ROCKY FLATS STEWARDSHIP COUNCIL

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Jefferson County -- Boulder County -- City and County of Broomfield -- City of Arvada -- City of Boulder
City of Golden -- City of Northglenn -- City of Westminster -- Town of Superior
League of Women Voters -- Rocky Flats Cold War Museum -- Rocky Flats Homesteaders
Arthur Widdowfield

Board of Directors Meeting – Agenda
Monday, April 4, 2011, 8:30 – 11:30 AM
Rocky Mountain Metropolitan Airport, Terminal Building, Mount Evans Room
11755 Airport Way, Broomfield, Colorado

8:30 AM Convene/Introductions/Agenda Review

8:35 AM Chairman's Review of February 25th Executive Committee meeting

8:45 AM Business Items (briefing memo attached)

1. Consent Agenda
   - Approval of meeting minutes and checks

2. Executive Director's Report

8:55 AM Public Comment

9:15 AM Briefing on History of Rocky Flats Stewardship Council (briefing memo attached)

- With changes to the Board composition since the group's inception in 2006, we will take a step back and discuss the reasons for the Stewardship Council – our legislative roots, mission, and focus since 2006.
- This conversation will help set the stage for DOE's review of our role as the Local Stakeholder Organization (LSO) for Rocky Flats that will occur later this year.

9:45 AM Board Discussion of Soil Sampling in the Eastern Part of the Rocky Flats Buffer Zone (briefing memo attached)

- There will be no briefing, so please review the briefing memo and associated backup materials.
- In conversations about moving the water quality points of compliance from Indiana Street to the eastern part of DOE's management boundary, one question that has emerged is contamination levels between the terminal ponds and Indiana Street.
- Questions about contamination levels have also arisen regarding the proposed Jefferson Parkway and the Parkway's acquisition from the USFWS of a 300' right-of-way along Indiana Street.

- The conversation will focus on issues, questions and concerns board members have. The June meeting will then focus on addressing those issues, etc, and will likely include briefings by CDPHE, EPA and DOE.
- Importantly, the conversation and subsequent briefing(s) will not concern the wisdom or feasibility of building the Parkway, but will provide information board members can use in the appropriate forum(s).

10:45 AM Update on Dam Breach EA and Changes to RFLMA Points of Compliance (briefing memo attached)

- As discussed at the February meeting, DOE, EPA and CDPHE are hosting public meetings to discuss development of an Adaptive Management Plan (AMP). The AMP focuses solely on the dam breach EA.
- Stewardship Council members have actively participated in this process.
- Based on the many concerns a broad range of members have expressed with DOE's plans to breach the terminal dams, the conversation will serve to update members who are not involved in the AMP process, and to identify common issues members share.

11:15 AM Public comment

11:25AM Updates/Big Picture Review

Adjourn

Next Meetings: June 6
September 12
November 14

Business Items

- February 7, 2011, draft board meeting minutes
- List of Stewardship Council checks

Stewardship Council History

- Cover memo
- LSO authorizing legislation
- Letter from DOE to the Rocky Flats Coalition
- DOE's letter approving the LSO
- Fiscal year 2005 Congressional funding authorization

ROCKY FLATS STEWARDSHIP COUNCIL
Monday, February 7, 2011, 8:30 AM – 11:45 AM
Rocky Mountain Metropolitan Airport, Terminal Building, Mount Evans Room
11755 Airport Way, Broomfield, Colorado

Board members in attendance: Maria VanderKolk (Alternate, Arvada), Lisa Morzel (Director, City of Boulder), Meagan Davis (Alternate, Boulder County), Lori Cox (Director, Broomfield), David Allen (Alternate, Broomfield), Greg Stokes (Alternate, Broomfield), Bill Fisher (Director, Golden), Faye Griffin (Director, Jefferson County), Sheri Paiz (Director, Northglenn), Shelley Stanley (Alternate, Northglenn), Chris Hanson (Alternate, Superior), Bob Briggs (Director, Westminster), Mary Fabisiak (Alternate, Westminster), Jeannette Hillery (Director, League of Women Voters), Shirley Garcia (Director, Rocky Flats Cold War Museum), Ann Lockhart (Alternate, Rocky Flats Cold War Museum), Roman Kohler (Director, Rocky Flats Homesteaders), 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.), Jennifer Bohn (RFSC accountant), Erin Rogers (consultant).

Attendees: Mickey Harlow (citizen), Anne Fenerty (citizen), Vera Moritz (EPA), John Dalton (EPA), Carl Spreng (CDPHE), Scott Surovchak (DOE-LM), Joe Legare (Stoller), Bob Darr (Stoller), Rick DiSalvo (Stoller), Jeremiah McLaughlin (Stoller), John Boylan (Stoller), Linda Kaiser (Stoller), John McCord (Stoller), Lynn Bowdidge (Stoller), Cathy Shugarts (Westminster), Tamara Moon (Northglenn), Stuart Feinhor (Rep. Polis).

Convene/Agenda Review

Chair Lori Cox convened the meeting at 8:37 a.m. The first item was introductions of attendees. She then asked if there were any suggested changes to the agenda, and there were not. The next item was the election of officers for 2011. Lori took moment to say how much she had enjoyed her term as Chair. David Abelson announced those members who had expressed interest in serving as offers -- Bob Briggs for Chair, and Lisa Morzel, Jeannette Hillery, and Sheri Paiz for the Vice Chair and Secretary/ Treasurer positions. He then asked if anyone else was interested. No one replied. David asked for confirmation that those who had expressed interest were still interested, and they were. The Board was asked to vote for Chair, and Bob Briggs was the unanimous choice. For Vice Chair, the nominees were Jeannette Hillery, Lisa Morzel and Sheri Paiz. Sheri requested to be taken off the ballot for this position. After voting, the results were Jeannette (3) and Lisa (8). Lisa Morzel was elected as the new Vice Chair. Jeannette Hillery then withdrew her name for the Secretary/Treasurer position. Sheri Paiz was elected unanimously. Lisa Morzel thanked Lori for her excellent service as Chair for the past year.

Bob Briggs took over as Chair of the meeting, thanking Lori for her work. David Abelson introduced a new Board member from the City of Westminster, Mary Fabisiak. Mary has been in the Public Works department for six years. The next item on the agenda was for the Board to approve a resolution regarding 2011 meeting dates and notice provisions. Lori Cox moved to

approve the resolution and meeting notice provisions. The motion was seconded Lisa Morzel. The motion passed 11-0.

Lori Cox moved to approve the November Board meeting minutes and checks. The motion was seconded by Roman Kohler. The motion to accept the minutes and checks passed 11-0.

Executive Director's Report

David Abelson provided several updates to the Board. He announced that he would be attending the Energy Communities Alliance meeting the following week on behalf of Stewardship Council. He said that although there is not a significant focus on Legacy Management at these meetings, they are a good opportunity to dialogue with people from other communities. While in Washington, D.C. for this meeting, David will also meet with DOE-LM Director Dave Geiser. He will discuss the upcoming review of the Stewardship Council's role as the Local Stakeholder Organization (LSO) at Rocky Flats. David said he had already spoken with Scott Surovchak about this issue. David said these discussions have a lot of implications, including continued funding for the Board. He said he did not think that DOE has put much thought into how their LSO review will look, but based on his conversation with Scott, believes DOE will look at the enacting legislation and determine whether the group is meeting its goals. He said the Board will begin discussing this topic in June and that it will tie in with the triennial review. Lisa Morzel asked if David thought there would be any real changes in what DOE might expect from this organization. David said he did not. He added that there are some things from the original guidance that are now complete (e.g., approval of cleanup documents and adoption of the post-closure regulatory agreement). Lori asked if DOE would be looking at the Stewardship Council work plan to review its activities. David explained that in 2005, the creators of this group took the legislation and identified the steps necessary to implement its goals. He referred to the LSO organization plan, which could be found in the meeting packet. He also pointed out how the Board separated LSO and non-LSO activities. The sections in bold were taken directly from the legislation, and those in italics were the Stewardship Council plans.

David next noted that Doug Young, previously with Senator Udall, had taken a position with Governor Hickenlooper. David said it will be a good thing to have someone in the governor's office who understands Rocky Flats issues. Lisa Morzel asked who took over Doug's position with Sen. Udall. David said this person had not been named. He also pointed out Stuart Feinhor from Rep. Polis' office and noted that, historically, the representative from this district has taken the lead on Rocky Flats issues.

The Board had asked for an update on NRD claims. David said he had been sending out information on this topic from Carl Spreng. There will be an update at the Board's June meeting. There will also be some discussion about the Jefferson Parkway at this meeting. David specified that the Board will only speak about the proposed tollway as it relates to Rocky Flats, and will not debate or take a position on whether or not to build the road. In its work plan, the Board determined it would answer questions if any issues arise as to Rocky Flats, but would not get involved in the decision. David said one question the Board may discuss is plans for the money that the Parkway Authority would pay to DOE for the right-of-way purchase. Although slated to go into the general treasury, the Board may consider whether it would want to advocate for a

specific use of these funds. Another aspect that the Stewardship Council may weigh in on is anything related to the provision of data regarding the cleanup and current conditions of the area in question. David said that the Board would arrange a briefing about monitoring in the eastern buffer zone.

Maria VanderKolk noted another issue. She said Arvada has some concerns about monitoring stations that are currently in the right-of-way area and what will happen once the parkway is built. Lori Cox said that at some point, it might be necessary for the Stewardship Council to make some sort of statement about safety concerns. She added that the issue comes up at DRCOG meetings frequently, and that they look to these members for input. Lisa Morzel said that this group needs to see the data first about moving Points of Compliance (POC), which goes hand-in-hand with briefings on the ponds. David noted that if DOE had not already talked about moving the POC's, the answer would probably be that they would just be moved 300 feet west to align with the new boundary. However, since there are other discussions, it can be a separate issue. Sheri Paiz said she had previously stated she did not want to take position on the parkway. Lori clarified that she was not asking that that Board take a position on the building of the parkway, rather that members consider taking the position that the new location of the POCs should not be part of discussion of whether to build or not to build. David said there is also interest in contamination issues related to moving dirt for construction of the parkway. Utilizing objective information, the Board could provide an assessment regarding this question. Lisa Morzel said that they still need monitoring data and then this body can address the facts. She said she does not want it to be a political issue. Chris Hanson said that Superior has the same concerns, and that they want to be involved in all discussions.

David said that he had recently distributed quarterly and annual financial reports to the Board. He also mentioned a letter from Broomfield that was sent to CDPHE, and said it aligned with proposed Washington, D.C. talking points that the Board would discuss later in the meeting.

Board attorney Barb Vander Wall distributed annual oaths of office to Board members and asked them to sign, have witnessed and return to her. She said members could also send them to her after the meeting.

Public Comment

Mickey Harlow (Arvada citizen) referred to the Board's November meeting minutes, and said she agreed with Lisa Morzel that it was disappointing that more people from the public did not attend these meetings. She said that that posting notices with city clerks is not enough public notice. She suggested that the group take a look at the local 'Hub' inserts The Denver Post. She said she was happy to hear that the Board will be attaching public comment statements to meeting minutes and adding them to website. She was disappointed that there was no action yet regarding posting these comments on the website.

Ann Fenerty (Boulder citizen) said she supported Mickey's statements. She said she gave the Board a copy of an article published in *Physics Today* last year about this time. She said she would like to have that posted along with other public comments. She said local governments are not concerned about contamination, but many people are. She said a 'MARSSIM' analysis was

not done at Rocky Flats and there was not a scientific evaluation of the cleanup. She was also concerned about pond C-2 being breached.

David Abelson responded to Mickey that, as requested, written public statements have been attached to the meeting minutes, both in board packets and on the website, since April. He said she was right about the public comment component of the website. Although plans had fallen by the wayside, he will make sure this gets done soon. Mickey said she did not hand out written comments, and that they are condensed in the minutes. She said these should be on website as well. David said members of the public should let him know how they would like their comments to be handled. Mickey said she recommend that they follow the recommendations in David Geiser's letter. Shirley Garcia said she liked idea of putting comments on the website.

Lisa Morzel said she was not familiar with the 'Hub' insert. Maria VanderKolk said it is called 'Your Hub', and comes out every Thursday. She said there is no cost, but the paper decides which items to run. At minimum, submittals will be included in the online version. David said he would follow up about this.

Host DOE Quarterly Meeting

DOE was on hand to brief the Stewardship Council on Rocky Flats activities for the third quarter of 2010 (July-September). DOE has posted the full report on its website. Activities for the quarter included surface water monitoring, groundwater monitoring, ecological monitoring, and site operations (inspections, maintenance, etc.).

Surface Water Monitoring – George Squibb
Beginning in July, the site discharged Pond C-2 for first time in years. Transfers from A-3 to A-4 also were made as part of flow-through operations. At the end of the quarter, pond levels were about 15% of capacity, and A-3 has been empty since the end of November. George said they would probably discharge A-4 and B-5 before spring runoff begins. They will take them down to about 10%, as low as they can go. After a pretty wet spring of 2010, July through September was pretty dry; this resulted in low flow conditions.

Performance monitoring at both the Original and Present Landfills (OLF & PLF) showed that surface water quality results were all below standards for the quarter. These were the results of grab samples only; results for the composite sample started on July 1, 2010 are pending.

George next discussed Point of Evaluation (POE) monitoring results. An exceedance was identified as part of the collection of samples for the 12-month rolling average for plutonium at SW027. DOE reported these results preemptively, and the next sampling did not change the calculation of the average at .6 pCi/L (well above the .15 pCi/L standard). Details can be found in contact record 2010-06. Since plutonium and americium primarily only move when attached to suspended solids and sediment, actions to address the exceedance involved looking for areas with exposed top soil in the drainage. Remedies included adding wattles and revegetation, in order to make the low level residual contamination more immobile. As part of the 903 pad cleanup in this area, 300 acres were stripped of vegetation and topsoil. Lisa Morzel asked much topsoil was removed. George said it was about a foot on the lip area, and up to 13-15 feet on the

pad area itself. Lisa asked if the excavation hit bedrock. Scott said he was not sure, and that they kept removing soil until the soil tested below regulatory standards and then sampled and confirmed. He said they have some photos and videos they can share. Rick DiSalvo explained that the wattles used were very heavy (Filltrex), and basically serve as living berms. They also used permanent type erosion mats. He said they would show this area on the next tour. Scott said it has really grown in well, and almost looks like it has not been disturbed. Additional information is on the website, including an August status report, maps and photos.

Water quality at all other POEs was below applicable standards during the quarter.

Groundwater monitoring – John Boylan
John noted that the third quarter is a light sampling quarter. All 10 RCRA wells were sampled. Results were reviewed in accordance with the RFLMA Attachment 2 decision flowchart and will be evaluated in the 2010 annual report.

Additional (non-RFLMA) monitoring included several locations associated with the Mound (MSPTS) and East Trenches (ETPTS). As reported in previous quarterly meetings, the samples support consultation and evaluation of system performance. System effluent contained some constituents above RFLMA Table 1 levels.

Treatment was found to be most effective at low-flow rates (high residence time), and less effective at high-flow rates (low residence time). Second-quarter flows represented relatively higher flow rates. Flows decreased into third quarter, and concentrations in system effluent similarly decreased. Evaluation will be included in the 2010 annual report.

There were also numerous sampling locations associated with the Solar Ponds (SPPTS). These were to done to support optimization of upgrades and pilot studies. They also supported evaluation of media replacement in Phase II cell.

Two off-site wells scheduled for abandonment were also sampled. The City of Broomfield requested collection of split samples. These were analyzed for VOCs and nitrates. No VOCs were detected, and nitrate concentrations were very low.

At the SPPTS, the main item addressed in the third quarter was changing the media in the Phase II cell. The cell was filled with ZVI/gravel mix. An early reduction in performance was not fully understood, but was most likely due to passivation of the ZVI – the iron grains became coated and no longer “available” for treatment. Hypotheses on cause included citrate dosing performed in the first weeks of the cell’s operation; accelerated weathering of granitic pea gravel; interferences from high nitrate, dissolved oxygen, calcium; and/or carbonate in the groundwater.

The new media incorporates a different pea gravel (quartzite), no citrate dosing, and slightly more ZVI in the mix. Current data indicate the citrate and gravel may have contributed to, but were not the cause for, the decreased treatment effectiveness

Samples were collected at least weekly. The locations support evaluation of Phase II, III, and the entire system. Most of these samples were analyzed by ESL, an in-house DOE lab in Grand Junction. Splits were also collected periodically for contract lab analysis.

Optimization of Phases II and III included transitioning to dosing Cell A with a pre-blended mixture of carbon and phosphorus. They evaluated the effects of recirculation in Cell A and increased flow to Cell B [from approximately 0.005 to 0.25 gallons per minute (gpm)]. They also stopped regularly sampling Cell B because it was no longer a Phase IV candidate.

The site also attempted to improve flow conditions in the original cells. They installed an auxiliary distribution gallery in Cell 1, but it clogged quickly and repeatedly (biological, and some mineral precipitates). They are now working on a Phase IV design which incorporates a Phase III, Cell A approach to treatment (inert media dosed with liquid carbon source). John showed several graphs depicting uranium and nitrate levels throughout the phases. David Allen asked about a spike in nitrate levels at the SPOUT location. John said this was probably due to flow conditions.

Ongoing activities included preparing for the media replacement project at MPPTS. This involved designing an effluent polishing component based on principal of air stripping, which was tested in small-scale version in January. It was slowed down because of weather. Shirley Garcia said that, based on the Contact Record, the Mound treatment system is going to be down for several weeks and asked how they will be dealing with contaminated water. She was also worried about losing the cover. John said they will use water management, and that there is a large trench to contain groundwater. If it rises too high, they will transfer it to the East Trenches system for treatment. He added that the cover is not there to prevent contamination and that they will not be changing the grade, only about 3 inches.

Site Operations -- Jeremiah McLaughlin
Monthly inspections at the OLF were completed on July 19, August 31, and September 23, 2010

He provided an overview on seeps at the OLF. Seep 1 was dry throughout the third quarter. The Seep 2 and 3 area was saturated in third quarter. It showed some surface expression but no surface flow, and supported small stands of wetland vegetation. The Seep 4 and 5 area was saturated in the second quarter. It showed surface expression, but drained via the Berm 3 drain as designed. There is a thriving wetland vegetation in the Seep 4 and 5 area. The Seep 6 area was dry most of the third quarter and supported a small stand of wetland vegetation.

Seep 7 surface expression stopped in third quarter. Wetland vegetation areas mostly dried up and about half of the wetland vegetation died. Seep 8 flowed at approximately 2 to 5 gpm throughout the third quarter. In the second quarter, seep flows were noted to have saturated the base of Berm 7. A geotechnical engineering evaluation of Berm 7 stability was conducted in the third quarter due to continued saturation. The design criteria were met in saturated condition. The geotechnical report will be included in the 2010 annual report.

OLF settlement monuments were surveyed on September 23 and data were within the expected range per the Original Landfill Monitoring and Maintenance Plan. OLF inclinometers were

measured July 28, August 30, September 9, and September 30. Inclinometers 5, 6, and 7 were measured September 9. September 30 measurements were invalidated due to instrument orientation error. Subsequent readings taken in the fourth quarter showed very little deflection.

Jeremiah next reported on OLF Slumps. A Berm 1 crack was filled and compacted in the second quarter and no new cracking appeared in the third quarter. The end of Berm 7 at the East Perimeter Channel was repaired in the second quarter and no problems were noted in the third quarter.

Finally, the PLF quarterly inspection was completed on August 31 and no areas of concern were observed.

OLF Soil Sampling project -- Rick DiSalvo
This work was a preliminary evaluation of residual contamination levels in relation to CDPHE's August 2008 policy, End of Post-Closure Care. This project is covered by CR 2010-01. Pre-closure residual soil contamination data are now between 15 and 19 years old. This project provided data for comparison to risk-based levels. It does not necessarily mean that post-closure controls for the OLF will end, although some monitoring and maintenance requirements possibly may be reduced. The area also remains subject to land-use restrictions under the Environmental Covenant.

CDPHE approved the OLF Sampling and Analysis Plan (SAP) on June 9, 2010. The goal was twelve 25-foot boreholes, below 2-foot cover soil and to sample 5-foot core intervals. There were six OLF IM/IRA targeted locations - three from the surface soil data set, and three from subsurface soil data set. Six additional locations were chosen to provide subsurface data from the east and west side. They were analyzed for VOCs, SVOCs, pesticides and PCBs, metals, and rads (plutonium, americium, and uranium).

Sampling was conducted June 29 to July 8, 2010. 228 samples were collected. Data evaluation and summary reporting were completed in the fourth quarter and will be included in 2010 annual report.

One objective of this study was to evaluate whether any analyte concentrations were above CDPHE Colorado Soil Evaluation Values (CSEVs) or wildlife refuge worker Preliminary Remediation Goals (WRW PRGs). The 2010 data were generally similar to OLF IM/IRA data. Arsenic (100 percent of samples) and SVOC and PCB samples (6 to 44 percent of samples) were greater than CSEVs or WRW PRGs. Several analytes that were above screening levels in OLF IM/IRA data were below CSEVs or WRW PRGs in the 2010 samples, including antimony, copper, tetrachloroethene, trichloroethene, iron (less than WRW PRG), chrysene (less than WRW PRG), and PCB Aroclor 1260 (less than WRW PRG).

Another objective was to evaluate whether residual contamination levels are stable or have decreased. The 2010 data showed decreases in concentrations for some analytes, compared to OLF IM/IRA data. This might have been caused by the mixing of some soils from the cutting, filling, and contouring work in closing the OLF. 2010 SVOC and PCB results that were greater than CDPHE CSEVs or WRW PRGs are from samples deeper than seven feet below ground

surface. For example, the targeted surface soil sample location SS510593 at 7-12 feet below ground surface showed SVOCs at about an order of magnitude higher than the OLF IM/IRA data maximum.

A final objective was to evaluate risk if subsurface soils were to become exposed to the surface. Based on comparison to surface soil WRW PRGs, the risk from residual contaminants is within the normally acceptable remedy risk range of 10-6 to 10-4. Other than arsenic, only one sample in the OLF localized instability area exceeded the WRW PRG (Aroclor 1254 at OLFS-02 in 2 to 7 feet below ground surface).

Lisa Morzel asked how much recovery they got from the sampling. Rick said it was about 75%. The full data summary will be published in the 2010 Annual Report, and will be posted on the website. DOE has given copies to technical staff from local governments. Shirley Garcia asked for a copy. Rick emphasized that contamination from the OLF does not impact Pond C-2. It drains into Woman Creek, which diverts around C-2 (the SID does drain into C-2).

There were approximately 7,000 individual results. Generally, the same analytes that were above screening at pre-closure were above now and some were lower. SVOCs are associated with coal tars, asphalt, and related materials that were used back before 1960's. They were a product of incomplete combustion (such as starting cars) settling on asphalt. The OLF was used to dispose of street sweeping debris and old asphalt. SVOCs do not break down very much, and are not very soluble (not found in groundwater). The plan is to include this study in the upcoming 2012 CERCLA Five-Year review and see if there are any additional things they should be doing. There are no recommendations to do any additional monitoring at this point.

All radionuclides were well below WRW PRG screening values. Lisa asked about why arsenic was so elevated. Rick said arsenic is ubiquitous in Colorado, and background levels are above the screening. In the Feasibility Study for the remedy, they did a special evaluation of arsenic to compare Rocky Flats values to background. Rocky Flats risk levels were equal to the standard.

Lisa asked Rick to elaborate on the possibility of cutting back on monitoring and maintenance. Rick clarified that the OLF is not a hazardous waste landfill, it is a solid waste landfill, but some of the criteria for hazardous waste were imposed. Based on the studies, the frequency of inspections may be reduced. There is also a prohibition on woody vegetation in landfill area which also may be removed. Lisa said she was concerned about reducing monitoring, especially because of the existence of slumping and other problems. Shirley Garcia asked what the process would be for any proposed changes. Rick said that to change the monitoring and maintenance requirements, DOE would need to submit a modification proposal to CDPHE. They would also communicate through forums such as this and solicit feedback. There would be multiple opportunities to get involved. Also, the Five-Year Review will be introduced at a Stewardship Council meeting and feedback will be requested. David Abelson noted that the Stewardship Council's big picture schedule calls for the Board to start talking about the Five-Year Review in June. He has also started discussing the public involvement process with Scott Surovchak.

Ecological Monitoring – Rick DiSalvo
During the third quarter, the site completed Preble's meadow jumping mouse (PMJM) mitigation monitoring and results will be presented in the annual PMJM report to USFWS. Wetland mitigation monitoring was also completed and these results will be presented in the annual wetland mitigation report to EPA. Both DOE and EPA worked on revegetation monitoring. Results will be presented in the annual RFS report. Finally, photopoint monitoring results will be presented in the reports listed above.

Review and Approve Draft Washington, D.C. Talking Points

In the coming months, Board members are scheduled to meet in Washington, D.C. with Congress and DOE. To ensure that the message these members will carry reflects the position and policies of the Stewardship Council Board, the Board will approve talking points for their meetings.

Lisa Morzel brought up the idea of using the $2.8M from the sale of the right-of-way for the Jefferson Parkway at Rocky Flats for the wildlife refuge. David Abelson pointed out that that USFWS really needs long-term funding in order to operate the refuge. However, funding might still be of use for a specific projects or prep work for opening the refuge area. David also flagged the section on Water Management #6. This bullet point addresses the need to enlist the help of congressional representatives to slow down the decision process regarding breaching ponds in order to allow time for all parties to come to an agreement. Lisa Morzel asked if anyone from the Stewardship Council was a member of ECA. David said individuals were not, but the organization is a member.

David asked if talking points made sense. There were no objections raised.

Update on Dam Breach EA and Changes to RFLMA Points of Compliance

Since the November meeting, DOE hosted two public meetings to discuss development of an Adaptive Management Plan (AMP). The AMP focuses solely on the dam breach EA. Stewardship Council members have actively participated in this process. The goal of the conversation at this meeting was to chart a path forward to resolving these issues.

David Allen began with update. He said there had been quite a bit of activity since the last meeting in November. Before the first AMP meeting, downstream communities sent a letter to the agencies requesting that they look at current issues in an inter-related manner. DOE responded that they would be starting the AMP process independently of other issues. The first AMP meeting took place during the second week in December, and since then there have been two more. David said they have been going well, and the members have been delving into technical issues. Broomfield has identified some key issues that need to be resolved. One is a limitation on excavations deeper than three feet in the Rocky Flats institutional controls, which would be an issue with dam breaches. DOE and CDPHE are working on revising language in the environmental covenants. Broomfield wants to make sure that any amendments have the same level of protection. There is also an outstanding issue related to a Broomfield water lease with Rocky Flats. They are waiting on a response, and have heard it is forthcoming. David said there

are discussions ongoing about flow-through conditions. Until legal issues on breaching dams (i.e. three foot excavation limit) are resolved, Broomfield does not think they should be discussed in the AMP meetings. If they are, Broomfield will have to refrain from participation. He passed along his appreciation to the agencies for their attendance. He added that Broomfield is looking at the AMP deadline as set in stone, since it is not regulatory driven.

Carl Spreng (CDPHE) added that the agenda for the meetings have been provided by the cities and the Woman Creek Reservoir Authority. He said two more meetings are scheduled. He added that there are also meetings occurring on other technical issues, such as modifications to RFLMA. Vera Moritz (EPA) echoed the comments that these meetings have been productive, very technical, and open to anyone. Scott Surovchak said there was another meeting on Thursday at 1 pm. David Abelson asked Scott about the possibility of looking at monitoring points more as data points. Scott said that under the AMP process, anything is fair game. He reiterated that, although it will not be a regulatory requirement, he will continue to monitor at Indiana Street. Broomfield still does not think this is enough.

David Abelson asked how will this issue be resolved, and whether the parties will agree to disagree. David Allen said that DOE suggested issues for AMP discussions, and asked for input, although not all were included. The communities then requested separate meetings to vet these other issues, which is what Carl mentioned. Broomfield sent a letter requesting that the agencies postpone making changes to RFLMA. They want to make sure that the AMP process is completed first. They are also looking at data gaps and believe it is too early to remove regulatory points and the associated oversight.

David Allen said they are not comfortable that DOE would be able to make a unilateral decision to discontinue this non-regulatory monitoring. Scott said that DOE is looking at even adding data points and have made a commitment to continue to monitor in these areas. Lisa Morzel asked if there will be anything binding DOE to maintaining these data points. Scott said that is what AMP is all about. David Abelson pointed out that the AMP is not part of a NEPA decision, and does not require regulator approval. He said it is a management tool and can be discarded unilaterally by DOE. Scott said he did not think that is how the Department of the Interior sees it. He said the criteria for opting out will have to be described, like RFLMA. He said it is part of the NEPA process. David Abelson asked for a clarification from the downstream communities that their concern is that DOE will have the unilateral discretion to discontinue monitoring without sign-off by the regulators. He asked if they also believe fines need to be an option for the regulators. David Allen said that ideally they would like to have this, but their main concern is a requirement to continue monitoring.

Briefing on History of Rocky Flats Stewardship Council

With changes to the Board composition since the group's inception in 2006, the Board has determined a need to take a step back and discuss the reasons for the Stewardship Council – its legislative roots, mission, and focus since 2006. David asked whether the members would like to have this discussion now or table it to a later meeting. Sheri Paiz said since she had originally made this request, she thinks it would be a good idea to also look at what the Board will be doing in the future, so she recommended putting it off.

Public comment

Mickey Harlow (Arvada citizen) said she was concerned about the combination of the proposed flow-through configuration at Pond C-2 and the impact on Woman Creek Reservoir, along with the removal of regulatory monitoring at the Indiana boundary. She said that once water gets into the reservoir, there is no additional sampling and water is passed along to the public. She said she did not think this was ever the intent in the original cleanup agreements.

Regarding the AMP, she said she did not think it had ever been used at other sites with radioactive contamination. She asked if there would be guidance from Dave Geiser (Director, Office of Legacy Management) about how to use this process at LM sites. She questioned how the site defines a remedy and said that this EA is only being pushed because it saves money. Mickey said the agencies are bypassing the process, and that the public is not involved. She said CDPHE needs to decide that protecting the public is more important than getting along with DOE. She also mentioned a Clemson grant from DOE to study plutonium interaction with soil, and more accurately assess waste disposal. She asked why DOE cannot put off removal of the ponds until they can use the results of their own study and urged them to be more conservative.

Updates/Big Picture Review

Lisa Morzel said she was very concerned that things seem to be changing a lot faster than she anticipated, even the institutional controls. She also mentioned landfill monitoring, and that she was concerned that the landfill is not a stable slope in the long term. She said she did not understand why DOE is bringing these things up this early.

Lori Cox responded that this is the crux of Broomfield's concerns. She said they worked through cleanup and closure, and she remembers talking in terms of 30, 40, 50 years in the future. She pointed to all of the work still going on with remedies, and said they still have not figured out how to stabilize the site. She said she would like to see them actually get to this point and then maintain a substantial holding pattern before moving forward. Lisa added that it will be difficult to stabilize because it is an active geological site.

Shirley Garcia said DOE is proposing actions that are in violation of institutional controls and water agreements, and that these key issues have to be addressed.

Arthur Widdowfield said that these issues were bothering him, and that he agreed with what others were saying. He added that he was concerned that the agency representatives had already left and were not hearing this.

Bill Fisher said that these were not just downstream community issues. He said Golden has been hearing more concerns about what is going on. He said it is also harder to come up with answers given what they have been hearing about the remedies. He said that the agencies should not be surprised if this backfires, as it is opening doors for people to get more involved and engaged and start asking more questions about what was left in the ground after cleanup. He said that the perception is that these are just cost-saving measures, and not based on public safety.

David Allen said that there are changes at the site that DOE is reacting to and that is what they should be doing. However, there are other things they are doing prematurely. He said the communities understand the need to cut costs, but that there is also a responsibility factor to consider, along with a history of distrust. He said that the public has shown they can work together with the agencies, and they want to continue doing that. Rather than reacting to plans put out by DOE, he believes it would be better to hash everything out and work together to make decisions. At this point, he is not sure DOE is truly incorporating public concerns, and may simply be appeasing.

Lisa Morzel suggested that perhaps the group should be asking DOE what else they may be considering changing.

Bob Darr said that they are not proposing to remove any institutional controls. They are looking at how DOE can do necessary excavation work with the approval of CDPHE and EPA. He said the original language was intended to allow DOE to do necessary work, and that breaching dams was part of cleanup plans in 2004. He also clarified that there are no proposals to discontinue monitoring at the OLF.

April 4, 2011

Potential Briefing Items

- Update on Original Landfill
- Continue discussing water issues (focus on dam breach EA)
- Update on Natural Resource Damage claims and acquisition of lands for parkway
- McKinley legislation?

June 6, 2011

Potential Business Items

- Initial discussion of RFSC IGA triennial review

Potential Briefing Items

- Initial discussion with DOE about Stewardship Council's role as LSO
- Continue discussing water issues (focus on dam breach EA)
- DOE quarterly briefing
- DOE update on start of CERCLA 5-year review

<u>Issues to Watch</u>
Original landfill performance, including special sampling program results
Changes to water systems
Solar Ponds performance
Data for CERCLA review

The meeting was adjourned at 11:48 p.m.
Respectfully submitted by Erin Rogers.

Rocky Flats Stewardship Council
Check Detail
January 18 through March 8, 2011

Type	Num	Date	Name	Account	Paid Amount	Original Amount
Check		**1/28/2011**		**CASH-Wells Fargo-Operating**		**-3.50**
				Admin Services-Misc Services	-3.50	3.50
TOTAL					-3.50	3.50
Bill Pm...	**1472**	**2/6/2011**	**Crescent Strategies, LLC**	**CASH-Wells Fargo-Operating**		**-8,254.27**
Bill	1/31/...	1/31/2011		Personnel - Contract	-6,850.00	6,850.00
				Telecommunications	-130.40	130.40
				TRAVEL-Local	-63.75	63.75
				Postage	-235.99	235.99
				TRAVEL-Out of State	-669.39	669.39
				Supplies	-19.70	19.70
				Printing	-285.04	285.04
TOTAL					-8,254.27	8,254.27
Bill Pm...	**1473**	**2/6/2011**	**Jennifer A. Bohn**	**CASH-Wells Fargo-Operating**		**-569.50**
Bill	11-10	1/31/2011		Accounting Fees	-569.50	569.50
TOTAL					-569.50	569.50
Bill Pm...	**1474**	**2/6/2011**	**Seter & Vander Wall, P.C.**	**CASH-Wells Fargo-Operating**		**-357.28**
Bill	60033	1/31/2011		Attorney Fees	-357.28	357.28
TOTAL					-357.28	357.28
Check	**1475**	**2/6/2011**	**Qwest**	**CASH-Wells Fargo-Operating**		**-28.12**
				Telecommunications	-28.12	28.12
TOTAL					-28.12	28.12
Bill Pm...	**1476**	**3/3/2011**	**Crescent Strategies, LLC**	**CASH-Wells Fargo-Operating**		**-7,863.43**
Bill	2/28/...	2/28/2011		Personnel - Contract	-6,850.00	6,850.00
				Telecommunications	-135.40	135.40
				TRAVEL-Local	-146.37	146.37
				Postage	-15.99	15.99
				TRAVEL-Out of State	-690.68	690.68
				Supplies	-24.99	24.99
TOTAL					-7,863.43	7,863.43
Bill Pm...	**1477**	**3/3/2011**	**Jennifer A. Bohn**	**CASH-Wells Fargo-Operating**		**-578.00**
Bill	11-18	2/28/2011		Accounting Fees	-578.00	578.00
TOTAL					-578.00	578.00
Bill Pm...	**1478**	**3/3/2011**	**Tricia Marsh**	**CASH-Wells Fargo-Operating**		**-210.00**
Bill	1186	2/22/2011		Website	-210.00	210.00
TOTAL					-210.00	210.00
Check	**1479**	**3/3/2011**	**Qwest**	**CASH-Wells Fargo-Operating**		**-27.11**
				Telecommunications	-27.11	27.11
TOTAL					-27.11	27.11

ROCKY FLATS STEWARDSHIP COUNCIL

P.O. Box 17670
Boulder, CO 80308-0670
www.rockyflatssc.org

(303) 412-1200
(303) 600-7773 (f)

MEMORANDUM

TO: Board
FROM: David Abelson
SUBJECT: Discussion of the History of the Rocky Flats Stewardship Council
DATE: March 22, 2011

I've scheduled 30 minutes for this discussion. Since this discussion has been postponed, it is the first discussion item for this meeting. The discussion will provide the foundation for DOE's review of the Stewardship Council activities.

Background

In 1999, the Rocky Flats Coalition of Local Governments (the predecessor organization to the Stewardship Council) and the Rocky Flats Citizens Advisory Board (CAB) formed a joint dialogue, the Rocky Flats Stewardship Working Group. The group's dialogue focused on incorporating into cleanup decisions post-closure management needs and requirements (what we called "long-term stewardship"). A key component of long-term stewardship is establishing institutional controls. Institutional controls, as the name implies, include institutions such as a site manager (DOE), regulators (EPA and CDPHE), a community oversight group, and legal/regulatory controls. (Institutional controls stand in contrast to physical controls [e.g., fences, monitoring stations, signs, etc.].)

The Rocky Flats cleanup project benefitted greatly from the active and consistent involvement of the Coalition and CAB, among others. In 2003, it became clear that post-closure management would likewise benefit from ongoing local government and community oversight. Accordingly, in 2004, as DOE's Office of Environmental Management (EM) was nearing completion of active remediation activities, and Congress and DOE were taking steps to establish the Office of Legacy Management (LM), Senator Wayne Allard secured legislation establishing Local Stakeholder Organizations (LSO). The legislation (attached) authorized establishing LSOs at Rocky Flats, Mound (Ohio) and Fernald (Ohio). For different reasons, the local governments and communities surrounding Mound and Fernald opted not to establish LSOs for their sites.

Members
After a challenging public dialogue, and the involvement of Senators Allard and Salazar, and Representatives Udall and Beauprez, DOE agreed to appoint nine governments (with Golden and Northglenn serving in rotating positions) and four community organizations/individuals.

Choosing the governments was challenging and somewhat political. During cleanup, the seven Rocky Flats Coalition governments were highly engaged, so it was clear that these governments would be part of the Stewardship Council. Golden was also engaged through one of their former councilors, Bob Nelson. Among other things, Bob actively participated in the aforementioned Rocky Flats Stewardship Working Group meetings, and attended the majority of the Coalition board meetings. Northglenn was not engaged outside of their membership in the Woman Creek Reservoir Authority. Yet, like Golden, they wanted to be formally involved in the Stewardship Council.

So, a deal was struck where Golden and Northglenn would both be board members. They would participate in all of the meetings. The only difference is that in alternating years they would have a vote.

The other challenge the Coalition faced was the Stewardship Council membership being dominated by local governments. The members of the CAB wanted greater community representation. Part of the challenge was that the LSO legislation provided in part that the LSO

> shall be composed of such elected officials of local governments in the vicinity of the closure site concerned as the Secretary considers appropriate to carry out the responsibilities set forth in subsection (c) who agree to serve on the organization, or the designees of such officials.

The other part of the deal that Allard et al. worked out with DOE was to establish a board of 12, with four seats for community members/groups. That agreement did not appease the CAB's concerns, but was still adopted.

Local Stakeholder Organization (LSO) Mission
As provided in the LSO legislation, the LSO are charged with

1. soliciting and encouraging public participation in appropriate activities relating to the closure and post-closure operations of the site;
2. disseminating information on the closure and post-closure operations of the site to the State government of the State in which the site is located, local and tribal governments in the vicinity of the site, and persons and entities having a stake in the closure or post-closure operations of the site;
3. transmitting to appropriate officers and employees of the Department of Energy questions and concerns of governments, persons, and entities referred to paragraph (2) on the closure and post-closure operations of the site; and
4. performing such other duties as the Secretary and the local stakeholder organization jointly determine appropriate to assist the Secretary in meeting post-closure obligations of the Department at the site.

The Stewardship Council in turn adopted the following mission:

> The mission of the Rocky Flats Stewardship Council is to provide continuing local oversight of activities at the Rocky Flats site and to ensure local government and community interests are met with regards to long-term stewardship of residual contamination and refuge management. The mission also includes providing a forum to track issues related to former site employees and to provide an ongoing mechanism to maintain public knowledge of Rocky Flats, including educating successive generations of ongoing needs and responsibilities regarding contaminant management and refuge management.

Funding is provided through a grant from DOE. Initial funding came through a 2005 direct Congressional appropriation; subsequent funding came directly from DOE at the agency's discretion.

Focus Since Closure

DOE and its prime contractor, Kaiser-Hill, completed active remediation activities in October 2005. The cleanup was certified as complete by the EPA in September 2006. Despite this huge success, remediation activities continue as DOE continues to treat contaminated groundwater. (Because DOE is still treating groundwater, the DOE retained lands remain on the CERCLA National Priorities List.)

From its inception in March 2006, the Stewardship Council's primary focus in 2006 and 2007 was on the final cleanup regulatory documents, and on the post-closure regulatory documents, including the Rocky Flats Legacy Management Agreement. In 2007, we also worked on the first post-closure CERCLA review. (The next CERCLA review is scheduled for 2012.)

While addressing these macro regulatory issues, we've also focused more narrowly on specific areas of the site. That work can be divided into remediation challenges – e.g., 991 hillside slump, original landfill, solar ponds – and changes DOE is making to the site – e.g., changes in monitoring locations, changes in site standards, dam breaching.

The organization has also focused on communications. That includes (but is not limited to):

1. participating in national forums;
2. preparing and circulating briefing information to community members, congressional staff, and others;
3. developing fact sheets and addressing questions and concerns member groups raise; working with USFWS on signage for the site;
4. meeting with Congressional staff; and
5. developing and managing the website.

Biggest Challenge

When Congress authorized the creation the LSO, there was great uncertainty regarding how community involvement post-closure would change from structures we established during cleanup. There was no roadmap – and in fact, the Stewardship Council is setting the model for how to work in this regulatory environment. While the work is no less important than it was during closure, the nature of the work (and the issues we tackle) has changed. Our role is to

oversee and to communicate, and to provide a public forum to discuss issues. However, save for a few issues, there are no great disputes that tend to energize the group and focus attention. And yet, with this changing emphasis, the board has remained committed to our role as the LSO.

Documents
Attached to this memo are a few documents worth reviewing:

1. LSO authorizing legislation
2. Letter from DOE to the Rocky Flats Coalition stating membership shall be eight governments and four non-elected groups/individuals. Local government membership was later increased to nine, with Golden and Northglenn annually alternating voting.
3. DOE's letter approving the LSO
4. Fiscal year 2005 Congressional funding authorization (funds were provided to the Rocky Flats Coalition to use in establishing the Stewardship Council; $400,000, the balance remaining from the $500,000, was subsequently transferred from the Coalition to the Stewardship Council).

108th CONGRESS
2d Session
Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005

AN ACT

To authorize appropriations for fiscal year 2005 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe personnel strengths for such fiscal year for the Armed Forces, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the `Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005'.

SEC. 3118. LOCAL STAKEHOLDER ORGANIZATIONS FOR 2006 CLOSURE SITES.

(a) Establishment. –

(1) The Secretary of Energy shall establish for each Department of Energy 2006 closure site a local stakeholder organization having the responsibilities set forth in subsection (c).

(2) The local stakeholder organization shall be established in consultation with interested elected officials of local governments in the vicinity of the closure site concerned.

(b) Composition. – A local stakeholder organization for a Department of Energy 2006 closure site under subsection (a) shall be composed of such elected officials of local governments in the vicinity of the closure site concerned as the Secretary considers appropriate to carry out the responsibilities set forth in subsection (c) who agree to serve on the organization, or the designees of such officials.

(c) Responsibilities. – A local stakeholder organization for a Department of Energy 2006 closure site under subsection (a) shall –

(1) solicit and encourage public participation in appropriate activities relating to the closure and post-closure operations of the site;

(2) disseminate information on the closure and post-closure operations of the site to the State government of the State in which the site is located, local and tribal governments in the vicinity of the site, and persons and entities having a stake in the closure or post-closure operations of the site;

(3) transmit to appropriate officers and employees of the Department of Energy questions and concerns of governments, persons, and entities referred to paragraph (2) on the closure and post-closure operations of the site; and

(4) perform such other duties as the Secretary and the local stakeholder organization jointly determine appropriate to assist the Secretary in meeting post-closure obligations of the Department at the site.

(d) Deadline for Establishment. – The local stakeholder organization for a Department of Energy 2006 closure site shall be established not later than six months before the closure of the site.

(e) Department of Energy 2006 Closure Site Defined. – In this section, the term ``Department of Energy 2006 closure site'' means the following:

(1) The Rocky Flats Environmental Technology Site, Colorado.

(2) The Fernald Plant, Ohio.

(3) The Mound Plant, Ohio.

Department of Energy
Washington, DC 20585

June 27, 2005

Mr. Shaun McGrath, Chair
Rocky Flats Coalition of Local Governments
8461 Turnpike Drive, Suite 205
Westminster, CO 80031

Dear Mr. McGrath:

This is in response to your letter dated June 6, 2005, regarding the Rocky Flats Coalition of Local Governments (RFCLOG) approach to establishing the Rocky Flats Local Stakeholder Organization (LSO). We understand that your approach is consistent with the guidance provided in the April 26, 2005, letter from Senators Allard and Salazar and Congressmen Udall and Beauprez.

The Office of Legacy Management (LM) concurs with your approach to membership of eight local elected officials and four non-elected officials, all with equal stature, and the establishment of the LSO no later than six months prior to regulatory closure. As stated in Secretary Bodman's letter dated June 13, 2005, to Senators Allard and Salazar and to Congressmen Udall and Beauprez, "the LSO will be established at least six months prior to signature of the final Record of Decision for the site."

As next steps, LM is requesting that the local elected officials develop a plan that addresses how the three main activities required by Section 3118 of the Fiscal Year 2005 National Defense Authorization bill will be conducted. The plan should explain how the LSO anticipates working within the context of the draft Rocky Flats post-closure public involvement plan (PIP). The plan should include a timeline of the actions/activities identified by the LSO including the stand-up of the Rocky Flats LSO.

The plan should also include the approach to be used for determining how the non-elected officials will be nominated to serve on the LSO. At this point, LM is interested in the method; the membership of the LSO will not be determined until LM has reviewed the Rocky Flats LSO plan. Finally, LM requests that all elected officials sign the Rocky Flats LSO plan; we understand that this currently includes the City of Golden and the seven members of the RFCLOG.

LM encourages you to develop and discuss your plan with members of the public and other key stakeholders (e.g., the Rocky Flats Citizens Advisory Board, retiree/workers groups, environmental groups as well as other interested key stakeholders). Specifically, It would be valuable to discuss the types of information and the levels of participation that will be needed after the Corrective Action Document/Record of Decision (CAD/ROD) is signed and the site is in long term surveillance and maintenance.

LM looks forward to working with you and receiving the Rocky Flats LSO proposed plan by October 31, 2005. Please contact me or Scott Surovchak at 303-966-3551 (email: scott.surovchak@rf.doe.gov) with any questions or concerns.

Sincerely,

Michael W. Owen
Director
Office of Legacy Management

Cc: Senator Wayne Allard
Senator Ken Salazar
Congressman Mark Udall
Congressman Bob Beauprez
Gerald L. DePoorter, RFCAB

Department of Energy
Washington, DC 20585

December 21, 2005

DEC 28 2005

Mr. Shaun McGrath
Chairman
Rocky Flats Coalition
of Local Governments
8461 Turnpike Drive, Suite 205
Westminster, CO 80031

Mr. McGrath,

This is in response to your letter dated November 16, 2005, that forwarded the *draft Local Stakeholder Organization (LSO) Plan* to me for approval. The Department of Energy approves the enclosed plan, as amended. We see this plan as the set of activities that will be done by the LSO on behalf of DOE. A summary discussion of the amendments is provided below:

- Amendments to the LSO responsibilities section of the document included moving two items from sub-section 4. (Perform other duties...) to sub-section 2. (Disseminate information) to better reflect the scope of the LSO.

- References to working with the U.S. Fish and Wildlife Service and Congress were removed as inappropriate. We can not direct an organization to work with another federal agency nor can we fund an organization to represent us before the Congress.

- A statement on educating the public on integration of contaminant management and refuge management was deleted. Management of the Rocky Flats National Wildlife Refuge is the responsibility of the U.S. Fish and Wildlife Service; we expect that agency to determine how to best interact with the communities surrounding the site.

- The paragraph addressing direct communication between LM and the communities was removed as unnecessary; it was never intended that the LSO would be the only forum for stakeholders to communicate with DOE.

- Finally, specific reporting requirements such as those used as examples in the proposed plan are addressed in other, regulatory documents such as the *Interim Surveillance and Maintenance Plan* and will be including in the *Long-term Surveillance and Maintenance Plan* following the completion of the CERCLA Record of Decision (ROD) for the site.

The Office of Legacy Management appreciates your efforts to develop this plan and looks forward to its implementation. If you have any questions, please contact Scott Surovchak locally at 303-966-3551, or Tony Carter in our Washington D.C. office at 202-586-3323.

Sincerely,

Michael W. Owen
Director
Office of Legacy Management

Local Stakeholder Organization Plan

As Amended
DOE Office of Legacy Management
December 14, 2005

Background

In a June 27, 2005 letter to the Board of Directors of the Rocky Flats Coalition of Local Governments, Legacy Management (LM) requested the Coalition spearhead the development of a Local Stakeholder Organization (LSO) Plan. Per LM's request, the LSO Plan should "address how the three main activities required by Section 3118 of the Fiscal Year 2005 National Defense Authorization bill will be conducted." The letter further requests the LSO plan identify how the LSO anticipates working within the context of the Rocky Flats Post-closure Public Involvement Plan (or PCPIP) and include "the approach for determining how the non-elected officials will be nominated to serve on the LSO." This Plan addresses these issues.

Local governments represent constituencies closest to the Site, and through their exercise of representative government, they are able to pull groups together to address issues. The partnership that has developed between DOE and local governments needs to be maintained, and thus governments are charged with spearheading the development of this plan.

The PCPIP includes the following relevant information (quoting from the PCPIP):

Public Meetings

- **Site Transition:** Public meetings will be held as needed to address significant transition issues. In addition, EM and LM will present information about ongoing transition activities from EM to LM during regular RFCLoG and RFCAB meetings.
- **Post-Closure:** The establishment of a Rocky Flats LSO will provide the post-closure forum for stakeholders to continue a dialogue with DOE. LM plans to coordinate with the LSO to hold three quarterly and one annual general public meetings during the first 2 years post-closure to discuss post-closure issues of importance to stakeholders. These meetings will provide information about LTS&M activities being conducted at the site and will present the results of annual site inspections.

Briefings for Local, State, and Federal Elected Officials

- **Site Transition:** Rocky Flats will continue to hold briefings throughout site transition. LM will participate in or hold its own meetings with elected officials as needed to discuss specific topics related to site transition.
- **Post-Closure:** LM plans to continue briefing elected officials through the LSO to discuss new data trends or the evaluation of post-CAD/ROD changes.

Meetings With Stakeholder Groups

- **Site Transition:** Rocky Flats will continue to support and participate in RFCAB and RFCLOG meetings. LM will frequently attend, especially when issues related to post-closure activities are on the agenda. EM and LM will continue to meet with stakeholder groups as requested through site transition.
- **Post-Closure:** Stakeholder groups will be included in the LSO public meetings held post-closure.

The following LSO responsibilities, which draw on these sections of the PCPIP, track the responsibilities set forth in Section 3118 of the Fiscal Year 2005 National Defense Authorization Act.

NDAA Section 3118 – LSO Responsibilities

To ensure maximum buy-in by the LSO Board of Directors, the LSO Plan that LM will approve must be a high-level document with final decisions about the work plan being reserved for the yet-unnamed LSO Board, in consultation with LM.

Section 3118 of the Fiscal Year 2005 Defense Authorization Act includes the following provisions. The legislative language is in **bold**; actions that the LSO will likely take to meet each responsibility are in *italics*. Note, because of the interrelated nature of the responsibilities Congress established in Section 3118, the specific actions that have been identified can fall under more than one subsection below.

> **(c) RESPONSIBILITIES.--A local stakeholder organization for a Department of Energy Environmental Management 2006 closure site under subsection (a) shall—**
>
> 1. **Solicit and encourage public participation in appropriate activities relating to the closure and post-closure operations of the site.** These actions include:
>   a. *Host regular, public meetings for LSO members and the general public, including Board meetings, the frequency to be determined by the LSO Board. Meetings will provide an opportunity:*
>   i. *To discuss with federal, state, and local elected officials and agencies issues related to the long-term stewardship and management of the Rocky Flats site;*
>   ii. *To be briefed on the results of the operational and performance monitoring data of site operations.*
>   iii. *Other items as necessary.*
>   b. *Work with DOE on implementation of Post-Closure Public Involvement Plan, including meetings identified in the PCPIP.*
>   c. *Work with DOE to identify the role of the LSO in the four public meetings LM identified in the PCPIP.*
>   d. *Provide opportunities at meetings and between meetings for education and feedback.*
>   e. *Provide interface and communicate with federal, state, and local elected officials and agencies.*

f. Provide a mechanism for LSO members and the general public to review annual DOE budgets for implementation of DOE responsibilities.
g. Participate in CERCLA Five-Year Reviews and other reviews that DOE, the State, or EPA undertake.

2. **Disseminate information on the closure and post-closure operations of the site to the State government of the State in which the site is located, local and Tribal governments in the vicinity of the site, and persons and entities having a stake in the closure or post-closure operations of the site.** These actions include:
   a. Develop and implement mechanisms for LSO members and the general public to be informed of the results of the monitoring data and other relevant information, recognizing that not all communication between LM and Rocky Flats constituencies will flow through the LSO. Potential options include:
      i. Periodic newsletters and/or annual reports
      ii. Email updates
      iii. Other mechanisms as necessary
   b. Provide a mechanism for educating succeeding generations about the residual hazards at Rocky Flats and the continued need for a comprehensive site-wide stewardship program.
   c. Evaluate legal and regulatory issues regarding implementation of site-wide long-term stewardship plan and provide information to the LSO Board and to the community.
   d. Work with DOE and the regulators to understand technical data regarding implementation and effectiveness of cleanup remedies and long-term controls and provide information to the LSO Board and to the community.
   e. Track, and communicate as necessary, issues related to former site workers.
   f. Work with DOE on funding for LSO operations and other related legislative and regulatory issues that affect the management of Rocky Flats and the LSO.

3. **Transmit to appropriate officers and employees of the Department of Energy questions and concerns of governments, persons, and entities referred to paragraph (2) on the closure and post-closure operations of the site.** These actions include:
   a. Solicit and transmit to the appropriate DOE organization community comments on regulatory closure and post-closure documents, including
      i. CAD/ROD
      ii. Delisting/EPA certification
      iii. Post-closure RFCA
      iv. CERCLA Five-Year Reviews
      v. Other items as necessary

b. *Solicit and transmit to DOE comments on long-term surveillance and maintenance issues as other issue as necessary.*

4. **Perform such other duties as the Secretary and the local stakeholder organization jointly determine appropriate to assist the Secretary in meeting post-closure obligations of the Department at the site.**
   a. *Additional activities may be assigned as conditions or circumstances dictate.*

The challenge in developing the LSO Plan comes is detailing the specific actions the LSO will take to meet the work scope identified in the PCPIP. LM notes that as activities at Rocky Flats decrease, LM anticipates a corresponding reduction in topics that warrant communication with stakeholders. The LSO Plan and corresponding LSO work plan will need to evolve to address the changing needs at the site. For that reason, the specifics of how the LSO will work with LM to implement the PCPIP must, for the purposes of the LSO Plan, remain at a high level.

Timeline For Standing Up LSO

The LSO must be established no later than six months prior to regulatory closure of Rocky Flats. Given that regulatory closure is, based on best estimates, scheduled for fall 2006, the LSO should be established on or around February 1, 2006. The following timeline is based on this date.

July – October:

- Prepare LSO Plan for submittal to DOE

November – January:

- Work with DOE to identify non-elected members for the LSO
- Draft IGA and present it to member governments for their approval
- Draft LSO bylaws for modification and approval by LSO
- Draft policies and procedures, including procurement policy, for modification and approval by LSO
- Analyze LSO staffing needs
- Draft LSO work plan for modification and approval by LSO
- Draft LSO budget for modification and approval by LSO

February:

- Hold initial LSO meetings – modify and approve work plan and budget
- Hire staff and/or consultants as determined by LSO Board of Directors
- Finalize bylaws and policies and procedures

Process for identifying non-elected officials to serve on the LSO

There is no single formula for determining which non-elected officials should serve on the LSO. In determining membership, LM should look to balance people with knowledge of Rocky Flats with adding new perspectives and engaging constituencies not traditionally engaged on Rocky Flats issues, including non-elected officials who represent organizations or individuals who have experience or skills that would benefit the LSO.

Membership should be tied to the LSO work plan. Characteristics that could serve to guide membership include:

1. Impacted by and interested in a majority of the scope topic areas of the LSO
2. Willingness to invest time and energy on all of the topic areas
3. Some familiarity with Rocky Flats history, the cleanup process, etc.
4. Represent a broad constituency with a wide diversity of viewpoints
5. Bring new ideas to the table

LM has indicated that entities considered for membership should include Rocky Flats retirees/former workers, environmental groups, and educational institutions. Individuals who have established a history of involvement in Rocky Flats issues also may be considered.

As for government representatives, following the Coalition's June 6, 2005, recommendation, LM tentatively set government membership of the LSO as the seven Coalition governments and the City of Golden. Subsequently the City of Northglenn formally expressed interest in serving on the LSO. In light of this request, the Coalition now recommends that the seven Coalition governments get permanent seats of the LSO and that the cities of Golden and Northglenn serve annually on a rotating basis.

Colorado Sunshine Act

The LSO will likely be organized as a unit of local government under the Colorado Constitution. As such the LSO shall comply with the Colorado Sunshine Law (§ 24-6-402). Compliance with this law will, in part, ensure that meetings are open to the public, that notice is provided, that actions are not taken without a quorum of the Board, that minutes of the meetings are recorded, and that meetings cannot be held in closed session unless they qualify under a limited number of circumstances as provided in law. Further, as a unit of local government, the LSO would be subject to the Colorado Open Records Act (§ 24-72-201). By following both laws, the LSO would ensure greater openness than is specified under the Federal Advisory Committee Act.

from FY05 Omnibus Appropriations – statement of the managers

Small caps

Legacy Management

The conferees support the established mission of the office of legacy management to manage the long-term stewardship responsibilities at the department's clean up sites. The conference agreement provides a total of $46,895,000 for the office of legacy management of which $13,201,000 is provided for program direction. Within available funds, the conferees provide $8,000,000, to remain available until expended, for planning, design, construction, and land acquisition, if necessary, to establish a records management facility centrally located near sites transferring into Legacy Management status, and in close proximity to the Office of Legacy Management's records management capability. The conferees urge the Department to accelerate these activities with the goal of such a facility being ~~operation~~ operational by early fiscal year 2007. From within available funds, the conference agreement provides $1,200,000 to complete transition of the STAR Center in Pinellas County, Florida and $4,000,000 for the final payment, subject to the existing requirement for matching funds, to the Miamisburg Mound Community Improvement Corporation. From available funds, $500,000 is provided to establish a Local Stakeholder Post-Closure organization in the State of Colorado.

U.C

Small Caps

Funding for Defense Activities in Idaho

The conference agreement provides $114,347,000 for defense-related activities at the Idaho National Laboratory (INL) and associated Idaho cleanup sites.

Buffer Zone Sampling

- Cover memo
- Buffer Zone Exposure Unit map
- Lower Walnut Drainage Exposure Unit info
- Windblown Area Exposure Unit info
- Lower Woman Drainage Exposure Unit info
- Southern Buffer Zone Exposure Unit info
- EPA Sampling Data
- 2000 Dust Sampling
- 1977 Ward Wicker Soil Study
- Rik Getty, RFCLOG statistical analysis primer

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MEMORANDUM

TO: Board
FROM: Rik Getty & David Abelson
SUBJECT: Contamination levels in the eastern part of the buffer zone
DATE: March 22, 2011

We have scheduled one hour for the board to discuss contamination levels in the eastern part of the former DOE buffer zone (the area between the terminal ponds and Indiana Street). This area is now part of the Rocky Flats National Wildlife Refuge. Per the executive committee's decision, there will be no briefing. The only briefing materials you will receive are attached to this memo. In addition, as provided in this memo, there are other documents that you might want to consult.

The need to review past sampling and residual contamination levels has arisen in two conversations. First, DOE's plan to breach the terminal ponds and move the existing points of compliance (POC) from Indiana Street to the eastern edge of its management area has raised numerous questions about contamination levels in DOE's former buffer zone. Second, USFWS' planned transfer of a 300' right-of-way for the Jefferson Parkway is raising concern about the extent of residual contamination along that strip of land.

In discussing these subjects, there are two key points to bear in mind. First, the question of the POC move is a DOE management issue. Examining DOE remediation issues – in this case, proposed move of the POCs – falls squarely within our role as the Local Stakeholder Organization (LSO) for Rocky Flats. Second, regarding the proposed Jefferson Parkway, two years ago the board decided that the Stewardship Council was not the appropriate forum to discuss and debate Parkway issues. Accordingly, based on the board's direction – and consistent with our role as the LSO – we will use this discussion and any subsequent briefings only to inform board members about these issues so that they can have and use that information in the appropriate forum(s). Accordingly, this discussion at the Stewardship Council about sampling and residual contamination cannot be geared towards discussing the wisdom and feasibility of the Parkway.

In reviewing this material there are a few key points to bear in mind:

1. These lands in question are now part of the Rocky Flats National Wildlife Refuge. They have been certified as meeting all applicable standards and thus have been delisted from

the CERLA National Priorities (Superfund) list. These lands are available for any and all uses, without restriction.

2. Prior to closure, the Rocky Flats Coalition of Local Governments, one of the Stewardship Council's predecessor organizations, contracted for an independent review of the sampling methodology DOE, Kaiser-Hill (prime cleanup contractor), and the regulatory agencies used to determine residual contamination levels on lands that are now part of the Refuge. That analysis concluded the site soil sampling conducted by Kaiser-Hill and validated by additional EPA sampling was technically sound.
3. Residual contamination remains on these lands. The 1957 fire and attempts to remediate the 903 pad in the 1960s caused airborne contamination to spread east on Rocky Flats and onto lands east and southeast of Rocky Flats. All of these lands – both Refuge lands and all off-site lands – have been deemed to meet all applicable standards, and thus there are no restrictions regarding their use. That does not mean, however, that they are free of contamination.

Summation of Sampling

The discussion below captures some of the main sampling activities that have taken place at Rocky Flats. The additional studies we reference through web-links provide important, technical detail.

During production and cleanup, DOE, the regulatory agencies, community members and others conducted a range of sampling that helps quantify the extent of contamination in the buffer zone and offsite lands. That sampling, which includes soil sampling, air quality sampling, and dust sampling, consistently shows that contamination in the buffer zone is present, but at levels that support DOE and the EPA's decision to allow the lands that now comprise the Refuge to be released without restrictions.[1]

Soil sampling

Soil sampling, in short, has taken place throughout the buffer zone, with the greatest efforts in the buffer zone extending from the eastern edge of the former Industrial Area to the site boundary at Indiana Street. The results consistently show that the further one moves away from the former Industrial Area (the area where the operations took place) the concentrations decrease. Contaminant concentration for most of the buffer zone is barely distinguishable from background levels.[2] In the eastern part of the buffer zone, concentration levels range from background levels of 0.09 picoCuries/gram (pCi/g) to 9.19 pCi/g. (There is on sample that registered 49 pCi/g. We are not sure the reason for this anomaly, but we are investigating whether it was close to the 903 Pad.)

Air quality analysis

In addition to direct sampling, one way to help gauge contamination levels is to monitor air quality. Contamination spread into the buffer zone and onto neighboring lands through wind-dispersal. During production and cleanup, there was an extensive network of air monitors both

[1] The reason water monitoring at Indiana Street is vitally important is that those monitoring stations are the only means to measure any contamination that could move off-site.

[2] Background now is not the same as pre-Cold War. Because of atmospheric testing, contamination is spread throughout the country and to many parts of the world. Background levels vary from region to region.

on-site and off-site. These air monitors provided data showing the extent to which production and clean-up operations could result in airborne contamination. Even though some airborne contamination spread to off-site lands during production, it never triggered an exceedance for air quality standards during the years the network was in place. However, there could have been exceedances in the late 1950s and 1960s before the network was formed.

Dust Sampling

In recent years, claims have been made that DOE did not test dust samples, and that in dust samples one will be able to better characterize concentrations. These claims that DOE did not test dust are inaccurate. As discussed below, in 2000, DOE took dust samples following a fire in the eastern part of the buffer zone. Those tests are notable because denuded areas present the greatest risk of contamination being mobilized. The tests, which found similar levels of very low level residual contamination, align with the results on the numerous soil sampling studies.

Soil contamination levels on lands west of Indiana Street

Extensive soil testing has been performed on both sides of Indiana Street. Lands within the federal boundary were divided into exposure units (EU). (Lands north, east and south of Rocky Flats are known as Operable Unit 3 (OU3). OU3 is discussed at the end of the memo.)

Exposure Units

During cleanup, Rocky Flats was divided into 12 EUs. (See attached map; also found at: http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005645.pdf) These EUs were based on topography, past uses, and other factors. There are four EUs that border Indiana Street to the west (presented here from north-to-south):

- Lower Walnut Drainage Exposure Unit
- Windblown Area Exposure Unit
- Lower Woman Drainage Exposure Unit
- Southeast Buffer Zone Exposure Unit

Beginning in 2004, during the final stages of cleanup, within each EU, DOE and its prime contractor performed a complex risk-based analysis using results from environmental sampling. This CERCLA analysis is termed a comprehensive risk assessment (CRA). CRAs examine environmental sampling results for soil, air, and water, and try to determine what impact, if any, contamination may have on human health and the environment. There were two CRAs performed in each EU – one for human health risk, and the other for environmental risk (risk to flora and fauna). Although there was extensive historical soil testing, a few data sets could not be used due to suspect data quality, so additional testing was necessary. Accordingly, DOE, with oversight from EPA and CDPHE, implemented a new sampling effort. That work generated additional characterization data for these EUs.

A discussion of each EU, sampling points, and results follow below. We have attached soil sampling location maps for each of these four EUs, as well as summary data tables for plutonium (Pu) and americium (Am) concentrations. Am is a daughter product of Pu.

Lower Walnut Drainage Exposure Unit
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005640.pdf
sample location: page 101 of pdf
summary data tables:
number of samples: page 54 of pdf
radiation results: page 55 of pdf

The soil sampling locations for this EU are shown in Figure 1.6 (attached). Table 1.2 (attached) lists 81 samples tested for radionuclides. Results for Pu can be found in Table 1.3 (attached). Please note, instead of reporting 81 separate Pu values, the report shows the following: minimum concentration (0 pCi/g), maximum concentration (1.02 pCi/g), and mean (0.163 pCi/g). Also note the sample locations on the east side of this EU near Indiana Street where the 300' right-of-way is located.

Windblown Area Exposure Unit
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005641.pdf
sample location: page 148 of pdf
summary data tables:
number of samples: page 71 of pdf
radiation results: page 73 of pdf

The soil sampling locations for this EU are shown in Figure 1.6 (attached). Table 1.2 (attached) lists 347 samples tested for radionuclides. Results for Pu can be found in Table 1.3 (attached). Please note, instead of reporting 347 separate Pu values, the report shows the following: minimum concentration (0 pCi/g), maximum concentration (49 pCi/g),[3] and mean concentration 9.19 pCi/g). Also note the sample locations on the east side of this EU near Indiana Street where the 300' right-of-way is located.

The most intensive soil sampling was conducted in the western portion of the windblown area,[4] since Pu/Am levels were higher due to contamination emanating from the 903 Pad. Although the other three EUs had fewer sample locations, there were still a large number of sample locations that DOE and the regulators used in determining the overall site risk.

Lower Woman Drainage Exposure Unit
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005643.pdf
sample location: page 146 of pdf
summary data tables:
number of samples: page 71 of pdf
radiation results: page 73 of pdf

The soil sampling locations for this EU are shown in Figure 1.6 (attached). Table 1.2 (attached) lists 144 samples tested for radionuclides. Results for Pu can be found in Table 1.3 (attached). Please note, instead of reporting 144 separate Pu values, the report shows the following:

[3] Note, the trigger concentration requiring soil remediation was 50 pCi/g.
[4] The windblown area was land to the east of the contaminated 903 pad where airborne contamination transported by westerly winds settled out.

minimum concentration (0 pCi/g), maximum concentration (12.2 pCi/g), and mean concentration (1.58 pCi/g). Also note the sample locations on the east side of this EU near Indiana Street where the 300' right-of-way is located. This EU has a smaller boundary with Indiana than the two previous EUs, and there were fewer sample locations near the boundary.

Southeast Buffer Zone Exposure Unit
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005645.pdf
sample location: page 72 of pdf
summary data tables:
number of samples: page 38 of pdf
radiation results: page 39 of pdf

The soil sampling locations for this EU are shown in Figure 1.6 (attached). Table 1.2 (attached) lists 55 samples tested for radionuclides. Results for Pu can be found in Table 1.3 (attached). Please note, instead of reporting 55 separate Pu values, the report shows the following: minimum concentration, (0 pCi/g), maximum concentration (4.60 pCi/g), and mean concentration (0.251 pCi/g). Also note the sample locations on the east side of this EU near Indiana Street where the 300' right-of-way is located. This EU also has a smaller boundary with Indiana than the first two EUs.

Additional soil/air testing on lands west of Indiana Street
In addition to the EU sampling, starting in 2004 DOE decided that it needed additional soil testing to further characterize contamination levels in the buffer zone, so a new round of soil testing was conducted. The buffer zone was split into 30 acre grid cells where additional samples were obtained. Five samples were taken and composited into one sample for analysis. Results from this new round of testing helped to inform decisions made during the comprehensive risk assessment for the buffer zone, and to support the decision to release the Refuge lands without restriction.

In addition, the EPA also performed additional soil testing in each of the EUs (results attached). Based on DOE's buffer zone testing, the EPA picked the grid cell location within each EU which had the highest level of Pu contamination. The EPA then collected five soil samples from that grid location and analyzed them separately (they did not composite the five samples into one sample.) The EPA results aligned with those obtained by DOE. The results show for Pu concentrations are follows:

- Lower Walnut EU: min (0.026 pCi/g), max (0.146 pCi/g), mean (0.06 pCi/g)
- Windblown Area EU: min (1.04 pCi/g), max (10.9 pCi/g), mean (5.55 pCi/g)
- Lower Woman EU: min (2.16 pCi/g), max (5.02 pCi/g), mean (3.16 pCi/g)
- Southeast BZ EU: min (0.036 pCi/g), max (0.21 pCi/g), mean (0.13 pCi/g)

Another important data point flows from an April 2000 controlled burn. When DOE and the U.S. Forest Service conducted this burn on 50 acres in the southern buffer zone, air samplers were set up to monitor the burn, for potential airborne radionuclides. Very little airborne Pu was detected as a result of the burn which would have resulted in a tiny exposure to anyone who happened to breathe the smoke. The greater risk was from respiratory failure resulting from smoke inhalation.

For a summary of these tests, please go to
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/BZ/BZ-A-000289.PDF
This link provides the entire report.
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/BZ/BZ-A-000290.PDF

Dust Sampling

One recent claim that has generated some concern which is not accurate is the claim that DOE did not sample any of the dust. We found one occasion – July 2000 – in which DOE did perform such a test. (There may be others but we were not able to find them in DOE's huge database.)

In July 2000, a lightning-caused fire burned 20 acres in the Windblown EU. The area is just south of the former east guard station, a few hundred yards west of Indiana, very near the 300' right-of-way proposed for the Jefferson Parkway. DOE collected samples in several locations using a whisk broom and sweeping up dust from the surface. The samples were then analyzed for Pu content. In addition, a portable wind tunnel was placed on top of the sampled area and airborne samples were collected for analyses. The intent of the project was to determine how much, if any, Pu contamination could be re-suspended in air by wind in areas where wildfires occurred.

The results are important. Very low levels of Pu were detected in the soil (dust) samples, well below the regulatory-threshold level. These results were similar to other soil samples obtained from other studies in this area. The report is found at:
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-006047.pdf

1977 Soil Study

In the mid-1970s, Dr. Ward Whicker of CSU conducted soil testing for Pu contamination near the 903 Pad. During the course of this investigation, 931 samples were obtained and analyzed. Pu results were similar to past studies and also to future studies performed decades later. He concludes that soil contamination is the result of wind dispersal, and that contamination is limited to the upper inches of the soil column. Note: the study talks about leaking drums in the southwest corner of Rocky Flats. He is talking about the original site boundary and the 903 pad.

His report, titled *Plutonium Distribution in Rocky Flats Soil*, can be found at:
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-004619.PDF

Overflights – radiological survey

In June 2005, DOE commissioned Bechtel-Nevada to perform a helicopter radiological survey of the entire site. The aerial survey did not have the sensitivity to detect small area hotspots in surface soil. Rather, it detected larger areas where low level waste was stored prior to shipment.

This survey and accompanying report were important at the time as community members had raised concerns regarding the lack of such a survey. For the questions the board will discuss at the meeting, the value this survey adds is to confirm that there are no large hot-spots in the buffer

zone. The results, however, cannot speak to low level contamination levels. The report can be found at: http://rockyflats.apps.em.doe.gov/references/189-Bechtel%20Aerial%20Survey.pdf

Soil contamination levels on lands east of Indiana Street (OU3)
OU3 are the non-federal lands north, east and south of Rocky Flats. While these lands are not the focus of the board's discussion, questions have been raised about these lands, so we are including some basic information.

In 1997, DOE and the EPA determined that the contamination levels were low enough to allow the land to be used without restriction. Accordingly, these lands, which had been included on the CERCLA Superfund list, were delisted. The following two links address contamination levels on these lands.

- EPA's 1997 Record of Decision (ROD) decision delisting OU3 from the CERCLA Superfund list
  http://www.epa.gov/superfund/sites/rods/fulltext/r0897196.pdf
- CDPHE's Health Advisory Panel's soil testing
  http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000585.pdf

EPA's 1997 Record of Decision (ROD) decision for OU3
To define the nature and extent of hazardous substances in surface soil in OU3, DOE relied on the following 3 data sets;

1. 144 surface soil samples collected from 61 ten-acre plots in OU3.
2. 47 surface soil samples collected from tilled and untilled portions of OU3 land directly east of the site (known as the Remedy Lands).
3. Soil sample set was collected from the Rock Creek drainage area on the northwest corner of the site. Soils from this area were used as background soil to compare with OU3 soils. (The Rock Creek data set indicated that upper-bound background values (the mean plus two standard deviations) were 0.09 pCi/g for plutonium-239/-240 and 0.04 pCi/g for americium-241.)

As provided in the ROD, "19 of the 61 samples in the ten-acre plots data set and all of the surface soil samples…had levels of plutonium-239/-240 and/or americium-241 that were above background levels." The highest surface soil level "for plutonium-239/-240 (6.468 pCi/g) was recorded…from a location approximately 1,800 feet east of the [Rocky Flats] east gate, and about 1,500 feet south of the western end of Great Western Reservoir." The highest value of "americium-241 (0.52 pCi/g) occurred…across Indiana Street from the [Rocky Flats] east gate. The arithmetic mean of all values is 0.057 pCi/g for plutonium-239/-240 and 0.017 pCi/g for americium-241.

CDPHE Health Advisory Panel
Responding to citizen concerns over contamination from Rocky Flats, Governor Roy Romer formed the Health Advisory Panel (HAP) in 1992. The HAP realized the large amount of interest in their work and wanted to get members of the public involved. The HAP encouraged the formation of the Citizen's Environmental Sampling Committee (CESC). As stated in the

following link (CESC Soil and Sediment Study Summary):
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000585.pdf

> "The Health Advisory Panel task force wanted to involve the public directly. In late 1992 representatives of various groups, including homeowners' associations public interest organizations, local health departments, as well as individuals concerned about Rocky Flats were invited to participate as a group to consider and conduct a soil-sampling study.
>
> The study was designed to fill gaps where there were no existing data or where data were in question, and to generate a data set that could be used for comparison with results of other off-site sampling studies. The first meeting of the CESC was held in December 1992."

The CESC summary further provides:

> "The CESC selected 28 soil-sampling sites, most of which were within a five to six mile radius of the Rocky Flats Plant. At each site, two samples were collected: one surface soil sample (0 to 1 inch deep) and one soil core sample (0 to 8 inches deep). In addition, one sediment core sample, divided into 10 one-inch layers, was taken at Standley Lake, a reservoir southeast of the Rocky Flats Plant. This reservoir serves as adrinking water supply for three nearby communities. Samples were analyzed for isotopes of plutonium (plutonium-238, plutonium-239,240), americium (americium-241), cesium (cesium-137), strontium (strontium-90) and uranium (uranium-235, uranium-238).
>
> The results of the study correlated well with the concentrations and distribution of radionuclides found by other studies of the area. A number of soil samples did have levels of plutonium-238, plutonium-239,240, americium-241, cesium-1 7, and strontium-90 above the background levels for this area. Background values for these radionuclides are the expected amounts in soils from nuclear testing and other global fallout. With the exception of strontium-90, almost all elevated levels were found in the surface soil samples. These results are consistent with the deposition and transport mechanisms associated with the Rocky Flats Plant region. Off-site contamination has been dispersed as airborne emissions, transported through surface water to local creeks or resuspended as wind-dispersed soil particles.
>
> Six of the 28 surface soil sites yielded samples that contained plutonium-239,240 at levels above 0.084 picocuries per gram of soil (pCi/g). This value of 0.084 pCi/g is a statistical estimate of the upper limit of background concentrations due to global fallout along the Front Range. Plutonium-239,240 concentrations at these six sites ranged from 0.09 to 4.5 pCi/g. The highest level of off-site plutonium was found approximately one mile east of the Rocky Flats Plant near Great Western Reservoir. This sampling site with the highest surface soil concentration of plutonium also yielded a core sample containing plutonium-239,240 above the upper limit of background."

Finally, the CESC conclusions state:

> "The sampling results confirm conclusions from past soil studies: plutonium was released by the Rocky Flats Plant to the nearby off-site environment, generating soil concentrations above the upper limit of background expected from nuclear weapons testing fallout. The elevated plutonium values correspond in magnitude and location to those reported by other

researchers, but the scope of this study cannot exclude the possibility of having missed hot spots.

Care must be exercised in drawing further conclusions from this and similar studies. The CESC study was not designed to estimate total contaminant releases from the Rocky Flats Plant. However, it was intended to produce a picture of off-site conditions at specific locations at the time of sampling. An inventory of total amounts of plutonium released from the Rocky Flats Plant cannot be derived from such environmental studies.

The CESC data from locations that had not been sampled previously create a better understanding of the environment surrounding the Rocky Flats Plant. The CESC data from sites that have been sampled in the past by other studies are available for purposes of comparison with these other studies."

Additional Resources

There is a wealth of information beyond that which we have presented in this memo and attachments. For more information go to:

1. http://www.cdphe.state.co.us/rf/index.htm CDPHE link to the HAP historical public exposure studies with links to various topics related to the HAP.
2. http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#CAD 2006 Closure CAD/ROD This is the final regulatory document which completes the regulatory closure of the site. There is a section on soil testing in the document but it's more of a high level document than a detailed technical document with lots of data.
3. http://www.rockyflatssc.org/residual_contamination/IVV_Statistical_Confidence_white_paper_rev_1.pdf Statistical Confidence as it Relates to Soil Sampling at Rocky Flats (attached) This is a short summary Rik authored for the Rocky Flats Coalition to supplement his investigation into remaining contamination at the site. It is a basic primer on soil sampling statistics geared toward the general public.

Please let us know what questions you have.

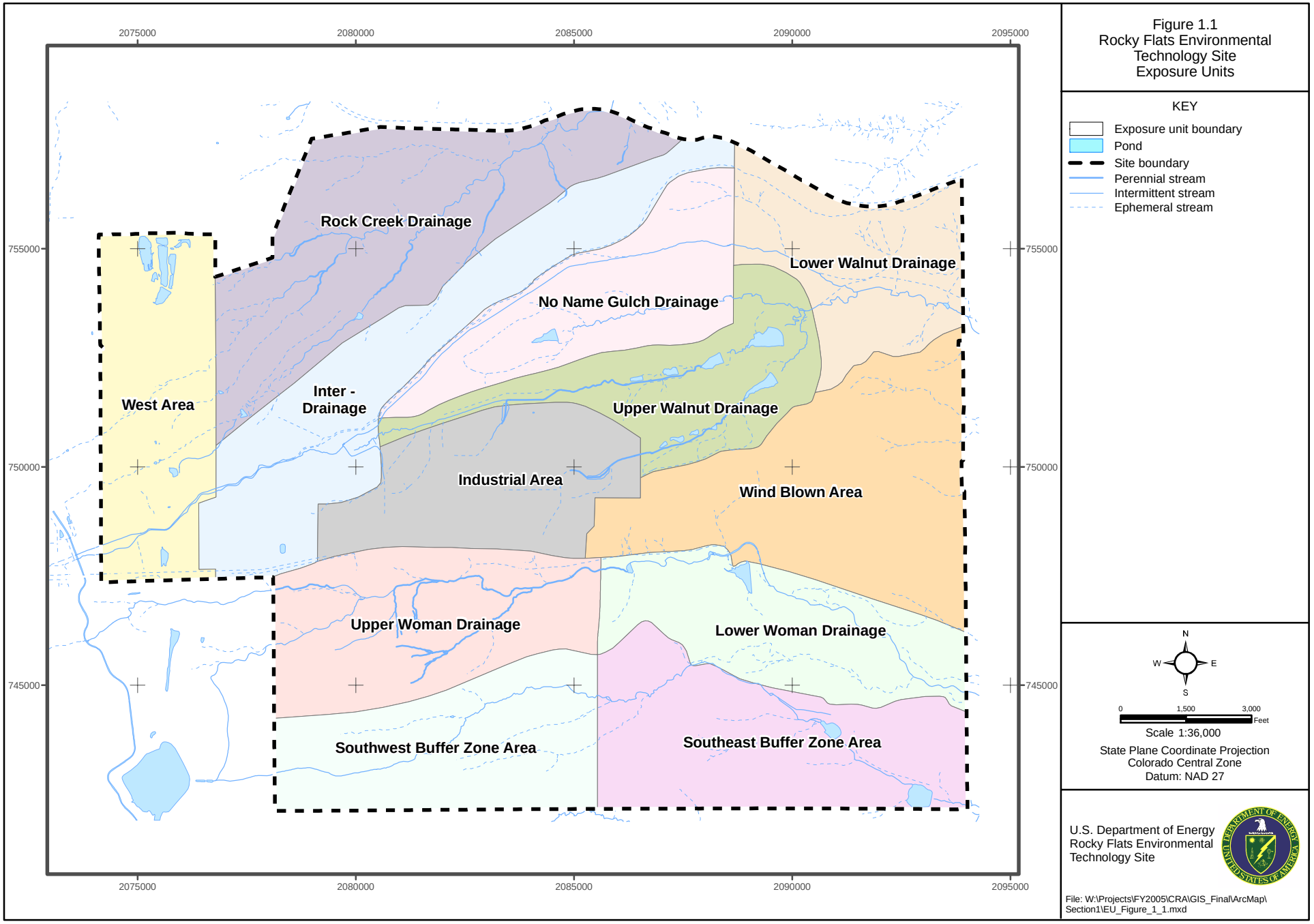

Figure 1.1
Rocky Flats Environmental
Technology Site
Exposure Units

KEY

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

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Section1\EU_Figure_1_1.mxd

Lower Walnut Drainage Exposure Unit

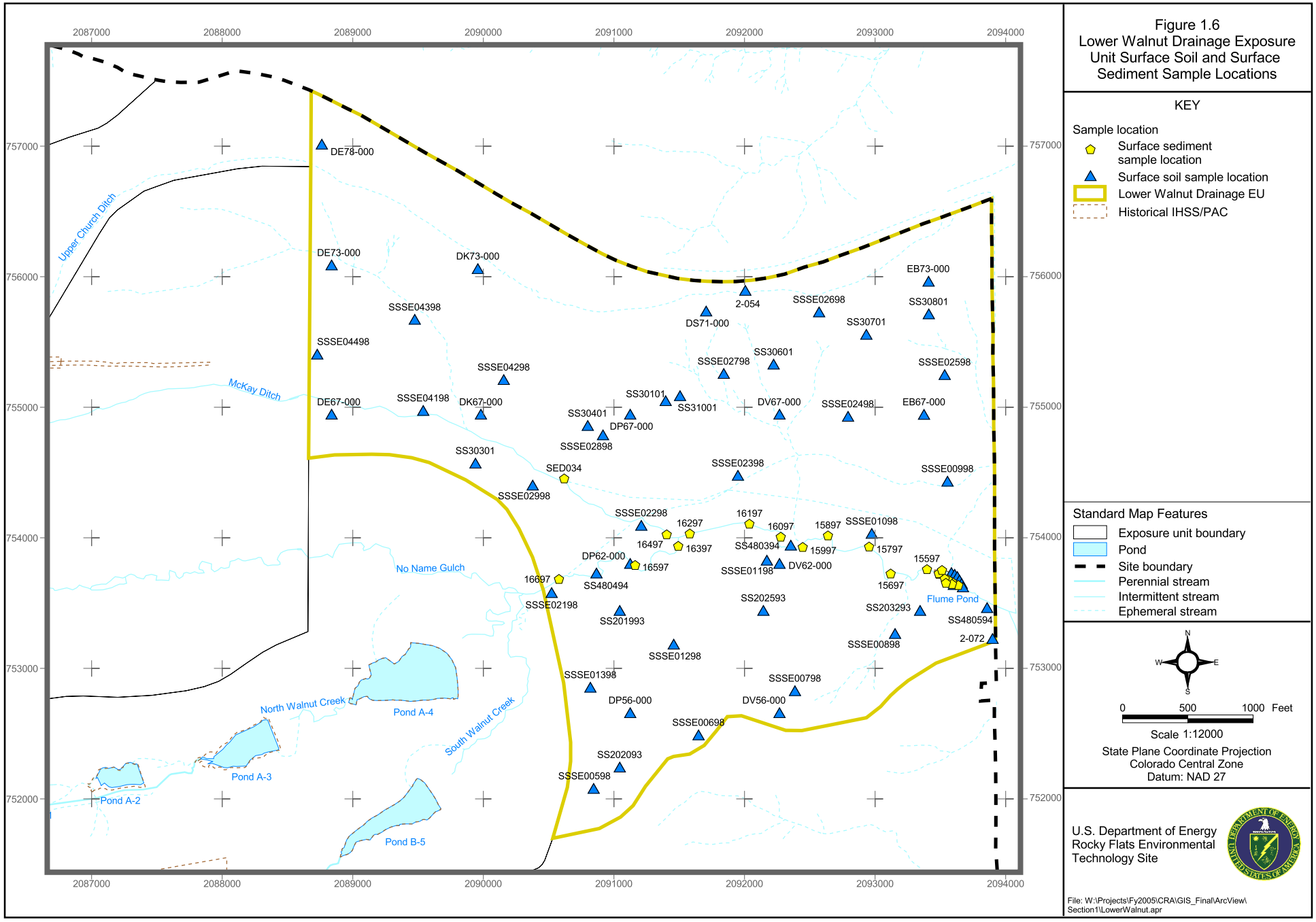

Figure 1.6
Lower Walnut Drainage Exposure Unit Surface Soil and Surface Sediment Sample Locations

KEY

Sample location

- Surface sediment sample location
- Surface soil sample location
- Lower Walnut Drainage EU
- Historical IHSS/PAC

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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0 500 1000 Feet

Scale 1:12000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

File: W:\Projects\Fy2005\CRA\GIS_Final\ArcView\Section1\LowerWalnut.apr

Table 1.2
Number of Samples in Each Medium by Analyte Suite

Analyte Suite	Surface Soil/Surface Sediment[a]	Subsurface Soil/Subsurface Sediment[a]	Surface Soil[b]	Surface Soil (PMJM)[b]	Subsurface Soil[b]
Inorganics	29	20	23	9	14
Organics	15	21	12	8	16
Radionuclides	81	17	57	12	11

[a] Used in the HHRA.

[b] Used in the ERA.

The total number of results (samples) in Tables 1.3 through 1.7 may differ from the total number of samples presented in Table 1.2 because not all analyses are necessarily performed for each sample.

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits[a]	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
Inorganics (mg/kg)							
Aluminum		25	100	7,460	17,000	11,600	2,490
Antimony	0.31 - 22.9	17	23.5	0.490	1.00	3.20	3.84
Arsenic		25	100	2.20	9.40	5.45	1.56
Barium		25	100	86.4	180	126	23.1
Beryllium	0.73 - 1.4	25	80	0.622	1.30	0.793	0.214
Boron		18	100	2.75	8.40	4.89	1.43
Cadmium	0.038 - 1.7	25	80	0.220	2.20	0.900	0.633
Calcium		25	100	1,160	18,000	5,640	3,680
Chromium		28	100	6.90	21.0	13.3	3.49
Cobalt		28	100	4.30	11.0	7.67	1.52
Copper		28	100	5.00	22.0	13.9	3.22
Iron		28	100	9,520	81,700	18,126	13,535
Lead		28	100	13.0	50.9	23.8	9.79
Lithium		28	100	4.80	17.0	9.87	2.96
Magnesium		28	100	1,490	4,200	2,512	597
Manganese		28	100	130	1,110	286	175
Mercury	0.011 - 0.14	28	53.6	0.013	0.036	0.031	0.019
Molybdenum	0.25 - 8	28	64.3	0.202	5.30	1.14	1.33
Nickel	16.2 - 16.2	28	96.4	7.00	22.0	14.0	3.14
Nitrate / Nitrite	3.4 - 3.84	4	50	0.880	2.50	1.75	0.671
Potassium		28	100	1,490	3,400	2,289	572
Selenium	0.24 - 2.1	28	7.14	0.660	0.780	0.386	0.232
Silica		17	100	710	2,000	1,138	376
Silicon		5	100	283	1,970	1,285	634
Silver	0.078 - 2.7	28	39.3	0.167	1.31	0.602	0.497
Sodium	110 - 270	28	53.6	26.9	790	146	186
Strontium		28	100	23.4	95.0	47.3	16.5
Thallium	0.33 - 1.6	28	7.14	0.610	0.678	0.373	0.174
Tin	0.97 - 37.9	28	35.7	0.289	93.3	6.87	17.9
Titanium		21	100	42.0	150	90.2	30.5
Vanadium		28	100	20.9	52.0	34.0	8.04
Zinc		28	100	36.7	130	60.0	18.2
Organics (µg/kg)							
1,4-Dichlorobenzene[c]	340 - 600	15	53.3	0.450	1.50	107	82.7
2-Butanone	10 - 128	11	18.2	25.0	38.0	50.2	5.99
4,4'-DDT	16 - 29	7	14.3	26.0	26.0	13.3	1.80
Acetone	116 - 210	11	9.09	210	210	81.7	3.82
Benzoic Acid	1,700 - 1,700	7	85.7	220	500	380	6.68
bis(2-ethylhexyl)phthalate	410 - 450	7	57.1	49.0	130	138	77.1
delta-BHC	8.1 - 14	7	14.3	23.0	23.0	8.01	45.8
Di-n-butylphthalate	410 - 600	7	14.3	38.0	38.0	209	5.99
Methylene Chloride	5.8 - 28	11	18.2	1.80	3.10	4.85	19.3
Phenol	340 - 600	7	14.3	110	110	206	120
Tetrachloroethene	5 - 10	11	54.5	0.380	0.420	1.85	229
Toluene	5.8 - 6.4	11	27.3	6.00	18.0	6.01	57.5
Radionuclides (pCi/g)[d]							
Americium-241		71	N/A	-0.022	0.336	0.064	0.070
Cesium-134		5	N/A	0.002	0.110	0.024	0.048
Cesium-137		10	N/A	0.004	1.25	0.597	0.497
Gross Alpha		11	N/A	-2.40	28.3	14.6	8.22
Gross Beta		11	N/A	8.45	33.8	24.2	7.03
Plutonium-239/240		77	N/A	-0.012	1.02	0.164	0.227
Radium-226		8	N/A	0.510	1.16	0.813	0.250
Radium-228		1	N/A	0.930	0.930	0.930	N/A
Strontium-89/90		4	N/A	-0.013	0.240	0.119	0.129
Uranium-233/234		41	N/A	0.351	1.47	0.894	0.249
Uranium-235		41	N/A	-0.093	0.196	0.055	0.063
Uranium-238		41	N/A	0	1.44	0.868	0.293

[a] Values in this column are reported results for nondetects (i.e., U-qualified results).

[b] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[c] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

Windblown Area Exposure Unit

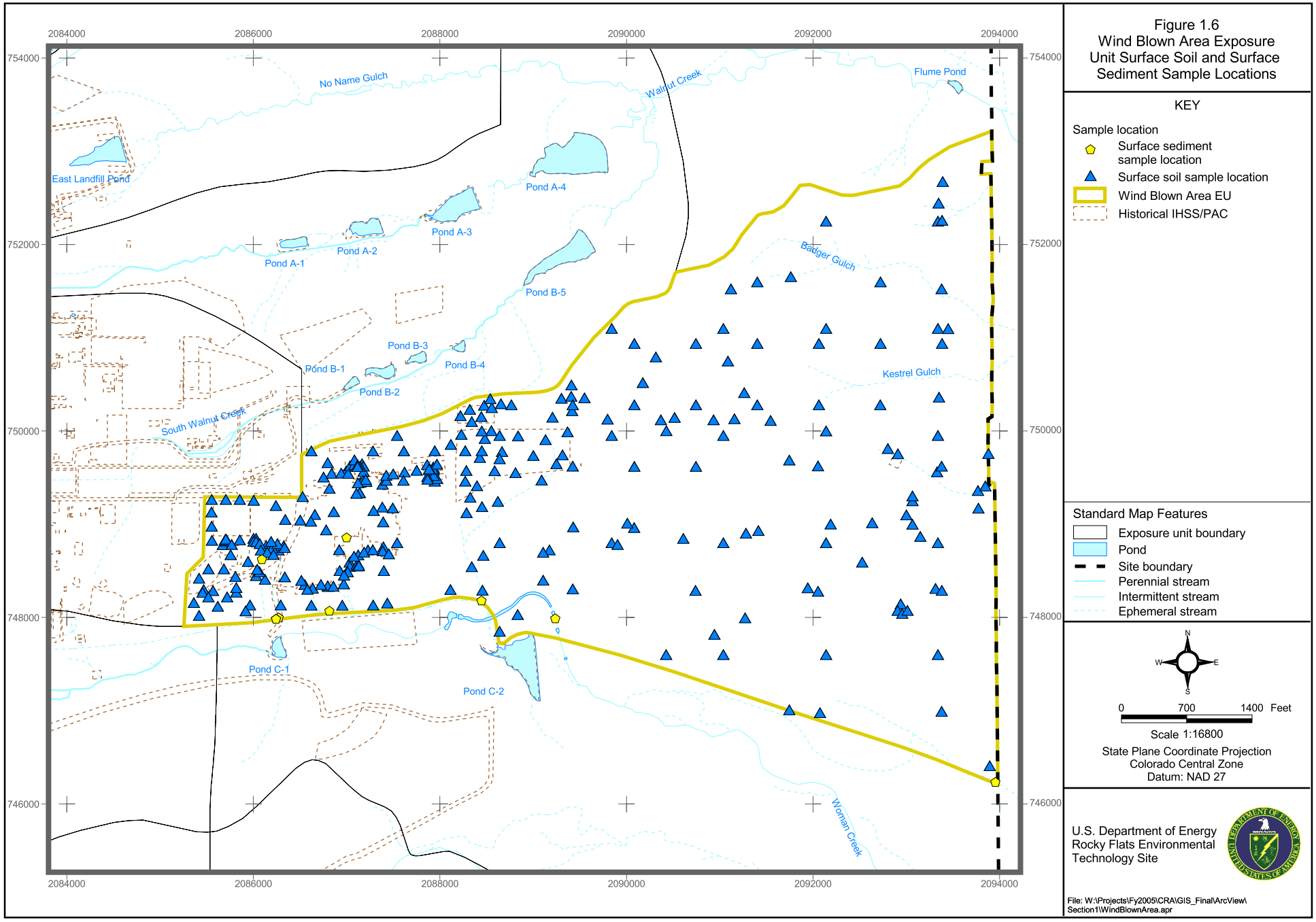

Figure 1.6
Wind Blown Area Exposure Unit Surface Soil and Surface Sediment Sample Locations

KEY

Sample location

- Surface sediment sample location
- Surface soil sample location
- Wind Blown Area EU
- Historical IHSS/PAC

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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Scale 1:16800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Table 1.2
Number of Samples Collected in Each Medium by Analyte Suite

Analyte Suite	Surface Soil/Surface Sediment[a]	Subsurface Soil/Subsurface Sediment[a]	Surface Soil[b]	Subsurface Soil[b]
Inorganic	160	314	151	313
Organic	107	580	98	579
Radionuclide	347	417	335	414

[a] Used in the HHRA.

[b] Used in the ERA.

Note: The total number of results (samples) in Tables 1.3 through 1.6 may differ from the total number of samples presented in Table 1.2 because not all analyses are necessarily performed for each sample.

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Reported Non-Detect Concentration[a]	Maximum Reported Non-Detect Concentration[a]	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
Inorganics (mg/kg)									
Aluminum	0.24 - 200	160	100			4,570	33,000	14,370	6,852
Ammonia	0.300	9	100			1.09	3.33	2.07	0.845
Antimony[c]	0.27 - 60	138	17.4	0.270	19.3	0.300	0.880	2.72	2.72
Arsenic	0.16 - 10	160	100			1	11	5.20	2.12
Barium	0.039 - 200	160	100			34.9	280	134	47.2
Beryllium	0.031 - 5	160	68.8	0.280	1.30	0.230	1.40	0.684	0.285
Boron	0.35 - 1.2	76	93.4	0.350	2.70	0.670	15	6.82	3.63
Cadmium	0.03 - 5	159	42.8	0.0300	1.30	0.0650	2.60	0.497	0.350
Calcium	1 - 5,000	160	100			1,740	185,000	21,387	38,037
Cesium	86.4 - 1,000	66	19.7	6.80	211	0.680	7.40	34.4	29.8
Chromium	0.053 - 10	160	100			2.20	80.5	16.1	10.2
Cobalt	0.079 - 50	160	100			2.20	21.6	6.61	2.41
Copper	0.045 - 25	159	100			2.20	49.8	14.8	6.09
Iron	0.68 - 100	160	100			3,680	27,000	14,299	5,207
Lead	0.12 - 3	160	100			3	120	33.6	20.2
Lithium	0.17 - 100	140	92.1	2	14.1	4.40	33	12.2	6.20
Magnesium	1.6 - 5,000	160	100			1,100	8,270	3,142	1,297
Manganese	0.033 - 15	160	100			54	1,200	283	144
Mercury	0.0012 - 0.2	141	48.9	0.0120	0.200	0.00560	0.250	0.0456	0.0350
Molybdenum	0.13 - 200	146	29.5	0.130	5.20	0.150	6.10	1.19	1.17
Nickel	0.19 - 40	160	96.9	8.80	9.60	4.40	101	14.6	10.0
Nitrate / Nitrite	0.2 - 1.8	18	88.9	1.60	1.80	0.738	3.83	2.14	0.944
Potassium	36 - 5,000	160	99.4	954	954	690	6,200	3,006	1,264
Selenium	0.24 - 5	158	21.5	0.200	4.50	0.260	0.880	0.415	0.386
Silica	2.7 - 5.3	76	100			175	1,100	596	202
Silicon[c]	0 - 100	46	100			81	2,160	1,076	694
Silver	0.055 - 10	151	23.8	0.0550	5.70	0.0810	42.8	1.27	4.09
Sodium	5.7 - 5,000	160	31.3	46.3	594	46	492	101	71.0
Strontium	0.0061 - 200	146	100			8.90	362	47.3	46.0
Thallium	0.32 - 10	160	20	0.200	2.20	0.210	3.30	0.409	0.404
Tin	0.24 - 200	146	17.8	0.860	52.3	1.30	77.2	8.41	12.4
Titanium	0.077 - 0.2	76	100			33	603	275	129
Uranium	1.4 - 7.2	76	5.26	1.40	7.20	1.90	8	1.89	1.41
Vanadium	0.25 - 50	160	100			12.1	72	32.0	12.0
Zinc	0.2 - 20	160	100			15	216	52.8	23.7
Organics (µg/kg)									
1,1,2,2-Tetrachloroethane[c]	4.86 - 12	21	4.76	0.899	12	1.39	1.39	1.74	1.70
1,2,3-Trichloropropane[c]	4.86 - 5.5	13	7.69	0.965	1.09	1.47	1.47	0.583	0.267
1,2,4-Trimethylbenzene	4.86 - 5.5	13	7.69	0.949	1.07	1.44	1.44	0.574	0.261
2-Butanone	10 - 110	21	4.76	9.29	24	19	19	6.42	3.36
4,4'-DDE	1.7 - 38	49	6.12	9.50	38	4	5.80	9.41	2.20
4,6-Dinitro-2-methylphenol	130 - 3,900	88	1.14	1,600	4,100	390	390	1,002	318
Acenaphthene	33 - 780	94	6.38	340	780	45	240	186	38.5
Acetone[c]	10 - 110	21	9.52	11	130	35	71	13.8	19.1
Aldrin	2.1 - 19	49	2.04	8.10	19	0	0	4.80	1.12
alpha-Chlordane	80 - 190	45	2.22	80	190	0	0	47.4	11.3
Anthracene	25 - 780	94	8.51	340	780	47	330	189	40.1
Aroclor-1248	6.2 - 240	90	1.11	0.759	12	840	840	47.8	93.2
Aroclor-1254	4.4 - 380	90	28.9	340	820	6.80	3,000	116	321
Aroclor-1260	4.9 - 380	90	15.6	340	820	6.20	240	70.8	57.5
Benzene[c]	4.86 - 12	21	4.76	340	820	1.44	1.44	1.70	1.73
Benzo(a)anthracene	26 - 780	94	24.5	340	820	39	830	198	111
Benzo(a)pyrene	43 - 780	94	14.9	340	820	48	750	211	90.4
Benzo(b)fluoranthene	31 - 780	94	14.9	1,600	4,100	40	810	215	95.2
Benzo(g,h,i)perylene	29 - 780	94	8.51	8.10	19	82	240	203	59.5
Benzo(k)fluoranthene	34 - 780	94	10.6	340	820	69	740	216	91.9
Benzoic Acid	300 - 3,900	88	30.7	0.918	12	77	1,100	810	468
beta-BHC	1.8 - 19	49	2.04	340	820	0	0	4.76	1.08
bis(2-ethylhexyl)phthalate	71 - 780	94	14.9	8.10	19	49	1,400	223	153
Chlorobenzene[c]	4.86 - 12	21	4.76	340	820	2.03	2.03	1.78	1.69

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Reported Non-Detect Concentration[a]	Maximum Reported Non-Detect Concentration[a]	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
Chrysene	30 - 780	94	28.7	340	820	39	790	196	109
delta-BHC	0.59 - 19	49	2.04	340	820	0	0	4.76	1.08
Dibenz(a,h)anthracene	26 - 780	94	4.26	340	820	43	92	203	68.2
Dibenzofuran	38 - 780	94	2.13	9.10	47	37	86	205	65.3
Dieldrin	2.9 - 38	49	4.08	8.10	19	4.30	5.80	10.2	3.41
Di-n-butylphthalate	22 - 780	94	6.38	9.50	38	39	1,000	206	106
Di-n-octylphthalate	37 - 780	94	1.06	0.987	12	210	210	207	61.5
Endosulfan I	2 - 19	49	2.04	340	790	0	0	4.76	1.08
Endrin	2 - 38	49	6.12	340	820	4.50	5.10	9.39	2.18
Ethylbenzene[c]	4.86 - 12	21	4.76	85	130	1.29	1.29	1.76	1.68
Fluoranthene	24 - 780	93	44.1	8.10	19	45	1,900	237	240
Fluorene	36 - 780	94	4.26	8.10	38	54	230	205	65.7
gamma-Chlordane	85 - 130	6	16.7	340	820	0	0	45.3	24.2
Heptachlor	2.5 - 19	49	2.04	18	190	0	0	4.76	1.08
Heptachlor epoxide	1.9 - 19	49	2.04	1.04	57	0	0	5.88	3.92
Indeno(1,2,3-cd)pyrene	24 - 780	94	9.57	340	820	72	220	203	67.2
Methoxychlor	0.91 - 190	49	6.12	0.765	820	3	9.40	45.5	14.5
Methylene Chloride	4.86 - 12	21	9.52	34	730	11	14	4.27	6.88
Naphthalene[c]	4.86 - 780	107	0.935	34	260	0.890	0.890	182	89.3
N-Nitroso-di-n-propylamine	24 - 780	94	1.06	34	730	400	400	210	64.8
Phenanthrene	37 - 780	94	35.1	340	820	40	1,600	216	193
Pyrene	41 - 780	94	56.4	340	820	43	1,800	221	239
Tetrachloroethene	4.86 - 12	21	4.76	1.18	12	1.73	1.73	1.84	1.63
Toluene[b]	4.86 - 12	21	4.76	1.22	12	2.26	2.26	1.88	1.62
Radionuclides (pCi/g)[d]									
Americium-241	0 - 0.261	290	N/A			0	15.6	1.81	2.42
Cesium-134	0.0271 - 0.2	35	N/A			-0.0101	0.200	0.0363	0.0537
Cesium-137	0.03 - 0.21	37	N/A			0.0500	2.01	0.781	0.565
Gross Alpha	2.2 - 56	49	N/A			-9.70	320	36.0	53.6
Gross Beta	1 - 21	56	N/A			4.95	64	33.2	8.88
Plutonium-238	0.0284 - 0.211	9	N/A			0.102	1.53	0.447	0.454
Plutonium-239/240	0 - 0.288	319	N/A			-0.00292	49	9.19	12.0
Radium-226	0.15 - 0.5	36	N/A			0.590	2.19	1.10	0.281
Radium-228	0.06 - 0.69	17	N/A			0.940	3.50	2.09	0.693
Strontium-89/90	0.04 - 0.99	17	N/A			-0.300	1.46	0.387	0.480
Uranium-233/234	0 - 0.674	204	N/A			0.119	7.96	1.11	0.792
Uranium-235	0 - 0.448	203	N/A			-0.0431	0.680	0.0802	0.0905
Uranium-238	0 - 0.438	204	N/A			0.300	3.78	1.11	0.463

[a] Values in this column are reported results for nondetects (i.e., U-qualified results).

[b] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[c] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

Lower Woman Drainage Exposure Unit

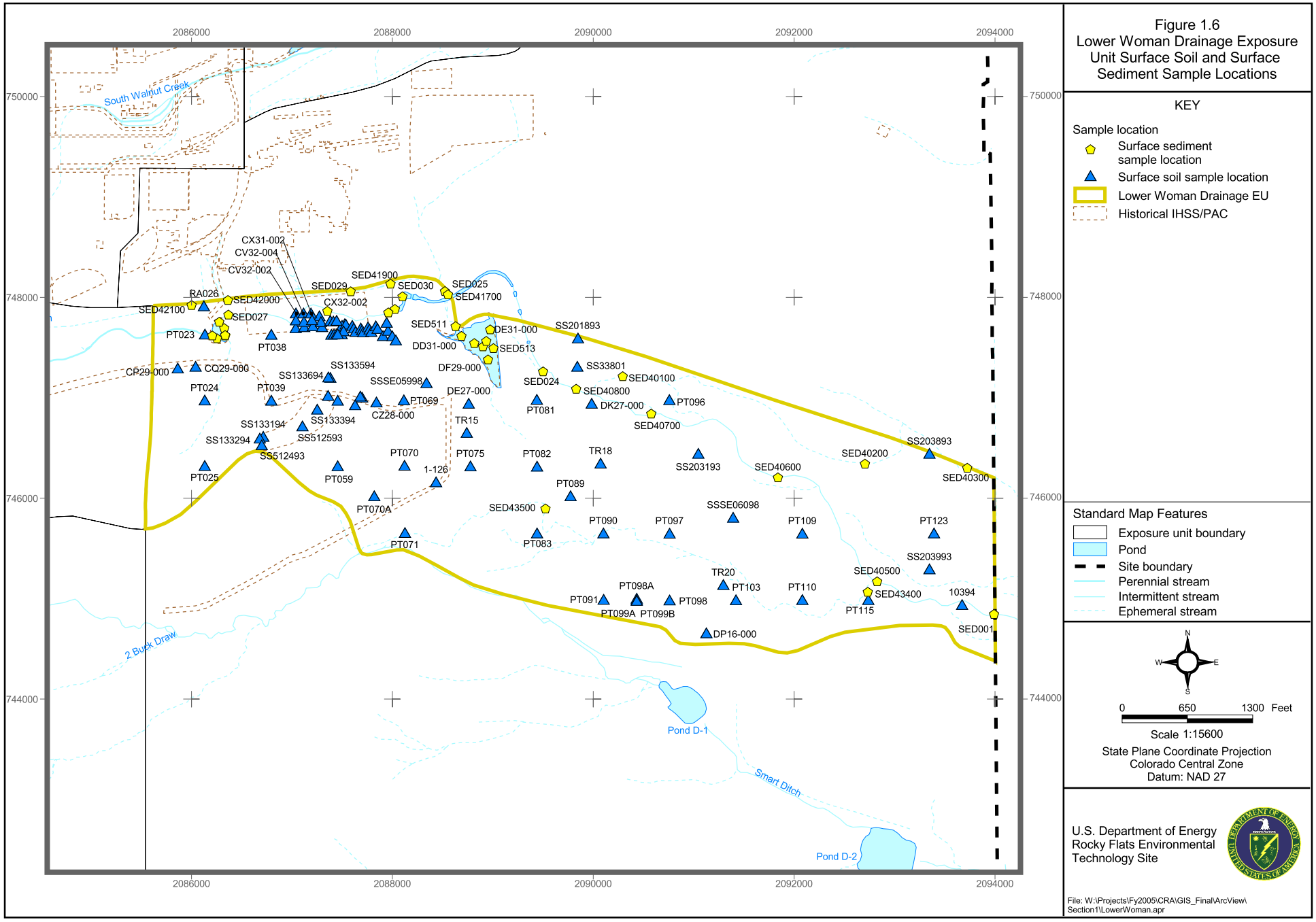

Figure 1.6
Lower Woman Drainage Exposure Unit Surface Soil and Surface Sediment Sample Locations

KEY

Sample location

- Surface sediment sample location
- Surface soil sample location
- Lower Woman Drainage EU
- Historical IHSS/PAC

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

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Scale 1:15600

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Rocky Flats Environmental Technology Site

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Table 1.2
Number of Samples in Each Medium by Analyte Suite

Analyte Suite	Surface Soil/Surface Sediment[a]	Subsurface Soil/Subsurface Sediment[a]	Surface Soil[b]	Surface Soil (PMJM)[b]	Subsurface Soil[b]
Inorganics	106	55	74	45	47
Organics	34	36	9	2	28
Radionuclides	144	31	98	41	20

[a] Used in the HHRA.

[b] Used in the ERA.

The total number of results (samples) for the analytes listed in Tables 1.3 to 1.7 may differ from the number of samples presented in Table 1.2 because not all analyses are necessarily performed for each sample.

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits[a]	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
Inorganics (mg/kg)							
Aluminum		106	100	1,990	31,000	14,428	6,497
Ammonia[c]		1	100	2.05	2.05	2.05	N/A
Antimony	0.29 - 19.4	91	33.0	0.300	9.80	2.23	2.84
Arsenic		106	100	1.50	9.80	5.60	1.77
Barium		106	100	26.6	330	151	53.4
Beryllium	0.27 - 1.3	105	86.7	0.180	6.70	0.850	0.656
Boron	5.7 - 7	56	94.6	2.30	14	7.30	2.28
Cadmium	0.028 - 1.9	104	49.0	0.110	1.80	0.436	0.281
Calcium		106	100	1,300	47,700	7,105	7,317
Cesium[c]	7 - 178	33	21.2	1.70	7	32.5	32.3
Chromium		106	100	3.30	30	15.8	6.48
Cobalt		106	100	1.60	20.2	8.02	2.42
Copper	5.5 - 8	106	98.1	7.60	170	18.8	16.1
Iron		106	100	4,320	38,000	17,697	5,720
Lead		106	100	6.40	210	42.1	38.3
Lithium	3.4 - 28.4	90	91.1	1.80	28	11.8	5.31
Magnesium		106	100	523	5,800	3,023	1,088
Manganese		106	100	106	1,580	388	208
Mercury	0.012 - 0.2	90	53.3	0.0130	0.680	0.0711	0.130
Molybdenum	0.4 - 6.7	90	62.2	0.370	5.40	1.17	1.03
Nickel	3.3 - 13.1	106	95.3	5.30	45.2	15.4	5.90
Nitrate / Nitrite	1.5 - 6.47	23	78.3	0.611	26.6	3.91	6.20
Potassium	1,080 - 2,610	106	96.2	401	5,160	2,672	1,039
Selenium	0.2 - 1.8	105	35.2	0.260	2.80	0.549	0.438
Silica[c]		56	100	560	1,600	1,016	211
Silicon[c]		20	100	145	2,000	653	615
Silver	0.079 - 2.5	97	6.19	0.150	1.70	0.376	0.422
Sodium	49.1 - 250	106	44.3	47.8	643	110	89.6
Strontium		92	100	9.70	167	47.6	25.2
Thallium	0.2 - 2.4	105	38.1	0.250	10	0.956	1.39
Tin	0.86 - 61.8	91	22.0	1.70	85.9	6.56	11.4
Titanium		56	100	53	360	192	69.9
Vanadium		106	100	6.90	71	37.2	12.6
Zinc		106	100	17.9	201	65.8	29.9
Organics (µg/kg)							
1,2,3,4,6,7,8-HpCDF		1	100	8.07E-04	8.07E-04	8.07E-04	N/A
2,4-Dinitrophenol	1,700 - 10,000	29	3.45	890	890	1,822	1,033
2-Butanone	12 - 23	12	16.7	3.00	63.0	12.7	16.0
4,6-Dinitro-2-methylphenol	1,700 - 10,000	31	3.23	750	750	1,776	1,016
4-Methyl-2-pentanone	12 - 32	15	6.67	3.00	3.00	9.10	3.08
4-Methylphenol	360 - 2,100	31	6.45	93.0	200	364	225
Acenaphthene	360 - 2,100	31	6.45	74.0	320	325	180
Acetone[c]	12 - 230	15	13.3	18.0	66.0	29.8	32.2
Aldrin	8.6 - 99	28	3.57	0	0	9.78	9.25
alpha-Chlordane	86 - 990	28	3.57	0	0	97.8	92.5
Anthracene	360 - 2,100	31	12.9	90.0	450	330	181
Aroclor-1254	360 - 2,100	31	12.9	64.0	190	322	208
Benzo(a)anthracene	360 - 2,100	31	9.68	66.0	170	341	214
Benzo(a)pyrene	360 - 2,100	31	9.68	120	180	342	205
Benzo(b)fluoranthene	360 - 2,100	31	3.23	150	150	360	211
Benzo(g,h,i)perylene	360 - 2,100	31	6.45	110	150	358	214
Benzo(k)fluoranthene	1,700 - 10,000	30	16.7	180	700	1,681	1,147
Benzoic Acid	8.6 - 99	28	3.57	0	0	9.78	9.25
beta-BHC	360 - 2,100	31	41.9	64.0	2,200	422	425
bis(2-ethylhexyl)phthalate	360 - 2,100	31	3.23	57.0	57.0	372	222
Butylbenzylphthalate	360 - 2,100	31	16.1	42.0	190	317	212
Chrysene	8.6 - 99	28	3.57	0	0	9.78	9.25
delta-BHC	360 - 2,100	31	3.23	530	530	372	209
Dibenz(a,h)anthracene	360 - 2,100	31	9.68	45.0	70.0	360	234
Di-n-butylphthalate	8.6 - 99	28	3.57	0	0	9.78	9.25
Endosulfan I	360 - 2,100	31	19.4	79.0	330	308	197
Fluoranthene	8.6 - 99	28	3.57	4.40	4.40	10.6	10.4

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits[a]	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
gamma-BHC (Lindane)	92 - 990	17	5.88	0	0	119	113
gamma-Chlordane	8.6 - 99	28	3.57	0	0	9.78	9.25
Heptachlor	8.6 - 99	28	3.57	0	0	9.78	9.25
Heptachlor epoxide		1	100	0.005	0.005	0.005	N/A
Heptachlorodibenzo-p-dioxin	360 - 2,100	31	6.45	340	500	363	204
Indeno(1,2,3-cd)pyrene	8 - 54	15	13.3	12.0	16.0	11.1	7.68
Methylene Chloride		1	100	0.031	0.031	0.031	N/A
OCDD		1	100	0.001	0.001	0.001	N/A
OCDF	58 - 2,000	32	9.38	94.0	220	199	202
Pentachlorophenol	1,700 - 10,000	31	3.23	950	950	1,782	1,009
Phenanthrene	360 - 2,100	31	19.4	46.0	360	322	184
Phenol	360 - 2,100	31	3.23	150	150	360	211
Pyrene	360 - 2,100	31	9.68	70.0	310	360	214
Toluene	6 - 12	16	31.3	2.00	410	75.4	149
Radionuclides (pCi/g)[d]							
Americium-241		131	N/A	-0.0153	1.66	0.265	0.306
Cesium-134		13	N/A	0.00200	0.200	0.0849	0.0520
Cesium-137		19	N/A	0.0391	1.18	0.349	0.315
Gross Alpha		29	N/A	-0.760	152	26.1	28.3
Gross Beta		29	N/A	8.02	45	28.6	10.5
Plutonium-238		6	N/A	0.00998	0.0601	0.0343	0.0198
Plutonium-239/240		140	N/A	-0.00192	12.2	1.58	1.98
Radium-226		10	N/A	0.985	2	1.30	0.310
Radium-228		9	N/A	1.19	2.80	1.94	0.519
Strontium-89/90		20	N/A	0.0300	3.24	0.636	0.932
Uranium-233/234		72	N/A	0.320	3.19	1.29	0.575
Uranium-235		72	N/A	-0.0562	0.405	0.0779	0.0789
Uranium-238		72	N/A	0.340	3.39	1.31	0.551

[a] Values in this column are reported results for nondetects (i.e., U-qualified results).

[b] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[c] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

Southeast Buffer Zone Exposure Unit

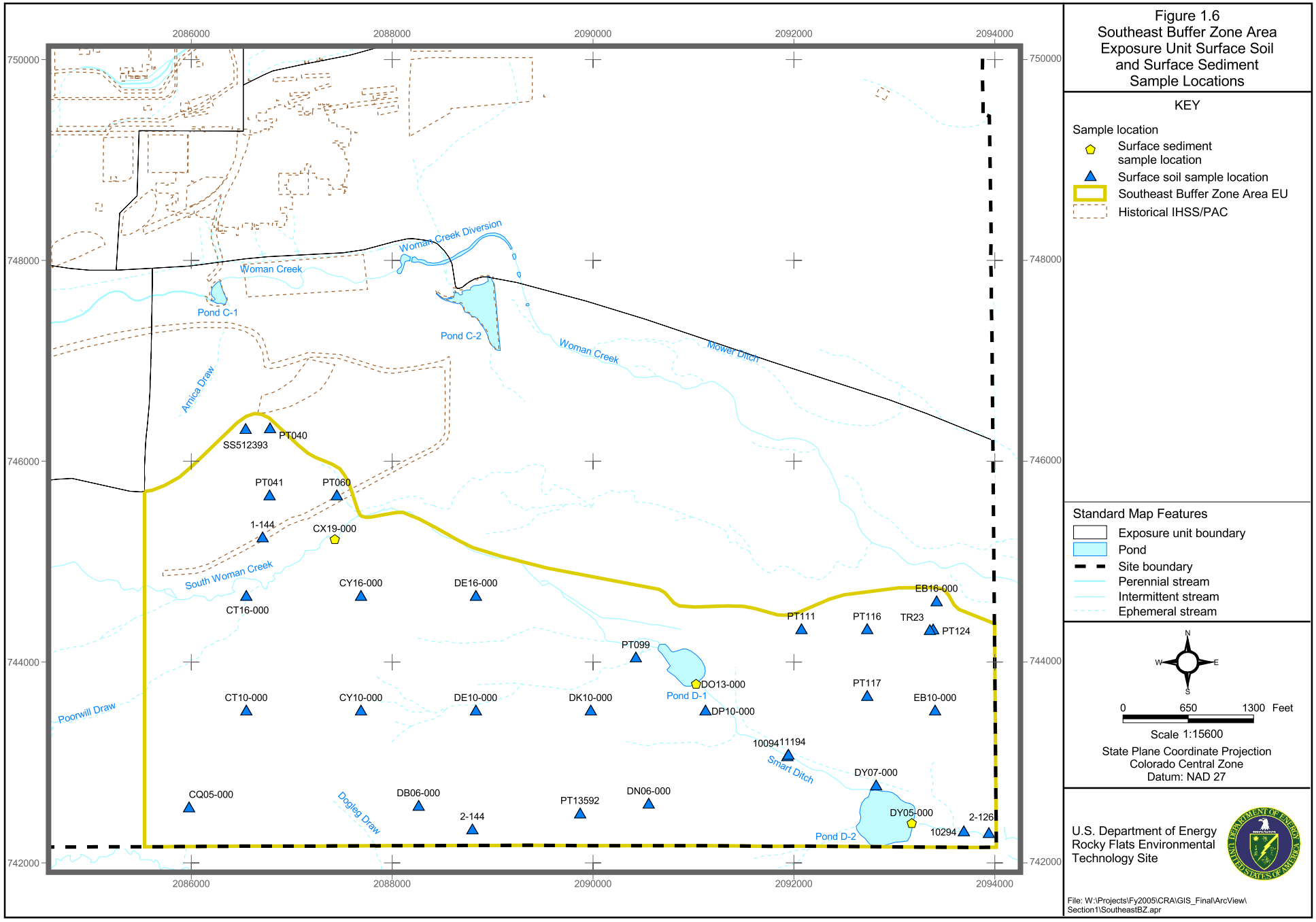

Figure 1.6
Southeast Buffer Zone Area
Exposure Unit Surface Soil
and Surface Sediment
Sample Locations

KEY

Sample location
- Surface sediment sample location
- Surface soil sample location
- Southeast Buffer Zone Area EU
- Historical IHSS/PAC

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W
E
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0 650 1300 Feet

Scale 1:15600

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

File: W:\Projects\Fy2005\CRA\GIS_Final\ArcView\Section1\SoutheastBZ.apr

Table 1.2
Number of Samples in Each Medium by Analyte Suite

Analyte Suite	Surface Soil/Surface Sediment[a]	Subsurface Soil/Subsurface Sediment[a]	Surface Soil[b]	Subsurface Soil[b]
Inorganic	22	7	19	6
Organic	1	7	1	7
Radionuclide	55	9	52	8

[a] Used in the HHRA.

[b] Used in the ERA.

Note: The total number of results (samples) in Tables 1.3 through 1.6 may differ from the total number of samples presented in Table 1.2 because not all analyses are necessarily performed for each sample.

Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits[a]	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[b]	Standard Deviation[b]
Inorganics (mg/kg)							
Aluminum		22	100	5,860	26,000	15,613	5,417
Antimony[c]	0.31 - 13.5	21	33.3	0.350	0.590	1.27	2.23
Arsenic		22	100	2.50	23	7.40	4.15
Barium		22	100	57	240	142	46.2
Beryllium	0.81 - 1	22	86.4	0.520	1.50	0.874	0.314
Boron		17	100	3.70	19	6.93	3.52
Cadmium	0.073 - 1	22	72.7	0.120	1	0.368	0.206
Calcium		22	100	1,760	55,000	9,195	11,667
Cesium[c]	6.8 - 7.8	3	33.3	14.5	14.5	7.27	6.27
Chromium		22	100	7.30	27	17.1	5.66
Cobalt		22	100	2.80	10.4	7.69	1.88
Copper		22	100	7.80	27	15.7	4.71
Iron		22	100	7,970	52,000	22,058	11,195
Lead		22	100	4.80	37	23.1	7.01
Lithium	6.7 - 6.7	19	94.7	5.20	23	13.6	5.62
Magnesium		22	100	1,360	7,100	3,236	1,316
Manganese		22	100	55	1,300	386	237
Mercury	0.0076 - 0.1	19	36.8	0.0140	0.0290	0.0155	0.0117
Molybdenum	0.86 - 4.7	21	81.0	0.260	1.90	1.08	0.591
Nickel		22	100	9.30	35	16.2	5.84
Potassium		22	100	1,200	5,200	3,066	873
Selenium	0.21 - 1.2	22	13.6	0.270	1.70	0.448	0.307
Silica		17	100	580	2,900	1,007	555
Silver	0.099 - 1.5	21	33.3	0.120	0.390	0.250	0.219
Sodium	56.5 - 130	22	22.7	54.8	510	79.0	98.2
Strontium		21	100	12.1	290	56.3	56.9
Thallium	0.21 - 1.1	22	9.09	2.30	2.60	0.575	0.632
Titanium		17	100	64	260	144	53.1
Uranium	1.3 - 1.7	17	23.5	1.60	2.80	1.09	0.640
Vanadium		22	100	22	140	50.0	25.7
Zinc		22	100	18	81	54.3	15.7
Radionuclides (pCi/g)[d]							
Americium-241		46	N/A	-0.00600	0.381	0.0466	0.0624
Cesium-137		1	N/A	0.661	0.661	0.661	N/A
Gross Beta		6	N/A	18	41	26.8	7.79
Plutonium-239/240		54	N/A	0.00205	4.60	0.251	0.628
Radium-226		1	N/A	2.02	2.02	2.02	N/A
Radium-228		1	N/A	1.59	1.59	1.59	N/A
Uranium-233/234		37	N/A	0.119	1.52	0.762	0.445
Uranium-235		37	N/A	-0.0564	0.344	0.0511	0.0725
Uranium-238		37	N/A	0.162	1.81	0.820	0.433
Cesium-134		1	N/A	-0.265	-0.265	-0.265	N/A
Gross Alpha		6	N/A	8.47	43	17.0	13.3
Strontium-89/90		3	N/A	0.110	0.171	0.140	0.0304

[a] Values in this column are reported results for nondetects (i.e., U-qualified results).

[b] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[c] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

Note: Organics were not detected.

EPA Sampling

Exposure Unit	Cell	Location	Csoil (pCi/g dry)																																
			Am241	Ba140	Be7	Bi212	Bi214	Ce141	Co60	Cs137	I131	K40	Pb210	Pb212	Pb214	Pu238	Pu239	Ra223	Ra224	Ra226	Ra228	Rn220	Sr89	Sr90	Th228	Th234	Tl208	U234	U235	U238	Alpha	Beta
West Area	A10	AK56-000	0.05	ND	--	2.13	0.835	--	ND	1.34	ND	15.2	ND	1.98	0.875	0.016	0.027	0.464	1.7	1.91	2	--	0.3	0.69	3	1.01	0.654	0.93	0.118	0.64	30	39.8
		AK56-A10-S1	0.17	ND	--	2.18	0.861	--	ND	1.03	ND	17.1	ND	2.05	0.915	-0.03	0.04	0.476	1.74	1.87	2.2	--	1.4	16.3	--	1.18	0.7	0.9	0.117	0.55	21	36.8
		AK56-A10-S2	-0.1	ND	0.29	2.25	0.891	--	ND	2.04	ND	18	ND	2.14	0.976	-0.03	0.027	0.462	2.11	2.12	2.27	--	-0.8	0.9	--	--	0.723	1.33	0.131	0.81	30	50.2
Inter Drainage	D8	AZ45-D8-00	-0.1	ND	--	2.34	0.908	--	ND	0.91	ND	18.2	ND	2.31	1.05	0.06	0.064	0.47	2.44	2.26	2.46	--	0.3	0.63	--	1.06	0.735	0.98	0.142	0.79	33	41.1
		AZ45-D8-NE	0.06	ND	--	2.54	0.969	--	ND	1.13	ND	18.1	ND	2.34	1.03	0.09	0	0.509	2.1	2.44	2.38	--	6.1	-1.2	--	1.01	0.825	0.73	0.151	0.77	29	35.1
		AZ45-D8-NW	0.25	ND	0.26	2.23	0.918	--	ND	1.04	ND	17.9	2.7	2.12	1.06	-0.02	-0.02	--	2.19	2.17	2.22	--	3.6	-0.69	3.9	--	0.722	0.84	0.136	0.53	40	42
		AZ45-D8-SE	0.17	ND	--	2.6	1	--	ND	1.3	ND	17.8	ND	2.4	1.06	-0.03	0.015	0.522	2.11	1.8	2.46	--	-0.1	0.8	--	0.71	0.826	0.9	0.113	0.63	38	40.5
		AZ45-D8-SW	0.05	ND	--	2.43	0.979	--	ND	1.1	ND	17	ND	2.18	1.03	-0.01	0.061	--	1.97	2.09	2.33	--	2.1	-0.11	--	0.67	0.75	0.61	0.131	0.61	26	45.4
Rock Creek Drainage	K14	CN79-K14-00	0.12	ND	0.47	1.56	0.73	--	ND	0.534	ND	16.4	ND	1.56	0.785	-0.04	0.006	0.36	1.3	1.73	1.62	--	0.2	0.69	--	--	0.518	0.85	0.109	0.62	15	35.6
		CN79-K14-NE	0.09	ND	--	1.53	0.749	--	ND	0.714	ND	13.3	2.16	1.24	0.806	0.05	0.012	0.393	1.21	1.98	1.29	--	1	0.24	--	0.97	0.445	0.96	0.126	0.87	19	28.8
		CN79-K14-NW	0.12	ND	--	1.55	0.776	--	ND	0.482	ND	16.3	ND	1.44	0.826	0.01	-0.01	0.42	1.41	1.77	1.55	--	1.1	0.25	--	0.97	0.499	0.67	0.111	0.7	19	29.9
		CN79-K14-SE	0.15	ND	--	1.25	0.515	--	ND	0.937	ND	14	ND	1.2	0.573	0.036	0.063	0.304	1.25	1.13	1.3	--	--	--	--	0.62	0.412	0.61	0.071	0.62	30	30.6
		CN79-K14-SW	0.02	ND	--	1.23	0.681	--	ND	0.706	ND	15.6	ND	1.23	0.706	0.035	0.027	0.333	1.32	1.6	1.28	--	--	--	--	--	0.412	0.83	0.099	0.83	17	26.5
Southwest Buffer Zone Area	H2	BW10-H2-00	0.14	ND	--	2.08	0.832	--	ND	0.526	ND	15	ND	2.05	0.858	0.016	0.072	0.461	1.69	ND	2.12	--	--	--	--	--	0.693	0.81	0.126	0.7	26	36.4
		BW10-H2-NE	0.16	ND	--	1.62	0.7	--	ND	0.788	ND	16.3	ND	1.66	0.758	-0.01	0.024	0.451	1.54	2.46	1.79	--	--	--	--	1.4	0.553	1.9	0.15	1.59	19	27.2
		BW10-H2-NW	0.01	ND	--	1.88	0.734	--	ND	0.74	ND	11.7	ND	1.76	0.801	0.034	0.062	0.398	1.89	1.89	1.9	--	--	--	--	0.89	0.582	0.99	0.119	0.77	24	33.6
		BW10-H2-SE	13.9	ND	--	2.06	0.743	--	ND	0.849	ND	13.9	ND	1.99	0.912	0.051	0.084	0.403	1.81	1.94	2.13	--	--	--	--	0.95	0.623	0.99	0.122	0.78	32	30.6
		BW10-H2-SW	-0.01	ND	--	1.94	0.776	--	ND	0.642	ND	13.6	ND	1.84	0.863	-0.01	0.055	0.503	1.66	1.96	2.07	--	--	--	--	--	0.578	0.9	0.123	0.87	30	30.6
Upper Woman Drainage	G3	BQ16-G3-00	0.16	ND	--	2.1	0.784	--	ND	0.76	ND	11.9	1.65	1.92	0.884	-0.02	0.077	0.463	2.06	1.71	1.98	--	--	--	--	1.29	0.63	0.91	0.107	0.85	30	27.9
		BQ16-G3-NE	0.01	ND	--	1.92	0.807	--	ND	1.03	ND	11.6	3.1	1.82	0.877	0.049	0.09	0.382	1.63	2.01	1.93	--	--	--	--	0.72	0.622	1.12	0.126	1.16	32	36
		BQ16-G3-NW	0.039	ND	--	2.24	0.821	--	ND	0.968	ND	13.4	3.46	1.85	0.866	0.071	0.046	0.372	2.23	1.79	1.97	--	--	--	--	1.82	0.653	1.09	0.112	1.08	23	32.7
		BQ16-G3-SE	0.01	ND	--	2.34	0.829	--	ND	0.827	ND	12.1	2.31	2.01	0.9	0.028	0.053	0.46	1.56	2.17	2.09	--	--	--	--	0.88	0.661	1.04	0.132	1.03	29	34
		BQ16-G3-SW	-0.01	ND	--	2.17	0.771	--	ND	1.15	ND	11.6	1.87	1.93	0.875	-0.02	0.096	0.399	2.01	1.77	2.03	--	--	--	--	1.19	0.656	1.03	0.109	1.03	31	39.3
Industrial Area	G8	BQ44-G8-00	0.069	ND	0.41	2.4	0.982	--	ND	1.16	ND	16.8	3.13	2.1	1.05	-0.01	0.055	0.478	2.03	2.32	2.19	--	--	--	--	0.99	0.699	1.06	0.146	1.15	41	43.7
		BQ44-G8-NE	0.08	ND	--	1.81	0.68	--	ND	0.713	ND	16.9	ND	1.91	0.821	-0.01	0.022	0.42	2	1.28	2.01	--	--	--	--	--	0.6	0.88	0.088	0.97	32	37.9
		BQ44-G8-NW	0.014	ND	--	2.31	0.986	--	ND	0.31	ND	18.3	1.09	2.14	1.04	0.033	0.052	0.491	1.84	1.98	2.22	--	--	--	--	0.8	0.706	0.8	0.123	1.17	16	39.1
		BQ44-G8-SE	-0.06	ND	--	1.78	0.739	--	ND	0.075	ND	17.8	2.06	1.63	0.788	-0.03	0.009	0.424	1.44	1.75	1.77	--	--	--	--	0.88	0.548	1.17	0.11	1.27	32	34.1
		BQ44-G8-SW	0.017	ND	--	2.44	0.906	--	ND	0.632	ND	17.6	ND	2.07	0.98	0.04	0.058	0.48	1.77	2.19	2.04	--	--	--	--	0.83	0.777	1.19	0.137	1.61	32	38.7
No Name Gulch Drainage	K12	CN67-K12-00	0.13	ND	--	1.61	0.83	--	ND	0.816	ND	15	ND	1.74	0.933	0.023	0.053	0.412	1.49	1.93	1.77	--	--	--	--	0.99	0.579	0.97	0.121	1.06	26	40.4
		CN67-K12-NE	0.018	ND	--	1.71	0.788	--	ND	0.84	ND	15.4	ND	1.71	0.842	-0.02	0.068	0.454	1.86	1.58	1.81	--	--	--	--	1.05	0.592	0.97	0.099	0.97	33	39.6
		CN67-K12-NW	-0.01	ND	--	1.65	0.723	--	ND	0.802	ND	15.5	ND	1.61	0.839	0.014	0.062	0.315	1.41	1.79	1.64	--	--	--	--	0.82	0.545	1.22	0.112	1.16	35	34.5
		CN67-K12-SE	-0.02	ND	--	1.78	0.781	--	ND	0.227	ND	15.4	ND	1.63	0.886	-0.06	-0	0.39	1.33	1.83	1.75	--	--	--	--	0.67	0.543	0.73	0.115	1.01	9	31.1
		CN67-K12-SW	0.105	ND	--	1.51	0.68	--	ND	0.238	ND	12.7	ND	1.51	0.776	0.037	0.037	0.401	1.31	1.54	1.53	--	--	--	--	0.58	0.506	0.76	0.096	0.75	12	29.5
Southeast Buffer Zone Area	N2	DE10-N2-00	0.02	ND	--	2.01	0.791	--	ND	0.919	ND	17	ND	1.61	0.928	0.025	0.209	0.36	1.67	2.12	1.83	--	--	--	--	--	0.531	0.91	0.133	1.01	13	28.5
		DE10-N2-NE	0.018	ND	--	1.67	0.861	--	ND	0.32	ND	16.9	ND	1.5	0.924	-0.08	0.036	0.377	1.01	1.76	1.66	--	--	--	--	--	0.522	0.9	0.111	0.92	14	28
		DE10-N2-NW	0.016	ND	--	1.63	0.811	--	ND	0.981	ND	17.9	ND	1.6	0.854	0.1	0.091	0.258	1.53	1.84	1.7	--	--	--	--	--	0.534	0.7	0.114	0.66	13	37.2
		DE10-N2-SE	0.027	ND	--	1.72	0.972	--	ND	0.66	ND	14.7	ND	1.7	1.02	0.06	0.129	0.409	1.37	2.3	1.74	--	--	--	--	0.94	0.568	0.89	0.142	0.96	20	34.5
		DE10-N2-SW	0.056	ND	--	1.63	0.873	--	ND	1.52	ND	14	ND	1.66	0.931	0.006	0.168	0.347	1.69	2.2	1.68	--	--	--	--	--	0.527	0.79	0.135	0.91	20	31
Lower Woman Drainage	O5	DK27-05-00	0.24	ND	--	2.17	0.94	--	ND	0.511	ND	17	ND	1.88	1.03	0.17	2.16	0.394	1.77	2.02	2	--	--	--	--	0.76	0.67	0.91	0.126	0.81	33	27.9
		DK27-05-NE	0.54	ND	--	2.62	1.09	--	ND	0.505	ND	17.7	ND	2.51	1.12	0.26	5.02	0.544	2.23	2.37	2.68	--	--	--	--	0.94	0.881	1.12	0.149	1.03	34	42.8
		DK27-05-NW	0.27	ND	--	2.59	1.04	--	ND	0.403	ND	16.8	ND	2.47	1.11	0.13	2.23	0.569	2.08	2.69	2.55	--	--	--	--	0.98	0.835	0.87	0.169	1	26	34.5
		DK27-05-SE	0.38	ND	--	2.38	1.01	--	ND	0.458	ND	17	ND	2.15	1.06	0.15	3.08	0.538	2.36	2.34	2.14	--	--	--	--	1.41	0.758	1.22	0.141	1.12	14	33.5
		DK27-05-SW	0.39	ND	--	2.18	1.06	--	ND	0.692	ND	17.1	ND	2.07	1.07	0.098	3.3	--	2.31	2.37	2.11	--	--	--	4.9	--	0.69	0.97	0.149	0.96	37	28.8
Wind Blown Area	N6	DE33-N6-00	0.22	ND	--	2.19	0.974	--	ND	0.127	ND	17.9	ND	2.01	1.05	0.136	1.56	0.505	1.97	2.29	2.16	--	--	--	--	0.96	0.671	1.11	0.138	0.86	19	30.7
		DE33-N6-NE	1.55	ND	0.28	1.52	0.684	--	ND	0.505	ND	16.3	ND	1.38	0.771	0.26	10.9	0.326	1.22	1.71	1.42	--	--	--	--	0.45	0.458	0.72	0.107	0.81	27	30.1
		DE33-N6-NW	1.73	ND	--	1.73	0.87	--	ND	0.674	ND	16.9	ND	1.77	0.948	0.51	13	0.403	1.87	2.29	1.91	--	--	--	--	--	0.624	1.18	0.144	1.03	49	34.6
		DE33-N6-SE	0.17	ND	--	2.2	0.924	--	ND	0.113	ND	18.4	2.16	1.99	1.03	0.059	1.04	0.491	1.9	2.04	2.12	--	--	--	3.1	0.9	0.674	0.86	0.125	0.92	21	34
		DE33-N6-SW	0.28	ND	--	1.82	0.924	--	ND	0.094	ND	16.9	2.21	1.87	1.07	0.016	1.27	0.434	1.56	2.21	1.9	8.4	--	--	--	0.86	0.603	0.87	0.132	0.78	16	33.4
Upper Walnut Drainage	N9	DE50-N9-00	0.04	ND	--	1.45	0.882	--	ND	0.219	ND	14	1.81	1.27	0.949	0.054	0.181	0.296	1.2	2.08	1.37	--	--	--	--	1.22	0.424	0.99	0.129	1.1	8	22.6
		DE50-N9-NE	0.14	ND	--	1.33	0.86	0.15	ND	0.556	ND	15	ND	1.17	0.939	0.23	0.59	0.328	1.05	2.06	1.33	--	--	--	--	0.93	0.379	1.38	0.128	1.15	14	23.9
		DE50-N9-NW	0.04	ND	--	1.47	0.984	--	ND	0.378	ND	16.4	ND	1.35	1.11	0.022	0.154	0.364	1.21	2.2	1.45	--	--	--	--	0.88	0.466	1.02	0.138	0.98	18	23.5
		DE50-N9-SE	0.21	ND	--	1.4	0.692	--	ND	0.838	ND	16.2	ND	1.31	0.764	0.04	0.72	0.299	1.25	1.83	1.46	--	--	--	--	0.63	0.431	0.78	0.115	0.59	19	29.7
		DE50-N9-SW-M	0.028	ND	--	1.35	0.778	--	ND	0.055	ND	15.9	ND	1.34	0.838	0.018	0.046	0.326	1.26	1.84	1.47	--	--	--	--	0.83	0.433	0.85	0.116	0.82	24	27.4
Lower Walnut Drainage	N14	DE78-N14-00	0.051	ND	--	1.58	0.898	--	ND	0.691	ND	16.8	ND	1.51	0.963	0.031	0.026	0.426	1.05	1.65	1.64	--	--	--	--	1.01	0.488	0.94	0.104	0.84	23	32.6
		DE78-N14-NE	0.039	ND	--	1.4	0.808	--	ND	0.782	ND	16.2	ND	1.38	0.903	0.009	0.035	0.339	1.27	1.8	1.56	--	--	--	--	0.82	0.459	0.75	0.113	0.69	26	33.4
		DE78-N14-NW	0.06	ND	--	1.55	0.852	--	ND	0.642	ND	16.2	ND	1.43	0.895	0.24	0.146	0.399	1.41	1.73	1.6	--	--	--	--	--	0.481	0.98	0.109	0.93	24	26.1
		DE78-N14-SE	0.05	ND	--	1.36	0.819	--	ND	0.952	ND	15.2	ND	1.34	0.912	0.023	0.038	0.356	1.22	1.47	1.49	--	--	--	--	0.54	0.447	0.75	0.092	0.81	18	27.1
		DE78-N14-SW	0.12	ND	--	1.74	0.864	--	ND	0.635	ND	18.1	ND	1.62	0.962	0.02	0.078	0.37	1.56	1.94	1.84	--	--	--	--	0.53	0.541	0.87	0.121	0.89	27	29.7

2000 Dust Sampling

Correlating Plutonium Activity in Fugitive Dust to Plutonium Concentration in Surface Soils at Rocky Flats, Colorado

Paper #170

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ABSTRACT

A primary source of airborne plutonium exposure to public receptors near the U.S. Department of Energy's Rocky Flats Environmental Technology Site is the wind resuspension of plutonium-contaminated soil particles. Attempts to model dispersion of plutonium-laden particulate matter by wind have been limited by uncertainty about the correlation between the measured soil plutonium concentration and the plutonium

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concentration observed in particles eroded from the soil reservoir by wind. This study examined the relationship between plutonium activity in resuspended dust in the less than 10 micrometer aerodynamic equivalent diameter size range and total suspended particulate size range (PM10 and TSP, respectively) as a function of soil particle size, plutonium activity, and surface condition.

A portable wind tunnel was used to simulate wind erosion of slightly contaminated soil surfaces and to sample the resulting resuspended particulate matter. Vegetation covering the study area had been burned by a lightning-caused wildfire six weeks prior to the study, which increased undisturbed soil erosion potential by removing much protective vegetation and thatch from the study area. Two wind tunnel trials were performed on soil surfaces that had been uniformly disturbed by raking; two additional trials were performed on undisturbed soil surfaces. Wind tunnel particulate samples were collected on a backup filter (PM10) and in a cyclone preseparator that retained particles larger than PM10. Cyclone samples were sieved to remove particles larger than ~45 micrometer diameter, leaving particles between 10 and ~45 micrometers (approximating TSP minus the PM10). Particulate samples were analyzed for radiochemical composition and the results were compared to radiochemical analyses of co-located surface soil samples collected to a depth of less than two centimeters. Soil samples were sieved into three size fractions to estimate soil plutonium activity distribution by particle size fraction.

This study determined that plutonium specific activity in TSP resuspended from disturbed and undisturbed soil surfaces was equal to the plutonium specific activity in the shallow soil reservoir; PM10 from disturbed soil behaved similarly. In contrast, the specific activity of PM10 resuspended from undisturbed soil was significantly lower than the specific activity of the underlying soil. These results suggest that soil samples are not necessarily representative of the source material actually available for wind erosion from undisturbed soil surfaces, though they may be used to accurately estimate the specific activity in dust blown from disturbed soil surfaces.

INTRODUCTION

Risk estimation for the inhalation of plutonium-contaminated airborne soil particles is limited by current knowledge of contaminant resuspension and transport mechanisms through the environment. Attempts to model resuspension and dispersion of plutonium-laden particulate matter by wind have been limited by uncertainty about the relationship between plutonium concentrations in source areas and downwind plutonium activity resulting from airborne resuspension of dust from those source areas.[1] This study quantifies the relationship between the average plutonium concentration in the top 2 centimeters (cm) of soil and the plutonium concentrations in airborne particulate matter samples collected using a portable wind tunnel to simulate wind erosion.

History

The U.S. Department of Energy's Rocky Flats Environmental Technology Site (Site), formerly the Rocky Flats Plant, has several areas of plutonium-contaminated soil as a

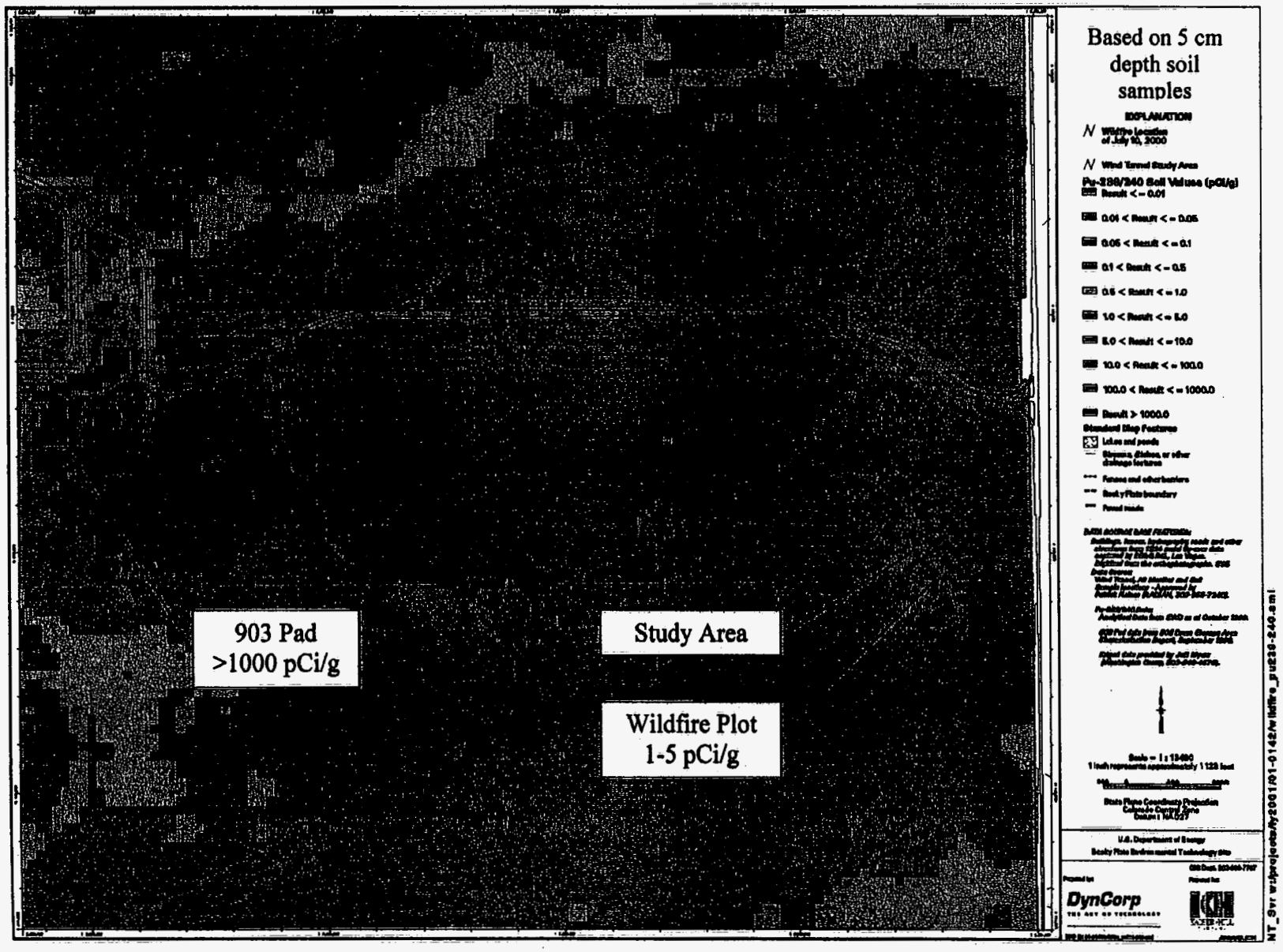
result of spills and releases during the Site's nuclear weapons production era. One of these areas, the 903 Pad, was contaminated when waste oils containing plutonium leaked out of corroded storage drums into the surrounding soils; this area source is a primary contributor to potential airborne plutonium exposure to public receptors near the Site.[2] Figure 1 illustrates the migration of plutonium particles in the predominant downwind direction from 903 Pad toward the study area. The isopleths shown are based on soil samples of 5 cm depth (the Site standard soil sampling procedure requires homogenized samples of 5 cm depth[3]). Strong westerly winds have redistributed plutonium contamination to the east of the 903 Pad. No spills or other significant releases are known to have occurred in the study area to the east of this source area – all plutonium activity in the study area soil is believed to have been redistributed from the 903 Pad through natural environmental processes, primarily wind resuspension and deposition.

In July 2000, a wildfire caused by lightning burned approximately 10 acres of grassland in the Site's buffer zone (a large, undeveloped area surrounding the Site's industrial area) east of the 903 Pad The burned area was denuded of vegetation and thatch, which increased undisturbed soil erosion potential by removing much of the protective cover. Previous wind tunnel experiments at the Site indicated that the dense natural cover of the buffer zone vegetation and thatch reduced initial wind erosion potential by up to nine-fold compared to soil exposed after a prescribed fire.[4] The soil exposed by the wildfire, which was contaminated over time through air deposition of plutonium-contaminated particles originating from the 903 Pad, provided an opportunity to determine experimentally the relationship between soil plutonium activity and plutonium activity in the dust resuspended from that soil.

Related Studies

Studies by Ranville, et al.,[5] have suggested that soil plutonium activity is partitioned among particle size classes in proportion to the particle masses, not in proportion to particle surface area. As will be shown in this paper, soil samples taken in this study confirmed Ranville's observations. These results are also consistent with Langer's characterization of plutonium activity correlating to increasing airborne particle size downwind of the 903 Pad.[6]

Figure 1: Buffer Zone Plutonium Isopleth



METHODS

Testing of wind-generated particle emissions was initiated on August 22, 2000. A wind tunnel provided by Midwest Research Institute was used to perform the tests. The wind tunnel is similar in design to the wind tunnel described in the *Air/Superfund National Technical Guidance Study Series, Volume II, Estimates of Baseline Air Emissions at Superfund Sites*,[7] but has a smaller working section (15 cm x 240 cm open floor) and cross-section (15 cm by 15 cm). Prior to conducting wind tunnel trials, soil samples of 1 to 2 cm depth were collected from four discrete locations around the wind tunnel test plots.

Soil Sampling

Four locations surrounding the wind tunnel test plots in the wildfire area were selected for surface soil sampling. These locations were representative of the source material available to wind erosion, based on soil type, slope angle, and type and density of vegetative cover. The texture of soils throughout the study area was essentially homogenous.

Soil samples were incrementally collected using whisk brooms and shallow pans. Surface soil was sampled to a depth of less than 2 cm. In each sampling area, approximately eight incremental samples were hand sieved into three size fractions until sufficient quantity of each size fraction had been obtained to fill a 125 milliliter (ml) sample jar. The purpose of the sample size segregation was to determine whether plutonium (Pu-239/240) specific activity (radioactivity per unit mass) in the fine fraction, which would be preferentially resuspended by the wind tunnel, was significantly different than plutonium specific activity in the bulk soil. The Site soil sampling protocol[3] requiring samples of 5 cm depth was not used for this study because particulates were not expected to become resuspended by wind from such depth. The <2 cm depth soil samples collected during this study corresponded with the 1-2 cm depth disturbance created by raking in two of the four wind tunnel trials.

Each incremental surface soil sample was hand sieved, using a nest of two sieves and a bottom pan. The coarse soil particles were collected on the top sieve, a standard sieve No. 30 (600 micrometer [μm] openings). An intermediate soil fraction passed through sieve No. 30 but was captured on a standard sieve No. 200 (75 μm openings). Finally, the fine fraction passed the standard sieve No. 200 and was captured in the pan. Before the incremental surface soil samples were sieved, the larger pebbles (few) and larger pieces of organic material (dead and burnt grass, occasional deer droppings) were manually retrieved and discarded.

Sieving was performed by manually rotating and tapping the covered nest of sieves at the sampling location. Forty rotations were performed by hand for each sample, and the sieves were tapped by hand after each ten rotations. After hand sieving, each size fraction was transferred to a labeled 125 ml sample bottle. This method is very similar to the hand-sieving procedure found in AP-42, EPA's *Compilation of Air Pollutant*

Emission Factors.[8] A gravimetric analysis of each size fraction was performed in the field at each sample location to determine the mass ratio of the soil size fractions.

Wind Tunnel Trials

In operating the wind tunnel, the open-floored test section was placed directly over the surface to be tested. Air was drawn through the tunnel at controlled velocities, increasing at 2 meter per second (m/s) (5 mile per hour [mph]) increments, to a maximum velocity of about 27 mph at the tunnel centerline. This corresponded to a wind speed of approximately 100 mph at 10 meters (m) height.[9]

A pitot was used to measure the centerline wind speed in the open-floored test section. The volumetric flow rate through the wind tunnel was determined from a published relationship between the maximum centerline velocity in a circular duct and the average velocity, as a function of Reynolds' number.[10] Because the ratio of the centerline wind speed in the sampling extension to the centerline wind speed in the working section was nearly independent of flow rate, the ratio could be used to determine isokinetic sampling conditions for any flow rate in the tunnel.

The exit air stream from the test section was passed through a circular duct fitted with a sampling probe near the downstream end. The particulate sampling train, which was operated at 68 cubic meters per hour (m^3/hr) (40 actual cubic feet per minute [acfm]), consists of the tapered sampling probe pointed into the airstream, cyclone pre-collector, glass fiber backup filter, and high-volume motor. Sampled total suspended particulate (TSP) emissions were separated into two particle size fractions by the calibrated[11] cyclone: particles smaller than 10 μm aerodynamic equivalent diameter (PM10) were collected on the backup filter below the cyclone, while the cyclone captured particles larger than PM10.

For test surfaces without a well-defined threshold velocity, as was the case for this study, sampling was initiated as air began to flow through the wind tunnel. After the prescribed sampling period, which ended at the highest wind speed plateau, the flow was shut off and the particulate samples were recovered. The cyclone catch was sieved using a standard sieve No. 325 (45 μm openings) to remove vegetative material and detritus. The sieved portion of the cyclone catch, when recombined (mathematically) with the PM10 from the backup filter, represented TSP.

A high-volume ambient air sampler was operated at 68 m^3/hr (40 acfm) near the inlet of the wind tunnel to provide for measurement of the contribution of the ambient background particulate matter. The filter was vertically oriented, parallel to the tunnel inlet face. By sampling under light ambient wind conditions, background interference from upwind erosion sources can usually be minimized. Unfortunately, during two of the four wind tunnel tests it appeared that recirculation of wind tunnel exhaust or dust resuspended during surface preparation of test plots may have entered the wind tunnel inlet and co-located background sampler. Background corrections of sample masses and activities accounted for any such bias.

Dust samples from the field tests were returned to an environmentally controlled laboratory for gravimetric analysis. Glass fiber filters were conditioned at constant temperature (23 degrees Celsius [°C] ±1°C) and relative humidity (45% ± 5%) for 24 hours prior to weighing (the same conditioning procedure as used before tare weighing). The particulate catch from the cyclone pre-collector was weighed in the tared poly bag.

Isotopic Analyses

After weighing, all soil and particulate samples were ashed and acid digested. Plutonium (Pu-239/240) was separated from other radioisotopes by anion exchange chromatography, then counted by alpha spectroscopy.[12,13] The Pu-239/240 specific activity in soil and cyclone dust was reported in pCi/g; Pu-239/240 activity on filters was reported in disintegrations per minute per filter (dpm/filter) and converted to pCi/g using the following equation:

$$\text{Specific Activity, pCi/g} = \frac{(\text{filter activity, dpm})(0.45\ \text{pCi/dpm})}{(\text{filter weight, g} - \text{filter tare, g})} \qquad (1)$$

RESULTS

As shown in Table 1, over 90% of the surface soil in the wildfire area was in the coarse and intermediate particle size ranges. The coarse soil fraction contained the least Pu-239/240 specific activity ($\bar{x}$ =1.27 pCi/g, σ =0.24). The two smaller size fractions exhibited similar specific activities of 2.09 pCi/g for the intermediate fraction (σ =0.35), and 1.77 pCi/g for the fine fraction (σ =0.31), with slightly more activity among intermediate size particles. Though variability existed among the specific activities of the three soil size fractions, the mean specific activity in the fine (resuspendable) fraction was essentially equal to the mean specific activity of the bulk soil. This suggests that, for this soil reservoir, specific activity of resuspendable fractions (fines) is equivalent to bulk soil specific activity. This is useful because most soil data for the Site do not include particle size information.

Four wind tunnel trials, identified as CB-20, CB-21, CB-22, and CB-23, were conducted in the study area. Runs CB-20 and CB-21 were conducted on a soil surface that was artificially disturbed by raking to a depth of 2 cm. At the time, it was not known if sufficient mass could be generated from an undisturbed wildfire surface, and the raking ensured the release of adequate soil emissions for characterization of plutonium specific activity. After preliminary analysis of mass collected during runs CB-20 and CB-21, runs CB-22 and CB-23 were conducted on an undisturbed soil surface. These tests best represent the natural soil erosion process for the study area. Table 2 summarizes the results.

Table 1. Soil Sample Results

Sample Point	<75μm particles				75-600μm particles				>600μm particles			
	1	2	3	4	1	2	3	4	1	2	3	4
Mass fraction of soil (%)	8.2	7.2	10.1	7.4	42.0	39.6	43.3	43.0	49.7	53.2	46.5	49.4
Mean mass fraction (%) / SD[a]	8.2 / 1.3				42.0 / 1.7				49.7 / 2.7			
Specific activity (pCi/g)	2.09	0.94	2.37	1.66	2.23	1.54	2.20	2.40	1.03	0.85	1.78	1.43
Total activity (pCi)	275.9	112.8	348.5	229.1	238.6	154.0	237.6	249.6	80.3	36.6	90.8	74.4
Mean specific activity (pCi/g) / SD[a]	1.77 / 0.31				2.09 / 0.35				1.27 / 0.24			
	<75μm particles				<600μm particles				All soil particles			
Mean Specific Activity, pCi/g / SD[a]	1.77 / 0.31				2.03 / 0.24				1.66 / 0.17			

[a] Relative standard deviation, square root of sum of squares method
pCi/g = picocuries per gram

Table 2. Wind Tunnel Sample Results

Background-Corrected Sample Characteristic[a]	Raked		Undisturbed	
	CB-20	CB-21	CB-22	CB-23
TSP mass (g)	0.381	0.608	0.108	0.011
PM10 mass (g)	0.196	0.461	0.070	0.023
TSP activity (pCi)	0.608	1.153	0.129	0.023
PM10 activity (pCi)	0.203	0.859	0.078	0.013
TSP mean specific activity (pCi/g[b]) / SD[c]	1.75 / 0.46		1.64 / 0.80	
PM10 mean specific activity (pCi/g[b]) / SD[c]	1.45 / 0.26		0.85 / 0.05	

[a] Data is blank and background corrected
[b] Calculated using Equation (1)
[c] Relative standard deviation, square root of sum of squares method
pCi/g = picocuries per gram

Ambient background concentrations were measured during all four tests, as summarized in Table 3. Because runs CB-21 and CB-22 were performed on the same day, only one background sample was required. Wind tunnel effluent samples were corrected for the corresponding particulate mass and activity measured in the background samples.

Table 3. Ambient Background Sample Results

Background Sample Characteristic[a]	During CB-20	During CB-21	During CB-22	During CB-23
TSP concentration (mg/m^3)	0.677	0.053	0.053	0.240
PM10 concentration[b] (mg/m^3)	0.264	0.020	0.020	0.093
TSP activity (pCi/m^3)	1.33E-03	5.50E-06	5.50E-06	1.82E-04
PM10 activity[b] (pCi/m^3)	5.20E-04	2.14E-06	2.14E-06	7.11E-05

[a] Data are blank corrected

[b] 39% of TSP mass and activity is assumed to occur as PM10, based on Site-specific data

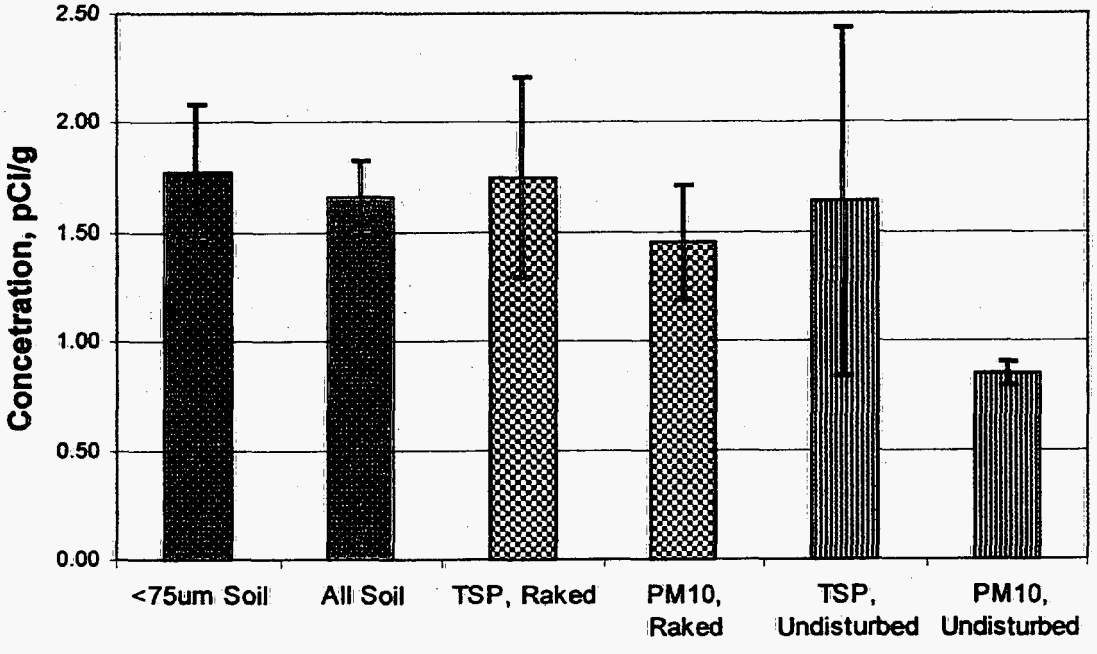
mg/m^3 = milligrams per cubic meter

pCi/m^3 = picocuries per cubic meter

The background particulate concentration and activity concentration measured during runs CB-21 and CB-22 are believed to represent the typical background levels for the test location. During background sampling for run CB-20, some contamination of the background sample filter may have occurred when dust raised during the preparation of the test plots by raking migrated into the wind tunnel air intake and into the background sampler, causing a significantly elevated background level. During background sampling for run CB-23, light and variable winds may have recirculated wind tunnel effluent, causing a slightly elevated background level.

Wind tunnel samples were compared to soil samples to quantify the correlation between the plutonium specific activity in resuspended dust and the parent soil, as shown in Figure 2.

Figure 2: Specific Activity of Wind Tunnel Dust Versus Soil



CONCLUSIONS

Figure 2 illustrates the similarities in specific activity between soil, TSP, and PM10 observed in this study. Specific activity in TSP resuspended from disturbed (raked) soil ($\bar{x}$ =1.75 pCi/g, σ =0.46) was not statistically different from the specific activity in both the fine soil and total soil reservoirs (1.77 and 1.66 pCi/g, respectively).[14] Specific activity in the PM10 resuspended from disturbed soil appears lower than TSP or soil specific activities, but was also statistically indistinguishable from either data set.[14] The undisturbed soil yielded PM10 particles with significantly lower specific activity than the soil reservoir even though undisturbed TSP specific activity was consistent with soil.[14]

The simplest explanation for the reduced specific activity observed in PM10 eroded from undisturbed surfaces is that the erodible layer of the undisturbed surface contains less Pu-239/240 than the erodible layer in disturbed soil. The explanation for the reduced Pu-239/240 presence is less clear. One possible explanation is that the uppermost thin layer of surface soil may be less contaminated with Pu-239/240 than a slightly lower soil profile at 1 to 2 cm below the surface, as a result of surface deposition of "cleaner" particles over top of more contaminated soil particles or through the downward migration of Pu-239/240 due to weathering. This explanation would be consistent with a redistribution model for the 903 Pad that moved most of the Pu-239/240 in a historical "slug" of migration, perhaps associated with past remediation efforts. It would also explain why mixed contaminated soil demonstrates more plutonium activity than undisturbed soil that has only the dilute surface layer available for erosion.

Alternatively, a periodic redistribution of Pu-239/240 may occur, in which the upslope winds of summer limit Pu-239/240 migration and cover the study area surface crust with "clean" dust from off-Site. During winter months, when upslope winds are infrequent, less dilution may occur. Since all test runs had essentially equivalent sample volumes, and background corrections were performed, the greater erosion potential of the disturbed soil reservoir nullified the diluting effects of uncontaminated fine particles sitting on the soil crust.

Based on these results, it appears that models and risk assessments for remediation projects and other events that disturb the soil surface could reliably assume that resuspended dust specific activity will match soil reservoir specific activity, assuming the soil specific activity is well defined for the depth of soil subject to wind erosion. This study suggests that the specific activity of fine soil particles may be accurately represented by the specific activity of bulk soil, but additional research would be needed to verify this hypothesis. Predicting resuspension of Pu-239/240 from undisturbed surfaces is less straightforward, due to the reduced specific activity observed in resuspended PM10 compared to soil. Sources of the apparent dilution effect could be explored in future experiments.

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PLUTONIUM DISTRIBUTION IN ROCKY FLATS SOIL*

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Abstract—Plutonium concentrations in Rocky Flats soil were inversely proportional to distance from the plutonium source, to depth of the sample, and to particle size of sieved soil samples Coefficients of variation ranged to more than 300%, and frequency distributions of plutonium concentrations in samples were highly skewed The plutonium distribution patterns and known characteristics of the plutonium source indicated that the mechanisms of environmental dispersion may have involved the attachment of plutonium oxide to soil particles; primary dissemination of contaminant from the source by wind, and weathering, microdispersal, and penetration into soil of deposited particles The high degree of spatial variability, in particular, suggested that the most common functional form of the contaminated soil during dissemination was probably an agglomerated particle containing many plutonium oxide and soil particles bound together

INTRODUCTION

A COSTLY fire at Rocky Flats in 1969 and later detection of off-site ^{239}Pu in soil samples (Ma70; Po72) spurred discussion of the environmental contamination problems and safety implications of the Rocky Flats installation (Jo76; Kr70; Ma70; Po72; Sh71) Further investigations indicated that the primary contaminating event was leakage from drums containing plutonium-laden cutting oil that had been stored outdoors in the southeast corner of the plant (Kr70; Po72).

Soil is the most important ecosystem compartment at Rocky Flats with regard to fraction of total plutonium contained and potential for plutonium transport (Li76) Consequently, this paper examines data from a study, begun in late 1971, of the patterns of plutonium contamination in Rocky Flats soil Specifically, this report describes (1) data on plutonium concentrations in soil, (2) the relationship of concentration to location, depth, and soil particle size, and (3) a description of the likely contamination mechanisms

The Rocky Flats (RF) installation, operated by Rockwell International for the Energy Research and Development Administration (ERDA), is located about 12 km, northwest (NW) of the nearest portions of the Denver, Colorado metropolitan area at an elevation of over 1800 m ERDA controls approximately 30 km^2 of land, most of which is used as a buffer zone to separate the public from plant production operations.

Topography of the installation is characterized by a series of flat, wind-scoured plateaux divided by five separate watercourses running roughly from west to east Rocky Flats climate is typified by strong and often gusty winds (3 7 m/sec mean) and moderate rainfall (40 cm/yr mean). Typically, the stronger winds at RF blow from the west (W) and NW, during 1975, 22% of the recorded winds were from the NW (An76). Vegetation at the installation is modified grassland. Ex-

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cept for a new buffer zone purchased in 1975, Rocky Flats land has not been significantly disturbed by man for over 25 yr. The flora and fauna have been described previously (We74; Wh73).

Data from RF air sampling station S-8 (Hu76), located about 75 m southeast of the barrel storage area, agree with information gathered by ERDA's Health and Safety Laboratory (Kr70) that identifies the barrel storage area as the source of the east-southeast contamination pattern at the site. Monthly averages of daily air samples indicated that gross alpha activity was associated with periods of known perturbation of the contaminated surface (Table 1, Fig. 1). These data indicate the time of the original plutonium dispersal and provide strong evidence that the barrel storage area was the main source of Pu contamination in the downwind ecosystem until the area was covered by asphalt in 1969.

*Table 1 Total monthly gross alpha activity in ambient air at station S-8 (75 m east of oil barrel storage area) during perturbation events of the storage area surface**

Dates	Event	Alpha activity (dis/min/m³)
7/59–9/63	No large scale leaking	0 020
1/64–1/65	Large scale leaking	0 056
1/65	Contaminated soil covered with fill	0.022
1/66	Small building added to filter contaminated oil from leaking to new drums	0 031
1/67	Drum removal activity begun	0 084
6/68	Last drums removed but high winds spread some activity	0.417
2/69	Weeds burned area graded for paving	0.067
9/69	Asphalt pad completed	0.029
11/69	Four sampling wells dug through pad	0.073
4/71	Drainage ditch dug on west side of asphalt pad	0 073

*Air filter material was counted directly in a gas-flow proportional detector Data adapted from Hu76.

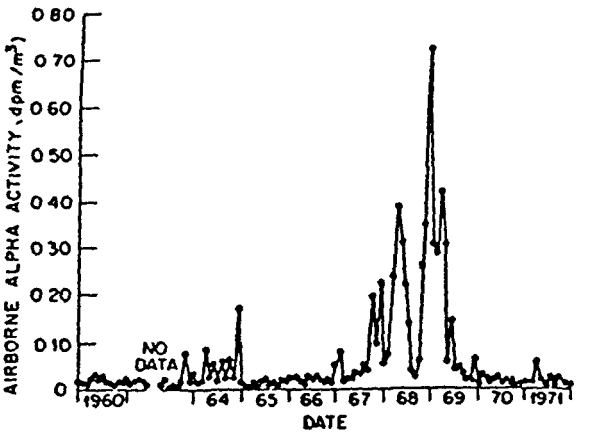

FIG 1 Monthly means of daily gross alpha activity in ambient air at station S-8 (75 m east of the oil barrel storage area) Aliquots of Gelman AE filter material were counted in a gas-flow proportional detector Data adapted from Hu76

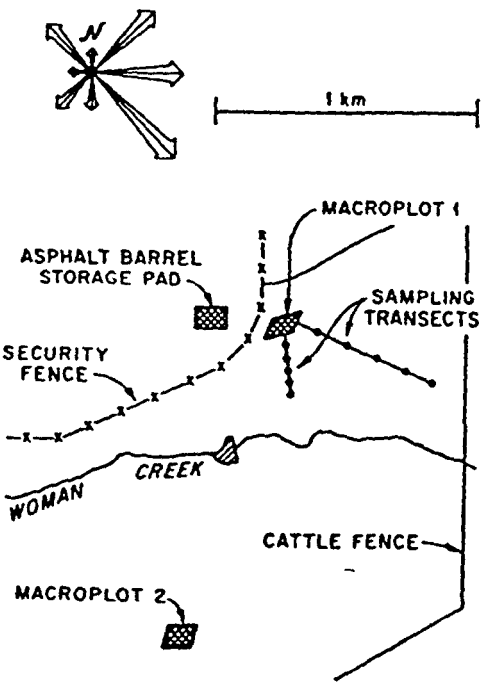

FIG 2 Schematic representative of southeast corner of Rocky Flats installation showing location of Macroplot 1 and two sampling transects in relation to barrel storage area The wind rose indicates the directions toward which the mean winds blew during 1974

METHODS AND MATERIALS

We established two macroplots for study (Fig. 2). The Macroplot 1 sampling grid covered about 0.58 ha and contained 100 microplots (grid intersections). The Macroplot 2 grid had 25 microplots and covered about 0.12 ha Macroplot 1 presumably had the highest concentrations of Pu in soil outside the security fence and had a reasonably undisturbed vegetative community Conversely, Macroplot 2, by virtue of distance, direction, and the presence of sheltering topography between the source and the macroplot, was presumed to be nearly background Vegetative communities of the two

macroplots were similar. During 1972–1974, four replicate soil samples from each 3-cm increment from 0 to 21 cm were taken at ten and five randomly chosen sample microplots (intersections) on Macroplot 1 and Macroplot 2, respectively.

We established two sampling transects: one extending 500 m east-southeast (ESE) from the eastern boundary of Macroplot 1 and the other running 250 m approximately south (S) from the southern boundary of Macroplot 1 (Fig 2). Four soil samples 0–3 cm were taken at each 100-m and 50-m interval along the ESE and S transects, respectively. Using aerial photographs, we estimated the distance east (X) to each sample location from a north–south line through the center of the asphalt pad and, similarly, the distance south (Y) from an east–west line to each sample of Macroplot 1 and the two transects.

Soil samples were air dried, and material greater than 0.5 cm in diameter was removed from the sample. After drying the samples in an oven, they were weighed and mechanically shaken on brass soil sieves with meshes ranging from 2000 to 45 μm, as listed in Table 2. The accumulation on each sieve and the underlying pan was weighed and sealed into a paper envelope.

Soil samples weighing approximately 5 g were sent to commercial laboratories (LFE Environmental, Richmond, California, and Eberline Instrument Corp., Albuquerque, New Mexico) or analysed in our laboratory LFE Environmental used concentrated hydrofluoric acid (We71) and Eberline modified a pyrosulfate fusion technique to dissolve samples (Si69) Ion exchange columns were used to remove interfering nuclides and to isolate plutonium from the samples before counting by alpha spectrometry. Chemical recovery was measured by addition of ^{236}Pu tracer to each sample (We71; Si69) Agreement between homogenized split samples sent to these laboratories was good (Li76). In our laboratory, a procedure incorporating harsh digestion with HNO_3 and HF, ion exchange, organic extraction, and liquid scintillation (LS) counting was used and had an estimated minimum detectable concentration of 0 18 dis/min/g for 5-g samples (Li76) Plutonium data are ^{239,240}Pu unless otherwise noted

RESULTS

Surface soil samples had a higher mean concentration than the samples below the surface (Table 2), and Macroplot 1 had a higher mean Pu concentration than Macroplot 2 Variations in soil Pu concentrations, with regard to depth, particle size distribution, and spatial dispersion, were large in samples from both macroplots (as great as 2 0 in Macroplot 1 and 4 0 in Macroplot 2) In one case, three adjacent soil columns (5 × 5 cm) from a 5 × 15 cm area of Macroplot 2 had mean plutonium concentrations of 1060 (column A), 11 9 (column B), and 1 26

Table 2. Mean plutonium concentrations and coefficients of variation (CV = standard deviation ÷ mean) of soil samples from two Rocky Flats macroplots. The number of samples totaled 931

Macroplot	Soil particle size range (μm)	Plutonium concentration dis/min/g [mean CV] of depth group aliquots 0–3 cm	3–6 cm	6–9 cm	9–12 cm	12–15 cm	15–18 cm	18–21 cm	0–21 cm
1	2000–850	1600, 2 0	300, 1 4	200 1.8	59 0.8	30 1.6	12, 0 9	4 0 0.6	3^0 3.9
	850–425	1000 0.8	270, 0 8	230 1 7	81 1.0	65 0 7	16, 0.9	12 0.5	290 1.8
	425–250	980 0.6	290, 0.8	200 1.8	66 0.5	66 0.5	29 0 8	13 0 2	300 1.6
	250–180	1000 0.5	280, 0.6	290 1 4	86 0 9	66 0.5	31 1 1	20 0 7	310 1.5
	180–150	1700 1 1	280, 0.6	230 1 7	77 0.6	310 1.6	57 0.7	14 1 1	450, 2.1
	150–75	1900, 0 7	460 0.8	230 1 4	150 0.9	120 0 7	97 1.3	24 0 9	530 1 7
	75–45	3100 0.5	700, 0.5	460 1 4	220 0.6	360 0.7	190 1 4	79, 0 6	880 1.5
	45–0	3300 1.6	400 1 1	1800 1 8	430 1.0	500 1.0	190 1.3	60 0.3	1300 2.4
	<2000	1900, 1.5	360, 0 9	590 2.8	150 1 4	190 1.6	75 1.8	27 1 1	570 2.7
2	2000–850	13 1 7	2.1, 0.9	0.8 1.6	1.2, 1.6	0 7 1.3	0 8 1.5	1.3 0.8	3.2, 3 1
	850–425	12, 1 7	1.5, 0 9	1.0 1.5	1.2, 1.6	0.8 1 4	0.9 1.6	2.7 0 6	3.2, 3.0
	425–250	30 1 9	4.5 1 1	3 0 1.2	3 4 1.6	3 2, 1.5	3 4 1.5	8.1 0 7	8.7 2.9
	250–180	59 2.3	12, 1 1	5 1 1.5	4.5 1 4	8 7 1 4	5.8 1 4	9.5 1 1	17 3.5
	180–150	110, 2.8	22, 2.0	5.8 1.3	7 0 0 9	8.2, 1 6	8.9 1 1	11 1 0	28 4 7
	150–75	150, 3.3	4.2, 1 1	3 9 1 4	3 9 1 1	4 7 1.6	6.1 1.3	7 9 0 8	31, 6.7
	75–45	340, 3.2	13, 1.0	6.7 1 4	6 0 1.2	12, 1.9	29 1 7	12, 0 9	69 6.5
	45–0	29 1.3	7 4 1 1	9 0 1 4	7 1 1.0	8 0 1 6	25 1 4	11 0.5	14, 1.6
	<2000	92, 4.6	8 1 2.1	4 5 1 6	4 2, 1.3	5.8 2.0	9.3 2.3	8 0 1 0	22, 8.4

(column C) dpm/g at the 0–3 cm depth. Differences between the three columns extended below the surface as well, but the pattern shown in the 0–3 cm depths did not hold. Virtually all of the plutonium in column A was found in the top 3 cm, the other depths being at or near background. In columns B and C, however, the majority of the plutonium was found at lower depths.

Generally, radionuclide contamination of the environment results in log-normal distributions (Wh66; Ce69; Pi75). Following that pattern, plutonium data from soil sampling were highly skewed (Sn67, $P < 0.05$). However, the natural log transformation of these data did not result in normal distributions [as judged by the Kolmogorov–Smirnov one-sample test, (Si56)], but did generally reduce the skewness for the seven depth groups from each macroplot tested

Linear, exponential, and power function regressions of Pu concentrations in the surface samples as functions of X or Y distance from the asphalt pad were calculated. The power function was significant ($P < 0.01$) and gave the best fits of the data for both curves (Figs 3 and 4) Based on a t-test (Dr66), the slope of the Y curve (Fig 4) was significantly steeper ($P < 0.05$) than the X curve (Fig. 3). Of several multiple linear regression models attempted, the one accounting for the largest amount of the total variation, 86.8% had the following parameters:

$$\ln \mathrm{Pu} = 24.76 - 0.1187 \ln X - 3.615 \ln Y,$$

where Pu = Pu concentration (dis/min/g), X = distance east of asphalt pad centerline (m) and Y = distance south of asphalt pad centerline (m).

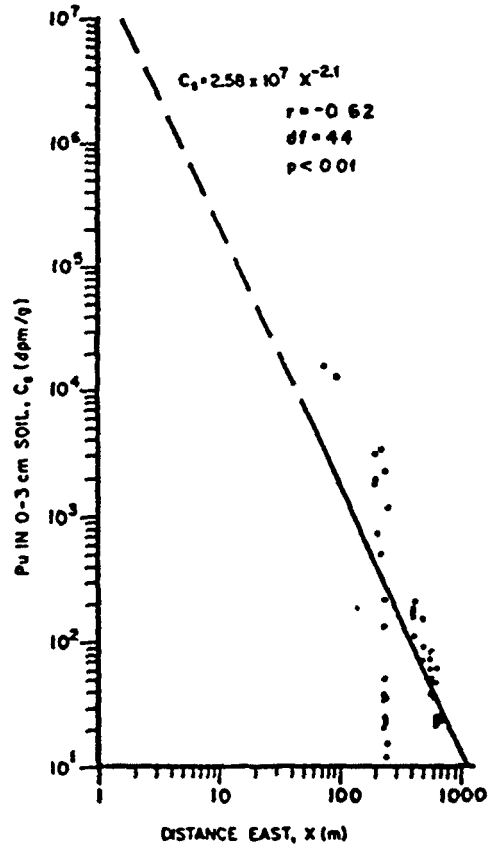

FIG 3. Plutonium concentration in 0–3-cm Rocky Flats Macroplot 1 soil as a function of distance east of the center of the asphalt oil barrel storage pad.

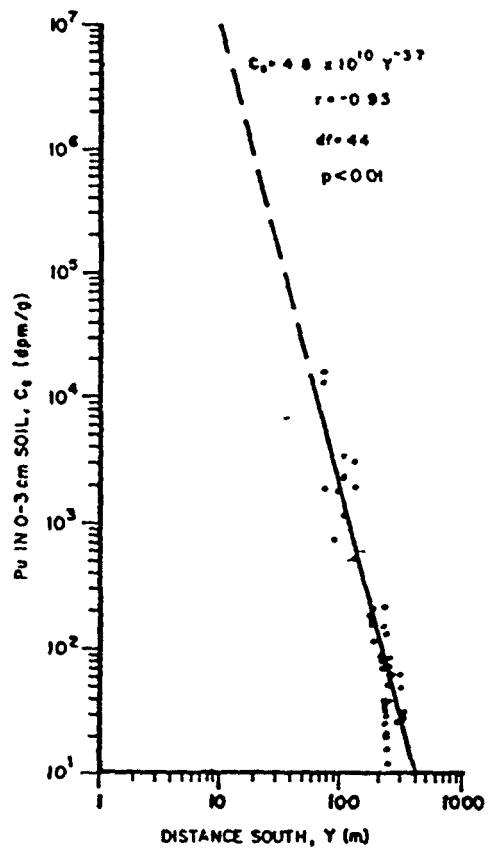

FIG 4 Plutonium concentration in 0–3-cm Rocky Flats Macroplot 1 soil as a function of distance south of the center of the asphalt oil barrel storage pad

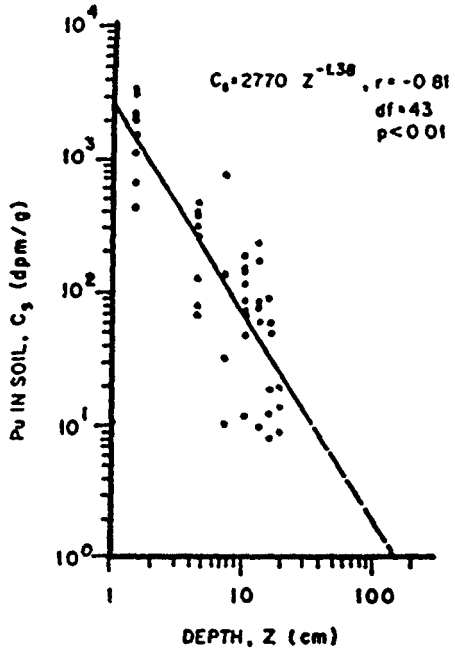

FIG 5 Plutonium concentration in Rocky Flats Macroplot 1 soil as a function of depth of sample. Sample concentrations corrected for distance east and south of center of asphalt oil barrel storage pad

Using this model, Pu concentrations of samples in the soil depth profile were adjusted to the expected concentration at a common location. The adjusted values were then regressed as a function of the sample depth (Fig. 5). The power function form of the relationship was significant ($P < 0.01$) and had the highest correlation of Pu concentration with depth of the models attempted.

The relationship of plutonium concentration in Macroplot 1 soil vs soil particle diameter (as represented by the opening of the final passage sieve) was examined for each depth using linear, exponential, and power function models. The following model most often gave significant results: ln Pu concentration = $b_0 + b_1$ ln diameter (Table 3). The steepest slope, at the 12–15-cm depth, was significantly different from the flattest slope, at the 3–6-cm level ($P < 0.05$). However, there seemed to be no clear-cut trend in slope of the Pu vs soil-particle size relationship with depth.

A tabulation of the sieve fraction data by size range and depth for both macroplots did not produce any particular pattern with either depth or particle size range Furthermore, regressions of fraction of total soil mass per sample as a function of depth were not significant for most sieve fractions.

Table 3 Regression parameters of soil plutonium concentration (Pu) dpm/g adjusted for the sample location on macroplot 1, as a function of soil particle diameter (D), cm, at various depths. The model used was ln Pu = $b_0 + b_1$ ln D

Depth (cm)	Intercept (b_0)	Slope (b_1)	Correlation coefficient (r)	Significant at $\alpha =$	n
0–3	5.62	−0.336	−0.312	0.01	72
3–6	4.40	−0.270	−0.291	0.05	69
6–9	1.69	−0.753	−0.471	0.001	50
9–12	2.40	−0.544	−0.564	0.001	69
12–15	1.47	−0.799	−0.719	0.001	52
15–18	0.583	−0.775	−0.706	0.001	47
18–21	0.375	−0.572	−0.358	—	22

DISCUSSION

A scenario of the contamination process based on these and other data is postulated The Pu-contaminated cutting oil, comparable to lightweight motor oil but often thinned by carbon tetrachloride, was stored in 55-gal barrels for up to 7 yr (1957–1964) Before placement in barrels, the oil was reportedly drained through 2–3-μm filters. Dilute hydrochloric acid formed by reaction of carbon tetrachloride and water may have led to the production of very low concentrations of plutonium chloride, a relatively soluble Pu compound (Cl76) Supporting this contention, a 0 01-μm filter removed only about 50% of the plutonium from similarly contaminated oil stored for shorter periods, indicating that much of the Pu was either monomeric or very small particles (Na76) However, during the long storage period, the Pu species remaining in the oil might have combined to form aggregates (Cl76) Unfortunately, the size and binding tenacity of these conglomerates, if formed, is unknown

Leakage from the barrels was most likely not large or fast at first, but may have become so with time. Contaminated oil was deposited onto the ground surface and stabilized the soil where plutonium became available for binding to soil particles Plutonium deposited as metal particles likely oxidized slowly at normal temperatures in the presence of air The resulting plutonium

oxide was relatively soluble in water compared to high-fired oxides but relatively insoluble in water compared to most metallic oxides. If plutonium chloride were deposited on the soil, it was likely hydrolyzed soon after first contact with water and eventually became oxidized. The solubility of these compounds was again probably low relative to most compounds but greater than the high-fired oxides (Cl76).

It is probable that all PuO_2 particles, or molecules, eventually became attached to soil particles. Most likely, this attachment took the form of easily erodible, agglomerated particles, each containing numerous PuO_2 and soil particles

Redistribution of contaminated soil from the various drum leakage events was probably a relatively short or erratic process occurring with surface disturbance and high winds, as indicated by the S-8 air sampler data The regressions of Pu concentration as a function of X or Y distance and the multiple regression including the same data indicated that the slope associated with the Y (south) term was steeper than the slope of the X (east) variable. Since the X term is primarily in the direction of the predominant wind and the Y direction is subjected mostly to downward slope, wind seems to be the more likely transport force.

The S-8 air data, coupled with prevailing wind information, and the regression of plutonium concentration vs distances east and south of the source are strong evidence that wind was the primary mode of plutonium dispersion from the oil barrel storage area to the study macroplots.

In time, dispersed plutonium-contaminated soil particles no longer were significantly redistributed by wind. Wind, precipitation, and gravity may have caused particles to migrate from exposed surfaces downward into the soil, where they were sheltered by larger particles, litter, or vegetation Soil–plutonium particles may have gradually broken down by natural weathering processes, allowing the constituents to disperse on a microscale (i e on the order of a few centimeters). This concept is supported by results of autoradiographic studies of soil from Macroplot 1 (Mc78) that indicated that most contaminated particles are very small or single particles. Furthermore, this process is compatible with the high degree of spatial variability observed

In summary, the major facets of the scenario include· (1) either before or shortly after leakage onto the ground surface, the Pu contaminant was in the form of an oxide; (2) the Pu oxide became attached to soil particles, (3) gusty winds combined with periods of surface disturbance heterogeneously redistributed the particles to the east and southeast of the barrel storage area; and (4) the soil–Pu particles were eventually broken down by weathering and were dispersed laterally and downward into the soil profile

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Statistical Confidence as it Relates to Soil Sampling at Rocky Flats

Rik Getty, Technical Adviser, Rocky Flats Coalition of Local Governments (RFCLOG)

Introduction

The Board of Directors of RFCLOG requested that I author a short discussion for the general public on what statistical confidence means relative to soil sampling at Rocky Flats. Over the course of many briefings by the Department of Energy (DOE) and their primary clean-up contractor, Kaiser-Hill (K-H), to the RFCLOG Board and general public, various statistical confidence levels have been mentioned. Unless one is quite familiar with basic statistical sampling methods it can be quite a daunting task to understand what these various types of statistical methods actually mean in lay terms.

To begin this discussion I thought I would start with a brief background on how soil sampling methodology was developed for Rocky Flats and then have a short discussion of sampling statistics in general. Finally I would transition into real examples used by DOE and K-H to describe statistical confidence in their soil sampling.

Rocky Flats Soil Sampling Methodology

The soil sampling methodology used at Rocky Flats is a combination of various techniques that are in widespread use around the world. In the U.S., CERCLA sites like Rocky Flats use many of the guidelines established by the U.S. EPA for soil sampling. In addition, geostatistical sampling methods developed for different geological-based industries are also used for soil sampling. The site (DOE, K-H, and their subcontractors) formed a working group with regulatory staff from the EPA and CDPHE to develop the Sampling & Analysis Plans (SAPs) for the Buffer Zone (most of which is slated to become part of the Wildlife Refuge) and the Industrial Area (all of which will remain as DOE-retained land).

The working group selected different soil sampling strategies depending on what existing characterization data was available for a given location. For example, areas where there was known contamination due to releases of:

- Radionuclides (primarily plutonium, americium, and uranium isotopes);
- volatile organic compounds (VOCs; primarily chlorinated solvents);
- semivolatile organic compounds (SVOCs; liquid chemicals that don't evaporate readily like machining oils, polychlorinated biphenyls);
- hazardous metals (e.g., lead, cadmium, chromium, etc.); and,
- other regulatory chemicals such as nitrates.

Generally speaking the vast majority of areas contaminated with the contaminant species listed above were located in the Industrial Area. Due to their known locations of contamination, targeted soil sampling was selected as the appropriate sampling methodology. Targeted sampling involves determining the general contamination levels within a known area.

Areas where there was no indication of prior contamination, primarily in the Buffer Zone, utilized a statistical grid sampling methodology. The grid spacing for sample locations was determined by the working group based on the required statistical confidence. Typically a 90% confidence was used to characterize soils in the Buffer Zone (I will discuss the 90% confidence later in this briefing).

Some areas such as the 903 Lip Area required both targeted and grid spacing soil sampling per the working group requirements. The 903 Lip Area was the largest (36 acres) remedial project at

the site. It is considered part of the Buffer Zone but will remain as part of the DOE-retained land and will not be transferred to the Wildlife Refuge. I will present soil sampling data on the 903 Lip Area at the end of this briefing.

Basic Statistical Sampling

When one is trying to understand statistical sampling applications there are a few basic parameters to define (after that statistics delves into very complex scenarios). However for the sake of this briefing I want to confine my explanations of statistical sampling to a basic level.

Many things exhibit properties of statistics in nature and the everyday world. I'm sure the reader of this briefing has some personal experiences that delve into aspects of statistics. Examples could be the outcome of simple coin tosses, gambling experiences, voter survey results, or perhaps even some who utilize more complicated statistics as part of their work or hobbies. Whatever the case, statistics are a very useful tool in a wide variety of applications.

In this briefing we are interested in how statistics are used for soil sampling at the site. Sampling of soil generates a collection of data that must be interpreted. Suppose you have a large number of results (a population) for a given analysis. The simplest statistical model for a population of results is that of a "normal" or Gaussian (Gauss was a famous statistician) distribution of results. The normal distribution of results exhibits behavior like that shown in Figure 1 (page 4). The x-axis represents the different range of values of the results. The y-axis represents the relative frequency of the values. In other words the more results there are with the same value the higher the relative frequency. Normal sample distributions are centered around a "central" value known as the population mean (average value). The shape of the normal distribution curve tails off to the left and right of the mean value. As one follows the curve to the right of the mean, the values increase (+) and their relative frequency decreases. As one follows the curve to the left the values decrease (-) and their relative frequency decreases. The total area under the curve, including the "wing" sections to the left and right represent the total sample population.

Not all sample populations exhibit a normal distribution. Figure 2 (page 4) shows a normal distribution as well as a population which has the same mean but exhibits different +/- ranges. There are several other types of sample distributions such as "log-normal" distributions. I will not delve into their behavior but instead focus on normal distributions.

Figure 3 (page 5) is a normal distribution with 90% and 95% confidence ranges added for illustrative purposes. If one were to take the total area under the curve between the two 90% values then that area represents 90% of the sample population. It also tells you the range of the sample values for 90% of the population. Likewise the two 95% values represent 95% of the sample population.

903 Lip Area Example

As previously mentioned, the 903 Lip Area remediation project was the largest environmental restoration project at the site encompassing 36 acres. The regulator-approved (EPA & CDPHE) Buffer Zone SAP specified a combination of targeted and grid spacing soil samples for the 903 Lip Area. The remediation required the site to remove contaminated soil which exceeded the Wildlife Refuge Worker Action Level of 50 picocuries of plutonium activity per gram of soil (50 pCi/g). The site used a geostatistical technique known as probability Krieging to determine the boundaries of the remediation project. The stated objective of the probability Krieging was to have a 90% level of confidence that all of the contaminated areas in the 903 Lip Area which exceeded the 50 pCi/g Pu were contained within the Krieging boundary. Of course that objective

means there is a 10% probability that there were areas which exceeded the 50 pCi/g limit outside the Krieging boundary.

The 903 Lip Area remediation was broken down into small sections of remediation work. Contaminated soil which exceeded the 50 pCi/g was removed from a section and then confirmation samples were taken to verify that the section was below the 50 pCi/g limit. Many times, the confirmation samples failed (exceeded 50 pCi/g) and more contaminated soil had to be removed. This required additional confirmation samples until the section met the requirements. Hundreds of confirmation samples were taken by the site during this remediation project. After completion, the mean value for remaining plutonium contamination in the remediated sections was 14 pCi/g.

Figure 4 (page 5) is an example of one way the remaining contamination in the 903 Lip Area sections can be viewed. This depiction may not be accurate but is for illustrative purposes only. The site's confirmation sampling and probability Krieging specified a 90% confidence level. The distribution curve in Figure 4 is not a normal distribution in the sense that the curve is shifted somewhat to the right. This shift is to reflect the fact that there is a probability of some of the soils exceeding 50 pCi/g. The site's confirmation sampling concluded there were no areas in the remediated 903 Lip Area which exceeded 50 pCi/g plutonium at the 90% confidence level.

After the remediation was completed, DOE retained an independent contractor (Oak Ridge Institute for Science and Education, a.k.a. ORISE) to verify the remaining soil conditions in the 903 Lip Area remediation. ORISE's examined two areas or survey units each about 45 meters by 45 meters (2025 square meters). The initial soil samples from these two survey units was in close agreement with the site's values. None of the ORISE samples exceeded 50 pCi/g plutonium. ORISE specified a 95% confidence in their sample results. After ORISEZ performed the confirmation sampling additional "hand scans" were performed with file-portable instrumentation. Using this technique ORISE found several "hotspots" which exceeded the 50 pCi/g plutonium. These areas were further characterized by the site and ORISE and were subsequently remediated. The total area of the hotspots was only 1.6% of the total area of the 2 survey units. So in practical terms, the "discovery" of the hotspots should not come as a surprise since the site's stated confidence in detecting hotspots was 90%. ORISE's report to the site on their verification activities stated that the presence of hotspots in the 2 survey units are likely representatative of the remaining 903 Lip Area.

Closing Remarks

I hope this briefing has not been overly tedious and confusing. I had a challenging time deciding how to approach the briefing structure.

FIGURE 1. "NORMAL" OR GAUSSIAN SAMPLE DISTRIBUTION

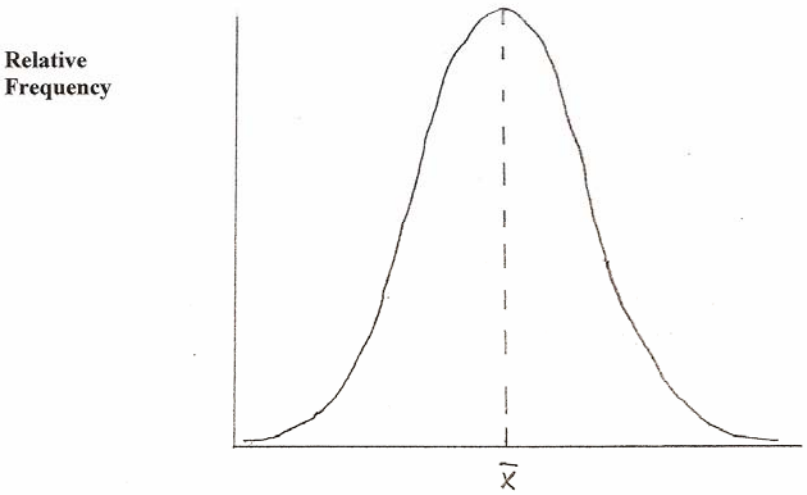


FIGURE 2. TWO DIFFERENT SAMPLE DISTRIBUTIONS WITH SAME MEAN

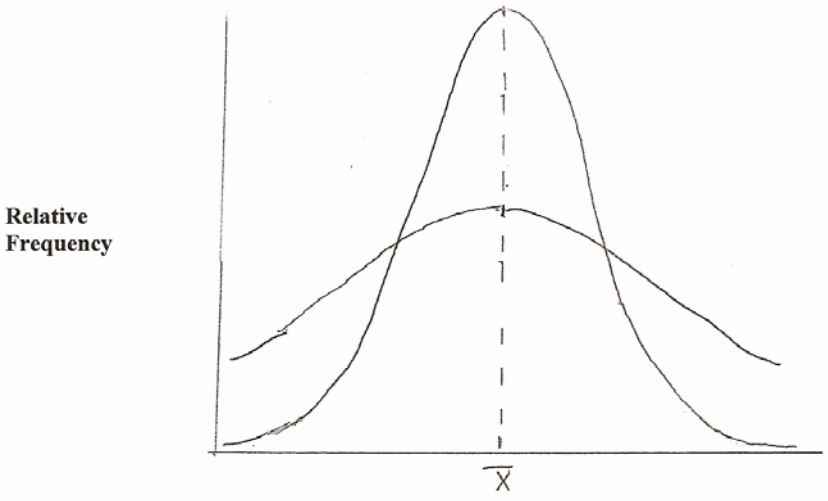


FIGURE 3. NORMAL DISTRIBUTION WITH 90% & 95% CONFIDENCE

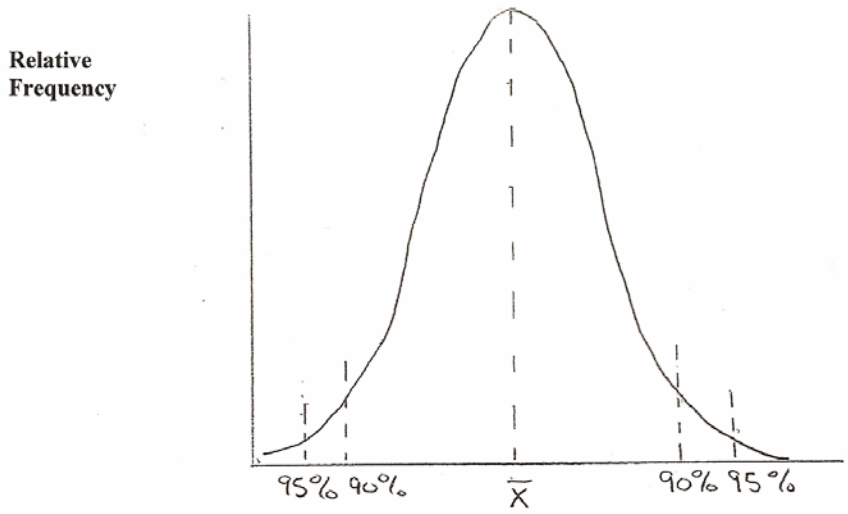
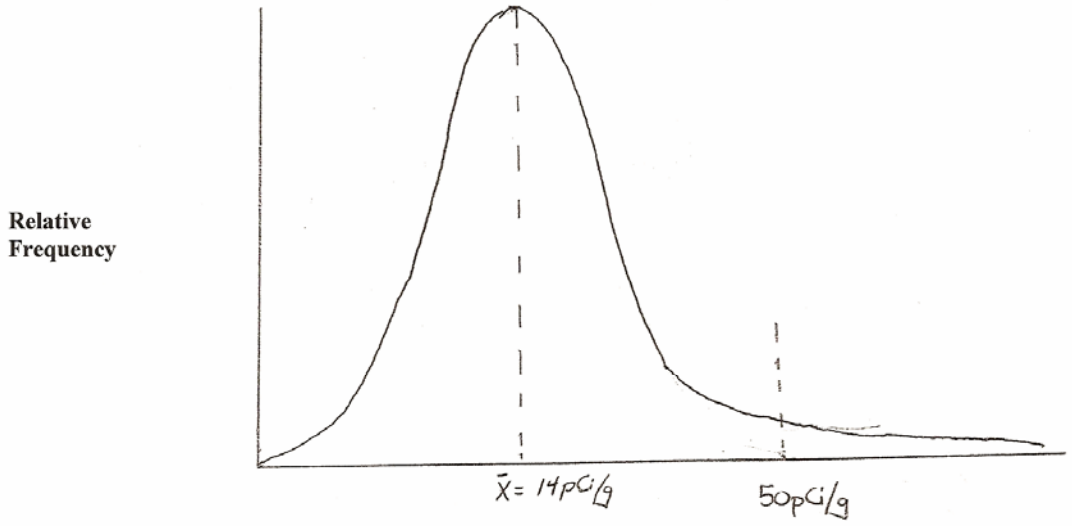


FIGURE 4. EXAMPLE OF REMAINING Pu CONTAMINATION IN 903 LIP AREA



DOE AMP Proposal

- Cover memo
- AMP meeting notes – 2/3/11 meeting
- AMP meeting notes – 2/10/11 meeting
- AMP meeting notes – 2/17/11 meeting
- AMP meeting notes – 3/3/11 meeting
- Broomfield 2/15/11 proposed AMP language
- Broomfield 3/2/11 proposed AMP language
- Broomfield 2/1/11 letter to CDPHE
- CDPHE reply to Broomfield's 2/1/11 letter

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City of Golden -- City of Northglenn -- City of Westminster -- Town of Superior
League of Women Voters -- Rocky Flats Cold War Museum -- Rocky Flats Homesteaders
Arthur Widdowfield

MEMORANDUM

TO: Stewardship Council Board
FROM: Rik Getty
SUBJECT: Update on Dam Breach EA/AMP and Changes to RFLMA Points of Compliance
DATE: March 22, 2011

We have scheduled 30 minutes for the downstream communities (the cities of Broomfield, Westminster and Northglenn), DOE, CDPHE and EPA to update the board on the dam breach environmental assessment (EA)/Adaptive Management Plan (AMP). We will weave into the conversation DOE's proposal to move the Indiana Street water points of compliance to the eastern edge of the DOE lands.

As Stewardship Council staff has communicated to you, DOE has delayed issuing the dam breach EA as it works with local communities and others to resolve a number of outstanding issues. (DOE has initiated an AMP planning process in an effort to address and resolve their concerns.) The AMP, in short, is geared towards reassuring "an engaged public on how the Proposed Action would be monitored and eventually implemented. DOE intends that the AMP and the EA decision document will be finalized in April 2011."

To date, DOE has hosted six well-attended meetings of the AMP working group. There have been three AMP meetings since the February 7th Stewardship Council meeting. DOE wants to finalize the AMP and issue the EA according to their original schedule.

DOE AMP Timeline:

- December – Early March: AMP team will identify measurements, controls and actions
- Late January – Late March: AMP Team will draft the AMP
- Early March – Early April: DOE will incorporate AMP commitments into the EA
- Late April: DOE will finalize the AMP and issue the EA

The February and March meeting summaries are attached. All of the meeting summaries can be found at: http://www.lm.doe.gov/Rocky_Flats_AMP.pdf . In addition the following contains information on the proposed dam breaching: http://www.lm.doe.gov/Rocky_Flats_NEPA.pdf .

Also attached are the following documents which are new since the last Board packet:

- 2-15-11 Broomfield letter to DOE suggesting new language for the AMP
- 3-2-11 Broomfield letter to DOE requesting items be included in the AMP
- 2-1-11 Broomfield letter to CDPHE requesting delay of POC moves pending AMP outcome
- 3-4-11 CDPHE response to Broomfield concerning delay of POC moves

Beginning with the first meeting and continuing through the most recent meeting there have been a consistent set of common positions adopted by the cities and the Woman Creek Reservoir Authority. They are as follows:

1. Institutional Control (IC) prohibiting excavations below 3 feet in non-remedy areas
    a. Risk assessment of sub-surface soils in regard to the IC
    b. Environmental covenant in regard to the IC
2. Monitoring points in the Walnut Creek and Woman Creek drainages
3. Levels of contamination that would require DOE to close the valves at terminal ponds A-4, B-5, and C-2
4. Monitoring protocols
5. DOE's obligation/commitment under EA/AMP to monitor water quality
6. Water lease with Broomfield
7. Standley Lake Protection Project (Woman Creek Reservoir) operating agreement
8. Contingency plans
9. Explanation of the reason or basis for proceeding with the proposed action
10. Present Landfill pond dam breaching
11. Requests for more timely information exchange concerning water quality issues

If there is not enough time prior to the Board meeting to review all of the attached material, I recommend you review the letters and March 3rd AMP meeting summary. Notes from this meeting provide a glimpse into the ongoing AMP discussions. There are several contentious issues still undergoing discussion, and reaching consensus agreement on these issues will be challenging.

Finally, DOE has agreed that the next AMP meeting will be determined by completion of the draft AMP. They propose to have the meeting one week following distribution of the draft AMP. During that meeting, DOE plans to discuss the draft and hopes to achieve as much verbal agreement as possible before sending the document out for written comments. DOE will notify the working group as soon as possible of the projected completion of the draft AMP, then will schedule a discussion meeting.

Please contact me if you have any questions.

NOTES SUMMARY
AMP development working group meeting
02/03/11

Follow-up action status:

- State issue letter on IC?
  - CDPHE will keep people informed and provide a letter as soon as it is ready
- Letter from DOE re water lease?
  - DOE will provide letter concerning water lease in the next few weeks when it is completed
- Broomfield – city manager sent letter to CDPHE asking to hold off RFLMA until AMP done.
- Broomfield – doesn't want to go too far down AMP until IC issue resolved and can't indicate support through AMP until issues resolved. Doesn't want to discuss triggers, etc. because IC issue is fundamental – legal issues must be resolved. Will have to withdraw participation in AMP process if path forward on ICs not know.

Questions:

- Will a new contact record be issued re subsurface IC modification?
  - Will be done when RFLMA parties' consultation on a path forward is completed.
- Will this IC change have public comment?
  - Still working on defining the process and what's needed to make the change. DOE explained contact record process used to document RFLMA Party consultations and that they are posted to Rocky Flats LM website for public information. RFLMA parties are not sure if IC clarification will reach threshold requiring public review and comment, but proposed changes will be result of RFLMA Party consultation and public will be kept informed of path forward. CDPHE said IC resolution is a priority.
- Briefing – environmental covenant vs. restrictive notice (see end of notes)
- Was a risk analysis done for soil below 3 feet? Broomfield wants clarification – believes a risk assessment for soil below 3 feet is needed before can change IC/covenant. Citations/quotes from CAD/ROD: pages 47, 54, 66, 70. Broomfield will send to DOE in an e-mail.

Discussion topic 1 – Triggers to close C-2 valve in flow-through (need a strategy)

- South-facing hillsides and 903 lip area (wildfire)
  - DOE - some lightning strikes in north side, but no wildfires have occurred in this drainage to date
- Exceedance of standard at SW027 – trigger?
  - Need to decide what will trigger at GS01, GS31 and/or fence line(any downstream POC), based on 30-day, 12-month average?

    - WCRA - with any exceedance would like to see C-2 closed until source located. Focus on SW027 – perhaps 12-month average?
- Exit strategy after closing valve (to reopen)?
    - SW027 can be a trigger to show something has gone wrong, need to identify steps to close valve during evaluation to identify the issue and steps and criteria to re-open valve.
    - Seasonal?
        - Low-flow vs wet years – may not have enough data to meet criteria to resume flow-through in dry year.
    - Within normal variability?
        - Issue of single bottle exceedance – could be settling problem, C-2 only has by-pass water, not Woman Creek flow
- When POC changes, this decision matrix would be modified accordingly.
    - Response could be based on whether using upstream data or downstream data.
- Is there a trigger based on level of flow? (pending rain event)
    - WCRA – flow-through is a test/proof of principal
    - DOE – concentration and how fast it flows is what matters. Closing valve based on flow raises a technical concern, stops step-wise understanding of final breach and downstream data collection.

Topic 4 – Response Actions to SW027 exceedance in 2010

- Is there intent to let SW027 response vegetation grow for a growing season before go to flow-through? WCRA recommendation
    - DOE – wattles are short-term, vegetation long-term.
    - SW027 response is to accelerate vegetation establishment.
    - There would be a trade-off of losing a year of flow-through data
- Is flow level/storm event a trigger

Broomfield question on flow-through operation.

- WWE evaluation – what are flow conditions downstream with valves open? Was that evaluated?
    - It falls between the scenarios they evaluated. Not relevant, was a worst-case floodplain analysis for the two alternatives,
- Request – show flow rate out of pond with valve open in 100 year event
    - Valve would not be fully open during flow-through. Won't open valves all the way, flow restricted by the diameter of the outflow pipe. Already have inflow, attenuation and outflow information.

Topic 5 – Minimizing missed sampling periods at GS01

- Concern is missing sampling during large precipitation events
    - 2 cases:
        a. Bottle fills and we can't change right away
        b. Can't get to the bottle or the flume is flooded – too much water
- WCRA recommends back-up bottle, or bigger bottle, in place that picks up when 1st bottle gets full, especially at GS01

- DOE will research to see if back-up bottle or larger bottle is feasible, effective.

Topic 3 – Communications/info provision to WCRA

- WCRA requests increased communication between DOE and WCRA so can do real-time water management
- Share data with WCRA as DOE gets it to help with reservoir management – fence line info is a priority.
  - What kind of time frame the AMP would provide for notification of WCRA?

Topic 2 – Additional AMP-specific data collection

- AMP-specific data collection in Woman Creek
  - Pu/Am with solids
- Would be nice to use this period to understand how system works before any review to change AMP.
- Focused data – like additional sampling in Walnut Creek
- Turbidity probes – GS31 most critical
- SW027 tend to get rising limb – add downstream of pond C-2 as well to see how C-2 responds to events (GS31?), TSS info
  - Want rising limb to be AMP specific for downstream of C-2 for data collection. See how C-2 responds to worst case while recognizing not have any base data.

Topic 6 – AMP re-evaluation timeframes and triggers

- Evaluate data with annual report data or quarterly after annual report or technical meetings?
  - Not resolved yet
- Revisit AMP at "no less than" (possible AMP modification)
  - Periodic reviews – two year review period
  - Set criteria for reviews
  - Recognize steps for re-evaluation and modifications
- Email communication as things happen
- Comment – Broomfield will submit draft AMP language

Request – Plots for Walnut Creek for April storm similar to Woman Creek for next meeting.

Future meetings:

- Feb. 10, 1 p.m.
  - Walnut Creek
  - PLF and No Name
- Feb. 17
  - Ecology
- March 3

- ❖ Woman and Walnut Creeks > start to agree

Environmental Covenant vs Restrictive Notice briefing:
Difference between covenant and restrictive notice

- May not be any difference
- Covenant assumed to be based on state's police power, but it doesn't specifically say and there are disagreements on what it means and how binding it is.
- Restrictive notice – binds anyone with interest in the property
- Practical difference
  - Covenant may not be binding on all parties (prior interest)
- Public notice if do change
- If in doubt, use restrictive notice
- Any changes to covenant would be made at the same time as any changes to the IC.

NOTES SUMMARY
AMP development working group meeting
02/10/11

I. Walnut Creek Drainage

a. FC-1 – seeps in this area?
   - No significant seeps. There will always be some seeps as the area is on top of the Laramie formation, there is a low spot on top of the Mesa from the borrow material removed during cleanup that was filled.

b. FC-2 – review of data for: GW 37505, 37405, 37705, 20705, 20505, 20205, 42505. Data from GW wells and how they contribute.
   - 37 wells – no changes, below Pu standard and no significant nitrate.
   - 20 wells, fairly consistent, 20205 most interesting – increasing trend in U, concentrations below threshold, some VOCs since before closure, some carbon tet.
   - 42505 – AOC well, nothing remarkable, very low results, nothing special.
   - Question – 771 wells, how long for groundwater to move from basements to wells? Can't really tell, 20205 is carbon tet well, estimate 5 feet per year flow rate, not showing much

c. SW018 VOCs, why not Pu/Am?
   - Used as an investigative location for source evaluation, sample more to "not find than find", collected for 3 years, then exit strategy of no analysis if no hits at the downstream POEs. Currently take samples and hold for 6 months, but don't analyze any longer. (Pu/Am analysis was not required by RFLMA Attachment 2.).

Broomfield question – looking for a written response on what happens if a hit.
   - Get into RFLMA response.

d. FC-3-Discusion of current non-RFLMA sampling
   - Review of non-RFLMA sampling per Contact Record 2010-03. What is the basis for not sampling Pu at SW093 or LANL?
     - Pu and LANL already done at SW093

e. Review of what the non-RFLMA data reflects for this past year.
   - North Walnut creek – nitrate shows a lot of variability, U – bounces up and down, similar variability pre and post closure
   - South Walnut – downward trend for U as you go down stream
   - LANL analysis – do it when you have some U event you want to evaluate. It is a way to tell if a known source area is contributing.

II. Sampling during flow-through

a. When will the valve be opened?
   - Depends on NEPA decision from DOE. If a FONSI is issued, some time after that if DOE determines they are ready.
   - Sample pre-release? Yes, pre-discharge sampling.

- Process? Pre-discharge sample; open valve; approximately two weeks at lower flow (300 gpm) to bring dam levels down; continue automatic flow-paced sampling at POCs; continue monitoring at Indiana POCs just like doing now.
- What triggers closing valve if there is an exceedance? Normal RFLMA process – consult with RFLMA Parties and make determination of next step
- Sample results turnaround? 28 days normal; can request shorter turnaround but increased costs. Pu/Am cannot be done faster than about 1 week.
- Broomfield - concerned that it will be months before data is validated. DOE – If see results of interest, can accelerate normal validation process – can get validation in a day or two.

Question and related discussion – If there is an exceedance upstream will you close the valve – for example a 1-time grab sample?
Answer – No, but would close the valve if there is an exceedance at a RFLMA POC and consultation with RFLMA Parties determines closing the valve is the right thing to do.

Broomfield – there is a public perception that if you have an exceedance, how can you not close the valve and let it go downstream – we need a trigger that would close the valve at any exceedance.
DOE – an isolated hit upstream is not an indication of a threat to surface water quality, not a threat to drinking water supplies.

Broomfield – water on site has to meet all use standards.

DOE – yes, this is a remedial action objective of the CAD/ROD – will take time to achieve RAO.

Westminster – perhaps the response to an upstream exceedance at a POE would be to crank up the time frame for turn-around of POC samples.

DOE – It is a wrong message to send to close the valve as a first response. It (closing) is one response that would be based on the threat to water quality and what the data says.

Broomfield – It seems very simple to shut the valve, rather than assuming it is a drastic measure.
DOE – It is drastic if it is based on a single grab sample. The water from the site is not used for consumption. The point is to not overreact because that can send the wrong message, and the regulators have the choice to close the valves anyway. The message is, the dams are not needed for protection, and also all downstream drinking water is protected already. We would not see an impact from only one hit. The standards are based on long term exposure.

Broomfield – Take it to a middle ground?

CDPHE – It might rise to a level where that (closing the valve) would be the logical move upon evaluation of mitigating actions, it's on the list of responses to consider.

Broomfield – We want to know what process will be when there is an exceedance, what will make DOE close the valve?

DOE – Trending, level of exceedance (out of expected variability), consultation with the agencies, what other steps should be taken (based on what ongoing data shows). We need to base closure on a sampling protocol. But if the numbers are continuously high, it would represent an issue and would justify closing the valves to evaluate.

Broomfield – How will you collect nitrate samples at the POCs?
DOE – Presently grab samples. We are looking at use of flow paced automated sampling for 7 days (based on the hold time for nitrate) or could continue to use grabs. Could start a comparison of collection methods in the spring.

- Broomfield - how often will the data be reviewed, trended, evaluated?
  DOE – will work with you to determine process/timing. Depends on what/how long it takes to collect enough data.
- Broomfield – what are the key objectives for non-RFLMA monitoring?
  DOE – CR 2010-03 provides the objectives, want to understand the ambient conditions for uranium; SPPTS influence on nitrate, uranium; precipitation runoff, performance criteria for remedy – revegetation, removal, etc. AMP process DQOs, triggers. What is the fate of nitrate in the stream reaches. Could be site specific or segment specific standards. Noted that Great Western Reservoir has agricultural standards, while water supply standard at Rocky Flats. DOE will distribute the citation prior to the next meeting.

b. Volume of terminal ponds at 10 percent of capacity?
   - A-4 = 3.3 mill gal
   - B-5 = 2.47 mil gal
   - C-2 = 2.31 mil gal

Westminster – what do you mean when you say you'll open the valves "when ready?"
DOE – need a FONSI; pre-discharge sample; field practicalities, i.e. if installing new flumes; vegetation status, will discuss with the AMP group.

Major storm events, etc.

- Similar response at Walnut and Woman Creeks
- Different concerns/contamination

III. Annual costs to maintain terminal ponds and Present Landfill pond
    - Current cost figures were distributed at the meeting and will be attached to this notes document.
    - Broomfield still wants to see a contingency plan for the PLF pond in flow-through. Broomfield said they don't believe in dilution, or letting contaminated water flow off site.

Next meeting – 1 p.m. Thursday, Feb. 17, 2011 at the Rocky Flats Site office

- Topics to be discussed
    - Evaluation steps
    - Data communication
    - How long AMP monitoring will be conducted/exit strategy
    - Ecological improvements/changes that will result from flow-through/dam breach

NOTES SUMMARY
AMP development working group meeting
02/17/11

Broomfield (BF) opened the discussion with suggested language to include in the AMP that was modeled on the language in RFLMA. The purpose of the language was to establish in writing the level of participation for interested parties.

- BF described their perception of the AMP process and believes the objective of the AMP is to asses the flow-through condition over the next eight years to determine whether to breach or not. Identified three objectives.
    1. Prior to breaching want to reassess conditions via the AMP at set time intervals.
    2. Want to define the process of assessment – define explicitly who is involved.
    3. Wants technical information available at an earlier timeframe than they have previously.

Summary of discussion of BF's proposed language.

Role of parties in AMP decision making:

- BF wants to be sure they are at and remain at the table during the process of making the dam breach decision. BF wants to be at the table, not necessarily as regulators. Don't want to over-ride RFLMA, want an understanding of the parties involved, access to data and the ability to discuss the data in a timelier manner as part of the consultative process. Concerned that DOE has not provided the model that will be used to define roles in the process. Would like to see that.
- DOE – regulators are already defined and consultation is part of the process. AMP is not a regulatory document or agreement. The regulatory process is defined in RFLMA and the other stakeholder involvement is defined in the Public Involvement Plan (PIP). BF proposed regulatory language to a process that doesn't fit under the regulatory model.
- CDPHE – BF extracted language in an agreement between the DOE, EPA, and the state. It's more appropriate to use language from the PIP for the AMP process because the AMP is not regulated by CDPHE or EPA. Talked about this before, the possibility of adding language to the PIP, and BF indicated that the existing language is sufficient. Think BF already has assurances that it will get all the info needed.
- EPA – under NEPA, the initiating federal agency has sole authority.

Summary of discussion of how data will be shared:

- DOE – Data should be available on Geospatial Environmental Mapping System (GEMS) immediately after it is validated. DOE can commit to making data available on a specific basis. DOE has an existing public involvement process that DOE uses to share information, wonder what BF's basis for changing the timing of notifications? The cities/public are notified at the same time as the regulators under RFLMA. DOE

understands that participants want earlier information, but why decrease the current timing? What is the technical basis?

- BF – Dealing with flow-through is a different condition, could present problems. No technical basis, just want a shorter time than in RFLMA. If we can identify triggers we may not have to worry.
- DOE – what is the relationship between the AMP and some of BF's recommendations, for example, violation of institutional controls?
- BF – DOE will be digging below 3 feet and BF thinks it affects the whole system. Dams are BF's last line of defense. The whole reason BF is here is BF doesn't want the terminal dams breached, but after 7-8 years we might have enough data to breach. The site is dynamic enough that DOE can't make a breaching decision. BF wants to be part of and be able to provide input in the decision-making process. BF wants more opportunity to participate as things are happening on site. Wants language in AMP that ensures BF is part of the process when changes are made to the AMP. Doesn't want new regulations, but wants a role on consultation and consensus over the next 8 years. Want to be involved in the resolution of disputes, but will differ to CDPHE and EPA.

Summary of discussion of topics provided by DOE.
Evaluation steps -

- DOE – need to develop monitoring objectives (MO). What do the cities want to do and what does the data mean? Focus is AMP, what is the objective of the monitoring? Goal is to demonstrate to the communities through the AMP process that there will be no exceedances and determine how to apply the new data to this process. DOE identified examples of MOs, which are the type of information to establish – non-RFLMA sampling to establish ambient standards; spatial info on reaches of streams where DOE thinks it knows, but not have enough evidence yet; impact of revegetation and erosion control, which is expected to be positive. Overall goal of MOs is to get more detailed data.
- BF – what about nitrates, for example, how they change through the system?
- DOE – Uranium is major issue (in Walnut Creek drainages) because of high background and low standard. Can also include other constituents as part of the sampling data evaluation at no extra cost, but they are not a compliance issue at the POCs. Issue is learning where in the system the U is picked up – where and how natural U is occurring at Rocky Flats.
- BF – Are MOs a link to operational changes? BF sees three operation actions that need an evaluation process – open valve – close valve – breach dams – BF questions for the AMP are deciding whether/when to open/close/breach.
- DOE – also looking at habitat improvement and returning the areas to a natural condition. Want to stabilize soils and water levels at dams to establish the ecological fluctuation.

Summary of discussion of Woman Creek Reservoir Authority (WCRA) recommended monitoring objectives by number (WCRA list attached at the end of the notes)
#5 – additional AMP specific monitoring

- WCRA – concerned with Pu/Am in Woman Creek, data collection in current locations pretty good to get what data is needed at flow-through. Want a refined

assessment (real time assessment) of solids as they move through the stream. MOs to help determine the relationship between turbidity and Pu/Am concentrations. Use rising limb to collect TSS data, then connect turbidity to TSS, if found to be useful.

- WCRA – exit strategies and 2 year review. Want review of AMP at no more than 2-year intervals to review all the information listed and have good background data – want to look at all the documentation, not just a snapshot.
- DOE – flow at 027 is about every other year, so 2 years is a good timeframe.
- BF – what about GS031, it won't be a RFLMA reporting location after it is not a POC?
- DOE – could continue sampling at GS031 under AMP, can put in turbidity sampling, rising limb etc., it just won't be a POC. Can use data in AMP based on MO goals. Monitoring data will be available to public on GEMS, which is posted at nearly the same time as DOE receives the validated data.

#6 – communication issues

- WCRA – Will AMP result in annual report, part of RF site annual report?
- DOE – Re-thinking including in annual report because annual report is a regulatory requirement. May split it up, may put on different schedule than site annual report, but would use all the data. One possibility is separate periodic reports, but with summary included in annual report. Communication process will be included in AMP.
- WCRA –technical meetings, regular or periodic meetings? Specify in the AMP? One problem, GEMS data doesn't give any evaluation, just raw data.
- DOE – could add an explanation at quarterly meetings to add AMP information, but don't want to use RFSC to hold technical meetings. Could agree to a regular schedule or to schedule meetings when there is a trigger from the data.
- WCRA – need an exit strategy, perhaps for individual pieces of the AMP, strategy should be staged.
- DOE – need parameters of actions, or a range of behaviors, with flexibility for implementation.

WCRA question – Where did the dirt in the dams come from?
DOE response – still researching that information. (Information was obtained following the meeting that the material removed during spillway excavation was used in dam construction.)

Ecological outcomes of dam breach anticipated in Draft EA presented by site ecologist.

- Will result in losing open water habitat. Because pond bottoms will be filled, it will create a flat, shallow emergent wetland. Areas above water line level will develop upland vegetation, grassland. A native seed mix will be planted. Downstream areas will be similar, dependent on what vegetation can grow in the armoring used in spillways.
- Changes – will lose some aquatic animals, water fowl will lose pond surfaces, but some bird species will decline and others increase.

- Preble's' Meadow Jumping Mouse – open water is not Preble's' habitat, emergent wetlands are critical mouse habitat, so will increase the amount of mouse habitat on site. By enhancing habitat, will be following directives for federal facilities.
- Trees and herbaceous habitat in areas downstream of the COU boundary could benefit from more consistent flows during the growing season in a flow-through/breached condition.
- WCRA – when open valve for flow-through will pond bottoms be flattened (as projected for final breaching)?
- Grass and erosion control matting will be placed on the exposed pond bottoms.

Action Items
DOE – distribute sign-in sheets for previous meetings.
distribute table of topics of agreement
BF – will send MOs to DOE

Next meeting – Thursday, March 3, 1-4 p.m. at DOE RFS office.

DRAFT – WCRA-Requested AMP Inclusion Items_ 2-17-2011 Meeting

The following text comprises the initial draft list of WCRA-requested items for inclusion in the AMP. We look forward to additional discussion and anticipate an opportunity to modify this list, as needed, through edits to the draft AMP and/or other future communications with DOE prior to AMP finalization.

1. **AMP Triggers to Close C-2 Valve During Flow-through Conditions -** Items WCRA requests in the AMP as triggers for closing the Pond C-2 valve during flow-through conditions (i.e., prior to breaching):

- Wildfire in C-2 drainage,
- Significant slumping/ erosion observations in C-2 drainage, and
- Exceedance of standard at GS31, GS01 or SW027

We also recognize that in the event a valve is closed, the AMP will need reasonable language to allow for re-opening of the C-2 valve following review of available data. WCRA would like the process to include a public technical meeting to present the findings of the follow-up analysis and conclusions/basis to reopen.

2. Communications/Info Provision to WCRA – WCRA requests additional communications/information from DOE. Currently, WCRA only receives notice if an exceedance occurs at GS01. Throughout the AMP implementation (during flow-through conditions and following dam breaching), WCRA would like to receive notification of:

- Sample collection at GS01,
- Water quality results as soon as DOE receives them (GS01 [priority], GS31, SW027) – pre-validation/validation notification, and
- Flow data (in an electronic format on a quarterly basis or upon request if more immediate information is needed).

3. Response Actions to SW027 Exceedance in 2010 –WCRA requests that initiation of flow-through at Pond C-2 wait until at least one growing season has passed to allow the reseeding portion of the SW027 response to 'take root'. We also request a review of the revegetation status prior to valve opening.

4. Minimizing Missed Sampling Periods at GS01 – WCRA recommends use of backup sample bottles (master-slave configuration at bottle-#1 flow pace) to minimize the chance/duration of missed sampling periods at GS01. DOE noted that a larger sample bottle could provide the same result, and this might be easier to implement due to the use of "refrigerated" samplers which have ample space for larger bottles. WCRA would request/support either option. There should be no change in the number (monthly sample count targets) of samples collected due to implementation of this approach.

WCRA also recognizes that missed sampling intervals could still occur due to flooding and/or equipment failures. This measure is only to minimize missed sampling during the cases when bottles fill due to rapid changes in flow rate before field staff can visit the sampling station.

5. Additional AMP-Specific Data Collection – WCRA proposed studies that could provide useful information to monitor Pu/Am migration under the new hydrologic conditions of flow-through. These data would also provide information to evaluate in the event of an exceedance at GS31 or GS01:

- Collection of continuous (15-minute) turbidity data below pond C-2 (GS31), and
- Collection of rising limb storm event samples below Pond C-2 (GS31). WCRA is interested in collecting Pu/Am and TSS. This approach would allow for successful collection of TSS, which is currently often missed due to hold-time issues.
- AMP exit strategies to discontinue this additional sampling – Assess need and value during 2 year review (consider event sizes captured, any trends, etc.)

6. **AMP Ongoing Evaluation and Reassessment**–WCRA supports the following approach to ongoing evaluation and periodic reassessment of the AMP:

- Evaluation of the AMP sampling results within the annual reports to allow for consideration of results with all of the data collected at the RFS,
- Discussion of AMP sampling results at periodic technical meetings (greater frequency than annual/quarterly reporting),
- A timeline of no-more-than 2 years before revisiting the AMP. The 2 year timeframe seems reasonable to allow for adequate data collection to assess the changing conditions, noting that the size of hydrologic events captured in the 2 year window should be considered in the evaluation. The "no more than" language leaves the door open for more frequent reassessment as warranted by any unanticipated findings.
- Participation by downstream communities in AMP reassessment/revision.

NOTES SUMMARY
AMP development working group meeting
03/03/11

Broomfield (BF) Monitoring Objectives (MO) (attached at end of notes)
(Notes are referenced to topic number on Broomfield's list of MOs)

Broomfield initiated the discussion by reviewing their proposed MOs (attached for reference following notes). Key points are noted below.

- BF – Broad range of concerns. Not trying to supersede, over-ride or replace RFLMA. Want more frequent reporting of things already monitored, more frequent monitoring
- BF – like to review draft AMP 2 weeks before last AMP development meeting
- BF/Woman Creek Reservoir Authority (WCRA) – go over draft AMP at last AMP development meeting.
- DOE – agrees the AMP participants will have time to review draft before finalizing.

1: Dams remain in place until 2036

- BF – not support any breach before 2036, but willing to negotiate specifics. Disagree with DOE position on water lease. Willing to negotiate modification of lease.
- DOE – will post DOE's letter to Broomfield on water lease to LM website. DOE does not agree with Broomfield's contention that the lease precludes dam breach. DOE considers the water lease is not appropriate subject for the AMP. This issue will be handled by the attorneys.

2: Flow-through operations

- BF – Triggers for closing or reopening valves during flow-through. Want same type of triggers as proposed by WCRA.
- DOE – flexibility on response to water quality issues is discussed in the EA and will be included in AMP.

3: Criteria for breaching dams

- BF – Identify data used to support breach. Want 2, 5-year review (5YR) cycles under AMP before breaching to show site is stabilized. If lease not modified, 5YR cycles start in 2036, could start sooner if lease modified.
- RFSC – define terms, elevated, etc. used in bullets
- BF – AMP working group would define in AMP.

4: Institutional controls issue needs to be resolved before AMP finalized

5: AMP deadline – should reach consensus prior to finalizing, not rely on targeted date (April 2011)

6: Downstream cities should be involved in future changes to the AMP

- DOE – The AMP will include language defining the process.

3: criteria

- BF – want to see the data proving the remedy is effective. Could have rising trends that are below the standards that could indicate problems (shouldn't breach). Not looking at this as part of the CERCLA process, looking at as a time frame for breaching. Monitoring is needed to demonstrate the remedy is working, has had sufficient time to reach steady state and no problems remain. Then BF could relax stance that ponds are the last line of defense. Need at least 2- 5Yrs with no

exceedance for any of the AMP criteria. Any time one of the criteria is exceeded, would reset the starting point for the 2- 5YR cycles before a determination to breach. BF is looking for criteria (that must be met prior to breaching) that would allow BF to support breaching the dams. 2-5YR cycles would allow BF to go to its constituents and say DOE has meet the criteria, so it is okay to breach dams.

- DOE – not agree to set 2 5YR cycles as basis for breach decision and restarting clock after any exceedance. During 5YR regulators verify protectiveness of remedy. Would BF accept the protectiveness statement to verify remedy is protective? DOE is concerned about language addressing operation of treatment systems as a trigger for re-starting the review cycle would provide a disincentive to improvements to treatment systems. DOE is obligated to continue to try to improve treatment effectiveness. (referring to 4th bullet). DOE will always provide information to the public regarding proposed changes to treatment systems. Proposed 5YR review criteria language will be in the draft AMP for discussion by the AMP participants prior to finalizing.
- CDPHE – some things, data, could lead us to look at carefully, but don't necessarily mean the remedy is not protective.
- CDPHE/DOE – both have issue with setting back the clock, too many restrictions that may not be related to remedy effectiveness.

4: institutional controls

- DOE – the process to resolve the IC issue regarding excavation below 3 feet is being discussed by RFLMA parties and will need to be resolved prior to breaching the dams. That doesn't preclude completing and implementing the AMP.

5: AMP deadline

- DOE – the April deadline is for completing the plan, the adaptive management components of the plan will continue for the long term, probably post-dam breach. Plan needs to be completed in order to issue the EA/FONSI in timely manner to meet scheduling and procurement requirements.

6: process for involving communities in AMP decision making

- DOE – public involvement and participation is based on the Public Involvement Plan. Language addressing notification, discussion, reviews and AMP modifications will be included in the AMP document. DOE invites full participation of CDPHE and EPA.

BF question: will CDPHE delay the proposed RFLMA mods until after the AMP is completed as requested in the BF letter to the director?

CDPHE: the final decision on the RFLMA mods is not tied to the AMP, but is still in process.

7: Monitoring programs

- BF wants to continue monitoring at identified locations for 2-5YR cycles, wants to keep the existing monitoring locations, regardless if they are changed under RFLMA.

Indiana St. monitoring

- DOE – does not see replacing Indiana St. locations in event they have to be removed due to Jefferson Parkway construction. Won't seek to maintain locations on non-federal land and doesn't want to reinstall monitoring locations outside of NPL site.
- BF – If parkway authority built monitoring stations, would DOE monitor, operate and maintain the new locations?

- DOE – would agree to operate for some time, probably not 2-5YR cycles, but for some period of time as long as have access. If property changes hands, that changes the legal status. Federal government needs agreement to access private land.

Present Landfill/No Name gulch

- BF – wants to analysis of all analytes on Table; 1 new groundwater well above confluence with No. Walnut Creek; continue monitoring at locations that will be eliminated from RFLMA.
- DOE – the locations indicated by BF are not being eliminated, they will continue to be monitored under RFLMA.
- CDPHE/DOE – All of the analytes on Table 1 are based on state standards, and includes the contaminants of concern for Rocky Flats and many additional analytes that were included prior to closure. Analytes are evaluated under RFLMA as specified for each particular monitoring location. Table 1 does not include all "priority analytes". The lab reports the entire suite of analytes for each particular analytical method, including many that are not included on Table 1. DOE reports all laboratory results for all of those analytes and evaluates those that are listed on Table 1.

North Walnut Creek

- DOE – questions why BF wants daily grab samples for nitrate. What is the objective, benefit? There is no way to do grab daily. Possibly do automated sampling, but need to resolve holding time issues. Need to prioritize so the cost-effectiveness of the additional monitoring can be determined. May prefer to spend the limited budget on other analytes like U at other locations rather than for nitrates at SW018. Have to think of what it will buy you.
- BF – wants to make sure that DOE is capturing the same data downstream during flow-through as is currently being captured at upstream locations. It is tied to the uncertainty with the proposed RFLMA changes. Objective of daily monitoring is to get a better resolution of data to show how treatment units are working.
- DOE – already doing bi-weekly grabs, SW018 has no history of nitrate. As for the proposed RFLMA mods, DOE isn't changing any of the RFLMA monitoring currently in place.

South Walnut Creek

- DOE – not doing enhanced nitrate sampling because nitrate is not a concern there, have never seen it and there is no source there based on current monitoring.
- BF – would like to look at it for a while to prove there is no source or concern, especially during flow-through. Looking for a holistic response, how do all the segments interact at the POCs? Also want the POCs that are proposed to be modified to remain as AMP monitoring below confluence of N and S Walnut Creeks. Also want DOE to keep reporting on GS-03.

Groundwater Wells

- BF – increase frequency of groundwater monitoring. Higher frequency of data obtained by more monitoring during runoff season. BF would like to see more refined data to assure the site is stable before breaching dams.
- DOE – What is the value of more frequent analysis of groundwater wells when constituents are below standards and the wells are above the area where the dams will be breached? Runoff probably won't make much difference, AOC wells are out in

front of the plumes, so wouldn't see much there. If don't see contamination above the standards in the wells now, how would more frequent data be of benefit?

Additional discussion

- BF – this group should define consensus and have that language in AMP. How many more meetings until April AMP deadline? Want to see AMP language before hold any more meetings. Want written response to their requests before seeing AMP draft. Doesn't have to be detailed response, but would like a yes or no. Could this group discuss comments on the draft AMP rather than waiting for written response?

  DOE – will lay out in the AMP how the AMP consultation process will work. Scheduling future meetings depends on when the AMP draft is completed, but DOE is committed to flexibility in making this process work. Responses to monitoring objectives provided by BF and WCRA will be addressed in the draft AMP. A lot of the yes or no response should be apparent from the notes summary. Discussion of draft AMP comments could occur at the next AMP development working group meeting.

WCRA monitoring objectives follow-up discussion

- WCRA – What if C-2 is discharged before the AMP is completed? Would like to see turbidity monitoring installed before the next discharge if possible to create a baseline for future flow-through. Multiple bottles with more than one composite per event could be beneficial for rising limb sampling at GS-31.
- Previous recommendations were based on RFLMA sampling staying the same. Propose that RFLMA changes act as a trigger for AMP review and revision. Either require GS-31 sampling in AMP, or, if RFLMA changes, that would trigger an AMP review. If GS-31 sampling goes away, want to continue sampling at a nearby location for two more years just to make sure.
- Recommendations all based on taking a look at the AMP every 2 years.
- Westminster – will the AMP include specifics on how monitoring locations will be set up?
- DOE – that is too specific for AMP. AMP will have the "what and where", similar to RFLMA, and the "how" of specific monitoring could be added to an attachment to the Site Operating Guide (RFSOG) that is being developed that addresses non-RFLMA monitoring.

Next meeting

- DOE – next meeting will be determined by completion of the draft AMP. Propose 1 week following distribution of draft AMP to discuss and achieve as much verbal agreement as possible before sending out for written comments. DOE will notify the working group as soon as possible of the projected completion of the draft AMP, then will schedule a discussion meeting for approximately 1 week after the draft is distributed.

For reference, Broomfield's monitoring objective proposals are attached below:

The City and County of Broomfield's Requested Items for the Rocky Flats Surface Water Configuration Environmental Assessment – Adaptive Management Plan

Suggested Language for the Adaptive Management Plan
Rocky Flats Site, Jefferson County, Colorado

Submitted by the City and County of Broomfield
February 15, 2011

Introduction

Suggested Language. Broomfield suggests that the language below be included in the Adaptive Management Plan ("AMP") agreement related to the U.S. Department of Energy ("DOE") proposal to implement a flow-through condition at the terminal dams which may lead at some time in the future to a determination to breach the terminal dams.

In summary, the language here replicates (with suggested additions) the language of:

(a) paragraph 11 of the Rocky Flats Legacy Management Agreement ("RFLMA") concerning "consultation; " and

(b) section 6 of Attachment 2 of the RFLMA concerning "Action Determinations" at the site, i.e., "triggers" which the parties have been discussing at the AMP meetings.

Invitation for additional language. The parties to the AMP discussions may wish to suggest additional language for the AMP Agreement including, but not limited to,

(a) additional "triggers" or "reportable conditions" which would require notification by DOE to the parties and which would begin the consultative process, and

(b) variations to the listed "flowcharts" which are appended to the RFLMA and which are listed in paragraph 3, below.

Need for "default action" language? The parties to the AMP discussions may wish to suggest "default actions" which would be implemented by DOE depending upon the data or circumstances which might arise.

For example, as discussed in recent AMP meetings, is it advisable to require DOE to "close the valve(s)" on one or more of the terminal dams in the event of:

(i) any particular size of precipitation event; or

(ii) the occurrence of any particular type of data result,

in order to pursue the consultative process identified herein?

Suggested Language for the AMP Agreement

1. Parties to the AMP.

The parties to this Adaptive Management Plan Agreement ("AMP Agreement") shall include the U.S. Department of Energy ("DOE"), the U.S. Environmental Protection Agency ("EPA"), the Colorado Department of Public Health and Environment ("CDPHE"), the City and County of Broomfield ("Broomfield"), the City of Westminster ("Westminster"), the City of Northglenn ("Northglenn"), and the Woman Creek Authority ("WC Authority") (each individually referred to herein as a "Party" and collectively referred to herein as the "Parties").

2. Consultation Upon the Occurrence of a Reportable Condition.

Upon the occurrence of a reportable condition at the site (as defined herein at paragraph 3, below), the Parties agree to follow a consultative process in implementing this Agreement.

"Consultation" and "the consultative process" mean the responsibility of one Party to meet and confer with another Party and any appropriate contractors, consultants, advisors, or representatives of the Parties in order to reach agreement, to the extent possible, regarding a proposed course of action.

Consultation involves a cooperative approach to problem solving at the staff level. Consultation includes the responsibility to raise any concerns or suggestions regarding the implementation of this Agreement as soon as the concern or suggestion is identified, to maximize the chances of reaching agreement before (i) action at the site is taken, (ii) a document must be submitted or (iii) a regulatory determination rendered.

Consultation means timely participation at the staff or management level, as appropriate, to reach consensus among the Parties so that there is a clear understanding of the actions or direction to be taken based upon the outcome of the consultative process.

3. Action Determinations Based on the Occurrence of Reportable Conditions.

(a) Whenever any of the following reportable conditions are observed at the site, DOE, in cooperation with all of the other Parties to this AMP Agreement, shall follow the appropriate procedures in this section.

Reportable conditions include:

 Exceedances of surface water standards at any surface water and/or groundwater monitoring locations as monitored by an Party (??? consistent with the attached flowcharts ???);

- Evidence of significant erosion in areas of residual subsurface contamination;

- Evidence of adverse biological conditions;

- Conditions affecting the effectiveness of the landfill covers;

- Evidence of violation of the institutional controls;

- Physical control failure that may adversely affect the remedy; or

- Other abnormal conditions that may adversely affect the remedy.

(b) When reportable conditions occur (except in the case of evidence of violation of institutional controls as described below), DOE will inform all of the other Parties within three (3) calendar days of receiving the inspection reports or other data (validated or otherwise).

(c) Within fifteen (15) calendar days of receiving inspection reports or analytical data (validated or otherwise) documenting a reportable condition, DOE will (a) if requested by any Party, meet with the other Parties to review the reports or other data, and (b) submit a plan and a schedule for an evaluation to address the condition.

(d) DOE will consult with the other Parties as described in Paragraph 2 of this AMP Agreement to determine if mitigating actions are necessary. Final plans and schedules for mitigating actions, if any, will be agreed to by the Parties hereto as contemplated by the consultative process defined in paragraph 2 of the AMP Agreement and approved by CDPHE in consultation with EPA. DOE is not, however, precluded from undertaking timely mitigation once a reportable condition has been identified, provided that such actions are subject to subsequent agreement among the Parties to either (a) confirm such mitigation as appropriate or (b) to make changes to such mitigation if warranted by the data and circumstances.

(e) (i) In the case of evidence of violation of institutional controls, DOE will notify the Parties hereto within two (2) calendar days of discovering any evidence of such a violation, and at that time will initiate the consultative process identified in paragraph 2 herein to address the situation.

(ii) In no case will DOE notify the other Parties hereto more than ten (10) calendar days after the discovery of a situation that may interfere with the effectiveness of the institutional controls. DOE will notify the other Parties hereto of the actions it is taking within ten (10) calendar days after beginning the process to address the situation.

(f) The Parties hereto will consult whenever reportable conditions are observed or at the request of one of the Parties when routine communication processes are not sufficient or appropriate. The objective of the consultation will be to determine a course of action to address the reportable condition and to ensure the remedy remains protective.

(g) Results of consultation will be documented in contact records and/or written correspondence which shall be communicated to all the Parties hereto as soon as such contact records or written correspondence are prepared.

(h) Surface water and groundwater monitoring results will be evaluated as described in the following flowcharts:

- Figure 5 Flowchart – Points of Compliance
- Figure 6 Flowchart – Points of Evaluation
- Figure 7 Flowchart – Area of Concern Wells, Boundary Wells, and SW018
- Figure 8 Flowchart – Sentinel Wells
- Figure 9 Flowchart – Evaluation Wells
- Figure 10 Flowchart – RCRA Wells
- Figure 11 Flowchart – Groundwater Treatment Systems
- Figure 12 Flowchart – Original Landfill Surface Water
- Figure 13 Flowchart – Pre-discharge Pond Sampling

The City and County of Broomfield's Requested Items for the Rocky Flats Surface Water Configuration Environmental Assessment – Adaptive Management Plan

March 2, 2011

The City and County of Broomfield (Broomfield) requests that Department of Energy, Office of Legacy Management (DOE-LM) include the following items in the Adaptive Management Plan (AMP) for the Draft Rocky Flats Water Configuration Environmental Assessment (EA), dated April 2010. The items below are not mutually exclusive and any proposed changes or revisions will require further evaluation and review by Broomfield.

Broomfield has stated in various written and verbal communications that it is concerned with the DOE-LM's proposal to breach the dams so soon following closure. Broomfield believes that the following items will address unanticipated changes in environmental conditions or the subsequent information that might effect the environmental protections as analyzed in the EA, and provide Broomfield with the necessary technical data and assurances regarding the long-term performance and reliability of the remedy.

Please provide us with a written response on our request before the draft AMP is released for comment and review. In addition, we are requesting that DOE-LM distribute a draft copy of the AMP 2 weeks before the final working group meeting. The final working group meeting would be reserved for reviewing and discussing the draft AMP before it is finalized. We are looking forward to continuing our technical discussions on the AMP so that the items listed below can be included in the development and implementation of the AMP.

1. **The dams for Ponds A-4, B-5, and the Present Landfill should remain in place until 2036.**

   - The water lease with Broomfield specifies that the DOE-LM must collect and test the water prior to release as part of the operations for the A- and B-Series Ponds until 2036.
   - The terms and conditions of the water lease for this mode of operation shall remain in effect, unless otherwise amended in writing and approved by both parties.

2. **The goals and objectives of the AMP must clearly identify the triggers for commencing and ceasing flow-through operations and the criteria that will be used to decide whether or not to breach the dams.**

   - The following language was extracted directly from the sixth paragraph of a handout entitled "*Rocky Flats Surface Water Configuration Environmental Assessment, Adaptive Management Plan Purpose and Process*," that DOE provided at the January 13, 2011(AMP) working group meeting:

     > *DOE envisions a flexible process that integrates long-term monitoring and analysis with adjustments to management actions to address unforeseen changes in site operations. … Examples of elements that could be adjusted include, adding water monitoring locations and modifying monitoring frequency, setting parameters for the*

decision to breach, and determining the specific time-frame for breaching the terminal dams.

- Consistent with the information provided, the DOE-LM should include a contingency plan for opening and closing the valves during flow through conditions (similar to the triggers provided by the Woman Creek Reservoir Authority at the February 27, 2011 AMP working group meeting).
- The breaching of the terminal ponds should be based on meeting data quality objectives rather than a specified timeframe as stated in the EA.

3. Broomfield proposes that the criteria for breaching the dams for Ponds A-4, B-5, and the Present Landfill should be based on the successful demonstration that the remedy continues to function properly without significant issues, site changes, or water quality exceedances for 2 consecutive 5-year Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review periods.

- The determination of successful site operations will include, but are not limited to, the following performance indicators:
    - No water quality exceedances or elevated levels at any surface water Points of Compliance (POC), surface water Points of Evaluation (POE), surface water monitoring at Indiana Street (regardless of the designation as a POC, or not), and groundwater Area of Concern (AOC) wells.
    - Surface water and groundwater monitoring are not showing increasing trends.
    - Sustained functional performance of the groundwater treatment units without changes, modifications, or alterations to the treatment process.
    - No significant erosion activities, landslides, slippage, slope failure or other geological activity where surface or subsurface soils are mobilized or disturbed.
    - No abnormal or unforeseen condition that could have an adverse effect on the breaching of the dams.
- The eligible review period will not commence until after the year 2036 unless the DOE-LM's Water Lease with Broomfield is amended. (If the Broomfield Water lease is amended, the review period would not begin until the AMP has been finalized and a Record of Decision (ROD) for the Rocky Flats Surface Water Configuration EA is published in the Federal Register.)
- Whenever there is a water quality exceedance, modification to the site, or soil movement, the beginning of the subsequent CERLA review period would become the new starting point.
- Similarly, if the Colorado Water Quality Control Commission (CWQCC) adopts less stringent water quality standards or stream segment designation than what currently exists at the DOE-LM's request, then the new staring point would coincide with the beginning of the next CERCLA review period.

4. **All outstanding legal issues related to the institutional controls for the Central Operable Unit and compliance with the Resource Conservation and Recovery Act (RCRA) for the Present Landfill must be resolved, including any requirements for public participation, before the AMP is finalized.**

   - The DOE-LM has an opportunity to continue the public process of developing an AMP while proposed changes and amendments to the institutional controls in the Proposed Plan, Corrective Action Decision/Record of Decision (CAD/ROD), Rocky Flats Legacy Management Agreement (RFLMA), and the Environmental Covenant are being considered.
   - Broomfield has not been provided with any written responses to whether the breaching of the Present Landfill complies with the RCRA and the Colorado Hazardous Waste Act (CWHA).

5. **The preparation and release of the AMP should be linked to achieving a goal based outcome rather than an arbitrary deadline.**

   - There is no regulatory basis for completing the AMP by April 2011.
   - Since the breaching of the terminal dams is not planned for many years in the future, development and preparation of the AMP should be based on meeting the needs of all the parties.

6. **The AMP needs to include a process where the downstream communities are involved and "at the table" when any future changes, modifications, or amendments to the AMP are being considered, or when any significant decisions to implement the AMP or Proposed Action in the EA are made.**

   - Any changes, modifications, or amendments to the AMP should be made through a consensus building, public participation process.
   - DOE must invite the Colorado Department of Public Health and Environment (CDPHE) and the Environmental Protection Agency (EPA) to all future technical meetings related to the AMP.

7. **The following surface and groundwater monitoring programs, delineated by stream segment, needs to be included for the full duration of the AMP implementation and continued for a minimum of two complete CERCLA review cycles after the last terminal dam at the site is breached.**

   - The proposed sampling program listed below should be included in the AMP regardless of any current or future proposals to amend the RFLMA.
   - If the Indiana Street monitoring sites are forced to be relocated due to the construction of the proposed Jefferson Parkway, DOE will install and continue to operate new surface water monitoring sites at the western boundary of the Jefferson Parkway right-of-way.

Present Landfill / No Name Gulch

Objectives: (1) Ensure that the groundwater treatment unit for the Present Landfill continues to function properly and (2) water quality standards for a closed landfill are being met.

- Conduct monthly/quarterly analyses of all analytes listed in the Rocky Flats Legacy Management Agreement, Attachment 2, Table 1 dated February 2007 for the following locations:
    - **PLFSYSEFF** (this location is being proposed for elimination from RFLMA)
    - PLPONDEFF (or NN01 after the Present Landfill dam has been breached)
    - **New No Name Gulch AOC Well** (This would be a new groundwater monitoring location above confluence with North Walnut Creek)

North Walnut Creek

Objectives: (1) Ensure that the Solar Ponds groundwater treatment unit continues to function properly and (2) water leaving the site meets CWQCC surface water standards.

- Increase the frequency of the monitoring program from semiannually to monthly during the runoff season and after significant precipitation events for the following monitoring locations listed in the Rocky Flats Legacy Management Agreement, Attachment 2, Table 2 dated September 2009:
    - **SW-018** (Current RFLMA monitoring is limited to semiannually)
    - **SPIN** (Current RFLMA monitoring is limited to semiannually)
    - **SPOUT**(Current RFLMA monitoring is limited to semiannually)
- Calculate and report 30-day and 12-month flow weighted rolling averages for Americium, Plutonium, and Uranium, and collect daily grab samples for Nitrates, at the following locations:
    - **SW-018** (Current RFLMA monitoring does not include radionuclides or nitrates)
    - **SW-093** (Currently, only 12-month averages are reported as part of RFLMA)
    - **GS-13** (Currently, only 12-month averages are reported as part of RFLMA)
    - **GS-11** (Currently, only 12-month averages are reported as part of RFLMA. In addition, DOE is proposing to delete this monitoring location from the RFLMA)

South Walnut Creek

Objectives: (1) Ensure that the Mound Site and East Trenches groundwater treatment units continue to function properly and (2) water leaving the site meets CWQCC surface water standards.

- Increase the frequency of the monitoring program from semiannually to monthly during the runoff season and after significant precipitation events for the following monitoring locations listed in the Rocky Flats Legacy Management Agreement, Attachment 2, Table 2 dated September 2009:
    - **MOUND R1-0** (Current RFLMA monitoring is limited to semiannually)
    - **MOUND R2-E** (Current RFLMA monitoring is limited to semiannually)

  - **ET INFLUENT** (Current RFLMA monitoring is limited to semiannually)
  - **ET EFFLUENT**(Current RFLMA monitoring is limited to semiannually)

- Calculate and report 30-day and 12-month flow weighted rolling averages for Americium, Plutonium, and Uranium, and collect daily grab samples for Nitrates, at the following locations:
  - **GS-10** (Currently, only 12-month averages are reported as part of RFLMA)
  - **POM2** (Currently, only 12-month averages are reported as part of RFLMA)
  - **GS-08** (Currently, only 12-month averages are reported as part of RFLMA. In addition, DOE is proposing to delete this monitoring location from the RFLMA)
- Conduct monthly analyses of VOC's at **GS-10** and **GS-08**:

Walnut Creek (below confluence of North and South Walnut Creeks)
Objective: Ensure that the migration of contaminants from the site do not result in exceedances of the CWQCC surface water standards.

- Calculate and report 30-day and 12-month flow weighted rolling averages for Americium, Plutonium, and Uranium, collect daily grab samples for Nitrates, and conduct monthly analyses of VOC's at the following locations:
  - **Proposed Walnut Creek POC**(The DOE-LM is proposing to replace GS-03 as the Walnut Creek POC with a new monitoring site further upstream)
  - **GS-03** (DOE is proposing to delete this monitoring location from the RFLMA)

Groundwater Wells
Objectives: (1) Ensure that the existing contaminated groundwater plumes are not migrating and (2) groundwater at the Area of Concern (AOC) wells meets the CWQCC groundwater standards.

- Increase the frequency of the monitoring program from semiannually to monthly during the runoff season and after significant precipitation events for all of the AOC groundwater wells listed in the Rocky Flats Legacy Management Agreement, Attachment 2, Table 2 dated September 2009.

OFFICE OF THE CITY AND COUNTY MANAGER

One DesCombes Drive • Broomfield, CO 80020 • Phone: (303) 438-6300 • Fax: (303) 438-6296 • Email: info@broomfield.org

February 1, 2011

Ms. Martha Rudolph
Executive Director
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

RE: Request to Postpone RFLMA Decisions Pending AMP Process Completion

Dear Ms. Rudolph:

Proposal

The City and County of Broomfield hereby requests that the Colorado Department of Public Health and Environment ("CDPHE") temporarily postpone any decisions with regard to changes to the Rocky Flats Legacy Management Agreement ("RFLMA") pending completion of the discussions being undertaken with the U.S. Department of Energy ("DOE") in the context of the Adaptive Management Plan ("AMP") process.

Our Goal

As indicated in a joint letter to CDPHE, DOE, and the Environmental Protection Agency dated November 30, 2010, the goal of the communities affected by Rocky Flats is to ensure an open and transparent communication process during which all substantive issues related to current proposals can be fully vetted (i.e., fully appraised, verified, and checked) and subsequently resolved ***before*** decisions related thereto are made by the agencies. These proposals include:

(1) breaching the dams at the site (the subject of the draft Environmental Assessment ("EA"), and

(2) revising the points of compliance locations and protocols (the subject of the RFLMA changes),

We submit that a piecemeal approach only adds to the feeling of anxiety and distrust which DOE fostered over several decades of operations at the Rocky Flats site.

DOE and CPDHE representatives at the AMP meeting on January 13, 2011, acknowledged that there are no statutory or regulatory deadlines which are driving the current timetable. In addition, we understand that there are no substantive reasons to separate the timelines for either (1) final decisions related to the Environmental Assessment related to the dam breaching, or (2) responding to public comments and finalizing the suggested changes to the RFLMA, other than a desire to move ahead on the schedules the agencies have identified, to date.

Indeed, it appears the primary driving force to proceed on separate paths is an unyielding, yet we believe unsupported, desire to "stick to an arbitrarily imposed timetable."

It is a simple matter to revise the timetable. Therefore, please postpone making any final decisions on the proposed changes to RFLMA in order to allow the parties to coordinate their resources and focus on all the substantive issues with the RFLMA and the AMP process, simultaneously.

Thank you, and we look forward to continuing our work in a cooperative manner that meets all needs.

Sincerely,

George Di Ciero
City and County Manager

cc: Doug Young, Governor's Office
Carolyn Boller, Senator Udall's Office
Zane Kessler, Senator Bennet's Office
Andy Schultheiss, Representative Polis' Office
Stuart Feinhor, Representative Polis' Office
Bill Holen, Representative Perlmutter's Office
Dave Geiser, DOE-LM
Thomas Pauling, DOE-LM
Jane Powell, DOE-LM
Scott Surovchak, DOE-LM
James Martin, USEPA
Carol Rushin, USEPA
Larry Svoboda, USEPA
Vera Moritz, USEPA
Howard Roitman, CDPHE
Joe Schieffelin, CDPHE
Gary Baughman, CDPHE
Carl Spreng, CDPHE
Steve Berendzen, USFWS
John Watson, Esquire, Berenbaum Weinshienk PC
Lori Cox, Broomfield Councilmember
Jeff Stoll, Broomfield Public Health Officer
David Allen, Broomfield Deputy Director of Public Works
Mike Smith, Westminster Director of Public Works
David Willett, Northglenn Director of Public Works
Bud Elliot, Thornton Deputy City Manager – Infrastructure
David Abelson, Rocky Flats Stewardship Council

STATE OF COLORADO

John W. Hickenlooper, Governor
Christopher E. Urbina, MD, MPH
Executive Director and Chief Medical Officer

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Colorado Department
of Public Health
and Environment

February 24, 2011

Mr. George DiCiero
Manager
City and County of Broomfield
One DesCombes Drive
Broomfield, CO 80020

Dear Mr. DiCiero,

Thank you for your letter of February 1, 2011 requesting that the Colorado Department of Public Health and Environment (CDPHE) delay its decision regarding the modifications being proposed for Attachment 2 of the Rocky Flats Legacy Management Agreement (RFLMA). As a party to the RFLMA and as the lead regulatory agency, CDPHE has approval authority for those modifications. As you know, we have not yet made any decision regarding any modifications.

My staff has kept me apprised of the many meetings and conversations that have occurred to work through the issues that have been raised by the communities impacted by Rocky Flats. I know that you and your staff have been actively engaged in these meetings. One series of meetings, the technical working group, has addressed details of the substantive issues with the RFLMA modifications. A separate series of meetings, pursuant to DOE's Adaptive Management Plan process, is addressing concerns related to DOE's proposed changes to pond management at Rocky Flats. I am pleased to learn that both sets of meetings have proven fruitful and have resulted in increased recognition and understanding by all the participants of the concerns, positions, known and unknown facts and legal underpinnings that influence the resolution of the issues. In response to discussions during these meetings, the RFLMA parties are working to revise the originally proposed RFLMA modifications. We expect to share with you the decision on the proposed modifications in the coming weeks.

Sincerely,

Martha Rudolph
Director of Environmental Programs