

## **ROCKY FLATS STEWARDSHIP COUNCIL**

**Monday, June 4, 2012, 8:30 AM – 11:30 AM**

**Rocky Mountain Metropolitan Airport, Terminal Building, Mount Evans Room  
11755 Airport Way, Broomfield, Colorado**

**Board members in attendance:** Jim McCarthy (Alternate, Arvada), Lisa Morzel (Director, City of Boulder), Tim Plass (Alternate, City of Boulder), Meagan Davis (Alternate, Boulder County), Greg Stokes (Director, Broomfield), Mike Shelton (Alternate, Broomfield), David Allen (Alternate, Broomfield), Dan Hartman (Alternate, Golden), Kate Newman (Alternate, Jefferson County), Joyce Downing (Director, Northglenn), Shelley Stanley (Alternate, Northglenn), Joe Cirelli (Director, Superior), Bob Briggs (Director, Westminster), Mary Fabisiak (Alternate, Westminster), Emily Hunt (City of Thornton), Shirley Garcia (Director, Rocky Flats Cold War Museum), Roman Kohler (Director, Rocky Flats Homesteaders), Jeannette Hillery (Director, League of Women Voters), Arthur Widdowfield (citizen).

**Stewardship Council staff members and consultants in attendance:** David Abelson (Executive Director), Rik Getty (Technical Program Manager), Barb Vander Wall (Seter & Vander Wall, P.C), Erin Rogers (consultant).

**Attendees:** Vera Moritz (EPA), John Dalton (EPA), Carl Spreng (CDPHE), Marilyn Null (CDPHE), Charles Adams (CDPHE), Scott Surovchak (DOE-LM), Karen Reed (DOE), Bob Darr (Stoller), Rick DiSalvo (Stoller), Yvonne Deyo (Stoller), John Boylan (Stoller), Jody Nelson (Stoller), George Squibb (Stoller), Heidi Frasuk (Stoller), Linda Kaiser (Stoller), Tami Moon-Carlson (City of Northglenn), Ian Paton (Wright Water Engineers), Robert Weiner (Wright Water Engineers), Jennifer Bohn (RFSC accountant).

### **Convene/Agenda Review**

Chair Lisa Morzel convened the meeting at 8:34 a.m. She asked if there were any suggested changes to the agenda and there were not.

### **Chairman's Review of May 7 Executive Committee meeting**

Chair Lisa Morzel noted that an Executive Committee meeting was held on May 7, 2012. Meeting attendees included the Executive Committee members (Bob Briggs, Lisa Morzel and Jeannette Hillery) along with David Abelson. The purpose was to develop the agenda for this meeting. These meetings are always open to public, and have been held at the Boulder Municipal Building.

### **Consent Agenda**

Murph Widdowfield presented one minor editing change to the April Board meeting minutes (on page 8, it should say that plutonium decays into americium rather than the other way around). David Allen made one other minor edit that was recorded by staff.

Bob Briggs moved to approve the May Board meeting minutes as amended and the checks. The motion was seconded by Joe Cirelli. The motion to accept the minutes and checks passed 13-0.

### **Executive Director's Report**

David Abelson was in Washington, D.C. in May. During this visit, he met with staff from DOE and the Energy Communities Alliance (ECA). A primary issue being discussed had to do with a provision stemming from the recent Congressional debt ceiling struggle. Over the next 10 years, Congress is tasked with figuring out how to cut \$917 billion from the budget. If Congress does not agree on what cuts to make, there will be automatic cuts. As part of this, there is a huge push to protect the Defense Department budget. David noted that there will be cuts to DOE, but no one is yet sure what they will look like. These decisions will start being made early next year. The House of Representatives recently discussed the energy and water appropriations bill, which includes DOE. There is a major split between renewable energy and fossil fuels programs, and no agreement on what to cut. David recommended that local governments begin a dialogue with their national contacts and advisors, as these budget cutting requirements may affect any number of federal funding programs.

David next moved on to a quick update regarding a book about Rocky Flats coming out in June, authored by Colorado native Kristin Iverson. Staff put together talking points for the Board to have available in case of media contact. He summarized the main points. One is that Board Members take their responsibilities very seriously. Also, although no one can change past actions, local government representatives and citizens are engaged and working hard to understand and monitor any risks, in order to make sure human health and the environment are protected. This includes making sure that DOE and regulators are doing their jobs. Finally, Board Members can report that all relevant data shows that regulatory standards are being met.

David noted that the State and Tribal Government Working Group will be having their annual meeting in Denver in late June. This organization, funded by DOE, was formed in the mid-1990s, and primarily addresses sites that have a Native American population (such as Hanford and Idaho). This meeting will incorporate a focus on Rocky Flats, including a site tour. David, Scott Surovchak and Carl Spreng will be on a panel discussing the Rocky Flats cleanup process. Joe Cirelli asked if these were public meetings. Scott said that much of it is open to the public.

Rik Getty spoke about the Board's annual site tour, which was to occur later in the week. Attendees were asked to arrive at the west entrance at 9 am for a 2-3 hour tour. They were asked to bring water, sunscreen, sturdy shoes, long pants, cameras, and binoculars. There is make-up date in case of weather issues. About 25 people signed up to go on the tour.

### **Public Comment**

There was none.

### **Receive Stewardship Council 2011 Financial Audit**

Eric Barnes, from Wagner Barnes, briefed the Board on the results of the recent audit, which covered calendar year 2011. While the Stewardship Council is not required to conduct an audit, the Board has had one done every year, based on staff recommendations. Since there are no employees, an independent review is a reliable way for the Board to make sure everything is in order with its finances.

Mr. Barnes complemented the Board's accountant Jennifer Bohn on her work of keeping the Board's records. He said that the audit resulted in a 'clean opinion', which is about as good as it gets in an audit report. He reviewed sections of the audit report, including the balance sheet, statement of revenues, budget-to-actual statement (which showed actual expenditures were less than what was budgeted), assets, and insurance. There were no proposed adjustments to the records. Overall, no material problems were found and the Stewardship Council was deemed to be in compliance with all applicable laws and regulations. Chair Lisa Morzel noted that she was glad the Board continues to have audits performed even though the annual budget is not large. She said it keeps everything clear about how all money is spent.

Roman Kohler moved to accept the 2011 audit. The motion was seconded by Murph Widdowfield. The motion passed 13-0.

### **Member Updates**

The Board had a quick round-robin session, allowing each member an opportunity to provide a brief update about activities within their organization. Joe Cirelli noted that the Town of Superior was updating their comprehensive plan, and developing a town center plan. Bob Briggs said Westminster was working on the Westminster Center redevelopment, and recently hired a new Parks Director. Shirley Garcia said that the Rocky Flats Cold War Museum was in the second phase of their development and was about to finalize a new logo. Roman Kohler noted that the former workers were taking another stab at gaining special cohort status with NIOSH, and were hoping they will get community support. Lisa Morzel brought up the question of whether the Board should write another letter in support of the workers' efforts. David Abelson noted that the Charlie Wolf Act was not going to move forward, simply because of cost. Jeannette Hillery said that the Board needed to weigh in again, and asked Roman to let the Board know when this would be most timely. Lisa asked David Abelson to draft a letter before the next meeting. Murph Widdowfield noted that the Rocky Flats Cold War Museum had a booth at the People's Fair. He said many people stopped by the booth, and that there were many connections to former workers, even grandchildren. He reported a great deal of enthusiasm for the Refuge and the Museum, as family members were interested in learning what their parents and grandparents did at Rocky Flats.

### **Host DOE Annual Meeting**

DOE was on hand to brief on site activities for calendar year 2011. DOE has posted the report on its website and will provide a summary of its activities to the Stewardship Council. Activities included surface water monitoring, groundwater monitoring, ecological monitoring, and site operations (inspections, maintenance, etc.).

### ***Surface Water Monitoring – George Squibb***

George began by showing a map of the current monitoring sites and then discussed pond operations. Terminal ponds A-4 and B-5 were discharged in March 2011 and started flow-through operations in September. The other terminal pond (C-2) started flow-through operations in November. Pond A-3 to A-4 operated in flow-through operations January 1 through October 12, and then pond A-3 was 'offline' for dam breach for the remainder of 2011. As of January 1, 2012, Ponds A-3, A-4, B-5, and C-2 and the Landfill Pond were holding approximately 6.7 MG

(6.8 percent of capacity). The Present landfill and A-3 ponds were recently put into flow through. Precipitation for the year was about average and flow rates were a little below average.

When showing the water quality plots, George noted that the newer flow-paced sampling was expected to show more variability than batch sampling. All Points of Compliance (POC's) showed levels below applicable standards. At the Points of Evaluation (POE's) monitoring, only GS10 and SW027 presented reportable conditions. Reportable 12-month rolling average values for uranium at GS10 were observed starting April 30, 2011. Additional sampling is being conducted both upstream of and downstream of GS10. Contact Records 2011-04 and 2011-05 can be found on the Rocky Flats website. Reportable 12-month rolling average values for americium at GS10 were observed starting August 31, 2011. Additional sampling is being conducted both upstream of and downstream of GS10. Contact Record 2011-08 can be found on the Rocky Flats website. Reportable 12-month rolling average values for plutonium at SW027 were initially observed starting April 30, 2010. Plutonium was no longer reportable at SW027 starting on April 30, 2011. Contact Record 2010-06 can be found on the Rocky Flats website.

David Abelson asked what these results are telling us on a macro level. George said that they are showing a lot of what was expected, and also prompts them to get a better understanding of what is going on in these areas. He re-iterated that that remedy was designed to include monitoring and that the contaminant levels are about a tenth of what was present during closure.

Reportable 12-month rolling average values for plutonium at SW027 were initially observed starting April 30, 2010. Plutonium was no longer reportable at SW027 starting on April 30, 2011.

Routine quarterly sampling at the Present Landfill (PLF) showed selenium and arsenic concentrations above the standard at the treatment system effluent. These concentrations triggered sampling at an increased frequency (monthly). Selenium and arsenic were not detected in the subsequent monthly samples, and the sampling frequency reverted back to quarterly.

David Abelson suggested that, given the impact of the Solar Ponds on much of the surface water contamination, it would make sense at future meeting to review the background of this area.

#### *Groundwater monitoring – John Boylan*

John noted that each type of monitoring (such as AOC, sentinel, RCRA, etc.) has particular objectives. RFLMA monitoring includes all AOC, Sentinel, and RCRA wells. AOC wells are monitored for the impact of groundwater on surface water. Sentinel wells provide indication of plume movement, and RCRA wells support the landfills (PLF, OLF). RFLMA monitoring also includes the treatment system locations. Non-RFLMA monitoring includes additional sampling at the Solar Ponds Plume Treatment System (SPPTS); continued evaluation of air stripper at Mound Site Plume Treatment System (MSPTS); confirmatory sampling at several locations; and extra sampling to support the GS10 evaluation.

During the calendar year, all RFLMA-required monitoring was performed. Analytical data was evaluated per RFLMA Attachment 2. Groundwater treatment systems continue to remove

contaminants from the groundwater. The MSPTS media was replaced and the prototype polishing component (solar-powered air stripper) was installed.

Seepage velocities (groundwater flow rates) were estimated from water levels measured across the COU. They used 22 well pairs for this analysis. The median velocity (127 ft/yr) and range (8 to 428 ft/yr) was very similar to results from 2010.

Locations where velocity is at least 200 ft/yr:

- Part of 881 hillside
- B771 hillside
- OLF
- Part of 903 Pad/Lip
- Oil Burn Pit #1

Locations where velocity is less than 50 ft/yr:

- South IA
- North side of solar ponds

Statistical analyses of groundwater quality data were performed per RFLMA. An analysis of variance (ANOVA) for RCRA wells looked at downgradient groundwater vs. upgradient groundwater. Statistical trending was used for Sentinel and RCRA wells, plus several evaluation wells were sampled for non-RFLMA purposes. Additional, non-RFLMA statistical analyses were performed on selected data from AOC wells. John recommended referring to the Annual Report text, tables, figures, and Appendix B for well- and chemical-specific details. He added that references to concentration trends in his presentation were for those calculated to have 95 percent statistical confidence.

John presented a summary of the statistical analysis for OLF groundwater. ANOVA results for 2011 were the same as for 2007–2010. Concentrations of two metals are higher in downgradient than upgradient groundwater - boron in all three wells, and uranium in one well (80205). All were below applicable RFLMA levels. These results may be attributable to natural sources. Uranium was characterized as 100 percent natural (2007). Statistical trending calculations were also the same as 2010, and showed no increasing trends at downgradient wells. Boron and uranium were decreasing at well 80005. Per RFLMA, higher downgradient concentration or an increasing trend trigger consultation – and boron and uranium conditions meet this requirement.

John moved on to a summary of the statistical analysis for PLF groundwater. ANOVA results for 2011 were very similar to preceding years. Concentrations of several metals are higher in downgradient than upgradient groundwater. Statistical trending calculations were also similar to preceding years. Boron concentrations at well 73105 and chromium and selenium at well 73005 are on increasing trends. John added that numerous non-detects in the dataset suggest that trends may not be real. Boron at 73105 and chromium and selenium at 73005 meet the RFLMA requirement to trigger consultation. As in 2008–2010, only selenium exceeded the applicable RFLMA level. This may be attributable to natural sources (such as ore mineralization or organic-rich sediments).

One VOC (and no SVOCs) were detected in downgradient OLF groundwater (1,1-DCE, second quarter, well 80105). The applicable RFLMA standard is 7 µg/L and the concentration is estimated at 0.48 µg/L. No VOCs were detected in downgradient PLF groundwater.

John moved on to an update on the Mound and Oil Burn Pit #2 (OBP #2) Plume. Source area evaluation wells were not scheduled for RFLMA sampling in 2011. OBP #2 well was sampled to support other evaluations. The results were generally consistent with previous data. Sentinel well 15699 is downgradient of the Mound source area and the MSPTS collection trench, and showed fourth-quarter increases in PCE, TCE. This may reflect water storage in the trench during MSPTS maintenance in 2011. Concentrations decreased in follow-up sample. Sentinel well 91299 is downgradient/side-gradient of the OBP #2 source area. Concentrations of several VOCs decreased in 2011 and several trends were identified and noted in the Annual Report.

The MSPTS treated approximately 546,000 gallons of water in 2011, which was the highest volume ever treated at this location. It continues the trend of higher volumes observed since closure, and is due to the addition of OBP #2 water, and continuing effects of a wet 2010. Influent concentrations of PCE and TCE remained higher in 2011 and influent continues to reflect presence of OBP #2-impacted groundwater.

System maintenance was performed at MSPTS in February and March 2011 (ZVI media replaced, subsurface discharge gallery repaired, and small solar-powered air stripper was installed in the effluent manhole). Optimization and testing continues. Effluent water quality has improved and results from surface water performance location GS10 also improved over 2010. Four detections of VOCs were reported, but none exceeded applicable RFLMA standards.

At the East Trenches Plume Treatment System (ETPTS), source area evaluation wells were not scheduled for sampling during the calendar year. Water quality at downgradient Sentinel and AOC wells was consistent with previous years. Downgradient Sentinel well 23296 (next to South Walnut Creek) showed increasing trends in main degradation byproducts, and decreasing trends in main parent compounds. There have also been higher water levels since the dam breach.

The ETPTS treated approximately 890,000 gallons, which was much lower than 2010 and more similar to previous post-closure years. Effects are still seen from the wet 2010.

Concentrations of some VOCs at the ETPTS system influent are higher, especially TCE. These are typically in the 2500 µg/L range, but have been greater than 3000 µg/L since fourth quarter 2010. The effluent showed much higher TCE concentrations in the fourth quarter sample. A follow-up sample showed similar results. To address this, the site reconfigured the flow from parallel upflow in both treatment cells to a series - upflow in the first cell and downflow in the second cell. They collected a sample in January 2012 to evaluate the flow reconfiguration, which showed that treatment effectiveness had been restored. Results from the surface water performance location POM2 included no VOC detections.

At the SPPTS, source-area evaluation wells were not scheduled for sampling. Three wells on the south/southeast portion of the source area were sampled to support the GS10 evaluation. Results were consistent with previous samples, including continued decreasing uranium in one well.

Overall patterns at downgradient sentinel wells showed that higher uranium was often not accompanied by higher nitrate. Wells nearer the source area (Sentinel well P210089) may be lower in uranium than wells farther away (Sentinel well 70099, AOC well 10594). This illustrates the importance of natural uranium.

The SPPTS treated approximately 507,000 gallons. The annual average volume treated has increased since Phase I upgrades in 2008. The average for 2006–2011 is more than twice the average from 2000–2005. The average for 2009–2011 is almost three times the 2000–2008 average.

Overall SPPTS trends include the finding that higher flow rates reduce residence time and treatment effectiveness. Also, average concentrations of nitrate and uranium remain much lower at the SPP Discharge Gallery than prior to site closure. Finally, results from surface water performance location GS13 indicate that the overall effectiveness of SPPTS is improving.

John also provided a summary of SPPTS upgrades:

- Phase I (October 2008) collects more contaminated groundwater and routes to treatment cells, routes effluent via new, nonperforated line
- Phase II (May 2009) moves uranium treatment to first step in easily accessible cell
- Phase III (May 2009) evaluates pilot-scale nitrate treatment

The main SPPTS activities were:

- Continued operation of Phase III components
- Cleaned media (biomass removal) in Phase III Cell A
- Conceptualization of revised approach to uranium treatment (“microcell”) to address reduced effectiveness of Phase II Cell
  - Shorten residence time and attempt to replicate successful lab results
  - Testing underway in 2012

Phase III optimization has concluded. The results showed that the organic media alternative requires a much larger treatment cell, and the active alternative requires much more maintenance and power.

John noted that only a few source-area evaluation wells were sampled in 2011:

- 903 Pad/Ryan’s Pit plume
- IA plume
- Vinyl chloride plume
- IHSS 118.1 plume
- Other areas - Former B991 and AOC well B206989 (No Name Gulch)

At the 903 Pad/Ryan’s Pit Plume, results from source-area evaluation wells were generally consistent with previous data. 903 Pad groundwater shows primarily carbon tetrachloride and PCE. Ryan’s Pit groundwater shows primarily TCE. Well 07391 (Ryan’s Pit) produces samples

with the highest VOC concentrations. AOC wells 10304 and 00193 do not suggest impacts to surface water.

The next area John discussed was the Industrial Area (IA) plume. In the southern portion, no evaluation wells were sampled. Sentinel well results were consistent with previous samples. The results for AOC well 11104 (at Woman Creek) do not suggest an impact to surface water. Uranium concentrations were also consistent with previous results and remain below the threshold. The central portion was not sampled. In the northern portion, biodegradation of VOCs is suggested at Evaluation well 21505 (located between two other areas that support biodegradation). Parent compounds (PCE, TCE) were decreasing, and daughter products were on an uncertain trend. VOCs in Sentinel well 52505 and Surface Water Support location SW018 were consistent with previous results (well below RFLMA standards). Also, no VOCs were detected in AOC well 42505.

At the Vinyl Chloride Plume, the site replaced the downgradient, kinked Sentinel well 33711 (original: 33703). Second-quarter results from the replacement well were higher than typical in the original well. Confirmatory sample and fourth quarter sample results were lower. Source-area results were consistent with previous years. Concentrations of daughter products are higher, and parent compounds lower. Biodegradation appears to be continuing.

At the IHSS 118.1 Plume, source-area Evaluation well 18199 was sampled. Results suggest some rebound of carbon tetrachloride and chloroform (main contaminants). Downgradient Evaluation well 20902 was not sampled in 2011. Downgradient Sentinel wells (north of B771) do not suggest impacts from this plume.

In the B991 area, uranium concentrations at well 99405 continued rebound after the 2009 low, but are still calculated to be on a decreasing trend. Uranium at well 99305 was calculated to be increasing. Both wells were characterized as natural uranium.

AOC well B206989 (east of Landfill Pond dam) had shown a reportable condition for nitrate in 2007. A decreasing trend was calculated, and results since early 2010 have been below the 10 mg/L standard.

John was asked how deep the wells onsite were. He said they range from 12-45 feet.

#### *Site Operations – Rick DiSalvo*

At the OLF, 12 monthly inspections were performed in 2011. Settlement monuments were surveyed in March, June, September, and December. Results were within the expected range per the Monitoring and Maintenance Plan, and did not trigger any maintenance. A biannual topographic survey was performed in March 2011. Berm height maintenance was conducted to meet minimum height criteria. Lisa Morzel asked how topographic surveys are conducted at the site. Rick said they are laser-based, and very accurate to a tenth of an inch. Lisa would like to see maps showing differences over time. He said that the 2009 survey map is in the landfill plan. Three surveys have been done to date – once after closure, and again in 2009 and 2011. These will be done every two years.

At the OLF, inclinometers were measured on October 20, November 22, and December 21, 2011. Very little deflection was noted in the fourth quarter (and all of 2011). A review of 2011 data by the geotechnical engineer was consistent with the 2008 Geotechnical Report. Localized slumping occurs as groundwater levels saturate the organic layer near bedrock. 2011 data support the conclusion that monitoring and implementing maintenance to fill and grade surface cracking is effective. Filling and grading to reduce the depth and slope of the west perimeter channel and to promote drainage of seeps in 2008 and 2009 may contribute to gradual stabilization. Shelley Stanley asked if they are seeing deflection in same inclinometers that showed movement before. He said they were, and these are in an area that historically shows slumping. Seven inclinometers were installed, but they cannot access data down to the original depth in three of these because soil movement has deformed the tubes. This was expected by the geotechnical engineer.

At the PLF, four quarterly inspections were completed in 2011. Nine settlement monuments and six side slope monitors were surveyed in December 2011. The results were within the expected range per Monitoring and Maintenance Plan and did not trigger any maintenance.

The annual site inspection of the Central Operable Unit was conducted on March 15, 2011. This annual project entails inspection and monitoring for evidence of significant erosion. Personnel conduct visual observation for precursors of significant erosion and evaluate proximity of any significant erosion to subsurface features. They also look for evidence of any adverse biological conditions. Finally, site officials inspect the effectiveness of institutional controls (ICs), evaluate any evidence of violation of ICs, determine whether required signs are in place, and verify that Environmental Covenant is in Administrative Record and on file with Jefferson County.

In order to perform the inspection, the COU was divided into five areas:

- A – Former 300 and 400 Areas
- B – Former 700 and 991 Areas
- C – Former 800 Area
- D – Former 903 Pad and East Trenches Area
- E – Former Ash Pits Area

The SW027 drainage area was also inspected, as erosion controls were added in 2010 as follow-up to elevated plutonium levels found that year. Landfills, treatment systems, and water monitoring stations are inspected during the year on a routine basis. The team walked down the surface of each area (A–E) and SW027 drainage area to observe conditions.

No significant erosion was noted, although there were some holes and surface debris. A deep hole was found above a stairwell in former B881. It was about 5 feet in diameter and 18 feet deep. It was filled with about four truckloads of soil. Tim Plass asked how this large of a hole could have developed. Rick said that the building had been imploded and filled in, but soil can move into voids. The other, smaller holes were also filled in, and all debris and trash was collected or flagged for pick up. No adverse biological conditions or evidence of IC violations were noted. All necessary signs were in place.

*Ecology -- Jody Nelson*

Project support for ecological issues was provided for the:

- A-3/PLF dam breach project
- POC flumes project
- Annual roads project
- Annual dam mowing and riprap spraying project
- OLF maintenance
- Pond bottom revegetation project (A-4, B-5, and C-2)
- Stoplog removal project
- Solar Ponds Plume Treatment System projects
- Annual weed control efforts

2011 ecological monitoring included:

- OLF and PLF vegetation surveys
- Weed and water level surveys in the mitigation wetlands
- Revegetation monitoring
- Weed monitoring and mapping
- Preble's mouse mitigation monitoring
- Wetland mitigation monitoring
- Bluebird box monitoring

2011 wildlife monitoring included:

- Prairie dogs – no active towns within COU
- Raptor nests
  - 1 Great Horned Owl nest – 3 young fledged
- Bluebird nest boxes
  - No bluebirds using nest boxes yet
  - Some boxes used by tree swallows

Jody showed maps for revegetation monitoring and weed monitoring, as well as a series of before-and-after photos of how different areas of the site have changed since closure.

Shelley Stanley asked whether the site would do anything if prairie dogs got into areas of concern. Jody said they would.

### **Briefing on the Actinide Migration**

Since many new members have been added since closure, the Board has been making sure that these members are educated on basic Rocky Flats issues, so they can understand information in context. This briefing was designed provide an overview of the radioactive contaminants at Rocky Flats, the risks that they could pose in the environment.

The Actinide Migration Evaluation (AME) projects were commissioned at Rocky Flats in 1995 to address how actinide elements could potentially move in the local environment. Initially,

AME advisors were recruited to evaluate and provide guidance on environmental conditions (including actinide chemistry, geochemistry, migration, and erosion) at Rocky Flats. The charter was expanded to include recommendations of paths forward for long-term protection of surface-water quality as the primary technical and regulatory measure of remedial action quality. Understanding how actinides move in the environment is central to the cleanup and long-term protection strategies.

Ian Paton and Dr. Robert Weiner (retired professor of chemistry), both with Wright Water Engineers and the Actinide Migration Evaluation, were brought in to provide this presentation.

Dr Weiner began by stating that uranium (U), plutonium (Pu) and Americium (Am) were the main radionuclides of concern at Rocky Flats. Actinide elements (all are radioactive) are close together on the periodic table and have similar properties. Uranium is a naturally-occurring element, and was used in weapons manufacturing. Plutonium is produced artificially when making fissionable materials. Americium is produced by the radioactive decay of plutonium. An element's atomic structure is defined by a different number of electrons around the nucleus. The ratio of neutrons to protons determines the radioactive properties. The number of electrons and their spatial arrangement determines the chemical properties. Chemical properties determine the mobility of an element. Electron arrangement is described by a quantity called the oxidation state, which is essentially the number of electrons in the atom available for reaction with other atoms. Oxidation state values range from I-VIII. The oxidation state determines the chemical properties which in turn determine mobility. The two important chemical properties are solubility and sorption (when something adheres). A high oxidation state means high solubility, and less sorption; while a low oxidation state means lower solubility and greater sorption.

When looking at potential pathways for the movement of actinides, solubility and sorption may or may not apply. With the wind pathway, solubility is not applicable. Sorption is important because actinides can be sorbed on dust particles. In the surface water pathway, solubility is important, but sorption is also important, because of sediments and eroding solids. With the groundwater pathway, solubility is important, while sorption is not.

Plutonium and americium can be found almost everywhere on earth because of nuclear testing. Man-made background concentrations are as follows: Plutonium .04 pCi/g and americium .01 pCi/g. There are different possible oxidation states for actinides. The predominant forms at Rocky Flats had to be measured. They were found to be Pu(IV) and Am(III), which represent a low oxidation state. These have low solubility and high sorption strengths. Solubility tends to be between 1 -.01 ppb. Pu and Am have similar chemical properties and dispersal mechanisms.

Uranium is also found virtually everywhere. There is a high natural background across the Front Range, as well as a man-made background from nuclear testing. Near Rocky Flats, background levels are about 2.25 pCi/g. Uranium exists in two oxidation states at Rocky Flats – U(VI) is more soluble and U(IV) is less soluble. All transport pathways are possible for uranium.

Dr. Weiner provided a summary of mobility pathways at Rocky Flats:

- Wind - Pu, Am and U
- Surface water - Pu, Am and U (however, only U has significant solubility)

- Groundwater - only U (only with high solubility)

These specific conclusions drove remediation decisions.

Ian Paton explained how these principles and findings apply at Rocky Flats. In 1996, an Actinide Migration Evaluation (AME) group was formed, consisting of independent, internationally-recognized experts with various specialties. This project lasted through closure, which was almost ten years. They held regular meetings with stakeholder groups. One of the first activities was to develop pathway models, as well as more sophisticated models for Pu/Am and uranium. The AME experts worked on these for approximately six years. An example of one of their studies was looking at the 903 Pad, which had the highest Pu concentrations onsite. The AME team collected soil samples under the asphalt which was used to fix the contamination in place. They analyzed the atomic structure and confirmed that it was Pu(IV). This form of Pu is insoluble and only moves in particles in surface water and air. This supported data previously gathered regarding contamination patterns. 90% of the contamination was found to be in the first five inches of soil, and 100% was in first eight inches. Ian was asked about the potential for transport via colloids. He explained that colloids are very small, sub-micron particles and added that studies were done to look into this, but that very limited concentrations were found. He said that while this was potential pathway, it was not a dominant one.

This pathway data was used as a foundation for soil cleanup standards at the site. Because of the lack of mobility in soil, cleanup work was focused on the top three feet. This was intended to be conservative, since almost no contamination was found below eight inches. The bulk of the cleanup took place at and around the 903 Pad. During the cleanup, a tent/weather enclosure was constructed over the area being excavated, and then clean fill dirt was added on top. Once cleanup was confirmed through sampling, erosion 'blankets' were laid on to in order to reduce erosion. This cleanup effort took place over an area of approximately 34 acres. After remediation, the same pathways continue to apply for any residual material left in the soil and the goal is to prevent movement by controlling wind and water erosion. Tim Plass asked what volume of contamination was left onsite. Ian said this has not been quantified, but in the 903 Pad lip area, the average remaining contamination levels were about 13 pCi/g. There is a continuing focus on re-vegetation and erosion control, as well as ongoing monitoring. Lisa Morzel asked how much fill soil was used at the 903 Pad. Scott Surovchak said they replaced the same amount that was removed. She also asked if the site looked at soil column migration. Scott said they did not. Joe Cirelli asked how the extent of the lip area to be remediated was determined. Scott said it was determined prior to cleanup via sampling. He added that after the Actinide Migration Evaluation report, a more stringent soil standard was instituted, which in turn increased the area to be remediated. Scott said that soil characterization showed plutonium contamination only at 903 Pad and around building foundations, and this was only to a depth of about 6 inches. Mary Fabisiak asked if work done recently that would minimize projected plutonium loads in the South Interceptor Ditch (SID) for a 100-year rain event, as noted in the AME report. Ian pointed out that these calculations were done based on pre-remediation contamination levels on the lip area, and were no longer relevant.

### **Public comment**

There was none

## **Updates/Big Picture Review**

### **September 10, 2012 (second Monday)**

#### *Potential Business Items*

- Initial review of 2013 budget
- Initial review of 2013 work plan

#### *Potential Briefing Items*

- Solar Ponds performance
- DOE Quarterly update
- Regulatory overview
- Update on CERCLA 5-year review

### **November 5, 2012**

#### *Potential Business Items*

- Approve 2013 budget
- Approve 2013 work plan

#### *Potential Briefing Items*

- DOE Quarterly update
- NRD update
- Original landfill performance

Tim Plass asked if the Stewardship Council was planning to participate in Rocky Mountain Greenways discussions. David Abelson said that this was up to the Board. He said it could not be addressed under the Board's DOE grant, but that other funding was available. Barb Vander Wall noted that any work items need to fall under the Stewardship Council's IGA. David said that the IGA does address Refuge issues and this discussion could tie in. Lisa Morzel said a committee had been formed to work on a vision, get discussion going, and think about how to move forward with a regional open space network. She suggested that the Board could get a quick update on this topic at the next meeting.

#### **Issues to watch:**

Americium and uranium levels upstream of pond B-3  
Re-vegetation efforts (especially if drought-like conditions continue)  
Adaptive Management Plan water quality testing results

The meeting was adjourned at 11:42 a.m.

*Respectfully submitted by Erin Rogers.*