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Arthur Widdowfield

MEMORANDUM

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

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

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

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

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

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

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

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

Summation of Sampling

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

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

Soil sampling

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

Air quality analysis

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

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

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

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

Dust Sampling

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

Soil contamination levels on lands west of Indiana Street

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

Exposure Units

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

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

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

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

Lower Walnut Drainage Exposure Unit

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005640.pdf

sample location: page 101 of pdf

summary data tables:

number of samples: page 54 of pdf

radiation results: page 55 of pdf

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

Windblown Area Exposure Unit

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005641.pdf

sample location: page 148 of pdf

summary data tables:

number of samples: page 71 of pdf

radiation results: page 73 of pdf

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

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

Lower Woman Drainage Exposure Unit

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005643.pdf

sample location: page 146 of pdf

summary data tables:

number of samples: page 71 of pdf

radiation results: page 73 of pdf

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

³ Note, the trigger concentration requiring soil remediation was 50 pCi/g.

⁴ The windblown area was land to the east of the contaminated 903 pad where airborne contamination transported by westerly winds settled out.

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

Southeast Buffer Zone Exposure Unit

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005645.pdf

sample location: page 72 of pdf

summary data tables:

number of samples: page 38 of pdf

radiation results: page 39 of pdf

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

Additional soil/air testing on lands west of Indiana Street

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

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

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

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

For a summary of these tests, please go to
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/BZ/BZ-A-000289.PDF

This link provides the entire report.
http://www.lm.doe.gov/cercla/documents/rockyflats_docs/BZ/BZ-A-000290.PDF

Dust Sampling

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

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

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

1977 Soil Study

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

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

Overflights – radiological survey

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

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

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

Soil contamination levels on lands east of Indiana Street (OU3)

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

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

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

EPA's 1997 Record of Decision (ROD) decision for OU3

To define the nature and extent of hazardous substances in surface soil in OU3, DOE relied on the following 3 data sets;

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

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

CDPHE Health Advisory Panel

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

following link (CESC Soil and Sediment Study Summary):

http://www.lm.doe.gov/cercla/documents/rockyflats_docs/OU03/OU03-A-000585.pdf

“The Health Advisory Panel task force wanted to involve the public directly. In late 1992 representatives of various groups, including homeowners’ associations public interest organizations, local health departments, as well as individuals concerned about Rocky Flats were invited to participate as a group to consider and conduct a soil-sampling study.

The study was designed to fill gaps where there were no existing data or where data were in question, and to generate a data set that could be used for comparison with results of other off-site sampling studies. The first meeting of the CESC was held in December 1992.”

The CESC summary further provides:

“The CESC selected 28 soil-sampling sites, most of which were within a five to six mile radius of the Rocky Flats Plant. At each site, two samples were collected: one surface soil sample (0 to 1 inch deep) and one soil core sample (0 to 8 inches deep). In addition, one sediment core sample, divided into 10 one-inch layers, was taken at Standley Lake, a reservoir southeast of the Rocky Flats Plant. This reservoir serves as a drinking water supply for three nearby communities. Samples were analyzed for isotopes of plutonium (plutonium-238, plutonium-239,240), americium (americium-241), cesium (cesium-137), strontium (strontium-90) and uranium (uranium-235, uranium-238).

The results of the study correlated well with the concentrations and distribution of radionuclides found by other studies of the area. A number of soil samples did have levels of plutonium-238, plutonium-239,240, americium-241, cesium-137, and strontium-90 above the background levels for this area. Background values for these radionuclides are the expected amounts in soils from nuclear testing and other global fallout. With the exception of strontium-90, almost all elevated levels were found in the surface soil samples. These results are consistent with the deposition and transport mechanisms associated with the Rocky Flats Plant region. Off-site contamination has been dispersed as airborne emissions, transported through surface water to local creeks or resuspended as wind-dispersed soil particles.

Six of the 28 surface soil sites yielded samples that contained plutonium-239,240 at levels above 0.084 picocuries per gram of soil (pCi/g). This value of 0.084 pCi/g is a statistical estimate of the upper limit of background concentrations due to global fallout along the Front Range. Plutonium-239,240 concentrations at these six sites ranged from 0.09 to 4.5 pCi/g. The highest level of off-site plutonium was found approximately one mile east of the Rocky Flats Plant near Great Western Reservoir. This sampling site with the highest surface soil concentration of plutonium also yielded a core sample containing plutonium-239,240 above the upper limit of background.”

Finally, the CESC conclusions state:

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

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

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

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

Additional Resources

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

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

Please let us know what questions you have.