

903 Pad and Lip Area IHSS Briefing Summary

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Briefing Summary Revision Number

Rev 1 (4/06)

IHSS Group Number

900-11

IHSS/PAC Number

IHSS 900-112, 903 Pad (903 Drum Storage Area)

IHSS 900-155, 903 Lip Area (Inner and Outer Lip)

Approximate Location

Northing: 749,060 (900-112); 749,000 (900-155)

Easting: 2,085,760 (900-112); 2,086,500 (900-155)

Location Relationship to other Site areas: IHSS 900-112 is located south of the former Central Avenue and east of the former Building 886. The 903 Pad was composed of about 146,000 square feet of asphalt. IHSS 900-155 is located adjacent to the former 903 Pad area. IHSS 900-155 is an area of approximately 35 acres directly east and southeast of the 903 Pad.

Historical Information

(For a detailed history on IHSS Group 900-11 see Reference 1)

The following is a somewhat condensed history of the 903 Pad and Lip Area. In the mid 1950's, after the first few years of production activities, it became clear to the Site that inadequate waste treatment facilities had been built to process contaminated oil and solvent mixtures. Due to warhead design changes, manufacturing operations began using more and more chlorinated solvents (e.g., carbon tetrachloride, perchloroethylene, and trichloroethylene) in combination with cutting oils and lathe coolants. Drums of liquid wastes containing plutonium and uranium residues from machining operations were generated even though the Site had no effective means of processing this waste form. As a result the initial production facilities, Buildings 771, 881, and 444 began storing these waste drums outside of the buildings.

Leaking drums outside of Building 444 were discovered in 1958 and their contents were transferred to new drums for storage at the newly designated 903 drum storage area. This storage area was also known as the "bullpen". Waste drums from the manufacturing facilities were stored on wooden pallets in this area and were exposed to adverse environmental conditions. In 1959 a number of leaking drums (due to corrosion) were observed at the 903 drum storage area. A rust inhibitor (ethanolamine) was added to waste drums in an attempt to stop leakage caused by corrosion. By 1960 the Site had a significant problem on their hands with the spread of both radioactive and volatile organic compound (VOC; solvents) contamination. Over 5,000 drums of contaminated liquid wastes were stored in the 903 drum storage area. About 3,500 were Pu contaminated drums and about 1,500 were U contaminated drums. Many of these 5,000 drums were leaking and some drums had leaked their entire contents to the environment (except for small amounts of drum residuals). An estimated 5,000 gallons of waste contaminated with 150 grams of Pu leaked from the drums. (Note: the 150

grams of Pu is only a rough estimate, the actual amount could be much higher). High winds and rain began to spread the radioactive contamination while the VOCs seeped into the ground and reached groundwater tables. The spread of the radioactive contamination primarily to the east and southeast of the storage area resulted with the contaminated land being known as the 903 “Lip Area”. Other nicknames for this portion of the Site were the “wind-blown area” (so-called because the Pu and Am contamination was primarily spread by wind) and the “americium zone” (so-called because the Pu activity was determined indirectly by detecting Am gamma ray activity and converting to Pu activity).

In an inexplicable display of slow response (it can only be attributed to a lack of appreciable environmental concern at that time), it took the Site until 1968 to completely remove the drums from the 903 drum storage area, install clean fill on top of the most contaminated area and then cover it with an asphalt pad (about 146,000 square feet). Thus the 903 Pad name (Reference 2). The Site transferred the contents of leaking drums into new drums and shipped them to the production facilities for inside storage.

Due to the leaking drums and spread of Pu contamination, the soils of the 903 Area (Pad and Lip Areas) became some of the most contaminated soils on the Site. The spread of Pu by wind and surface water from the 903 Area contributed more Pu to the environment than the Building 771 fire in 1957 and the Building 776/777 fire in 1969.

Pre-remediation Characterization Data

Extensive soil and groundwater characterization was performed on the 903 Area over many decades. Detailed pre-remediation characterization data can be found in Reference 3. The primary contaminants of concern (COCs) for environmental media were Pu, Am, U, and VOCs (primarily chlorinated solvents such as carbon tetrachloride and perchloroethylene). A large number of locations in the 903 Area were contaminated with COCs that exceeded Wildlife Worker Action Levels (WRW ALs). In many locations the COCs were many orders of magnitude higher than WRW ALs. As a result the 903 Area required extensive environmental remediation.

Remedial Actions Taken

903 Pad

Based on the pre-remediation characterization data an *Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation* (ER RSOP, Reference 4) was prepared by the Site which detailed the remediation plan for the 903 Pad. An *Interim Measure/Interim Remedial Action* (IM/IRA, CERCLA decision document) was generated which detailed remediation plans for the 903 Lip Area (Reference 5). Both these plans were approved by the regulatory agencies.

Remedial actions specified in the 903 Pad ER RSOP included:

- removal and disposal of the asphalt pad as low level waste (LLW, <100 nCi/g Pu);
- removal, characterization, and appropriate disposal of the fill dirt under the pad;
- removal of native soil (soil which contained the leaked COCs) exceeding WRW ALs (e.g. remove soil containing Pu >50 pCi/g) under the fill dirt as LLW; and
- backfill the area with clean soil, regrade, and revegetate.

The 903 Pad remediation occurred between November 2002 and December 2003. The following summary highlights the remediation activities (Reference 6):

- removed about 4,500 cubic yards of asphalt for disposal as LLW;
- removed and characterized fill material for appropriate waste disposal;
- removed and disposed of about 20,000 cubic yards (about 800 dump truck-equivalents) of soil with contaminant concentrations greater than WRW ALs;
- collected confirmation samples (to show remaining contaminant concentrations to be below WRW ALs) per Reference 4; and,
- backfilled the remediated area with clean soil, regraded, revegetated, and added erosion matting (porous, biodegradable coconut fiber).

Although Reference 6 includes a detailed discussion of the 903 Pad remediation, several major omissions were left out of this Close-out Report that the EPA approved. The Close-out Report briefly mentions the difficulty in implementing the ER RSOP plan for this project. This was in fact one of the most challenging projects of any at the Site. However, the report omitted the fact that very high levels of Pu contamination were encountered during excavation activities at certain locations in the 903 Pad. In addition the Site had to remove contaminated soil at depths greater than expected (8 feet in some cases). Both these difficulties point out that the 903 Pad pre-remediation characterization data was incomplete.

Some of the soils were contaminated at levels that classified the waste as TRU (transuranic >100 nCi/g Pu). In some cases the Site had to blend the TRU waste with soil to reduce its concentration to LLW. In other cases, the soil had to be shipped to the TRU waste disposal site in New Mexico (WIPP) instead of the LLW disposal sites in Utah and Nevada. The highest Pu concentration encountered was about 10,000 nCi/g Pu (10,000,000 pCi/g Pu) at a known "hotspot". This Pu activity was several orders of magnitude higher than expected (Reference 7). Although the TRU contamination levels were not expected, the Site had extensive experience dealing with TRU waste remediation, so the soil remediation was not severely impacted.

903 Lip/ Windblown Area

The 903 Lip/Windblown Area was remediated according to guidelines outlined in Reference 5 (IM/IRA). This environmental project was the largest of any at the Site in terms of physical size. About 36 acres in the 903 Lip Area were excavated. The primary purpose of the project was to remove soil contaminated with Pu >50 pCi/g between the ground surface and a depth of 3 feet. The following is a summary of the remedial actions for this project (Reference 8):

- removed about 50,000 cubic yards (about 2,000 dump truck-equivalents) of LLW soil for off-site disposal;
- filled 3,452 intermodal-type waste containers with LLW soil for off-site disposal;
- filled 588 DRT (dirt, rubble, and trash) bags with LLW soil for off-site disposal;
- backfilled/regraded excavations with clean fill as needed; and,
- revegetated area which included the use of biodegradable porous coconut matting for erosion control (Figures 1 and 2, pages 6 and 7).

Post-remediation Remaining Contamination

Radionuclides such as Pu, Am, and U still exist in soils in the 903 Area but they are less than WRW ALs according to References 6 and 8. For example, in the 903 Lip/Windblown Area the

average remaining Pu between 0 and 3 feet is 13 pCi/g. Additional ground-based scanning and sampling of the 903 Area will be conducted by the Site and their independent review contractor ORISE (Oak Ridge Institute for Science and Education). The additional sampling is intended to validate the 903 Area radionuclide soil remediation. When the confirmation characterization data becomes available it will be incorporated as a revision to this document.

(Insert for New Revision 4/06)

ORISE completed their independent review and released a final report on their findings in November 2005 (Reference 11) after the physical closure of the site on October 13, 2005. The initial ORISE sampling was conducted in June 2005 with follow-up sampling conducted in September 2005 based on results from June. ORISE performed a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) independent verification survey. MARSSIM independent verification survey guidance was developed by the Nuclear Regulatory Commission, Department of Energy, EPA, and the Department of Defense. In addition to the 903 Area MARSSIM survey, ORISE performed MARSSIM independent verification surveys on all major Pu buildings at the site prior to their demolition.

ORISE selected two areas to survey in the remediated 903 Area. One area was located in the Inner Lip and one area was located in the Outer Lip. ORISE designated these two locations as MARSSIM class 1 survey units. For this investigation the class 1 survey units were 2,025 square meters (which is about 45 yards by 45 yards). These two survey units only accounted for about 2 or 3% of the total 36 acres that were remediated. ORISE performed soil sampling according to MARSSIM protocols which were very similar to the regulator-approved soil sampling protocols performed by the site after soil remediation to confirm that the remediated areas were less than the WRW AL of 50 pCi/g Pu. The soil samples were sent to the ORISE lab in Oak Ridge, Tennessee for analysis. Results of the ORISE soil samples agreed closely with those of the site for the 2 survey unit locations.

However, ORISE performed additional MARSSIM characterization of the 2 survey units that the regulators did not require the site to perform. This second type of characterization involved performing scans using hand-held instrumentation over 100% of each survey unit. When ORISE reported they had found elevated “hotspots” above the 50 pCi/g Pu, DOE instructed Kaiser-Hill and ORISE to determine the areal extent of the hotspots.

The detection of the hotspots was not surprising since the site’s regulator-approved sampling methodology was based on 90% confidence—meaning that there was a 10% probability that hotspots above 50 pCi/g were possible after soil remediation occurred. The approved sampling methodology allowed isolated hotspots up to three times the WRW AL for a given substance. In the case of Pu the allowable hotspot value would be $3 \times 50 = 150$ pCi/g (termed elevated measurement comparison).

Thirteen hotspots were characterized by ORISE and Kaiser-Hill ranging from 65 to 425 pCi/g Pu in areas from 0.8 to 35.3 square meters in size. The total area of the hotspots was about 66 square meters which amounts to only 1.6% of the 4050 square meters in the two class 1 survey units. Figure 3 is a photo of one of the smaller hotspots (located surrounding the stake) which has been outlined in red spray paint and Figure 4 is a close-up view. Of the thirteen hotspots 5

were over the 150 pCi/g Pu limit for hotspots allowed by the regulators. Initially DOE decided not to remediate these hotspots and received an outburst of public comment. Based on the public outcry DOE eventually decided to reverse their position and instructed Kaiser-Hill to clean up all 13 hotspots even those that were between 50 and 150 pCi/g Pu and would have been allowed per the regulators.

In summary ORISE concluded that the presence of hotspots in the remaining 97 or 98% of the 36 acre 903 remediation area which they didn't survey is likely. With this new information the site and regulators decided to perform a risk-based assessment with the new assumption that the entire 903 Area has small isolated hotspots that exceed the WRW AL of 50 pCi/g Pu. Based on the new assumption the site and regulators calculations showed there would only be a very small increase in cancer risk to the WRW well within federal and state regulations.

End of ORISE insert

In addition to the residual radionuclide contamination, the Site is also investigating the remaining VOC contamination in the 903 Pad soil. Although the 903 Pad remediation removed large amounts of VOC-contaminated soil when the radionuclide-contaminated soil was removed, the site and regulators believe additional characterization data is necessary. The additional VOC characterization would confirm if the residual VOC contamination is indeed below WRW ALs. This additional characterization requirement is discussed in References 9 and 10. When additional VOC characterization data of the 903 Area becomes available it will be incorporated as a revision to this document.

(Insert for New Revision 4/06)

As part of the final Groundwater IM/IRA (CERCLA regulator-approved closure document) the site was required to perform additional VOC sampling in 903 Pad soil. Based on the results of the sampling the site performed an additional remedial action for the 903 Pad soil. The additional remedial action consisted of injecting Hydrogen Releasing Compound (HRC) into the soil to help degrade residual VOC contaminants which threaten groundwater that flows through the 903 Pad area and could eventually reach surface water. Figure 5 (page 11) is a photo showing drilling rigs injecting the HRC into the 903 Pad soil.

End of insert

Potential Exposure Pathways to Remaining Contamination

There are several exposure pathways to the remaining contamination in the 903 Area. Exposure to radionuclide contamination can occur primarily through erosion of remediated soils and subsequent transport of the contamination into surface water. It is a well-known fact at the Site that Pu activities as low as 10 pCi/g (or possibly lower) in soils (well below the WRW AL of 50 pCi/g) can contaminate surface water resulting in activities above 0.15 pCi/l (regulatory standard). In fact during the remediation of the 903 Lip/Windblown Area, reportable Pu values at surface water monitoring locations which drained the remediation area (Woman Creek drainages) exceeded 0.15 pCi/l Pu on several occasions.

Exposure to remaining VOCs in the 903 Area is primarily through groundwater transport to surface water. VOCs in the 903 Area are believed to contribute to the East Trenches VOC plume

which daylight to surface water in the South Walnut Creek drainage (see East Trenches IHSS briefing memo).

Long-term Stewardship Controls

Establishment of a robust vegetation cover in the 903 Area is very important to the success of the environmental remedy. The first few years are critical in establishing a vegetative cover that will protect remediated soils containing residual Pu contamination from erosion which could lead to surface water contamination. Periodic inspections of the remedy area are important to monitor re-vegetation progress and potential soil erosion. Long-term groundwater and surface water monitoring are also important controls for the 903 Area. Groundwater wells and surface water monitoring locations for the 903 Area are part of the post-closure monitoring network at the Site. These post-closure monitoring locations will help ensure that the 903 Area remedy is functioning as planned, protecting surface water from radionuclide and VOC contamination.

Notes

1. Some of the cited references have pending CERCLA AR#. When these AR#s are located this document will be revised.
2. Photos of the 903 Area remediation project can be found in References 6 and 8.

Document references

1. 1992 Historical Release Report (document path, CERCLA AR# SW-A-000378)
2. The Past 30 Years at Rocky Flats Plant, Ed Putzier, November 1982 (heavily referenced report in Reference 1, not available on-line, copy of document at Reading Room)
3. Characterization Report for the 903 Drum Storage Area, 903 Lip Area, and Americium Zone, 1999 (document path, CERCLA AR # I112-A-000028)
4. ER RSOP Notification #02-09, 2002, (document path, EDDIE database/document archive/Environmental Restoration/2002)
5. Interim Measure/Interim Remedial Action for the 903 Lip Area and Windblown Area, 2004, (document path, EDDIE database/document archive/Environmental Restoration Stewardship/2004)
6. Close-out Report for IHSS Group 900-11, IHSS 112-903 Pad (903 Drum Storage Area), 2005 (document path, CERCLA AR # pending)
7. DOE presentation to Rocky Flats Coalition of Local Governments, Board of Director's meeting, August 4, 2003 (document path, RFCLOG database homepage/Board Meeting Minutes/8-4-03)
8. Close-out Report for IHSS Group 900-11, IHSS 900-155, 903 Lip Area, 2005 (document path, CERCLA AR # pending)
9. Draft Groundwater IM/IRA, 2005 (final, regulator-approved IM/IRA pending)
10. Industrial Area and Buffer Zone Sampling and Analysis Plan Addendum #IABZ-05-02 903 Pad Volatile Organic Compounds, 2005 (document path, CERCLA AR # pending)
11. ORISE Independent Verification of Soils at the 903 Pad Inner and Outer Lip Areas, November 16, 2005 (document path, CERCLA AR # pending)

Figure 1. Photo of portion of remediated 903 Lip Area, August 2005 looking east with coconut matting covering soil and new vegetation emerging, Standley Lake in background



Figure 2. Portion of remediated 903 Lip Area August 2005 looking west, Woman Creek drainage on left.



Figure 3. Photo of small Pu hotspot (stake) found by ORISE in the remediated 903 Area, the red spray paint surrounding the stake is the areal boundary of the hotspot



Figure 4. Close-up of Pu hotspot shown in Figure 3 (red spray paint marks hotspot boundary). This hotspot along with 12 others found by ORISE were remediated to below the 50 pCi/g WRW AL for Pu



Figure 5. Drilling rigs in background injecting HRC to degrade VOCs in soil at the 903 Pad area

