA's risk assessor's comments on the report: the data set used to generate the COPCs list was truncated in that it used data from 2004 to 2006, despite the availability of data dating back to 1996; and it appears that the development of the COPCs list was inaccurate because contaminant concentrations were compared to ARARs (applicable, relevant, and appropriate requirements) only, and not to other risk screening numbers, resulting in about 22 analytes being eliminated from the list, which could have changed the cumulative risk number.

Ms. Jennings noted that the risk assessor had also remarked on the risk characterization conclusion that no soil COPCs were identified via the leaching to groundwater pathway – which is perhaps one of the most significant issues being addressed at this time for risk assessments at all the sites. She explained that in many cases the contaminants in soil aren't seen in groundwater and modeling is used in the risk assessment to predict what the concentrations in groundwater, if any, eventually would be. From this information, exposure risk is calculated. Ms. Jennings noted that many assumptions go into these calculations and EPA and the IAGWSP still need to work out a lot of issues in this regard. She also said that she therefore doesn't know that EPA would agree with the risk assessment conclusion she'd mentioned.

Ms. Jennings then stated that although the L Range risk assessment was based on exposure to groundwater, there are a number of UXO at the site, which pose not only risk to safety issues, but also the possibility of leakage that could lead to further groundwater contamination in the future. She also referred to the presentation slide statement, "Risks not likely significant considering conservatism and uncertainties." She said that she agrees that many conservative assumptions go into a risk assessment, and then explained that the purpose behind that conservatism is to be protective and account for the many uncertainties associated with the process.

Mr. Gregson said that his only comment is that the risk assessment process is set up such that many compounds that were carried through probably aren't really a risk and should be screened out further. He noted, for example, that ultimately only three or four compounds at the Demolition Area 1 plume made it to the final analysis, although even more were initially detected there than were detected at the L Range.

Mr. Dow asked whether acute toxicity or chronic toxicity was used as a reference dose for the hazard assessment for non-cancer risk. Mr. Cain replied that chronic toxicity was used, and added that it's usually a lifetime or long-term exposure.

Mr. Dow mentioned the uncertainty of future training activities at the base and the possible subsequent use of the land and asked whether this was considered in the risk assessment. Mr. Gregson replied that because the risk assessment focused on groundwater, the possibility that someone could build a house right on the L Range and start drinking the groundwater was considered. However, many things would have to fall into place in order for that scenario to become reality.

Agenda Item #5. Northwest Corner Remedial Investigation Report

Mr. Gregson showed a map of the Northwest Corner area, which encompasses approximately 500 to 600 acres, both off-base and and-on base. He also pointed out the Cape Cod Canal, the town of Bourne, the base boundary, and the Impact Area. Mr. Gregson noted that the Archives Search Report indicates that the military activities that took place in the area included: small unit maneuvers and bivouac areas; training with small arms ammunition and various forms of pyrotechnics, including artillery simulators, illumination signals, and flares, some of which contained perchlorate; small arms firing at the L-3 Range; and artillery firing from gun positions (GP-12, GP-14, GP-16, and GP-19), where excess propellants also might have been burned, as was the practice at that time. The propellant used in those rounds did not contain perchlorate, but did contain compounds such as 2,4-DNT. Mr. Gregson also noted that GP-19 was also used for heavy equipment training by engineer troops.

Mr. Gregson stated that the Northwest Corner investigation, which yielded no indications of buried munitions that contain perchlorate, began with the discovery of shallow perchlorate detections, for which sampling results suggest that the gun positions are not a source. Also discovered as part of the investigation is the complicating factor of a thin plume of RDX, the primary source for which is thought to be upgradient at the A Range, or further upgradient at the Central Impact Area. Mr. Gregson said that it's possible that the RDX plume could be handled as part of the Central Impact Area operable unit, and he also mentioned that the IAGWSP is conducting a wide-area source assessment to look at other potential sources on the base.

Mr. Gregson also spoke about a civilian activity that took place in the Northwest Corner area, commercial fireworks displays, which occurred from 1996 through 2003, with the launch area located behind the technical school near the Cape Cod Canal. He noted that fireworks contain about 70% potassium perchlorate and that fireworks debris has been observed along the roads in the area. Mr. Gregson said that fireworks are another potential source that the IAGWSP considered.

Mr. Gregson also discussed the components of the Northwest Corner RI, which included: an historic land use evaluation, which keyed in on the Archives Search Report; geophysical surveys at GP-14 and GP-16 and an anomaly removal at GP-16 that yielded 12 supplemental charges with TNT filler and 212 blank small arms cartridges, none of which contained perchlorate; and a geophysical survey at the historic L-3 Range, which revealed bullets, bullet fragments, a partially filled box of blanks, and similar items. Soil sampling, which began in the late 1990s/early 2000s at the gun positions, was also conducted as part of the investigation. Additional soil sampling was conducted in 2003, both before and after the Fourth of July fireworks. Groundwater sampling was also conducted, at the 25 existing monitoring wells, six private wells, and two commercial supply wells in the area, and at the more recently-installed 43 monitoring wells at 19 different locations. Mr. Gregson also mentioned that the IAGWSP is currently installing or has installed drive-points at eight different locations. He further noted that fireworks debris was collected and analyzed, and air dispersion modeling was conducted in order to get an idea of how that debris might be

distributed across the site. The IAGWSP worked with the regulators to determine the parameters that went into the air dispersion model.

Mr. Gregson then reviewed soil sampling results from the gun positions, as follows: perchlorate was detected in 7 of 93 samples (all at less than 5 ppb, with the proposed state cleanup standard being 100 ppb); 2,4-DNT, a propellant compound, was detected in 8 of 102 samples collected at the gun positions (the maximum concentration detected was 600 ppb, with the MassDEP cleanup number being 700, and the EPA preliminary remediation goal (PRG) number being 720 ppb); 2,6-DNT, another propellant compound, was detected in one sample at 30 ppb; and also detected at GP-12 and GP-14 were several SVOCS, none of which exceeded any PRGs.

Mr. Gregson also referred to the soil sampling results from the area south of GP-16 and reported that perchlorate was detected at concentrations ranging from 6 to 28.8 ppb, and no explosives were detected. He noted that the samples were analyzed for dyes and hexachloroethene, which would be expected in military smokes and flares, but none were detected. He also mentioned that metals were generally consistent with MMR background concentrations. Mr. Gregson then reported that no perchlorate or explosives were detected in soil samples from the L Range; however, some metals and SVOCs were detected there.

Mr. Gregson then noted that soil sampling results from the area along Canal View Road was focused on assessing apparent fireworks debris from the launch area. Samples taken on July 3, 2003 showed perchlorate in 2 of 11 samples at concentrations less than 5 ppb. Samples taken on July 7, 2003, however, showed perchlorate in 8 of 11 samples, with three being above 1,000 ppb, and a maximum concentration of 7,560 ppb. Subsequent sampling, conducted in fall 2003, showed that perchlorate detections had dropped to a range of 5.3 ppb to 64 ppb. The decrease may have been due to use of a slightly different sampling technique (sampling at depth from 0 to 6 inches rather and 0 to 1 inch) and because some of the perchlorate might have dissolved in rainfall that occurred between July and September. Mr. Gregson also reported that no explosives, dyes, or hexachloroethane were detected in the samples from along Canal View Road; however there some low-concentration detections of PAH (polycyclic aromatic hydrocarbon) compounds and metals. He further noted that analysis of fireworks debris found along Canal View Road after the fireworks display showed fairly high concentrations of perchlorate, between 302 and 34,200 ppb.

Mr. Gregson went on to discuss groundwater sampling results by reminding the group of the RDX plume that extends to Cape Cod Canal and is thought to be associated with a source at the former A Range or the Central Impact Area. He noted that RDX detections were generally in the 1 to 2 ppb range, with just one detection, in a water table well (MW-338), above the reporting limit. This particular detection indicates a more nearby source, which is difficult to explain based on the existing data. Mr. Minior asked if this was a model prediction or whether RDX had actually been detected near the canal. Mr. Gregson replied that it had actually been detected there.

Mr. Gregson referred to the perchlorate plume map, noted that the highest perchlorate detections were located along Canal View Road, and pointed out the 1-ppb, 4-ppb, and 18-ppb plume contours. He also noted that the highest perchlorate concentrations seen were in the mid 20s-ppb range, with the most recent maximum concentration being about 9.5 ppb. He also noted that the higher perchlorate levels correspond to the concentration of fireworks debris, and “concentrations drop off north, south, and east from that location.”

Mr. Gregson showed a figure of cross-section I-I', which runs from the canal up onto the base, and pointed out the deeper RDX contamination and the shallower perchlorate. He also noted, however, that both perchlorate and RDX had been detected in a couple of the wells: an off-base irrigation well, but whose screen depth is unknown such that the well may be spanning both

plumes rather than indicating a commingled situation; and MW-284M2, a relatively shallow well in the perchlorate plume where RDX was detected just above the reporting limit.

Mr. Gregson stated that the purpose of the air dispersion modeling, which the IAGWSP conducted primarily at the request of the regulators, was to assess the location and distribution of particulates deposited from the fireworks displays. He showed a figure that depicted the pattern of deposition based on that assessment and superimposed over the current groundwater plume and pointed out how fireworks debris "from here heading off to the northeast, deposited in this general area" might have contributed to the perchlorate groundwater plume. He also showed a figure that included the soil data and said that it "kind of matches" although there are a number of nondetects that might be explained by how quickly perchlorate leaches.

Mr. Gregson also reviewed the following conclusions pertaining to risk characterization of the Northwest Corner: there are no current receptors for the groundwater, as all downgradient residences have town water hookups; based on the current reference dose in EPA's IRIS database (24.5 ppb), there is no risk to future groundwater users from perchlorate; risk for future groundwater users from RDX is within the 10^{-4} to 10^{-6} range; there's no direct exposure risk to current receptors and non-residential future receptors on base; and no ecological risk is expected.

Mr. Conron requested and received from Mr. Gregson confirmation of each of the risk characterization conclusions, and then said that he'd "like to see the risk characterizations more fully developed than they are here." Mr. Minior made a point of noting that the Bourne Board of Health has an ordinance in place to prevent the installation of private drinking water wells in areas of known contamination; therefore the probability of someone legally installing a private well in that area is "virtually nil."

Mr. Gregson continued his presentation by reviewing the following RI report recommendations regarding perchlorate: based on the 24-ppb number, no remedial action is recommended to address the perchlorate; the investigation will continue through the feasibility study process; plume monitoring may be appropriate to ensure conditions remain unchanged; and the need for remedial action will be reevaluated when the new perchlorate standard is promulgated, at which time the RI would be revised. He also reviewed RI report recommendations regarding RDX: the RDX plume at the Northwest Corner will be further assessed and handled as part of the Central Impact Area operable unit, which is its likely source; contamination at the gun positions will be looked at as part of the Gun and Mortar investigation; and other training areas will be investigated as part of the Wide-Area Source Assessment. Mr. Gregson also said that once regulatory agencies comments are received, the IAGWSP will go through its usual comment resolution process.

Ms. Jennings said that EPA made a great effort to finalize its comment letter by tonight's meeting, but it is still in draft form. She also noted that the letter is 22 pages long and contains more than 90 comments. She then reviewed four major areas of concern noted in the draft letter, the first having to do with the designation of sources of perchlorate contamination. Ms. Jennings explained that while EPA agrees that there are many compelling arguments that fireworks contributed to the perchlorate contamination at the Northwest Corner, it does not believe that there's enough information to designate fireworks as the primary source, in part because of the lack of a pre-fireworks displays baseline. Another example that calls into question the overall conclusion of what's primary and what's secondary is the deep perchlorate contamination detected in one of the monitoring wells, which cannot be explained. Ms. Jennings also noted that EPA doesn't think it's "really necessary or relevant" to debate the issue of primary and secondary sources, as it's clear that military contamination is commingled with another source of contamination in this situation, and the RDX contamination alone warrants further work.

Ms. Jennings then referred to the second major area of concern by noting that 10 of the 22 pages of its comment letter pertain to risk assessment. She said that she expects that EPA's comments

on this issue will result in an overall recalculation of the risk numbers. She also told Mr. Conron that she'd be interested in having him provide specifics on his request for more fully developed risk assessment presentations in the future, as his suggestions could prove helpful in improving future presentations.

Ms. Jennings noted that the third major concern is the way the site is defined. She explained that a number of operable units overlap in that area, including gun positions and training areas, all of which remain under investigation, and the RI report is confusing with regard to how those investigations will be completed and how those results will "feed into this final report." She further noted that the report concludes that the RDX contamination tracks back to three potential sources: GP-19, the former A Range, and the Central Impact Area; however, the report also concludes that all of the RDX will be addressed as part of the Central Impact Area work, without any discussion of what will occur at GP-19 and the former A Range as it relates to RDX. Ms. Jennings said that she thinks that the report needs more clarity in terms of the way forward.

Ms. Jennings' fourth point was that due to the presence of RDX above the health advisory and due to the fact that there's perchlorate contamination at concentrations above the state's soon-to-be promulgated standard, EPA believes that it makes sense to conduct a feasibility study of the Northwest Corner. She said that although she's not presuming that there will be active restoration of the site, she does believe that the IAGWSP should go forward with the next step and conduct a feasibility study. Ms. Jennings also noted that the RI report doesn't discuss how long the RDX and perchlorate plumes are expected to persist, and there's no modeling to predict where the plumes will go, yet the recommendation is for long-term monitoring. She said that she thinks it makes sense to go forward with a feasibility study that focuses on groundwater and takes into consideration all the various sources that have been discussed, but it does not make sense at this point to be drawing conclusions "about source actions for this operable unit" until the investigations have been completed and it's clear how they'll affect the groundwater remedy that's selected. Ms. Jennings then invited Mr. Pinaud to share MassDEP's perspective on the report.

Mr. Pinaud stated that most of the comments in MassDEP's comment letter, which is about 8 pages long, overlap with EPA's comments. He also noted that the state perchlorate standard is anticipated to be promulgated by the end of this week, and the expectation is that the IAGWSP will use that toxicological data and it will be seen in the revision of the report, which will change the risk assessment significantly.

Mr. Pinaud also noted that MassDEP is concerned about the way the plume is delineated, in that there appears to be a lack of bounding wells along its southern edge, where MassDEP would like to see some additional investigation. He also said that MassDEP thinks it would be difficult to "partition the various sources of perchlorate," and added that while there's obviously a military source for the RDX, it's also believed that some of the commingled RDX and perchlorate contamination is coming from a source farther upgradient than the fireworks area. Mr. Pinaud said that it's hoped that MassDEP's comment letter will be issued late this week or early next week. He then turned to Elliot Jacobs of MassDEP for any further comments.

Mr. Jacobs remarked that building a CSM is like putting together a jigsaw puzzle and occasionally there are pieces that don't fit – such as the commingling of contaminants in some cases at the Northwest Corner. He mentioned the low concentrations of RDX detected within the shallow perchlorate plume, for example. He also referred to some of the perchlorate particle tracks that go back to areas about 1,000 to 1,500 feet upgradient of where the air deposition model suggested that particulate fallout of perchlorate from fireworks would occur, which he believes could point to a significant on-base perchlorate source. Mr. Jacobs acknowledged that uncertainties are inherent in all modeling, but added that the inconsistencies need to be resolved.

Mr. Minior asked Ms. Jennings to clarify her comment about a need for "further work." Ms. Jennings replied that she was referring the need for a feasibility study as the logical next step. Mr. Minior then inquired about the amount of money spent on the Northwest Corner investigation to date. Mr. Gregson replied that he believes that amount is about $3 to $4 million.

Mr. Gregson also referred to the regulators' comments about primary and secondary sources of perchlorate and indicated that understanding whether the military is a significant contributor to the shallow perchlorate plume is important when moving forward with the CSM, in order to avoid running the risk of conducting an "endless sampling exercise" to try to find a source in soil that isn't really there. Mr. Gregson then mentioned MassDEP's comment about a need for additional investigation to the south, and noted that the IAGWSP had worked very closely with the regulators to design this investigation program and believed that that side of the plume was "covered."

Mr. Mullennix remarked that he's very concerned that after three years of study of the Northwest Corner there continues to be a difference of opinion between the regulators and the IAGWSP regarding the source of contamination there. He suggested that the regulators appear to be "desperately" trying to find that the perchlorate source is from the military and not from the fireworks display, while millions of dollars have been and will continue to be spent. He also said that as the bill rises, he thinks it would be justifiable to share the cost of the work, perhaps with the town as a responsible party. Mr. Mullennix also said that he thinks the situation is clear – the source of contamination has stopped, nature is taking its course, and the contaminants are moving through the soil, into the groundwater, and ultimately into the canal where they will become diluted and go out to sea. He further stated that he believes that the ongoing process of continuing to spend money on this study and "going back and forth" provides no real environmental benefit.

Mr. Dow said that while he doesn't personally understand the advantage of knowing which portions of the perchlorate contamination are due to military training or to fireworks, he would like to comment on the IAGWSP's sampling scheme and some of the inconsistencies he sees in its interpretation. He then said that the mass, not the concentration, has to be known in order to determine the source. He also said that there's a lack of samples in an area where the air dispersion model predicts that particulate should have been deposited, and further noted that the model doesn't explain the lower-concentration portion of the perchlorate plume that's actually on the base. Mr. Dow also suggested that there's a fairly high-concentration portion of the perchlorate plume that he thinks couldn't be explained by fireworks, given the air dispersion model results. He then said that because of these apparent inconsistencies, he doesn't think that any conclusions could be drawn. Rather, he thinks that some kind of scientific sampling program, based on the air dispersion modeling, needs to be conducted to determine the mass distribution, and not the concentrations.

Mr. Gregson clarified that the air dispersion modeling, which was requested by the regulatory agencies, was not intended to guide a future sampling effort. Rather, its purpose was to try to explain existing sample distribution and determine whether the fireworks could indeed be a source of the concentrations that were being seen. Regarding Mr. Dow's second point, Mr. Gregson said that the prevailing wind directions that have occurred in the past can explain "all the detections in that part of the plume." He also said that a possible explanation for the area of higher-concentration perchlorate contamination that Mr. Dow mentioned could be that it's directly downgradient of the fireworks launch area.

Mr. Mullennix emphasized that it appears to him that a double standard is being fostered by the regulators against the military, with the regulators going after this perchlorate contamination "to a much larger degree because of the perceived deep pockets" and the base's whole cleanup infrastructure. He also said that he thinks it's well recognized by many that fireworks launched at

any location contribute to perchlorate contamination. Mr. Mullennix then said that it's a mystery to him why the "churning continues," with multiple pages of comments being generated, which he considers to be "completely out of context to the situation." He also said that he doesn't know if it's desperation or an attempt to "get after the military in a double-standard enforcement regime compared to others." Mr. Mullennix further noted that as a Bourne resident he's disappointed that he now has to go out of town to see fireworks, and supposes that he's a potentially responsible party (PRP) in this case given that he's contributed money toward past fireworks displays in Bourne.

Mr. Minior said that he agrees that with Mr. Mullennix's suggestion about "deep pockets." He also noted, however, that the onus would be on the military if it wants to pursue other PRPs, not on the state or EPA. Mr. Minior also requested that the IAGWSP provide a clearer Northwest Corner perchlorate map, which includes a 2-ppb contour, and that it also provide a timeline for finalizing the Northwest Corner RI report and risk assessment.

NWC Groundwater Monitoring Plan

Mr. Gregson showed a map depicting the Northwest Corner and noted that the sampling locations shown in blue would be sampled twice a year and those shown in green would be sampled once a year.

Agenda Item #6. Adjourn

Mr. Murphy noted that the IART would meet next on September 26, 2006 at a location to be determined. He then adjourned the meeting at approximately 9:10 p.m.

Action Items:

1. Mr. Mullennix asked the IAGWSP to check on the availability of a duplicate sample related to the sample that tested 560 ppb for tungsten at B Range.
2. Mr. Conron asked the IAGWSP to provide copies of any completed risk assessment reports.
3. Mr. Conron requested that the IAGWSP develop a "measuring stick" for communicating to the public the cleanup progress to date.
4. Mr. Minior asked EPA to provide a copy of the explanation of how the MMR 10^{-6} risk value was determined, as noted in the January 2006 Administrative Order.
5. Mr. Minior requested that the IAGWSP provide a clearer Northwest Corner perchlorate map, which includes a 2-ppb contour, and that it also provide a timeline for finalizing the Northwest Corner Remedial Investigation report and Risk Assessment.

Potential Future Agenda Topics:

September:

- Gun and Mortar Positions Remediation Investigation & Groundwater Monitoring Plan
- Central Impact Area Feasibility Study Screening Report Status
- Former K Range Update on Supplemental Remedial Investigation
- J-1 and J-2 Range Soil Remedial Investigation Update

October:

- Western Boundary Remedial Investigation
- Former A Range Remedial Investigation
- Demolition Area 2 Groundwater Remedial Investigation/Feasibility Study

- Phase IIB Remedial Investigation

Agenda Topics TBD:

- Natural Resources Discussion
- Wellhead Treatment vs. Aquifer Restoration

Handouts Distributed at the Meeting:

1. Responses to Action Items from the June 27, 2006 IART Meeting
2. Presentation handout: Introduction to Risk Assessment
3. Presentation handout: L Range Groundwater Human Health Risk Assessment
4. Presentation handout: Northwest Corner Remedial Investigation Update
5. Presentation handout: Groundwater Monitoring Plan Northwest Corner
6. Presentation handout: Small Arms Ranges Investigation Update
7. UXO Discoveries/Dispositions Since Last IART (Ending 7/20/06) All Awaiting CDC
8. News Releases, Neighborhood Notices and Media Coverage – 6/30/06 – 7/21/06
9. IART Meeting Evaluation form
10. MassDEP fact sheet: Tungsten and Tungsten Compounds