

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 Thornton -- City of Westminster -- Town of Superior
League of Women Voters -- Rocky Flats Cold War Museum -- Rocky Flats Homesteaders
Nancy Newell

Board of Directors Meeting – Agenda

Monday, January 26, 2015, 8:30 AM – 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 January 12th Executive Committee meeting
- 8:40 AM Business Items (briefing memo attached)
1. Election of Stewardship Council Officers for 2015
Action Item: Elect Officers
 2. Consent Agenda
 - o Approval of meeting minutes and checks
 3. Approve 2015 Meeting Dates and Notice Provisions Resolution
Action item: Adopt resolution and meeting notice provisions
 4. Approve letter to Colorado Congressional Delegation (re)introducing the Rocky Flats Stewardship Council
Action item: Approve letter
 5. Executive Director’s Report
- 9:00 AM Public Comment
- 9:10 AM Host DOE Quarterly Meeting (briefing memo attached)
 - o DOE will brief the Stewardship Council on site activities for the third quarter of 2014 (July – September).

- Activities include surface water monitoring, groundwater monitoring, ecological monitoring, and site operations (inspections, maintenance, etc.).

- 10:00 AM Briefing/Discussion on USFWS' Plans to Conduct a Prescribed Fire at Rocky Flats (briefing memo attached)
- USFWS has signaled its intent to conduct a prescribed fire on 700 acres in the southern portion of the Rocky Flats National Wildlife Refuge.
 - At this meeting, the Board will meet with and hear from USFWS, CDPHE and DOE.
 - The issues to be addressed include USFWS' plans, alternatives to burning, contaminate levels in the buffer zone, results of the 2000 burn, and related issues.

11:15 AM Public comment

- 11:25 PM Updates/Big Picture Review
1. Review Big Picture
 2. Member Updates

Adjourn

Upcoming Meetings: All dates are proposed and will be set at this meeting

April 6
June 1
September 14
October 26

Acronym or Term	Means	Definition
Alpha Radiation		A type of radiation that is not very penetrating and can be blocked by materials such as human skin or paper. Alpha radiation presents its greatest risk when it gets inside the human body, such as when a particle of alpha emitting material is inhaled into the lungs. Plutonium, the radioactive material of greatest concern at Rocky Flats, produces this type of radiation.
Am	americium	A man-made radioactive element which is often associated with plutonium. In a mass of Pu, Am increases in concentration over time which can pose personnel handling issues since Am is a gamma radiation-emitter which penetrates many types of protective shielding. During the production era at Rocky Flats, Am was chemically separated from Pu to reduce personnel exposures.
AME	Actinide Migration Evaluation	An exhaustive years-long study by independent researchers who studied how actinides such as Pu, Am, and U move through the soil and water at Rocky Flats
AMP	Adaptive Management Plan	Additional analyses that DOE is performing beyond the normal environmental assessment for breaching the remaining site dams.
AOC well	Area of Concern well	A particular type of groundwater well
B	boron	Boron has been found in some surface water and groundwater samples at the site
Be	beryllium	A very strong and lightweight metal that was used at Rocky Flats in the manufacture of nuclear weapons. Exposure to beryllium is now known to cause respiratory disease in those persons sensitive to it
Beta Radiation		A type of radiation more penetrating than alpha and hence requires more shielding. Some forms of uranium emit beta radiation.
BMP	best management practice	A term used to describe actions taken by DOE that are not required by regulation but warrant action.
BZ	Buffer Zone	The majority of the Rocky Flats site was open land that was added to provide a

		"buffer" between the neighboring communities and the industrial portion of the site. The buffer zone was approximately 6,000 acres. Most of the buffer zone lands now make up the Rocky Flats National Wildlife Refuge.
CAD/ROD	corrective action decision/record of decision	The complete final plan for cleanup and closure for Rocky Flats. The Federal/State laws that governed the cleanup at Rocky Flats required a document of this sort.
CCP	Comprehensive Conservation Plan	The refuge plan adopted by the U.S. Fish and Wildlife Service in 2007.
CDPHE	Colorado Department of Public Health and Environment	State agency that regulates the site.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	Federal legislation that governs site cleanup. Also known as the Superfund Act
cfs	cubic feet per second	A volumetric measure of water flow.
COC	Contaminant of Concern	A hazardous or radioactive substance that is present at the site.
COU	Central Operable Unit	A CERCLA term used to describe the DOE-retained lands, about 1,500 acres comprised mainly of the former Industrial Area where remediation occurred
CR	Contact Record	A regulatory procedure where CDPHE reviews a proposed action by DOE and either approves the proposal as is or requires changes to the proposal before approval. CRs apply to a wide range of activities performed by DOE. After approval the CR is posted on the DOE-LM website and the public is notified via email.
Cr	chromium	Potentially toxic metal used at the site.
CRA	comprehensive risk assessment	A complicated series of analyses detailing human health risks and risks to the environment (flora and fauna).
D&D	decontamination and decommissioning	The process of cleaning up and tearing down buildings and other structures.
DG	discharge gallery	This is where the treated effluent of the SPPTS empties into North Walnut Creek.
DOE	U.S. Department of Energy	The federal agency that manages portions of Rocky Flats. The site office is the Office of

		Legacy Management (LM).
EA	environmental assessment	Required by NEPA (see below) when a federal agency proposes an action that could impact the environment. The agency is responsible for conducting the analysis to determine what, if any, impacts to the environment might occur due to a proposed action.
EIS	environmental impact statement	A complex evaluation that is undertaken by a government agency when it is determined that a proposed action by the agency may have significant impacts to the environment.
EPA	U.S. Environmental Protection Agency	The federal regulatory agency for the site.
EEOICPA	energy employees occupational illness compensation program act	This act was passed by Congress in 2000 to compensate sick nuclear weapons workers and certain survivors. Unfortunately the program has been fraught with difficulties in getting benefits to these workers over the years.
ETPTS	east trenches plume treatment system	The treatment system near the location of the east waste disposal trenches which treats groundwater contaminated with organic solvents emanating from the trenches. Treated effluent flows into South Walnut Creek.
FC	functional channel	Man-made stream channels constructed during cleanup to help direct water flow.
FACA	Federal Advisory Committee Act	This federal law regulated federal advisory boards. The law requires balanced membership and open meetings with published Federal Register meeting dates.
Gamma Radiation		This type of radiation is very penetrating and requires heavy shielding to keep it from exposing people. Am is a strong gamma emitter.
GAO	Government Accountability Office	Congressional office which reports to Congress. The GAO did 2 investigations of Rocky Flats relating to the ability to close the site for a certain dollar amount and on a certain time schedule. The first study was not optimistic while the second was very positive.
g	gram	metric unit of weight
gpm	gallons per minute	A volumetric measure of water flow in the

		site's groundwater treatment systems and other locations.
GWIS	groundwater intercept system	Refers to a below ground system that directs contaminated groundwater toward the Solar Ponds and East Trenches treatment systems.
IA	Industrial Area	Refers to the central core of Rocky Flats where all production activities took place. The IA was roughly 350 of the total 6,500 acres at the site.
IC	Institutional Control	ICs are physical and legal controls geared towards ensuring the cleanup remedies remain in place and remain effective.
IGA	intergovernmental agreement	A cooperative agreement between local governments which sets up the framework of the Stewardship Council.
IHSS	Individual Hazardous Substance Site	A name given during cleanup to a discrete area of known or suspected contamination. There were over two hundred such sites at Rocky Flats.
ITPH	interceptor trench pump house	The location where contaminated groundwater collected by the interceptor trench is pumped to either the Solar Ponds and East Trenches treatment systems
L	liter	Metric measure of volume, a liter is slightly larger than a quart.
LANL	Los Alamos National Laboratory	One of the US government's premier research institutions located near Santa Fe, NM. LANL is continuing to conduct highly specialized water analysis for Rocky Flats. Using sophisticated techniques LANL is able to determine the percentages of both naturally-occurring and man-made uranium which helps to inform water quality decisions.
LHSU	lower hydrostratigraphic unit	Hydrogeology term for deep unweathered bedrock which is hydraulically isolated from the upper hydrostratigraphic unit (see UHSU). Data shows that site contaminants have not contaminated the LHSU.
LM	Legacy Management	DOE office responsible for overseeing activities at closed sites.
LMPIP	Legacy Management Public Involvement Plan	This plan follows DOE and EPA guidance on public participation and outlines the methods of public involvement and communication used to inform the public of

Rocky Flats Acronym List
 Prepared by Rik Getty, Rocky Flat Stewardship Council
 October 2014

		site conditions and activities. It was previously known as the Post-Closure Public Involvement Plan (PCPIP).
M&M	monitoring and maintenance	Refers to ongoing activities at Rocky Flats.
MOU	Memorandum of Understanding	MOU refers to the formal agreement between EPA and CDPHE which provides that CDPHE is the lead post-closure regulator with EPA providing assistance when needed.
MSPTS	Mound site plume treatment system	The treatment system for treating groundwater contaminated with organic solvents which emanates from the Mound site where waste barrels were buried. Treated effluent flows into South Walnut Creek.
NEPA	National Environmental Policy Act	Federal legislation that requires the federal government to perform analyses of environmental consequences of major projects or activities.
nitrates		Contaminant of concern found in the North Walnut Creek drainage derived from Solar Ponds wastes. Nitrates are very soluble in water and move readily through the aquatic environment
Np	neptunium	A man-made radioactive isotope that is found as a by-product of nuclear reactors and plutonium production.
NPL	National Priorities List	A listing of Superfund sites. The refuge lands were de-listed from the NPL while the DOE-retained lands are still on the NPL due to ongoing groundwater contamination and associated remediation activities.
OLF	Original Landfill	Hillside dumping area of about 20 acres which was used from 1951 to 1968. It underwent extensive remediation with the addition of a soil cap and groundwater monitoring locations.
OU	Operable Unit	A term given to large areas of the site where remediation was focused.
PCE	perchloroethylene	A volatile organic solvent used in past operations at the site. PCE is also found in environmental media as a breakdown product of other solvents.
pCi/g	picocuries per gram of	A unit of radioactivity measure. The soil

	soil	cleanup standard at the site was 50 pCi/g of soil.
pCi/L	picocuries per liter of water	A water concentration measurement. The State of Colorado has a regulatory limit for Pu and Am which is 0.15 pCi/L of water. This standard is 100 times stricter than the EPA's national standard.
PLF	Present Landfill	Landfill constructed in 1968 to replace the OLF. During cleanup the PLF was closed under RCRA regulations with an extensive cap and monitoring system.
PMJM	Preble's Meadow Jumping Mouse	A species of mouse found along the Front Range that is on the endangered species list. There are several areas in the Refuge and COU that provide an adequate habitat for the mouse, usually found in drainages. Any operations that are planned in potential mouse habitat are strictly controlled.
POC	Point of Compliance (surface water)	A surface water site that is monitored and must be found to be in compliance with federal and state standards for hazardous constituents. Violations of water quality standards at the points of compliance could result in DOE receiving financial penalties.
POE	Point of Evaluation (surface water)	These are locations at Rocky Flats at which surface water is monitored for water quality. There are no financial penalties associated with water quality exceedances at these locations, but the site may be required to develop a plan of action to improve the water quality.
POU	Peripheral Operable Unit	A CERCLA term used to describe the Wildlife Refuge lands of about 4,000 acres.
Pu	plutonium	Plutonium is a metallic substance that was fabricated to form the core or "trigger" of a nuclear weapon. Formation of these triggers was the primary production mission of the Rocky Flats site. Pu-239 is the primary radioactive element of concern at the site. There are different forms of plutonium, called isotopes. Each isotope is known by a different number. Hence, there are plutonium 239, 238, 241 and others.
RCRA	Resource Conservation and Recovery Act	Federal law regulating hazardous waste. In Colorado, the EPA delegates CDPHE the

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		authority to regulate hazardous wastes.
RFCA	Rocky Flats Cleanup Agreement	The regulatory agreement which governed cleanup activities. DOE, EPA, and CDPHE were signors.
RFCAB	Rocky Flats Citizen Advisory Board	This group was formed as part of DOE's site-specific advisory board network. They provided community feedback to DOE on a wide variety of Rocky Flats issues from 1993-2006.
RFCLOG	Rocky Flats Coalition of Local Governments	The predecessor organization of the Rocky Flats Stewardship Council
RFETS	Rocky Flats Environmental Technology Site	The moniker for the site during cleanup years.
RFLMA	Rocky Flats Legacy Management Agreement	The post-cleanup regulatory agreement between DOE, CDPHE, and EPA which governs site activities. The CDPHE takes lead regulator role, with support from EPA as required.
RFNWR	Rocky Flats National Wildlife Refuge	The approximate 4,000 acres which compose the wildlife refuge.
RFSOG	Rocky Flats Site Operations Guide	The nuts-and-bolt guide for post-closure site activities performed by DOE and its contractors.
SEP	Solar Evaporation Ponds	In the 1950's when the site's liquid waste treatment capability was surpassed by the liquid waste generation rate, the site resulted to transferring liquid wastes to open-air holding ponds where solar energy was utilized to evaporate and concentrate the waste. The original SEPs were not impermeable and substantial quantities of uranium and nitrates made their way into groundwater. As a result the solar ponds plume treatment system was necessary to treat the contaminated groundwater before it emerged as surface water in North Walnut Creek.
SPPTS	solar ponds plume treatment system	System used to treat groundwater contaminated with uranium and nitrates. The nitrates originate from the former solar evaporation ponds which had high levels of nitric acid. The uranium is primarily naturally-occurring with only a slight portion man-made. Effluent flows into

		North Walnut Creek
SVOCs	semi-volatile organic compounds	These compounds are not as volatile as the solvent VOCs. They tend to be similar to oils and tars. They are found in many environmental media at the site. One of the most common items to contain SVOCs is asphalt.
TCE	trichloroethylene	A volatile organic solvent used in past operations at the site. TCE is also found in environmental media as a breakdown product of other solvents.
U	uranium	Naturally occurring radioactive element. There were two primary isotopes of U used during production activities. The first was enriched U which contained a very high percentage (>90%) of U-235 which was used in nuclear weapons. The second isotope was U-238, also known as depleted uranium. This had various uses at the site and only had low levels of radioactivity.
UHSU	upper hydrostratigraphic unit	A hydrogeology term describing the surficial materials and weathered bedrock found at Rocky Flats. The UHSU is hydraulically isolated from the lower hydrostratigraphic unit (see LHSU). Groundwater in some UHSU areas of the site is contaminated with various contaminants of concern while groundwater in other UHSU areas is not impacted. All groundwater in the UHSU emerges to surface water before it leaves the site.
USFWS	United States Fish & Wildlife Service	An agency within the US Department of the Interior that is responsible for maintaining the nation-wide system of wildlife refuges, among other duties. The regional office is responsible for the RFNWR.
VOC	volatile organic compound	These compounds include cleaning solvents that were used in the manufacturing operations at Rocky Flats. The VOCs used at Rocky Flats include carbon tetrachloride (often called carbon tet), trichloroethene (also called TCE), perchloroethylene (also called PCE), and methylene chloride.
WCRA	Woman Creek Reservoir Authority	This group is composed of the three local communities, the Cities of Westminster,

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		Northglenn, and Thornton, who use Stanley Lake as part of their drinking water supply network. Water from the site used to flow through Woman Creek to Stanley Lake but the reservoir severed that connection. The Authority has an operations agreement with DOE to manage the Woman Creek Reservoir.
WQCC	Water Quality Control Commission	State board within CDPHE tasked with overseeing water quality issues throughout the state. DOE has petitioned the WQCC several times in the last few years regarding water quality issues.
ZVI	zero valent iron	A type of fine iron particles used to treat VOC's in the ETPTS and MSPTS.

Business Items

- Cover memo
- October 27, 2014, draft board meeting minutes
- List of Stewardship Council checks
- 2015 meeting dates resolution
- Letter to Congress

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Nancy Newell

MEMORANDUM

TO: Board
FROM: David Abelson
SUBJECT: Business Items
DATE: January 15, 2015

In addition to approving the consent agenda (minutes and checks), the Board will need to

1. Appoint officers for 2015
2. Adopt a resolution regarding 2015 meeting dates
3. Approve letter to the Colorado Congressional Delegation (re)introducing the Rocky Flats Stewardship Council

Election of officers

In accordance with the Stewardship Council bylaws, “the Chair, Vice Chair, and Secretary/Treasurer shall be elected annually by the Board of Directors.” The terms commence starting at this meeting. There are no limitations as to the number of terms one can serve. If you are interested in serving as an officer and have not yet let me know of your interest, please email or call me. That way I can notify your fellow board members of your interest. Additional names can be added for consideration at the meeting.

As of the drafting of this memo, the following people have expressed interest in serving on the executive committee:

Joyce Downing (Northglenn) – Chairman
Lisa Morzel (Boulder) – any position
Jeannette Hillery (League of Women Voters) – Secretary/Treasurer

Action Item: Elect officers

Resolution Re: 2015 Meeting Dates and Notice Provisions

Each year, the Board is required to adopt a resolution establishing the meeting dates for the year. The proposed schedule, with the exception of the first meeting of the year, follows the Board’s meeting dates for 2014 and 2013. Accordingly, the 2015 proposed meeting dates are:

January 26 (fourth Monday of the month)
April 6 (first Monday of the month)
June 1 (first Monday of the month)
September 14 (second Monday of the month)
October 26 (fourth Monday of the month)

Because the first Monday of November is the day prior to Election Day, the meeting is scheduled for October 26.

The attached notice provisions track the Stewardship Council's bylaws.

Action item: Adopt resolution and meeting notice provisions

Letter to the Colorado Congressional Delegation (re)introducing the Stewardship Council

At the October meeting, the Board agreed to write the Colorado Congressional Delegation reintroducing the Rocky Flats Stewardship Council. The attached letter was vetted with the executive committee and reflects its input and edits.

At the meeting the Board will approve, as amended, the attached letter.

Action item: Approve letter

ROCKY FLATS STEWARDSHIP COUNCIL

Monday, October 27, 2014, 8:30 – 12:00 PM

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

Board members in attendance: Sandra McDonald (Alternate, Arvada), Lisa Morzel (Director, City of Boulder), Tim Plass (Alternate, City of Boulder), Megan Davis (Alternate, Boulder County), Mike Shelton (Director, Broomfield), Sharon Tessier (Alternate, Broomfield), David Allen (Alternate, Broomfield), Laura Weinberg (Director, Golden), Faye Griffin (Director, Jefferson County), Joyce Downing (Director, Northglenn), Joe Cirelli (Director, Superior), Emily Hunt (Alternate, Thornton), Bob Briggs (Director, Westminster), Mary Fabisiak (Alternate, Westminster), Jeannette Hillery (League of Women Voters), Sue Vaughan (League of Women Voters), Roman Kohler (Rocky Flats Homesteaders), Arthur Widdowfield (Director, Rocky Flats Institute & Museum), Ann Lockhart (Alternate, Rocky Flats Institute & Museum), Nancy Newell (citizen).

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

Attendees: Vera Moritz (EPA), Carl Spreng (CDPHE), Scott Surovchak (DOE-LM), Linda Kaiser (Stoller), Bob Darr (Stoller), John Boylan (Stoller), Jody Nelson (Stoller), Jeremiah McLaughlin (Stoller), David Ward (Stoller), Kurt Franzen (Stoller), Anya Palmieri (Stoller), Heather Brown (Stoller), Art Burmeister (citizen), Mike DiPardo (citizen), Anne Fenerty (citizen).

Convene/Agenda Review

Chair Joyce Downing convened the meeting at 8:39 a.m. The Chair also noted that an Executive Committee meeting was held on September 29, 2014. Meeting attendees included the Executive Committee, Bob Briggs and David Abelson. The purpose was to develop an agenda for this meeting. These meetings are open to public.

Bob Briggs moved to approve the September 2014 Board minutes and the checks. The motion was seconded by Lisa Morzel. The motion to accept the minutes and checks passed 14-0.

Executive Director's Report

David Abelson began by discussing a class about Rocky Flats issues that Sue Vaughan had recently coordinated at the University of Denver. This four week continuing education class incorporated a site tour, as well as presentations by David Abelson and Rik Getty, the Rocky Flats Museum and Institute, CDPHE, and DOE. David said that the discussion was excellent and many good questions were asked. David noted that in the general public today, Kristen Iversen's book still has a huge influence on public perception. Some of the students had read her book, as well as Len Ackland's book about Rocky Flats. Sue added that her main goal was to get more information out to citizens. There were 25 students in the class. She said she received excellent

feedback, and learned a lot herself through the presentation of complicated science at a level people that could understand. She noted that even skeptics walked out of the class with better information. She said there was great interest in doing the class again, maybe in another way. David noted that the group size helped to make it successful, as it was not too large to be unwieldy. He said it also helped that people were there to learn, as opposed to using the forum to press an agenda.

David next addressed sampling conducted in soil of the Woman Creek Reservoir. Located in Westminster, this reservoir opened in 1996 and severed the hydrological connection between Rocky Flats and Standley Lake. Because of excavation during construction, the bottom of the reservoir was made into blank slate in terms of radioactive contamination. It lacks any effects from past fires at Rocky Flats, atmospheric nuclear testing, or other activities that may have deposited particles of materials on the surface. David said that Tim Plass had asked at a meeting following the September 2013 floods how much contamination had moved offsite during the flood. David noted that in addition to water quality monitoring, soil sampling in the Reservoir soils helps provide another important data point. The Woman Creek Reservoir Authority has conducted soil sampling, finding extremely low levels of contamination that were far below any risk level. Carl Spreng commented that it was an extremely important piece of information that these results came back near background levels. Contamination levels at the Reservoir, because of its history, would reflect any contamination traveling off-site since 1996. This time period includes nearly all cleanup activities, including excavation at the 903 Pad. Mary Fabisiak reported that work had begun on berm repairs at the reservoir. Carl added that the reservoir sampling numbers were used to develop a risk assessment, which came back well below any levels of concern. This risk assessment used an ultra-conservative approach. Sue Vaughan asked if it would be worth the Stewardship Council creating a white paper on this issue. David said it would and that it could be folded into the broader discussion of offsite contamination. Additional information about the reservoir can be found on the City of Westminster website.

David concluded by mentioning that the Board's quarterly financial report was recently completed and distributed to Board members. He said to contact him if there were any questions.

USFWS' Plan to Conduct a Prescribed Fire at the Rocky Flats National Wildlife Refuge

David explained that the Board started discussing this topic at the last meeting in the context of its 2015 workplan. The Executive Committee continued discussing this plan at its October meeting. USFWS has indicated it plans to burn approximately 700 acres in the southern part of the Refuge. The goal is to restore native habitat, remove non-native species and reduce fuel load. David noted that there are several questions among Board members regarding this plan. Board members have expressed an interest in learning about various options to address prairie management, and about any plans that are in place for the agencies to address community concerns prior to embarking upon this strategy. Concerns include the risks from fire. There is also concern about the protection of homes in the Candelas development. David noted that DOE, CDPHE and EPA should help address these concerns prior to USFWS moving forward with its burn.

David noted that, as background, in 2000, DOE conducted a test fire in the buffer zone. Results from that test showed that the greatest risk during a fire was to the people fighting the fire. David also discussed that local elected officials bore the brunt of public concern during this fire, which is a big reason that the Board needs to have a very good understanding of all of the factors going into this decision. David directed the Board to the draft motion in the Board packet that was developed prior to the meeting. He described it as narrowly-tailored, not touching on the question of risk, but focusing on anticipated public concerns. He said there would be an opportunity to further discuss these issues at a later date, advising the Board think of this motion as one point in time, with much more discussions to take place starting at the first Board meeting of 2015.

Megan Davis noted that although Commissioner Gardner could not be at this meeting, she had shared her concerns at the Executive Committee meeting. Megan said that adequate engagement and a tremendous amount of public information need to be provided well in advance of the fire. The public will see fire and smoke, and turn to local governments to address numerous questions. Lisa Morzel noted that during the test fire in 2000, there was a lot of public concern in Boulder. She said the City received more phone calls than ever before and had many members of the public attended Council meetings to discuss their concerns. She added that some people were not satisfied with the conclusions from the tests, and that a negative perception exists about fire safety at Rocky Flats, whether true or not. Lisa said that the motion being discussed was developed in order to get everyone up to speed and to encourage additional dialogue with the agencies. She said that the City of Boulder approved the motion. Lisa also noted that the test fire took place prior to the publication of Kristen Iverson's book, and that there may be more fear in the community now.

Joyce Downing said that the Northglenn City Council was extremely concerned, but has not taken a position. She said that they would support alternative method for prairie management. Bob Briggs said that Westminster has the same concerns about public perception. Joe Cirelli said that Superior echoed these concerns, and that certain Board members were very concerned about risk. Mike Shelton said that Broomfield Councilman Greg Stokes presented some questions about the fire that had been answered. Mike said that there is a role for prescribed burns; however, with Rocky Flats, they would worry about erosion control. He added that it seems that there are plenty of other ways to accomplish the same prairie management goals. Sandra McDonald said that Arvada realizes that public perceptions are important. One question they had was whether another burn would be required down they road. They would like to see a more long term plan created upfront. She also asked if there would be enough time to address all of the issues prior to a burn is implemented.

David said that the refuge manager David Lucas partially addressed this issue by saying that they are planning the burn for after the snow melts; however, that makes exact timeframe still very uncertain. Ann Lockhart asked who would fight a lightning strike fire at Rocky Flats. Scott Surovchak said that local fire departments would respond as there is a cooperative agreement with local fire departments. Scott also noted that Boulder County had used prescribed burns for their own land. Megan said that for them, fire was the best option, as it was in more of a forest environment. She clarified that the County is not opposed to fires as tools; they just want to make

sure it is safe and the best option in this case. Ann asked how many fires had there been onsite in recent years. Jody Nelson estimated that there had been about 10-11 unplanned fires since 1994.

Lisa Morzel moved to approve the following motion:

“The Rocky Flats Stewardship Council opposes USFWS’s plan to conduct a prescribed burn at the Rocky Flats National Wildlife Refuge. Our opposition rests primarily on two factors: (1) A burn will cause widespread community concern that will not be sufficiently alleviated through any public education process; (2) given that concern, there are other management options USFWS can employ, thereby obviating the need to burn at this time.”

The motion was seconded by Joe Cirelli. The motion passed 14-0.

The motion and supporting documentation is found at: <http://rockyflatssc.org/USFWS%202015%20burn%20motion%20approved%2010%2027%202014.pdf>

Public Comment

There were no comments. Art Burmeister provided a handout from LeRoy Moore to the Board, which will be posted on the website. He also clarified that a recent fire at the Rocky Mountain Arsenal encompassed 280 acres.

DOE Quarterly Update

DOE’s activities during the second quarter of 2014 included surface water monitoring, groundwater monitoring, ecological monitoring, and site operations (inspections, maintenance, etc.). All reports are available on the Rocky Flats website.

As background, DOE’s focus is detailed in the Rocky Flats Legacy Management Agreement (RFLMA) and was designed to document that the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedy continues to be protective. The primary goal is protection of surface water. Response actions were developed under the final remedy in order to meet this goal. The response actions include the following requirements:

- Maintain two landfill covers
- Maintain four groundwater treatment systems
- Surface water and groundwater monitoring
- Physical controls
 - Signage
 - Restricted access
- Institutional controls
 - No building construction or occupation
 - Restrictions on excavation and soil disturbance
 - No consumption or agricultural use of surface water
 - No groundwater wells except for monitoring

- Protection of landfill covers and engineered remedy components

Surface Water – George Squibb

George first showed a map of the monitoring locations onsite. He then summarized quarterly performance monitoring at the Original Landfill (OLF) and Present Landfill (PLF). All sampling results met water quality standards during the quarter.

George next spoke about Point of Compliance (POC) and Point of Evaluation (POE) monitoring. Reportable 12-month rolling average values for americium and plutonium at GS10 were observed during the quarter. All plutonium and americium results since August 2013 have been below the 0.15 pCi/L standard. Additional sampling continues to be conducted downstream of GS10. As of June 30, 2014, uranium was no longer reportable.

At WALPOC, reportable 30-day average values for uranium were first observed during December 2013. As of May 18, 2014, the 30-day average for uranium was no longer reportable. The 12-month rolling average remains below the 16.8 µg/L standard. Additional sampling is being conducted upstream of WALPOC. George noted that it is projected that the 12-month rolling average will approach the standard. It is currently at 6-7 µg/L. October looks like it will be about 17 µg/L. He said RFLMA parties are evaluating this condition.

Groundwater Monitoring -- John Boylan

John began by noting that the second quarter is a heavy quarter in terms of sampling requirements, especially in even numbered years. Sampling during the quarter included all RFLMA groundwater monitoring locations:

- 10 RCRA wells (quarterly)
- 9 AOC wells (semiannually, 2nd and 4th quarters)
- 28 Sentinel wells (semiannually, 2nd and 4th quarters)
- 42 Evaluation wells (biennially, 2nd quarter; by convention, all in even-numbered years)
- Treatment system locations (semiannually, 2nd and 4th quarters)
- 1 Surface Water Support location (semiannually, 2nd and 4th quarters)

He said that one Sentinel well was dry, which was expected for that location.

At the Mound Site Plume Treatment System (MSPTS), TCE (a VOC) was detected at GS10 above the RFLMA level:

- Reported at 2.8 ug/L; RFLMA level is 2.5 ug/L)
- After re-sampling, concentrations were back below RFLMA levels
- Caused by 2013 flood-related groundwater recharge
 - More groundwater means higher flow rates
 - Higher flow rate means shorter residence time in treatment system
 - Shorter residence time limits treatment

Statistical evaluations and discussion of 2nd quarter results will be included in the 2014 annual report.

Non-RFLMA monitoring was also conducted at the treatment systems:

- MSPTS: air stripper, including data to evaluate adjacent French drain
- East Trenches Plume Treatment System (ETPTS): air stripper
- Solar Ponds Plume Treatment System (SPPTS): microcell and lagoon testing

General activities at the treatment systems during the quarter included:

MSPTS Air stripper

- Cleaned pump, nozzles, plumbing
- Maintained ventilation fans
- Sampled

ETPTS Air stripper

- Cleaned & Sampled

SPPTS

- Continued microcell tests
- Continued pilot-scale lagoon tests
- Sampled

John also updated the group on the ETPTS Reconfiguration Project. Bids were solicited and a Notice of Award was issued June 18. This project will convert the system from a treatment using ZVI to one using a commercial air stripper. It will treat water in batches (not run continuously) and will use the existing solar/battery power, with minor additions and revisions. The air stripper will be housed in a small enclosure next to tanks (former treatment cells). It is scheduled to be completed in late CY 2014.

Site Operations -- Jeremiah McLaughlin

Quarterly sign inspections are required as a physical control under RFLMA. All signs were found to be in good condition. At the OLF, three monthly inspections were performed, as well as weekly inspections of areas where recent slumping or cracking had been noted. Eight settlement monuments and seven inclinometers were monitored. No significant cracking was noted within the landfill boundaries during the second quarter. Cracking and slumping were noted on the east side of the East Perimeter Channel, outside of the landfill boundary, and the cracks were filled as required by the M&M Plan. There was also one quarterly inspection of the PLF. Lisa Morzel asked if there has ever been a fire on top of the OLF. Jeremiah said he was not aware of any fires in this location.

Ecology -- Jody Nelson

Second quarter ecology activities included:

- Weed Mapping
- Prairie Dog Surveys (still no prairie dogs on COU)
- Wetland Water-level Surveys

- Wetland Weed Surveys
- Herbicide Applications (~58 acres treated)
- Planted 130 trees/shrubs for habitat enhancement (Rocky Mountain Juniper [30], 4-Wing Saltbush [50], and Skunkbush [50])
- Set up irrigation system for plantings and watered weekly.
- Preparations made for revegetation, Preble's mouse, and wetland monitoring that will occur in the 3rd quarter.

Jody said that herbicides were used for diffuse knapweed and thistles. Mary Fabisiak noted that an area that burned in 2006 in the northeast corner of the site was some of the best grassland onsite and asked what it was like now. Jody said that because that was part of the refuge, he had not been out there in a long time.

Briefing/Discussion on Groundwater at Rocky Flats – Treatment Systems

As part of the Board's ongoing study of groundwater issues at Rocky Flats, John Boylan discussed the four groundwater treatment systems. He began with a quick summary of the two previous Board presentations related to groundwater. Part One covered the geology and science of groundwater at Rocky Flats. It explained why groundwater is monitored in order to watch for threats to surface water. Part Two reviewed the development and design of the site groundwater monitoring network, and began a discussion of groundwater treatment systems.

For this briefing, John went into more detail about the four groundwater treatment systems that were installed at Rocky Flats as long term stewardship remedies. Treatment systems in the Corrective Action Decision/Record of Decision for Rocky Flats (CAD/ROD) were originally designed to reduce contaminant load reaching surface water. RFLMA has more stringent requirements (effluent compared with Table 1 standards). These requirements and the CERCLA 5-year review process drive continuing efforts to improve the treatment systems.

Treatment system locations were dictated by the detection of contaminated groundwater at or near surface water and fed by a source area. Analytical data and modeling showed systems would be appropriate at four locations:

Present Landfill Treatment System (PLFTS)

- Designed to treat very low levels of VOCs by cascade aeration

Mound Site Plume Treatment System (MSPTS)

- Former Seep SW059
- Designed to treat VOCs by passing water through ZVI

East Trenches Plume Treatment System (ETPTS)

- Designed to treat VOCs by passing water through ZVI

Solar Ponds Plume Treatment System (SPPTS)

- Designed to treat nitrate and uranium by passing water through sawdust and ZVI

Each system includes a groundwater intercept component. Except for PLFTS, all systems have received upgrades since closure. Each system treats very low flows of water (0.75 – 1.5 gpm). In comparison, a garden hose on ‘full blast’ is approximately 10 gpm and the recommended minimum flow rate for a household-supply spring or well is typically at least 5 to 6 gpm. All four treatment systems combined contribute less than 5% of the average flow measured at WALPOC.

The Present Landfill (PLF) occupies the ‘headwaters’ of No Name Gulch. A seep developed on the east face of PLF. The Groundwater Intercept System (GWIS) intercepts groundwater flowing toward PLF. Water from the GWIS and seep enters the Present Landfill Treatment System (PLFTS). This system was designed to treat very low levels of VOCs via cascade aeration (concrete steps). It is a very simple, gravity-driven, minimal maintenance system.

The Mound, East Trenches and Solar Ponds treatment systems (MSPTS, ETPTS, and SPPTS) are similar to one another. In these systems, groundwater intercept trenches feed collected water to treatment cells, where the treated effluent is discharged to the subsurface. John recapped the history, performance and series of upgrades to each of these three systems.

At the MSPTS, after numerous wells were installed to define groundwater contamination, the treatment system was installed in 1998. The system is comprised of a 220-foot-long groundwater intercept trench and two ZVI-filled treatment cells. In 2005, groundwater flow from Oil Burn Pit #2 was routed to MSPTS, which increased flows and contaminant loads. As a result, residence times and treatment effectiveness decreased. The ZVI media has been replaced twice since closure (2006, 2011) and air stripping was added to ‘polish’ the effluent water quality. Air stripping was tested in 2010–2011, a prototype was installed in 2011, and a larger-scale unit was installed in 2013. The result was a significant reduction in recalcitrant VOCs in the system effluent.

At the East Trenches, contaminated groundwater was produced in wells along South Walnut Creek drainage, and VOCs were detected in surface water during the pre-closure period. Numerous wells were installed to define groundwater contamination. In 1999, the ETPTS was installed to intercept and treat the East Trenches Plume as it migrates towards the creek. This system includes a 1,200-foot-long groundwater intercept trench and two ZVI-filled treatment cells. The ZVI media has been changed several times (approximately every three to four years). In 2013, air stripping (based on the MSPTS prototype) was added to reduce influent contaminant concentrations. Currently, the site is reconfiguring the ETPTS to treat water more effectively using a commercial air stripper.

The Solar Ponds plume required a more complex system, and is a much more complex story. During the pre-closure period, seeps and wells on the hillside and in the North Walnut Creek drainage produced contaminated groundwater. Nitrate from the former Solar Evaporation Ponds (SEPs) was detected in surface water. Six intercept trenches were installed in the early 1970s to collect seepage and shallow groundwater. An Interceptor Trench System (ITS) was completed in 1981. This system encompassed approximately 2 miles of French drains to intercept and collect shallow groundwater. Collected water was drained to a sump and then routed for disposition. Numerous wells were installed to define groundwater contamination. Nitrate contamination was

reaching the valley bottom. Uranium was more localized in the area of the SEPs. VOCs were present on the western side of SEPs.

The SPPTS was installed in 1999 to intercept and treat the Solar Ponds Plume as groundwater migrates toward the creek. This system included an 1,100-foot-long groundwater intercept trench that intercepted the ITS. Collected water was routed through two cells. The first cell contained sawdust with 10% ZVI and the second contained ZVI with gravel. Treated effluent was routed back into the downgradient portion of ITS, ultimately to the subsurface Discharge Gallery. The original design required water to build up in the trench. The result was episodic flow, including long periods of no flow. In 2002, a collection well was installed and equipped with solar-powered pump.

Treatment system flows increased after the pump was installed and effluent data confirmed satisfactory treatment. Water from the vicinity of the Discharge Gallery contained higher concentrations of contaminants than untreated influent. Through the CAD/ROD there was regulatory acceptance for conditions as they existed. Cell 2 clogged in early 2005 (pre-closure) and the media (ZVI with pea gravel) was replaced. Site closure was in late 2005. Rocky Flats had a Temporary Modification through 2009 for the nitrate standard in North Walnut Creek (100 mg/L).

In 2006, after costly repairs, the site began investigating design improvements for the SPPTS. Treatability studies were conducted in 2006 and 2007. In 2008, the site began laboratory and bench-scale tests of different treatment components and approaches.

Phased upgrades were conceived in 2008.

Phase I: Collect, treat more of the contaminated groundwater

- Water quality at Discharge Gallery showed a portion of the plume was not being intercepted

Phase II: Install new uranium treatment cell

- Easily accessible
- First in treatment train, so nitrate treatment media would not be potentially contaminated

Phase III: Install pilot-scale treatment cells and operate pilot studies to identify more efficient method of nitrate treatment

Phase IV: Install full-scale nitrate treatment component based on previous testing and results

Throughout these phases, the site continued to try new approaches to come up with better treatment results.

John reviewed the potential path forward for uranium and nitrate treatment at SPPTS:

Microcells for uranium treatment

- Continue testing to determine optimal treatment media for raw influent

- Testing microcells using lagoon effluent
 - May require effluent polishing (settling, filtration, sterilization) to reduce clogging
 - May require different media design
- Results drive design of uranium treatment component
 - How many microcells, what size, what media, effective lifetime....

Lagoons for nitrate treatment

- Continue testing to determine response to cold weather, suitable controls
- Provide effluent to test with downstream uranium-treating microcells
- Results drive design of nitrate treatment component

The anticipated timing of installed full-scale components is 2016.

In conclusion, John noted several overall concepts related to groundwater treatment at Rocky Flats.

- The CERCLA process requires consideration of new technologies
- RFLMA requires that effluent meet Table 1 levels
- Adjustments to systems are the result of several factors, such as:
 - RFLMA requirements more stringent than original treatment objectives
 - CERCLA 5-year review process
 - Need for environmentally-sensitive, cost-effective, efficient systems
 - Requirements for maintenance and spent media disposition
- PLFTS is very simple, influent has very little load
- MSPTS and ETPTS are more complex
 - Greater influent contaminant loads than PLFTS
 - Both now incorporate air stripping
 - ETPTS undergoing additional reconfiguration right now
- SPPTS is complex
 - Partly due to history, setting
 - Undergoing lengthy testing to support ultimate reconfiguration
- Adjustments can be expected to continue, episodically
- Updates will be provided in quarterly and annual reports, and in presentations to RFSC

Tim Plass asked about the lifespan of VOCs. John said they naturally degrade through minerals and bacteria in the ground. The rate at which they degrade depends on many factors and is location-specific. Tim also asked about the cost and lifespan of the ETPTS air stripper. Linda Kaiser said that it cost about \$600K. In terms of expected lifespan, they have lasted multiple decades at other sites.

Mary Fabisiak asked about the life expectancy of the liner in the intercept trenches. Scott said the manufacturer says they will last 30 years; however, that is based on the material being exposed to elements. Because it is underground, he said it should last longer in the trenches. She asked if they are able to inspect these materials. Scott said they could not, but they can tell based on flow

rates and water levels whether the barrier has been breached. Sandra asked if there were cleanouts. Scott said there are.

Tim asked John for his current assessment of the treatment system technology. John said that they were using mature technologies, but the overall success will depend on data once everything is installed. They will know much more in a year or two. Scott noted that plans for ZVI treating solvents at ETPTS and MSPTS were based on tests using lab groundwater, not Rocky Flats groundwater. They saw right away that these systems were not going to be what they were hoping for in terms of being low maintenance. The technology for these two systems is now on point. At the SPPTS, they are dealing with two competing contaminants, nitrate and uranium. Nitrate interferes with uranium treatment. He said that they still have a little while to go in terms of optimizing this treatment, but it is looking a lot more promising than it was a few years ago. Scott said that the bottom line is that water quality is still good. Mary asked if there were any opportunities to inject oxidants into source areas. John said that while they looked at this option, the areas were not readily accessible and thousands of holes would be needed, making it not practical.

Board Approval of 2015 Work Plan

The Board reviewed the 2015 Work Plan at its September meeting. A few small changes were noted in the version provided in the Board packet. There were no questions or comments.

Jeannette Hillery moved to approve the 2015 work plan. The motion was seconded by Roman Kohler. The motion passed 14-0.

Board Approval of 2015 Budget

The Board also reviewed the draft budget at its September meeting. No changes were offered. David pointed out a new column in the budget based on a Board request to highlight 'over-budgeted' items.

The Board's attorney Barb Vander Wall explained the required budget review process. Because the Board was created as a political subdivision and is a unit of local government, it must adhere to state budget statutes. Prior to finalizing the budget, the Board must provide public notice, hold a budget hearing and allow time for public comment. Following the public hearing, the Board must approve the budget resolution. This must occur before the end of each year. She also noted that after the budget is approved, it is filed with the State by the end of the year

Chair Joyce Downing officially opened the budget hearing at 10:55 a.m. There were no comments from the audience. The Chair then closed the budget hearing at 10:56 a.m. There were no comments from Board members.

Joyce Downing moved to approve the 2015 budget. The motion was seconded by Lisa Morzel. The motion passed 14-0.

Public Comment

Anne Fenerty stated that she would like to thank the Stewardship Council for not automatically endorsing the plans for a prescribed burn at Rocky Flats. She said she was speaking for her friend Jon Lipsky, who could not be at the meeting. He asked her to refute some comments from last Stewardship Council meeting. She said he disagreed with David Abelson's assessment of the event in June commemorating the raid on Rocky Flats. She handed out copies of his detailed remarks, and asked that his comments be posted on the website.

Updates/Big Picture Review

February 2, 2015

Potential Business Items

- Elect 2015 officers
- Adopt resolution re: 2015 meeting dates

Potential Briefing Items

- DOE quarterly update
- Proposed prescribed fire at Rocky Flats
- Begin identifying goals for Rocky Flats visitor's center

April 6, 2015

Potential Business Items

- TBD

Potential Briefing Items

- Continue discussing proposed prescribed fire at Rocky Flats
- Finalize goals for Rocky Flats visitor's center

David Abelson noted that Scott Surovchak developed a pictorial history of Rocky Flats a few years ago, and suggested that this may be a good time for the Board to revisit this information.

Member Updates

Joe Cirelli said he would report on any changes resulting from the upcoming election. Laura Weinberg said that Golden passed a resolution to continue as a member of Stewardship Council. Faye Griffin reminded everyone to get their ballots in. Murph Widdowfield reported that representatives from the Rocky Flats Institute and Museum gave presentations for several groups, including the Colorado School of Mines, University of Denver and Regis University. He also mentioned the upcoming Colorado Gives Day on Dec. 9. Donations could be accepted via the Museum website or Colorado Gives website, and matching funds would be provided through sponsors. He also mentioned an upcoming four-day bus tour, which included a visit to the Trinity site, which is only open once per year. He said that the Museum has many good presenters if anyone would like them to speak to a group. Lisa Morzel suggested re-introducing the

Stewardship Council to the new and returning crop of U.S. Senators and Representatives. She also noted that Boulder was recently funded to do a study in Yellowstone, pertaining mercury and other toxic metals in fish.

At 11:15 a.m. Joyce made a motion to move into Executive Session for the purpose of discussing personnel issues, and to receive legal advice on such issues, as authorized under Sections 24-6-402(4)(b) and (f), C.R.S. Joe Cirelli seconded the motion. The motion passed 14-0.

The Board reconvened from Executive Session at 11:33 a.m. and affirmed that no actions had been taken during Executive Session.

Bob Briggs noted that the Board had not recently discussed the usefulness of the Executive Committee meetings and process. Joyce said she thought it was working well. Lisa Morzel said the process has helped the Board work better, and that she would love to see more people attend. Jeannette Hillery said that the Executive Committee gets a lot accomplished. David Abelson clarified that serving on the Executive Committee is not a big time commitment.

Issues to watch:

- Americium, plutonium and uranium levels upstream of pond B-3 and U levels at WALPOC
- AMP sampling
- Original landfill

The meeting was adjourned at 11:48 a.m.

Respectfully submitted by Erin Rogers.

10:07 PM
01/11/15

Rocky Flats Stewardship Council Check Detail-2015 October 9, 2014 through January 11, 2015

Type	Num	Date	Name	Account	Paid Amount	Original Amount
Check		10/28/2014		CASH-Wells Fargo-Operating		-3.50
				Admin Services-Misc Services	-3.50	3.50
TOTAL					-3.50	3.50
Check		11/28/2014		CASH-Wells Fargo-Operating		-3.50
				Admin Services-Misc Services	-3.50	3.50
TOTAL					-3.50	3.50
Bill P...	1704	11/9/2014	Blue Sky Bistro	CASH-Wells Fargo-Operating		-270.00
Bill	1904	11/9/2014		Misc Expense-Local Government	-270.00	270.00
TOTAL					-270.00	270.00
Bill P...	1705	11/9/2014	Crescent Strategies, LLC	CASH-Wells Fargo-Operating		-7,695.08
Bill	10/3...	10/31/2014		Personnel - Contract	-6,850.00	6,850.00
				Telecommunications	-138.26	138.26
				TRAVEL-Local	-59.36	59.36
				Postage	-15.99	15.99
				TRAVEL-Out of State	-352.20	352.20
				Supplies	-66.77	66.77
				Printing	-212.50	212.50
TOTAL					-7,695.08	7,695.08
Bill P...	1706	11/9/2014	Jennifer A. Bohn	CASH-Wells Fargo-Operating		-389.50
Bill	14-64	10/31/2014		Accounting Fees	-389.50	389.50
TOTAL					-389.50	389.50
Check	1707	11/9/2014	Century Link	CASH-Wells Fargo-Operating		-27.33
				Telecommunications	-27.33	27.33
TOTAL					-27.33	27.33
Bill P...	1708	11/9/2014	Seter & Vander Wall, P.C.	CASH-Wells Fargo-Operating		-3,026.68
Bill	70298	10/31/2014		Attorney Fees	-3,026.68	3,026.68
TOTAL					-3,026.68	3,026.68
Check	1709	12/6/2014	Century Link	CASH-Wells Fargo-Operating		-27.30
				Telecommunications	-27.30	27.30
TOTAL					-27.30	27.30
Bill P...	1710	12/6/2014	Crescent Strategies, LLC	CASH-Wells Fargo-Operating		-8,605.75
Bill	11/3...	11/30/2014		Personnel - Contract	-6,850.00	6,850.00
				Telecommunications	-138.26	138.26
				TRAVEL-Local	-116.48	116.48
				Postage	-15.99	15.99
				TRAVEL-Out of State	-1,106.80	1,106.80
				Misc Expense-Local Government	-28.00	28.00
				Website	-350.22	350.22
TOTAL					-8,605.75	8,605.75
Bill P...	1711	12/6/2014	Jennifer A. Bohn	CASH-Wells Fargo-Operating		-380.00
Bill	14-74	11/30/2014		Accounting Fees	-380.00	380.00
TOTAL					-380.00	380.00
Bill P...	1712	12/6/2014	Seter & Vander Wall, P.C.	CASH-Wells Fargo-Operating		-81.00
Bill	70471	11/30/2014		Attorney Fees	-81.00	81.00

10:07 PM
01/11/15

Rocky Flats Stewardship Council
Check Detail-2015
October 9, 2014 through January 11, 2015

Type	Num	Date	Name	Account	Paid Amount	Original Amount
TOTAL					-81.00	81.00
Check	1713	1/11/2015	Century Link	CASH-Wells Fargo-Operating		-27.13
				Telecommunications	-27.13	27.13
TOTAL					-27.13	27.13
Bill P...	1714	1/11/2015	Crescent Strategies, LLC	CASH-Wells Fargo-Operating		-7,037.85
Bill	12/3...	12/31/2014		Personnel - Contract	-6,850.00	6,850.00
				Telecommunications	-138.26	138.26
				TRAVEL-Local	-33.60	33.60
				Postage	-15.99	15.99
TOTAL					-7,037.85	7,037.85
Bill P...	1715	1/11/2015	Jennifer A. Bohn	CASH-Wells Fargo-Operating		-171.00
Bill	14-82	12/31/2014		Accounting Fees	-171.00	171.00
TOTAL					-171.00	171.00
Bill P...	1716	1/11/2015	Seter & Vander Wall, P.C.	CASH-Wells Fargo-Operating		-198.75
Bill	70796	12/31/2014		Attorney Fees	-198.75	198.75
TOTAL					-198.75	198.75
Bill P...	1717	1/11/2015	The Rogers Group, LLC	CASH-Wells Fargo-Operating		-600.00
Bill	1/9/1...	12/31/2014		Personnel - Contract	-600.00	600.00
TOTAL					-600.00	600.00

**RESOLUTION
OF THE
BOARD OF DIRECTORS
OF
ROCKY FLATS STEWARDSHIP COUNCIL**

regarding

2015 MEETING SCHEDULE AND NOTICE PROVISIONS

WHEREAS, pursuant to an Intergovernmental Agreement dated as of February 13, 2006, and as amended thereafter, (the "IGA"), the Rocky Flats Stewardship Council ("Stewardship Council") was established; and

WHEREAS, the Stewardship Council was created to allow local governments to work together on the continuing local oversight of the activities occurring on the Rocky Flats site to ensure that government and community interests are met with regards to long term stewardship of residual contamination and refuge management; and

WHEREAS, the Board of Directors of the Stewardship Council has a duty to perform certain obligations in order to assure the efficient operation of the Stewardship Council; and

WHEREAS, on March 6, 2006, the Board of Directors of the Stewardship Council adopted Bylaws regarding the operations of the Stewardship Council, governing, *inter alia*, meeting and notice requirements; and

WHEREAS, § 24-6-402, C.R.S., of the Colorado Sunshine Law, specifies the duty of the Board of Directors at its first regular meeting of the calendar year to designate a public posting place within the boundaries of the Stewardship Council for notices of meetings, in addition to any other means of notice; and

WHEREAS, pursuant to its Bylaws and Colorado laws, the Stewardship Council desires to establish its regular meeting schedule and location, and to designate its public posting place(s) for 2015.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE ROCKY FLATS STEWARDSHIP COUNCIL THAT:

1. Meeting Schedule/Location. The Board of Directors determines to hold regular meetings the **fourth Monday of January and October, first Monday of April and June, and the second Monday of September at 8:30 AM** at the Rocky Mountain Metropolitan Airport Terminal Building, 11755 Airport Way, Broomfield, Colorado; and to hold special meetings as may be necessary, in accordance with the Bylaws of the Stewardship Council.

2. Regular Meeting Notice. The Board of Directors determines to annually post its regular meeting schedule at the Clerk and Recorder's office of the following counties: Jefferson, Boulder, Broomfield, Adams and Weld; and at the City or Town Clerk's Office of the following cities and/or towns: Arvada, Boulder, Broomfield, Westminster, Golden, Superior, Thornton, and Northglenn, for posting in a public place. In addition, the Board shall post its regular meeting schedule on the website established for the Stewardship Council. These notices shall remain posted throughout the year. At least seven (7) days advance notice of the regular meeting time, place and date shall be provided to the

{00049168}

directors and alternate directors, and to those members of the public who so request. The general nature of the business proposed to be transacted or the purpose of any meeting of the Board of Directors shall be specified in the notices of such meeting where possible.

3. Special Meeting Notice. In the event of a special meeting, a notice of such special meeting shall be posted at least seventy-two (72) hours in advance at the clerks' offices of the counties, cities and towns indicated above, for posting in a public place. At least seventy-two (72) hours advance notice of the special meeting time, place and date shall be provided to the directors and alternate directors, and to those members of the public who so request. The general nature of the business proposed to be transacted at or the purpose of any meeting of the Board of Directors shall be specified in the notices of such meeting where possible. The Board of Directors' ability to act on matters brought before it at a special meeting is restricted to those items specified in the notice.

4. Emergency Meeting Notice. Should the Board of Directors determine an emergency special meeting is necessary, a notice of such emergency meeting shall be posted at least twenty-four (24) hours in advance at the clerks' offices of the counties, cities and towns indicated above in accordance with the Colorado Open Meetings Act. The general nature of the business proposed to be transacted at, or the purpose of, any meeting of the Board of Directors shall be specified in the notices of such meeting where possible. The Board of Directors' ability to act on matters brought before it at a special meeting is restricted to those items specified in the notice.

5. Written Notice Requirements. Written notice of each meeting of the Board of Directors shall be given by telefax or electronic mail; provided, however, that in the instance of any Director who in writing requests that such notice not be given by telefax or electronic mail, the notice shall be by hand delivery to an address within the boundaries of the Parties designated in writing.

6. Additional Notification. The Stewardship Council shall maintain a list of persons who, within the previous two years, have requested notification of all meetings, or of meetings with discussions of certain specified policies, and shall provide reasonable advance notification of such meetings to the individuals.

APPROVED AND ADOPTED THIS _____ DAY OF _____, 2015.

(SEAL)

ROCKY FLATS STEWARDSHIP COUNCIL

By: _____
Chair

ATTEST:

By: _____

ROCKY FLATS STEWARDSHIP COUNCIL

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

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

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

January ___, 2015

To the Colorado Congressional Delegation

Re: Local Government Engagement on Rocky Flats Issues

As the new session of Congress convenes, we are reaching out to you to (re)introduce our organization and offer our assistance on any issues that emerge regarding Rocky Flats, the former nuclear weapons facility in the northwest Denver-metro area.

The Rocky Flats Stewardship Council formed in March 2006 following completion of the \$7 billion remediation project. Our ten governments border the former weapons facility and, along with our community member representatives, have been actively engaged for many years on the suite of issues comprising the cleanup. Since we established our first intergovernmental organization in the early 1990s, our communities have been able to transcend numerous political differences to become unified in our positions on Rocky Flats. We remain committed to this important model of government dialogue as we represent the communities most directly affected by the cleanup and ongoing management actions.

The Stewardship Council is the DOE-designated local stakeholder organization for Rocky Flats. That designation follows legislation Congress approved as part of the 2005 National Defense Authorization Act. Our mission 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.” Our 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.”

Through our public Board meetings and other forums (e.g., council meetings, member meetings, community forums, etc.) the Stewardship Council helps constituents and members understand the scope of the cleanup, ongoing activity, and challenges. Central to this effort is providing objective, technically-accurate information.

We welcome the opportunity to work with you as issues arise and questions about the cleanup and long-term impact to our communities, members and constituents emerge. Our experience has shown that through a close working relationship with the delegation we are able to tackle the many issues and ensure that Rocky Flats issues are appropriately understood and addressed.

Our executive director is David Abelson. He can be reached at (303) 412-1200 and dabelson@rockyflatssc.org. David has worked on these issues for nearly 20 years, first as a congressional staffer, and since 1999 for our member governments.

Our best regards,

Joyce Downing
Chairman
Mayor, City of Northglenn

DOE Quarterly Report Briefing

- Cover memo
- Section of quarterly report

ROCKY FLATS STEWARDSHIP COUNCIL

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Boulder, CO 80308-0670
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City of Golden -- City of Northglenn -- City of Thornton -- City of Westminster -- Town of Superior
League of Women Voters -- Rocky Flats Cold War Museum -- Rocky Flats Homesteaders
Nancy Newell

MEMORANDUM

TO: Stewardship Council Board
FROM: Rik Getty
SUBJECT: Quarterly Report Briefing
DATE: January 15, 2015

We have scheduled 50 minutes for DOE to present its quarterly update for the third quarter of 2014 (July - September). The report (110 pages), can be found at: http://www.lm.doe.gov/Rocky_Flats/Documents.aspx The cover, table of contents and introduction are attached to this memo.

DOE will brief on the following topics in a format similar to past quarterly report updates:

- surface water monitoring;
- groundwater monitoring;
- ecological monitoring; and,
- site operations (inspections, pond operations, general maintenance, etc.).

Executive Summary

The following are highlights from the third quarter 2014:

- Surface water leaving the DOE-retained lands at monitoring locations WALPOC (Walnut Creek) and WOMPOC (Woman Creek) met all regulatory standards (primary contaminants of concern are plutonium, americium, uranium and nitrates).
- During the quarter there were no reportable conditions at point of evaluation GS 10 (South Walnut Creek located upstream from former Pond B-1) or WALPOC. Note: The recent uranium exceedance at WALPOC occurred in the fourth quarter 2014.
- In response to previous reportable conditions, a qualified geochemistry subcontractor is currently conducting an extensive evaluation of the fate and transport of uranium. The study also evaluates data to attempt to identify source terms that may have contributed to elevated plutonium (Pu) and americium (Am) results at the GS10 location (see Contact Record 2011-08).
- The three major groundwater plume treatment systems (Solar Ponds Plume, East Trenches Plume and Mound Site Plume) continue to effectively treat (reduce) volatile organic compounds (East Trenches and Mound) and uranium and nitrates (Solar Ponds) in

contaminated groundwater. DOE is making ongoing process improvements to all three systems to make the treatments even more effective.

- Routine Original Landfill (OLF) inspections during the third quarter were performed on July 24, August 27, and September 30, 2014. DOE reports there were no significant issues observed in the inspections.

More detailed information on the third quarter report follows (quoting from the report).

Water Monitoring Highlights

During the third quarter of CY 2014, water monitoring successfully met the targeted monitoring objectives as required by the RFLMA and was in conformance with RFSOG implementation guidance. The routine RFLMA network consists of 8 automated gaging stations, 11 surface water grab-sampling locations, 8 treatment system locations, and 89 wells (DOE 2014). Additional locations are occasionally sampled in support of investigations in response to reportable conditions. During the quarter, 16 flow-paced composite samples, 10 surface water grab samples, 18 treatment system samples, and 10 groundwater samples were collected (in accordance with RFLMA protocols) and submitted for analysis.

All RFLMA POC analyte concentrations remained below reporting levels throughout the third quarter of CY 2014.

All RFLMA POE analyte concentrations also remained below reporting levels throughout the third quarter of CY 2014.

There are currently no ongoing reportable conditions at monitoring locations GS10 or WALPOC. The evaluations established in Contact Records 2011-04, 2011-05, 2011-08, and 2014-05, and in prior quarterly reports, will be completed. The results of the evaluations will be reported in future RFLMA annual reports.

In response to previous reportable conditions, a qualified geochemistry subcontractor is currently conducting an extensive evaluation of the fate and transport of uranium at the Site. The study also evaluates data to attempt to identify source terms that may have contributed to elevated plutonium (Pu) and americium (Am) results at the GS10 location (see Contact Record 2011-08).

Groundwater monitoring results will be evaluated as part of the annual report for CY 2014.

Groundwater Treatment System Monitoring

Four groundwater treatment systems are operated and maintained in accordance with requirements defined in the RFLMA and the RFSOG. Three of these systems (the Mound Site Plume Treatment System [MSPTS], the East Trenches Plume Treatment System [ETPTS], and the Solar Ponds Plume Treatment System [SPPTS]) include a groundwater intercept trench (collection trench), which is similar to a French drain with an impermeable membrane on the down-gradient side. Groundwater collecting in the bottom of the trench is routed through a drainpipe into one or more treatment cells, where it is treated and then discharged. Solar-powered air strippers were added in early 2013 to the MSPTS (to polish effluent from the treatment cells) and the ETPTS (to pretreat water before it enters the treatment cells). The fourth

system, the Present Landfill Treatment System (PLFTS), treats water from the northern and southern components of the Groundwater Intercept System and water that flows from the PLF seep.

Mound Site Plume Treatment System

Routine maintenance activities continued at the MSPTS through the third quarter of CY 2014. These activities included checking flows, piping, and water levels and servicing the air stripper. The air stripper operated throughout the quarter. Air stripper maintenance mainly consisted of monitoring the water pressures and nozzle spray patterns, maintaining the fan assembly that provides powered ventilation, monitoring and adjusting flows into the two treatment cells, and cleaning the pump, lines, and nozzles as warranted.

The annual report for 2014 will provide a more detailed discussion of the MSPTS, including the air stripper.

East Trenches Plume Treatment System

Routine maintenance activities continued at the ETPTS in the third quarter of CY 2014, but were adjusted to support the ETPTS reconfiguration project. (This project will revise the ETPTS from a zero-valent iron [ZVI]-based treatment approach, with the air stripper added in 2013, to an approach that relies solely on air stripping for treatment.) The routine activities included checking flows, piping, and water levels and servicing the air stripper.

The air stripper operated throughout the quarter. Routine air stripper maintenance mainly consisted of monitoring the water pressures and nozzle spray patterns and cleaning the pumps, lines, and nozzles as warranted.

Solar Ponds Plume Treatment System

Routine maintenance activities continued at the SPPTS through the third quarter of CY 2014. These activities included weekly inspections of the solar/battery systems that power the pumps, the operation of the pumps, and influent and effluent flow conditions. Also, the vaults continued to accumulate groundwater as a lingering effect of the heavy precipitation in September 2013; this water was pumped out as necessary.

PLF Treatment System

Routine maintenance activities continued at the PLFTS through the third quarter of CY 2014. These activities generally consisted of inspecting the system for potential problems. During the quarter no problems were noted.

Original Landfill

The OLF is inspected monthly in accordance with the requirements in the OLF M&M Plan (DOE 2009a) and the RFLMA. It was anticipated that after the first year, the inspection frequency might be reduced to quarterly for an additional 4 years. However, because of observed localized slumping and seep areas, and because of the investigation and repairs to the OLF cover completed in 2009, no change to the monthly inspection frequency was recommended in the third Five-Year Review of the Site (DOE 2012b).

Routine OLF inspections during the third quarter of CY 2014 were performed on July 24, August 27, and September 30, 2014. Evaluations of the landfill cover vegetation have been discontinued, as the success criteria, according to the requirements outlined in the RFLMA, have been met. The completed inspection forms are presented in Appendix A.

Erosion Control and Revegetation

Maintenance of the site erosion control features required continued effort throughout the third quarter of CY 2014, especially following high-wind or precipitation events. Erosion wattles and matting that were loosened and displaced by high winds or rain were repaired. Erosion controls were installed and maintained for the various projects that were ongoing during the third quarter of CY 2014.

Adverse Biological Conditions

No evidence of adverse biological conditions (e.g., unexpected mortality or morbidity) was observed during monitoring and maintenance activities in the third quarter of CY 2014.

Ecological Monitoring

During the third quarter of CY 2014, Preble's meadow jumping mouse (PMJM) mitigation monitoring, wetland mitigation monitoring, and re-vegetation monitoring were conducted.

The PMJM monitoring data will be summarized and delivered to the U.S. Fish and Wildlife Service (USFWS) in the 2014 Preble's Meadow Jumping Mouse Mitigation Monitoring Report for Biological Opinions at the Rocky Flats Site. This report was due to USFWS on December 1, 2014.

The wetland mitigation monitoring was conducted to evaluate the status of selected mitigation wetlands. A portion of this data is summarized and submitted to the U.S. Army Corps of Engineers in a report that was due by December 31, 2014. The remainder of the data will be summarized in the site annual report for CY 2014.

Re-vegetation monitoring was conducted at several monitoring locations throughout the COU to evaluate the status of the re-vegetation parcels. These data will be summarized in the annual report for CY 2014.

Other ecological monitoring conducted during the third quarter included weed mapping, vegetation mapping, prairie dog and nest box surveys, forb nursery monitoring, and photo-point monitoring.

The shrubs planted last spring as a habitat enhancement project were irrigated through the end of the growing season. Approximately 60 acres were treated with herbicides to help control various noxious weed species during the third quarter.

Sign Inspection

"U.S. Department of Energy - No Trespassing" signs are required to be posted at intervals around the perimeter of the COU to notify persons that they are at the boundary of the COU. Signs listing the use restrictions (ICs) and providing contact information are also required to be

posted at access points to the COU. The signs are required as physical controls of the remedy, are inspected quarterly, and are maintained by repairing or replacing them as needed. Physical controls protect the engineered components of the remedy, including landfill covers, groundwater treatment systems, and monitoring equipment, which are also inspected routinely during monitoring and maintenance activities. The signs were inspected on September 10, 2014, and they met the requirements.

Please let me know if you have any questions.

**Rocky Flats, Colorado, Site
Quarterly Report of
Site Surveillance and
Maintenance Activities
Third Quarter
Calendar Year 2014**

January 2015



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

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Appendixes

- Appendix A Landfill Inspection Forms and Survey Data
- Appendix B *Technical Memorandum Regarding Rocky Flats Original Landfill*
- Appendix C Analytical Results for Water Samples—Third Quarter CY 2014

Abbreviations

Am	americium
AOC	Area of Concern
CAD/ROD	Corrective Action Decision/Record of Decision
CDPHE	Colorado Department of Public Health and Environment
COU	Central Operable Unit
CY	calendar year
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ETPTS	East Trenches Plume Treatment System
IC	institutional control
LM	Office of Legacy Management
µg/L	micrograms per liter (sometimes expressed as ug/L)
M&M	monitoring and maintenance
MSPTS	Mound Site Plume Treatment System
OLF	Original Landfill
PLF	Present Landfill
PLFTS	Present Landfill Treatment System
PMJM	Preble's meadow jumping mouse
POC	Point of Compliance
POE	Point of Evaluation
Pu	plutonium
RCRA	Resource Conservation and Recovery Act
RFLMA	<i>Rocky Flats Legacy Management Agreement</i>
RFSOG	<i>Rocky Flats, Colorado, Site Site Operations Guide</i>
Site	Rocky Flats Site
SPPTS	Solar Ponds Plume Treatment System
U	uranium
USFWS	U.S. Fish and Wildlife Service
ZVI	zero-valent iron

1.0 Introduction

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) is responsible for implementing the final response action selected in the *Corrective Action Decision/Record of Decision for Rocky Flats Plant (USDOE) Peripheral Operable Unit and Central Operable Unit (CAD/ROD)* (DOE, EPA, and CDPHE 2006), issued on September 29, 2006, and amended on September 21, 2011 (DOE, EPA, and CDPHE 2011), for the Rocky Flats Site (the Site) in Colorado. DOE, the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE) are implementing the monitoring and maintenance requirements of the CAD/ROD as described in the *Rocky Flats Legacy Management Agreement (RFLMA)*. Attachment 2 of the RFLMA (DOE 2012a) defines the Central Operable Unit (COU) remedy surveillance and maintenance requirements, the frequency for each required activity, and the monitoring and maintenance locations. The requirements include environmental monitoring; maintenance of the erosion controls, access controls (signs), landfill covers, and groundwater treatment systems; and operation of the groundwater treatment systems. The RFLMA also requires that the institutional controls (ICs), in the form of use restrictions as established in the CAD/ROD, be maintained.

This report is required in accordance with Section 7.0 of RFLMA Attachment 2. The purpose of this report is to inform the regulatory agencies and stakeholders of the remedy-related surveillance, monitoring, and maintenance activities being conducted at the Site during this quarter. LM provides periodic communications through several means, such as this report, web-based tools, and public meetings.

LM prepared the *Rocky Flats, Colorado, Site Site Operations Guide (RFSOG)* (DOE 2013a) to serve as the primary internal document to guide work to satisfy the requirements of the RFLMA and to implement best management practices at the Site.

Several other site-specific documents provide additional detail regarding the requirements described in RFLMA Attachment 2, including all aspects of surveillance, monitoring, and maintenance activities, as well as data evaluation protocols.

Monitoring data and summaries of surveillance and maintenance activities for past quarters are available in the quarterly reports. Extensive discussion and evaluation of surveillance, monitoring, and maintenance activities are presented each calendar year in the annual report of Site surveillance and maintenance activities.

This report addresses remedy-related surveillance, monitoring, and operations and maintenance activities conducted at the Site during the third quarter of calendar year (CY) 2014 (July 1 through September 30). This report describes the following activities:

- Maintenance and inspection of the Original Landfill (OLF) and Present Landfill (PLF)
- Maintenance and inspection of the four groundwater treatment systems
- Inspection of signs posted at the perimeter of the COU as physical controls
- Erosion control and revegetation activities
- Routine (in accordance with the RFLMA and the RFSOG) water monitoring

USFWS Prescribed Fire Briefing

- Cover memo
- Memo from David Lucas, USFWS refuge manager, explaining the agency's intent and reasons for concluding that a burn is protective of human health and the environment
- Stewardship Council's policy as adopted at the October 27, 2014, meeting
- USFWS maps
 - Indicating the area to be burned
 - Showing recent fires at Rocky Flats (both pre- and post-cleanup)
- Superior letter to USFWS opposing the proposed burn
- Arvada letter to the Stewardship Council opposing the proposed burn
- DOE April 2000 test burn
 - John Rampe (DOE-Rocky Flats) memo summarizing air quality monitoring during the fire
 - Wind test study following the test burn (only part of the report)
 - Analysis of impacts to the firefighters (only part of the report)

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League of Women Voters -- Rocky Flats Cold War Museum -- Rocky Flats Homesteaders
Nancy Newell

MEMORANDUM

TO: Board
FROM: David Abelson
SUBJECT: Briefing on USFWS' Proposal to Conduct a Prescribed Fire at the Rocky Flats National Wildlife Refuge
DATE: January 14, 2015

We have scheduled 75 minutes for the US Fish and Wildlife Service (USFWS), CDPHE and DOE to brief on and for you to discuss issues related to USFWS' plan to conduct a prescribed fire at the Rocky Flats National Wildlife Refuge in spring 2015.

The following information and attached documents are designed to provide a broader understanding of the issues, opportunities and concerns. Due to the enormous amount of information, this memo and attached documents are not comprehensive. I have focused on information that may be less known to the Board with the goal of expanding your background on the issues, and in doing so, present a broad understanding of the technical issues and community concerns.

Towards this end, attached to this memo are a few key documents:

1. Memo from David Lucas, USFWS refuge manager, explaining the agency's intent and reasons for concluding that a burn is protective of human health and the environment
2. Stewardship Council's policy as adopted at the October 27, 2014, meeting
3. USFWS maps
 - a. Indicating the area to be burned
 - b. Showing recent fires at Rocky Flats (both pre- and post-cleanup)
4. Superior letter to USFWS opposing the proposed burn
5. Arvada letter to the Stewardship Council opposing the proposed burn
6. DOE April 2000 test burn
 - a. John Rampe (DOE-Rocky Flats) memo summarizing air quality monitoring during the fire
 - b. Wind test study following the test burn (only part of the report)
 - c. Analysis of impacts to the firefighters (only part of the report)

USFWS will open the briefing by discussing its plans and addressing questions about alternatives, fire management, emergency management, and related issues. CDPHE and DOE will then address residual contamination, risk, impacts on DOE lands should the fire burn those lands, and related issues. The questions the Stewardship Council posed as part of its burn motion will guide the conversation.

Executive Summary

1. USFWS has the legal authority to use prescribed fire as a management tool, subject to securing an air quality permit from CDPHE. The legal authority comes from prior regulatory decisions made by DOE, CDPHE and EPA. The air quality permit is drafted and will soon be issued.
2. USFWS believes fire is the best management tool to meet the agency's conservation goals.
3. The 2000 test burn that DOE conducted provides one of the technical bases for the agency's determination that USFWS' plan will not result in unacceptable or illegal impacts to the firefighters or communities.
4. Community opposition to the fire is broad.

A few thoughts to bear in mind

In reviewing the materials there are a few things to keep in mind. The executive committee considered each of these in crafting the draft Board policy:

1. Prescribed fire is allowed on the Rocky Flats National Wildlife Refuge. Fire was evaluated as part of the environmental impact statement that was developed in support of USFWS' site conservation plan.
2. In approving the final regulatory documents for the cleanup of Rocky Flats, there are no use restrictions that DOE, CDPHE or EPA imposed on the refuge as a result of the historic use of Rocky Flats.
3. USFWS would not have taken the land from DOE had there been management restrictions imposed by DOE, CDPHE and EPA.
4. USFWS has suggested that while there are different management tools the agency could employ, fire presents the best tool to achieve its management goals.
5. DOE's test burn in 2000 was the most contentious issue the community faced during cleanup. It garnered more concern than any other issue. This proposed burn is shaping up to rival that level of concern.
6. In 2000, local elected officials bore the brunt of the community's concern.
7. The 2000 test burn showed that the greatest risk was to those fighting the fire, and that the risk to neighboring communities was minimal.
8. Members of the Colorado Congressional delegation are hearing from constituents and are starting to evaluate USFWS' plan. It is far too soon to predict what position Members might take, or whether the delegation will present a united front.

The Board briefing and conversation will address both technical issues and policy concerns. As I indicated to the executive committee at its January 12th meeting, simply because the regulatory agencies have released the land for all use, including prescribed fire, does not mean that burning

the refuge is the best policy prescription. Additionally, support for the cleanup and opposition to the burn can co-exist. One does not negate the other.

April 2000 test burn

In April 2000, against strong community opposition, DOE conducted a test by burning approximately 50 acres. The purpose of the burn was to evaluate using prescribed fire for prairie restoration and control of noxious weeds. The burn also presented an opportunity to better understand re-suspension rates and erosion potential following fires.

There are three key analyses to note:

1. Sampling conducted in the smoke plume as the fire was burning
2. Post-fire wind tunnel test
3. Health impact analysis on the firefighters

1. Sampling conducted in the smoke plume as the fire was burning

During the test burn, DOE and EPA places air monitors in the smoke plumes and took samples. DOE's report on that test is attached. As provided in that report, the dose to a person standing in the smoke plume would be 0.2 millirem (mrem). (The greater risk would be smoke inhalation, not radioactivity.) By comparison, the EPA standard for plutonium exposure via inhalation is 10 mrem/year. Average terrestrial dose (different from air inhalation) along Colorado's Front Range is closer to 400 mrem/year.

2. Post-fire wind tunnel test

DOE hired independent contractors to conduct the test. Three tests, which occurred over one week period, started the day following the burn, and then 25 and 73 days following the fire. The report, which is attached, shows little re-suspension of contaminants.

3. Health impact analysis on the firefighters

Based on DOE standards and the more conservative EPA standards, the study of impacts to firefighters concluded that exposures to airborne contaminants during a site grass fire would be negligible, a tiny fraction of the maximum allowed EPA limit. That study is also attached.

Additionally, following the fire in spring 2006 that burned approximately 1000 acres on Rocky Flats (lands that are now part of the Refuge) and lands adjacent to Great Western Reservoir, DOE conducted an analysis. Here is the relevant section discussing the 2000 test burn and post-burn health analysis.

Air Quality Modeling of a Hypothetical Grass Fire at RFS

In the summer of FY 2000, Rocky Flats environmental protection staff developed an assessment of probable exposure consequences of a grass fire to firefighters who might be called to the Site. The reason for this assessment was the recognition that a fire would inevitably occur, as had been demonstrated that summer by a small fire ignited by a lightning strike in the eastern Buffer Zone. That fire was confined to about 10 acres due to the close proximity and easy access of observers and firefighting personnel on the site.

Local fire teams had been called to assist in extinguishing that fire and some interest was expressed by these firemen regarding the potential radiological hazards they might have encountered.

The modeling assessment, performed for both typical and worst case meteorological conditions, estimated the concentrations to which a firefighter might be exposed should the firefighter remain in the downwind smoke plume continuously for periods of from 1 to 5 hours, and assessed the potential inhalation dose from such an exposure. The results of the modeling assessment are reported in a “White Paper on the Radiation Dose Assessment for Firefighters During a Grass Fire” (Attachment 1).

The white paper provides strong evidence that the radiological hazards of a grass fire at RFS are negligible, based on both U.S. Department of Energy (DOE) guidelines and U.S. Environmental Protection Agency (EPA) regulations. DOE requirements provide that no member of the public is to receive a potential dose in excess of 100 millirem (mrem) per year. EPA regulations limit emissions of airborne contaminants to a level below which any member of the public would be exposed to concentrations that could result in a potential dose of 10 mrem per year via the airborne pathway.

The modeling assessment asked two fundamental questions: what air concentrations would result at breathing height in the downwind smoke plume for a fire that occurred in an area with a 1 pCi/g uniform soil contaminant concentration; and what would be the limiting uniform soil contaminant concentrations that would result in no more than a 1 mrem dose to the firefighter who remained in the plume continuously for the varying time periods of the study? The answer to the first of these questions suggested that the average concentration of plutonium and americium in air would be 0.0004 pCi/m³ per pCi/g under the worst probable conditions of meteorology and exposure time. This level would result in a potential inhalation dose of 0.00066 mrem, considerably less than the 10 mrem limit to which a member of the public could be exposed for an entire year without exceedance of the EPA’s airborne radionuclide dose standards. The estimates were adjusted considering the increased breathing rate of the firefighters compared to the breathing rates used to derive the EPA standard. Modeling to a dose limit of one mrem, one tenth of the EPA standard, resulted in the conclusion that this arbitrary 1 mrem dose limit would not be exceeded for a fire burning in a uniformly contaminated area of less than 115 pCi/g plutonium and less than 102 pCi/g depleted uranium (Depleted uranium is the limiting case for uranium isotope mixtures; the limiting natural uranium concentration is higher, as is the limiting concentration of enriched uranium). Americium contribution to dose is included with the plutonium.

Using these results, the probable emissions from the grass fire of April 2006 can be evaluated. Following the cleanup of the contaminated soils at RFS where some soil concentrations initially exceeded 50 pCi/g of plutonium, there are assuredly no significant contaminated surface soil areas exceeding this concentration. In the area of the burn, where project cleanup was not required, the soil concentrations are known to be very low with the average concentration over the area being less than 1 pCi/g, with much of the area showing considerably less, approaching or achieving insignificant background levels. This information, and the results of the modeling study, lead to the conclusion that no significant

air concentrations resulted from radionuclide emissions during the April 2006 fire. The model results can be extended to show that maximum air concentrations would not have exceeded about 0.0004 pCi/m³, as noted above, and concentrations further downwind would have rapidly diminished due to normal dispersion of the smoke. Firefighters with higher breathing rates than the population used to establish the ambient-based standard, would have received doses considerably less than one mrem, one-tenth of the Radionuclide NESHAP (National Emission Standards for Hazardous Air Pollutants) standard upon which the concentration limits of these analyses were based.

Caveat emptor regarding comparing the 2000 test burn to USFWS' plan to conduct a prescribed fire: The relevance of the 2000 test burn assumes that contaminant levels at the two burn sites are relatively equal. DOE, CDPHE and EPA believe they are.

Community opposition

A petition opposing the burn is circulating in moveon.org. The petition can be found at: http://petitions.moveon.org/sign/cancel-the-prescribed-1?source=c.em.mt&r_by=364519
Here is the text:

Title: Cancel the "prescribed burn" at Rocky Flats

Petition by LeRoy Moore

To be delivered to **James W. Kurth, Chief, National Wildlife Refuge System, David Lucas, Manager, Rocky Flats National Wildlife Refuge, Sally Jewell, Secretary, Department of the Interior, John Faulkner, Aide to Sen. Mark Udall, Margot Beausey, Aide to Sen. Michael Bennet** and 5 other targets ([click here to see more](#))

U.S. Fish & Wildlife Service must cancel the "prescribed burn" planned for the Rocky Flats National Wildlife Refuge in the Spring of 2015. Doing the burn will endanger public health by releasing plutonium particles.

PETITION BACKGROUND

The Rocky Flats National Wildlife Refuge, managed by U.S. Fish & Wildlife, occupies most of the site of a now-closed nuclear weapons plant. During almost 40 years of production the plant released highly toxic plutonium into the environment. The Superfund cleanup of the site left tiny plutonium particles in the soil. The proposed burn would make particles available to be inhaled, the worst way to be exposed to plutonium.

As of January 13th, 737 people have signed the petition.

Relatedly, the November 11, 2014, edition of the Daily Camera included an op-ed by LeRoy Moore opposing the burn. It can be found at: http://www.dailycamera.com/Opinion/ci_26988064/LeRoy-Moore:-Rocky-Flats-burn-a-bad-idea

Additional resources about the history of fire at Rocky Flats

These documents are found in the administrative record for the site.

BZ-A-000482 7/19/1996

1994 grass fire burn report in northeast Buffer Zone Final Draft of the 1994 Grass Fire Burn in the Northeast Buffer Zone, which scorched approximately 69 acres.

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/BZ/BZ-A-000482.PDF

SW-A-006228 4/1/2000

Grass Fire on Wind Erosion Rates from Surface Soil at RF, Colorado Effects of Prescribed Grass Fire on Wind Erosion Rates from Surface Soil at Rocky Flats (RF), Colorado. The US Department of Energy (DOE), Rocky Flats Environmental Technology Site (RFETS/Site) has several area of actinide-contaminated soil as a result of spills and release during the Site's nuclear weapons production era.

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-006228.pdf

SW-A-004356 5/16/2001

Effects of Wildfires on Soil Erodibility by Wind Midwest Research Institute submits the Effects of Wildfires on Soil Erodibility by Wind, Final Test Report dated May 16, 2001. This report includes Appendices A through D, which consists of the results of Gravimetric and Soil Isotopic Analysis. Appendix C and D give results of Filter and Cyclone Catch Isotopic Analysis and the CB-22 Example Calculation.

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-004356.pdf

SW-A-004690 10/1/2001

Results of the Interagency Review of Radionuclide Soil Action Levels: Task 4 Results of the Interagency Review of Radionuclide Soil Action Levels: Task 4 reports on the New Scientific Information that may Impact Radionuclide Soil Action Levels (RSALs). The annual review that is required by Paragraph 5 of Rocky Flats Cleanup Agreement (RFCA), the agencies committed to conduct an annual review of the Radionuclide Soil Action Levels (RSALs), which were most recently calculated by the agencies in 1996. The question to be addressed is whether there is any scientific information available that may impact the RSALs. The purpose of this report is to summarize the information in the likelihood, extent and impact of fires on resuspension of soil due to reduction of ground cover. The results from two wind tunnel studies, following a burn in 2000 and the look at resuspension of soils and vegetation green up following the fires. The third is a report describing air calculations in the old and the new RESRAD and the model used by the Risk Assessment Corporation. The last two subjects in this report discuss the recent studies and reports produced by the Actinide Migration Evaluation (AMES) group on actinide transport and solubility, soil erosion, transport pathway and other topics. Other recent studies and reports from the National Academy of Sciences, the National Research Council, the General Accounting Office, and Rocky Mountain Remediation Services (RMRS) that may impact the RSALs.

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-004690.PDF

SW-A-006052 5/16/2001

Final Test Report Effect of Wildfires on Soil Erodibility by Wind The Final Test Report Effect of Wildfires on Soil Erodibility by Wind. The purpose of this study was to determine the impact of a wildfire on the potential for wind-generated particulate

emissions from radioactive soils and vegetation at the Rocky Flats Environmental Technology Site (RFETS/Site), Northwest of Denver.

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-006052.pdf



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rocky Mountain Arsenal National Wildlife Refuge
6550 Gateway Road, Building 121
Commerce City, Colorado 80022-1748
Telephone (303) 289-0232 Fax (303) 289-0579



January 14, 2015

MEMORANDUM

To: Rocky Flats Stewardship Council

From: Project Leader, Rocky Mountain Arsenal NWR Complex /s/ **David Lucas**

Subject: Prescribed Burning at the Rocky Flats National Wildlife Refuge

The U.S. Fish and Wildlife Service (Service) will provide a brief presentation at your January 26 meeting and will be available to respond to questions on current and future management of the Rocky Flats National Wildlife Refuge (Refuge).

- Lands transferred to the Service that would become the Refuge contain no use restrictions.¹ It is well understood that fire at the Rocky Flats is not considered a risk to human health.² The proposed burn is located in the southwest portion of the Refuge and within what was previously called the southern buffer area. Average concentrations of Plutonium in surface soil within the burn area were calculated by the CDPHE and are generally at or below background and significantly below the most conservative risk criteria.³
- This will be the first prescribed burn conducted by the Service at the Refuge. For this reason, the Service, DOE, CDPHE, and EPA will conduct greater public outreach on why we burn, how we burn, and why it is safe to burn.
- The Service completes numerous prescribed burns each year. We only burn under appropriate conditions and when it is safe to do so. There are extensive policies and procedures directing the plans for a burn. Contingency planning is an essential element to all of our burns.

¹The Notice of Intent states, in part, that “no hazardous substances, pollutants, or contaminants occur in the Peripheral OU above levels that allow for unlimited use and unrestricted exposure.” EPA deleted the Peripheral OU from the National Priorities List on May 25, 2007 (72 FR 29276). In accordance with the Rocky Flats National Wildlife Refuge Act of 2001, the Refuge was officially established on August 3, 2007 (72 FR 43293).

² The final CAD/ROD for the Peripheral Operable Unit (September 2006) states that emissions from a fire, even a scenario involving a fire in the historic 903 Pad area, will be much lower than those requiring further action.

³ Pu 239/240 Surface Soil Samples – SW Part of Rocky Flats National Wildlife Refuge (extracted from Analytical Data Set, Attachment 1, Section 3.0, RI/FS Report).

- The Service makes decisions on management based on sound science and best professional judgment. We have reviewed our options and the decision to burn is based on best available science and our desire to manage the Refuge for the purposes for which it was established. Other options, such as no action, grazing, mowing, and increased herbicide use, may or may not be feasible and do not effectively meet all of our goals in this situation.⁴
- The Service follows all laws and regulations associated with our management. All required planning and environmental compliance for a prescribed burn on the Refuge is either underway or has been completed. This includes the timely submission of a smoke permit to the CDPHE and will conclude with a unit-specific burn plan.
- The Service is committed to working with appropriate stakeholders on its decisions. We have coordinated with State and federal organizations with jurisdictional responsibilities for a prescribed burn on the Refuge. The Service has no responsibility to submit its burn plans for review by the Stewardship Council.

To assist with discussions, attached is a map showing the burn unit and new development south of the Refuge.

Thank you and please free to contact me with any questions.

Attachment

⁴ The Service's master plan also discusses grazing as a habitat management technique available to the Refuge. The Service believes grazing is not a feasible option. Similar to fire, the EPA did not restrict grazing of Refuge lands. However, the Service expects similar unsubstantiated issues impacting the future disposition of livestock. For the record, the Service responded to City of Arvada regarding their communications with Church Ranch about grazing the Refuge, but there is no mention of our communication in its November 11, 2014 letter to the Stewardship Council.

ROCKY FLATS STEWARDSHIP COUNCIL

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

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

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

Motion to Oppose USFWS' Plan to Conduct a Prescribed Fire in Spring 2015 on the Southern Portion of the Rocky Flats National Wildlife Refuge

“The Rocky Flats Stewardship Council opposes USFWS’s plan to conduct a prescribed burn at the Rocky Flats National Wildlife Refuge. Our opposition rests primarily on two factors: (1) A burn will cause widespread community concern that will not be sufficiently alleviated through any public education process; (2) given that concern, there are other management options USFWS can employ, thereby obviating the need to burn at this time.”

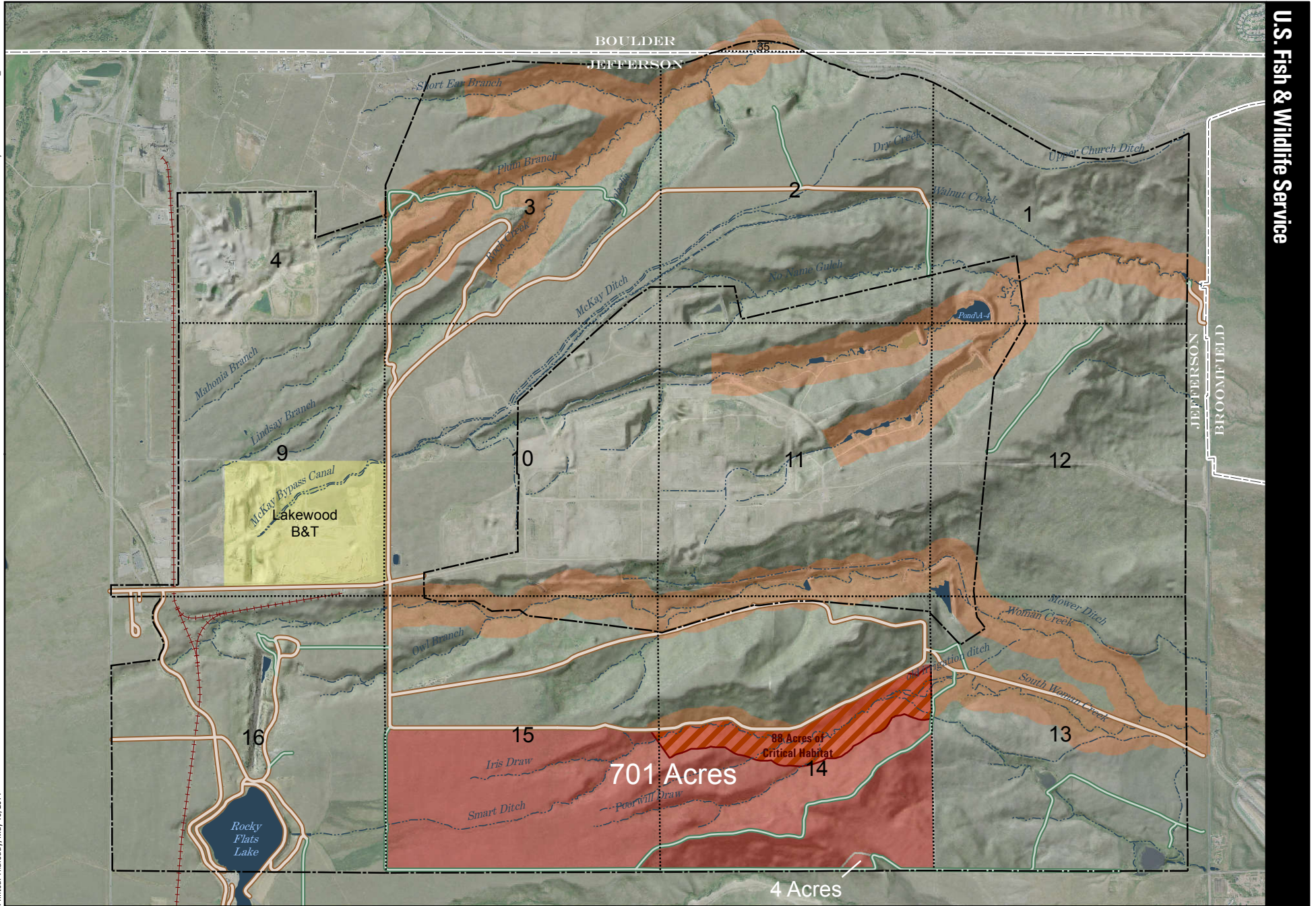
Adopted 14-0; no abstentions

In approving this motion, the Board stressed that at this time it is not speaking to the question of risk. The Board reiterated its plan to use its February 2015 meeting to meet with USFWS, DOE, CDPHE, and EPA to understand USFWS’ plans and discuss with the four agencies questions of risk.

Additionally, the Board further agreed that if the USFWS does proceed with the prescribed burn as planned, the Rocky Flats Stewardship Council requests that:

- The USFWS share with the RFSC its burn management plan including:
 - How the burn plan is aligned with the State of Colorado minimum standards for prescribed burns (The 2014 Prescribed Fire Planning and Implementation Guide), or if the USFWS has adopted guidelines and standards for the use of prescribed fire.
 - How the burn will be staffed and the qualifications of those staff (including the presence of state or nationally certified prescribed burn managers and staff).
 - How an escaped burn will be managed should it go onto the DOE controlled portion of Rocky Flats.
- The USFWS share with the RFSC the ecological advantages of the burn including:
 - Explanation of why grazing and other management tools are insufficient in addressing the management of Rocky Flats.
 - Expected ecological outcomes and cost-benefits of the prescribed burn as compared to the application of other management tools at this location.

- Examples of successful prescribed burns conducted by USFWS on similar ecosystems with previously contaminated or environmentally compromised landscapes.
- The USFWS work with CDPHE to:
 - Anticipate and understand any potential implications of the prescribed burn on contamination within the Refuge and beyond.
 - Convey to the public information about smoke mitigation plans and any information about the potential occurrence of contaminated soil disbursement resulting from smoke, ash and embers.
 - Provide a briefing to reporters prior to the fire.
 - Conduct public meetings in any of the surrounding communities that request such meeting to inform the public about the burn plans and to address concerns in advance of the burn.



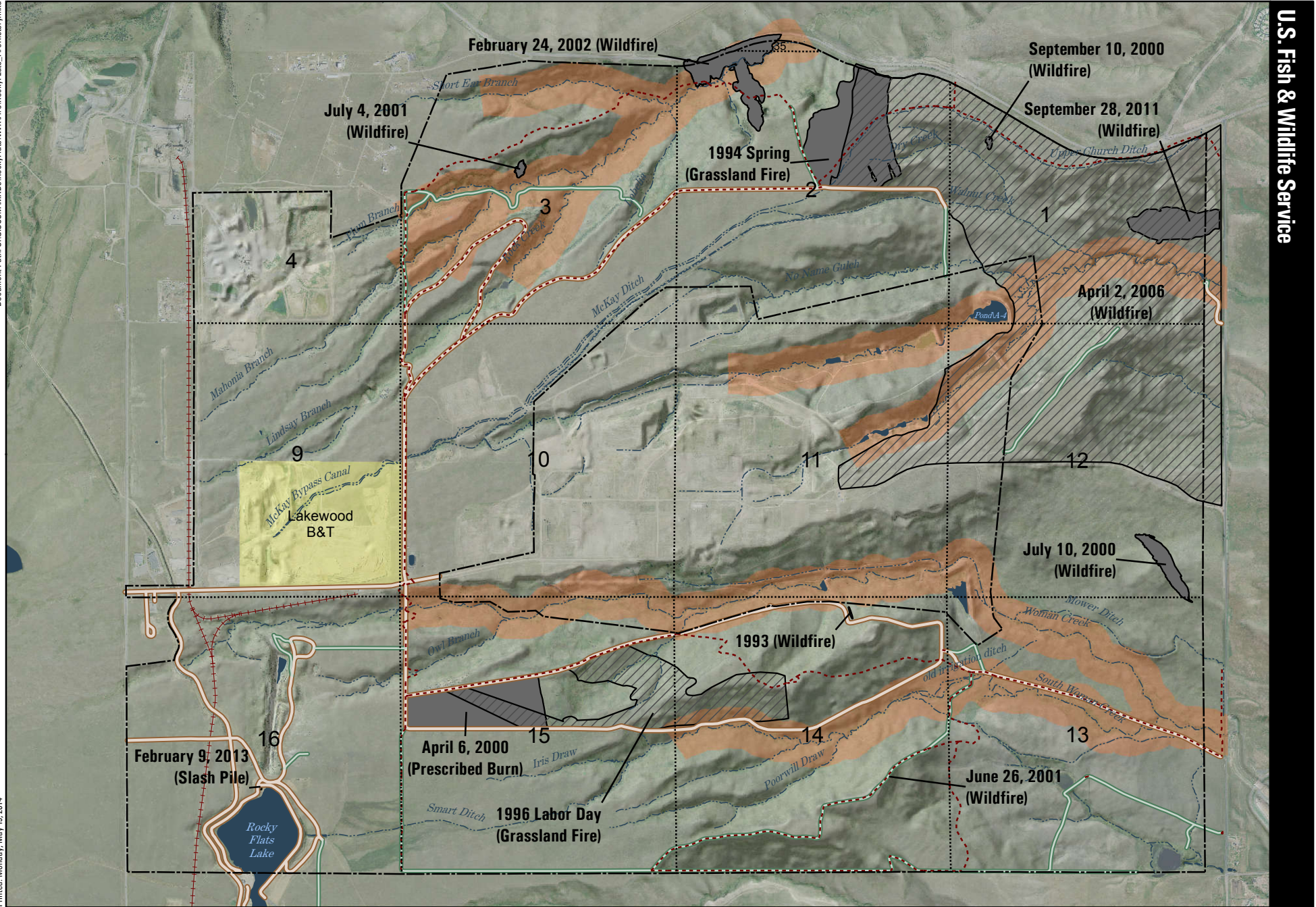
Rocky Flats
National Wildlife Refuge
 Burn Plan - 2014

- | | | | |
|---------------------------|-----------------|-------------|--|
| Planned Burn Area | Refuge Boundary | Stream | Preble's Meadow Jumping Mouse Critical Habitat |
| Critical Habitat w/i Burn | Section Line | Lakes | Church Pit (Private Quarry) |
| | County Boundary | Gravel Road | |
| | | Two-Track | |
| | | Railroad | |

0 Feet 1,500
 0 Meters 500

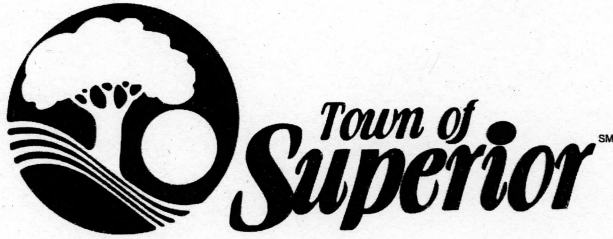


Transvers Mercator Projection
 UTM Zone 13 North - Units Meters
 North American Datum 1983



Rocky Flats
National Wildlife Refuge
 Fire History

--- REFUGE BOUNDARY	--- STREAM	--- GRAVEL ROAD	--- HIKING TRAIL (Proposed)	PREBLE'S MEADOW JUMPING MOUSE CRITICAL HABITAT	0 Feet 1,500	N	Transvers Mercator Projection UTM Zone 13 North - Units Meters North American Datum 1983
..... SECTION LINE	LAKE	--- TWO-TRACK	--- RAILROAD	CHURCH PIT (Private Quarry)	0 Meters 500		



December 8, 2014

Mr. Dan Ashe
Chief
United States Fish and Wildlife Service
1849 C. Street, NW, Room 3331
Washington, DC 20240

Mr. David Lucas
Project Leader
Rocky Mountain Arsenal National Wildlife Refuge Complex
U.S. Fish and Wildlife Service
134 Union Blvd
Lakewood, CO 80228

Dear Mr. Ashe & Mr. Lucas:

On behalf of the Superior Town Board of Trustees, I am submitting this letter as formal comment and protest of U.S. Fish and Wildlife Service (USFWS) plans to conduct a prescribed burn at the Rocky Flats National Wildlife Refuge (Refuge) in the spring of 2015.

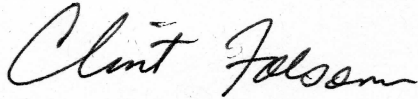
While we appreciate the efforts of the USFWS to work with the communities surrounding the Rocky Flats site to reach common goals and objectives, the Town of Superior strongly opposes any plans to conduct prescribed burns at the Refuge. A prescribed burn will cause unnecessary concern to the residents of Superior and has the potential for airborne contamination from the site. The potential harm that could be done if there were any radioactive matter released as a result far outweighs the benefit. It is the Board's position that there are other viable options available to USFWS to achieve the same result as a prescribed burn for effective management of the site.

The Town of Superior:

- strongly recommends that prescribed burns never be used on DOE retained lands
- recommends the USFWS engage in alternative methods to control invasive weeds throughout the site

We look forward to continued cooperative efforts to make the Rocky Flats National Wildlife Refuge an asset for all our communities.

Sincerely,



Clint Folsom
Mayor

Cc: Superior Town Board of Trustees
Matt Magley, Town Manager
Joyce Downing, Chairman Rocky Flats Stewardship Council
David Abelson, Exec. Dir., Rocky Flats Stewardship Council
Senator Michael Bennet
Senator Mark Udall
Senator-elect Cory Gardner
Representative Ed Perlmutter
Representative Jared Polis
Scott Surovchak, Department of Energy
Carl Spreng, CDPHE



CITY OF ARVADA

OFFICE OF THE CITY MANAGER
FACSIMILE: 720-898-7515 ▲ TDD: 720-898-7869
PHONE: 720-898-7500

November 11, 2014

Mr. David Abelson
Rocky Flats Stewardship Council
P.O. Box 17670
Boulder, CO 80308-0670

Dear Mr. Abelson:

This letter is provided in response to your memo to the Rocky Flats Stewardship Council Board of Directors dated October 16, 2014. Your memo summarized the Board's action in response to a proposal from the United States Fish and Wildlife Service (USFWS) to conduct a prescribed burn on the Rocky Flats National Wildlife Refuge in the spring of 2015. The memo described a motion approved by the Council Board on October 27. Specifically, the motion reads: "The Rocky Flats Stewardship Council opposes USFWS's plan to conduct a prescribed burn at the Rocky Flats National Wildlife Refuge. Our opposition rests primarily on two factors: (1) A burn will cause widespread community concern that will not be sufficiently alleviated through any public education process; (2) given that concern, there are other management options USFWS can employ, thereby obviating the need to burn at this time."

After receiving a copy of your memo, I felt it was my duty to report this matter to the Arvada City Council and to our development partners associated with Candelas. This information was reported to the City Council on October 31 and discussed briefly during the November 3 City Council meeting. The council expressed its serious concerns with the proposed prescribed burn. The city council's concerns are consistent with the concerns expressed in your memo.


On November 4, I discussed this matter during a monthly meeting with the Candelas development partners. One of the partners, Charles McKay, has offered the alternative option to resume controlled grazing in sections 13, 14 and 15 of the Rocky Flats site. Mr. McKay points out that these sections have been historically grazed by the Church Ranch before they were included as a buffer zone.

Mr. McKay's proposal demonstrates that there are alternatives to the proposed USFWS prescribed burn that would be much less controversial and may be able to accomplish the objective of controlling invasive weeds and grasses. Therefore, the City of Arvada supports the Rocky Flats Stewardship Council Board of Directors opposition to the prescribed burn and offers any assistance to the Council Board in working with the USFWS to develop alternatives to the proposed action.

As you know, Arvada is represented on the Rocky Flats Stewardship Council by Mayor Pro Tem Mark McGoff. Arvada's Utilities Project Manager Sandra McDonald supports Mayor Pro Tem McGoff's responsibilities as Arvada's representative. Please transmit any further information regarding the prescribed burn to Mayor Pro Tem McGoff so that we may be able to work collaboratively with the Stewardship Council and the USFWS to develop another acceptable alternative.

Thank you for your service to the Rocky Flats Stewardship Council and diligent response to the proposal from the USFWS.

Sincerely,


Mark G. Deven
City Manager

c: Mayor and City Council

Summary of Air Monitoring Data from the Rocky Flats test burn of April 6, 2000

By John Rampe
Deputy Assistant Manager, Environment and Infrastructure
Rocky Flats Field Office
April 11, 2000

Background

The Rocky Flats Environmental Technology Site conducted a controlled test burn of approximately 50 acres of its buffer zone Thursday morning, April 6, 2000. The following discusses the methodology and preliminary results.

Methodology

During the test burn DOE contractors and the U.S. Environmental Protection Agency Region VIII (EPA) took separate air monitoring samples using high-volume air samplers. Both sets of samplers collected samples three to six feet from the ground, were well immersed in the plume, and collected substantial samples of smoke from the burn. These samplers were placed on the upwind and the downwind side of the burn.

Data from these samples, as well as a simplified calculation of the possible radiation dose resulting from exposure to the smoke from the test burn, are attached.

The air monitors are designed to capture essentially all airborne particles on filters. These filters are then analyzed for alpha radiation activity. Plutonium is an alpha particle emitter. There are also numerous naturally occurring and common elements that emit alpha radiation, such as radon.

A blank filter is analyzed and compared to the filters used in the sampling to distinguish any alpha activity that might occur naturally from the filter.

Preliminary Results

Alpha radiation levels for both upwind samples and for the blank filter were below the laboratory detection limit of 1.5 disintegrations per minute (dpm), or showed less than minimum detectable activity. Only the downwind sample had a measurable activity, slightly above minimum detectable activity, of approximately 2.0 dpm. Using the volume of air sampled, and correcting for the area of the filter, this resulted in an alpha activity of 0.2 picoCuries per cubic meter of air sampled (pCi/m³).

The analysis then treated all of the activity as though it had resulted from plutonium. This is a conservative assumption, since the natural radionuclide sources, e.g. Uranium, have not been subtracted. Also, the dose resulting from plutonium activity is somewhat higher than the dose from the same activity for some other radionuclides such as uranium.

The analysis resulted in an extrapolated dose of 0.2 millirem (mrem) to someone located at that air sampler (which was continually in the smoke plume) for the entire time the

sampler was running. This value was derived using regulatory-based values for the concentration of plutonium in air that would result in a 10 mrem annual exposure (these were from the National Emission Standards for Hazardous Air Pollutants, NESHAP) and converted to allow for the time the air monitor was actually running (82 minutes).

Since all the alpha activity was assumed to be from plutonium, the actual dose a co-located individual would have received is less, since most of the activity observed on the filter is from natural radioisotopes.

This estimated dose is low when compared to natural radiation exposures, which range to about 400 mrem/year or about 1 mrem/day in Colorado. This calculated dose is consistent with other observations made during the test burn.

Radiological scans of burn site personnel exiting the area showed no detectable radioactivity, and results from dosimeters worn by firefighters also showed no detectable exposure.

This level of exposure from this burn would be roughly equivalent to a burn in similar areas outside of Rocky Flats

Additional Analysis

EPA Region VIII is conducting an isotopic analysis of the filters, as well as an alpha-beta analysis. This isotopic analysis will distinguish individual radioactive elements such as Plutonium and Uranium. It will show what specific contaminants are present and in what quantities. An isotopic analysis takes three-four weeks to complete. EPA has agreed to share these results with the community as soon as they are available

DOE will continue to analyze data from the air monitors, including calculating the potential exposure to an off-site individual (such as someone along Highway 93), and, as isotopic data become available, doing more detailed exposure modeling of a person at the scene of the test burn. All of this information will be available to the public. Additionally, DOE will hold its remaining filter samples, and will make them available on request for analysis by an independent party.

Effects of Prescribed Grass Fire on Wind Erosion Rates from Surface Soil at Rocky Flats, Colorado

Patrick Haines and Susan Templeman
URS/Radian, 8181 East Tufts Ave., Denver, Co 80237
patrick.haines@rfets.gov

Martha Hyder
Wind River Environmental Group LLC, 3785 S. Poplar Street, Denver, CO 80237
martha.hyder@rfets.gov

Chatten Cowherd, Jr. and Mary Ann Grelinger
Midwest Research Institute, 425 Volker Boulevard, Kansas City, MO 64110
ccowherd@mriresearch.org

ABSTRACT

Removal of plants and plant litter by fire significantly increases the erosion potential of the underlying soil for some period of time. By using a portable wind tunnel to simulate high winds across test plots within a prescribed burn area, the effects of fire on soil erosion potential may be quantified as a function of wind speed and elapsed time following the fire.

A portable wind tunnel was used to generate high winds and collect soil particles eroded from a 50-acre study area that underwent a controlled burn in April 2000. Wind tunnel studies of the burned area and neighboring control areas were performed following the test burn, and again at intervals of 25 and 73 days following the fire. Soil erosion rates at incremented wind speeds were determined using optical particle counters and gravimetric analysis of dust samples. Shallow soil samples were collected from areas around the wind tunnel study plots for analysis in a soil dustiness test chamber.

The study was directed at answering the following questions:

- What increase in soil erosion potential may be expected as a result of grassland fire?
- What is the recovery rate of soil protective elements (vegetation and litter) for an area denuded by fire, as indicated by soil erosion potential?
- What algorithms may be employed to estimate increases in fugitive dust emissions resulting from post-fire increases in soil erosion potential?
- How may such algorithms be employed in common atmospheric dispersion models?

INTRODUCTION

The U.S. Department of Energy's Rocky Flats Environmental Technology Site (Site) has several areas of actinide-contaminated soil as a result of spills and releases during the Site's nuclear weapons production era. Most such areas are well vegetated, which has stabilized potential wind-driven resuspension of actinide-contaminated soil particles. The Site is currently undergoing cleanup and closure, and as plans are being made for post-closure use, the increase in actinide emissions that might result following removal of vegetation by fire has become an issue of great interest. The Site has experienced three small lightning-caused grass fires in the past 10 years, so fires represent reasonably foreseeable occurrences.

RFP 5345

ADMIN RECORD

48
SW-A-006228

In Spring 2000, the Site conducted a test burn to evaluate a proposed program of prescribed burning for weed control and prairie restoration. The test burn, which covered approximately 50 acres in the Site's buffer zone (the large, undeveloped area surrounding the Site's industrial area), presented an opportunity to gather data on post-fire resuspension rates and subsequent recovery for use in estimating emissions and impacts from wildfires at the Site. A portable wind tunnel was used to generate high winds and collect soil particles eroded from soil surfaces following the test burn, and again at intervals of 25 and 73 days following the test burn. Wind tunnel tests were performed by Midwest Research Institute (MRI) on representative portions of the test-burn area and also on an adjacent, unburned grassy area within the Rocky Flats site.

Because removal of standing plants and plant litter by fire significantly increases the erosion potential of the underlying soil for some period of time, one goal of the study was to evaluate the length of time it takes for a burned surface to regain protection against wind erosion comparable to pre-burn conditions. The objectives of the study also included determining how dust resuspension increases from one wind speed plateau to the next and how resuspension rates decay in time at a given wind speed. The wind tunnel tests determined wind erosion emission rates that will be used in the future to model short-term and annual particulate matter and actinide emissions from potential fires at the Site. The methods and results of the study are described below.

TEST EQUIPMENT AND PROCEDURES

The prescribed burn was conducted on April 6, 2000 and wind tunnel testing was initiated the day after the burn. Wind tunnel tests were performed by MRI using a portable reference wind tunnel, described in the *Air/Superfund National Technical Guidance Study Series, Volume II, Estimates of Baseline Air Emissions at Superfund Sites*.¹ Two TSI DustTRAK monitors were used to provide real-time concentrations of PM₁₀ (particles less than or equal to 10 micrometers [μm] in aerodynamic diameter) in the tunnel effluent. Laboratory dustiness tests were run on bulk surface soil samples from burned areas to characterize the soil texture and to investigate the effects of soil moisture on erosion potential.

Wind Tunnel Trials

Field tests of the prescribed burn area at Rocky Flats were performed over one-week periods beginning April 7, May 2, and June 19, 2000. During each test, the wind tunnel was moved three times over the test area, to collect additional particulate on the back-up filter in the effluent sampling train and to improve the detection and precision of the PM₁₀ erosion potential estimates.

The primary test device used in the evaluation was MRI's portable reference wind tunnel, shown in Figure 1. Although the portable wind tunnel does not generate the larger scales of turbulent motion found in the atmosphere, the turbulent boundary layer formed within the tunnel simulates the smaller scales of atmospheric turbulence. It is the smaller scale turbulence that penetrates the wind flow in direct contact with the erodible surface and contributes to the particle entrainment mechanisms. The wind tunnel method relies on a straightforward mass balance technique for calculation of particulate emission rates. Previous wind erosion studies using the MRI reference wind tunnel have led to the U.S. Environmental Protection Agency (EPA) recommended emission factors for industrial wind erosion presented in *Compilation of Air Pollutant Emission Factors (AP-42)*.²

For each run, 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 40 mph at the tunnel centerline. This corresponded to a wind speed between 97 and 145 mph at a 10 meter (m) height; the equivalent 10-m speed varied with the roughness height of the surfaces tested in each trial.

Typically, each time the wind speed was increased, a PM_{10} concentration spike was observed. Furthermore, upon each successive increase, the peak value of the spike increased and the rate of decay decreased. The PM_{10} concentration values for each wind speed plateau were observable in the "real-time" concentration histories, recorded by the DustTRAK monitors (described below). For higher wind speed plateaus, the duration of sampling was increased to allow additional time for the spike to decay. An example of the concentration spikes that occurred during wind tunnel testing on the burned area can be seen in Figure 2.

A pitot tube 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.³ 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 surface roughness heights for the test runs were determined by fitting vertical profiles of wind speed in the test section of the wind tunnel to a logarithmic function. An average roughness height was calculated for each test series, for purposes of calculating friction velocities and 10-m equivalent wind speeds. The friction velocity, which is a measure of wind shear at the erodible surface, characterizes the capacity of the wind to cause surface particle movement.

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]), consisted of the tapered sampling probe, cyclone pre-collector, quartz backup filter, and high-volume motor. The sampling probe was pointed into the air stream, and isokinetic sampling was achieved by fitting the sampling probe with a nozzle of appropriate size. Sampled total airborne particulate (TP) emissions were separated into two particle size fractions by the cyclone: particles larger than PM_{10} were collected inside the cyclone, and PM_{10} was collected on the backup filter below the cyclone.

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 and subtraction of the contribution of the ambient background particulate level. The filter was vertically oriented, parallel to the tunnel inlet face.

At the completion of each test series, the sampling train was disassembled and taken to the field instrument van, where the collected samples of dust emissions (cyclone catch and backup filter) were carefully placed in protective containers. Dust samples from the field tests were returned to an environmentally controlled laboratory for gravimetric analysis. Quartz filters were conditioned at constant temperature (23 degrees Celsius [$^{\circ}C$] $\pm 1^{\circ}C$) and relative humidity (45% \pm 5%) for 24 hours prior to weighing (the same conditioning procedure used prior to tare weighing). The particulate catch from the cyclone pre-collector was weighed in a tared poly bag.

DustTRAK Monitoring

Continuous monitoring of particulate concentration in the sampling extension provides for a greater level of detail in tracking the dynamics of the wind erosion process. For this study, two portable DustTRAK Aerosol Monitors (TSI, Inc., St. Paul, Minnesota) were used to continuously sample the air between the cyclone and the backup filter to track the PM₁₀ concentrations in the tunnel effluent.

The DustTRAK monitor is a portable, battery-operated instrument that gives real-time measurements and has a built-in data logger. The operating principle of the DustTRAK is based on 90° light scattering. Light scattering (deflection) by local variations in refractive index is caused by the presence of particles whose size is comparable to the wavelength of the incident light. The theoretical detection efficiency peaks at about 0.2-0.3 μm and gradually decreases for larger particle sizes. A pump draws aerosol into the optics chamber where either solid or liquid particles are detected using a laser diode light source and a solid-state photodetector. The instrument can store measurements at programmable intervals for later trending and reporting.

The DustTRAK PM₁₀ monitor was calibrated against the actual PM₁₀ mass collected on the backup filter of the wind tunnel effluent sampling train during a given test run. This calibration required an integration of the real-time DustTRAK PM₁₀ concentration profile (versus time) and calculation of the average DustTRAK PM₁₀ concentration. The average DustTRAK PM₁₀ concentration was then compared to the average PM₁₀ concentration calculated from the PM₁₀ mass collected on the backup filter below the cyclone.

Use of the DustTRAK monitor provided a more comprehensive analysis of surface erodibility than wind tunnel sampling alone, especially appropriate to study surfaces that do not have a well defined wind erosion threshold velocity. There are multiple contributors to wind generated particulate emissions on the burned vegetative surfaces at the Site: 1) bulk soil, 2) settled surface dust trapped by vegetation, and 3) the vegetation itself. The particle releases from these reservoirs are all driven by different mechanisms, each with a different wind speed dependence.

The approach taken in this study was to expose each test surface to a well-defined time history of increasing wind speeds, while simultaneously monitoring the PM₁₀ concentration in the tunnel effluent. Each time the wind speed was increased, a concentration spike was observed. Time integration of these spikes generated erosion mass increments of PM₁₀ that when added together yielded cumulative erosion potential as a function of wind speed.

Dustiness Testing

In April and May 2000, six subareas in the controlled burn area were sampled for surface soil. The soil samples were collected to a depth of approximately 1 to 1.5 centimeters (cm) using a whiskbroom and dustpan. The areas were judged to be representative of the wind tunnel test areas.

Dustiness testing was performed on samples of surface soil to characterize the potential for release of airborne PM₁₀ when the soil is disturbed. Dustiness tests were also run under varying soil moisture levels to provide information on the mitigating effect of soil moisture in reducing PM₁₀ emissions. The moisture levels selected for dustiness testing were 0%, 2%, 4%, 6%, and 8%.

The MRI Dustiness Test Chamber is a laboratory device used to determine the tendency of finely divided bulk materials (e.g., soils, powders) to release fine particles. Within the chamber, the particles

generated from controlled pouring of material are captured on an overhead filter with a sampling rate of 5 liters per minute. The net weight of particulate matter caught on the filter (final filter weight minus tare weight) is divided by the mass of material poured to calculate the mass emission rate in units of milligrams of dust per kilogram of material poured. This quantity is defined as the dustiness index of the test material.

TEST ANALYSIS

Because wind erosion is an avalanching process, it is reasonable to assume that the loss rate from a surface is proportional to the amount of erodible material remaining:

$$\frac{dM}{dt} = -kM \quad (1)$$

where

- M = quantity of erodible material on the surface at any time, grams per square meter (g/m^2)
- k = proportionality constant, inverse seconds (s^{-1})
- t = cumulative erosion time, seconds (s)

Integration of Equation 1 yields:

$$M = M_0 e^{-kt} \quad (2)$$

where

- M_0 = erosion potential, i.e., quantity of erodible material present on the surface before the onset of erosion, g/m^2

The loss of erodible material (g/m^2) from the exposed surface area during a test is calculated:

$$L = \frac{CQt}{A} \quad (3)$$

where

- C = average particulate concentration in tunnel exit stream (after subtraction of background concentration), g/m^3
- Q = tunnel flow rate, cubic meters per second (m^3/s)
- A = exposed test surface area (0.918 square meters [m^2] for the reference wind tunnel)

Alternatively, the erosion potential can be directly calculated from the cyclone and filter net mass (after correction for background).

For a specific surface, the wind erosion potential is dependent on the wind speed and on the frequency of disturbance of the erodible surface. Each time that a surface is disturbed, its erosion potential is restored. A disturbance is defined as an action that results in the exposure of fresh surface material. For this study, a disturbance occurred when the soil surface was exposed by the prescribed burn.

Whenever a surface is tested at sequentially increasing wind speeds, the measured losses from the lower speeds are added to the losses at the next higher speed and so on. This reflects the hypothesis that, if the lower speeds had not been tested beforehand, correspondingly greater losses would have occurred at the higher speeds.

In summary, the calculated test results for each test surface included:

- Roughness height: from extrapolated subthreshold velocity profile;
- Friction velocity: from measured centerline wind speed and roughness height;
- Equivalent wind speed at reference 10-m height: from measured centerline wind speed and roughness height; and
- Erosion potential (for "limited reservoir" surfaces) for a maximum wind speed: equivalent to the cumulative particle mass loss.

In addition to the wind tunnel results, 6-second concentrations were graphed and integrated over wind tunnel run time to calculate the hypothetical mass that would have been collected by each DustTRAK monitor. As discussed previously, the integrated mass (erosion potential) for each wind speed plateau included integrated masses from each previous plateau. Finally, the average PM₁₀ mass for the entire DustTRAK sampling period was compared to the actual PM₁₀ mass collected on the PM₁₀ backup filter.

TEST RESULTS

The results of the wind tunnel tests and erosion potential calculations are presented in Table 1. As expected, the average PM₁₀ concentration in the wind tunnel effluent for the April test series was much higher for the burned areas than for the adjacent unburned areas. At the beginning of the first test series, one day after the burn, the average PM₁₀ erosion potential was approximately nine times higher than found for unburned grassland adjacent to the burn area.

The PM₁₀ erosion potentials, normalized to a 10-m wind speed of 95 mph, are shown graphically in Figure 3. Normalization was performed because the growth of vegetation between the prescribed burn and the later tests, on both burned and unburned plots, resulted in different surface roughness heights and consequent 10-m wind speed equivalents for the maximum wind tunnel centerline speeds. This effect is also shown in the progression of roughness heights and friction velocities between the earlier and later tests that can be seen from Table 1.

From Figure 3, the PM₁₀ erosion potential of the burned area appears to decay in time with the regrowth of vegetation. Observations made at the time of each test series also indicated that the ground was somewhat moist in May but was fairly dry for both the April and June test series on the burned area. The dustiness tests that were performed with soil from the burned area showed that moisture is very effective in limiting PM₁₀ erosion potential. As moisture was increased from 2% to 8%, for example, in the laboratory testing, the dustiness (potential for release of airborne PM₁₀) was seen to decrease by over an order of magnitude.

The PM₁₀ erosion potential for the unburned grassland remained consistently low, in the range of 0.05 g/m² or less, as seen from April and June tests shown in Table 1. The PM₁₀ erosion potential for the unburned areas also decreased between April and June as the vegetation grew.

Table 1 also shows erosion potential for total particulates. The results show a somewhat different pattern than found for PM_{10} and indicate that erosion potential increased with time, on both the burned and unburned areas. These results are somewhat misleading, because the results cannot be normalized in the same manner as the PM_{10} since DustTRAK data are not available for the larger particles, nor would they be reliable. However, the indicated trend may also result from changes in vegetation with time. As the vegetation grew, it would have presented a larger surface area to catch and hold deposited dust. Other researchers have found that larger particles may be more easily dislodged from vegetation surfaces than smaller particles, such as PM_{10} , which may be better protected by boundary layer effects on the leaves themselves.^{4,5} As a result, the growing vegetation may constitute an effective reservoir of erodible particles, particularly in the larger size fractions that contribute to total airborne particulate.

The logging mode of the DustTRAK provided 6-second average concentration values for each of the test runs. After subtracting out a minimum value assumed to be background, these values were used to find an average concentration value from the beginning of the test run to the end of the run time for each 10-m wind speed. The average concentration along with the tunnel volumetric flow rate, the length of time from the beginning of the test until the end of the specified wind speed plateau, and the exposed test surface area were used to determine the (cumulative) erosion potential for that wind speed.

It should be noted that the actual average PM_{10} concentration in the tunnel effluent was several times higher than the average PM_{10} concentration indicated by the DustTRAK. This reflects the fact that while the coarse mode of the PM_{10} (particles larger than $2.5 \mu m$) constitutes much of the PM_{10} sample mass, it does not scatter light very effectively. Calibration of DustTRAK results to backup filter mass corrected for this bias.

Figure 4 shows average erosion potential values versus wind speed (mph) at a 10-m height. The same pitot tube pressure differentials for the predetermined tunnel centerline wind speeds were used for the three test periods, yet the roughness height of the surface changed over the three-month period, corresponding to increases in 10-m wind speeds, in relation to centerline values.

It is clear from Figure 4 that the erosion potential distributions (versus 10-m wind speed) decay with time after the prescribed burn. The May curve lies below the June curve because of the damp soil conditions encountered during the May testing.

DISPERSION MODELING APPROACH

Wind tunnel test results are being used to model the movement of airborne particulate matter and actinides in the Site environment. A Site-specific wind erosion equation was developed from previous wind tunnel studies performed at the Site by MRI in 1993.⁶ In that approach, particulate emissions from undisturbed, vegetated surfaces at the Site were calculated as a function of the 1-hour average wind speed measured at a 10 m height, and the presence or absence of snow cover. Actinide emissions were calculated based on concentrations in the underlying soil.

Emissions were then modeled using a Site-specific implementation of EPA's Industrial Source Complex Short Term model (ISCST3) (the model uses a 1-hour time step). Comparison of model predictions to measured ambient air plutonium and americium concentrations at various locations around the Site indicated that the approach overpredicts actinide concentrations by up to an order of magnitude close to source areas and by a factor of 3 to 6 at the downwind fence line (located 2,500 to 3,000 m east of source areas)⁷. Much of this overprediction is presumed to be caused by the inability of

the present model to account for limitations in the available reservoir of erodible particles. Rather than depleting the supply of particles that can be eroded in an hour at a given wind speed, the model assumes that each subsequent hour at a similar wind speed could erode a similar mass of material.

Refinements are being made to the modeling approach to take this limitation into account. The modeling approach is also being revised to account for removal of vegetation by a fire and to incorporate the subsequent, temporary increases in erosion potentials that were the subject of the study reported here. The refined approach is outlined below for a 1-year modeling scenario, using historical meteorological data measured at the Site.

- **Track 15-Minute Wind Speed and Precipitation**

The 15-minute mean wind speeds are representative of maximum sustained winds (wind data from the Site are recorded as 15-minute averages). The 15-minute wind speed and precipitation data will be used to calculate wind erosion rates.

- **Develop 15-Minute Emission Rates as a Function of Wind Speed Using Wind Tunnel Data From Undisturbed Areas**

Dispersion models for open dust sources require emission rates in units of mass per unit area per unit time (i.e., $g/m^2/s$). In contrast, particulate emissions from wind erosion are expressed in terms of mass per unit area (g/m^2) for the maximum sustained wind speed (minimum of 2 minutes) between surface disturbances. To account for these differences, the refined approach will assume that the erosion potential for a given wind speed will be exhausted within a 15-minute time step and the total particulate and actinide emissions will be averaged over the time step. It will be assumed that additional erosion for subsequent wind speeds at or below the initial wind speed will be insignificant until the erosion potential is replenished by surface disturbance; subsequent higher wind speeds will be allowed to erode an additional increment of material based on wind tunnel erosion potential data for undisturbed, vegetated surfaces.

- **Eliminate Periods During and Immediately After Precipitation Events and When Snow Cover is Present**

High winds that occur in the same 4-hour period as light precipitation or within 24 hours of significant precipitation are unlikely to cause significant wind erosion. Emission rates for these periods will be reduced to zero for calculation purposes. Similarly, periods with snow cover (based on measured albedo data) will also be reduced to zero.

- **Project Hourly Particle Deposition and Erosion Potential Replenishment**

A small replenishment of erosion potential will occur on an ongoing basis because of particle deposition, freeze/thaw events, etc. Hourly estimates of particle and actinide deposition will be made based on measured meteorological data and historical PM_{10} , total suspended particulate, and ambient actinide concentration data for the Rocky Flats area. A small additional increment will be added for ongoing, small-scale soil disturbances such as freeze/thaw cycles, rainsplash, and animal activity.

- Calculate Hourly Emission Rates, Taking into Account Erosion Losses from Previous Wind Events

The erosion potential will be reduced with each high wind event. If the erosion potential at 35 mph (10-m height) is $x \text{ g/m}^2$, then that erosion potential will no longer be available for future winds of 35 mph or less until the erosion potential is restored by deposition or other means. Only winds above ~35 mph will produce future soil erosion. In addition, if a 50-mph wind event follows a 25-mph wind event, the curve will produce $y \text{ g/m}^2$ erosion potential, but the previous wind erosion potential must be subtracted to give only $(y - x) \text{ g/m}^2$ for the 50-mph wind event.

Hourly emission rates will be calculated for each source area by treating this situation using a mass balance, "bookkeeping" approach. Beginning with an assumed initial erosion potential at the beginning of the modeling period, increases and decreases in erosion potential will be calculated for each 15-minute period based on losses due to emissions and inputs due to deposition, etc. Emissions will be constrained for each 15-minute time step so that they do not exceed the net remaining erosion potential for the applicable wind speed. The calculated 15-minute emissions will be used to develop hour-by-hour emission rates for input to ISCST3.

To model resuspension following a fire, multipliers will be developed and applied to the above-estimated emissions. The multipliers will vary based on the elapsed time following the fire and based on soil moisture conditions, as follows.

- Generate Erosion Potential Decay Curves for Each Tested Wind Speed, Soil Condition, and Time Period Following a Grass Fire

Erosion potentials for three different elapsed times following the test burn are given in g/m^2 for each tested wind speed in Figure 4. May is assumed to represent "damp soil" erosion potential, while the April and June tests are assumed to represent dry conditions. Erosion potentials at intermediate wind speeds can be interpolated from the curves.

- Use Damp/Dry Soil Curves as Appropriate for each 15-Minute Period

High winds that occur within 24 to 48 hours of significant precipitation should be associated with a damp soil curve for calculation of erosion potential and emissions.

- Model 1-yr Periods (Assume Full Revegetation and Restoration of Original, Reduced Erosion Potential Within 1 Year)

Decay curves will be assumed to decline to a level represented by the unburned area tests after one year. Restoration of the full vegetation protection against wind erosion will not be complete until a new layer of thatch is laid down and covers the soil between grass clumps.

CONCLUSIONS

The results of the wind erosion tests on the Rocky Flats prescribed burn area showed that low PM_{10} emissions occurred below 40 mph (equivalent wind speed at a height of 10 m above ground). Above 40 mph, PM_{10} emissions increased with increasing wind speed. After burning, the land was

observed to retain many of the characteristics that limit wind erosion—including soil crusts, rocks/pebbles that protected the surface soil, and grass clumps. Grass clumps, even when burnt, are very protective of soil erosion, but usually were not spaced closely enough on Rocky Flats land for good protection of all of the exposed area.

PM₁₀ emissions were observed to increase as wind speed increased, and erosion potentials were calculated for various wind speed plateaus during each of the three months of testing. Erosion potentials from the prescribed burn area were always somewhat greater than for unburned areas, even for the June tests—approximately 2½ months after the burn. This was clearly due to the wind protection afforded by dead grass thatch that had formerly covered the unburned areas, but was not present after the prescribed burn.

Even though the burned areas had revegetated to a large extent by the June test period, bare soil that constituted an emission source was still visible between the revegetating plants. Moreover, the vegetative restoration of the prescribed burn areas included mostly tall, thin plants that did not completely protect the soil from wind erosion through late June, when the latest wind tunnel tests were conducted. During May tests, soil moisture was observed to be effective in reducing soil erosion rates from high winds at moderate temperatures. However, when rainfall wets the soil surface and temperatures are warm, the surface dries quickly in the relatively low humidity environment of Rocky Flats, so this mitigating effect is transient.

A new approach to ambient impact modeling of a grass fire is being developed for wind erosion sources to reflect a limited reservoir erosion potential (emission rate) in units of g/m². This approach tracks historical 15-minute mean wind speeds. The times and extent of wind erosion are dominated by the occurrence of the highest wind speeds. Wind tunnel data provide the relationship between particulate emission rates and maximum sustained winds. The modeling approach takes into account losses of erosion potential from previous high wind events, the mitigating effects of vegetation, and the role of background dust deposition.

The new approach will account for the absence of emissions during precipitation events and when snow cover is present. Increases and decreases in erosion potential will be calculated for each 15-minute period based on losses due to resuspension and input due to deposition and other natural processes (e.g., freeze/thaw). A mass balance accounting will be performed so that emissions will not exceed the net remaining erosion potential for a given source area for the applicable wind speed. Calculated 15-minute emissions will be used to develop hour-by-hour emission rates for input to ISCST3. To model resuspension following a fire, multipliers based on the elapsed time following the fire and on soil moisture conditions will be applied to the above-estimated emissions.

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- 4) Garland, J.A. *Resuspension of Particulate Matter From Grass Experimental Programme 1979-1980*. UKAEA Atomic Energy Research Establishment, Environmental and Medical Sciences Division, Harwell, England, 1982; AERE-R-10106.
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- 6) Midwest Research Institute. *OU3 Wind Tunnel Study*, Vol. I: *Test Report*. Prepared for EG&G Rocky Flats, Inc., Golden, CO, 1994.
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Figure 1. MRI portable wind tunnel.

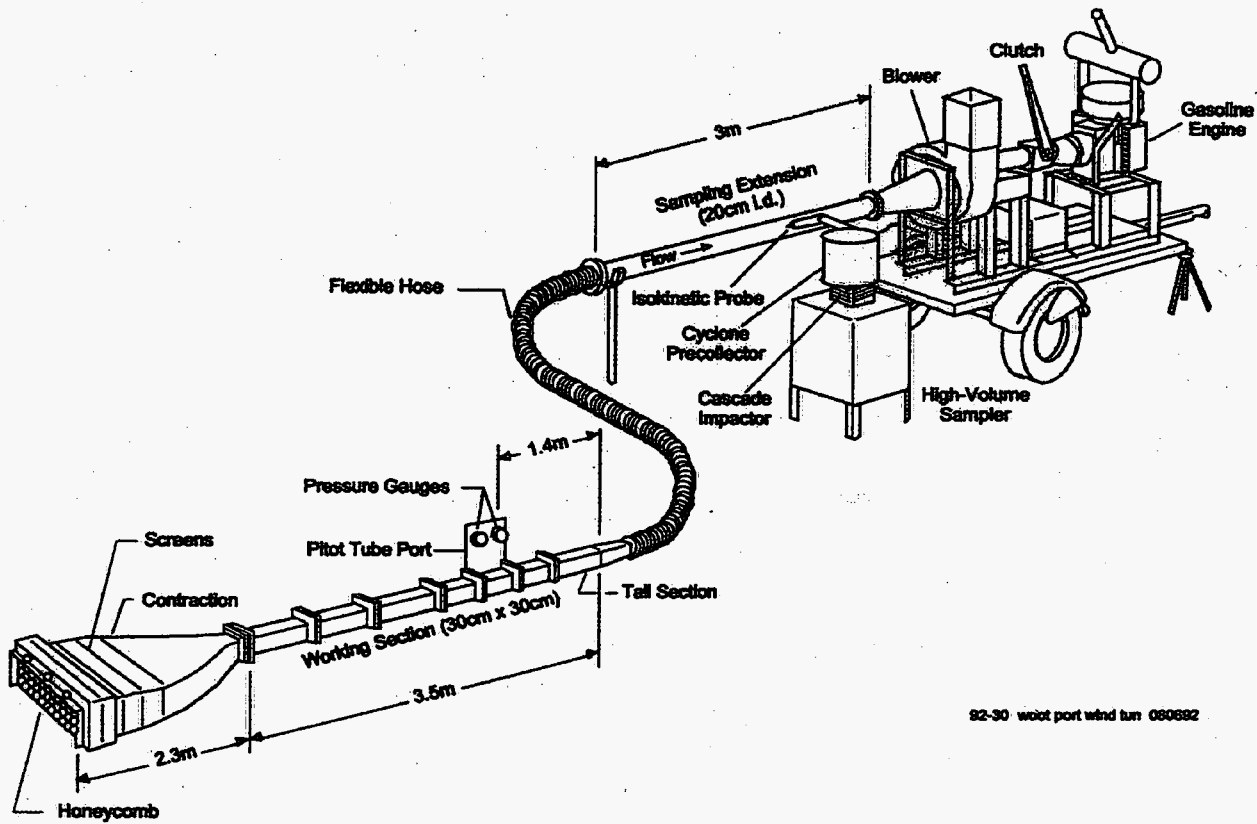


Figure 2. DustTRAK graph for run CB-8B.

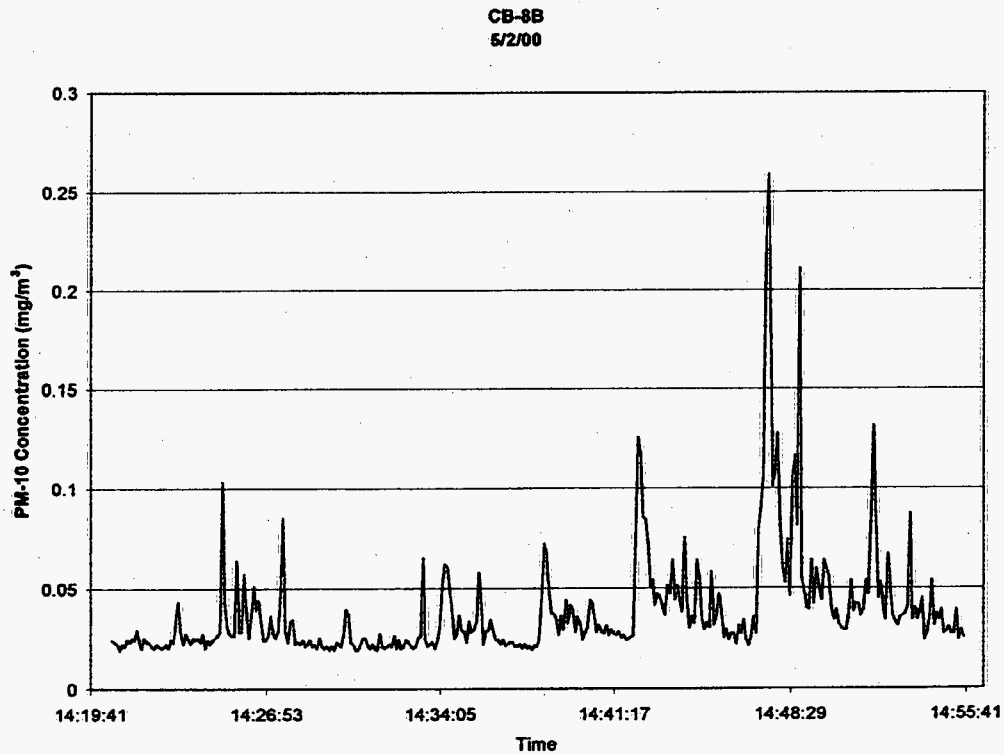


Figure 3. Erosion potential history for each test series.

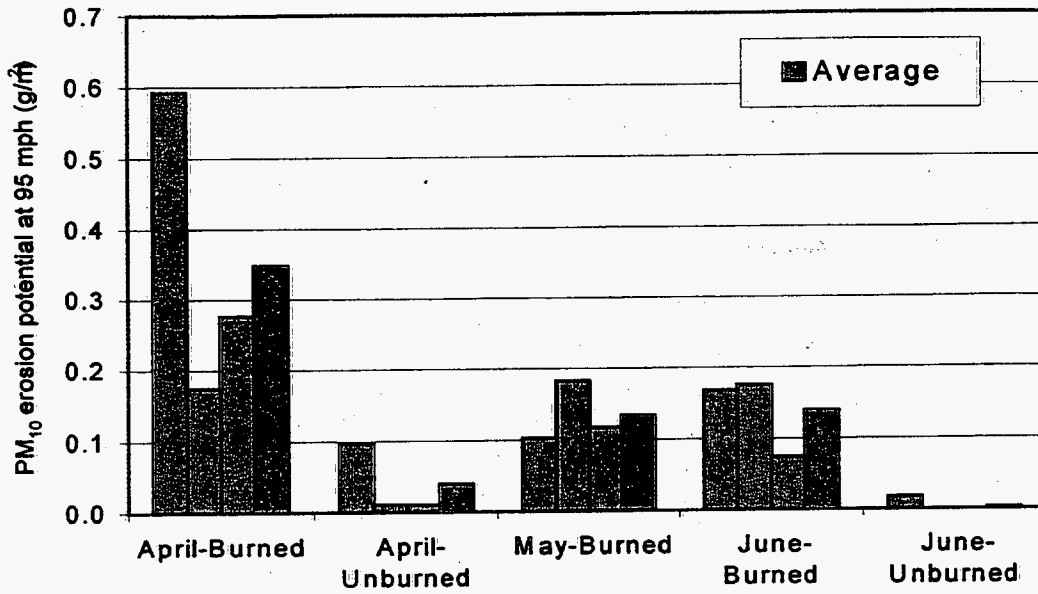


Figure 4. Erosion potential at 10-m wind speeds as determined from DustTRAK data.

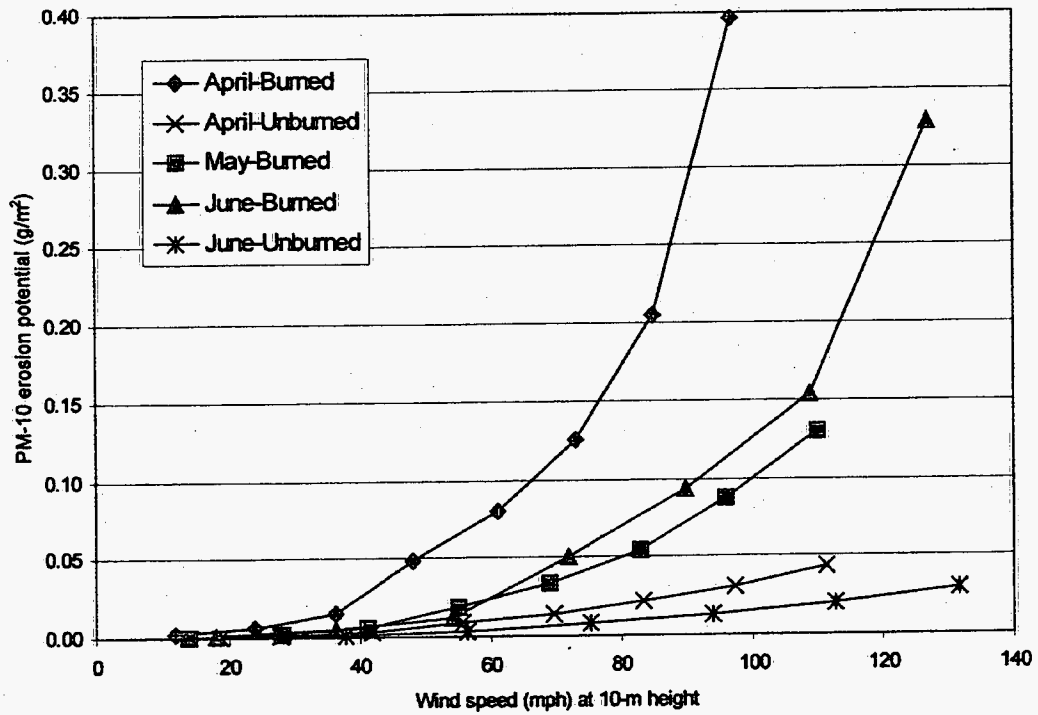


Table 1. Wind tunnel erosion potentials.

Date of test series	Surface condition	Average roughness height (cm)	Maximum wind speed (mph) at tunnel CL ^a	Equivalent maximum wind speed (mph) at 10-m height ^b	Corresponding friction velocity ^b (cm/s)	Erosion potential ^c (g/m ²)		
						TP	PM ₁₀	PM ₁₀ normalized to 95 mph at 10-m height
4/7/00	Burned	0.85	40.3	97.6	244.7	1.33	0.65	0.59
4/8/00	Burned	0.66	40.3	97.6	244.7	0.61	0.19	0.17
4/8/00	Burned	0.89	40.3	97.6	244.7	0.62	0.30	0.28
4/9/00	Unburned	1.65	39.7	110.1	301.0	0.31	0.14	0.10
4/10/00	Unburned	1.76	40.3	111.9	305.8	0.13	0.02	0.01
4/11/00	Unburned	0.92	40.3	111.9	305.8	0.18	0.02	0.01
5/2/00	Burned	1.10	37.0	100.5	271.4	1.07	0.12	0.10
5/2/00	Burned	1.31	40.3	109.6	295.8	2.50	0.26	0.18
5/3/00	Burned	1.57	37.2	101.2	273.3	0.76	0.14	0.12
6/21/00	Burned	3.00	38.6	138.3	425.9	11.09	0.67	0.17
6/21/00	Burned	3.12	29.2	104.7	322.4	1.67	0.23	0.18
6/22/00	Burned	2.91	35.8	128.4	395.3	3.65	0.23	0.07
6/22/00	Unburned	3.17	39.3	145.2	452.5	0.16	0.05	0.02
6/23/00	Unburned	3.16	34.8	128.6	400.6	0.45	<0.02	<0.02
6/23/00	Unburned	3.32	37.5	138.8	432.4	0.83	<0.02	<0.02

Notes:

cm = centimeter
 mph = miles per hour
 CL = centerline
 m = meters

cm/s = centimeters per second
 g/m² = grams per square meter
 TP = total particulate


^a Average maximum wind speed at tunnel centerline for all three tests.

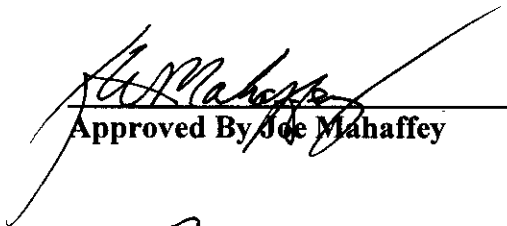
^b Average roughness height over three runs used to calculate equivalent 10-m wind speed and friction velocity.

^c Calculated using net mass.

**WHITE PAPER
ON THE
RADIATION DOSE ASSESSMENT FOR FIREFIGHTERS
DURING A GRASS FIRE**


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RADIATION DOSE ASSESSMENT FOR FIREFIGHTERS DURING A GRASS FIRE

Introduction

A radiation dose assessment was performed for firefighters at the Rocky Flats Environmental Technology Site (RFETS) trying to extinguish a grass fire. This dose assessment is being performed to assure that firefighters would not exceed any radiation dose limits. This radiation dose assessment will be used to delineate areas at RFETS where firefighters would be advised to not follow a grass fire based on increased radiation dose potential.

Radiation dose could be received by the firefighter through the inhalation of resuspended radioactive material. This resuspended radioactive material augments naturally occurring radioactive material in the air. For the purposes of this study, the radiation dose to firefighters located adjacent to a grass fire will be assessed so that the maximum radiation dose to the firefighter is estimated. Conservative assumptions were made in the dose assessment to assure that radiation dose to the firefighter was overestimated in the calculations.

It is recommended that the "Soil Contamination Area" (SCA) radiological posting limits be used as the demarcation where firefighters should not follow a grass fire based on potential radiation dose. SCA posting limits for Pu-239/Am-241, enriched uranium and depleted uranium in surface soils have been set at 115 pCi Pu-239/gram soil, 188 pCi Total Enriched U/gram soil and 102 pCi Total Depleted U/gram soil, respectively, based on soil action levels prescribed presently in the Rocky Flats Cleanup Agreement (RFCA). By following this recommendation, a firefighter should not receive more than 1 mrem of radiation dose while extinguishing a grass fire at RFETS (See Table 1, "Allowable Soil Concentration Based on Radiation Dose to Firefighters From Grass Fires.").

The radiation dose assessment was performed by: 1) defining the locations where individuals could receive radiation dose, 2) calculating the amount of radioactive material in air at this location during grass fires and 3) computing the radiation dose with its associated acceptable soil concentration. Each of these steps is discussed below.

Location of Individuals

In order to assess the radiation dose to a firefighter, the location of the firefighter must first be defined. The maximum radiation dose would be received by a firefighter directly adjacent to the grass fire and downwind since these individuals would be exposed to the highest air concentrations of radioactive material. For conservatism, it is assumed that a firefighter is located immediately downwind of the burning grass for the duration of the grass-burning episode. It is also assumed that this firefighter is not wearing any type of

respiratory protection. It should be noted that normal fire fighting methods do not place the firefighters in the path of the fire or the direct smoke plume from the fire.

Air Concentrations at Firefighter Location

Radioactive material present in the environment is resuspended and transported downwind during a grass burning episode. By knowing the amount of radioactive material in the grass, the concentration of radioactive material in air can be calculated using resuspension factors applicable to a fire. The firefighter can subsequently inhale some fraction of this radioactive material in the air.

This dose assessment is based on a computer model of emissions from a series of hypothetical fire and atmospheric conditions (See Attachment A – “Hypothetical Wildfire Air Modeling Analysis.”). For this radiation dose assessment, the concentration of radioactive material in air is maximized. By modeling, the firefighter immediately downwind of the fire is exposed for several different time-periods and for several different wind conditions in this assessment. To capture a range of air concentrations, a grass fire duration of 1, 2 and 5 hours is assessed for average and worst-case conditions.

Radiation Dose

To calculate radiation dose, the concentration of radioactive material in the air is initially multiplied by the firefighters breathing rate and the duration of the grass fire. This product will be the estimated amount of radioactive material inhaled. This amount inhaled is then multiplied by a dose conversion factor to calculate radiation dose. The radiation dose to the firefighters from plutonium, americium and uranium are outlined in Table 2, “Radiation Dose from Plutonium & Americium to Firefighters Due to Inhalation of Particulates During a Grass Fire,” Table 4, “Radiation Dose from Enriched Uranium to Firefighters Due to Inhalation of Particulates During a Grass Fire,” and Table 5, “Radiation Dose from Depleted Uranium to Firefighters Due to Inhalation of Particulates During a Grass Fire.”

The firefighters at the boundary of the burn site will inhale at a rate of 3.2 m³/hr. The firefighters inhalation rate is indicative of a short term, heavy activity inhalation rate. This inhalation rate was taken from EPA’s “Exposure Factors Handbook,” dated August 1997 (EPA/600/P-95/002).

The radiation Dose Conversion Factor (DCF) is used to convert the amount of radioactive material taken into the body into a radiation dose. The inhalation DCF used to calculate radiation dose for Am-241, Pu-239, U-234, U-235 and U-238 were taken from EPA’s Federal Guidance Report No. 11, “Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion,” dated September, 1988 (EPA-520/1-88-020). The inhalation DCF used to calculate

radiation dose was the highest DCF available and corresponded to the Committed Effective Dose Equivalent.

It was assumed that the Am-241/Pu-241 activity ratio is 18%. This is consistent with the median Am-241/Pu-241 activity ratio seen in surface soils east of RFETS (Health Physics, Vol. 70, No. 4, April 1996). For assessing uranium isotope ratios, typical values for depleted and enriched uranium were taken from the "Health Physics and Radiological Health Handbook." Uranium isotope ratios are outlined in Table 3, "Uranium Isotope Characterization."

The acceptable soil concentration was then calculated by dividing a radiation dose limit by the radiation dose calculated for a unit concentration of activity. This will give the soil concentration that would give the firefighter the designated radiation dose limit for the given burn conditions (See Table 1).

Recommendations

The results of this assessment indicate that the maximum dose will be less than 1 mrem to any individual downwind of a fire if the fire is not in an area exceeding the SCA radiological posting limit. It is therefore recommended that the SCA radiological posting limit be used as the demarcation where firefighters should not follow a grass fire. SCA posting limits for Pu-239/Am-241, enriched uranium and depleted uranium in surface soils are at 115 pCi Pu-239/gram soil, 188 pCi Total U/gram soil and 102 pCi Total U/gram soil, respectively. By following this proposal, a firefighter should not receive more than 1 mrem of radiation dose.

Attachments

Attachment A – Hypothetical Wildfire Air Modeling Analysis

Tables

Table 1 - Allowable Soil Concentration Based on Radiation Dose to Firefighters from Grass Fires

Table 2 - Radiation Dose from Plutonium & Americium to Firefighters Due to Inhalation of Particulates during a Grass Fire

Table 3 - Uranium Isotope Characterization

Table 4 - Radiation Dose from Enriched Uranium to Firefighters Due to Inhalation of Particulates during a Grass Fire

Table 5 - Radiation Dose from Depleted Uranium to Firefighters Due to Inhalation of Particulates during a Grass Fire