Pinedale Anticline LLPHC Meeting – Minutes

November 22, 2013
2:35 pm – 6:15 pm
Janet Bellis

Numerical Groundwater Modeling Report - Evaluation of Potential Sources of LLPHC Detected in Groundwater
Report Results

Please refer to all powerpoint presentations as the minutes will not repeat information that appears there.

2:35 pm Welcome - Shane DeForest, BLM: This is a special anticline annual planning meeting. He introduced staff and special guests: Janet Bellis, BLM PFO, Merry Gamper, BLM WSO, Mark Thiesse, WDEQ, Andrew Schmidt, EPA, Beth Johnson, AMEC, K. Bill Clark, NewFields, Joel Jacobson, NewFields, Cam Stringer, NewFields

Mr. DeForest indicated that the LLPHC report represents the third and final technical report prepared by AMEC/NewFields as required under the Interim Groundwater/Aquifer Pollution Prevention, Mitigation and Monitoring Plan, known as the Interim Plan. It was reviewed by BLM, WDEQ, and EPA, and reviewed by two experts in the field of hydrogeology and geochemistry. The study is very complicated and prepared in accordance with BLM's Regional Framework (2007). It was built on the previous two reports and sought to answer whether naturally occurring hydrocarbons, oil and gas activities, and/or water well materials caused the detections of hydrocarbons identified in the sampling program conducted by Sublette County Conservation District (SCCD) in 2006. Now that this report is final and the studies complete, the BLM will work with the Wyoming Department of Environmental Quality (WDEQ) and U.S. Environmental Protection Agency, Region 8 (EPA) to develop the Final Groundwater/Aquifer Pollution Prevention, Mitigation and Monitoring Plan.

The first part of the meeting will focus on the study design and numerical model; findings of the LLPHC will start at 4:30.

2:40 pm Introduction and Background of Study K Bill Clark, NewFields: Mr. Clark explained the history of the studies and AMEC/NewFields' involvement since 2007. There will be four presentations: Interim Plan, Numerical Model, LLPHC Study Design and Implementation, and LLPHC Study results.

Interim Plan: A Technical Team upwards of 20 people from BLM/EPA/WDEQ/Ultra, SWEPI, and QEP (USQ) was involved throughout the process and reviewed every single document.

They (AMEC/NewFields) designed and prepared a geodatabase that contains data collected and assembled throughout the project. As part of the initial Hydrogeologic Data Gaps investigation, AMEC/NewFields installed 30 wells and 13 piezometers throughout the study area and worked with industry to find locations, which included locating wells on the perimeter of the study area. Depths of study wells ranged from 15 to almost 800 feet. Wells were installed according to environmental standards; wells that were flowing were shut in. They collected depth to water and water quality samples, and conducted pumping tests and measured drawdown which are techniques to measure hydraulic properties. A "Groundwater Occurrence Chart" (slide 14) shows the various types of wells in the PAPA including depths and hydrogeologic units.

From information gathered, AMEC/NewFields developed a geologic model showing interbedded and alternating sequences of sandstones and siltstone/shale which was used as a basis for the numerical model. To gather information about surface/groundwater interaction, they took synoptic flow measurements over a two day period in the New Fork River and tributaries.

Groundwater flow maps were produced to show the direction of groundwater flow. In the alluvium, the direction of flow is generally down valley. Flow in the Wasatch Formation, north of New Fork River, is generally south to the New Fork. South of the New Fork River, the groundwater flow direction is generally to the southwest toward the Green River.

Travel times in the alluvium were estimated to be about 5 feet per day or about 0.75 to 1.5 miles over a two-year period. Velocities in the Wasatch Formation were much slower and estimated to be about 100 to 1,440 feet over a 20 year period.

A groundwater balance was developed to enable AMEC/NewFields to understand how water is recharged (inflow) and discharged (outflow) throughout the study area. The main source of groundwater inflow was from underflow (87%) from the Wind River Range and north of the study area. Less than 4% of the recharge to the study area occurs through precipitation. The primary component of groundwater discharge was to rivers (74%) and evapotranspiration (19%). Only 0.5% of the groundwater balance is attributed to pumpage by water wells.

A hydrogeologic conceptual model was developed and used as the basis of the numerical model.

3:00 pm <u>Numerical Model Study Design and Implementation Cam Stringer, Newfields</u>
Modeling process occurred with the cooperation of the technical team. The conceptual model formed the basis of the numerical model. To construct the conceptual model we simply took all data available and tried to make sense of it. The objective was to explain our current understanding of the physical flow system in graphical representations.

There are three main hydrogeologic units in the study area: the Tertiary Wasatch Formation, the alluvium, and the terrace gravel cap deposits. AMEC took lithologic data from more than 240 well logs and developed the grid model. The groundwater system is recharged along the Wind River mountain front and converges along the New Fork River. Aquifer properties, such as transmissivity and hydraulic conductivity (measures of the capacity of rock to transmit water) and storativity were determined from aquifer testing results from the previous study and literature values. From the groundwater budget developed above, the greatest amount of groundwater discharges into the New Fork River. Recharge near boundaries causes downward gradients and then regional results in upward gradients into the rivers. Elements of the conceptual model formed the framework for design of the numerical model.

The objectives of the project were to: 1) Construct a model capable of simulating regional groundwater flow, 2) Identify areas and receptors in the PAPA that are potentially vulnerable to contamination, 3) Assess fate and transport of petroleum hydrocarbons and chloride from hypothetical releases, and, 4) Predict the magnitude and extent of impacts and from hypothetical releases.

AMEC/NewFields assigned a finite grid to the study area using MODFLOW SURFACT which extends the capabilities of the USGS MODFLOW model developed in 1980s. The model consisted of 69 layers and more than 2.4 million cells that ranged in size from 300 to 2,000 feet, with smaller grid spacing in the area of interest. Boundary conditions were applied to simulate recharge and discharge points (sources and sinks). Specified flux boundaries include Recharge Package cells simulating net infiltration form precipitation and Well Package cells simulating pumping of water supply wells. Head dependent boundaries include River Package cells simulating flow between the streams and ditches and the aquifer, General Head Package cells simulating groundwater underflow entering and leaving the model domain and Evapotranspiration Package cells simulating water drawn from the aquifer by evaporation and evapotranspiration from plants and crops. All cells within the model were populated by assigning initial estimates of aquifer properties derived from the aquifer tests to each cell.

The model was then calibrated to assure the model is capable of simulating the conceptual model and field data. Model inputs such as hydraulic conductivity and recharge were adjusted iteratively until model output matched the field measurements as closely as possible An iterative approach to calibration was used that included both manual and automated techniques (using parameter estimation (PEST) software). Manual calibration involved adjustments to parameters such as hydraulic conductivity and stream conductance. PEST was used to adjust hydraulic conductivity values to minimize the difference between observed and simulated head values.

Residual statistics were calculated to allow quantitative evaluation of the calibration (residual is the difference between observed and simulated head values). The residual mean was 0.16, which is near the goal of zero. The mean of the residual absolute values was 3.77 feet. The residual standard deviation divided by the range in target head values is 0.012 which is well below the goal of 0.10

Simulated potentiometric surface maps were then compared to the potentiometric surface maps developed for the conceptual model and plotted to qualitatively judge the overall quality of th3e calibration Flow directions and gradients on simulated potentiometric maps generally match those from the conceptual model indicating a good over match to field data.

Advective Transport using particle tracking techniques were first used to assess transport of potential contaminants in the aquifer, which simply tracks a c path through aquifer at the average groundwater velocity. Advective transport was used as a first cut to identify areas potentially vulnerable to contamination. Initially particles were run backwards (reverse particle tracking) for 110 years, which is the tow time the expected life of the PAPA using a worst case scenario. The farthest the particle got in 110 years was 1.5 miles in Wasatch Formation. Groundwater velocities in the alluvium are much faster meaning that contaminants in the alluvial aquifer can be transported much further. Based on Reverse Particle Tracking, wells in and near the town of Pinedale would not be affected releases in the PAPA because the wells are upgradient from the anticline and are recharged by groundwater originating along the front of the Wind River Range.

Forward Particle Tracking was then used to simulate hypothetical releases (spills, pads, pipeline leaks, produced water disposal). Only particles from natural gas pads in or near alluvial material near the New Fork River and Sand Springs Draw reached identified potential receptors.

Areas that were more vulnerable to some type of release were prioritized. Potential receptors with natural gas activities within a worst-case 110-year travel time of natural gas activities were identified as the most vulnerable to potential release. These potential receptors are all located along New Fork River valley between Boulder Creek and the downstream PAPA boundary. The lease vulnerable potential receptors are those with no natural gas activities upgradient of them and include receptors in the area in and near Pinedale and along the Green River. Particle tracking does not take into consideration does not take into account mechanical spreading of a contaminant plume or natural attenuation of contaminants that may occur during transport in the aquifer.

Solute Transport takes into account chemistry and mechanical mixing in the aquifer. Benzene, Toluene, and chloride were selected because they would be considered good surrogates for contaminants for potential release: benzene and toluene the move more slowly than groundwater through the aquifer. Organic carbon in the aquifer material acts like a magnet to benzene and

toluene which slows the rate of transport. In addition, bacteria in the aquifer breakdown these compounds further limiting their mobility. . Chloride does not interact chemically with the aquifer and is transported at the same rate as groundwater. Five hypothetical release scenarios were developed by the technical working group including from a road spill, a pipeline leak, a Liquid Gathering Facility spill, a tank leak at a gas pad, and a poor seal in a shut-in pre 1984 gas well. Source terms were developed for each scenario. The model was used to simulate the transport of contaminants from each hypothetical release site. The model predicts that benzene and toluene would only move 150 feet in the aquifer in 110 years under in all scenarios simulated. The model predicts chloride would move less than 1,500 feet in 110 years.

Model Limitations: Most of the data that the model is based on comes from along the axis of anticline and New Fork River, so the model is not as reliable along the edges of the anticline. In addition, the transport models have not been calibrated because there are no large spills to calibrate to. The size of the cells (300 feet) does not allow for small scale determinations. In bedrock there are a lot of geological structures, such as faults and fractures which can create barriers or preferential pathways. These are unknown.

Conclusions drawn from the numerical modeling are: 1) natural gas activities in the PAPA will not affect groundwater in or around the town of Pinedale, 2) particles outside the river corridors travel less than 1.5 miles in 110 years, 3) Except for a few stock wells, identified potential receptors farther than 1.5 miles from the New Fork River are not at risk of contamination, 4) the most susceptible area is the New Fork River valley between Boulder Creek and the downstream PAPA boundary, 5) predicted benzene and toluene concentrations do not exceed standards greater than 150 feet from simulated sources, 6) an individual release is unlikely to impact large portions of the Wasatch or the alluvial aquifers, and 7) model results are helpful in identifying regions within system that are most susceptible to groundwater quality impacts, and identifying appropriate locations for long-term water quality monitoring.

3:30 pm LLPHC on study design K Bill Clark, NewFields: The technical team developed very specific study protocols and a sampling and analysis plan (SAP). The SAP took a year to develop and included a very defined technical approach. Basic terms for hydrocarbons, and volatiles and semivolatiles constituents are described on slides 4 and 5 of the powerpoint presentation. **Low-level petroleum hydrocarbon detections are considered those that are *below* applicable groundwater standards.** There were five sampling events. AMEC was unable to complete the 2010 sampling becauseno fracking operations were occurring when groundwater and gas samples were taken, and therefore, they could not sample flowback fluids until 2011. There are approximately 3000 pages of lab results which have been put into the geodatabase.

Very intense chemical analyses were conducted on the various potential source material, gas and groundwater samples. AMEC compared groundwater sample analysis to the potential source material sample analysis and also looked at the temporal, operational, spatial and physical factors including well age, production facilities, and physical properties of the site. The technical team reviewed every draft version of report.

4:00 pm Q & A

Q: Tony Gosar, retired Geologist: Please provide the previous reports in the library. In evaluating water flow, can we get an isotopic analysis of the oxygen in water to see where the water is originating from?

A: Cam Stringer, NewFields: The isotopic method is typically done for these types of analyses, but not a part of this study. Isotopic studies can lend insight, but are not definitive in quantifying.

Q: Tony Gosar, retired Geologist: Since the beginning of anticline, extractions of groundwater should have been accounted for and reported to the SEO or BLM to show how much water has been extracted/recycled.

A: Merry Gamper, BLM: Operators do report their water usage.

Q: Linda Baker, Upper Green River Alliance: WOGCC has reported that more than 16,000 acre feet of groundwater have been extracted from the anticline.

A: Merry Gamper, BLM: Water numbers represent produced water, from the Lance Pool, not groundwater from the Wasatch Formation.

Q: Linda Baker, Upper Green River Alliance: It could be from vertical communication.

A: Merry Gamper, BLM: Would suggest looking at the results.

Q: Darrell Walker, NRCS: How much groundwater is coming into the New Fork River from the Wasatch Formation?

A: K Bill Clark, NewFields: The New Fork River shows a gain of about 30 cubic feet per second (cfs) in the reach between the East Fork and near the Hwy 351 bridge over the New Fork River originating from the Wasatch Formation, which is under artesian conditions.

Q: Darrell Walker, NRCS: Is there a change in water quality is it brackish?

A: K Bill Clark, NewFields: Groundwater is helping to sustain baseflow in the New Fork River and does not change the water quality; it is a natural condition that has always been there. SCCD has not detected any hydrocarbons in the New Fork River.

Q: Tony Gosar, retired Geologist: Production records to WOGCC producing water indicates that more than 16,000 barrels of water per day are being used for fracking and recycled for new natural gas wells. I would like to have a substantive report on volumes produced and what has been used for fracking. Lots of water injected as well into state sections and BLM sections. When you start looking at the 3,000 wells already drilled, they not using that much fresh water. What kind of balance from fresh water injected water and tally water utilized since day one? All the agencies should be tied together to develop a water program. Finalize a high number and a low number.

A: Janet Bellis/Merry Gamper, BLM: Yes, it is reported, at the Annual Air and Water meeting in August. Reporting should be compiled for the 5 years of data.
Q: Mike Kramer, citizen: Why haven't we seen hydrocarbons before 2006?
A: K Bill Clark, NewFields: Sublette County Conservation District (SCCD) used different analytical methods prior to 2006 and more sophisticated methods starting in 2006.
Q: Linda Baker, Upper Green River Alliance: I would like to see the slide of conclusions for the numerical modeling study again.

4:20 - 4:40 pm Break

4:40 pm <u>LLPHC Report Results AMEC Beth Johnson</u>
This portion of the presentation will concentrate on the four main conclusions of the report. We are talking about very low levels of petroleum hydrocarbons in water samples, as low as part per billions. Gasoline Range Organics (GRO) were not detected within reporting levels in 43 of the 52 wells sampled for LLPHC and Hydrogeological Data Gaps investigation. The only well above the GRO standard is in the state of Wyoming VRP program and is a high level detection. The conclusions of the report are: 1) source of low-level VOCs is largely attributable to upward seepage of natural gas from the Lance Pool which has been subsequently altered, 2) sources of low level SVOCs is not readily apparent, but could be from substances introduced during drilling, installation or operation of wells, or naturally occurring organic material, 3) there is no widespread impact from exploration and production activities, and, 4) no further mitigations are necessary.

The contrast in chemical signatures in potential sources and what was seen in the low level wells and the types and amounts in the samples should lead you back to the source of the detection. For potential source materials sampled, multiple detections of VOCs are complementary detections, not just one but we see them all. We looked at tentatively identified constituents (TICs), which are noted by the lab, SVOCs fractions. The inorganic compounds were more elevated in potential source material samples than one would expect in the normal range of groundwater constituents. Gas composition in groundwater ranged from thermogenic, intermediate, and microbial, and gas showsshows alteration versus natural gas. Chromatographic profiles in potential source materials are diagnostic, it is good to look at typical chromatographic profiles for sources and compare to groundwater.

Ms. Johnson showed a series of comparisons between total purgeable hydrocarbons and total extractable hydrocarbons associated with typical chromatographic signatures from laboratory analysis of potential source materials and groundwater samples from low-level wells. The peakspeaks (detections) fall in specific zones on the chromatographic profile. Retention time reflects the amount of time it would take to get a response (detection) when analyzing a sample. Chromatographic profiles of produced water and drilling mud were developed. Would see more

peaks with VOCs in produced water. Produced water and drill mud show the two end members of the volatile and semivolatile range. Typical chromatographic profiles in the low level wells were generally flat and picked up some early peaks. There is an unresolved complex signature. This explanation only shows the two end members of the potential sources and what we were seeing in low level groundwater.

1) <u>The source of low-level VOCs is largely attributable to upward seepage of natural gas from the Lance Pool which has been subsequently altered over geologic time.</u> Hydrocarbon gases are not the same as natural gas produced in PAPA, natural gas leakage is common in natural gas fields and can be picked up in water wells. All wells contain methane and about half of the wells sampled contain higher molecular weight carboncarbon gases (C2+ gases). VOC fractions were detected in half of these wells. Fewer or no detections were noted except as picked up as TICs, which are complimentary to thethe dissolved hydrocarbon gas observed in low level wells. Methods utilized are different between SCCD and AMEC. That is why SCCD shows no detection of dissolved hydrocarbon gases and they do show detections. There is a change in methane concentration as you move south in the PAPA. White circles on the maps on slide 11 represent very low levels as methane and ethane. Once you cross the New Fork River, you see moderate methane concentrations- and wells contain methane ethane and propane. As you continue to move south, see moderate methane concentrations and gas components ofmethane through butane and some low level wells with hexane. Wells in the south end have the highest methane concentrations and methane through hexane as gas components. Here we see all standard gas components.

Where does methane come from? We look at methane isotopes to provide indication of gas source or origin. Methane is a simple hydrocarbon- comprised of one carbon atom and four hydrogen atoms. Isotopes of elements, such as carbon, have the same number of protons but different number of neutrons. We also look at ratio of gas components observed and see a complimentary trend of methane concentrations, methane isotopes, and gas components in low level wells.

Standard genetic gas scheme, based on methane and hydrogen isotopes, can source gas such as thermogenic, microbial gas by fermentation (land fill gas) and microbial gas by carbon dioxide reduction. These gases plot differently based on their carbon and hydrogen isotope values of methane. Shows these wells are microbial in origin in mid-anticline. As we move further south we see methane signatures moving toward thermogenic gas. Something is different in the southern portion of the anticline. Use different methods to determine source. Look at gas component ratios in water wells that exhibit alteration. Plot to see differences between gas components in the sampled wells (dissolved and casing gas) as compared to the gas components in natural gas samples.

Why do we have dissolved gas in these wells? Different gas signatures are observed in sampled wells as compared to the gas produced from natural gas production wells of the PAPA. If there is a leaking gas pipeline, then the gas signatures should be the same. Gas is known to migrate upwards over time through the published literature. They were looking at gas as shallow as 1,000 feet in early development of the PAPA (pre-1984). Drillers knew of gas in the Wasatch when drilling water wells.

The cross section of gas generation and seepage through sediment in the PAPA is shown in slide 14. Gas is generated in lower sediments (source rocks) and then migrates upward into the gas reservoir and accumulates at the gas trap, which in this case is the anticline with bounding faults. Eventually some gas moves through the trap and upward through the trapping material to the near-surface.

2) <u>The sources of low level SVOCs is not readily apparent, but could be from substances introduced during drilling installation, and operation of wells or naturally occurring organic material.</u> SVOCs, originate from substances introduced during drilling/completion of water wells. The chemical signature closely resembles the chemical signature of pump installation materials. Some detections could be attributable to naturally entrained material in the sediment surrounding the well bore. The distribution of detections throughout the PAPA, and contain total extractable hydrocarbons; TPH-DRO detections show no complimentary detections of SVOCs.

There are lots of TICs in the potential sources but not in these wells. The chromatographic profiles are similar to pipe dope signatures. The laboratory suggested that we be cautious in drawing conclusions from chromatographs due to low response. There is an exception at RS 15-12 which shows close resemblance to drilling mud. The peaks in DRO chromatogram are alkanes. This well was identified as having the backflow of constituents into the industrial water supply well, which was enrolled in the VRP program. The water well has been pumped and cleaned and the constituents are now very low. The constituents are confined to the well bore and they have not extended further into the Wasatch.

In the end, low levels are very low. This could be attributable to naturally occurring organic matter through disturbance of sediment in the vicinity of the well and could be picked up in the samples.

DRO extracts in the sampling program for hydrogeological data gaps investigation were given silica gel treatment to remove naturally occurring organic material. The gel picks up polar compounds (SCCD used this method) and leaves the non-polar compounds, which would be the hydrocarbons.

The green symbols in figure on slide 24 showed SVOC fraction detected after silica gel treatment. Shallow wells typically have no detections or detections were removed after silica gel treatment. Deeper wells generally showed no improvement, and are located along the axis and east crest of anticline. The response is so low that it could be attributed to other sources. In fact, this type of response of several study wells is very similar to a mineral oil signature contained in the lab catalog. The bottom line is that we cannot get away from the use of these carbon-based materials because they are in the greases which are used in drilling gas or water wells.

3) <u>There is no widespread impact from exploration and production activities</u>. Evidence from the hydrogeologic study, results from numerical model, SCCD data (historical information), and current best practices, as well as that there is no signature of potential sources in water wells showing low level of carbon constituents,, indicate there is no widespread impact to groundwater from exploration and production activities. The thick vadose zone of between 200-500 feet inhibits migration of hydrocarbons. TheThe hydrocarbons would have to move through all that sediment to get to the WasatchFormation. Mechanical and chemical reactions would slow that movement of hydrocarbons through soil. There is a difference in the signatures between gas in groundwater and natural gas produced from the Lance Pool. They are not the same. There is not enough time to get an impact at a well to move an appreciable distance. Based on sources identified, detections would stay relatively inside the well bore rather than move outward. For a widespread impact, the chemical would have to move relatively quickly along the anticline and that would not be likely.

Look at the time line from 2000 to 2012. Detections in 2006 occurred before widespread liquids gathering system (LGS) was in place. Great thought goes into construction of natural gas wells and water wells. Pits are lined and reclaimed and close looped systems are utilized now. Gas operations are much better now.

4) <u>No further mitigations are needed</u>. Low level VOCs are the result of upward seepage of natural gas through the overlying sediments over geologic time and is a natural process that cannot be mitigated. The use of hydrocarbon-based greases are necessary for the drilling and construction of water wells and therefore cannot be mitigated.

Q: Linda Baker, Upper Green River Alliance: Would it make sense that sources introduced in construction of water wells should be mitigated in future wells?
A: Beth Johnson, AMEC: Substances have to be used and always will have those constituents in the construction of water wells. No additional mitigations. These substances do not travel out into the aquifer. It is important to use environmentally sensitive materials when drilling and constructing water wells. Contamination is confined within the wellbore and vicinity of the well bore. No additional water wells have been added since 2008.

Q: Linda Baker, Upper Green River Alliance: We need better guidance in the construction of water wells. Concerning the tables in the technical report, Table 4, where VOCs, (benzene, toluene, xylene) are reported in mg/kg. Method 8260 reports mg/L micrograms per liter-why are they different?
A: Beth Johnson, AMEC: mg/kg and mg/L are correlative to ppm. Lab reported in micrograms per liter (ug/L) for liquid materials and mg/kg for solid materials. Liquid-based potential source materials were converted to milligram per liter (mg/L) to provide consistency relative to the mg/kg unit that is also reported in the table and aid in comparison aid in comparison of liquid and solid samples based on ppm range.
Q: Linda Baker, Upper Green River Alliance: Some of the reports from lab didn't have the sample identification or names of the customers to identify the samples.
A: Beth Johnson, AMEC: There should be sample identification numbers on chain of custody that will correlate back to laboratory identification numbers in the laboratory report. They didn't identify by customer because of multiple customers.
A: Merry Gamper, BLM: Some samples were sent as a batch with an associated chain of custody.
Q: Linda Baker, Upper Green River Alliance: The client name and the ID were not there.
A: Beth Johnson, AMEC: I will get with Linda to see an example. (note: Beth and Linda later discussed after Q&A session. The sample identifications were not on laboratory sheets for tentatively-identified compound analysis, but are tied back to the VOC and SVOC analysis towards the front of the reports by laboratory identification number. This is a laboratory-specific reporting protocol).
Q: Tim Barber, Yates Petroleum: It would be valuable to include in the record the several water wells drilled prior to the drilling of natural gas wells, as anecdotal information to note that gas was in those samples.
A: Beth Johnson, AMEC: Gas showings in water wells installed before any gas wells were installed on the gas well pad is noted in Section 4.0 of the report and was evaluated during the crafting of the Plan of Study and SAP.
Q: Delsa Allen, SCCD: I am curious where the naturally occurring organic matter comes from, is it bacteria, newly decaying organic matter. Is this something we could test for?
A: Beth Johnson, AMEC: There are probably things such as dissolved organic matter, or small particulates in groundwater, which were not sampled for directly in this study. Even though it appears to be completely clear water, there could be colloidal material.
A: KBill, NewFields: a study provided by DEQ indicates it has been evaluated in the Powder River Baskin. The particulates are of colloidal size.

5:45 6:00 pm Break

6:00 pm <u>Project Next Steps Shane DeForest, BLM</u>: This report represents a culmination of 5 years of study. Thank you (AMEC/NewFields) for bringing it down to the level of

understanding. Many questions will be answered and we will be working with cooperators and agencies to develop final plan. We will reconvene the team, develop outline, and develop the final monitoring plan.

Q: Paul Hagenstein, citizen: I look forward to the next one.
Q: Delsa Allen, SCCD: What is the anticipated time line and will it affect the 2014 sampling season.
A: Shane DeForest, BLM: No because of the 6 month time line.
A: Merry Gamper, BLM: Thank everyone in this process for their participation. We wanted to make sure the data supported the conclusions. Critical next step is to prepare the monitoring plan so we can further evaluate the results. The process is good, but it can be better. This is just one step in the process. Recommendations have been made in this regard. Thank everyone for coming and thank everyone for their patience and work on the project.

End at 6:15 pm

Janet Bellis

MEETING ATTENDANCE FORM

URPOSE: LLPHC Meeting

IME: FROM 2:30 TO 7:00 DATE: 11-22-13

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MEETING ATTENDANCE FORM

URPOSE: _____

IME: FROM _____ TO _____ DATE: _____

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Eric Petersen	SCCD		
Shane DeForest	BLM		
Merry Gamper	BLM		