MEMO

TO: Weldon Spring Work Group

FROM: Ron Buchanan, SC&A

DATE: July 9, 2012

SUBJECT: Potential Drying of Weldon Spring Pits

During the recent June 2012 Weldon Spring Work Group meeting, the potential of the raffinate pits drying out and causing airborne contamination was discussed. The following is a summary of this issue.

Two articles (May 27, 1988, *Raffinate Pit Sampling Plan* and September 1989 *EPA Environmental Impact Statement*) make reference to the fact that Pits #1 and #2 sometimes become dry in the hot summer months, while a report by National Lead Company of Ohio (NLO 1977) states that even during prolonged dry periods, the inherent consistency of the raffinate residue preclude the drying out of the surfaces of the pits. If conditions did exist where the pit surfaces dried out and the dust became airborne, this could create an environmental intake of radioactive materials that would not be readily related to uranium bioassay, or air sample results, by using a ratio method. This would be of particular concern for Pits #1 and #2 for environmental Th-230, as Th-230 intake would be determined by using the uranium-to-thorium ratio. Because of the time period of use, Th-232 would be restricted to Pits #3 and #4, for which there were no indications that these pits dried out.

Portions of the 1988 (4 pages included) and 1989 (3 pages included) articles are attached.

Reference:

NLO 1977. *Study of Radioactive Waste Storage Areas at ERDA – Weldon Spring Site*, NLCO-1144 (Special). National Lead Company of Ohio under Contract No. EY-76-C-05-1156, United States Energy Research and Development Administration, Oak Ridge Operations Office. April 25, 1977 (SRDB Ref ID #3583). Republished August, 1981 (SRDB Ref ID #3576).

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ADMIN FILE 3.2 - CORRESP.
3589-88-I-DOE-227
* Sludge not covered in not months
* Processing of thorium recycle materials

Department of Energy
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
Route 2, Highway 94 South
St. Charles, Missouri 63303

May 27, 1988

ADDRESSEES

RAFFINATE PIT SAMPLING PLAN

Enclosed is Revision 1 of the "Waste Assessment Raffinate Pit Sampling Plan" for the Weldon Spring Site. This plan has been revised to address comments received from USEPA and the Missouri Department of Natural Resources as indicated in the "Responsiveness Summary," also enclosed.

We trust that this adequately resolves the issues raised during the review of this Plan. We are proceeding with sampling activities as described in the enclosures.

If you have any questions concerning these items, please call.

Sincerely,

R. R. Nelson

R. R. Nelson
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosures

cc w/o enclosures:
R. E. Hlavacek, MK-Ferguson

Pit 3 was constructed in 1959 with a design volume of 127,500 m^3 (166,700 cy), a surface area of approximately 3.4 ha (8.4 acres), and a depth of about 3.5 m (11 ft). The natural terrain slopes downward toward the west boundary so that the dikes around Pits 3 and 4, although approximately at the same elevation as those around Pits 1 and 2 are, in fact, much higher with respect to the original grade. A portion of the dike in the northeast corner of Pit 3 was constructed on existing terrain so that the dike is about 7 m (23 ft) above original grade in that area. Pit 3 contains approximately 99,100 m^3 (129,600 cy) of radioactive residues from past uranium refining and metal production operations and is 78 percent filled (NLO, 1977; Weidner and Boback, 1982).

Pit 4 was constructed in 1964 with a design volume of 339,800 m^3 (444,400 cy) and is approximately 12 percent filled. The east dike of Pit 4 is common to the west dike of Pit 3. The west dike of Pit 4 extends to a maximum of about 11 m (35 ft) above the existing grade. Approximately 42,500 m^3 (55,600 cy) of radioactive materials are stored in Pit 4, and the residue fill is irregular across the pit. Pit 3 is designed to overflow into Pit 4 through a connecting pipe 2 m (7 ft) below the top of the common dike.

The sludge material in the pits is covered with water for most of the year. The amount of water in the pits varies depending on the climatic conditions of a given year. During the hot, dry

summer months, the surface water in Pits 1 and 2 often evaporates, leaving the raffinate sludge with a dry and cracked surface. The level of water in Pits 3 and 4 also varies, but past observation has found some surface water always present.

Maintenance, surveillance, and environmental monitoring have been continually conducted at the WSRP site since the former DOE contractor, Bechtel National, Inc., began operation in 1981. The site is fenced, posted, and patrolled by security guards. The grass is mowed, brush is cleared for access to each pit, and the fences are repaired as necessary.

In 1982, a portion of the dike around Pit 4 was repaired to stabilize a shallow, circular arc slide. The slide occurred because of the steep (38-47%) side slopes of sections of the existing dikes. The side slopes of Pit 4 were constructed at undesirably steep slopes in this section because a perimeter road encroached on the space needed for construction.

1.1.3 Process Waste Description

There are three major waste types present at the WSRP site. These are:

1. Neutralized raffinate liquors generated from uranium refining operations, including washed slag residues

from uranium metal production operations and raffinate solids from the processing of thorium recycle materials;

2. Contaminated water ponded on each raffinate pit; and
3. Contaminated rubble.

Each of these waste types is addressed in greater detail in the following text.

1.1.3.1 Neutralized Raffinate Liquors

Neutralized raffinate liquors were generated as follows: the Weldon Spring Uranium Feed Materials Plant (WSUFMP) received yellow cake ore from various uranium mills across the U.S. The yellow cake feed material was ultimately dissolved in a process stream containing nitric acid solution. This solution contained the dissolved uranium along with all the other impurities found in the yellow cake ore. Once the uranium was stripped from the solution, the resulting waste was mixed with lime to produce what is referred to as neutralized raffinates. These neutralized raffinates were discharged directly to the raffinate pits.

In the final stage of the uranium production process, uranium tetrafluoride was reacted with magnesium producing uranium metal and magnesium fluoride. The magnesium fluoride slag was then redissolved with yellow cake feed material to recover unreacted uranium contained in the slag. The remaining magnesium

United States
Environmental Protection
Agency

Office of Radiation Programs
(ANR-459)

EPA/520/1-89-007
September 1989

EPA

Economic Assessment

* Processing thorium recycle products

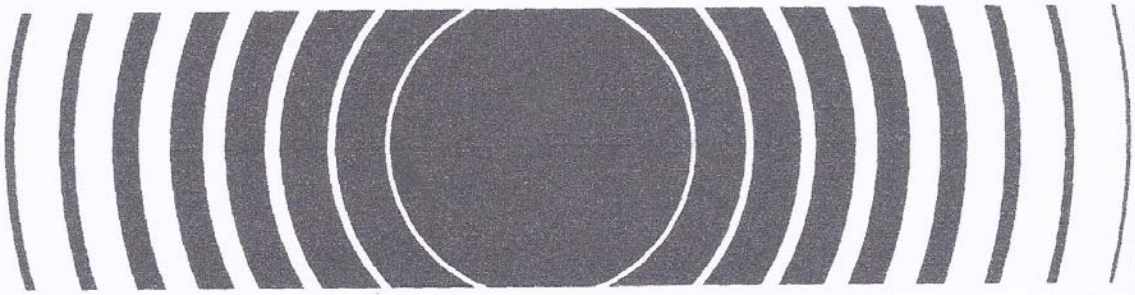
Environmental Impact Statement

NESHAPS for Radionuclides

Background Information Document — Volume 3

Thorium Recycled

RADON RADIUM



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7.2.1 Feed Materials Production Center (FMPC)

The FMPC is located near Fernald, Ohio, and is currently operated under contract by Westinghouse Materials Company of Ohio for the DOE. The facility produces purified uranium metal and components for use at other DOE facilities. The feed materials include ore concentrates, recycled uranium from spent reactor fuel, and various uranium compounds. Thorium can also be processed at the site. The primary source of radon emissions at the FMPC is pitchblende residues stored in two concrete storage tanks referred to as silos. The residues resulted from the recovery of uranium from pitchblende ores during World War II.

7.2.2 Niagara Falls Storage Site (NFSS)

The NFSS, located in Lewiston, New York, is a DOE surplus facility operated by Bechtel National, Inc. The 77 ha site is part of the former Lake Ontario Ordnance Works and is used solely for storage of uranium and pitchblende residues. The residues were formerly stored in six buildings that were originally part of the facility's water treatment plant and in a pile nearby. Subsequently, by the end of 1986, the residues were consolidated in the Interim Waste Containment Facility (IWCF).

Descriptions of the consolidation process can be found in the annual environmental reports [BEC87]. The IWCF structure comprises the short-term closure system for the wastes until the long-term management plan is completed. The selected long-term plan calls for in-place management as described in the final environmental impact statement [DOE86]. The IWCF occupies 4 ha of the site and measures 274 m by 137 m. The structure's outer perimeter is composed of a dike and cutoff wall, both of which are constructed of compacted clay which forms a finished structure with an engineered compacted clay cover that sits directly over the wastes and extends beyond the perimeter dike. This cover is the principal barrier against moisture intrusion and radon emanation. The 0.9 m of clay is covered with 0.3 m of general soil and 0.15 m of top soil.

7.2.3 Weldon Spring Site (WSS)

The WSS, located near Weldon Spring, Missouri, is a surplus DOE facility that also stores uranium and thorium wastes. The site was operated by Bechtel National, Inc. in a caretaker status until 1986 when M-K Ferguson Company assumed control as Project Management

Contractor for the WSS Remedial Action Project. The site consists of two separate properties: the 89 ha Weldon Spring Chemical Plant together with the Weldon Spring Raffinate Pits form one (WSCP), and the other is the 3.6 ha Weldon Spring Quarry (WSQ) area, which is about six kilometers southwest of the raffinate pits.

The raffinate pits area is a remnant of the Weldon Spring Chemical Plant. The pits received residues and waste streams from uranium mining operations and washed slag residues from uranium metal production. Pits one and two contain neutralized raffinates from these sources while pits three and four contain similar wastes plus thorium-contaminated raffinate solids from processing thorium recycle products. Surface water covers pits three and four continuously, but pits one and two may be occasionally exposed due to seasonal evaporation.

Pit 3
1959

*

The quarry site was initially used to dispose of radioactive thorium in drums, and subsequently thorium-contaminated building rubble, process equipment, and contaminated equipment. The Army also subsequently disposed of TNT-contaminated stone and earth to cover these thorium residues and finally, in 1969, placed contaminated equipment and rubble from the chemical plant in the pits.

7.2.4 Middlesex Sampling Plant (MSP)

The MSP site of Middlesex, New Jersey, was used by the Manhattan Engineering District and the Atomic Energy Commission between 1943 and 1967 for sampling, weighing, assaying, and storing uranium and thorium ores. Upon termination of operations, the site was decontaminated and released to the U.S. Marine Corps for use as a training center. Radiological surveys of the site and nearby private residences revealed contamination from windblown materials and use of materials as fill. DOE took responsibility for the site and its cleanup, which was completed in 1982.

The Middlesex Municipal Landfill also required remedial action, which was initiated in 1984 and completed in 1986. The contaminated materials were consolidated in storage piles, which are surrounded by concrete curbing and covered with a hypalon material to prevent the movement of materials.