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By Electronic Mail

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Re: Comments on Proposed Amendment No. 10 to the Radioactive Materials License for the White Mesa Uranium Mill

Dear Mr. Howard:

Energy Fuels Resources (USA), Inc. has asked the Division of Waste Management and Radiation Control for permission to process and dispose of two new, so-called "alternate feed" materials at the White Mesa uranium mill.[1] One of those materials is a waste generated in the Republic of Estonia whose disposal in Estonia that country's government has disallowed for health and safety reasons.

And yet, over the objection of another sovereign nation—the Ute Mountain Ute Tribe—the Division is proposing to amend Energy Fuels' radioactive materials license for the mill to approve the company's requests, yet again imposing a deeply unjust burden on the small tribal community of White Mesa that sits next to the pits at the mill in which this waste is to be forever buried.[2]

We recognize that balancing the competing demands facing the

[1] *See* Application for an amendment to Radioactive Materials License No. 1900479 to authorize processing of NPM Silmet OU alternate feed material, DRC-2019-003761 (Apr. 18, 2019) ("Silmet Application"); Application for an amendment to Radioactive Materials License No. 1900479 to authorize processing of Moffat Tunnel alternate feed material, DRC-2019-017284 (Dec. 23, 2019) ("Moffat Tunnel Application").

[2] *See* Division of Waste Management and Radiation Control, "Statement of Basis: Radioactive Material License (RML) No. UT 1900479," DRC-2020-007011 (Mar. 2020) ("Am. 10 Statement of Basis").

Division as it regulates the White Mesa mill is a tall order and that the Division has improved upon the work of the Nuclear Regulatory Commission in that task. Yet the Division can do better still, especially on the subject of regulating alternate feeds. That is what we urge the Division to do in these comments on the proposed license amendments submitted on behalf of the Grand Canyon Trust, Center for Biological Diversity, Downwinders Inc., Friends of Cedar Mesa, Great Old Broads for Wilderness, Healthy Environment Alliance of Utah, Multicultural Alliance for a Safe Environment, New Mexico Environmental Law Center, Sierra Club Utah Chapter, Southern Utah Wilderness Alliance, The Wilderness Society, Utah Audubon Council, Utah Diné Bikéyah, Western Watersheds Project, and WildEarth Guardians.

For ease of review, the principal requests we make in these comments are listed below. This list isn't exhaustive and isn't meant to diminish the importance of other requests or critiques made elsewhere in these comments. We ask the Division to:

1. Deny Energy Fuels' requests to allow the company to possess, process, and dispose of the two new alternate feeds, from Estonia and from Colorado.

2. If the Division nonetheless approves Energy Fuels' application concerning the material from Estonia, the Division should make its approval subject to two conditions: (a) that Energy Fuels acquires a specific import license from the Nuclear Regulatory Commission; and (b) that Energy Fuels returns to Silmet in Estonia all waste resulting from processing the Silmet material at the mill.

3. The Division should revise its assertions in the licensing documents that "11(e)(2) byproduct" material is not "waste."

4. The Division should not approve Energy Fuels' request to increase the volume of in-situ leaching waste discarded at the mill, for that license change is not adequately justified in the proposed licensing documents.

I. The Commenters

A. The Grand Canyon Trust

The Grand Canyon Trust is a membership-based, non-profit advocacy organization founded in 1985. It's headquartered in Flagstaff, Arizona, and has offices in Salt Lake City and Castle Valley, Utah, and Durango and Denver, Colorado. The mission of the Trust is to safeguard the wonders of the Grand Canyon and the Colorado Plateau, while supporting the rights of its Native peoples. In service of that mission, the Trust has worked for years to oppose irresponsible uranium mining and milling on the Plateau, and to see that the contamination around the Plateau that the uranium industry has repeatedly left in its wake is cleaned up.

B. Center for Biological Diversity

The Center for Biological Diversity ("Center") is a 501(c)(3) non-profit environmental organization with over 1.5 million members and online activists. The Center is headquartered in Tucson, Arizona and has offices in Arizona, New Mexico, California, Colorado, Nevada, Oregon, Alaska, Illinois, Minnesota, Vermont, Florida, Washington, D.C., and Baja California Sur, Mexico. The Center works through science, law, and policy to secure a future for all species, great or small, hovering on the brink of extinction. The Center and its members have for more than a decade engaged federal and state agency decision-making to ensure that uranium mining and milling in the Four Corners region does not further harm people and the environment.

C. Downwinders, Inc.

Downwinders, Inc. is a nonprofit educational foundation created in the late 1970′s to bring a halt to all nuclear weapons testing, development and deployment, and to seek justice for victims and survivors of radiation exposure from fallout from atmospheric atomic testing and weapons manufacturing, and from participation in the uranium industry. Downwinders has been a critic of the operation of the White Mesa mill and waste disposal operation since the mid-1990′s, and more broadly, of a flawed and failing radioactive waste disposal regime nationally and regionally.

D. Friends of Cedar Mesa

Friends of Cedar Mesa is a non-partisan, non-profit conservation organization founded in 2010. The Friends work to protect and build respect for the cultural and natural landscapes of the greater Bears Ears region (e.g. the lands that surround the White Mesa Mill). Because the lands we work to protect are ancestral lands of many indigenous peoples, we work closely to support Tribes like the Ute Mountain Ute nation, which is the community most impacted by the Mill. With our headquarters in the town of Bluff just 17 miles from the Mill, our staff and board members drink water that flows from the aquifer underlying the Mill's tailing ponds.

E. Great Old Broads for Wilderness

Great Old Broads for Wilderness ("Broads") is a national grassroots organization, led by women, that engages and inspires activism to preserve and protect wilderness and wild lands. Founded in 1989 with the national office based in southwestern Colorado, Broads currently has 40 chapters around the country that focus on education, advocacy, and stewardship for public lands protection. With three chapters in Utah and four in western Colorado, the organization has a strong interest in protecting the lands, water and people of this region. We have witnessed the short- and long-term impacts of inappropriate industrial development of lands in the Four Corners region, and find particularly abhorrent the disproportionate impact on indigenous communities. A former council member of the Ute Mountain Ute Tribe serves on our Council of Advisors.

F. Healthy Environment Alliance of Utah

The Healthy Environment Alliance of Utah (HEAL) is a non-profit advocacy organization, headquartered in Salt Lake City with 15,000 members. For over twenty years, HEAL has worked to prevent the exposure of Utahns to hazardous waste including the above ground storage of high-level nuclear waste on the Goshute Reservation, the construction of a nuclear power plant on the Green River, and Energy Solutions attempts to dispose Class B and C waste, depleted uranium, and Italian waste at their Clive facility. We continue to inform and support both citizens and state agencies about the risks of such proposals in order to assure that Utah will be a safe and healthy place to live for us and future generations.

G. Multicultural Alliance for a Safe Environment

The Multicultural Alliance for a Safe Environment is a network of five groups based in New Mexico. We work collaboratively to stop new uranium mines and to address the environmental and health legacy from past uranium mining. We are rooted in the experiences of uranium-impacted communities, working to restore and protect the natural and cultural environment through respectfully promoting intercultural engagement among communities and institutions for the benefits of all life and future generations.

H. New Mexico Environmental Law Center

Founded in 1987, the Law Center's mission is to engage in environmental protection litigation and advocacy with a primary focus on pursuing issues that advance the interests of environmental justice. The Law Center works with communities to protect New Mexico's land, air, and water from challenges posed by local, state, national and worldwide threats to the environment.

The Law Center works with communities to address disparities in environmental protection and exposure to pollution that are a result of racist and classist legal and social frameworks. The Law Center has two goals of equal priority. The first is to provide legal representation to low-income communities and communities of color to address the environmental pollution issues those communities have identified as important. The second is to work with environmental justice communities to impact environmental laws, regulations and policy.

I. Sierra Club Utah Chapter

Today, the Utah Chapter is a grassroots environmental organization that harnesses the power of people working together to make change happen. We amplify the power of its members and supporters to protect and enjoy Utah's outdoors and natural landscapes; educate and advocate for the responsible preservation of clean air, water and habitats; support development of clean energy to benefit present and future generations; and advance principles of equity, inclusion, and justice throughout our organization and the broader community.

J. Southern Utah Wilderness Alliance

The Southern Utah Wilderness Alliance is a non-profit, membership-based environmental organization with members in all fifty states and offices in Washington, D.C. and Utah. It is dedicated to the sensible management of all federal public lands within the State of Utah, the preservation and protection of plant and animal species, the protection of clean air and water found on federal public lands, the preservation and protection of cultural and archaeological resources, and the permanent preservation of Utah's remaining wild lands.

K. The Wilderness Society

The Wilderness Society is a non-profit national organization founded in 1935, with members who reside throughout the nation. TWS works to protect America's wilderness lands through public education, scientific analysis, and advocacy. TWS's mission is to protect wilderness and inspire Americans to care about our wild places, so that future generations will enjoy the clean air, water, wildlife, beauty, and opportunities for recreation and renewal that pristine deserts, mountains, forests, and rivers provide. Protecting wilderness quality and other sensitive lands managed by BLM is vital to achieving The Wilderness Society's mission.

L. Utah Audubon Council

Utah Audubon Council is the public policy arm of the four Audubon societies in Utah, and consists of the leadership of Great Salt Lake, Wasatch, Bridgerland, and Red Cliffs Audubon, representing over 1,200 members statewide. Utah Audubon Council works to protect and preserve birds and wildlife and their habitats, and the human and natural environment.

M. Utah Diné Bikéyah

Utah Diné Bikéyah (UDB) has an all-Native American Board of Directors (comprised of Navajo and Ute community leaders) and is based in San Juan County, Utah. The Board works on public lands conservation by integrating traditional knowledge and Native leadership into land planning. UDB's primary goal is assisting Tribes and federal agencies in engaging Indigenous communities and Indigenous knowledge keepers in developing truly well-informed policies and plans that protect communities and indigenous cultures over the long term. These lands are the homes of Ancestors, Native American sacred spaces, villages areas, traditional cultural properties, and burial places that exist in and around the White Mesa mill and throughout Bears Ears National Monument and are the most at-risk when poor decisions and bad management planning occurs. All of the Native American communities in San Juan County have been harmed by the toxic impacts and legacy of uranium mining, processing, testing, and transportation. UDB's mission is, "to preserve and protect the cultural and natural resources of ancestral Native American lands to benefit and bring healing to people and the Earth."

N. Western Watersheds Project

Western Watersheds Project is a non-profit organization with more than 12,000 members and supporters. Our mission is to protect and restore western watersheds and wildlife through education, public policy initiatives and legal advocacy. Our watersheds work includes advocating for the protection of the health and well-being of Indigenous people and environmental justice communities. We work throughout the western United States, including Utah.

O. WildEarth Guardians

WildEarth Guardians (Guardians) is a membership-based non-profit organization dedicated to protecting and restoring the wildlife, wild places, wild rivers, and health of the American West. Guardians envisions a world where wildlife and wild places are respected and nature has an inherent right to exist and thrive. Guardians has more than 220,000 members and supporters, including many who use and value federal public lands on the Colorado Plateau for hiking, observing archeological sites, bird watching, observing wildlife, spiritual rejuvenation, photography, and other recreational and professional pursuits.

II. Background

A. The White Mesa Mill

No description of the mill's operations appears in any of the documents on which the Division is seeking comment. So that the record is complete, and for the sake of readers who aren't already familiar with the White Mesa mill and the regulatory framework at issue, we've set out below a brief factual background about the mill. The last time the Grand Canyon Trust submitted comments with a background section along these lines, the Division responded that "[m]uch but not all of this information is accurate."[3] If the Division continues to believe that any part of the following account is inaccurate, we would be grateful for an explanation of what specific points the Division disputes so that we may reevaluate our understanding of the facts.[4]

The White Mesa mill is an acid-leaching, uranium-processing mill that turns uranium ore and other uranium-bearing substances into a product called yellowcake, which is then enriched for use in nuclear reactors. Black flake, a substance used in other industrial processes, has also been made at the mill by extracting vanadium from some feeds. Mostly what comes out of the mill, though, is radioactive waste. This waste, commonly called tailings, is discarded in big pits spanning about 275 acres next

[3] Ex. 1 at 214.

[4] We recognize that the Division prefers to use a "regulatory lexicon," Am. 10 Statement of Basis at 3, that varies from the ordinary language we often use, and we take as a given that the Division disputes our word choice. Our request is simply to understand if the Division believes we've misunderstood the facts.

to the mill. There are five of these pits, or "impoundments," at the mill, named Cell 1, Cell 2, Cell 3, Cell 4A, and Cell 4B. They and the mill are about five miles north of the centuries-old Ute Mountain Ute community of White Mesa and about six miles south of downtown Blanding.

A company called Energy Fuels Nuclear, Inc., began building the mill in the late 1970s to process low-grade uranium ore from the surrounding region.[5] Back then, the company planned to run the mill for 15 years, then close and reclaim it.[6] The radioactive tailings were to be cleaned up in phases while the mill was operating.[7]

But that didn't happen. Instead, Energy Fuels Nuclear, fired up the mill in 1980, made yellowcake for about three years, and pumped the resulting radioactive tailings into Cells 1, 2, and 3.[8] Then, when the price of yellowcake plummeted, the company laid off most of the mill's workers and let the mill go mostly, if not completely, dormant.[9] This pattern has continued ever since. An ore-processing "campaign" is run when enough source material has piled up at the mill and yellowcake is fetching a good enough price, and then the mill lapses into "standby" when the price of yellowcake falls.[10] Though about 40 years have now passed, not one of the mill's big waste pits has been completely reclaimed.

Ownership of the mill has been similarly tumultuous. Over the years, it has changed hands at least four times.[11] In the mid-1990s, after Energy Fuels Nuclear sold and rebought the mill, the company ran out of money. When it couldn't pay its

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[5] Ex. 2 at 1-3 (arguing that the mill has independent utility for the purpose of processing low-grade, regional ores); *id.* at 10-21 (observing that small mines with low-grade ore would not be economically viable without the mill); Ex. 3 at 2-1.

[6] Ex. 2 at iii (explaining that production will last for 15 years); *id.* at 1-1, 3-15 (same); *id.* at 3-18 (showing projected operating life of 15 years and phased reclamation schedule extending no more than 5 more years); *id.* at 4-3 ("Based on the capacity of the tailings cells, the mill has a potential to operate 15 years."); Ex. 4 at 1-2 ("The mill is planned to have a 2,000 tons-per-day capacity and a projected life of 15 years."); *id.* at 5-38 ("The area occupied by the proposed mill and tailing retention system (about 310 acres) would be committed until the life of the mill ends, about 15 years.").

[7] Ex. 2 at 3-17 ("The tailings ce1ls will be reclaimed sequential1y as each cell is filled, beginning after about the fourth year of operation and every four years thereafter until termination of project operations.").

[8] Ex. 5 at 11 (Table 3 showing "tailings placement period" beginning in 1980 for Cell 2, 1981 for Cell 1, and 1982 for Cell 3).

[9] Ex. 6 at 2–3; Ex. 7; Ex. 8.

[10] Ex. 5 at 5 (showing "standby" periods with no production of U_3O_8 in 1984, 1991–1994, 2000–2004, with minimal production in 1998 and 2005).

[11] Ex. 3 at 2-1.

employees, it laid them off.[12] Within a month, the asset-holding parts of Energy Fuels Nuclear declared bankruptcy,[13] and the mill was sold for "almost nothing."[14]

Today, a company called Energy Fuels, Inc., owns and operates the mill through subsidiaries. Energy Fuels is careful to claim that it and Energy Fuels Nuclear are "unrelated entities," [15] perhaps to distance itself from any environmental liabilities that Energy Fuels Nuclear could not discharge through bankruptcy. But Energy Fuels, Inc., was formed in 2005 by a prior owner of Energy Fuels Nuclear[16] and touts on its website that "much of our senior management team began their careers and learned about the U.S. uranium industry from the earlier successes of Energy Fuels Nuclear."[17]

The mill's business model has also changed over time, no doubt due to volatility in the uranium market. Around the early 1990s, Energy Fuels Nuclear began pursuing a new source of revenue by processing "alternate feeds" and discarding the resulting waste at the mill. These feeds include uranium-bearing wastes from other contaminated places around the country. In 1998, for example, Energy Fuels[18] was paid over $4 million to process and dispose of radioactive soil that was contaminated not only by the Manhattan Project, but also by other industrial and chemical ventures.[19] From these sorts of feeds, the waste pits at the mill now contain radioactive and contaminated wastes from rare-metals mining,[20] uranium-conversion plants,[21] and contaminated defense facilities,[22] among other sources. The two new "alternate feeds" that the company is seeking permission to accept—which the Division calls the Silmet "material" and the Moffat Tunnel "material"—would bring the list of materials that Energy Fuels has been licensed to process and discard to around twenty.

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[12] *See* Ex. 9.

[13] Ex. 10 at Addendum to Permit Transfer Request (PDF p. 38).

[14] Stephane A. Malin, The Price of Nuclear Power: Uranium Communities and Environmental Justice, 96 (2015) ("Malin").

[15] Ex. 11 at PDF p. 4.

[16] Malin at 95–96.

[17] Ex. 11 at PDF p. 4.

[18] At the time, the mill was owned by a company called International Uranium (USA) Corporation. For simplicity's sake, these comments generally refer to the mill's prior owners as Energy Fuels.

[19] *See* Ex. 12 at 1 (observing that Energy Fuels would be paid a fee of $4 million to process and dispose of the material, an amount that far exceeded the value of the yellowcake to be produced).

[20] *See* Ex. 13 at 2–3.

[21] *See* Ex. 14 at 1.

[22] *See, e.g.*, Ex. 15 at 1–4.

Processing alternate-feeds is not the mill's only waste-disposal business. Wastes generated at operations that recover uranium by in-situ leaching are also buried in the mill's pits. Unlike alternate feed, these wastes aren't processed at the mill before being discarded. These wastes include, for example, barium-sulfate sludge from treating waste solutions at an in-situ uranium leaching operation Wyoming.[23] Leaking shipments of that sludge have arrived at the mill twice since 2015.[24] In the past, similar wastes have been shipped, at a minimum, from Texas, Nebraska, and Wyoming to be buried at the mill.[25]

By running its business, Energy Fuels has also fouled the groundwater beneath the mill. Exactly how some of that contamination got into the groundwater aquifers beneath the mill is a subject of debate. But it's undebatable that the groundwater is contaminated by pollutants like nitrate, nitrite, chlorides, and chloroform.

B. Source-Material and Byproduct Material Licensing

To mill uranium, Energy Fuels is required to get a license from the Utah Division of Waste Management and Radiation Control that authorizes the company to possess and process "source material"—generally meaning uranium ore—and to dispose of the waste "byproduct material" that the mill generates.[26] The Division is authorized to issue this license under state law, exercising authority delegated to the state by the U.S. Nuclear Regulatory Commission.

That delegation was made under the Atomic Energy Act of 1954, the fundamental federal law regulating source, byproduct, and other nuclear materials. That Act authorizes the Nuclear Regulatory Commission to issue regulations governing the possession and use of source and byproduct material "to promote the common defense and security or to protect health or to minimize danger to life or property…."[27]

The Commission has issued three main rules regulating uranium milling: (1) the agency's general standards setting radiation dose limits for the general public and mill workers (10 C.F.R. Part 20); (2) the Commission's rules for domestic licensing of source material (10 C.F.R. Part 40), which establish health, safety, financial, and other requirements that uranium-mill operators must meet to get a license; and (3) Appendix A to those licensing regulations, which establishes standards for managing and reclaiming mill tailings. The State of Utah has set its own radiation-dose standards and has adopted wholesale many, but not all, of the latter two

[23] *See* Ex. 16.

[24] *Id.*

[25] Ex. 17.

[26] Utah Code § 19-3-104.

[27] 42 U.S.C. § 2201.

Commission rules.[28]

The main requirements for managing and disposing of tailings originate from a federal law passed in 1978 called the Uranium Mill Tailings Radiation Control Act. Congress found in UMTRCA that "uranium mill tailings located at active and inactive mill operations may pose a potential and significant radiation health hazard to the public" and sought to regulate tailings in "a safe and environmentally sound manner … to prevent or minimize radon diffusion into the environment and to prevent or minimize other environmental hazards from such tailings."[29] It was to comply with UMTRCA that the Commission issued Appendix A.[30]

III. The Division should reject Energy Fuels' requests to process the Silmet and Moffat Tunnel Materials.

A. The Silmet Material

The "Silmet material" is a waste generated by a rare-metals plant in Sillamäe, Estonia run by NPM Silmet OÜ.[31] The plant sits on land that has been an industrial site for about a century.[32] The area first housed a production plant for oil shale,[33] but in the 1940s, it was converted by the Soviet Union into a "top secret," "large industrial complex" for producing uranium.[34] Modifications in the 1970s allowed the plant to begin producing niobium, tantalum, and rare earth metals, which the plant continues to do today.[35]

Until Estonia joined the European Union in 2004, wastes from the industrial operations at the Silmet plant site were dumped in a pit about twenty to fifty meters from the Baltic Sea.[36] Owing to the threat this posed to the environment and public health, the pit was taken out of use in 2004 and cleaned up over the next four years.[37]

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[28] Utah Admin. Code R313-24-4 (incorporating much of 10 C.F.R. Part 40 and Appendix A by reference); Utah Admin. Code R313-15 (establishing standards that apply to the Division's licensees for protection against ionizing radiation).

[29] 42 U.S.C. § 7901.

[30] "Uranium Mill Licensing Requirements," 45 Fed. Reg. 65,521 (Oct. 3, 1980).

[31] Silmet Application at 1.

[32] *Id.* at 3.

[33] *Id.*

[34] Ex. 18 at 171.

[35] *Id.*

[36] *Id.* Energy Fuels uses a different set of dates in the Silmet Application. *See* Silmet Application at 4. It is unclear which dates are accurate, so we've elected to use those given in the article attached as Exhibit 18, which was co-authored by a staff member of the Estonian Radiation Safety Department.

[37] Ex. 18 at 171–72.

But that created a new problem for Silmet, for it continued to produce a radioactive waste stream in its rare-metals operations.[38] And by 2004, under Estonia's Radiation Act, these wastes could not be discarded in Estonia, for "there is no radioactive waste management operator for [naturally occurring radioactive materials] waste in Estonia."[39] As a result, the plant's operator has been packaging the wastes in 55-gallon drums and storing them at the plant for about the last 15 years while searching for a foreign, waste-disposal option.[40] When operating, the plant generates about 80 tons per year of this waste.[41]

Silmet now has about 600 metric tons of this waste stored at its Sillamäe plant in about 2,000 drums.[42] The company's radiation practice license allows it to accumulate no more of this waste, and as a consequence, the plant's niobium and tantalum operations have ceased, and the Estonian Ministry of Environment has refused to allow operations to resume until the waste is discarded off site.[43] It is this waste, and any additional waste generated if operations at the plant resume, that Energy Fuels is seeking permission to process and discard at the White Mesa mill.

B. The Moffat Tunnel Material

The Moffat Tunnel "material" is a waste containing radionuclides that is generated by a water-treatment plant in Winter Park, Colorado that was built to clean up discharges from the Moffat Tunnel.[44] The Moffat Tunnel was built a century ago to allow trains to travel under the Continental Divide near Colorado's Front Range.[45]

Groundwater and other precipitation seeps into the tunnel and flows out each end, carrying with it contaminants picked up on the way.[46] About five years ago, the Colorado Department of Public Health and Environment required the Tunnel's operator, the Union Pacific Railroad, to build a water treatment plant at the Tunnel's west end to treat the discharge before it flows into the Fraser River.[47]

Because the outflows from the west end of the tunnel contain radionuclides, the "centrifuge cake" generated by the water treatment plant has "elevated" levels of

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[38] *Id.* at 172.

[39] *Id.* at 173.

[40] Silmet Application at 4.

[41] *Id.*

[42] *Id.* at 1.

[43] *Id.* at 1–2.

[44] Ex. 19 at 3; Ex. 20 at 1-1, 2-2.

[45] Ex. 19 at 2; Ex. 20 at 1-1.

[46] Ex. 19 at 3; Ex. 20 at 1-1.

[47] Ex. 19 at 3; Ex. 20 at 2-2.

radionuclides.[48] As a consequence state regulators in Colorado have required the Union Pacific Railroad to get a radioactive materials license to dispose of this waste centrifuge cake.[49] This is the Moffat Tunnel "material" that Energy Fuels is seeking permission to process and discard at the White Mesa mill. Energy Fuels anticipates that it may receive this waste material "indefinitely" in quantities of up to 200 tons per year on a wet basis.[50]

C. The Division may deny the alternate-feed applications to protect the environment and public health, and it should exercise that authority.

Licensing alternate feeds for processing and disposal at the mill is a practice that ought to end outright, absent the consent of the Ute Mountain Ute Tribe, absent an act of Congress specifically allowing uranium mills to process alternate feeds, and absent an open public debate about whether that practice should occur at the White Mesa mill.

The Division has the discretion under existing law to reject alternate-feed license applications upon finding that their issuance would be "inimical to the health and safety of the public."[51] We urge the Division to exercise that discretion to deny the applications to process the Silmet and Moffat Tunnel materials.

To lawfully make yellowcake and bury the resulting wastes at its mill, Energy Fuels must process "ore" primarily for its "source material" content.[52] Source material means uranium or thorium, or any ore containing one of those elements at concentrations established by the Nuclear Regulatory Commission.[53] In the 1990s, Commission staff released guidance that defined "ore" to mean anything from which uranium or thorium are extracted in a licensed mill.[54] This tautological definition had the effect of allowing Energy Fuels to run anything from which it could extract uranium through the White Mesa mill and discard the resulting wastes on site, provided the feed wasn't a so-called "listed" hazardous waste.[55] And Energy Fuels took the view that it could even charge fees to process and discard wastes that the

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[48] Moffat Tunnel Application at 1.

[49] *Id.*

[50] *Id.* at 3.

[51] Utah Admin. Code R313-22-33(1)(d).

[52] *See* 42 U.S.C. § 2014(e)(2).

[53] 42 U.S.C. § 2014(z).

[54] "Uranium Mill Facilities, Notice of Two Guidance Documents: Final Revised Guidance on Disposal of Non-Atomic Energy Act of 1954, Section 11e.(2) Byproduct Material in Tailings Impoundments; Final Position and Guidance on the Use of Uranium Mill Feed Materials Other Than Natural Ores," 60 Fed. Reg. 49,296, 49,296 (Sep. 22, 1995).

[55] 60 Fed. Reg. at 49,296–297.

waste generator was willing to pay to get rid of.[56]

The State of Utah balked at this idea and took the issue to the Nuclear Regulatory Commission.[57] The Commission ultimately decided against the State.[58] As a result, through a guidance document issued by Commission staff and an administrative appeal before the Commission, Energy Fuels was given permission to make money disposing of radioactive waste at the White Mesa mill. That outcome bypassed any true public debate about how to get rid of a host of uranium-bearing wastes that have been discarded at the mill since the early 1990s. Indeed, Energy Fuels' "alternate-feed" business has never been blessed by an act of Congress, nor a state law, nor any other publicly debated kind of lawmaking.

The result of this quiet revolution in the law is that the White Mesa mill, as a practical matter, has been given a license to operate indefinitely, not milling much or any uranium ore, but instead accepting wastes for "processing" and disposal. The core problem with that outcome, though there are others, is that the prospect of an indefinitely operating *waste-disposal business* was not at all the subject of discussion and analysis when the federal government and Energy Fuels chose in the late 1970s to build the mill on White Mesa. What was debated back then was whether to license a uranium mill to process low-grade uranium ore from the region for 15 years, before closing and reclaiming the mill.[59] Forty years later, the community of White Mesa is burdened by something else entirely: a landfill for low-level radioactive waste that may forever be running, fed by massive waste-hauling trucks, polluting the air, killing wildlife, and making the already-polluted groundwater ever more toxic.

Indeed, for most or all alternate feeds, the additional pollution from running the mill to process those feeds—the toxins the mill puts into the air, the chemicals it uses to extract yellowcake, and the like—burdens the environment and the people around the mill *only* so that the resulting waste may be deemed "byproduct material" that can be discarded on site. This pollution would not happen if it was the market for selling yellowcake, rather than the market for disposing of radioactive waste, that controlled

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[56] Ex. 12 at 1.

[57] *Id.*

[58] *Id.*

[59] Ex. 2 at 1-3 (arguing that the mill has independent utility for the purpose of processing low-grade, regional ores); *id.* at 10-21 (observing that small mines with low-grade ore would not be economically viable without the mill); *id.* at iii (explaining that production will last for 15 years); *id.* at 1-1, 3-15 (same); *id.* at 3-18 (showing projected operating life of 15 years and phased reclamation schedule extending no more than 5 more years) *id.* at 4-3 ("Based on the capacity of the tailings cells, the mill has a potential to operate 15 years."); Ex. 4 at 1-2 ("The mill is planned to have a 2,000 tons-per-day capacity and a projected life of 15 years."); *id.* at 5-38 ("The area occupied by the proposed mill and tailing retention system (about 310 acres) would be committed until the life of the mill ends, about 15 years.").

whether these alternate-feed deals occurred. Put another way, the expense of transporting and processing the feeds so far outweighs the value of the resulting yellowcake that it is only for waste-disposal that most or all alternate-feeds are ever brought to the mill.

All of this is happening over the persistent objections of the Ute Mountain Ute Tribe. And rather than listen to those objections and confront the failure of governance motivating them, the Division appears to believe that it is bound by federal law to approve any alternate-feed application if the feed has uranium in it (i.e., is ostensibly "ore"), does not contain listed waste, and will be processed at the mill.[60] But this is not so, for the Division has discretion to reject alternate-feed license applications on the grounds that they are "inimical to the health and safety of the public" regardless of the Commission's guidance,[61] and the Utah Waste Management and Radiation Control Board has the power—which it could exercise at the Division's behest—to amend or abandon the Commission's guidance altogether.[62]

The Division contends that, when Utah first obtained agreement-state status, it agreed to use "best efforts … to assure that the State's program will continue to be compatible with the program of the Commission for the regulation of like materials."[63] Yet that commitment does not require the Division to approve any license amendment that would be "inimical to the health and safety of the public," including an amendment to process alternate feeds, for protecting the health and safety of the public is surely compatible with the Commission's regulations.[64]

The Division also observes, without citation, that the State committed in its 2003 agreement-state application to apply the Commission's guidance for evaluating whether to license alternate feeds for processing.[65] But that description of the application omits a crucial caveat: The agreement said nothing about the alternate feed guidance, but made only a general commitment to follow guidance issued by the Commission writ large "unless doing so will compromise protection of human health

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[60] Utah Division of Waste Management and Radiation Control, "Technical Evaluation and Environmental Analysis: Silmet Alternate Feed Request," DRC-2020-007005, p. 13 (Apr. 2020) ("Silmet Technical Evaluation") ("The Division concludes that using its "best efforts" includes following established judicial and administrative precedents, as well as NRC guidance and regulations.").

[61] *See* Utah Admin. Code R313-22-33(1)(d).

[62] *See* 42 U.S.C. § 2021(o)(2); Utah Code §§ 19-3-104(7) and 19-3-104(8)(a).

[63] *See* Ex. 21, Article VI.

[64] *See* Utah Admin. Code R313-22-33(1)(d).

[65] Silmet Technical Evaluation at 15; Utah Division of Waste Management and Radiation Control, "Technical Evaluation and Environmental Analysis: Moffat Tunnel Alternate Feed Request," DRC-2020-007007, p. 16 (Apr. 2020) ("Moffat Tunnel Technical Evaluation").

and the environment."[66] And the amendment that the Commission and the State of Utah ultimately signed to expand the State's agreement-state power, which reflects the binding commitments each party made, says nothing about following the Commission's guidance, concerning alternate feeds or any other subject.[67]

Added to that, the State of Utah has the authority to depart from the Commission's alternate-feed guidance, for the Atomic Energy Act explicitly allows agreement states to adopt requirements that are more stringent than federal law:

> In the licensing and regulation of byproduct material … a State shall require … compliance with standards which shall be adopted by the State for the protection of the public health, safety, and the environment from hazards associated with such material which are equivalent, to the extent practicable, *or more stringent than*, standards adopted and enforced by the Commission for the same purpose….[68]

It is consequently not true that the Division's hands are tied by federal law.

We accordingly urge the Division to exercise its authority to find that it is inimical to the health and safety of the public to allow Energy Fuels to process the Silmet and Moffat Tunnel wastes at the mill. At the very least, the Division has the power to find that it is inimical to the health and safety of the public to allow alternate feeds to be shipped to the White Mesa mill when the feed's generator is incurring more expense in the deal than Energy Fuels stands to gain from processing the feed, for in that circumstance the feed would never be sent to the mill *but for* the ability to discard the resulting waste in Utah's environment, next to Utah's communities. This financial arrangement, as explained below, doubtless applies to the Silmet material, and we suspect it is true of the Moffat Tunnel waste too. And at least on this basis, we urge the Division to deny the applications to process these alternate feeds.

IV. If the Division approves the request to process the Silmet material, that approval should be contingent on Energy Fuels' acquisition of a specific import license.

While we urge the Division to deny outright Energy Fuels' application to process the Silmet waste, if the Division nonetheless approves that request, that approval should be conditioned on Energy Fuels' acquisition of a specific-import license from the Commission, for the Commission's general-import license does not authorize Energy Fuels to import the Silmet material.

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[66] *See* Ex. 22 at PDF p. 3.

[67] Ex. 23.

[68] 42 U.S.C. § 2021(o)(2) (emphasis added); *see also* Utah Code §§ 19-3-104(7) and 19-3-104(8).

A. Energy Fuels cannot import the Silmet material using a general-import license.

Energy Fuels has asserted that it may bring the Silmet material into the United States from Estonia using a general-import license established by 10 C.F.R. § 110.27(a).[69] The Division has concurred with that view.[70] Yet the general license in § 110.27(a) does not allow for the importation of "radioactive waste," as that term is defined by the Commission's import regulations.[71] And because the Silmet material is a "radioactive waste," it cannot be imported under a general license.

1. The Silmet material is a "radioactive waste" if Energy Fuels will not import it "solely" for the purpose of recycling.

The Commission's regulations provide that "a general license is issued to any person to import … source … material if the U.S. consignee is authorized to receive and possess the material under the relevant NRC or Agreement State regulations."[72] But that general license is subject to conditions,[73] one of which provides that "radioactive waste" may not be imported under a general license.[74]

"Radioactive waste" has a unique and complex definition in the Commission's export and import rules, which provides in pertinent part:

> Radioactive waste … means any material that contains or is contaminated with source … material that by its possession would require a specific radioactive material license in accordance with this Chapter and is imported or exported for the purposes of disposal in … a disposal area as defined in Appendix A to 10 CFR part 40…; or recycling, waste treatment or other waste management process that generates radioactive material for disposal in … a disposal area as defined in Appendix A to 10 CFR part 40….[75]

Further complicating the matter, some radioactive materials that would otherwise be radioactive wastes under this definition are excluded by rule. These include materials "[i]mported solely for the purposes of recycling and not for waste management or disposal where there is a market for the recycled material and evidence of a contract or business agreement can be produced upon request by the NRC."[76] It is

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[69] *See* Silmet Application at 12–13.

[70] *See* Silmet Technical Evaluation at 20.

[71] 10 C.F.R. § 110.27(c); 10 C.F.R. § 110.2 (defining "radioactive waste").

[72] 10 C.F.R. § 110.27(a).

[73] *Id.* (granting license "[e]xcept as provided in paragraphs (b) and (c) of this section…").

[74] 10 C.F.R. § 110.27(c).

[75] 10 C.F.R. § 110.2.

[76] *Id.*

under this exclusion that Energy Fuels asserts that it can import the Silmet material.[77] But that assertion is flawed.

For the Silmet material to qualify under this exclusion, it must be imported *solely* for the purpose of recycling.[78] When adopting this exemption in 2010, the Commission warned against its misuse:

> The Commission is aware that there could be instances in which a person intends to import what is in fact radioactive waste, but which is argued to be for recycling purposes (i.e., sham recycling). Any person who imports materials under a general license for recycling, but with the purpose of disposing of them in the United States, would be subject to NRC enforcement action.[79]

The Commission further recognized that "there may be instances in which some small value may be obtained from the materials that are imported, but the primary intention is for disposal."[80] In such cases, to avoid possible enforcement action, the staff recommends that the Commission be consulted before any such imports are made."[81]

For the reasons explained below, the possible value that Energy Fuels might obtain from processing the Silmet material is a small fraction of the expense of transporting it to White Mesa and processing it, not accounting for permitting costs, overhead, marketing, and the like. At best, this is the precise circumstance that the Commission envisioned would amount to "sham recycling" and warned licensees not to attempt.

And it is important to stress that, on the subject of "sham recycling," the analysis under the Commission's import rules is different than the domestic-licensing rules for alternate feeds. The core question of law for "alternate feeds" originating in the United States is whether processing them will result in "wastes produced by the extraction or concentration of uranium … from any ore processed *primarily* for its

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[77] *See* Silmet Application at 12–13.

[78] 10 C.F.R. § 110.2. There is no question that the remaining elements of the definition of "radioactive waste" are satisfied. Processing the feeds will generate radioactive material to be disposed of in a "disposal area"—the tailings cells at the mill—as that term is defined in Appendix A. *See* 10 C.F.R. Part 40, App. A ("Disposal area means the area containing byproduct materials to which the requirements of Criterion 6 apply.").

[79] "Export and Import of Nuclear Equipment and Material," 75 Fed. Reg. 44,072, 44,076 (July 28, 2010).

[80] *Id.*

[81] *Id.*

source material content."[82] The Commission has interpreted this language to allow a licensee to process a "source material"—like an alternate feed—even if the licensee's primary motive is to receive a disposal fee, so long as the act of processing is completed primarily to extract the feed's source-material content and not something else.[83] In so holding, the Commission observed that there is "no reason under UMTRCA why licensees cannot have several motives for a transaction."[84]

But this analysis does not apply when evaluating how a foreign-sourced "alternate feed" should be treated under the Commission's import regulations, for those regulation require that the material be imported "solely" for the purpose of recycling. It is not enough that "recycling" is *one* ostensible reason, however trivial, among other reasons for importing a material: It must be the sole reason.

For similar reasons, the Division's legal review of the import-license question should be revisited. In that analysis, the Division reasons that the Commission would not require an import license today because it did not require one when Energy Fuels began importing materials from Cameco Corporation's operations in Ontario, Canada in 1998.[85] But the Commission changed its import rules in 2010 to adopt the definition of "radioactive waste" discussed above, including the recycling exclusion.[86] Thus, the Commission's conclusions about the 1998 import license have no bearing on how its modified import rules apply today.

All told, conceding for the sake of argument that Energy Fuels may process domestically sourced "alternate feeds" at the mill even if the company's primary motivation is to generate waste-disposal fees, that is not true of whether Energy Fuels may *import* foreign-sourced "alternate feeds." On that score, it must import the material "solely" for the purpose of recycling, a requirement that—as explained below—is not met here.

2. Energy Fuels is not importing the Silmet material *solely* for the purposes of recycling.

Even assuming, for the sake of argument, that one of the purposes for importing the Silmet material is to "recycle" the tiny fraction of uranium it contains, there is no denying that another purpose—and indeed, in our view, the only purpose[87]—is disposal of the remaining 99.5-plus percent of the Silmet material. This

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[82] 42 U.S.C. § 2014(e)(2) (emphasis added).

[83] *In re Int'l Uranium (USA) Corp.*, 51 NRC 9, 23 (2000).

[84] *Id.* at 18.

[85] Silmet Technical Evaluation at 20.

[86] 75 Fed. Reg. at 44,076.

[87] For this reason, we believe that it is proper to conclude that Energy Fuels is importing the Silmet waste "for the purposes of disposal in … a disposal area as defined in Appendix A to 10 CFR part 40…" and that the recycling exclusion does not apply at all,

is evident for several reasons.

First, Energy Fuels estimates that the Silmet material averages about 0.27 percent U_3O_8.[88] So, if Energy Fuels receives 2,000 drums of the Silmet material, Energy Fuels would effectively bury just over 1,994 of those drums in the mill's waste pits and produce a bit less than 6 drums' worth of yellowcake (assuming *all* the uranium could be extracted from the Silmet material, which it cannot).[89] As a simple mathematical matter, the outcome of importing the Silmet material will be to discard nearly all of it permanently at the mill.

Second, it is plain that Silmet treats the "Silmet material" as waste that Silmet is anxious to dispose of. Energy Fuels' application to process the material explains that the Republic of Estonia has refused to renew Silmet's radiation activity license and has shut down Silmet's plant until it gets rid of the "Silmet material."[90] For Silmet, and for the Republic of Estonia, the only goal is to export the material from the country because it cannot be lawfully discarded in Estonia due to its radioactive content.[91] Silmet's purpose is decidedly not "recycling," but rather, waste disposal.

Third, the finances of the transaction reveal that the value in the deal for Silmet and Energy Fuels is from waste disposal, not "recycling." Though Energy Fuels has not disclosed any information about the financial aspects of the Silmet deal, we have no doubt that the cost of transporting the material to White Mesa and processing it far exceed the revenues Energy Fuels could generate from selling uranium "recycled" from that material.

Indeed, the cost of transporting the Silmet material *alone* surely exceeds the value of any yellowcake it can yield. The rough estimates we've unearthed suggest that shipping 20′ intermodal or similar containers from the Port of Tallinn in Estonia to the Port of Houston is likely to cost at least $1,700 per container, with a range up to $2,800, perhaps more.[92] At the midpoint of those rates, shipping 50 containers, as

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though we direct our comments here to disputing Energy Fuels' claim that it is importing the material "solely" for the purposes of recycling.

[88] Silmet Application at 6.

[89] 2,000 * 0.0027 = 5.4 drums of yellowcake.

[90] Silmet Application at 1–2.

[91] *See* Ex. 18 at 170–74 (explaining that the Radiation Control Act, as amended after Estonia joined the European Union, imposes disposal requirements that cannot currently be met, for "[t]here is no radioactive waste management operator for [naturally occurring radioactive material] waste in Estonia.")

[92] *See* Ex. 24 at 1, Ex. 25 at 1. Energy Fuels' application does not describe the container size that would be used to ship the materials from Estonia to Houston, but based on the math, it appears the company intends to use 20′ shipping containers, given the volume of materials (2,000 drums) and the number of containers Energy Fuels expects to ship (50).

Silmet plans to do to export the material it currently has on hand, would cost $112,500.[93] And judging by Energy Fuels' past estimates for transporting similar shipments by truck to the mill, the cost to deliver the material to White Mesa from Houston is likely to be on the order of another $160,000.[94] These calculations, though rough, suggest that transporting the materials from Estonia to White Mesa will cost somewhere around $275,000.

That probable shipping cost will far exceed the value of any uranium produced from the Silmet material at today's uranium prices. Assuming that the Silmet material contains on average 0.27% U_3O_8 and that the mill has a 100% recovery rate (which it does not), processing 600 metric tons of Silmet material would yield about 3,500 pounds of yellowcake.[95] At a spot-market price of $33/lb, 3,500 pounds of yellowcake would fetch about $115,500.[96] Thus, considering only the transportation costs, the deal to "recycle" the material at the mill will generate a net financial loss of somewhere around $150,000.

And the milling cost will only significantly increase the net financial losses entailed by the Silmet transaction. In 2008, the Nuclear Regulatory Commission estimated that the per-ton milling cost for another alternate feed was about $125, a figure we suspect does not include overhead, marketing, and other expenses necessary to sell the resulting yellowcake.[97] Using that cost estimate adjusted to today's dollars, processing 600 tons of material would set Energy Fuels back by about $91,000.[98] Taken together with the transportation cost, the expense to process the Silmet material will far exceed the value of the yellowcake that can be made from that material. Indeed, we suspect that Silmet is willing to pay not only the cost to transport the material to White Mesa but also a tipping fee to compensate Energy Fuels for processing the material and discarding the waste.

Added to all this, there is no evidence, in the record or otherwise that Silmet has an alternative option for disposing of the "Silmet material" and is electing instead to incur additional cost to "recycle" it out of environmental goodwill or for some other reason. That is, it is not the case that Silmet prefers to spend more to "recycle" the

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[93] $2,250 * 50 = $112,500.

[94] *See* Ex. 26 at F-11 (estimating, in 2008, average per-ton cost to truck raffinate sludge 975 miles from Gore, Oklahoma to White Mesa of $189.40). We calculated a figure of $160,000, by adjusting this per-ton trucking cost to account for inflation and the distance from Houston to White Mesa (1,200 miles), as so: $189/975 mi. = $0.1938 cost per mile * 1,200 = $232.61/per ton * 600 tons = $139,569 (2008). Adjusted for inflation, this figure comes to $165,186.

[95] 600 metric tons = 1,322,772 lbs. 1,322,772*0.0027 = 3,500 lbs.

[96] *See* Ex. 27 at 1 (showing average spot price as of late June 2020 of about $33/lb).

[97] *See* Ex. 26 at F-11, F-24 (showing estimated processing cost of $125/ton from "NRC, 1/23/08"). Sillamäe, Ida-Viru County, Estonia

[98] $125 (2008) in today's dollars = $152 * 600 tons = $91,200.

material even though it could discard it in Estonia or elsewhere. What matters to Silmet is securing some way to dispose of the waste that it cannot lawfully discard in Estonia.

All told, it is overwhelmingly clear that the purpose for sending the Silmet material to the White Mesa mill is to reclassify it as a "waste[] produced by the extraction or concentration of uranium … from any ore processed primarily for its source material content" so that the Division will allow Energy Fuels to discard that waste at the mill. Put differently, there can be no doubt that if the waste could not be discarded at the mill, Energy Fuels and Silmet would not contract to transport the material 5,000 miles to White Mesa for "recycling."

We recognize that the figures we've used to reach this conclusion are estimates, though those estimates are based on the best information we've been able to gather. And consequently, we fear that the Division may be inclined to contend that our analysis is imperfect and therefore should be disregarded. If that's the case, we urge the Division to check our work by performing and disclosing to the public an independent analysis of the economics of the Silmet deal and also by requiring Energy Fuels to submit information about its projections of the costs and revenues for importing, processing, and marketing the Silmet material. We're confident the Division's analysis will confirm our estimates, and without the Division having performed that analysis, there is no basis for concluding that Energy Fuels may import the Silmet material using a general license.

And regardless of whatever forecasts the Division makes about the Silmet deal and the parties' intent in undertaking it, we ask the Division to impose a simple test in the license that will unequivocally reveal whether "recycling" is the sole purpose for importing the Silmet material: Require Energy Fuels to ship *back* to Estonia for disposal all the waste that results from "recycling" the Silmet material at the mill. If Silmet and Energy Fuels decline to go forward with their deal with that condition, it will be plain that the purpose of importing the Silmet material is to discard it at the mill, not to recycle it.

* * *

It is plainly evident to us, as we believe it should be to the Division, that the Silmet material will not be imported "solely for the purposes of recycling" if Energy Fuels' license application is granted. That material is consequently a "radioactive waste" for the purposes of the Commission's import rules. And it therefore may not be imported under a general license. As a result, if the Division approves Energy Fuels' application to allow for possession and processing of the Silmet material, the Division should make its approval subject to two conditions: (1) that Energy Fuels acquires a specific import license from the Commission; and (2) that Energy Fuels returns to Silmet in Estonia all waste resulting from processing the Silmet material at the mill.

V. The Division should revise its assertions that "11(e)(2) byproduct" material is not "waste."

The Division claims in several of the documents published for public comment that 11(e)(2) byproduct material is not waste.[99] These claims are at odds with the statutory definition of byproduct material, and they imply incorrectly that radioactive wastes are not discarded at the mill. The Division should revise these assertions to accurately portray the waste-disposal business that occurs at the mill.

The Division has proposed to revise the text of Energy Fuels' radioactive materials license in several places to replace the word "waste" with the regulatory term "11(e)(2) byproduct material."[100] While the Division's proposal to use "byproduct material" as a term of art in the license for the sake of clarity is unobjectionable, the Division's explanation for that change is problematic. In particular, the Division's statement of basis for the proposed changes to the license makes the following assertion: "Byproduct material as defined under 11e.(2) is not the same thing as *waste*, a term that has a specific and narrow meaning in the radiological regulatory lexicon, and proper usage will provide clarity."[101]

Yet it is exactly the opposite effect—to sow confusion—that will result from claiming that byproduct material is not waste. Section 11(e)(2) of the Atomic Energy Act specifically defines "byproduct material" to be waste: "byproduct material" means the "tailings or *wastes* produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content."[102] Thus, there is no disputing that byproduct material is waste. And indeed there is no question that Energy Fuels and the Division intend for the mill's radioactive leavings to buried next to the mill and remain there forever. To suggest that this amounts to anything other than waste disposal is misleading.

The Division should accordingly revise the licensing documents to recognize that "11(e)(2) byproduct material" is by definition waste.

VI. The Division hasn't adequately explained its proposed approval of Energy Fuels' request to increase the volume of in-situ leaching waste discarded at the mill.

The Division has not sufficiently justified and should revisit its proposal to modify the limits in License Condition 10.5 governing the amount of in-situ-leaching

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[99] *See* Am. 10 Statement of Basis at PDF p. 3; Silmet Technical Evaluation at 2; Moffat Tunnel Technical Evaluation at 3.

[100] *See, e.g.*, Am. 10 Statement of Basis at PDF pp. 2–3 (describing changes to License Conditions 9.5 and 9.8).

[101] *Id.* at 3.

[102] *See* 42 U.S.C. § 2014(e)(2) (emphasis added); 10 C.F.R. § 40.4; Utah Code Ann. § 19-3-102(3); Utah Admin. Code R313-12-3.

wastes that Energy Fuels may accept for disposal.

License Condition 10.5 authorizes Energy Fuels to discard byproduct material from in-situ leaching operations at the mill. That Condition, however, limits the amount of waste from any one source to 5,000 cubic yards. The Division is proposing to replace that limit with a three-part standard, which would (1) establish an annual cap of 10,000 cubic yards on the amount of wastes accepted in the aggregate from out-of-state sources; (2) eliminate the cap altogether for sources owned by Energy Fuels or its affiliates; and (3) allow for unlimited disposal at the mill of byproduct material from sources located in Utah.

Energy Fuels has been authorized to accept in-situ-leaching wastes for disposal to foster a federal policy that disfavors the "proliferation of small waste disposal sites…."[103] Owing to that policy, the Commission's uranium-mill licensing regulations require wastes from in-situ leaching operations to be "disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations."[104]

Replacing the source-specific cap with an annual cap, as proposed, would allow in-situ-leaching operations to ship wastes to the mill in unlimited amounts, so long as the shipments from out-of-state operations that Energy Fuels doesn't own are less than 10,000 cubic yards total each year. This change in the license could allow for the disposal of in-situ-leaching wastes at the mill in large volumes even if the "advantages of onsite burial" near the waste generator "clearly outweigh the benefits of reducing the perpetual surveillance obligations" by shipping the wastes to the mill. And yet, the Division has not supplied any analysis of whether that standard may be satisfied.

Rather, the Division's analysis of this proposed license change reasons only that Energy Fuels is already licensed to receive 11(e)(2) byproduct material and that "changes in the quantities would not increase the impact to human health and the environment."[105] But that line of reasoning does not address the relevant standard under Appendix A, for it does not weigh the advantages of onsite burial against the benefits that the Division foresees of discarding those wastes at the mill.

Furthermore, it is indefensible for the Division to assert that changing "the quantities would not increase the impact to human health and the environment" and that "[a]s long as the material meets the definition of 11e.(2) byproduct material, changing the requirement to an annual limit does not affect the health and safety at the

[103] 10 C.F.R. Part 40, App. A, Criterion 2.

[104] *Id.*

[105] Am. 10 Statement of Basis at 4.

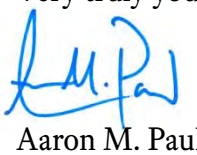
Mill."[106] It is indisputable that *some* increment of additional harm to the environment and public health results from discarding additional wastes at the mill, for it concentrates yet more radioactive material at the mill, intensifies and perhaps prolongs the mills operations, increases the likelihood of transportation accidents, and contributes to Energy Fuels' plans for building yet more waste pits. Indeed, trucks hauling in-situ-leaching wastes to the mill have spilled their contents in the past on roadsides stretching from Wyoming to Utah. The risk of yet more accidents will only increase if the limits on how much in-situ-leaching waste Energy Fuels may accept at the mill are all but eliminated.

Rather than giving Energy Fuels nearly carte blanche to discard at the mill as much in-situ-leaching waste as the company likes, the Division should evaluate the additional incremental risks to the environment and public health from allowing greater volumes of these wastes to be shipped to and discarded at the mill and should craft waste-volume limits that strike the balance that Appendix A calls for between consolidation of these wastes at existing large sites and on-site burial when warranted.

VII. Conclusion

We are grateful for the opportunity to comment on the proposed license amendments. Please don't hesitate to reach out with any question about our comments or to discuss any matters we've raised.

Very truly yours,



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[106] *Id.* at 4.

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Enclosures

EXHIBIT LIST

Exhibit 1	Utah Division of Waste Management and Radiation Control, "Public Participation Summary: Radioactive Material License UT1900479 Renewal, Groundwater Quality Discharge Permit UGW370004 Renewal and Sequoyah Fuels Alternate Feed Request," DRC-2018-000762 (2018).
Exhibit 2	U.S. Nuclear Regulatory Commission, "Final Environmental Statement Related to operation of White Mesa Uranium Project, Energy Fuels Nuclear, Inc." (May 1979).
Exhibit 3	Energy Fuels Resources (USA) Inc., "Reclamation Plan: White Mesa Mill, Blanding, Utah – Radioactive Materials License No. UT1900479, Revision 5.1" (Aug. 2016).
Exhibit 4	Dames & Moore, "Environmental Report: White Mesa Uranium Project, San Juan County, Utah for Energy Fuels Nuclear, Inc." (Jan. 30, 1978).
Exhibit 5	Letter from D. Frydenlund, V.P. Regulatory Affairs & Counsel, to C. Garlow, Attorney-Advisor, U.S. Environmental Protection Agency (June 1, 2009).
Exhibit 6	Letter from C.E. Baker, Manager, Regulatory Compliance, Energy Fuels Nuclear, Inc. to Utah Dep't of Natural Resources, Division of Oil, Gas and Mining (Jan. 27, 1983).
Exhibit 7	Letter from H. Roberts, Senior Project Engineer, Energy Fuels Nuclear, Inc., to T. Tetting, Utah Dep't of Natural Resources, Division of Oil, Gas and Mining (Mar. 12, 1984).
Exhibit 8	Energy Fuels goes on standby at Blanding, PAY DIRT, Jan. 1983.
Exhibit 9	Associated Press, "65 Lose Jobs as Ore Mill in Blanding Closes," Deseret News (Feb. 27, 1995) *available at* http://www.deseretnews.com/article/406882/65-lose-jobs-as-ore-mill-in-blanding-closes.html?pg=all.
Exhibit 10	Letter from H. Roberts, Executive Vice President, International Uranium (USA) Corporation, to M. Leavitt, Governor, State of Utah (June 18, 1997).
Exhibit 11	Energy Fuels, "Our History," 3 (July 11, 2017) available at http://www.energyfuels.com/corporate/history/ (last visited July 10, 2020).
Exhibit 12	Memorandum and Order, In re International Uranium (USA) Corp., CLI-00-01, Docket No. 40-8681-MLA-4 (Feb. 10, 2000).
Exhibit 13	Letter from M. Rehmann, Environmental Manager, International Uranium (USA) Corporation, to M. Leach, Director, Fuel Cycle Licensing Branch, U.S. Nuclear Regulatory Commission (Oct. 17, 2001).

Exhibit 14 Energy Fuels Nuclear, Inc., "Request to Amend Source Material License SUA-1358 White Mesa Mill, Docket No. 40-8681" (Sep. 20, 1996).

Exhibit 15 International Uranium (USA) Corporation, "Request to Amend Source Material License SUA-1358, White mesa Mill, Docket No 40-8681" (Mar. 16, 2000).

Exhibit 16 Letter from S. Anderson, Director, Division of Waste Management and Radiation Control, to B. Tharakan, U.S. Nuclear Regulatory Commission (Apr. 26, 2016).

Exhibit 17 Letter from D. Turk, Manager, Environmental Health and Safety, Energy Fuels Resources (USA) Inc., to R. Lundberg, Director, Division of Radiation Control (Nov. 8, 2013).

Exhibit 18 M. Lust and E. Realo, "NORM Related Production of Rare Earth metals in Estonia" in EU-NORM 1st International Symposium: 5–8 June 2012, Tallinn, Estonia (June 2012) (excerpts).

Exhibit 19 Colorado Department of Public Health & Environment, "Colorado Discharge Permit System (CDPS) Fact Sheet to Permit Number CO0047554: Union Pacific Railroad, Moffat Tunnel West Portal, Grand County" (Aug. 31, 2018).

Exhibit 20 Union Pacific Railroad, Letter Enclosing 2016 Compliance Report for Moffat Tunnel Permit CO-09947554 (Apr. 22, 2016).

Exhibit 21 Agreement Between the U.S. Nuclear Regulatory Commission and the State of Utah for Discontinuance of Certain Commission Regulatory Authority and Responsibility within the State Pursuant to Section 274 of the Atomic Energy Act of 1954 (Mar. 29, 1984).

Exhibit 22 Utah Department of Environmental Quality, Divisions of Radiation Control and Water Quality, "Elements of a Utah Agreement State Program for Uranium Mills Regulation" (Aug. 26, 2000).

Exhibit 23 Amendment to Agreement Between the United States Nuclear Regulatory Commission and the State of Utah for Discontinuance of Certain Commission Regulatory Authority and Responsibility within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended (Aug. 16, 2004).

Exhibit 24 Freightos, Freight Calculator: Air and Sea Shipping Costs (July 5, 2020) *available at* https://www.freightos.com/freight-tools/freight-rate-calculator-free-tool/.

Exhibit 25 World Freight Rates, Freight Calculator (July 5, 2020) *available at* https://www.worldfreightrates.com/en/freight.

Exhibit 26 U.S. Nuclear Regulatory Commission, "Final Environmental Impact Statement for the Reclamation of the Sequoyah Fuels Corporation Site in Gore, Oklahoma: Final Report" (May 2008) (excerpts).

Exhibit 27 Cameco, "Uranium Price" (July 5, 2020) *available at* https://www.cameco.com/invest/markets/uranium-price.

Exhibit 1

Public Participation Summary

Radioactive Material License UT1900479 Renewal
Ground Water Quality Discharge Permit UGW370004 Renewal
And
Sequoyah Fuels Alternate Feed Request
Energy Fuels Resources (USA) Inc. (Energy Fuels)
White Mesa Uranium Mill
San Juan County, Utah

Ownership of the mill has been similarly tumultuous. Over the years, it has changed hands at least four times.[15] *In the mid-1990s, after Energy Fuels Nuclear sold and rebought the mill, the company ran out of money. When it couldn't pay its employees, it fired them.*[16] *Within a month, the asset-holding parts of Energy Fuels Nuclear declared bankruptcy,*[17] *and the business was eventually liquidated.*[18]

Division Response: In this section of the Grand Canyon Trust's comments, a general discussion of the White Mesa Mill is provided. Detailed response to this comment is not required because it is in the nature of the commenter's version of background information regarding the Mill. Much but not all of this information is accurate. The Division incorporates, generally, by reference the Division General Response #1. In addition, the Division provides the following information in response to this background information:

The NRC has jurisdiction to determine the status of radioactive materials. A s discussed in detail in the Division's Response to Comment No. 1, mill discharges to the tailings management system are byproduct material, not waste. Further, in his recent order in a related matter involving the commenting party (referenced in Response to Comment No. 8), Judge Waddoups determined that this byproduct material has two components and that only the solids are called tailings, with the liquid portion of the slurry and any liquid discharge going by other names. To call the liquid "tailings" is not warranted by this record. As a result, Cells 1 and 4B do not receive tailings at this time. The fluids managed in Cells 1 and 4A are not tailings, and tailings have never been being placed in Cells 1 or 4B. *See* Memorandum Decision and Order at 35-38.

As with the reference to process fluid as tailings, the statement that the Mill did not operate as represented is misleading. The Mill has fulfilled its design function, and continues to do so to this day. Placing the Mill in standby status during periods of low demand is not a violation of the represented function of the Mill. The Licensee has been performing concurrent reclamation activities. *Grand Canyon Trust v. Energy Fuels Resources (U.S.A.) Inc.* (finding that the license had been engaged in decommissioning of Cell 2, contrary to the presentation here that the Licensee had done nothing toward cell closure).

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[9] *Ex. 2 at 1-3 (arguing that the mill has independent utility for the purpose of processing low-grade, regional ores); id. at 10-21 (observing that small mines with low-grade ore would not be economically viable without the mill); Ex. 1 at 2-1.*

[10] *Ex. 2 at iii (explaining that production will last for 15 years); id. at 1-1, 3-15 (same); id. at 3-18 (showing projected operating life of 15 years and phased reclamation schedule extending no more than 5 more years) id. at 4-3 ("Based on the capacity of the tailings cells, the mill has a potential to operate 15 years."); Ex. 3 at 1-2 ("The mill is planned to have a 2,000 tons-per-day capacity and a projected life of 15 years."); id. at 5-38 ("The area occupied by the proposed mill and tailing retention system (about 310 acres) would be committed until the life of the mill ends, about 15 years.").*

[11] *Ex. 2 at 3-17 ("The tailings ce1ls will be reclaimed sequential1y as each cell is filled, beginning after about the fourth year of operation and every four years thereafter until termination of project operations.").*

[12] *Ex. 4 at 11 (Table 3 showing "tailings placement period" beginning in 1980 for Cell 2, 1982 for Cell 1, and 1983 for Cell 3).*
[13] *Ex. 5 at 2–3; Ex. 6; Ex. 7.*
[14] *Ex. 4 at 5 (showing "standby" periods in 1984, 1991–1994, 2000–2004, with minimal production in 1998 and 2005).*
[15] *Ex. 1 at 2-1.*
[16] *See Ex. 8.*
[17] *Ex. 9 at Addendum to Permit Transfer Request (p. 37).*
[18] *Stephane A. Malin, The Price of Nuclear Power: Uranium Communities and Environmental Justice, 96 (2015) ("Malin").*

Exhibit 2

DCF copy

final

NUREG-0556

environmental statement

related to operation of

WHITE MESA URANIUM PROJECT

ENERGY FUELS NUCLEAR, INC.

MAY 1979

Docket No. 40-8681

U. S. Nuclear Regulatory Commission • Office of Nuclear Material Safety and Safeguards

NUREG-0556

FINAL ENVIRONMENTAL STATEMENT

related to the
Energy Fuels Nuclear, Inc.,

WHITE MESA URANIUM PROJECT

(San Juan County, Utah)

Docket No. 40-8681

May 1979

prepared by the
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUMMARY AND CONCLUSIONS

This Final Environmental Statement was prepared by the staff of the U.S. Nuclear Regulatory Commission and issued by the Commission's Office of Nuclear Material Safety and Safeguards.

1. This action is administrative.

2. The proposed action is the issuance of a Source Material License to Energy Fuels Nuclear, Inc., for the construction and operation of the proposed White Mesa Uranium Project with a product (U_3O_8) production limited to 7.3 x 10^5 kg (1.6 x 10^6 lb) per year.

3. The following is a summary of environmental impacts and adverse effects.

   a. Impacts to the area from the operation of the White Mesa Uranium Project will include the following:

      - Alterations of up to 195 ha (484 acres) that will be occupied by the mill, mill facilities, tailings area, and roads. Approximately 135 ha (333 acres) will be permanently committed to tailings disposal.
      - An increase in the existing background radiation levels of the mill area as a result of continuous but small releases of uranium, radium, radon, and other radioactive materials during operation.
      - Socioeconomic effects on the towns of Blanding and Monticello, Utah, where the majority of mill workers will be housed during mill construction and operation.
      - Production of waste material (tailings) from the mill, which will be produced at a rate of about 1.8 x 10^6 kg (2000 tons) per day for 15 years and will be deposited onsite in subsurface pits.

   b. Surface water will not be affected by normal milling operations. Mill process water will be taken from the Navajo aquifer, and process water will be discharged to the tailings impoundment at about 1.18 m^3 (310 gal) per minute. Approximately 5.9 x 10^5 m^3 (480 acre-ft) of water per year will be utilized by the mill, and this is not expected to have an effect on the Navajo aquifer.

   c. There will be no discharge of liquid or solid effluents from the mill and tailings site. The discharge of pollutants to the air will be small and the effects negligible. The estimated total annual whole-body and organ dose commitments to the population within 80 km (50 miles) of the proposed mill site are presented below. Natural background doses are also presented for comparison. These dose estimates were based on the projected population in the year 2000. The dose commitments from normal operations of the proposed White Mesa mill will represent only very small increases from those due to current background radiation sources. Radiation dose commitments to individuals living in nearby residences will not be permitted to exceed the 25-millirems-per-year EPA limit (40 CFR Part 190).

Annual population dose commitments
to the population within an 80-km
(50-mile) radius of the plant site in the year 2000

	Dose (man-rems/yr)	
Receptor organ	Plant effluents	Natural background
Total body	3.4	7,500
Lung	7.1	7,500
Bone	6.4	7,500
Bronchial epithelium	13.2	23,000

d. Construction and operation of the White Mesa mill will require the commitment of small amounts of chemicals and fossil fuels, relative to their abundance.

e. Construction and operation of the White Mesa mill will provide employment and induced economic benefits for the region, but may also result in some socioeconomic stress.

f. The area devoted to the milling operations will be reclaimed after operations cease, but the approximately 135 ha (333 acres) tailings area may be unavailable for further productive use. However, when reclamation is completed and testing shows that radiation levels have been reduced to acceptable levels, it may be possible to return the tailings area to its former use as grazing land.

g. Historical and archeological surveys have identified archeological and historic sites within the proposed project area. Pursuant to 36 CFR Part 63.3, the NRC requested a determination from the Secretary of the Interior that the area on which the archeological sites are located is eligible for inclusion in the National Register of Historic Places (National Register) as an Archeological District. The resulting determination was that the White Mesa Archeological District is eligible for inclusion in the National Register. Although a similar request was made for determinations of eligibility for the historic sites, these determinations await supplementary documentation. It is anticipated that the NRC will enter into a Memorandum of Agreement under 36 CFR Part 800, "Procedures for the Protection of Historic and Cultural Properties," to ensure adequate mitigation of impacts to cultural resources.

4. Principal alternatives considered are as follows:

a. alternative sites for the mill,
b. alternative mill processes,
c. alternative of using an existing mill,
d. alternative methods for tailings management,
e. alternative energy sources, and
f. alternative of no licensing action on the mill.

5. The following Federal, State, and local agencies were asked to comment on the Draft Environmental Statement:

Department of Commerce
Department of the Interior
Department of Health, Education, and Welfare
Federal Energy Regulatory Commission
Department of Energy
Department of Transportation
Environmental Protection Agency
Department of Agriculture
Advisory Council on Historic Preservation
Department of Housing and Urban Development
Utah Board of Health
Utah State Planning Coordinator
Utah Division of Oil, Gas, and Mining

6. This Final Environmental Statement was made available to the public and to the specified agencies in May 1979.

7. On the basis of the analysis and evaluation set forth in this Environmental Statement, it is proposed that any license issued for the White Mesa mill should be subject to the following conditions for the protection of the environment.

a. The applicant shall construct the tailings disposal facility to incorporate the features described in Alternative 1 of Sect. 10.3 and in Sect. 3.2.4.7 and to meet the safety criteria specified in NRC Regulatory Guide 3.11.

b. The applicant shall implement an interim stabilization program that minimizes to the maximum extent reasonably achievable dispersal of blowing tailings. This program shall include the use of written operating procedures that specify the use of specific control methods for all conditions. The effectiveness of the control methods used shall be evaluated weekly by means of a documented tailings area inspection.

c. The applicant shall implement the environmental monitoring program summarized in Table 6.2 of this document. The applicant shall establish a control program that shall include written procedures and instructions to control all environmental monitoring prescribed herein and shall provide for periodic management audits to determine the adequacy of implementation of these environmental controls. The applicant shall maintain sufficient records to furnish evidence of compliance with these environmental controls. In addition, the applicant shall conduct and document an annual survey of land use (grazing, residences, etc.) in the area surrounding the proposed project.

d. Before engaging in any activity not assessed by the NRC, the applicant shall prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not assessed, or that is greater than that assessed in this Environmental Statement, the applicant shall provide a written evaluation of such activities and obtain prior approval of the NRC for the activity.

e. If unexpected harmful effects or evidence of irreversible damage not otherwise identified in this Environmental Statement are detected during construction and operation, the applicant shall provide to the NRC an acceptable analysis of the problem and a plan of action to eliminate or reduce the harmful effects or damage.

f. The applicant shall conduct a meteorological monitoring program as specified in Section 6.1 of this document. The data obtained from this program shall be tabulated and made available for NRC inspection.

g. The applicant shall provide for stabilization and reclamation of the mill site and tailings disposal areas and mill decommissioning as described in Alternative 1 of Section 10.3 and in Section 3.3 of this document.

h. The applicant shall provide surety arrangements to ensure completion of the mill site and tailings area stabilization, reclamation, and decommissioning plans.

i. The applicant shall consult and coordinate with the Utah Division of Wildlife Resources regarding the extent of fencing and other ways to mitigate any adverse impacts that may occur to deer.

j. The applicant shall routinely monitor the tailings discharge system at 4-hr intervals and document the results. The applicant shall monitor the use of the impoundment by wildlife in conjunction with the program to monitor the tailings discharge system.

8. On the basis of the analysis and evaluation set forth in this Environmental Statement, it is proposed that any license issued for the White Mesa mill should be subject to conditions for the protection of historic, archeological, architectural, and cultural resources. The conditions should be similar to those outlined in the proposed Memorandum of Agreement in Appendix E.

9. The position of the NRC is that, after weighing the environmental, economic, technical, and other benefits of the operation of the White Mesa Uranium Project against environmental and other costs and after considering available alternatives, the action called for under the National Environmental Policy Act of 1969 and 10 CFR Part 51 is the issuance of a Source Material License subject to conditions 7a through 7j and in 8, above.

As announced in a *Federal Register* notice dated 3 June 1976 (41 FR 22430), the NRC is preparing a generic environmental statement on uranium milling. Although it is the NRC's position that the tailings impoundment method discussed in this Statement represents the most environmentally sound and reasonable alternative now available at this site, any NRC licensing action will be subject to express conditions that approved waste-generating processes and uranium mill tailings management practices may be subject to revision in accordance with the conclusions of the final generic environmental impact statement and any related rule making.

1. INTRODUCTION

1.1 THE APPLICANT'S PROPOSAL

Pursuant to Title 10, *Code of Federal Regulations* (CFR), Part 40.31 and to 10 CFR Part 51, Energy Fuels Nuclear, Inc. (the applicant), on February 6, 1978, applied to the Nuclear Regulatory Commission (NRC) for an NRC Source Material License to construct and operate a uranium processing mill. This mill, hereafter referred to as the White Mesa Uranium Project, will process ores from independent and company-owned mines. There will be no uranium mining at the project site.

The project will consist of construction and operation of a mill with a nominal processing capacity of 1800 metric tons (MT; 2000 tons) per day with provision for recovery of vanadium as well as uranium.

The applicant presently controls by ownership, lease, or contract, ore reserves of approximately 8600 MT (9500 tons) of U_3O_8 with an average ore grade of 0.125%. The proposed operating schedule is 24 hr/day, 340 days per year. At this schedule, there are about 11 years of ore supply. The applicant has designed for a 15-year project lifetime with the expectation that other ore sources will be discovered later. Based on these figures and a 94% recovery, the mill will produce approximately 730 MT (800 tons) of U_3O_8 per year.

Waste materials (tailings) from the mill will be produced at about 1800 MT (2000 tons) of solids per day and stored onsite. Sequential preparation, filling, and reclamation of tailings impoundment cells are planned (Sect. 3.2.4.7). This will decrease the amount of tailings exposed (and radon exhaled) during operation of the mill.

In accordance with NRC Guides 3.5 and 3.8, the applicant has submitted a Source Material License Application (Form AEC-2),[1] an Environmental Report (ER),[2] and supplements to the ER in response to questions by the NRC staff.

1.2 BACKGROUND INFORMATION

The proposed Energy Fuels Nuclear, Inc., mill will be located in San Juan County, Utah, about 8 km (5 miles) south of Blanding, Utah (Fig. 1.1). Ore for the mill feed will be provided through two existing ore buying stations, one near Hanksville in Wayne County, Utah, and the other adjacent to the planned mill on the same site (Fig. 2.1). These buying stations, owned by Energy Fuels, purchase ore from independent mines and will also receive ore from company-owned mines.

The surface area of the project site is owned by Energy Fuels Nuclear, Inc., or controlled by mill site claims. The mill will occupy about 20 ha (50 acres) of the site, including 6 ha (16 acres) presently occupied by the existing ore buying station. At the end of the proposed 15-year project lifetime, the tailings disposal cells will occupy approximately another 135 ha (333 acres).

The purpose of this Environmental Statement is to discuss in detail the environmental effects of project construction as well as monitoring and mitigating measures proposed to minimize the effects of the project on the immediate area and surrounding environs.

1.3 FEDERAL AND STATE AUTHORITIES AND RESPONSIBILITIES

Under 10 CFR, Part 40, an NRC license is required in order to "receive title to, receive, possess, use, transfer, deliver ... import ... or export ... source material ..." (i.e.,

uranium and/or thorium in any form or ores containing 0.05% or more of uranium, thorium, or combinations thereof). 10 CFR Part 51 provides for the preparation of a detailed Environmental Statement pursuant to the National Environmental Policy Act of 1969 (NEPA) prior to the issuance of an NRC license to authorize uranium milling.

The NEPA became effective on January 1, 1970. Pursuant to Section 102(2)(C), in every major Federal action significantly affecting the quality of the human environment, Federal agencies must include a detailed statement by the responsible official on

1. the environmental impact of the proposed action,
2. any adverse environmental effects that cannot be avoided should the proposal be implemented,
3. alternatives to the proposed action,
4. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
5. any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

This detailed Environmental Statement has been prepared in response to the above requirements.

The State of Utah implements other rules and regulations affecting the project through necessary permits and approvals provided by State agencies. The Utah Division of Oil, Gas, and Mining is the responsible agency for all mine and mill sites within the State under the "Utah Mined Land Reclamation Act of 1975." Title II of the "Uranium Mill Tailings Radiation Control Act of 1978" gives the NRC direct licensing authority over uranium mill tailings. Bonding arrangements will be required to assure funding for reclamation of the tailings impoundment and mill site grounds and for decommissioning of the facility.

1.4 STATUS OF REVIEWS AND ACTIONS BY FEDERAL AND STATE AGENCIES

The only regulatory action required from the NRC is the issuance of a Source Material License. In addition, before construction and operation of the White Mesa Uranium Project can be completely implemented, the State of Utah requires that permits or licenses be obtained prior to the initiation of various stages of construction and operation of the mill. The current status of these regulatory approvals and permits is given in Table 1.1.

1.5 NRC MILL LICENSING ACTIONS

In June 1976 [*Fed. Regist.* 41(108): 22430-22431 (June 3, 1976)], the NRC specified that applicants requesting a Source Material License prior to the NRC's issuance of its generic environmental impact statement on uranium milling (scheduled for release in 1979) should address five criteria that will be weighed by the Commission in licensing and relicensing actions. These criteria are considered below as they apply to the White Mesa Uranium Project.

1. *It is likely that each individual licensing action of this type would have a utility that is independent of the utility of other licensing actions of this type.*

   This statement is manifestly true for uranium mills in general and for the White Mesa mill in particular. This mill is located near multiple mining operations producing low-grade ore (≈0.13%). The costs of hauling this ore over longer distances make this project virtually independent of other milling operations. This milling project can be considered on its own merits, licensing actions with respect to other mills are independent of this mill, and a separate cost-benefit analysis can be performed.

Radon-222 gas is expected to be released in significant quantities from dry tailings areas. Releases from saturated tailings, or tailings that are under water, are severely limited due to the low diffusivity of radon gas in water. The staff assumes that two 40-ha (100-acre) cells may be drying prior to reclamation while a third cell is being filled. Radon releases from the driest cell (8% moisture content), the other cell drying out prior to reclamation (15% moisture content), and the beach area of the filling cell (50% beach, 37% moisture content) are estimated to be 5550 Ci/yr, 2480 Ci/yr, and 30 Ci/yr, respectively (see Appendix F for details). The total annual radon-222 release is estimated to be 8060 Ci/yr. Radon releases from underwater tailings materials or reclaimed tailings cells are insignificant in comparison and have been ignored.

3.2.4.8 Uranium concentrate transportation

The uranium concentrate will be transported in 55-gal drums by truck because no rail transportation is available at the site. Uranium shipment, about 2000 drums each year, will result in an external radiation dose[5] to an individual of 2 mR/hr at any edge of the truckbed. Under normal operating conditions, no significant release of radioactive particulates would occur. However, release could occur during transportation accidents as discussed in Sect. 5.3.1.

3.2.4.9 Source terms

Sections 3.2.4.1 through 3.2.4.8 describe the nature and quantity of radioactive effluents conservatively estimated to be generated by milling operations at the White Mesa Uranium Project. Estimates employed in the above discussions were derived from project design parameters and data from similar mills.[6-37] The estimates reflect operation of the fully developed mill and tailings area. Initial releases from the tailings area will be lower than the estimated values for several years after startup. Therefore, the use of full-scale operation as the basis for estimates adds some additional conservatism to the analysis. Table 3.2 gives the design parameters used in estimates of radioactive release rates. The source terms for the milling operations and areas are presented in Table 3.3.

3.3 INTERIM STABILIZATION, RECLAMATION AND DECOMMISSIONING

3.3.1 Interim stabilization of the tailings area

Interim *stabilization* is defined as measures to prevent the dispersion of tailings particles by wind and water outside the immediate tailings retention area. Such measures will be required at the White Mesa mill during the 15 years of operation (for in-use and drying cells) and the years required to dry the final tailings cell and evaporation cells after operation (see Sects. 3.2.4.7 and 10.3.2, Alternative 1) prior to reclamation.

As a license condition, the staff will require that the applicant implement an interim stabilization program which minimizes dispersal (via airborne particulates) of blowing tailings to the maximum extent reasonably achievable. The program shall include the use of written operating procedures that specify the use of specific control methods for all conditions. The effectiveness of this control measure shall be checked at least weekly by means of a documented site inspection.

3.3.2 Reclamation of the mill tailings area

In accordance with the Utah Mined Land Reclamation Act of 1975 and the requirements of the NRC, the applicant has prepared a stabilization plan for the tailings area. The goal of the applicant's plan is to meet the performance objectives for tailings management (Sect. 10.3.1).

The proposed reclamation program calls for a 0.6-m (2.0-ft) layer of compacted clay, a 1.2-m (4-ft) layer of silt-sand overburden material, and a 1.8-m (6-ft) layer of rock overburden material over the tailings area. The proposed cover is considered sufficient to reduce

The cover would also be graded and sloped at a grade of 2% or less to prevent impoundment of surface runoff. Slopes on the perimeter of the cover would be no steeper than 6:1 (horizontal to vertical) and would be constructed of riprap. A layer of topsoil 0.15 m (0.5 ft) thick will be placed over the cover. The area would be fertilized and revegetated with a suitable mixture of grasses, forbs, and shrubs. Grasses and shrubs whose root structures would penetrate the cover will not be planted. The approximate volumes of material required would be 7.38×10^5 m^3 (9.65×10^5 yd^3) of clay, 1.76×10^6 m^3 (2.30×10^6 yd^3) of overburden, 2.2×10^6 m^3

Table 3.2. Principal parameter values used in the radiological assessment of the White Mesa Uranium Project

Parameter	Value[a]
General data	
Average ore grade, % U_3O_8	0.15
Ore concentration, pCi of U-238 and daughters per gram	423
Ore processing rate, MT/day	1800
Days of operation per year	340
Blanding ore crusher	
Ore processing rate, MT/day	1800
Fraction released as particulates	4×10^{-7}
Fraction of radon released	0.1
Dust:ore concentration ratio	2.5
Ore storage piles[b]	
Actual area, ha (acres)	2.4 (6)
Effective dusting area, ha (acres)	3.0 (7.3)
Annual average dust loss rate, $g/m^2 \cdot sec$	1.8×10^{-7}
Dust:ore concentration ratio	2.5
Semiautogenous grinder	
Ore processing rate, MT/day	1800
Fraction released as particulates	1×10^{-6}
Fraction of radon released	0.2
Dust:ore concentration ratio	2.5
Yellow cake drying and packaging	
Fraction U to yellow cake	0.94
Fraction Th to yellow cake	0.05
Fraction Ra and Pb to yellow cake	0.002
Annual U_3O_8 production, MT	863
Annual yellow cake production, MT	959
Fraction of yellow cake to scrubber	0.012
Scrubber release fraction	0.01
Tailings impoundment system[b,c]	
Fraction U to tailings	0.06
Fraction Th to tailings	0.95
Fraction Ra and Pb to tailings	0.998
Area, ha (acres) per cell	40 (100)
Area subject to dusting, ha (acres)	100 (250)
Annual average dust loss rate, $g/m^2 \cdot sec$	1.8×10^{-5}
Dust:tails concentration ratio	2.5

[a] Parameter values presented here are those selected by the staff for use in its radiological impact assessment of the White Mesa Uranium Project. These values, which include emissions from the Blanding ore buying station, represent conservative selections from ranges of potential values in instances where insufficient data has been available to be more specific.

[b] Appendix F provides additional information regarding the calculation of radon releases.

[c] Effective dusting area is 36 ha (90 acres); 20% of two 40-ha (100-acre) cells drying prior to reclamation and 50% of a 40-ha (100-acre) operational cell.

(2.89×10^6 yd^3) of rock, and 2.2×10^5 m^3 (2.88 yd^3) of topsoil. Staged constructed, operation, and reclamation will minimize stockpiling and handling requirements.

The reclamation plans have been developed from recommendations from the U.S. Department of Agriculture (USDA) Soil Conservation Service and Forest Service (ER, Sect. 9.4). These plans are also in accordance with the regulations of the State of Utah Division of Oil, Gas, and Mining.[38,39]

Table 3.3. Estimated annual releases of radioactive materials resulting from the White Mesa Uranium Project

Source	Annual releases (Ci)[a]			
	U-238	Th-230	Ra-226	Rn-222
Blanding ore crusher	2.6×10^{-4}	2.6×10^{-4}	2.6×10^{-4}	2.6 X 10
Ore storage piles	1.7×10^{-4}	1.7×10^{-4}	1.7×10^{-4}	2.4×10^{2}
Secondary crusher	6.5×10^{-4}	6.5×10^{-4}	6.5×10^{-4}	5.2 X 10
Yellow cake scrubber	2.9×10^{-2}	1.6×10^{-3}	6.2×10^{-5}	0.0
Tailings system	1.3×10^{-2}	2.0×10^{-1}	2.1×10^{-1}	8.1×10^{3}

[a] Releases of other isotopes in the U-238 decay chain are included in the radiological impact analysis. These releases are assumed to be identical to those presented here for parent isotopes. For instance, the release rate of U-234 is taken to be equal to that for U-238.

The project site will be revegetated to return it to the original uses of grazing and wildlife habitation. The soils are relatively uniform and adequate for these reclamation procedures (ER, Sect. 9.1.1). The reclamation schedule for the tailings impoundment site is depicted in Fig. 3.9. The tailings cells will be reclaimed sequentially as each cell is filled, beginning after about the fourth year of operation and every four years thereafter until termination of project operations. A clay cap [0.6 m (2 ft)], and onsite clayey-silt soil [1.2 m (4 ft)], and rock overburden [1.8 m (6 ft)], will be placed over the dried tailings. Except for the rock-lined drainage ditches, rock-filled slopes along the edges of the soil-covered tailings cells, and the rock-filled southernmost dike of cell 5, about 0.15 m (0.5 ft) of topsoil will be placed on the surface of all disturbed areas and seeded with a mixture of grasses, forbs, and shrubs (Table 3.4). Any excess rock will be disposed of at the 14.6-ha (36-acre) borrow area prior to its reclamation.

The applicant's selection of seeds is representative of the vegetation on the site prior to construction and will suffice in reclaiming the site to the preconstruction land condition. The staged reclamation plan will permit optimizing the seed mixture for a maintenance-free vegetative cover which will maximize soil stability. In the long term native vegetation is expected to return to the area. The seed should be obtained from those areas that have soil characteristics and climate similar to the project site.[40]

The mixture of seed will be planted in November with a rangeland drill. Because soil nitrogen is low (ER, Sect. 2.10.1), it may be necessary to apply an appropriate fertilizer prior to seeding. The applicant claims that the topsoil will contain sufficient debris so that mulching will not be required. However, by the time reclamation begins, much of the debris will be decomposed. Mulches increase infiltration and reduce erosion and evaporation, thereby encouraging seed germination and plant growth. Therefore, it may be necessary to crimp mulch into the soil of all disturbed areas prior to seeding. Revegetated areas will be monitored (Sect. 6.2.2).

The staff notes that the information developed in the Generic Environmental Impact Statement on Uranium Milling being prepared by NRC could be used to modify or change the procedures proposed herein. The generic statement will contain the results of ongoing research to assess the environmental impacts of uranium mill tailings ponds and piles, and will suggest means for mitigating any adverse impacts. The current NRC licensing action regarding the White Mesa mill will be subject to revisions based on the conclusions of the Final Generic Environmental Impact Statement on Uranium Milling Operations and any related rule making.

The applicant will be required to make financial surety arrangements to cover the costs of reclaiming the tailings disposal area and of decommissioning the mill.

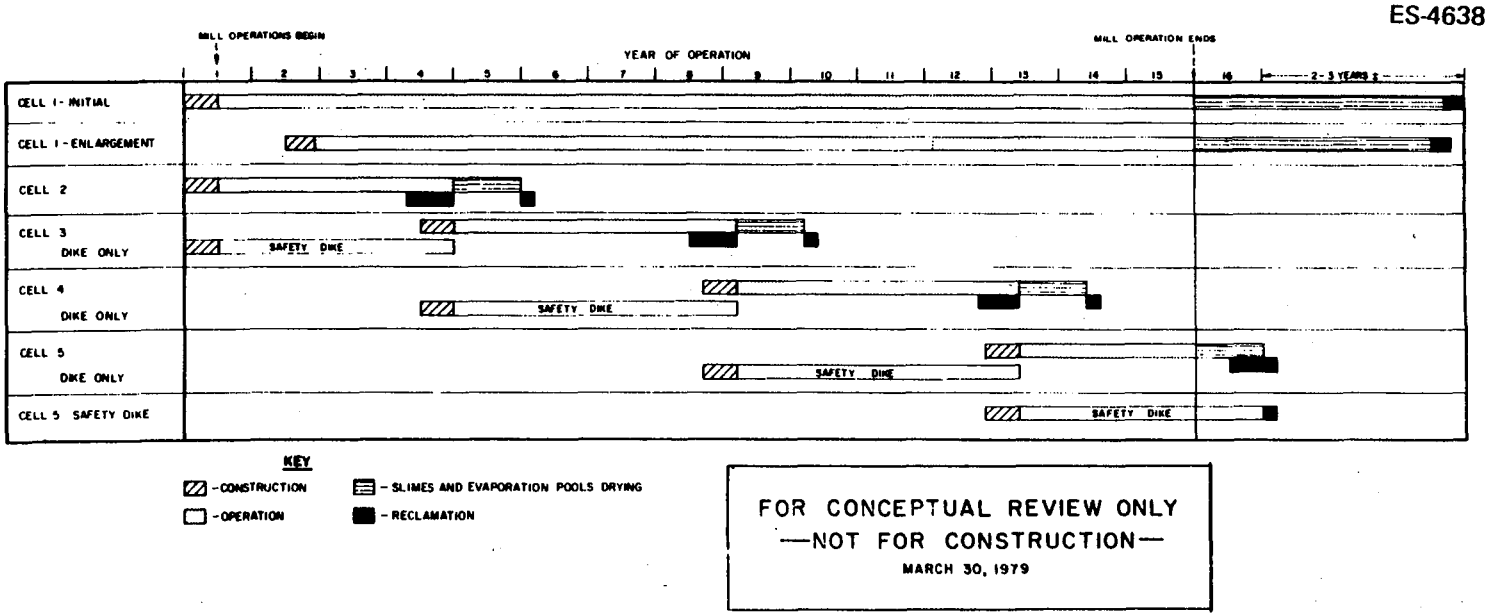

Fig. 3.9. System schedule. Source: Energy Fuels Nuclear, Inc., "Transmittal of Conceptual Review Construction Drawing Set and Synopsis, Tailings Management System, White Mesa Uranium Project, Blanding, Utah," Apr. 2, 1979.

Table 3.4. Species, seeding rates, and planting depths of tentative seed mixture to be used in reclamation of the project site

Species	Seeding rate		Depth	
	kg/ha	lb/acre	cm	in.
Grasses				
"Luna" pubescent wheatgrass	6.16	5.5	0–0.64	0–0.25
Fairway (crested) wheatgrass	1.68	1.5	0–0.64	0–0.25
Forbs				
Yellow sweetclover	1.12	1.0	1.27–2.54	0.5–1.0
Palmer penstemon	0.112	0.1	0–0.64	0–0.25
Alfalfa	1.12	1.0	1.27–2.54	0.5–1.0
Shrubs				
Fourwing saltbush	0.56	0.5	0.64–1.27	0.5–1.0
Common winterfat	0.56	0.5	0.64–1.27	0.5–1.0
Big sagebrush	0.112	0.1	0.64–1.27	0.5–1.0
Total	11.424	10.2		

Source: Energy Fuels Nuclear, Inc., *Source Materials License Application, White Mesa Uranium Mill, Blanding, Utah*, Denver, Sept. 26, 1978.

Prior to the termination of the license the NRC will require that the reclaimed tailings impoundment area be deeded to the Federal government.

In addition, although revegetation is an effective erosion control method under normal climatic and edaphic conditions, it is not known whether continued growth of vegetation can be assured at this site without irrigation or other supportive measures. Therefore, to assure that a stable cover will be established, the staff recommends that riprap (or gravel cover) over the entire basin be planned as an optional erosion control method. The final choice between gravel and vegetation can be made based on some years of testing and research currently in progress, and on the performance of various reclamation schemes which are completed in the interim.

3.3.3 Decommissioning

Near the end of the useful life of this project and prior to the termination of the license the NRC will require a detailed decommissioning plan for the White Mesa mill, which will contain plans for decontamination, dismantling, and removing or burying all buildings, machinery, process vessels, and other structures and cleanup, regrading and revegetation of the site. This detailed plan will include data from radiation surveys taken at the site and plans for any mitigating measures that may be required as a result of these surveys and NRC inspections. Before release of the premises or removal of the buildings and foundations, the licensee must demonstrate that levels of radioactive contamination are within limits prescribed by NRC and the then-current regulations. Depending on the circumstances, the NRC may require that the applicant submit an Environmental Report on decommissioning operations prior to termination of the license.

4. ENVIRONMENTAL IMPACTS

4.1 AIR QUALITY

4.1.1 Construction

The major nonradiological air pollutants associated with construction of the mill facility will be gaseous emissions from internal combustion engines and fugitive dust generated from moving vehicles and wind erosion. In general, these emissions will not produce significant impacts to air quality.

The maximum expected emission rate for any of the major pollutants (NO_2, SO_2, CO, and hydrocarbons) from each piece of construction equipment is less than 0.2 g/sec.[1] Using conservative χ/Q (sec/m^3) values (Appendix H, Table H.1), the staff calculated the annual atmospheric concentration of each pollutant per vehicle to be less than 1 $\mu g/m^3$ at the property boundary in the direction of the prevailing wind.

Fugitive dust associated with construction of the facility will average about 0.4 to 0.7 MT/ha (1 to 2 tons/acre) per month.[2] Based on a total of about 142 ha (344 acres) disturbed at any one time (Sect. 4.2.1), about 121 to 241 g/sec of particulates will be emitted. Annual average atmospheric concentrations of particulates were calculated by the staff using the χ/Q values (Appendix H, Table H.1) for the 16 compass directions at a distance of 2.4 km (1.5 miles). The average of these 16 concentrations indicates that particulate loading due to construction will range from 26 to 53 $\mu g/m^3$ (Table 4.1). These are conservative calculations because the χ/Q values assume a point source; the construction activities actually will be widespread, creating many scattered, diffuse sources. Furthermore, the larger dust particles would deposit rapidly, another condition not accounted for in the calculation. Although dust could cause occasional localized degradation of air quality at the site, the duration will be only during the construction phase. To minimize fugitive dust, the applicant will frequently water exposed areas and heavily traveled areas, and all vehicles will be operated at a reduced speed.[3]

4.1.2 Operation

Air quality during operation of the facility could be affected by atmospheric releases principally from the building and processing boiler, yellow cake and vanadium dryers, tailings disposal system, and ore stockpiles. The applicant's consultant's estimates of emissions from each primary source and their release heights are listed in Table 4.2. The staff estimates (Sect. 3) are somewhat different, but the conclusions drawn (below) remain the same. In addition, insignificant quantities will be released from other sources including the coal stockpiles, ore transport systems, and acid leach system. Atmospheric dispersion coefficients (χ/Q) for each release height are listed in Appendix H, Tables H.1 through H.4. Assuming all processes are operating simultaneously, annual atmospheric concentrations of particulates, SO_2, and NO_x at the property boundary in the direction of the prevailing wind were calculated by the staff to be approximately 13, 9, and 4 $\mu g/m^3$ respectively. These concentrations are well below applicable Federal and State air quality standards (Table 4.1). For reasons stated earlier, the particulate concentrations are quite conservative. The applicant calculated the atmospheric concentrations of the major pollutants using the CRSTER program, a program used by the U.S. Environmental Protection Agency.[4] Calculations were for five distances: 2, 4, 6, 8, and 10 km (3.2, 6.4, 9.7, 12.9, and 16.1 miles). Concentrations were the largest at the 2-km (3.2-mile) distance and are as follows: particulates, annual average = 0.26 $\mu g/m^3$, 24-hr average = 3.7 $\mu g/m^3$; SO_2, annual average = 1.1 $\mu g/m^3$, 24-hr average = 15.4 $\mu g/m^3$, 3-hr average = 66.6 $\mu g/m^3$; NO_x, annual average = 0.51 $\mu g/m^3$.

Although operation of the mill facility should not have any significant impact on air quality, Utah's Air Conservation Regulations[5] require that air pollution control equipment and processes be selected and operated to provide the highest efficiencies and the lowest discharge rates that are reasonable and practical. While the degree of control is subject to approval by the State Air Conservation Committee, the control must be a minimum of 85%. Utah regulations also restrict the sulfur content of coal and oil, used as fuels, to no greater than 1.0 and 1.5% respectively.

Table 4.1. Federal and State of Utah air quality standards

Pollutant	Averaging time[a]	Primary standard	Secondary standard
Nitrogen dioxide[b]	Annual	0.05 ppm (100 $\mu g/m^3$)	0.05 ppm (100 $\mu g/m^3$)
Sulfur dioxide	Annual	0.03 ppm (80 $\mu g/m^3$)	
	24 hr	0.14 ppm (365 $\mu g/m^3$)	
	3 hr		0.5 ppm (1300 $\mu g/m^3$)
Suspended particulates	Annual geometric mean	75 $\mu g/m^3$	60 $\mu g/m^3$
	24 hr	260 $\mu g/m^3$	150 $\mu g/m^3$
Hydrocarbons (corrected for methane)	3 hr 6 to 9 AM	0.24 ppm[c] (160 $\mu g/m^3$)	0.24 ppm (160 $\mu g/m^3$)
Photochemical oxidants	1 hr	0.08 ppm (160 $\mu g/m^3$)	0.08 ppm (160 $\mu g/m^3$)
Carbon monoxide	8 hr	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1 hr	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)

[a] All standards except annual average are not to be exceeded more than once a year.
[b] Nitrogen dioxide is the only one of the nitrogen oxides considered in the ambient standards.
[c] Maximum 3 hr concentration between 6 and 9 AM.
Source: ER, Table 2.7–19.

Table 4.2. Emission rates, sources, and release heights of major air pollutants associated with operation of the White Mesa mill

Air pollutant and source	Emission rate (g/sec)	Release height (m)
Suspended particulate		
Boiler	1.0	27.4
Yellow cake dryer	0.05	13.7
Vanadium dryer	0.06	13.7
Tailings	1.01	1.0
Ore stockpiles	1.08	3.0–6.0
SO_2		
Boiler	4.0	27.4
Yellow cake dryer	0.25	13.7
Vanadium dryer	0.25	13.7
NO_x		
Boiler	2.0	27.4
Yellow cake dryer	0.06	13.7
Vanadium dryer	0.06	13.7

Sources: Dames and Moore, "Responses to Comments from the U.S. Nuclear Regulatory Commission, June 7, 1978, White Mesa Uranium Project Environmental Report," Denver, June 28, 1978; Dames and Moore, "Supplemental Report, Meteorology and Air Quality, Environmental Report, White Mesa Uranium Project, San Juan County, Utah, for Energy Fuels Nuclear, Inc.," Denver, Sept. 6, 1978; Dames and Moore, "Responses to Comments Telecopied from NRC to Energy Fuels Nuclear, 25 September 1978," Denver, Oct. 4, 1978.

Regulations promulgated by the U.S. Environmental Protection Agency[6] require any major source of air pollutants to comply with the Prevention of Significant Deterioration (PSD) regulations. The White Mesa Uranium Project is currently being evaluated by the appropriate regulatory authorities to ascertain if the project is defined as a major source. If the project is deemed to be a major source, then the applicant will be required to file for the appropriate PSD permit and to comply with all regulations therein. Initial indications are that the atmospheric concentrations of pollutants associated with mill operation will be well within the PSD allowable increments.

Southeastern Utah, known for its scenic qualities (Sect. 2.5.2.2), attracts many visitors. Stack emissions (primarily steam) will be visible to the public traveling Highway 163 east of the site. However, they are not expected to be visible from major recreational areas in the vicinity. The closest historical site included in the National Register of Historic Places (National Register) is located about 10 km (6 miles) north of the proposed mill site (Table 2.17).

4.2 LAND USE

4.2.1 Land resources

4.2.1.1 Nonagricultural

The proposed White Mesa Uranium Project is not expected to alter the basic pattern of land ownership in the area (Table 2.15). Area land uses will change, however, as a result of the proposed mill. About 600 ha (1480 acres) are owned by Energy Fuels Nuclear, Inc.; roughly 195 ha (484 acres) will be directly used during operations (Sect. 2.5.1) for milling, ore buying, and tailings disposal. Increased residential and commercial land use is expected in neighboring communities to serve mill-produced population growth (Sects. 4.8.1 and 4.8.2). The volume of traffic using the highways in this area is also expected to grow substantially (Sect. 4.8.5), and mineral extraction is expected to increase in the project area in response to the mill's demand for uranium ore (Sect. 4.8.1.2).

4.2.1.2 Agricultural

Construction and operation of the facility will disturb about 20 ha (50 acres) directly (Table 4.3). In addition, the tailings will cover a total of about 135 ha (333 acres), and 39 ha (98 acres) will be used for stockpile and borrow areas. Because the tailings disposal system will be constructed as six separate cells (two cells for evaporation and four for tailings disposal), with a full tailings cell being reclaimed as a new cell is opened, a total maximum surface area of about 89 ha (222 acres) will be disturbed at any one time by the tailings system. Also, a maximum of about 15 ha (36 acres) of borrow area will be exposed at any given time. Therefore, total land area disturbed at any one time by construction and operation of the mill facilities will be about 141 ha (343 acres). However, until all operations have terminated, at least 195 ha (484 acres) will be unavailable for grazing. Based on the capacity of the tailings cells, the mill has a potential to operate 15 years. The duration of the impact will be somewhat longer than this depending on the time required for construction, the length of time between disturbance and reclamation, and the length of time it takes for a suitable vegetative cover to become established on each reclaimed area. Therefore, a realistic estimate of the amount of time the land will be disturbed is about 20 years.

Upon termination of the mill operations, all remaining disturbed areas will be reclaimed to ultimately restore the land to its original grazing use (Sect. 3.3.2). Loss of nearly 195 ha (484 acres) of grazing land each year the land is disturbed represents less than 0.1% of the private rangeland in San Juan County (Table 2.16). With successful reclamation (Sect.3.3.2), this land could be returned to its original grazing capacity.

4.2.2 Historical and archeological resources

As discussed in Sect. 2.5.2.1, a historical survey was conducted. Of the six historical sites identified during that survey, five were considered to be eligible for inclusion in the National Register of Historic Places (National Register). Pursuant to 36 CFR Part 63.3, a request on March 28, 1979, for determinations of eligibility for the historic sites was submitted and is currently under review. Of the five sites considered eligible, only one ("Earthen Dam") will be adversely affected by the mill project, and mitigation will be specified if the site is in fact eligible. (See the proposal for a Memorandum of Agreement in Appendix E.)

10.4 ALTERNATIVE OF USING AN EXISTING MILL

The option of utilizing existing ore processing mills requires the evaluation of numerous factors, including (1) the method and distance of mine-to-mill transport, (2) variations in ore grade, (3) quality of haul roads, (4) total tonnage to be transported, (5) haulage schedules, (6) traffic and weather conditions, (7) possible interim transfer and storage costs, (8) handling and milling costs, and (9) environmental costs and benefits.

The nearest currently operating uranium ore processing facilities (in relationship to the applicant's Hanksville and Blanding ore buying stations) are located in Moab, Utah; La Sal, Utah; and Uravan, Colorado. The approximate highway distances of these mills from the Hanksville and Blanding stations are, respectively, Moab, 189 km (118 miles) and 134 km (84 miles); La Sal, 243 km (152 miles) and 74 km (46 miles); and Uravan, 339 km (212 miles) and 170 km (106 miles).

Although the mill located in La Sal (Humeca) is reasonably close to the Blanding ore buying station, it would have drawbacks as an ore processing alternative for the following reasons:

1. The Humeca mill utilizes an alkaline leach process. Although tests conducted by the applicant indicated that some of the ores bought by its ore buying stations could be successfully treated by alkaline leaching, higher recovery rates could be obtained with acid for the majority of the ores. Because most of the ores are low grade (about 0.125%), any significant lowering of recovery rates would decrease the economic feasibility of ore shipment from the scattered, small mining operations.

2. Currently, only ore from a company-owned and company-operated mine is being processed; therefore, it is questionable whether the mill has the capacity, processing capability or the willingness to accept additional ore.

The mills at Moab and Uravan utilize acid leaching (the Moab mill also has an alkaline leach circuit); therefore, with process adjustments, acceptable recovery rates could be obtained. However, primarily because of high haulage costs and the limited capabilities of the mills to process additional ore, the staff has concluded that processing the ores at either or at both of these mills is not feasible. Assuming that (1) transportation costs are 10¢ per ton-mile[6] and (2) the average grade of the ore bought at the applicant's Hanksville and Blanding ore-buying stations will be 0.125%, the staff estimates that, if the ore is shipped to these currently operating mills, costs of producing each pound of U_3O_8 would increase by the following amounts for additional transportation costs alone (i.e., does not include incremental cost for toll milling):

1. Moab mill – $3.20 per pound.

2. Humeca mill (La Sal) – $3.04 per pound.

3. Uravan mill – $7.84 per pound.

Transporting the ores to existing mills could reduce the total land requirements for processing the ores. However, the environmental costs associated with uranium ore processing and tailings disposal would not be decreased and would only be shifted away from the Blanding area to the area of the mill receiving the ore. If the proposed mill is not constructed, there is a high probability that other mills (or expansions in capacity of existing mills) will be proposed in the area to process the ore now programmed for the applicant's mill. If no mills (or expansions) are constructed, a substantial economic base for the Hanksville-Blanding area will be removed because many of the small independent mines would not be economically viable.

Exhibit 3

Energy Fuels Resources (USA) Inc.
225 Union Blvd. Suite 600
Lakewood, CO, US, 80228
303 974 2140
www.energyfuels.com

August 10, 2016

Sent VIA OVERNIGHT DELIVERY

Mr. Scott Anderson
Director
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality
195 North 1950 West
P.O. Box 144880
Salt Lake City, UT 84114-4820

Re: Transmittal White Mesa Uranium Mill Reclamation Plan, Revision 5.1

Dear Mr. Anderson:

Pursuant to discussions with the Division of Waste Management and Radiation Control ("DWMRC") regarding the Stipulated Consent Agreement for the Cell 2 cover activities, enclosed are two copies of the White Mesa Uranium Mill Reclamation Plan, Revision 5.1. Also enclosed are two CDs each containing a word searchable electronic copy of the document.

If you should have any questions regarding this transmittal please contact me at 303-389-4160 or Kathy Weinel at 303-389-4134.

Yours very truly,

ENERGY FUELS RESOURCES (USA) INC.
Harold R. Roberts
Executive Vice President Conventional Operations

CC: David C. Frydenlund
Kathy Weinel
David Turk
Logan Shumway
Scott Bakken

Reclamation Plan

White Mesa Mill

Blanding, Utah

Radioactive Materials License No. UT1900479

Revision 5.1

August 2016

Prepared by:
Energy Fuels Resources (USA) Inc.
225 Union Blvd., Suite 600
Lakewood, CO 80228

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2 EXISTING FACILITY

The following sections describe the construction history of the Mill; the Mill and Mill tailings management facilities; Mill operations including the Mill circuit and tailings management; and both operational and environmental monitoring.

2.1 Facility Construction History

The Mill is a uranium/vanadium mill that was developed in the late 1970s by Energy Fuels Nuclear, Inc. ("EFN") as an outlet for the many small mines that are located in the Colorado Plateau and for the possibility of milling Arizona Strip ores. At the time of its construction, it was anticipated that high uranium prices would stimulate ore production. However, prices started to decline about the same time as Mill operations commenced.

As uranium prices fell, producers in the region were affected and mine output declined. After about two and one-half years, the Mill ceased ore processing operations altogether, began solution recycle, and entered a total shutdown phase. In 1984, a majority ownership interest was acquired by Union Carbide Corporation's ("UCC") Metals Division which later became Umetco Minerals Corporation ("Umetco"), a wholly-owned subsidiary of UCC. This partnership continued until May 26, 1994 when EFN reassumed complete ownership. In May 1997, Denison (then named International Uranium (USA) Corporation) and its affiliates purchased the assets of EFN. EFRI purchased Denison in July 2012 and is the current owner of the facility.

2.1.1 Mill and Mill Tailings System

The Source Materials License Application for the Mill was submitted to the NRC on February 8, 1978. Between that date and the date the first ore was fed to the Mill grizzly on May 6, 1980, several actions were taken including: increasing Mill design capacity, permit issuance from the United States Environmental Protection Agency ("EPA") and the State of Utah, archeological clearance for the Mill and tailings system, and an NRC pre-operational inspection on May 5, 1980.

Construction on the Mill tailings system began on August 1, 1978 with the movement of earth from the area of Cell 2. Cell 2 was completed on May 4, 1980, Cell 1 on June 29, 1981, and Cell 3 on September 2, 1982. In January 1990 an additional cell, designated Cell 4A, was completed and initially used solely for solution storage and evaporation. Cell 4A was only used for a short time and then taken out of service because of concerns about the synthetic lining system. In 2007, Cell 4A was retrofitted with a new State of Utah approved lining system and was authorized to begin accepting process solutions in September 2008. Cell 4A was put back into service in October 2008. Cell 4B was constructed in 2010 and authorized to begin accepting process solutions in February 2011.

2.2 Facility Operations

In the following subsections, an overview of Mill operations and operating periods are followed by descriptions of the operations of the Mill circuit and tailings management facilities.

2.2.1 Operating Periods

The Mill was operated by EFN from the initial start-up date of May 6, 1980 until the cessation of operations in 1983. Umetco, as per agreement between the parties, became the operator of record on January 1, 1984.

Exhibit 4

ENVIRONMENTAL REPORT

WHITE MESA URANIUM PROJECT
SAN JUAN COUNTY, UTAH

FOR

ENERGY FUELS NUCLEAR, INC.

PREPARED BY

DAMES & MOORE

JANUARY 30, 1978

ENVIRONMENTAL AND
APPLIED EARTH SCIENCES

DAMES & MOORE

ENVIRONMENTAL REPORT

WHITE MESA

URANIUM PROJECT

SAN JUAN COUNTY

UTAH

DAMES & MOORE

energy fuels nuclear, inc.
executive offices • suite 445 • three park central • 1515 arapahoe • denver, colorado 80202 • (303) 623-8317

May 15, 1978

Mr. E. A. Trager
United States Nuclear Regulatory Commission
Fuel Processing & Fabricating Branch
Division of Fuel Cycle & Material Safety
7915 Eastern Avenue
Silver Springs, Maryland 29096

RE: Docket No. 40-8681
White Mesa Uranium Mill

Dear Mr. Trager:

Submitted herewith is the revised "Environmental Report, White Mesa Uranium Project, San Juan County, Utah". This revision includes the initial report dated January 30, 1978 prepared by Dames & Moore and, as Appendix "I", an additional study entitled "Investigation of Alternative Tailings Disposal Systems, White Mesa Uranium Project" dated April, 1978, prepared by Western Knapp Engineering, a Division of Arthur G. McKee & Company.

Also included in Appendix "I" is a cover letter prepared by Energy Fuels Nuclear, Inc.'s staff giving their comments and a summary evaluation of the alternatives presented.

The revisions are made on the enclosed replacement and additional pages listed below:

Environmental Report, Appendix H, Page 4
Environmental Report, Appendix I, Entire Section

We are enclosing fifteen (15) of each replacement page and request that you insert them in the respective sections. Thank you for your assistance in this matter.

Very truly yours,

Muril D Vincelette

Muril D. Vincelette
Vice President-Operations

DKS/jp

Enclosures

xc: Mr. R. Scarano

ENVIRONMENTAL REPORT

WHITE MESA URANIUM PROJECT

SAN JUAN COUNTY, UTAH

FOR

ENERGY FUELS NUCLEAR, INC.

Prepared By

DAMES & MOORE

January 30, 1978

09973-015-14

be used to process the ore, including grinding, two-stage leaching, solvent extraction, precipitation and thickening, drying and packaging. Recovery of U_3O_8 is expected to be approximately 94 percent of that contained in the ore. The mill is planned to have a 2,000 tons-per-day capacity and a projected life of 15 years. Coal will probably be used as fuel for both process heat and heating of buildings.

The tailing retention system will consist of three partially excavated 70-acre cells. Each tailing cell will be surrounded by an embankment and lined with an artificial membrane to prevent seepage. Each cell is designed to contain a 5-year production of tailing and each will be constructed and used sequentially. Tailing stabilization and reclamation will be accomplished as soon as possible after each cell is filled, beginning about the fifth year of project operation for the first cell, about five years later for the second cell, and at the end of the project for the third cell. The tailing retention system will be located adjacent to the mill site. A slurry pipeline will transport tailing by pumping from the mill to the tailing cells.

Fresh water for the mill and potable needs will be supplied by wells. The total fresh water requirement is estimated to be 500 gpm. Of this, an average of 380 gpm will be required for mill make-up water.

A septic tank will be used to treat sanitary wastes and the discharge will go to a leach field. Chemical wastes from the laboratory will go to the tailing retention system.

Electricity will be supplied by Utah Power & Light Public Utility by way of an existing electric power line on the site to the mill. The total electrical capacity requirement for the mill is estimated to be 2800 KVA.

The present schedule anticipates initiation of mill construction by January 1979 and completion of construction and commencement of

Exhibit 5

Denison Mines (USA) Corp.
1050 17th Street, Suite 950
Denver, CO 80265
USA

Tel : 303 628-7798
Fax : 303 389-4125

www.denisonmines.com

June 1, 2009

Mr. Charles Garlow, Attorney-Advisor
OECA, Air Enforcement Division
U.S. Environmental Protection Agency
1200 Pennsylvania Ave. N.W. – MC2242A
Washington, DC 20460

Dear Mr. Garlow:

Re: Request to Provide Information Pursuant to the Clean Air Act
Denison Mines (USA) Corp.-White Mesa Uranium Mill, Blanding Utah

This is Denison Mines (USA) Corp's. ("Denison's") response to the United States Environmental Protection Agency's ("EPA's") Request For Information dated February 24, 2009. Each of EPA's questions is provided below in italics, followed by Denison's response in regular font.

The individuals responsible for responding to this request are David C. Frydenlund, Vice President Regulatory Affairs and Counsel, Steven D. Landau, Manager, Environmental Affairs and Harold R. Roberts, Executive Vice President, US Operations of Denison.

1. Please list each uranium mill and uranium mill tailings impoundment located in the United States of America that has been, or is currently, owned or operated by Denison or affiliated corporations located in the United States of America. Include the exact location of each uranium mill by map and legal property description:

Denison Response:

Denison owns and operates the White Mesa Uranium Mill (the "Mill") and its tailings impoundments (Cells 2, 3 and 4A), which are located in central San Juan County Utah approximately 6 miles south of the city of Blanding (see Figures 1-1 and 1-2 of the enclosed Reclamation Plan for the Mill). Within San Juan County, the Mill site is located on fee land and mill site claims, covering approximately 5,415 acres, encompassing all or part of Sections 21, 22, 27, 28, 29, 32, and 33 of Township 37S, Range 22E, and Sections 4, 5, 6, 8, 9, and 16 of Township 38S, Range 22E, Salt Lake Base and Meridian (See Figure 1-2 of the enclosed Reclamation Plan). A full legal description of the fee lands comprising the Mill site is contained in Section 3.1 of the enclosed Reclamation Plan.

The Mill produces uranium in the form of U_3O_8 and vanadium, principally in the form of V_2O_5, as a co-product from its uranium/vanadium ores. Historical production activity at the Mill is shown in Table 1 below:

Table 1-Historic Mill Production

Year(s)	Received Ore (Tons)	Production	
		lbs. U_3O_8	lbs. V_2O_5
1977-1983	1,511,544	6,005,721	13,008,155
1984	0	0	0
1985-1990	2,037,209	18,759,338	18,943,167
1991-1994	0	0	0
1995	163,046	1,472,614	0
1996	43,553	661,722	0
1997	1,995	619,193	0
1998	63,296	3,000	0
1999	90,308	652,100	1,512,801
2000-2001	0	0	0
2002	135,724	0	0
2003	36,469	0	0
2004	7,594	0	0
2005	2,399	46,092	0
2006	3,185	230,959	0
2007	76,889	254,442	0
2008	265,228	888,574	1,225,017

c. *The number and size (in acres), dimensions, locations within the facility or plant site, capacity in gallons and lining material of each "existing mill impoundment", as that term is used in 40 C.F.R. Subpart W, and any other waste holding areas such as evaporation or settling ponds.*

Denison Response:

Number of "Existing Impoundments" and any Other Waste Holding Areas such as Evaporation or Settling Ponds

At 40 CFR Subpart W an "existing impoundment" is defined as "any uranium mill tailings impoundment which is licensed to accept additional tailings and is in existence as of December 15, 1989."

In Denison's case only Cells 2 and 3 meet that definition. Cell 2 was in existence and licensed to accept tailings as of December 15, 1989. Cell 2 is currently at capacity and is not authorized to receive additional tailings at this time. Cell 2 is therefore not in operation and is in the beginning stage of final closure. Cell 3 was also in existence and licensed to accept tailings as of December 15, 1989. Cell 3 is currently near capacity but is still authorized and continues to receive tailings. Cell 3 is therefore currently in operation.

Cell 4A was constructed in 1989, with substantial completion on November 30, 1989. However, it was not licensed for use by NRC until March 1, 1990. Cell 4A was therefore not licensed to accept tailings as of December 15, 1989 and is therefore not an "existing impoundment" within

cell.

6) North Dike Splash Pads – three 20-foot wide splash pads have been constructed on the north dike to protect the primary FML from abrasion and scouring by tailings slurry. These pads consist of an extra layer of 60 mil HDPE membrane that was installed in the anchor trench and placed down the inside slope of Cell 4A, from the top of the dike, under the inlet pipe, and down the inside slope to a point 5-feet beyond the toe of the slope.

7) Emergency Spillway – a concrete lined spillway was constructed near the western corner of the north dike to allow emergency runoff from Cell 3 into Cell 4A. This spillway was limited to a 6-inch reinforced concrete slab set directly over the primary FML in a 4-foot deep trapezoidal channel. No other spillway or overflow structure was constructed at Cell 4A. All stormwater runoff and tailings wastewaters not retained in Cells 1, 2, and 3, will be managed and contained in Cell 4A, including the Probable Maximum Precipitation and flood event.

d. For each existing mill impoundment, evaporation pond, and settling pond indentified in response to request 3.c., identify the date(s) each was:

i. Constructed;
ii. Used for the continued placement of new tailings;
iii. Placed on "standby status; and
iv. Closed, and during what periods they were operational.

Denison Response:

The information requested is provided in Table 3 below. For completeness, we have also included information for Cell 1, which is an evaporation pond and is not a tailings impoundment, and for Cell 4A, which is not an "existing impoundment":

Table 3-Cell Construction and Operating Periods

Cell Designation	Date of Final Construction	Tailings Placement Period	Period of Standby Status	Date closed
Cell 1	1981	Used as an evaporative pond from 1981 to the present. Tailings have not been disposed of in Cell 1	None	NA
Cell 2	1980	1980-Mid 1980's	1984	Final Closure Process began in 2008[2]
Cell 3	1982	1982-Present[3]	1984, 1991-1994, 2000-2001	NA

[2] Cell 2 no longer receives tailings but has been provided with an interim cover as the first phase of the final closure process.

[3] Cell 3 was used for evaporative purposes until the solids capacity in Cell 2 had been utilized, at which time tailings solids were discharged into Cell 3.

Cell Designation	Date of Final Construction	Tailings Placement Period	Period of Standby Status	Date closed
Cell 4A	1989	1990	1991 Until re-lining in 2008	NA
Cell 4A Re-lined	2008	2008 to present	None	NA

4. *For each existing mill impoundment, evaporation pond, and settling pond identified in response to 3.d. above*
   a. *identify whether the "continuous disposal method", as defined in 40 C.F.R. Section 61.252(b)(2), is used;*

Denison Response:

The Mill has never used the "continuous disposal method" for tailings disposal.

   b. *describe the mechanical methods used to dewater tailings, the process used to dispose of tailings, the precise location of any and all disposal areas used for dewatered tailings, and the method of covering such tailings;*

Denison Response:

The Mill has never used the "continuous disposal method" for tailings disposal.

   c. *Provide all disposal records maintained by you, including any records that reflect the manner of disposal and method of covering such tailings;*

Denison Response:

Denison does not maintain active disposal records for typical production scenarios. Instead, the tailings resulting from the production periods described in answer 3.b. (Table 1) were disposed of into the tailings impoundments that were operating during those periods, as described in answer 3.d. (Table 3).

The Mill utilizes local soil as interim cover for tailings sands that are exposed above the pond solution level. These soils have natural background levels of activity and are deposited uniformly over the area of concern in order to reduce radon emanation at tailings "beach" areas. When a Cell ceases operations and begins final closure, such interim cover is extendaed over the entire surface area of the Cell. Such interim cover is the "minimum three feet of random fill (platform fill)" required under the Mill's Reclamation Plan. A copy of the Mill's Reclamation Plan is enclosed with this letter.

Annual testing in accordance with 40 CFR 61, Subpart W has demonstrated the success of this effort in maintaining radon emissions below the 20 p/Ci/m^2-s standard.

Exhibit 6

Copy To Pam & Tom T.
File
ACT/037/045

energy fuels nuclear, inc.
executive offices • suite 900 • three park central • 1515 arapahoe • denver, colorado 80202 • (303) 623-8317

JIM
FEB 08 1983

January 27, 1983

Utah Department of Natural Resources
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Gentlemen:

Attached is a copy of a letter recently forwarded to the U.S. Nuclear Regulatory Commission regarding curtailment of activities and eventual shutdown of the White Mesa Mill, near Blanding, Utah.

Because your office was involved in approving surety for the mill, it was felt you would be interested in receiving a copy of this notice. In addition, if any further action on our part is in order at this time, we would appreciate being so advised.

Sincerely yours,

C. E. Baker

C. E. Baker, Manager
Regulatory Compliance

CEB/kak

Enclosure

cc: G. W. Grandey
M. D. Vincelette
D. K. Sparling
D. E. Smith

energy fuels nuclear, inc.
executive offices • suite 900 • three park central • 1515 arapahoe • denver, colorado 80202 • (303) 623-8317

January 25, 1983

Mr. Dan Gillen
Uranium Mill Licensing Branch
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

Re: SUA-1358, Docket No. 40-8681

Dear Mr. Gillen:

This is to advise you of a planned curtailment of activities and eventual shutdown at the White Mesa Mill.

On or about February 1, 1983, the feeding of ore to mill process, other than "cleaning up" around the ore pads, will be discontinued. Once the ore pads are clean, work will commence on clearing out the various circuits in the mill. In-circuit inventories of uranium and vanadium will be recovered, and barren solids and solutions will be transferred to the tailings area in the normal manner.

By approximately February 6, all remaining slurry, pulp and solutions in the grind circuit, pre-leach, leach tanks, and pre-leach thickener will be processed.

By approximately February 12, all tanks and vessels in the grind, pulp storage, pre-leach, pre-leach thickener, and leach circuits will be drained and cleaned.

By approximately February 19, major equipment in the grind circuit through the leach circuit will be prepared for stand-by status.

By approximately February 22, all solutions will be processed, and tanks in the CCD circuit, including the clarifier, will be drained, cleaned, and filled with water.

By approximately February 28, yellowcake slurry in the precipitation and yellowcake thickeners will be dried and packaged, and the tanks drained, cleaned, and filled with water.

An hourly work force of approximately 85 people will be maintained for the first ten days in February. On February 11, 35 of these people will be laid-off and another 40 will be laid-off at the end of the month.

On or about March 1, recycling of tailings solution through the solvent extraction circuits for recovery of uranium and vanadium will commence. This activity will require approximately 16 workers for about an eight-month period. An additional 21 people will be scheduled for stand-by or routine assignments in the laboratories, safety and environmental group, and mill general.

After the eight-month period commencing March 1, the stand-by staff will be maintained at approximately 20 individuals for an indefinite period, depending on uranium market conditions.

We trust this information will allow you to understand the circumstances surrounding the planned curtailment. We will be contacting you in the future to determine the feasibility of discontinuing certain in plant radiation safety monitoring due to inactivity in certain areas of the mill and associated lack of routine personnel access.

Until such time as relief from monitoring is granted, Energy Fuels will maintain an adequate radiation safety staff to assure compliance with the terms and conditions of the mill license.

Sincerely yours,

C. E. Baker
Manager, Regulatory Compliance

CEB/kak

CERTIFIED MAIL
Return Receipt Requested

cc: G. W. Grandey
M. D. Vincelette
D. K. Sparling

Exhibit 7

File ACT/037/045

energy fuels nuclear, inc.
executive offices • suite 900 • three park central • 1515 arapahoe • denver, colorado 80202 • (303) 623-8317

March 12, 1984

Mr. Tom Tetting
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Re: Annual Operations and Progress Report, White Mesa Uranium Mill, ACT/037/045, San Juan County, Utah

Dear Mr. Tetting:

Pursuant to your February 15, 1984 request for a 1983 Annual Operations and Progress Report for the White Mesa Uranium Mill, the following information is being submitted in lieu of Form MR-3.

The White Mesa Mill processed 50,454 tons of ore in 1983. The Mill was shut down at the end of January and remained down except for some re-processing of tailings solutions through the summer months.

No additional tailings construction took place during 1983. Some tailings reclamation was done with the placement of 1-2 ft of soil cover over six acres of the Cell 2 Tailings pond to prevent the blowing of dried tailings sand.

Enclosed you will find an updated map of the mill and tailings area, as well as an aerial photograph of the area taken August 23, 1983.

As of January 1, 1984 a 70% interest in the White Mesa Mill was sold to Union Carbide Corp. Union Carbide will be the operator of the mill pending transfer of the NRC Source Material License. All future correspondence regarding the mill should be directed to:

Union Carbide Corp.
White Mesa Uranium Mill
P. O. Box 699
Blanding, Utah 84511

Attn: T. N. Washburn

If you have any questions, please feel free to call.

Very truly yours,

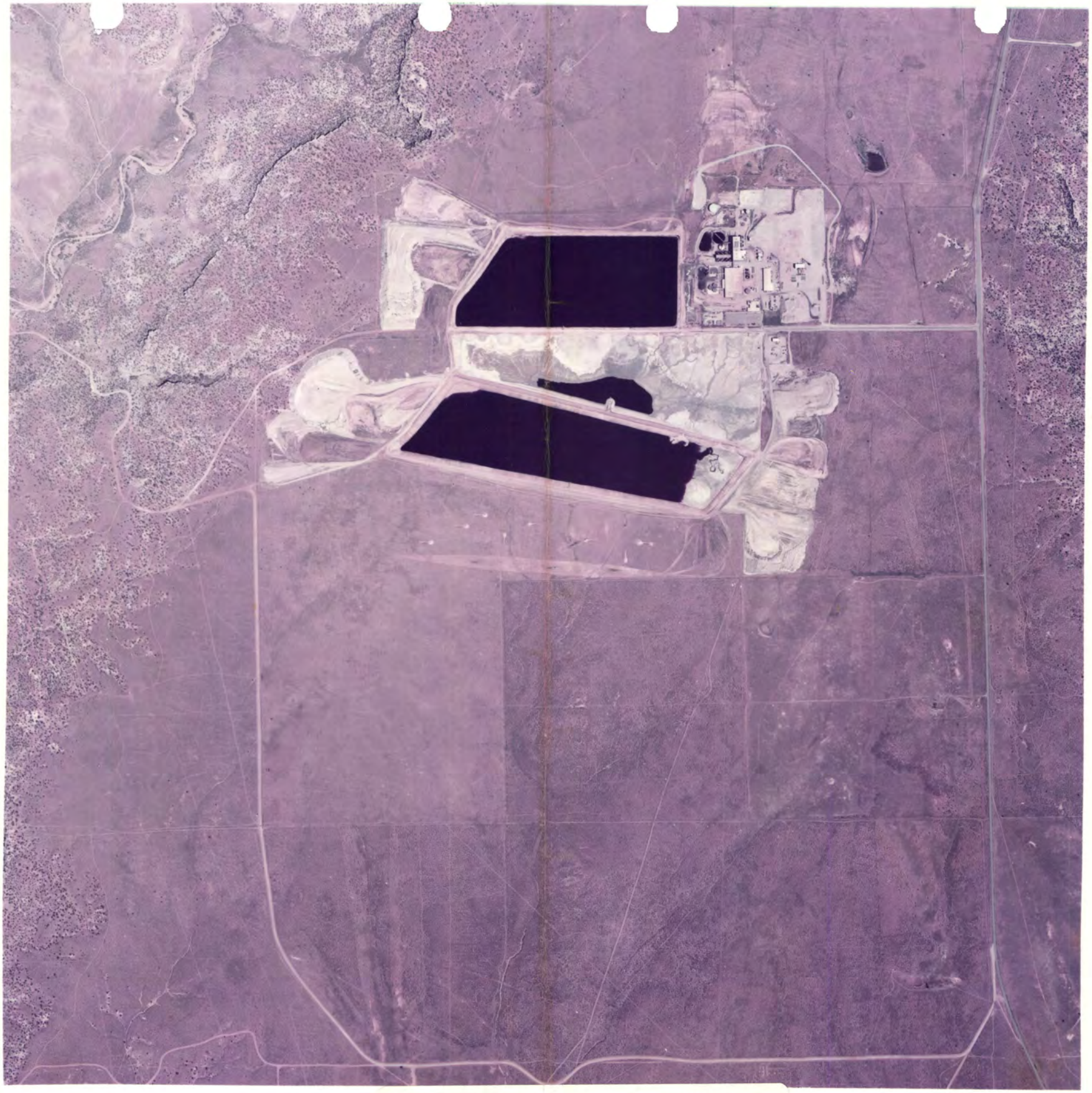
Harold R. Roberts

H. R. Roberts,
Senior Project Engineer

HRR/jf

Enc.

xc: MDV, GWG, DKS, TWashburn w/o enc.



WHITE MESA MILL - Photo taken 8/23/83

Exhibit 8

Synfuels funding...

Price tag for the first, nearly-complete phase, is put at $600 million.

Union Oil appears on the verge of success with its smaller-sized operation, while some of the bigger projects announced two or three years ago are just plans gathering dust.

UNION SETS EXAMPLE

Perhaps taking a lesson from Union and because some big companies have become more reluctant to come up with the megabucks necessary for initial development on a grand scale, many of the proposals the SFC received in its third round solicitation were for smaller projects. The trend away from the massive projects was obvious.

Witness the Cathedral Bluffs Shale Oil Company project, mentioned above, and the once-grand Ashland-Bechtel project in Breckenridge County, Kentucky.

When Ashland was still a partner, plans called for a plant to produce 50,000bpd of liquid fuels from coal. Remaining sponsor Bechtel is now asking federal funding help for a scaled-down plant which would produce 11,300 barrels of oil daily.

The number of applications received in the third solicitation was higher than anticipated. Karen Hutchinson, director of media relations for the U.S. Synthetic Fuels Corporation, told PAY DIRT the corporation was expecting to receive between 30 and 40 proposals.

The higher number, 46, came as a pleasant surprise, she said.

Not only the number, but the quality of the applications, were gratifying to the SFC.

"I am impressed by the number and variety of proposals submitted in the third solicitation," Edward Nobel, the corporation's board chairman, said when the list was announced January 11th.

"Clearly, this response demonstrates the private sector's continued commitment to synthetic-fuels development.

"Preliminarily, these projects reflect a significant growth in maturity from our first solicitation applications. That improvement in maturity signals a substantial investment of private funds in this emerging industry."

Within a few days after the list was announced, some of the projects had already been eliminated for further consideration for federal loan or price guarantees. When the board met January 20th, it started sifting through the list. Of the 14 projects it looked at, nine were dropped from further consideration and five passed the maturity test.

SEPTEMBER TARGET DATE

Hutchinson said the board hopes to be able to complete its maturity and strength reviews of all the proposals by the latter part of March.

"At that time, they can enter into detailed negotiations," she said. "We are aiming for a September award (of funds)."

While the board has yet to make an award, three projects are in line for funding. They were successful in passing board tests during second round solicitation considerations in December.

Sent letters of intent to provide funds were Santa Rosa, a tar sands venture north of Santa Rosa, New Mexico; First Colony, a peat-to-methanol project in Creswell, North Carolina; and Calsyn, a heavy oil conversion project in West Pittsburg, California.

The Santa Rosa project is sponsored by Solv-Ex Corporation of Albuquerque and Foster Wheeler Corporation. The SFC is making $41 million available, of which $20 million is a loan guarantee to help with construction and $21 million is in price guarantees.

When in operation, the Santa Rosa project will use a solvent extraction to generate 4,000 barrels of tar-sand oil a day from the ground.

The SFC can provide financial help for as much as three-fourths of a project's cost. The most it can loan any one project is $3 billion.

The board does not announce amounts sought by the various projects. While project sponsors may ask a specified amount, the actual amount of help is subject to negotiation in closed session.

The third round solicitation may be last general solicitation made by the SFC. That decision has not yet been made.

The corporation decided late last year to go to "targeted solicitations" in its efforts to attract projects which would meet funding criteria.

At its January meeting, it completed work on the first such solicitation. It will offer $1.6 billion in financial help to build a major oil shale project in Colorado or Utah.

It revealed some of the rules in December. The board said it would guarantee an average price of up to $67 a barrel for oil produced by the project. Analysts say a barrel of shale oil would cost between $40 and $70 to produce at a commercial facility in today's dollars.

The project must have a minimum production level of 10,000bpd and be completed before 1990.

The solicitation is now open. Applicants have until March 15th to submit their proposals, Hutchinson said.

A second targeted solicitation is planned, this aimed at a coal project. SFC staff is working up a proposal to submit to the board and it was discussed briefly at the January 20th meeting.

No determination has yet been made as to type of coal project, Hutchinson said, but a decision could be made in late February or early March.

What this renewed interest means remains to be seen. That industry can produce synthetic fuels is not the question. Whether they can eventually produce a competitive product that will not require perpetual price support from the government is the big question.

Pioneers, like Union Oil, the billion-dollar coal-to-natural-gas Great Plains Project in North Dakota and a few others, will be closely watched in the coming years. Should they prove successful, synthetic fuels may one day go from a speculative venture to a viable, essential part of American industry.

File ACT/037/045

Energy Fuels goes on standby at Blanding

By a PAY DIRT Staff Reporter

Energy Fuels Nuclear Inc. plans to drastically reduce operations at its Blanding, Utah uranium mill at the end of January.

The operation will be put on standby and approximately 100 employees laid off, a company spokesman told PAY DIRT.

Low market prices and reduced demand for processed yellowcake were blamed for the decision to curtail operations.

The Blanding mill opened in May 1980 and is considered one of the most sophisticated uranium ore processing plants in the United States. It processes ore from another Energy Fuels operation, the Hack Canyon mine near Fredonia, Arizona and has done a lot of toll processing for other companies, primarily Union Carbide Corporation.

In recent months, Union Carbide has greatly curtailed its uranium operations in Utah, Colorado and Wyoming. Energy Fuels has curtailed its Hack Canyon production.

In the coming months, Energy Fuels will recycle the liquor from the tailings ponds at Blanding. That is expected to take about eight months, the spokesman said.

During that period, some 35 to 40 employees will remain on the job at Blandings. After that, "we just don't know," the spokesman said.

The curtailment will have tremendous impact on Blanding, where Energy Fuels is the community's largest employer.

Unemployment rate now is about 10 percent. The layoffs at the mill will approximately double that rate.

When the planned closure was announced, a spokesman said the decision reflected the "dire straits" of the uranium industry in the United States, noting that the present market price for processed uranium is $20.25, but the cost to produce it is about $30.

The mill will likely remain closed until the market price comes closer to production cost, the spokesman said.

Exhibit 9

65 LOSE JOBS AS ORE MILL IN BLANDING CLOSES

Associated Press
Published: Feb. 27, 1995 12:00 a.m.

The 65 employees at Energy Fuels' White Mesa Mill have been told the company cannot meet its payroll and they no longer have jobs.

Harold Roberts, president of the company that processes uranium into fuel for nuclear reactors, told employees the measures were necessary because of financial problems with Energy Fuel's parent company, Denver-based Concord Corp. and the finances of its principal owner, Oren Benton.Concord hopes to restructure without filing for bankruptcy, Roberts said. He did not have a definite time on when the company could be operating again.

"We are working as rapidly as we can to ensure that no one gets hurt any more than, unfortunately, the damage that may have been done already," he said.

Clarence Yellow said he gave up a good job in Albuquerque two weeks ago "to come back home to Blanding to work at the mill. Now I'm looking for work," he told a reporter Thursday as he filled out paperwork in the Blanding Job Service office.

Blanding Chamber of Commerce President Rick Shelby, owner of a bicycle shop, described the layoffs as devastating.

Exhibit 10

IUC INTERNATIONAL URANIUM (USA) CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 [illegible] 779 [illegible] 303 [illegible] 4125 Fax

June 18, 1997

VIA OVERNIGHT MAIL

Honorable Michael O. Leavitt, Governor
State of Utah
State Capitol Building
201 State Capitol
Salt Lake City, UT 84114

Re: Letters from your office to Great Avikan™House and from Great Avikan™House to your office dated May 23, 1997 and May 24, 1997, respectively, regarding the White Mesa Uranium Mill

Dear Governor Leavitt:

Effective May 10, 1997, International Uranium (USA) Corporation ("IUC") assumed ownership and became the licensed operator of the White Mesa Uranium Mill. As your office is aware, the White Mesa Mill is a U.S. Nuclear Regulatory Commission ("NRC") licensed facility located approximately six miles south of Blanding, Utah, in San Juan County. As discussed in a previous letter dated May 8, 1997 (copy attached), the previous owner, Energy Fuels Nuclear, Inc. ("EFN"), received an amendment to the NRC license for the Mill, which authorizes the processing of an alternate feed material known as the "Cotter Concentrate" to recover the uranium it contains. IUC is implementing the approved amendment; but, we will also continue to offer, as EFN has, to provide any additional facts that the State of Utah may require to address questions concerning this processing.

We have copies of the May 23 letter from the Office of the Governor to Mr. Mason of the Great Avikan™House, and the response from a Mr. Mason, representing the Great Avikan™House. As your letter points out, in response to public interest in this issue, EFN and United States Department of Energy ("DOE") representatives attended the May 9, 1997 meeting of the Radiation Control Board ("RCB") to present information on the reprocessing amendment. Our presentations were intended to provide the Board and interested parties with facts concerning issues which appeared, in new articles and letters, to be misunderstood. The presentation materials and fact sheets addressed the same areas of concern addressed in our May 8 letter to your office.

Based on our review of the May 24 letter from the Great Avikan™House representative to your office, it again appears that a summary of facts regarding areas of concern raised in the letter may

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ADDENDUM TO PERMIT TRANSFER REQUEST

This Addendum to Permit Transfer Request describes (i) the current status of the bankruptcy proceedings in which affiliates of Energy Fuels Nuclear, Inc. ("EFNI") have been involved and (ii) the impending sale of the mining properties operated by EFNI. As previously reported by EFNI, Energy Fuels, Ltd. ("EFL"), and Energy Fuels Exploration Company ("EFEX") filed voluntary petitions for bankruptcy in the United States Bankruptcy Court for the District of Colorado (the "Bankruptcy Court") in February of 1995. The bankruptcy filings were part of a larger bankruptcy case involving Oren L. Benton. EFNI did not file a bankruptcy petition and has maintained its operations during the bankruptcy process. EFL, EFEX and EFNI are collectively referred to herein as the "Energy Fuels Companies".

In 1996, the mining assets of EFL and EFEX were offered for sale in the bankruptcy proceedings. After an extended due diligence and bidding process, a successful bidder was selected and a purchase agreement was entered into between the Energy Fuels Companies and International Uranium Holdings Corporation ("IUH"). EFNI is a party to the purchase agreement since it has acted as the operator of the mining properties that are being sold to IUH. The terms and conditions of the purchase agreement have been approved by an Order of the Bankruptcy Court (the "Sale Order").

Pursuant to the terms of the purchase agreement and Sale Order, EFNI is obligated to initiate the transfer of the various permits and licenses it holds to International Uranium (USA) Corporation ("IUC"). IUC is a subsidiary of the purchaser of the assets, IUH. IUC will operate the mining properties for IUH and its subsidiaries and in the course of such operations will be the permittee/licensee. Relevant information concerning IUC is included in the necessary transfer forms.

Under the terms of the purchase agreement, IUH has committed to offer employment with IUC to all current employees of EFNI. All the parties to the sales transaction believe that this will greatly facilitate the transition of operations between EFNI and IUC.

As you might expect, the process of "closing" the sales transaction is very complicated given the requirement that all actions necessary to transfer all properties, permits and other assets from each entity to IUH and IUC occur simultaneously. Additionally, the bankruptcy estates, Creditors' committee and a variety of creditors must resolve certain claims at the same "closing".

As a part of the closing, permits and licenses for the exploration and mining activities of the Energy Fuels Companies are to be transferred from EFN to IUC. The timing of the transfer is important since IUH obviously does not want to deliver the purchase price until it has received necessary approvals from the various regulatory agencies to operate the properties and the sellers do not want to end up with the permits and no property.

At the closing, IUH is obligated to post substitute or replacement surety bonds for those permits and licenses now held by EFNI which require financial surety. IUH and IUC are in the process of finalizing a bonding line with a major North American bonding company. In the event the final arrangements have not been made with this company by closing, IUH will cause a major national bank to issue letters of credit to support the permitting/reclamation obligations associated with the various permits and licenses it is acquiring.

As the closing is now structured, we are requesting regulatory agencies to approve permit and license transfers under their normal procedures, but add a condition to the approval of transfer which states that the transfer shall be effective only upon the receipt by the agency of replacement financial assurance in the form previously agreed upon by IUC and the agency. With the addition

of this condition, the permits and licenses can be effectively transferred at the closing by delivery of the requisite financial sureties to the appropriate agencies.

We understand that we must take the actions necessary to initiate the permit and license transfers and also provide to the proper divisions of the particular agency the proposed financial surety forms, be they corporate surety bonds or letters of credit. We also understand that EFNI and IUC must comply with all other appropriate requirements of each agency for transfer of the permits and licenses.

Energy Fuels personnel are involved in a variety of tasks associated with the closing and transition to IUC. Harold Roberts is assisting IUH/IUC in tasks which require Harold to be traveling extensively over the next three weeks. While Harold is in daily telephonic contact with the Denver and field offices, other individuals at the various offices of Energy Fuels are available for questions or comments.

Contact points at EFNI (Denver):

Rich A. Munson	Corporate Counsel	(303) 899-4469
Michelle R. Rehmann	Environmental Manager	(303) 899-5647
Terry V. Wetz	Project Manager	(303) 899-5649
Vicki L. Hoffsetz	Land Administrator	(303) 899-5632

The general phone number at EFNI (Denver) is (303) 623-8317 and the facsimile number is (303) 595-0930.

Contact point at EFNI (Blanding - White Mesa Mill):

William N. Deal	Mill Superintendent	(801) 678-2221

The facsimile number at EFNI (Blanding) is (801) 678-2224.

Contact point at EFNI (Grand Junction):

Rick A. Van Horn	Manager - Mine Operations Colorado Plateau	(970) 243-1968.

The facsimile number at Grand Junction is (970) 243-1973.

Contact points at EFNI (Fredonia):

Roger B. Smith	Manager - Mine Operations Arizona Strip	(520) 643-7321

The facsimile number at Fredonia is (520) 643-7328.

Exhibit 11

Our History

Energy Fuels primary goal is to become the dominant uranium producer in the United States. We believe we are well on our way of achieving this goal. Our company is led by a seasoned management team dedicated to responsibly producing uranium from world-class, US-based assets. Below is a timeline describing our company's dynamic growth profile and our quick ascent as a leader in the U.S. uranium sector.

- March: Energy Fuels to Acquire Mesteña Uranium
- March: Energy Fuels to Increase Its Interest in Roca Honda to 100%

2015: Energy Fuels Becomes an ISR Producer

2014: Energy Fuels Focuses on Organic Growth

2013: Energy Fuels Growth Continues

2012: Energy Fuels Becomes Major U.S. Uranium Supplier

2011: Energy Fuels Continues Path to Production

2010: Energy Fuels Names New President & CEO

2009: Energy Fuels' First Strategic M&A Transaction

2006: Energy Fuels Founded

1970 to 1997: Energy Fuels Nuclear, Inc.

The "Energy Fuels" name is well-respected in the U.S. uranium sector. Energy Fuels Nuclear was once the leading producer of uranium in the U.S., discovering and developing some of the projects we operate today. In fact, Energy Fuels Nuclear constructed the White Mesa Mill in 1980. While Energy Fuels Inc. and Energy Fuels Nuclear are unrelated entities, much of our senior management team began their careers and learned about the U.S. uranium industry from the earlier successes of Energy Fuels Nuclear.

THE HISTORY

Exhibit 12

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED 2/10/00

COMMISSIONERS:

SERVED 2/10/00

Richard A. Meserve, Chairman
Greta Joy Dicus
Nils J. Diaz
Edward McGaffigan, Jr.
Jeffrey S. Merrifield

In the Matter of	
INTERNATIONAL URANIUM (USA) CORPORATION	Docket No. 40-8681-MLA-4
(Request for Materials License Amendment)	

CLI-00-01

MEMORANDUM AND ORDER

I. Introduction

In this decision we review a Presiding Officer's Initial Decision, LBP-99-5, 49 NRC 107 (1999), which upheld a license amendment issued to the International Uranium (USA) Corporation ("IUSA"). The license amendment authorized IUSA to receive, process, and dispose of particular alternate feed material from Tonawanda, New York. The state of Utah challenges the license amendment and now on appeal seeks reversal of the Presiding Officer's decision. Envirocare of Utah, Inc., has filed an amicus curiae brief supporting Utah's challenge of the Presiding Officer's decision. The NRC staff and IUSA support the Presiding Officer's decision. We affirm the decision for the reasons we give below.

II. Background

IUSA owns and operates a uranium mill located at White Mesa, near Blanding, Utah. On May 8, 1998, IUSA submitted a request for a license amendment to allow it to receive and process approximately 25,000 dry tons of uranium-bearing material from the Ashland 2 Formerly Utilized Sites Remedial Action Program (FUSRAP) site, currently managed by the Army Corps of Engineers and located near Tonawanda, New York.[(1)] The NRC granted the IUSA license amendment on June 23, 1998. Utah timely petitioned for leave to intervene in the license amendment proceeding. On September 1, 1998, the Presiding Officer admitted Utah as a party to the proceeding. See International Uranium (USA) Corporation (Receipt of Material from Tonawanda, New York), LBP-98-21, 48 NRC 137 (1998).

At issue in this proceeding is the Atomic Energy Act's definition of 11e.(2) material, defined by the statute as "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." 42 U.S.C. § 2014e (emphasis added). Utah interprets this to mean that the primary purpose for acquiring the ore must be an interest in processing the material to recover the uranium. Emphasizing that IUSA is being paid over four million dollars to receive the Ashland 2 material from the FUSRAP site, Utah argues that IUSA's interest in obtaining the material is "primarily for payment of a disposal fee" and not for recovering any uranium the material might contain. Utah's Appeal Brief (May 24, 1999) at 11.

Utah explains that the fee IUSA will receive for this transaction far exceeds the monetary value of the uranium which might be extracted from the material. Utah accordingly suggests that the "primary" reason IUSA is processing the material is so that it can be reclassified as 11e.(2) material and then disposed of at the IUSA mill site. See id. at 10.

In short, Utah argues that the NRC staff improperly granted this license amendment because IUSA is not processing the Ashland 2 material "primarily" to recover its relatively minimal uranium content, but rather to obtain the generous handling and disposal fee. Utah emphasizes that IUSA's license amendment application failed to adequately substantiate that the material was to be "processed primarily" for its uranium content. Utah insists upon "some objective documentation" to show that recovery of the uranium, not payment for disposal, was IUSA's primary interest behind the license amendment. See Utah's Reply to NRC Staff's and IUSA's Briefs (June 28, 1999)("Utah's Reply Brief") at 10. Given the "wide disparity" between the fee IUSA will receive for taking and processing the material and the probable market value of the uranium that can be recovered, Utah claims that the "only reasonable conclusion" to be drawn is that the "primary purpose of applying for the license amendment was to receive a four million dollar disposal fee." Id. at 9-11.

In interpreting what is meant by § 11e.(2)'s requirement that ore be "processed primarily for its source material content," Utah relies heavily upon language in the NRC's "Final Revised Guidance on the Use of Uranium Mill Feed Material Other Than Natural Ores," 60 Fed. Reg. 49,296 (Sept. 22, 1995)("Alternate Feed Guidance"). The Alternate Feed Guidance asks licensees to "certify" that the feed material will be "processed primarily for the recovery of uranium and for no other purpose." Id. at 49,297. The Guidance goes on to enumerate three possible ways a licensee can "justify" this certification that feed material is to be processed for source material. The three possible factors a licensee can cite are "financial considerations, high uranium feed content of the feed material, or other grounds." Id. Throughout this proceeding, the parties sharply have disputed the meaning of these and other statements in the Alternate Feed Guidance.

Utah, for instance, argues that the Guidance included a "Certification and Justification" test expressly to prohibit licensees from "using a uranium mill to process material for the primary purpose of ... [reclassifying] the material to allow it to be disposed of in the mill tailings impoundment." See Utah's Appeal Brief at 10,12. Utah claims that processing material merely for the sake of reclassifying it as 11e.(2) material is "sham processing," and that the wastes or mill tailings generated from such "sham processing" do not meet the definition of 11e.(2) byproduct material. See id. at 10-11. Utah concludes that IUSA "failed to justify and document under the Alternate Feed Guidance any satisfactory or plausible grounds to show that [IUSA] was not engaged in sham processing." Id. at 11.

In LBP-99-5, the Presiding Officer rejected Utah's arguments. "[O]re is processed primarily for its source material content," stated the Presiding Officer, "when the extraction of source material is the principal reason for *processing* the ore," regardless of any other reason behind the licensee's interest in acquiring the material or seeking the overall transaction. See 49 NRC at 109.

On the other hand, the Presiding Officer went on to explain, "[i]f ... the material were processed primarily to remove some other substances (vanadium, titanium, coal, etc.) and the extraction of uranium was incidental, then the processing would not fall within the statutory test and it would not be byproduct material within the meaning of the Atomic Energy Act. That is, the adverb 'primarily,' applies to what is removed from the material by the process and not to the motivation for undertaking the process." Id. (emphasis added). In the Presiding Officer's view, "the only 'sham' that stops material from being byproduct material is if it is not actually milled. If it is milled, then it is not a sham." Id. at 111 n.6.

The Presiding Officer found this interpretation of § 11e.(2) consistent with the language and legislative history of the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA). He went on to conclude that the staff appropriately granted the license amendment because IUSA "is milling ore" to extract uranium and therefore is "not involved in a sham." See id. at 113. The Presiding Officer also found that Utah had misunderstood the NRC Alternate Feed Guidance. He rejected Utah's claim that the Guidance was intended to prevent material from being categorized as 11e.(2) byproduct material if the licensee's primary economic motive was to receive a fee for waste disposal instead of to recover the uranium. Id. at 112. "The Alternate Feed Guidance," the Presiding Officer stated, "is not supportive of the position, taken by the State of Utah, that material is to be considered byproduct only if the primary economic motivation is to remove uranium rather than to dispose of waste." Id. Under LBP-99-5, then, the licensee's underlying motive or purpose for acquiring the material in the first place is irrelevant. What matters is that the material actually is processed through the mill to recover source material.

Both the NRC staff and IUSA endorse the Presiding Officer's conclusions. The staff explains that "the Presiding Officer properly applied the [alternate feed] guidance by focusing on whether the processing was primarily to extract uranium," regardless of any economic motivations involved. See NRC Staff Opposition to Utah Appeal of LBP-99-5 ("Staff Brief")(June 14, 1999) at 13 (emphasis added). The staff also stresses that "[n]either a high uranium content nor economic profitability is 'required' under the guidance," which provides three separate and alternative reasons a licensee can describe to support a proposed license amendment, including any number of reasons which might fall within the category of "other grounds." See id. Indeed, the staff argues, the definition of § 11e.(2) byproduct material should be broad enough to encompass those fuel cycle activities involving the processing of even low grade -- with relatively low concentration of uranium -- feedstock. Id. at 15. "Utah's attempt to require an economic motive test and to require detailed financial review should be rejected," the staff urges. Id.

Focusing upon UMTRCA's legislative history, IUSA similarly concludes that at issue is simply whether the tailings and wastes were "produced as part of the nuclear fuel cycle." See IUSA's Reply to Utah's Appeal Brief and Envirocare's Amicus Curiae Brief ("IUSA Brief")(June 14, 1999) at 9-10. According to IUSA, those tailings and waste from feeds processed to recover uranium outside of the nuclear fuel cycle, as in a secondary or side-stream process at a phosphate recovery operation, would not be 11e.(2) material because the actual processing was not [intended] primarily for the source material content. Id. But where there is a licensed uranium mill involved, "the *only* question to be answered," argues IUSA, "is whether it is reasonable to expect that the ore will, *in fact*, be processed for the extraction of uranium." Id. at 15.

While not adopting the Presiding Officer's reasoning in its entirety, the Commission affirms LBP-99-5, for the reasons given below.

III. Analysis

To clear away a threshold matter, we must briefly consider the NRC staff's claim that the Ashland 2 material already was § 11e.(2) byproduct material, even before it was sent to IUSA and even before it was processed. See Staff Brief at 8 n.11; 14 n.18; 15 n.19. The staff's theory derives from the Department of Energy's certification that the Ashland 2 material was the residue of a Manhattan Project uranium extraction project, and therefore constituted "tailings or waste produced by the extraction ... of uranium ... from ... ore processed primarily for its source material content" within the meaning of section 11e.(2). We find it unnecessary to reach the staff argument. Historically, the NRC has maintained that it lacks regulatory authority over uranium-bearing material, like the Ashland 2 material, generated at facilities not licensed on or after 1978

(when UMTRCA was passed). See United States Army Corps of Engineers, DD-99-7, 49 NRC 299, 307-08 (1999). Nothing in this opinion addresses the pre-1978 question or should be understood to do so. Instead, our opinion rests solely on section 11e.(2)'s "processed primarily for its source material content" clause.

On appeal, Utah finds the Presiding Officer's "first error" to have been that of having "resort[ed] to interpretation of the AEA and the legislative history of UMTRCA in searching for the meaning of 'primarily processed for.'" See Utah Appeal Brief at 11-12. Instead, Utah argues, the Presiding Officer should have focused only upon the NRC's Alternate Feed Guidance to discern how the § 11e.(2) definition is to be applied and met. Id. at 12. The Commission, however, agrees with the Presiding Officer that the § 11e.(2) definition, with its requirement that material be "primarily processed for its source material content," can only be properly understood within the context of UMTRCA and its legislative history.

Based on an in-depth review of UMTRCA and its legislative history, and of the Alternate Feed Guidance and its background documents, the Commission reaches several conclusions. To begin with, the Guidance does appear to contemplate an NRC staff inquiry into a licensee's motives for a license amendment, just as Utah suggests. The Guidance, for instance, expresses a "concern that wastes that would have to be disposed of as radioactive or mixed waste would be proposed for processing at a uranium mill primarily to be able to dispose of it in the tailings pile as 11e.(2) byproduct material." 60 Fed. Reg. 49,296, 49,297 (Sept. 22, 1995). The Guidance thus outlines possible "justifications" that a licensee may describe in support of the license application, and these are intended to assist the staff "[i]n determining whether the proposed processing is primarily for the source material content or for the disposal of waste." Id. Indeed, the requirement of a licensee "justification" apparently stemmed from a 1993 Presiding Officer decision which questioned, in another proceeding, whether a simple licensee "certification, without more, would adequately protect against ulterior motives to dispose of waste." See UMETCO Minerals Corp., LBP-93-7, 37 NRC 267, 283 (1993)(emphasis added).

Such statements do not support the NRC staff's current view that under the Guidance all that matters is that processing for uranium was intended, regardless of underlying motive. On the contrary, the statements in both the proposed and final Guidance take as a given that processing for uranium content will take place, but also indicate that such processing should not be employed simply as a device to reclassify material to enable it to be disposed of -- as 11e.(2) byproduct material -- at a uranium mill site.[(2)] As Utah has maintained, therefore, the Alternate Feed Guidance certainly can be understood -- and is perhaps best understood -- as reflecting an intent to prevent material from being categorized as 11e.(2) byproduct material when the licensee's overriding economic motive is to receive a fee for waste disposal.

Yet, although the drafters of the Guidance apparently intended to distinguish between those license amendment requests where the licensee's overriding interest is obtaining uranium and those where payment for disposal is driving the transaction, the NRC staff apparently has not consistently utilized the Guidance in this way. While the language of the Guidance may suggest that a licensee's motivations are to be scrutinized, parsed, and weighed, the NRC staff typically has not relied upon such probing reviews of licensee motives. It has not been the staff's practice, for example, to require licensees essentially to "prove" quantitatively or otherwise that the value of the uranium to be recovered from a particular licensing action will outweigh other economic reasons for the transaction. See, e.g., UMETCO, 37 NRC at 274, 281-82; Staff Brief at 15-16. Since the Guidance was first issued, it seems, there has been little connection between what the Guidance seemingly proposes and what the staff in reality has required.

This fact has prompted the Commission on this appeal to take an in-depth look at the Guidance and its policy ramifications. We find that the apparent intent in the Guidance to have the staff scrutinize the motives behind the license amendment transaction is neither compelled by the statutory language or history of UMTRCA nor reflects sound policy. Our review of UMTRCA and its legislative history confirms the Presiding Officer's conclusion that the requirement that material be "processed primarily for its source material content" most logically refers to the actual act of processing for uranium or thorium within the course of the nuclear fuel cycle, and does not bear upon any other underlying or "hidden" issues that might be driving the overall transaction.

As we describe in further detail below, the purposes behind the wording of § 11e.(2)'s definition served: (1) to expand the types of materials that properly could be classified as byproduct material; (2) to make clear that even feedstock containing less than 0.05% source material could qualify as byproduct material; and (3) to assure that the NRC's jurisdiction did not cross over into activities unrelated to the nuclear fuel cycle. The IUSA license amendment is consistent with these statutory intentions, regardless of whether IUSA's bigger interest was payment for taking the material or payment for the recovered uranium. Indeed, even accepting Utah's claim that the four million dollar payment IUSA contracted to receive for processing and disposing of the Ashland 2 FUSRAP site material was the primary motivator for this transaction, the tailings generated from the processing can still properly be classified as § 11e.(2) byproduct material.

UMTRCA's Purposes and History

It may be helpful to outline a little of UMTRCA's legislative history and, in particular, how the § 11e.(2) definition came about. UMTRCA had two general goals: (1) providing a remedial- action program to stabilize and control mill tailings at various identified inactive mill sites, and (2) assuring the adequate regulation of mill tailings at active mill sites, both during processing and after operations ceased. As then Chairman Hendrie of the NRC explained to Congress, the agency at the time did not have direct regulatory control over uranium mill tailings. The tailings themselves were not source material and did not fall into any other category of NRC licensable material. The NRC exercised some control over tailings, but only indirectly as part of the Commission's licensing of ongoing milling operations. Once operations ceased, however, the NRC had no further jurisdiction over tailings. This resulted in dozens of abandoned or "orphaned" mill tailings piles.

To prevent future abandoned and unregulated tailings piles, Congress enacted the 11e.(2) definition, which expressly declared mill tailings to be a form of byproduct material. As Chairman Hendrie explained, tailings are "fairly regarded as waste materials from the milling operation," but the proposed definition would classify them as byproduct material and thus make them licensable under the AEA. Under the new § 11e.(2) definition, Chairman Hendrie emphasized, tailings generated during uranium milling operations would "formally be byproducts rather than waste." Uranium Mill Tailings Radiation Control Act of 1978, Hearings on H.R. 11698, H.R. 12229, H.R. 12938, H.R. 12535, H.R. 13049, and H.R. 13650, (hereinafter "UMTRCA Hearings I") Subcomm. On Energy & Power, House Comm. On Interstate & Foreign Commerce, 95th Cong. 2nd Sess. at 400 (1978)(statement of Joseph M. Hendrie, Chairman, NRC).

At the time Congress drafted UMTRCA, the Environmental Protection Agency had some authority over uranium mill tailings under the Resource Conservation and Recovery Act of 1976 (RCRA), but EPA had no authority over the milling process which generated the tailings. By defining mill tailings as a byproduct material, the new 11e.(2) definition removed mill tailings from RCRA's coverage since RCRA excludes all source, byproduct, and special nuclear material. This exclusion from RCRA was intended to minimize any "dual regulation" of tailings by both EPA and the NRC. Chairman Hendrie suggested that since the NRC already regulated the site-specific details of uranium milling, it seemed logical for the NRC to regulate the treatment and disposal of tailings "which we permitted to be generated in the first place." Id. at 342-43.

From the legislative history, we can glean a few conclusions about the actual wording of the 11e.(2) definition. As originally proposed, the definition of 11e.(2) byproduct material was directly linked to the Commission's definition of source material. The original definition referred to "the naturally occurring daughters of uranium and thorium found in the tailings or wastes produced by the extraction or concentration of uranium or thorium from source material as defined in [then] Section 11z.(2)." But Chairman Hendrie was concerned that a definition of byproduct material that was linked to that of source material would exclude ores containing 0.05% or less of uranium or thorium.[(3)] He proposed that the language be revised to "from any ore processed primarily for its source material content." His discussion with Congressman Dingell went as follows:

> **Mr. Hendrie**: The Commission is informed that there are a few mills currently using feedstock of less than 0.05 percent uranium. As high grade ores become scarcer, there may be a greater incentive in the future to turn to such low grade materials.
>
> Since such operations should be covered by any regulatory regime over mill tailings, the Commission would suggest that the definition of byproduct material in H.R. 13382 be revised to include tailings produced by extraction of uranium or thorium from any ore processed primarily for its source material content.
>
> **Mr. Dingell**: I am curious why you include in that the word "processed" primarily for source material content. There are other ores that are being processed that do contain thorium and uranium in amounts and I assume equal in value to those you are discussing here. Is there any reason why we ought not to give you the same authority with regard to those ores?
>
> **Mr. Hendrie**: The intent of the language is to keep NRC's regulatory authority primarily in the field of the nuclear fuel cycle. Not to extend this out into such things as phosphate mining and perhaps even limestone mining which are operations that do disturb the radium-bearing crust of the Earth and produce some exposures but those other activities are not connected with the nuclear fuel cycle.

UMTRCA Hearings I at 343-44.

There were, therefore, two principal intentions behind Chairman Hendrie's proposed language, which Congress accepted. First, the 11e.(2) definition was intended to reach even "low grade" feedstock with less than a 0.05% concentration of uranium. Second, the definition was intended to make sure that the NRC's jurisdiction did not expand into areas not traditionally part of the NRC's control over the "nuclear fuel cycle." The definition therefore "focuses upon uranium milling wastes" and not, for example, upon the wastes from phosphate ore processing which are also contaminated with small quantities of radioactive elements. Id. at 354 ("Section by Section Analysis of H.R. 13382 As Revised by NRC Recommended Language Changes"). Similarly, 11e.(2) material was not to encompass uranium mining wastes because, as Chairman Hendrie explained, "[w]e don't regulate mines. The mining is regulated by the Department of Labor under other regulations so our definition was drawn to maintain that and to keep us out of the mine-regulating business." Id. at 401.

We find, then, that the § 11e.(2) definition focused upon whether the process generating the wastes was uranium milling within the course of the nuclear fuel cycle. As Chairman Hendrie made clear, the concentration of the uranium or thorium in the feedstock was not a determinative factor in whether the resulting tailings should be considered 11e.(2) material. The focus was not on the value of the extracted uranium but on the activity involved.

In short, the § 11e.(2) definition focuses upon the process that generated the radioactive wastes -- the removal of uranium or thorium as part of the nuclear fuel cycle. See Kerr-McGee Chemical Corp. v. NRC, 903 F.2d 1, 7 (D.C. Cir. 1990). But UMTRCA does not require that the market value of the uranium recovered be the licensee's predominant interest, and thus UMTRCA does not require the NRC to assure that no other incentives lie behind the licensee's interest in processing material for uranium. There simply is no reason under UMTRCA why licensees cannot have several motives for a transaction.[(4)] That IUSA's primary goal here may have been the four million dollar payment for disposal, instead of potential profit from any recoverable uranium, does not in and of itself prevent the tailings generated from the milling process from falling within the § 11e.(2) definition. Moreover, as we touch upon further below, making such purely economic considerations a determinative

part of the staff's review would unnecessarily divert agency resources to issues unrelated to public health and safety.

The Need for Revising the Guidance

In this litigation, Utah and the other parties focused not upon UMTRCA and its legislative history, but upon the NRC's Alternative Feed Guidance. The Commission, however, is not bound by the Guidance. Like NRC NUREGS and Regulatory Guides, NRC Guidance documents are routine agency policy pronouncements that do not carry the binding effect of regulations. See, e.g., Curators of the University of Missouri, CLI-95-1, 41 NRC 71, 149 (1995); International Uranium (USA) Corp. (White Mesa Uranium Mill), LBP-97-12, 46 NRC 1, 2 (1997)(referring specifically to final Alternate Feed Guidance as "non-binding Staff guidance"). Such guidance documents merely constitute NRC staff advice on one or more possible methods licensees may use to meet particular regulatory requirements. See, e.g., The Curators of the University of Missouri, CLI-95-1, 41 NRC 71, 150 & n.121 (1995); Petition for Emergency and Remedial Action, CLI-78-6, 7 NRC 400, 406-07 (1978); Consumers Power Co. (Big Rock Point Nuclear Plant), ALAB-725, 17 NRC 562, 568 n.10 (1983); Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), CLI-74-40, 8 AEC 809, 811 (1974). These guides, however, do not themselves have the force of regulations for they do not impose any additional legal requirements upon licensees. Licensees remain free to use other means to accomplish the same regulatory objectives. See id. "[A]gency interpretations and policies are not 'carved in stone' but rather must be subject to re-evaluations of their wisdom on a continuing basis." Kansas Gas & Elec. Co. (Wolf Creek Generating Station, Unit 1), 49 NRC 441, 460 (1999)(referencing Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837, 863-64).

Accordingly, it has long been an established principle of administrative law that an agency is free to choose among permissible interpretations of its governing statute, and that at times new interpretations may represent a sharp shift from prior agency views or pronouncements. Chevron, 467 U.S. at 842-43, 862 (1984). This is permissible so long as the agency gives "adequate reasons for changing course." Envirocare of Utah v. NRC, F.3d , No. 98-1426 (D.C. Cir., Oct. 22, 1999), slip op. at 6. Given that: (1) the disputed portions of the Alternate Feed Guidance are not derived directly from UMTRCA or its history; (2) the Guidance apparently has not been consistently applied in the manner proposed by the State of Utah; (3) the precise terms of the Guidance are not entirely clear (c.f., e.g., "other grounds"); and (4) the Commission believes that literal adherence to the apparent intent of the Guidance would lead to unsound policy results, the Commission declines to follow it here and will require the NRC staff to revise it as soon as practicable.[(5)]

Several policy reasons support departing from the Guidance. First, the NRC's statutory mission is public health and safety. Our regulations establish comprehensive criteria for the possession and disposal of 11e.(2) byproduct material under NRC or Agreement State jurisdiction. See 10 C.F.R. Part 40, Appendix A. The criteria were designed to assure the safe disposal of bulk material whose primary radiological contamination is uranium, thorium, and radium in low concentrations. But whether the concentration of uranium in the feedstock material is .058% or .008% -- the initial high and low estimates, respectively, of the Ashland 2 material based upon samples taken -- has no impact upon the general applicability and adequacy of the agency's health and safety standards for disposal of § 11e.(2) material. Yet, in Utah's view, whether the actual uranium concentration proved to be .058% or .008% could well dictate whether the resulting tailings appropriately could be classified as § 11e.(2) material and regulated by the NRC.

Utah's interpretation thus divides byproduct material into two different regulatory camps based solely upon market-oriented factors, i.e., the expected profit from selling recovered uranium versus any other economically advantageous aspects of the license amendment. Utah emphasizes, for example, that it "has not objected to several [IUSA] alternate feed license amendment requests where the waste material contained [greater amounts] of uranium." See Utah's Petition for Review of LBP-99-5 (Feb. 26, 1999) at 9 n.10. From a health and safety perspective, though, there is no reason to prohibit IUSA from disposing of tailings material in its disposal cells solely on account of the feedstock having a lower uranium concentration or lower market value. Cf. Kerr-McGee, 903 F.2 at 7-8.

Second, the Guidance, if applied as originally intended, would cast the NRC staff into an inappropriate role, conducting potentially multi-faceted inquiries into the financial attractiveness of transactions. The staff essentially would need to look behind and verify every assertion about the economic factors motivating a proposed processing of material -- an unnecessary and wasteful use of limited agency resources, at a time when the Commission increasingly has moved away from performing economics-oriented reviews that have no direct bearing on safety and are not specifically required by Congress.[(6)]

In addition, the NRC seeks to regulate efficiently, imposing the least amount of burdens necessary to carry out our public health and safety mission. Yet, as this proceeding itself demonstrates, the Alternate Feed Guidance's unwieldy "Certification and Justification" test lends itself easily to protracted disputes among the NRC staff, intervenors, and the licensee over such issues as how much the licensee will "really" profit from selling recovered uranium, what the licensee's "bigger" motives may be, etc. All this effort and attention imposes burdens on the parties while detracting from our central mission -- radiological safety, i.e., assuring that there are no constituents in the alternate feed material that would prevent the mill from complying with all applicable NRC health and safety regulations.

Nor is it inconceivable that eventual potential changes in the marketplace could impact whether particular material might fall within the § 11e.(2) definition one year but not the next, merely on account of some new market factor. Purely economic factors, in short, should not determine how radioactive material is defined. Whether IUSA was paid a "substantial sum," as Utah emphasizes, a nominal sum, or had to pay a sum to acquire the Ashland 2 material has no bearing on health and safety issues. Therefore, this is not appropriately the Commission's concern and also should have no bearing on whether the resulting tailings meet the statutory definition of byproduct material under § 11e.(2).

While it may be true, as Utah states, that when Congress enacted UMTRCA there was no "thought of using offsite active uranium mills to process and dispose of industrial cleanup waste from FUSRAP sites," Utah's Reply Brief at 5, several Congressmen did express an interest in having private corporations take and reprocess materials as a means to offset the federal government's ultimate disposal costs for cleaning up UMTRCA's designated Title I sites. See, e.g., UMTRCA Hearings on H.R. 13382, H.R. 12938, H.R. 12535, and H.R. 13049 ("UMTRCA Hearings II") Subcomm. On Energy & the Environment, House Comm. On Interior & Insular Affairs (1978) at 82 (statement of Rep. Weaver)(some "companies might be interested in sharing the cost of stabilization of tailings in return for access to minerals remaining in the piles").[(7)] Then Chairman Hendrie voiced no objection, stating that "[i]f they want to reprocess the piling to make a complete recovery of the resource there, I think that is fine from a conservation standpoint. It also puts them back in the active business of milling." See UMTRCA Hearings II at 82.

Here, the Ashland 2 material has been approved for processing and disposal, and the resulting byproduct material will be disposed of pursuant to the same health and safety standards that apply to any other 11e.(2) material in an NRC-licensed mill: 10 C.F.R. Part 40, Appendix A. Though Utah may be dissatisfied with those standards, an adjudicatory proceeding is not the appropriate forum to contest generic NRC requirements or regulations. See, e.g., Duke Energy Corporation (Oconee Nuclear Station, Units 1, 3, and 3), CLI-99-11, 49 NRC 328, 334 (1999).

We note, additionally, that early in the proceeding Utah expressed concern that the Ashland 2 material, contrary to the NRC staff's findings, possibly contained listed hazardous waste. But while the accuracy of the license application can appropriately be the subject of an adjudication, notwithstanding staff findings, here subsequent events have rendered Utah's hazardous waste concern moot. Following negotiations with IUSA and, after analyzing investigations and data from the Ashland 2 site, Utah formally withdrew its allegation that the Ashland 2 material may contain listed hazardous waste. See Utah's Appeal Brief at 3 n.2. Instead, although Utah is upset that the staff's allegedly "scanty" review took only "about six weeks," its own review failed to uncover any errors in the staff's conclusion that the material contains no listed hazardous waste. Utah's remaining generalized complaint about how the staff reached its conclusion is not a litigable issue, given that Utah now concurs with the staff's conclusion and no longer alleges the presence of any listed hazardous waste.

Nevertheless, such disputes about the presence of hazardous waste are likely to recur, and the issue is a significant one, implicating three concerns: (1) possible health and safety issues, (2) the potential for an undesirable, complex NRC-EPA "dual regulation" of the same tailings impoundment, and (3) the potential for jeopardizing the ultimate transfer of the tailings pile to the U.S. government, for perpetual custody and maintenance. See generally UMTRCA, Title II, § 202 (Section 83 of the AEA). In view of our decision that the Alternate Feed Guidance requires revision to reflect our decision on the 11e.(2) definition, we will direct the staff to consider whether the Guidance also should be revised to include more definitive and objective requirements or tests to assure that listed hazardous or toxic waste is not present in the proposed feed material. We note, for example, that in a recent license amendment proceeding, the Presiding Officer declared it simply "impossible" for him to "ascertain the basis for the Staff determination that this material is not hazardous." International Uranium (USA) Corp. (White Mesa Uranium Mill), LBP-97-12, 46 NRC 1, 5 (1997). Similarly, in another earlier proceeding, the Presiding Officer found that the "Staff's new guidance for determining whether feed material is a mixed [or hazardous] waste appears confusing," and accordingly suggested there be more "specific protocols ... to determine if alternate feed materials contain hazardous components." UMETCO, 37 NRC at 280-81. The Commission concludes that this issue warrants further staff refinement and standardization.

In conclusion, applying the Commission's statutory interpretation of § 11e.(2) byproduct material, the Commission finds that the IUSA license amendment properly was issued and that the mill tailings at issue do constitute § 11e.(2) byproduct material. From the information in the record, we believe that it was reasonable for the NRC staff to have concluded that: (1) processing would take place, and (2) uranium would be recovered from the ore. Utah itself has acknowledged that "[i]n three different estimates, taken from DOE documents, the average uranium content of the material ranged from a high of 0.058% to a low of 0.008%." See Utah's Appeal Brief at 4; see also Utah's Brief in Opposition to IUSA's License Amendment (Dec. 7, 1998)("Utah's Brief in Opposition") at 8, and Attachment at 7-8. Utah's own expert estimated that up to $617,000 worth of uranium might be recovered from the Ashland 2 material. See Utah's Brief in Opposition at 8, and Attachment at 9. Utah's primary argument all along has been that the monetary value of the recovered uranium would be much lower than the 4 million dollar payment IUSA would receive, not that no source material would be recovered through processing. See, e.g., id., Attachment at 9 (where Utah's expert stressed that the value of the uranium-238 that could be extracted from the Ashland 2 material "represents a fraction (1.6 to 15 percent) of the $4,050,000 that [IUSA] will receive from Material Handling & Disposal Services fees"); Utah's Reply Brief at 11 (the "disposal fee received by [IUSA] ... is almost 60 times the value of the uranium recovery").

Not only was it reasonable to conclude that uranium could be recovered from the Ashland 2 material, but it was also reasonable to conclude that the processing would indeed take place. IUSA had a contractual commitment to do so; its contract with the Army Corps of Engineers required IUSA to process the material prior to disposal. See IUSA Brief at 18, 25. In addition, as the Presiding Officer noted, "IUSA has a history of successfully extracting uranium from alternate feed material and has developed credibility with the NRC ... for fulfilling its proposals to recover uranium from alternate feeds." 49 NRC at 112. This was not an instance, then, where there was no reasonable expectation that the mill operator would in fact process material through the mill to extract recoverable uranium. Moreover, it is also the Commission's understanding that the Ashland 2 material has in fact been processed in the IUSA mill and that approximately 8,000 pounds of uranium were extracted. While that quantity of uranium was on the low end of IUSA's estimates, it nevertheless represents more than a minute or negligible recovery of uranium.[(8)]

The Commission concludes, therefore, that the Presiding Officer's interpretation of the § 11e.(2) definition reflects a sensible

reading of the UMTRCA statute and legislative history -- one we hereby embrace -- and that the record overall supports the issuance of the license amendment.

III. Conclusion

For the foregoing reasons, LBP-99-5 is affirmed.

IT IS SO ORDERED.

For the Commission

[original signed by]

_____
Annette L. Vietti-Cook
Secretary of the Commission

Dated at Rockville, Maryland,
this 10th day of February, 2000.

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1. IUSA made a similar request to receive, process, and dispose of uranium-bearing material from the nearby Ashland 1 and Seaway Area D FUSRAP sites. That license amendment is the subject of a separate NRC adjudicatory proceeding (Docket No. 40-8681-MLA-5) currently held in abeyance pending the outcome of this appeal.

2. In fact, when the Guidance was first proposed, there was a description of how owners of low-level or mixed waste, facing the high costs of disposal, might find it "very attractive" to "pay a mill operator substantially less to process [the material] for its uranium content and dispose of the resulting 11e.(2) material," rather than to pay for disposal at a low-level or mixed waste facility. See "Uranium Mill Facilities, Request for Public Comments on Guidance on the Use of Uranium Mill Feed Materials Other Than Natural Ores," 57 Fed. Reg. 20,525, 20,533 (May 13, 1992)("Proposed Guidance"). The Proposed Guidance labeled such transactions "sham disposals," and implied they "would not meet the definition of 11e.(2) byproduct material." Id. at 20,533.

3. "Source material" has been defined by the Commission to exclude ores containing less than 0.05% of uranium or thorium. 10 C.F.R. § 40.4.

4. See also, e.g. Kerr-McGee, 903 F.2d at 7 (where the court suggested that the word "primarily" in the § 11e.(2) definition could be read to mean "substantially," and thus the tailings from the coproduction of source material and rare earths could still be deemed 11e.(2) byproduct material so long as one of the reasons for processing the ore was for extracting source material). The court's reasoning in Kerr-McGee is consistent with the UMTRCA history, which reflects that it has long been the case, for instance, that both vanadium and uranium might be extracted during a processing of material, and indeed that the amount of recoverable vanadium may very likely be much greater than that of the recoverable uranium. See, e.g., UMTRCA Hearings I at 155 (where private company reprocessing material was extracting 2 ½ pounds of vanadium for every ½ pound of uranium extracted); see also UMTRCA Hearings III at 136 ("We recover ... about 1,000 pounds a day of uranium, about 4,000 pounds of vanadium"). There was never any suggestion in the legislative history that if the amount or value of the vanadium proved higher than that of the uranium, the tailings could not be categorized as 11e.(2) byproduct material.

5. The Commission has promulgated no regulation implementing the Guidance. Thus, the Commission's rejection of the Guidance does not present a situation where the Commission has altered "suddenly and sub silentio settled interpretations of its own regulations." Natural Resources Defense Council, Inc. v. NRC, 695 F.2d 623, 625 (D.C. Cir. 1982). See generally Syncor Int'l Corp. v. Shalala, 127 F.3d 90 (D.C. Cir. 1997); Paralyzed Veterans of America v. D.C. Arena L.P., 117 F.3d 579 (1997), cert. denied, 523 U.S. 1003 (1998); United Technologies Corp. v. EPA, 821 F.2d 714 (D.C. Cir. 1987).

6. See, e.g., Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 28,467, 28,484 (June 5, 1996); Kansas Gas & Elec. Co. (Wolf Creek Generating Station, Unit 1), CLI-99-19, 49 NRC 441 (1999).

7. See also, e.g., UMTRCA Hearings 1 at 89-90 (written statement of Rep. Johnson); Hearings On S.3008, S.3078, and S.3253 ("UMTRCA Hearings III") Subcomm. On Energy Prod. & Supply, Senate Comm. On Energy & Natural Resources (1978) at 59 (statement of Sen. Haskell)(if private companies reprocessed some of the tailings, that would be regulated under the NRC's regulations).

8. Moreover, even if we had adhered to and sought to apply the Guidance's tests for licensee "motives," the record does not show that IUSA processed the Ashland 2 material as a means to change non-11e.(2) material into § 11e.(2) material. IUSA was aware that the NRC staff had accepted a DOE certification declaring that the Ashland 2 FUSRAP material met the 11e.(2) byproduct material definition. Based upon the DOE certification, the staff had concluded that "the material could be disposed of directly in the White Mesa tailings impoundments," without any need of processing at the mill. See Technical Evaluation Report at 6, attached to Amendment 6 to Source Material License Sua-1358 (June 23, 1998). The staff thus claims that "sham disposal" was not a concern "since it did not appear that the material was being processed to change its legal definition, and as such was truly being processed for its uranium content." See Staff Aff. of Joseph Holonich at 7. Whether the Ashland 2 material actually already was § 11e.(2) byproduct material under UMTRCA remains unclear. See supra at 6-7. Nevertheless,

IUSA was aware that DOE, the Army Corps of Engineers, and the NRC staff all had categorized the material as such, and that the staff indeed had stated that this was material that could have been disposed of without any further processing. This suggests that IUSA had a genuine interest in processing the material for the uranium and not simply an interest in "reclassifying" the material by processing it. The subtle and complex nature of this inquiry, however, reinforces our view that discerning a licensee's motives for a license amendment transaction is a difficult, virtually impossible and, in any event, unnecessary exercise. Accordingly, our approach in this decision rejects ultimate business motivations as irrelevant to the § 11e.(2) definition.

Exhibit 13

IUC INTERNATIONAL URANIUM (USA) CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

October 17, 2001

VIA EXPRESS COURIER

40-8681

Mr. Melvyn Leach, Director
Fuel Cycle Licensing Branch
Mail Stop T-8A33
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Re: Information on Drummed Uranium Material
Amendment Request to Process an Alternate Feed Material from Molycorp at White Mesa Uranium Mill
Source Material License No. SUA-1358

Dear Mr. Leach:

International Uranium (USA) Corporation ("IUSA") submitted on December 13, 2000 a request to amend Source Material License No. SUA-1358 to authorize receipt and processing of a uranium-bearing material from the Molycorp, Inc. ("Molycorp") facility located in Mountain Pass, California (the "Mountain Pass Facility"). This material resulted from the mineral recovery of natural ore for the production of lanthanides. IUSA also submitted supplemental information to NRC on January 2, 2001 relating to this amendment request. The material addressed in IUSA's amendment request and supplemental information letter will be removed by Molycorp's Lanthanide Division from three former impoundments at their mine and mill site at the Mountain Pass facility. The amendment request and January 2, 2001 letter referred to the material to be removed from the three Molycorp impoundments as the "Uranium Material." That Uranium Material is referred to herein as the "Pond Uranium Material." This letter addresses a small quantity of additional material from the Mountain Pass facility, currently stored in approximately 36 drums at that facility, which IUSA requests be included in the foregoing requested license amendment. This additional material is referred to herein as the "Drummed Uranium Material."

The Drummed Uranium Material is similar to the Pond Uranium Material in source, chemical composition, radiological composition, and physical properties, and is expected to be indistinguishable from the Pond Uranium Material during and after processing at the White Mesa Mill (the "Mill"), and in its impacts on Mill tailings. This letter provides a detailed comparison of the Pond Uranium Material with the Drummed Uranium Material, and demonstrates that the

NMSS/RPOB

Drummed Uranium Material is sufficiently similar that it can properly be included with the Pond Uranium Material in the same license amendment.

Historical Summary of Sources

As described in the January 2, 2001 letter, Molycorp has operated a surface mining and milling operation for the mineral recovery and chemical separation of lanthanides and other rare earths from bastnasite ores since the 1950's. From 1965 through 1984 Molycorp constructed and operated three lead sulfide ponds for the evaporation of lead sulfide sludges from the clarifier/thickener operation. The lead sulfide sludges contain uranium, which is also precipitated in the thickener. All three of the lead sulfide ponds were taken out of service prior to 1985. All of the Pond Uranium Material comes from these ponds and is associated with these pre-1985 activities.

From 1985 onward, the same uranium-bearing lead sulfide stream that had previously been transferred to the ponds, was managed as follows. From 1986 through 1995, this material was filtered and accumulated in drums. In 1995, Molycorp treated the drum contents with stabilization cement and sodium silicate to stabilize the lead content. For the period from 1995 to 1998, the stabilized material was returned to the Molycorp mineral recovery circuit for further recovery of lanthanides. During the same period, a portion was also shipped off site to recovery facilities and/or land disposal facilities. A Molycorp flow sheet and text, which describe the operations that generated the Drummed Uranium Material, are provided in Attachment 1.

The stabilized material that was returned to the Molycorp mineral recovery circuit was reintroduced just prior to the hydrochloric acid leaching step, and continued through the remainder of the circuit with the roasted bastnasite ores. These activities ceased in March 1998. The reintroduction area, containing only the equipment where the stabilized material was repulped and slurried, was decommissioned under the oversight of the State of California environmental authority after March 1998. The residuals from these decommissioning activities, containing the original stabilized drum contents treated with leach acid, were returned to drums. The approximately 36 drums (approximately 11 tons) from this area constitute the "Drummed Uranium Material."

The portion of the stabilized drummed material that Molycorp had previously shipped off site to other facilities was estimated to contain less than 0.05 percent total uranium and thorium. That material exhibited the RCRA TCLP characteristic for lead, and was shipped as RCRA characteristic waste D008. None of this previously shipped material will be included in the Drummed Uranium Material to be shipped to the Mill.

The Drummed Uranium Material to be shipped to the Mill is estimated to contain greater than 0.05 percent total uranium and thorium. Amendment 10 to Molycorp's Radioactive Material License, issued by the State of California, indicates that all the drummed stabilized lead sulfide sludges at the Mountain Pass facility have been classified as uranium and thorium source material. A copy of Molycorp's License Amendment 10 is provided in Attachment 2. Molycorp personnel have conducted ongoing telephone communications with the State of California environmental authorities, throughout 2001, regarding modifications to Molycorp's

decommissioning work plans. According to Molycorp personnel, based on those communications, the Drummed Uranium Material will be classified as uranium and thorium source material.

The December 13, 2000 amendment request sought authorization to process approximately 21,300 tons (16,400 CY) of Pond Uranium Material at the Mill as an alternate feed/ore. This letter requests that up to approximately 50 additional drums (approximately 16 tons) of Drummed Uranium Material be included in the same license amendment as the Pond Uranium Material for processing as an alternate feed/ore at the Mill, to ensure that all of the Drummed Uranium Material is also included in the requested amendment.

Radiochemical Data

Molycorp estimates that the Drummed Uranium Material has an approximate uranium content ranging from 0.10 percent to approximately 0.14 weight percent (0.12 to 0.18 percent U_3O_8), or greater, with an estimated overall average grade of 0.12 percent uranium (0.14 percent U_3O_8) for the entire volume of Drummed Uranium Material. This average uranium content is very similar to the Pond Uranium Material, which was estimated to have a uranium content ranging from 0.002 to 0.49 weight percent (0.0024 to 0.59 percent U_3O_8) and an approximate average of 0.15 weight percent uranium (0.18 percent U_3O_8). Data provided by Molycorp on the radiochemical content of the Drummed Uranium Material is included in Attachment 3.

According to data provided by Molycorp, the Drummed Uranium Material may have an approximate total thorium content ranging from 11 to 288 mg/kg (ppm). According to data provided by Molycorp, the Pond Uranium Material may have an approximate total thorium content ranging from 62 to 5954 mg/kg (ppm).

Consequently, as demonstrated by the Molycorp data, the Drummed Uranium Material is expected to be comparable in uranium content, but may be significantly lower in thorium content, than the Pond Uranium Material.

Hazardous Constituent Data

The December 13, 2000 amendment request demonstrated that the Pond Uranium Material was not and did not contain RCRA listed hazardous waste as defined in 40 CFR 261 et. seq. As will be described under the Chemical Composition and Hazardous Waste Protocol Sections, below, the Drummed Uranium Material also is not, and does not contain, RCRA listed hazardous waste.

Exhibit 14

Request to Amend
Source Material License SUA-1358
White Mesa Mill
Docket No. 40-8681

September 20, 1996

Prepared by:
Energy Fuels Nuclear, Inc.
1515 Arapahoe Street, Suite 900
Denver, CO 80202

Contact: Michelle R. Rehmann, Environmental Manager
Phone: (303) 899-5647

Submitted to:

United States Nuclear Regulatory Commission
2 White Flint North, Mail Stop T-7J9
11545 Rockville Pike
Rockville, MD 20852

INTRODUCTION

Energy Fuels Nuclear, Inc. ("EFN") operates an NRC-licensed uranium mill located approximately six miles south of Blanding, Utah. The mill processes natural (native, raw) uranium ores and feed materials other than natural ores. These alternate feed materials are generally processing products from other extraction procedures, which EFN will process primarily for the source material content. All waste associated with this processing is, therefore, 11e.(2) byproduct material; or, as stated in the alternate feed analysis noticed in Federal Register Volume 57, No. 93:

> "The fact that the term 'any ore' rather than 'unrefined and unprocessed ore' is used in the definition of 11e.(2) byproduct material implies that a broader range of feed materials could be processed in a mill, with the wastes still being considered as 11e.(2) byproduct material".

This application to amend NRC Source Material License SUA-1358 requests an amendment to allow EFN to process a specific alternate feed primarily for its source material content, and to dispose of the associated 11e.(2) byproduct material.

1.0 MATERIAL COMPOSITION AND VOLUME

Allied Signal, Inc. of Metropolis, Illinois, ("Allied") will repackage (as necessary), prepare, and load for shipping material described as uranium-bearing potassium diurinate ($K_2U_2O_7$) in a solution of potassium hydroxide/potassium fluoride ("KOH/KF") in water ("Material"). This Material is currently contained in approximately 11,000 drums. Approximately 110 loads, or 4,000 to 5,000 of 55-gallon drums (900 tons), of dry material will be shipped in drums, and approximately 98 loads will be shipped in slurry form (in tanker trucks) to the White Mesa Mill ("the Mill"). Specific gravity of the slurry is approximately 1.5 to 1.6. Approximately 5,000 cu. ft. of compacted drums, resulting from the repackaging of the Material, having been washed, pelletized, and wrapped, will also be sent to the Mill. It has been standard practice to dispose of drums in which alternate feed material is contained as 11e.(2) byproduct material as they are emptied for processing of the Material; however, in this case, environmental and waste minimization considerations demand that some of the Material be emptied from drums and shipped in tankers as slurry. The drums, however, remain an element of this recycling process. Further, as discussed below in subsection 1.3, these drums are considered to have become 11e.(2) byproduct when U_3O_8 (yellowcake) was placed in the drums for shipment to Allied.

Exhibit 15

Request to Amend
Source Material License SUA-1358
White Mesa Mill
Docket No. 40-8681

March 16, 2000

Prepared by:
International Uranium (USA) Corporation
1050 17th Street, Suite 950
Denver, CO 80265

Contact: Michelle R. Rehmann, Environmental Manager
Phone: (303) 389.4131

Submitted to:
United States Nuclear Regulatory Commission
2 White Flint North, Mail Stop T-7J9
11545 Rockville Pike
Rockville, MD 20852

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Attachment 4	Review of Constituents in Linde Site Uranium Materials to Determine Potential Presence of Listed Hazardous Waste
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INTRODUCTION

International Uranium (USA) Corporation ("IUSA") operates the NRC-licensed White Mesa uranium mill (the "Mill") located approximately six miles south of Blanding, Utah. The mill processes natural (native, raw) uranium ores and feed materials other than natural ores. These alternate feed materials are generally processing byproducts from other extraction procedures, which IUSA processes at IUSA's licensed uranium mill, primarily for their source material content. All waste associated with IUSA's processing is therefore 11e.(2) byproduct material.

This application to amend NRC Source Material License SUA-1358 requests an amendment to allow IUSA to process a specific alternate feed, and to dispose of the resulting 11e.(2) byproduct material in accordance with the Mill operating procedures.

Yellowcake produced from the processing of this material will not cause the currently-approved yellowcake production limit of 4,380 tons per year ("TPY") to be exceeded. In addition, and as a result, radiological doses to members of the public in the vicinity of the Mill will not be elevated above levels previously assessed and approved.

1.0 MATERIAL COMPOSITION AND VOLUME

IUSA is requesting an amendment to Source Material License SUA-1358 to authorize receipt and processing of certain uranium-bearing byproducts, which byproducts originally resulted from the processing of natural ore for the extraction of uranium. For ease of reference, this byproduct material is referred to herein as the "Uranium Material". The Uranium Material is located at a property being managed under the Formerly Utilized Sites Remedial Action Program ("FUSRAP") in Tonawanda, New York, known as the Linde property. The Linde property is one of four properties that comprise the Tonawanda Site. NRC has already granted license amendments to IUSA to process material from two of the other properties within the Tonawanda site, Ashland 1 and Ashland 2 which contained uranium byproduct material originally generated at the Linde property. The Uranium Material is not a residue from a water treatment process.

The Uranium Material will be transported by a U.S. Army Corps of Engineers ("USACE", or the "Corps") contractor, as part of the FUSRAP Program, from the Linde property to the Mill. A historic summary of the sources of the Uranium Material is provided below. This history was derived from the documents listed on page 4 of this Amendment Request.

1.1 Historical Summary of Sources

As described above, the Linde property is one of several properties within the Tonawanda, New York FUSRAP site, which includes Linde, Ashland 1, Ashland 2, and Seaway. The regional setting of Linde, Ashland 1, Ashland 2, and Seaway is shown in Figure 1-2 of Attachment 1. Figure 1-3 shows the specific locations of the Linde, Ashland 1, Ashland 2, and Seaway properties.

Union Carbide Corporation's former Linde Air Products Division purchased the Linde property and constructed a ceramics plant at the location in 1942. One of the ceramics processes conducted by Union Carbide Linde Division at this location consisted of extraction of uranium from ores to produce uranium salts, for coloration of product glasses. Based on their experience, Union Carbide was placed under contract with the Manhattan Engineering District ("MED") from 1942 to 1946 to extract uranium from seven different ore sources: four African pitchblende ores and three domestic ores. Laboratory and pilot plant studies were conducted from 1942 to 1943. From 1943 to 1946, Linde conducted full scale processing of 28,300 tons of ore. The Linde Division contract with the MED ended in the early 1950's.

The domestic ores processed at Linde were in fact residuals from commercial processing at other facilities which removed vanadium. The vanadium removal process also removed radium and other daughter products in the decay chain. As a result, the domestic uranium ores supplied to Linde had reduced concentrations of radium relative to the uranium and thorium levels. The African ores contained uranium in equilibrium with all the daughter products in its decay chain.

Figures D-1 through D-4, of the United States Department of Energy ("USDOE") Preliminary Site Assessment in Attachment 1, show the three-phase processes used for domestic and foreign ores. Triuranium octoxide ("U_3O_8") was separated from the feedstock by acid digestion, precipitation, and filtration. The solid, gelatinous filter cake from this step was discarded as solid waste in a temporary tailings pile on the Linde site. Insoluble precipitates from the solution steps were combined with the filter cake for disposal on site. Approximately 8,000 tons of filter cake and precipitates were later relocated to Ashland 1. U_3O_8 was converted to uranium dioxide and uranium tetrafluoride at the Linde site. Residuals from these two steps were reprocessed. A more detailed discussion of the ore composition, recovery processes, and waste disposal practices is provided in Attachment 1.

Five buildings at the site were involved in MED activities. Building 14 had been constructed by Union Carbide in the mid-1930's. Buildings 30, 31, 37, and 38 were constructed at the location by MED, and their ownership was transferred to Linde when the MED contract ended.

Residues from uranium ore processing at the Linde facility were disposed of and/or stored at the Ashland 1, Ashland 2 and Seaway properties. The majority of Linde facility residues were disposed of on the Ashland 1 property between 1944 and 1946. No material was transferred from Linde to Ashland 1 after this period. In 1974, the subsequent owner of the Ashland 1 property excavated a portion of the Linde residues and soils from the Ashland 1 site, and relocated them to the Ashland 2 property. NRC has already approved amendments to IUSA's license for processing of the portion of the Linde residues and soil moved to Ashland 1 and Ashland 2.

After transfer of residues to Ashland 1 was completed, Linde added manufacturing operations at the Linde facility that very likely contributed additional contaminants to materials remaining on the Linde site, but would not have affected materials already transferred to Ashland 1 and/or Ashland 2.

From 1955 to 1991, the Linde Division operated a gas equipment design and manufacturing facility on the property. The operation included design, manufacture, testing, and repair of gas compressors, chillers, filters and other equipment for installation at customer sites. The Linde Division was divested from Union Carbide in 1991, and changed its name to Praxair. Praxair discontinued manufacturing operations in 1991 but maintained engineering design offices on the property. There is no record of any processing activities other than uranium processing, occurring on the property, either before or after the MED activities.

Renovation of the facility over the years has resulted in consolidation of the MED wastes and radioactively contaminated soils remaining at the property. In 1977, MED contaminated soil was removed from the construction area for the new building 90, and placed in two windrows along the northern property line. The windrows were consolidated into one pile between 1979 and 1982, and covered in 1992.

The USDOE and the U.S. Environmental Protection Agency ("EPA") negotiated a Federal Facilities Agreement ("FFA") governing remediation of the Linde property. In 1997, Congress transferred management responsibility for the sites in the FUSRAP program, including the Linde Site, to the USACE. All actions by the USACE at the Linde Site are being conducted subject to the administrative, procedural and regulatory provisions of the Comprehensive Environmental Response Compensation and Liability Act ("CERCLA") and the existing FFA.

USACE issued a Proposed Plan for the Linde Property in 1999 (USACE, March 1999) and a Final Record of Decision ("ROD") in 2000 (USACE, March 2000). As a result, sufficient characterization information on the nature and extent of contamination is already available to assess the composition and sources of Uranium Material to be excavated.

Over the years, erosion and weathering have spread contamination from the residuals handled and disposed of at Linde to adjacent soils, increasing the volume of Uranium Materials to be removed during the remedial excavation. Physically, the Uranium Material is a moist material consisting of byproducts from uranium processing operations (i.e., "tailings"), mixed with site soils (Remedial Investigation ("RI") Report USDOE, 1992). According to the USACE Buffalo District, the USACE estimates the volume of soil to be excavated from the entire Linde property to range from approximately 35,000 to 70,000 cubic yards ("CY") or somewhat more, depending on conditions encountered during excavation. These volumes are estimates only. It is difficult to estimate the extent to which surrounding soils have been contaminated by the tailings, and hence the potential volumes, with precision. Pre-excavation estimates at other FUSRAP sites in Tonawanda have been as low as one-half the actual excavated volume. Therefore, to ensure that IUSA will not have to reapply for an increased volume from this site in the future, this request is for up to 100,000 CY of Uranium Material.

As described in detail below, 100,000 CY would not come near the Mill's currently approved yellowcake production limit of 4,380 TPY, and as, even without reprocessing, the composition of the Uranium Materials is very similar to the Mill's existing tailings, added volumes of Uranium Material will have no adverse effect on public health, safety, and the environment.

USACE expects to excavate and deliver the Linde Site materials over a period of ten to fourteen months or longer. IUSA has previously received NRC approval for a license amendment to process Uranium Material from the St, Louis FUSRAP site. As described in the IUSA Request for Amendment for the St. Louis material, the USACE may be expected to excavate and ship approximately 20,000 to 80,000 CY per year of Uranium Material from the St. Louis Site, and IUSA would expect to process this material over several years. If the entire volume of Linde material were received during a period that overlapped with shipments of the St. Louis material, the processing of the total estimated volume of 180,000 CY in one year would not come near the Mill's currently approved yellowcake production limit of 4,380 TPY.

Additional information on the Linde property is contained in Attachments 1 and 2. Attachment 1 includes the following items describing the Uranium Materials and the Linde property operational history:

1. A detailed site history of the Tonawanda Site, including the Linde property, is provided in Chapter 1 of the Remedial Investigation Report for the Tonawanda Site (USDOE, December 1992) (the "RI").

2. Additional detail on the uranium extraction process is provided in Section 7.0 of the Preliminary Assessment and Site Investigation for Linde Air Products Division of Union Carbide (USDOE, September 1987).

Attachment 2 includes the following items describing the composition of the Uranium Materials:

1. Chapters 3 and 4 of the Remedial Investigation Report for the Tonawanda Site (USDOE, December, 1992) describe uranium concentrations and metals and organic contaminant concentrations in surface and subsurface samples at the Linde property.

2. Portions of the Radiological Survey of the Ashland Oil Company (Former Haist Property), Tonawanda, New York (U.S. Department of Energy, May 1978) describe uranium concentrations in core samples and approximate distributions of tailings stored on the Linde property.

3. A summary of the concentrations of chemical contaminants is provided in the Linde Site Preliminary Material Characterization Report (USACE/IT, February 2000).

4. Portions of the Preliminary Plan for the Linde Site (USACE, March 1999) describe site history and radiological contamination.

5. Portions of the Record of Decision for the Linde Site (USACE, March 2000) describe the regulatory framework and remediation goals relative to the radiological and chemical contamination at the site.

Exhibit 16

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WASTE MANAGEMENT
AND RADIATION CONTROL
Scott T. Anderson
Director

April 26, 2016

Binesh Tharakan
U.S. NRC Region IV
Division of Nuclear Materials Safety
1600E. Lamar Blvd
Arlington, TX 76011-4511

RE: Transportation Incident at the White Mesa Mill Involving an 11e.(2) Shipment

Dear Mr. Tharakan:

On March 29, 2016, Energy Fuels Resources Inc.'s (EFRI) White Mesa Uranium Mill contacted the Division of Waste Management and Radiation Control to report a leaking shipment of 11e.(2) material that had arrived at its facility. The Radiation Safety Officer of the Mill described the material as a white paste like substance. The 11e.(2) shipment originated from the Cameco-Smith Ranch facility (a Nuclear Regulatory Commission (NRC) licensed facility) in Wyoming and was sent to the Mill to be disposed in the Mill's tailings cells.

The Mill's radiation safety staff documented the leak with photographs, radiological surveys and a written description. Documentation of the leak indicates that 11e.(2) material leaked onto the transport container, the transport conveyance and U.S. Highway 191 near the Mill. During transport, a winter storm with rain and snow went through Wyoming, Colorado and Utah when this incident occurred (March 28 and 29, 2016). Therefore, there is a high probability that any road contamination would have been washed away and making it impossible to determine when the leaking of the transport began.

A further description of the incident from EFRI dated April 4, 2016, including radiological survey results, is enclosed.

The following regulations are applicable to this incident:

1. 49 CFR 173.427(c)(1) – *Transportation requirements for low specific activity (LSA) Class 7 (radioactive) material and surface contaminated objects (SCO).*

(Over)

195 North 1950 West • Salt Lake City, UT
Mailing Address: P.O. Box 144880 • Salt Lake City, UT 84114-4880
Telephone (801) 536-0200 • Fax (801) 536-0222 • T.D.D. (801) 903-3978
www.deq.utah.gov

2. 49 CFR 173.443 - *Contamination control*
3. 10 CFR 71.43(f) – *General standards for all packages*
4. 10 CFR 71.71 - *Normal conditions of transport*

Contrary to 49 CFR 173.427(c)(1), 10 CFR 71.43(f) and 10 CFR 71.71, the Cameco-Smith Ranch Facility sent an 11e.(2) shipment to the White Mesa Mill in a roll-off container that did not contain the material under routine (normal) conditions of transport.

Contrary to 49 CFR 173.443, leakage from that container resulted in removable contamination on the outside of the container that exceeded DOT contamination limits for Alpha and an exterior dose rate greater than 0.5 mrem per hour.

This is the second incident of this type that has been reported to the Division with the first being reported on August 21, 2015. The Division requests that NRC take appropriate regulatory action with Cameco-Smith Ranch to prevent recurrence. Please find enclosed the EFRI report of the incident, photographs and shipping papers.

If you have any questions, please call Ryan Johnson at (801) 536-4255.

Sincerely,

Scott T. Anderson, Director
Division of Waste Management and Radiation Control

STA/RMJ/ka

Enclosures: Documentation Letter, dated April 4, 2016 (DRC-2016-006042)
Cameco Smith Ranch Shipping Paperwork (DRC-2016-006041)
Photographs (DRC-2016-006044)
Email from Ryan Johnson, dated March 29, 2016 (DRC-2016-006045)

c: Worthy Glover, Jr., MMHRM, CPM, Health Office San Juan Public Health Department
Rick Meyer, Environmental Health Director, San Juan Public Health Department
David Ariotti, P.E., DEQ District Engineer
Ms. Linda Gersey, U.S. NRC Region IV, Division of Nuclear Materials Safety
Ryan S. Schierman, State of Wyoming, Wyoming Department of Environmental Quality, Natural Resources Program Manager
Jennifer Opila, Colorado Department of Public Health & the Environment, Hazardous Materials & Waste Management Division, Radiation Program, Program Manager

Exhibit 17

Energy Fuels Resources (USA) Inc.
6425 South Highway 191, PO Box 809
Blanding, UT. US, 84511
435 678 2221, fax 435 678 2224
www.energyfuels.com

"DRC-2013-003465"

November 8, 2013

VIA UPS GROUND

Mr. Rusty Lundberg
Division of Radiation Control
State of Utah Department of Environmental Quality
195 North 1950 West
Salt Lake City, Utah 84114-4850

Re: Energy Fuels Resources (USA) Inc. White Mesa Mill, Blanding, Utah License Number UT1900479; Annual Summary of Disposal of 11e.(2) Byproduct Waste Material

Dear Mr. Lundberg:

Please find attached the annual summary of 11e.(2) Byproduct Waste Material which was disposed of at Energy Fuels Resources (USA) Inc.'s White Mesa Mill, Blanding, Utah for the year 2012.

This information is provided in accordance with License Condition 10.5 F. of Radioactive Materials License Number UT1900479. Should you have any questions regarding this information, please do not hesitate to call me at the mill at 435.678.2221.

Sincerely,

David Turk
Manager Environmental Health and Safety
Energy Fuels Resources (USA) Inc.

cc: David C. Frydenlund
Harold R. Roberts
Jo Ann Tischler

Energy Fuels Resources (USA) Inc. 11e.(2) Receipts for 2012

Generator	Received Tons 2012	Received Cubic Yards 2012	Tons Received from Inception	Cubic Yards Received from Inception	Comments
Crow Butte Resources	44.40	180.00	425.99	1100.00	Active
IEC	0.00	0.00	4826.37	4920.00	Closed
Mestena Uranium, L.L.C - Alta Mesa ISL Project	329.80	412.80	2950.71	2892.65	Active
Cameco - Highland	645.90	1663.54	1260.65	2876.57	Active
Cameco - North Butte	0.00	0.00	94.24	211.10	Active
Cameco - Smith Ranch Property	645.90	1663.54	940.64	1853.48	Active
UEC - South Texas Mining	1109.10	871.50	4920.80	3938.50	Active
UEC - Goliad	0.00	0.00	0.00	0.00	Active
UEC - La Palangana	74.30	95.50	167.90	171.50	Active
URI, Inc. - Rosita	0.00	0.00	489.27	588.79	Active
URI, Inc. - Kingsville Dome ISR Project	202.60	177.60	651.56	888.26	Active
URI, Inc. - Vasquez ISR Project	0.00	0.00	34.13	45.70	Active
USX - Texas Uranium operations	0.00	0.00	5099.99	4636.35	Closed

Exhibit 18

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1st International Symposium

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NORM Related Production of Rare Earth Metals in Estonia

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Abstract

Since 1970's rare earth, Nb and Ta metals and their compounds are produced in the plant, located at Sillamäe, Estonia. In imported mineral ores, which are used as commercial feedstock materials, NORM concentrations (both ^{238}U and ^{232}Th decay chain radionuclides) vary greatly, however they are usually high enough to cause exposure to workers and even sometimes concerns to the public. During processing operations radionuclides become mobilized, migrate to dusts, scales and process residues, leading to the enrichment in these materials. This means that the materials used and NORM waste produced as the by-product of processing, require proper management taking account the safety concerns. At workplaces doses to workers from external exposure, from radon/thoron and dusts in the air are or might be significantly higher than the dose limit for a member of the public. For this reason, these production activities are regulated as a radiation practice.

The paper gives an overview of performed studies and assessments on the impact of NORM, including material and waste streams, radiation exposures during pre-processing, chemical processing, generation of NORM waste, waste management and disposal, their environmental impact, etc. A comprehensive discussion on the establishment of the Estonian regulatory framework for NORM and the arising practical problems is also presented.

1. Introduction

In last decades multiple studies have identified the radiological concerns requiring regulatory control in specific NORM industries. EU has introduced the regulation of 'work activities' within its Directive 96/29/EURATOM (EC, 1996) and issued the recommendations for the implementation (EC, 1997). Production of niobium and tantalum, as well as of rare earths, belongs to work activities involving both potentially significant exposure of workers at the work-place (EC, 1999) and potential significance with regard to public exposure as a result of wastes and discharges (EC, 2003). The minerals in niobium (Nb) ores, various concentrates, oxides, etc., raw materials contain enhanced levels of NORM, mostly of ^{238}U, ^{232}Th and their decay products. Tantalum (Ta) occurs usually in combination with niobium and rare earths.

A major production facility of Nb, Ta and rare earths, Molycorp Silmet AS, is located at Sillamäe, North East Estonia. The large industrial complex produces the above materials (Nb, Ta metals and light rare earth metals as well as their compounds) from various imported ores and by-products.

The present paper discusses the establishment of the Estonian regulatory framework for NORM, the brief history of the facility at Sillamäe, performed studies and assessments on the impact of NORM at the Silmet facility, problems related to the generation of NORM waste, waste management and disposal, their environmental impact.

2. Radiation Act and related legislation

Estonia is a member state of the European Union since 1st May 2004. Thus, the regulations of the Union are in force in Estonia. When necessary, the Estonian regulations have been modified to take into account the EU regulations. The Radiation Act as the principal legal instrument of the radiation protection infrastructure was brought into force in 1997, while a new upgraded version was enforced in 2004 (Radiation Act, 2004). The Act bases on the concepts, principles, terms, and limits laid down in the International Basic Safety Standards (IAEA, 1995) and Directive 96/29/EURATOM (EC, 1996). The basic internationally approved principles, e.g., justification of practices, optimization of protection and safety, limitation of individual doses, adoption of justified and optimized interventions, the primary responsibility of the licensee, and authorization of practices, are explicitly formulated as provisions of the Act. The EU criteria for the exemption of practices from the requirements of the Act are adopted.

The Act sets requirements for identification and regulation of the work activities relevant to NORM. The general radiation safety principles apply also to the management of radioactive waste, including NORM waste, as well as those arising from decommissioning of a nuclear facility. According to the definitions given in the article 3 of the Radiation Act, radioactive waste is any material or object which contains or is contaminated by radionuclides, the activity or activity concentration of which exceeds the established clearance levels and for which no future use is foreseen.

The licensee in radiation practice is required to take any measures to render harmless radioactive wastes arising from its operation. The Regulation of the Minister of Environment No 10 (2005) issued under the Radiation Act specifies the requirements for radioactive waste management. Radioactive waste will be categorized by activity or specific activity, by half-life, by type of radiation and by heat generation as a result of radioactive decay. In conditioning and storing of radioactive waste their producer has to take into account, beside their type, also physical, chemical and biological properties of radioactive waste. Radioactive waste categorization includes NORM waste, which are defined as radioactive waste arising from processing of natural radionuclides, the activity concentration of which is higher than the exemption levels.

Article 59 of the Radiation Act sets that the dispersion, clearance and management of NORM waste, including the way of their storage, interim storage and disposal shall be determined by the license conditions. The Government Regulation No 163 (2004) enforces exemption levels for radionuclide activity and activity concentration in accordance with the terms and levels equal to those stipulated in the BSS (IAEA, 1995) and the EU Directive (EC,1999, 2003). Exemption levels are considered as basic criteria for decisions on licensing radiation practices. No license is needed for operations with activities or activity concentrations of radionuclides below the exemption levels. Examples of the exemption levels relevant to the raw material and waste containing NORM are given in Table 1.

Table 1. Exemption levels for NORM radionuclides

Radionuclide	Activity (Bq)	Activity concentration (kBq/kg)
^{210}Pb, ^{226}Ra, ^{235}U, ^{238}U	10^4	10
^{228}Th, ^{230}Th	10^4	1
^{232}Th nat, ^{238}Unat	10^3	1

For multiple radionuclides or mixtures in the materials, the sum of their activity or specific activity ratios to the corresponding exemption levels should be less than 1.

Environmental impact assessment procedure is required for radioactive waste management facilities, as they are considered in the legislation as activities with a significant environmental impact (EIA, 2005).

In 2009 in the course of reorganization, the Estonian Radiation Protection Centre, the former authority since 1996, was merged as a department with the Environmental Board. It is empowered to authorize practices by licensing, to assess practices and sources, to maintain the dose and source registers, to monitor and to assess radiation levels, to implement international conventions and agreements, to notify about the radiation accidents, etc. The other body, the Environmental Inspectorate, is provided to carry out regular inspections of the licensed radiation practices.

3. History of the Silmet facility

The large industrial complex at Sillamäe, about 190 km East from Tallinn, was launched as a top secret facility in 1948 for mining and milling of local alum shale (*dictyonema argillite*) containing ~ 0.03 % of U. Before Estonia regained independence, the facility under different names, including the Sillamäe Metallurgy Plant, was managed by the former USSR Ministry of Medium-Scale Engineering and it produced uranium for military and civil use. Later the mines were closed and much richer uranium ore of up to 1 % of U was imported from the Eastern European countries. Waste arising from uranium production was stored in a depository located near the Sillamäe plant, 20 - 50 m from the waterline of the Baltic Sea. After processing as a total of about 4 million tons of uranium ore, the uranium production was closed in 1977.

In the beginning of the 1970s the facility was modified for production of niobium, tantalum and rare earth metals, using loparite as a NORM-containing raw mineral from the Kola Peninsula. Later (till now) rare earths were produced from rare earth chloride mix. Composition of raw materials varies depending on the deposit, as niobium/tantalum are usually combined with iron, tin, titanium, manganese, radioactive elements (uranium, thorium) and their decay products. The composition and amount of technological waste from the processing depends on the share of each raw material type in its total amount. As the waste contained small amounts of thorium and uranium as well as their decay products, which were not recovered, the arising NORM waste were dumped together with other waste to the pond on top of uranium tailings depository near the plant. Since 1990 the main activity of the plant has been the continuation of the production of Nb and Ta metals and light rare earth metals as well as their compounds from various imported ores, e.g., columbite and chloride melts. In 1992 the facility becomes the state joint-stock company RAS Silmet, later AS Silmet and now Molycorp Silmet AS, which continues the production of Nb, Ta and rare earths.

With the establishment of the radiation protection infrastructure in Estonia, the NORM related working activities at the Silmet facility were considered of radiological concern, which required regulation as a licensed radiation practice. The performed studies, showed that at workplaces doses to workers from external exposure, from radon/thoron and dusts in the air were or might be higher than the established dose limits for a member of the public (see, e.g., Mustonen, R., et al., 2000). In addition, an analysis showed that the use of the former uranium tailings depository for dumping of the NORM waste might cause some radiological concerns to the members of the public (Realo, 2000).

4. Need for new NORM-waste management system

Until 2004 all radioactive waste from the rare earth and the rare metal production was dumped in the tailings pond. The first environmental impact assessment for the tailing pond was done in 1994 (Ehdwall et al, 1994, Nordlinder. S, et al. 1995). Mostly because of the impacts caused by releases and discharges of chemical pollutants from the depository and from the pond on its top, an international PHARE remediation project was initiated and the use of depository was terminated. The remediation project was

successfully finished in 2008. As a result, the need arouse to work out a new waste management option for the produced NORM waste. For creation of the new waste management system according to the Radiation Act and waste laws, international agreements and other legal acts, a number of assessments and studies there have been carried out.

It became clear that future radioactive waste arising would be caused exclusively by the production process of the Silmet facility (CASSIOPEE, 2002). The volume and activity of radioactive waste to store or respectively to dispose of would depend on from the following:

- content of NORM radionuclides in the raw materials,
- amount of processed raw materials,
- waste management system.

In the period 2001-2003 the developed radioactive waste management system included radioactive waste separation at an early stage of the technological process. The volume of future radioactive waste arising was estimated to be maximum 2000 t/y before vitrification. The specific α-activity of about 7000 Bq/g was estimated for non-vitrified radioactive waste. It was considered that all radioactive waste should be treated and conditioned together and after packaging in the special containers, it would be stored in an interim storage facility of a modular type. After 50-100 years of the interim storage period the waste could be used as feedstock for further processing or disposed of in a final repository (Behre Dolbear & Company, 2002). In case of the final disposal, the waste vitrification option was considered. The vitrified radioactive waste would be dumped into the existing oil-shale ash storage of the local power plant located at the Western side of the former tailings pond dam. This solution represented practically a final near-surface disposal of vitrified long-lived radioactive waste.

5. Environmental impact assessment for NORM waste management

The EIA process for all waste management systems of the facility (including also other forms of waste produced at the plant) was initiated in 2001 (E-Konsult, 2003). As the EIA report provided limited information about the proposed management system for the NORM waste and about the proposed guarantees or assessments for financing of the management options, a special EIA process of the NORM waste management was started in 2003 (E-Konsult, 2004). To meet the public concerns, the EIA program was amended and points covering the possibilities for the future waste management were included. This EIA process was finished in June 2004 and the proposed NORM waste management system was approved.

As the starting point of the EIA process it was taken into account that annually up to 2000 t of NORM waste with activity concentrations of 3000-4000 Bq/g were produced. The estimated amounts and activities of waste are given in Table 2. It was planned that this waste in the drums should be stored temporarily outdoors before the interim storage facility would be finished. In the same time it was expected that after 50 year storage period there would be enough material collected to be of interest to the reprocessing companies, e.g., in Russia or elsewhere.

Table 2. Estimate of NORM-waste in 2003

Production line	Average amount of waste per 1 t of processed raw material (kg)	Average activity concentrations of waste (Bq/g)	Estimated annual amounts of waste (t)
Rare earth metals	300-350	4300	1400
Rare metals	170-200	2300	600

Three different storage packages were investigated:

1. concrete containers with the dimensions of 1.63x1.63x1.35 m, which could contain up to 2.1 tons of the solidified NORM-waste. Putting these containers in 4 layers, would allocate up to 3.15 t of waste on 1 m^2 of the storage,
2. containers used in sea transportation, where the waste would be put in the plastic bags,
3. metal drums with the plastic inside cover of the volume of 0.43 m^3 for or 0.38 t of waste.

As the waste contains ^{235}U and ^{232}Th with their decay products, including radon, after several assessments and practical experiments the preference was givent to the last option. Radon was estimated as the major factor in causing doses for the radiation workers. The studies resulted in the conclusion that the best solution was the use of double package, which should avoid the leakage of radon for at least 10 y.

The first stage of the EIA process resulted in rather high dose estimates to the radiation workers, e.g., with annual doses over 20 mSv at some operations. A significant overestimation of doses, as it appeared later, was mostly due to the fact that at the start only few real data were available and that many default values and extremely conservative assumptions were used in the assessments. After data corrections and considering realistic protective measures, more realistic dose assessments were performed. As a result of these additional improvements the estimated average annual doses to the radiation workers remained under 4 mSv. The maximum annual doses of about 15 mSv/y, requiring limited working hours in that area were identified for the workers at the packaging facility.

In the safety assessment a number of accident scenarios were also considered:

1. falling and breaking of the drum containing the solid NORM waste in the packaging area or during the transportation;
2. falling and breaking of the drum containing the solid NORM waste in the interim storage;
3. fire in the storage of raw material or in the interim storage of NORM waste;
4. release of the material in the production process.

Based on the assessments and changes on the market, the Silmet plant started to import raw materials with significantly lower NORM radionuclide concentrations, which had resulted in the decrease of produced annually waste volumes by more than 10 times. E.g., they managed to find raw material for the rare earth metal production, which contained NORM below the exemption levels. Nevertheless, the production of Nb and Ta still uses radioactive raw material and the NORM waste generation continues.

6. Radiation practice license

Based on the radiation practice licence No 08/004, the Silmet plant is allowed to generate annually no more than 48 t of radioactive NORM containing waste with the activity concentration lower than 300 kBq/kg. At the facility, the generation of NORM waste is not constant in time and it depends to a great extent on the specific production line and the ore used. There is more than 31 t of NORM waste with the average ^{238}U and ^{232}Th activity concentrations of 98.8 kBq/kg and 36 kBq/kg, respectively, in the temporary storage. The composition and amount of the processing waste depends on the fraction of each raw material type in the total amount and on their Th, U and their progeny composition.

Under the Radiation Act, the producer of radioactive waste should transfer the arising waste to the radioactive waste management operator in at least 5 years. Unfortunately, there is no radioactive waste management operator for NORM waste in Estonia. At the moment, the NORM waste produced by the Silmet plant is temporarily stored and the company is continuing the search for possible management

solutions in the future. Unfortunately, so far without any success, as the amount of produced NORM waste is too small for further processing, while their activity concentrations significantly vary. One of the most realistic proposed management options might be the clearance of NORM waste under specified conditions.

7. Possible clearance option

The Silmet facility has a functioning power plant, which uses local oil-shale for producing of energy. The estimated annual production of oil-shale ash is around 100 000 t. The Estonian Environmental Board has allowed the use of oil-shale ash in the construction of the Sillamäe harbour, which is built close to the remediated waste depository. In the Environmental Impact Assessment of the Sillamäe Harbour it is estimated that the harbour building needs about 8.45 million m^3 of filling material, including about 2-3 million m^3 of oil-shale ash. Taking account the activity concentrations of NORM in oil-shale ash in Table 3 (Realo et al, 1996) and similarity of physical properties of oil-shale ash and the NORM waste produced in Sillamäe, a clearance option for possible management of the latter has been proposed. The clearance option bases on the assumption that the NORM waste and oil-shale mix (110000 tons of oil-shale ash together with 48 tons of NORM-waste) could be used (instead of oil-shale ash only) in the construction of the harbour.

Table 3. Activity concentrations of radionuclides in the Estonian oil-shale ash

Radionuclide	Activity concentrations (Bq/kg)
^{226}Ra	48 ... 78
^{238}U	48 ... 64
^{235}U	2.2 ... 3.0
^{232}Th	23 ... 30
^{40}K	530 ... 1100

The clearance levels of 1 kBq/kg for both ^{235}U and ^{232}Th based on the Radiation Act. The legislation also states that clearance of radioactive waste is possible if:

- the caused annual dose to the public is lower than 0.01 mSv;
- the caused collective annual dose is lower than 1 manSv;
- in the case of the NORM-containing material and waste, the public to the public is lower than 0,3 mSv/y.

The assessment of the annual public and collective doses caused by using the oil-shale and NORM waste mix in the construction of the Sillamäe harbour was performed (Lust, 2009). For the assessment of clearance options of NORM waste an assumption that future radioactive waste arising is caused exclusively by the production of the AS Silmet plant was taken into account. The doses were assessed for both workers and the public considering the following scenarios:

1) transportation of NORM waste;
2) inhalation in the process of NORM waste management;
3) ingestion in the process of NORM waste management;
4) fire in the waste management facilities;
5) doses to the harbour workers;
6) dose to the farmer, who lives and farms on the harbour area.

The main results of the assessment are the following. For the workers the highest doses arise via inhalation pathway. The highest doses for the public are characteristic of the farmer, who lives and produces in the area filled using the above mix. However, even in the case of the farmer the clearance requirement of NORM, i.e., annual doses lower than 0.3 mSv, is fulfilled with the probability of 95%. Taking into account that the harbour is been built next to the remediated radioactive waste tailings depository, it is hard to believe that farming is a very realistic scenario.

8. Conclusions

The outcome of active discussions and dialog between the operator and the regulator was the development of the waste management system for NORM waste, which, however, currently covers only the short range activities. Based on the performed assessments it was proved that in case using the NORM waste and oil-shale ash mix in the construction of the Sillamäe harbour, the clearance requirements would be fulfilled. Additionally, it can be easily proved that of the proposed management option is the optimal solution considering the type, radionuclide composition and amount of the radioactive waste. The final solution for the NORM-waste management is still under discussion.

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Radioactive impact on estuarine sediments affected by Acid Mine Drainage (AMD) and effluents from NORM phosphate fertilizer industries

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Abstract

In this paper is studied the estuary of Huelva formed by the Tinto and Odiel rivers, which are seriously affected by acid mine drainage (AMD) due to the long-term mining activities done in Iberian Pyrite Belt, and, as a consequence, their waters present an very low pH (< 3), and for that they contain very high heavy metals concentrations. Additionally, a large industrial complex is located in the surroundings of this estuary, which includes five phosphate rock processing plants that produce a waste called phosphogypsum (PG) containing high U-series radionuclides concentrations.

This estuary is governed by two mixing processes: 1) salt-induced mixture process, typical of the majority of estuaries, and 2) pH-induced mixture process, consisting in an acid neutralization as result of the mixture of acidy fluvial water coming from the drainage basins when reach the estuary. These mixture processes affect to the behavior of both heavy metals and natural radionuclides that reach the estuarine waters. The analysis of the radionuclides concentrations have allowed us to demonstrate that the behavior of these elements are very affected by these mixing processes, and to affirm that U-, Ra- and Th-isotopes levels in the current sediments are very dependent of the hydrochemical properties of the waters (mainly pH and chlorinity). This study has global significance for other polluted environmental systems that are impacted by AMD and PG.

1. Introduction

Estuaries are zones of complex interaction between fluvial and marine processes, where there are large mass exchanges, and big changes in the salinity, nutrients, sedimentary conditions and living organisms. The use of radioactive tracers is a valuable tool to analyze the transfer mechanisms between the different involved system phases (Zöllmer and Irion 1993).

The estuary formed by the Tinto and Odiel rivers presents a great interest due to it is very conditioned by two hydrochemical facts. The first one comes from fact that both rivers are seriously affected by acid mine drainage (AMD) from long-term mining activities developed in the Iberian Pyrite Belt, which produce in these rivers the transport of high amounts of heavy metals and radionuclides due to their extremely low pH (2.5-3.5) (Grande et al 2003). Secondly, in their mouths there is a large industrial complex which includes several phosphate rock processing plants that produce annually about 2.5 million tons of a by-product, called phosphogypsum (PG), containing enhanced U-series radionuclides levels (about 200 Bq kg^{-1} of ^{238}U, 650 Bq kg^{-1} of ^{226}Ra, and 450 Bq kg^{-1} of ^{230}Th). Until 1998, about 20 % of the generated PG was discharged directly into the estuarine waters, while the remaining 80 % was pumped in suspension with sea water (20 % PG plus 80 % seawater) to be disposed in large piles located on the Tinto river salt-marshes (Bolivar et al 2002). Since 31st December 2010, all P_2O_5 production plants were closed and for that the phosphogypsum production was stopped. Currently there is an environment al plan under study

to restore the PG piles, and it is estimated to take 10 years to complete this plan.These facts explain that estuary of Huelva is one of the most polluted estuarine systems in the world.

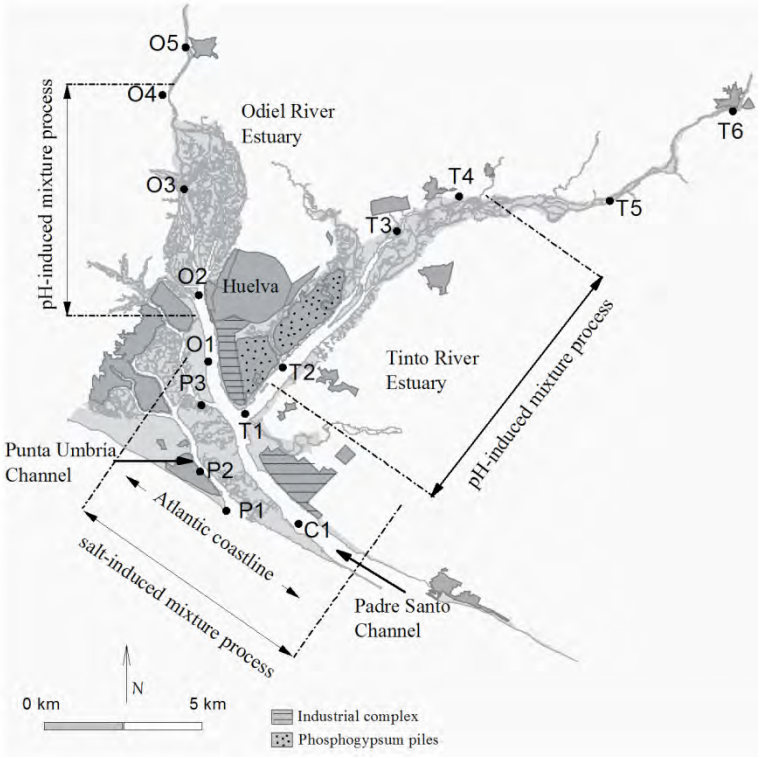

Figure 1. Map of the estuary of the Tinto and Odiel rivers with sampling points

It has been demonstrated that hydrochemical characteristics of the water in this estuary suffer two mixture processes, the salt-induced mixture process, and the pH- induced mixed. A strong tidal influence controls the salt-induced process, and it has been extensively studied by measuring the changes in the salinity of the mixing water. Specifically the process follows the mixture between seawater (pH over 8 and chlorinity above 21 g L^{-1}) and estuarine water (with pH around 6.0 - 7.0 and chlorinity average over 10 - 15 g L^{-1}). This is located in Padre Santo and Punta Umbría Channels, but can reach the upper sectors of the estuary during high tides (Fig. 1). The pH-induced mixture process is the neutralization resulting from the mixing of estuarine water (pH = 6.0 - 7.0) with the fluvial water (pH < 3), containing very high concentrations of dissolved materials, including metals and radionuclides. This neutralization process by dilution of water is restricted to estuarine areas of both rivers, and produces a positive gradient in the pH with a strong directionality outwards from the system (Carro et al 2006).

Taking in consideration previous facts, main aim of this work has been to report the behavior of different natural radionuclides in the surface sediments from an estuarine system very affected by both salt-induced and pH-induced water mixing processes.

2. Materials and methods

2.1. Sampling

Fifteen sampling stations were selected to study this system along Tinto River estuary (sampling points with code “T”), Odiel River Estuary (code “O”), where is clearly produced both the pH-induced and salt-induced mixing processes. Moreover, sampling points in Padre Santo Channel (code C1) connecting Punta Umbría Channel (code P) with the Odiel Channel have been selected since they are estuary sectors with

mainly marine influence, and for that in principle very low influenced by the AMD of the mining rivers and the PG piles (Fig.1). In selected sampling stations surface sediments were collected using sediment traps during each season (4 times a year). Samples were collected at the end of May 2007 (spring), December 2007 (autumn), March 2008 (winter) and September 2009 (summer). In addition to the sediment samples, superficial water samples were collected and the pH and conductivity were measured in situ.

2.2 Radionuclide determinations

Alpha-emitting radionuclides of U-isotopes were determined by alpha-particle spectrometry using ion-implanted silicon detectors in geometry with 25 % absolute efficiency. To the isolating of the radioelements (U, Th and Po), a sequential well-established radiochemical method based on extraction chromatography (UTEVA resins) was applied (Oliveira and Carvalho 2006).

^{226}Ra and ^{228}Ra were determined by gamma-ray spectrometry using a coaxial ultra pure germanium detector (HPGe ORTEC) with ~20 % relative efficiency and FWHM of 1.10 keV at 122 keV and 1.90 keV at 1333 keV. The photopeaks used in the radionuclides determination were: ^{226}Ra (352 keV - ^{214}Pb), ^{228}Ra (911 keV - ^{228}Ac). The efficiency calibration used in the gamma measurements is described in detail in our earlier papers (Pérez-Moreno et al., 2002).

3. Results and discussion

3.1 Physical-chemical parameters

In Figure 2 the pH and conductivity in water samples of Odiel-Tinto rivers estuary, Padre Santo and Punta Umbría channels are shown. In relation to the bulk densities of sediments for each season varied with a wide range, from 0.36 to 1.49 g cm^{-3}. For each season, the densities are similar for both Odiel and Tinto estuaries, with the highest values in summer and lowest in autumn.

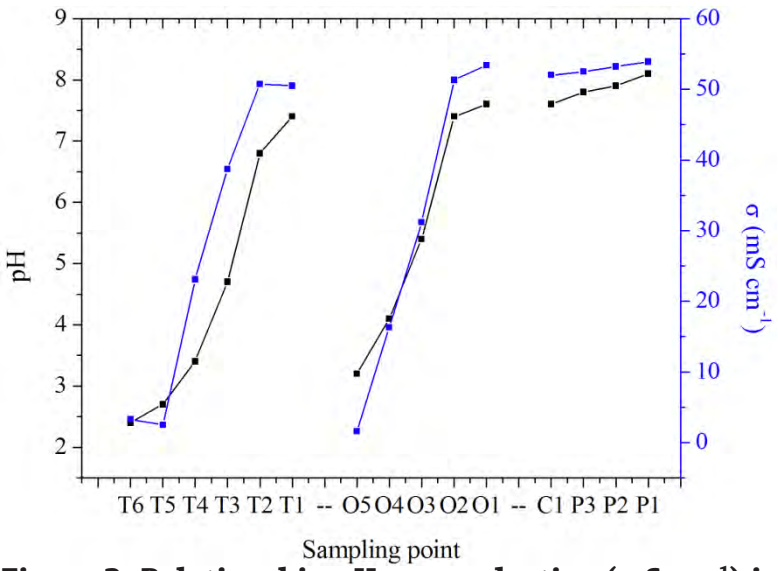

Figure 2. Relationship pH vs. conductivy (mS cm^{-1}) in water samples.

A progressive increase in pH towards the mouth of both rivers is observed in the estuary due to pH-induced and salt-induced mixture processes. The pH values ranged from 1.9 (Tinto River, T6-summer) up to 8.1 (sample C1-spring), showing high and similar gradients in the estuary for both rivers (pH varied between acid values lower than 3 and neutral conditions, higher than 7). On the contrary, the pH in both

Padre Santo and Punta Umbría channels showed few variations, oscillating between 7.0 and 8.1, fact coming from the proportion of seawater is very high.

As it is expected, the lowest pH is observed during autumn when the fluvial inputs are greater being more intensive the AMD, observing that location 3 (T3 and O3) reaches pH around 3-4, whereas during summer (lowest or null flows), the pH of the estuary is more uniform, with values higher than 5.4 in most of the stations (Fig. 2). This fact can be justify by the low fluvial contribution in summer allowed fast neutralizations of the acid water in the upper sector of the mixing zone.
On the other hand, as it is expected in figure 2 is observed that conductivity presents an similar pattern that pH, which is ratified by the good linear regression fit obtained between both parameters, σ (mS cm^{-1}) = - (18±4) + (8.3± 0.7)·pH, and observing that conductivity and pH increase towards the mouth of both rivers reaching typical values of seawater in the sample situated out of estuary (sample P1). One of the main features of the rivers that end in this estuary is their high dissolved sulphate concentrations due to the severe acid drainage mine they are receiving (Carro et al., 2006). This peculiarity is consistent with the high conductivity values measured in the fluvial zone of both estuaries (O5, T6 and T5), with values between 1-5 mS cm^{-1}, which is one order of magnitude higher than the typical surface waters (< 0.1 mS cm^{-1}) (Carro et al., 2006) (Fig. 2). As we move towards the Padre Santo and Punta Umbria channels, an increase in the marine component of the water occurs reaching values around 50 mS cm^{-1} (samples P1) which are typical of seawaters.

3.2 Uranium-isotopes

The annual average ^{238}U activity concentration at every sampling point is shown in figure 3. The ^{238}U and ^{234}U activity concentrations spatially vary over a wide range, from 6.6 to 2580 Bq kg^{-1} throughout the study period. Some differences can be seen between both the Odiel and Tinto channels. So, Tinto River estuary supports a greater burden of uranium, because it carries a higher concentration of uranium that will precipitate when both the river water and leached PG stacks water mixes with the estuarine water. In both estuaries the lowest values of activity concentrations of uranium are found in summer, when the rivers and PG piles have the smallest discharges. However, the highest values in both Tinto and Odiel estuaries are found in winter (followed by autumn), which correspond with the seasons of highest rainfall. This effect is more significant in the Tinto Channel. Due to the AMD received for both rivers, the activity concentrations for both ^{238}U and ^{232}Th nuclides in their surface waters generally range in the interval 0.1 - 1 Bq L^{-1}, which are 1 - 3 or 3 - 5 orders of magnitude, respectively, higher than worldwide typical rivers (Ketterer et al., 2011).

The highest activity concentrations are found in the Tinto Channel due to additional contribution of acid waters coming from PG piles due to the rain, which contain very high concentrations of U-series radionuclides as ^{238}U (50-200 Bq L^{-1}), ^{226}Ra (0.5-2.0 Bq L^{-1}), ^{210}Pb-^{210}Po (1-20 Bq L^{-1}), or ^{230}Th (1-5 Bq L^{-1}) (unpublished data). Rainwater that fall on the surface of the un-restored PG stack (more than 400 ha) dissolves a fraction of pollutant contained in PG, and so they are released into the estuary with high acidity (pH < 2), and contain high levels of radionuclides (especially U to be the most soluble at this low pH, although its concentration in PG is lower than other radionuclides, and other pollutants.By considering an average rainfall of 550 L m^{-2} and that 50% of this amount reaches the estuary, it can be estimated that annually about 0.3 million tons of these acid polluted waters are released into the Tinto Channel containing radionuclides concentrations of about 10^2 Bq L^{-1} for ^{238}U and 10^0 - 10^1 Bq L^{-1} for the rest of radionuclides from U-series (^{226}Ra, ^{230}Th, ^{210}Pb) (Bolívar et al., 2009). The effect of this PG-laden water releases are shown in the peak of ^{238}U concentration in the sediments found in points located near the PG stacks (points T2 and T3).

With regard to the sampling sites in the fluvial zone (O5, T6 and T5; Fig. 3), the values of uranium concentration in sediments are typical of unperturbed rivers (UNSCEAR, 1988), with about two orders of magnitude lower U than the estuarine sediments affected by the pH-induced processes. In these locations both rivers have highly acidic waters with a high loading of radionuclides, but they will not precipitate until these waters are mixed with the estuarine waters and pH increases to > 4.

Towards the sampling stations O4 and T4 the pH-induced process begins and the pH increases from 1.9 (fluvial zone) to 4.4 (O4 or T4), and finding similar changes found for all seasons. Higher values of uranium in these sampling points, T4 (421 Bq kg^{-1} for ^{238}U) and O4 (115 Bq kg^{-1} for ^{238}U) were found compared to unperturbed sediments of the fluvial zone (Fig. 3). UO_2^{2+} uranyl ion the is the most soluble specie in the Tinto and Odiel rivers (pH ~ 2-3), but an abrupt change of pH in this zone will produce the co-precipitation of uranium as metallic hydroxides, or sulphate salts, which will scavenge a very significant fraction of the dissolved metals (including the U one) carried out by the acid water of the rivers.

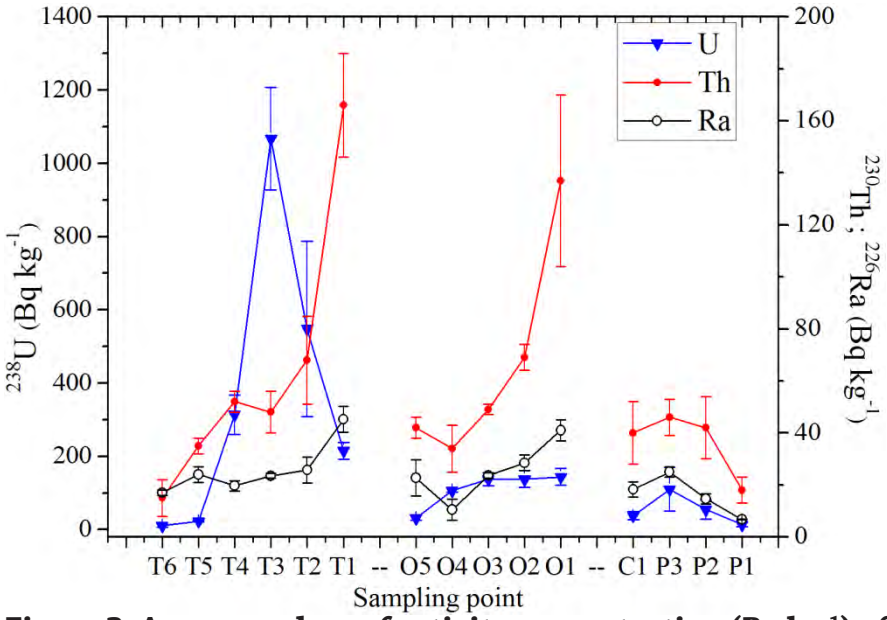

Figure 3. Average values of activity concentration (Bq kg^{-1}) of ^{238}U, ^{230}Th and ^{226}Ra in the sampling points.

In the sampling stations O3 and O2; T3 and T2 the pH-induced process continues. In this zone an abrupt change of pH (from 4.5 to 7) occurs in all seasons. Such a marked change in pH is expected to result in significant precipitation of U and, therefore, in a significant enhancement of its concentration in the sediments. The ^{238}U concentration was found to be the highest in T3 among all the sampling sites in the Tinto River, with an average concentration of 1342 Bq kg^{-1}, but for its equivalent point (O3) in Odiel River, the average concentration is much smaller (150 Bq kg^{-1}) (Fig. 3). This could be due to; a) the differences in the dissolved U concentrations in these waters (Tinto U concentration is twice than the Odiel one), and/or b) presence of acidic water releases from PG piles. Moreover while we move to offshore and the pH values are going up, the removal of uranium may also take place associated with adsorption of U^{6+} onto organic matter and Fe/Mn compounds (McKee et al., 1987), or phosphate complexes which compete with carbonate to complex U in the range 4-7.5 and the partial reduction of uranium VI to IV, a more insoluble form (Toole et al., 1987).

In locations T1 and O1, sited at the end of both estuaries (Tinto and Odiel, respectively), the values of pH, for the four samplings campaigns, range from 7.1 to 7.8 (average 7.4), and ^{238}U activity concentrations (215 Bq kg^{-1} ^{238}U for T1, and 144 Bq kg^{-1} ^{238}U for O1) are similar at both points. The salt-induced coagulation and precipitation is expected to be minimal at this zone. The exchange of sediment from this zone to the shelf is likely a significant mechanism of sediment transport to the shelf regions. In addition, ^{238}U

concentrations in the Punta Umbria Channel, which has a very low water exchange with the Odiel Channel, the radionuclide activity concentrations found were similar than in unperturbed sediments (Bolivar et al., 1995). Opposite of, the samples from P3 (El Burro Channel) were found to have slightly higher U concentration (171 Bq kg^{-1} of ^{238}U), which is expected because this channel exchanges water between the Odiel Channel (polluted) and the Punta Umbria Channel (un-polluted) (Fig. 3).

The impact of the new waste management policy resulting in no PG releases into Odiel Channel can be evaluated by the temporal analysis of the radionuclide concentrations evolution in sediments. Firstly, in the Tinto estuary the average ^{238}U activity concentration for the whole estuary in the sediments was constant in the years 1999 (policy changed in 1998), 2001 (Absi, 2004) and 2008, with ^{238}U concentrations of 219 ± 97 Bq kg^{-1}, 252 ± 112 Bq kg^{-1} and 380 ± 123 Bq kg^{-1}, respectively, while in the Odiel estuary these average concentrations decreased continuously from 343 ± 96 Bq kg^{-1} (1999 year) till 113 ± 11 Bq kg^{-1} (2008 year). The value found in 2000 is very similar to the average activity concentration found in our study, indicating that the sources of U in the Odiel estuary have been significantly reduced, but in the Tinto estuary the U sources have remained constant over time, and the new policy waste management has not resulted in a significant decrease in U concentration due to the release of radionuclides from 450 ha of un-restored PG piles.

3.3 Thorium-isotopes

In for the case of thorium isotopes, we observed that their concentrations throughout the study area are similar to uncontaminated estuarine sediments, except at certain points where ^{230}Th concentrations increase significantly (Fig. 3).

The ^{232}Th concentrations are relatively uniform along the study area and similar to the typical values obtained in unperturbed sediments (30 - 60 Bq kg^{-1}) (Martín et al., 1978). This is because of relatively less amount of leaching of ^{232}Th and PG does not contain high concentrations of ^{232}Th. On the contrary, ^{230}Th presents higher levels (from 5.9 to 232 Bq kg^{-1}), increasing from the fluvial zone towards the end of the estuary, and reaching the maximum values for all seasons at point 1 for both rivers (zone of salt induced processes, with averages of 175 Bq kg^{-1} for T1 and 153 Bq kg^{-1} in O1), which is the estuarine area where there are high and uniform values of pH (around 7.0). This is due to scavenging of Th by suspended particulate matter when the pH is ~7.

3.4 Radium-isotopes

In figure 3 and 4 is observed that the distribution pattern of both ^{226}Ra and ^{228}Ra is very similar throughout study area. The activity concentration of ^{226}Ra increases from the fluvial zone up to the end of the estuary, with a maximum at T1 and O1 in all seasons (average of 45 Bq kg^{-1} in T1 and 41 Bq kg^{-1} in O1), locations that represent only salt-induced processes (pH = 6.5 - 7). This ^{226}Ra behavior is similar to the ^{238}U and ^{230}Th ones discussed earlier, but ^{228}Ra does not present a clear pattern along both Tinto and Odiel channels, showing similar concentrations than unperturbed sediments (30 - 60 Bq kg^{-1}), the amount of radionuclides derived from the ^{232}Th-series both in AMD and PG piles are not significant. This very low impact found for Ra-isotopes comes from two facts; firstly, the very low solubility of Ra in aqueous solutions containing high concentrations of sulphates (as it is our case), and secondly, it is very established that radium tends to remain in dissolution for the majority of estuaries (Somayajulu and Goldberg, 1966; Martín et al., 1978).

Several studies in global estuarine systems have documented that radium is non-conservative in estuaries, with the release of Ra when Ra-laden suspended particulate matter in rivers are delivered into the river mouth and thus, higher dissolved ^{226}Ra concentrations were found. For example, studies in several

natural estuaries like Hudson estuary (Li et al., 1977), or Amazon estuary (Key et al., 1985) showed similar results. In figure 3 the average of ^{226}Ra concentration in sediments increases with pH towards the mouth of the estuary. This fact could be due to one or more of these two reasons: i) sediments with higher concentrations of ^{226}Ra are trapped near the confluence of both channels, as was seen for ^{238}U and other ^{238}U-series members; and ii) release of ^{226}Ra from suspended particulate matter which subsequently undergo pH-induced coagulation and eventual precipitation to the sediments (Aguado, 2003).

Reduction in the ^{226}Ra in sediments along the estuary since 1998 has been documented, primarily due to the elimination of the direct phosphogypsum releases into the estuarine system. The activity concentration of ^{226}Ra significantly decreased in the sediments from both Odiel and Tinto channels, falling from an average of around 700 Bq kg^{-1} in both channels before 1998 up to ~ 70 Bq kg^{-1} in 2005 (Villa et al., 2009), and finally reaching 28 ± 3 Bq kg^{-1} in 2008 year (our study). Therefore, the enhanced ^{226}Ra levels in the points 1 are likely due to resuspension of older polluted sediments. From the distribution of Ra in sediments, two observations can be made: first, the effect of the new waste management policy from 2008 year can be discerned in the current concentration of ^{226}Ra attaining typical values of background levels in sediments (20 - 50 Bq kg^{-1}, UNSCEAR, 1988). Second, it is noticeable from the concentrations found along the sampling points (Fig. 3), there is a fairly homogenization of the little remaining pollution in the sediments that still exist in the estuary.

3.5 Activity ratios

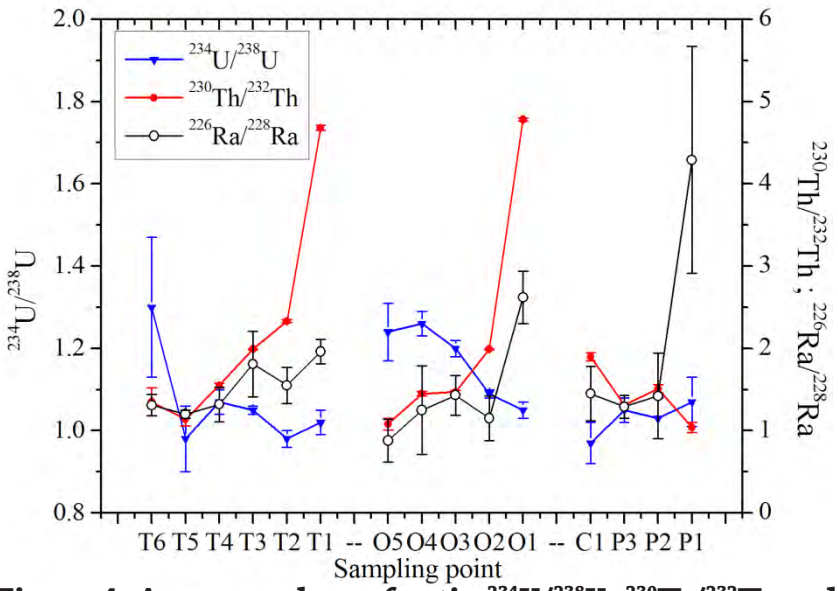

Figure 4. Average values of ratio ^{234}U/^{238}U, ^{230}Th/^{232}Th and ^{226}Ra/^{228}Ra in the sampling points.

Some of the discussions presented earlier can be validated by using activity ratios as ^{234}U/^{238}U, ^{230}Th/^{232}Th, ^{226}Ra/^{228}Ra ratios (Fig. 4). The ^{234}U/^{238}U activity ratios in our samples ranged from 0.89 to 1.58 in the Tinto River estuary and 1.01 to 1.39 in the Odiel River estuary. This result is in agreement with the activity ratios reported for different worldwide rivers (Scott, 1982). Overall, the ^{234}U/^{238}U activity ratios are slightly higher in Odiel River estuary compared to that in Tinto. Higher values are found in the fluvial zone and the values in the estuary are influenced by the U precipitation and the values in seawater (seawater AR is 1.14). Precise measurements with ICP-MS will aid in tracing the pathways and transport of U in the river/estuarine system.

The ^{230}Th/^{232}Th activity ratio varied between 0.6 and 5.0, with the highest values in Odiel River estuary in Spring. Although the amount of ^{232}Th derived from PG piles and the AMD discharge are likely negligible,

high variations appear to be due to variations in ^{230}Th derived from both PG and AMD. The average activity ratios of ^{230}Th/^{232}Th increase uniformly up to point 1 where it reaches a value of around 5, a value significantly higher than the one found in uncontaminated estuarine sediments from Huelva (Bolivar et al., 1995) and worldwide (Somayajulu and Goldberg, 1966). The surface sediment contamination of ^{230}Th samples from points 1, can proceed from two routes; either by direct transport from PG and AMD, or by resuspension of contaminated sediments, or by the adsorption of dissolved ^{230}Th on to suspended particulate matter before the implementation of policy (Bolívar et al., 2002). If we consider that the main pathway of contamination is through direct deposition of particulate phosphogypsum, resulting in high ^{238}U and its daughter products a high fraction of the sediments must be contaminated by this by-product. Since we are finding high concentrations in selected areas, the resuspended material could be a source of contamination in this estuary. The contamination by radionuclides from U-series of the sediments is also supported from the observed values of ^{226}Ra/^{228}Ra in figure 4, where a slow increase of this ratio can be seen in samples T1 and O1, demonstrating that radium is not removed from sediments.

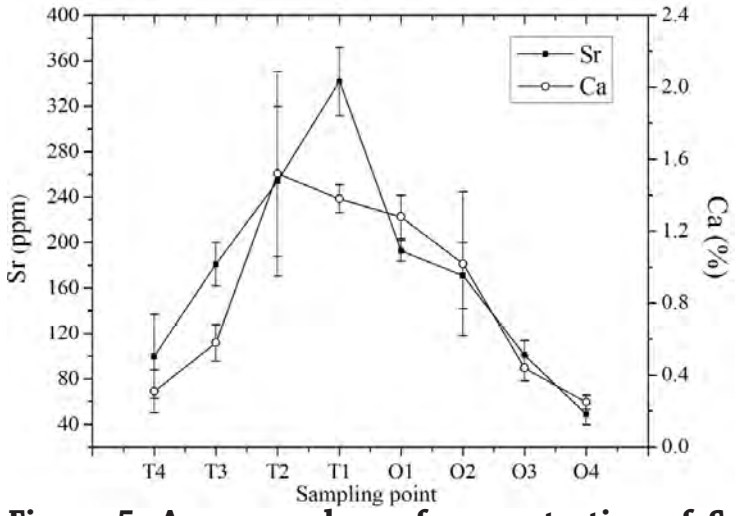

Figure 5. Average values of concentration of Sr (ppm) and Ca (%) in the sediments samples in the sense of the waterflow from T3 to O4.

To finish this extended abstract, to comment that in Figure 5 are observed significant peaks for both Sr and Ca in the points T2 and T1 (the points closest to the PG stacks), which could come from the PG piles leaching released generated by the rainy waters, and not from inputs from the acid rivers. To ratify this hypothesis, it is known (data unpublished) that average concentration of Sr and Ba in PG are very high and around 4×10^4 and 9×10^4 ppm, respectively, producing in its leaching waters that go into Tinto River estuary high levels of these elements (2×10^1 and 5×10^2 ppm, respectively), and being them very much higher that the found ones in the another source of pollution, the Tinto River waters (0.280 and 76.6 ppm for Sr and Ca, respectively). Taking into account the previous data, and the similar chemical behavior of these three elements (Ra, Sr, Ca), the same pattern found suggests that they share with the same source for their origin.

4. Conclusions

The hydrogeochemical characteristics of the water in both Tinto and Odiel rivers estuaries where analyzed, founding that acid fluvial water and marine water are mixed allows us to define the intervention of two geochemical processes: a typical process of salt-induced mixture bound to a neutralization process of acid water.

The temporal and spatial variations of indicators as pH and chlorinity regulate the behavior of U-, Th- and Ra-isotopes. This fact is produced by the adsorption (or co-precipitation) of the dissolved uranium onto the particulate matter in zones where is produced pH values between 4.0 - 5.0. In fact, the highest values of ^{238}U concentration are reached in these zones (values up 2520 Bq kg $^{-1}$), which are about fifty times higher than ones un-perturbed sediments. The maximum concentrations for ^{230}Th and ^{226}Ra are produced for higher values of pH (about 6.0 - 7.0) and the concentrations are much lower than those of uranium. So a non-conservative behavior of uranium has been verified in this estuary, and consequently the estuary of Huelva acts as a sink for U and other natural radionuclides. This effect is less important for Th- and Ra-isotopes.

And, as final remark, the enhanced levels from U-series in recent sediments from the estuary of Huelva, and very specially for U-isotopes, are mainly three sources: (1) leaching of phosphogypsum stacks located nearby, (2) the flows incoming from the Odiel and Tinto rivers that contain very high levels coming from the acid mine drainage existing along the Iberian Pyrite Belt, and (3), the waters from the Atlantic ocean entering into the estuary containing a significant concentration of U-isotopes (40 mBq L^{-1}) which could precipitate during the mixing pH processes.

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Exhibit 19

COLORADO
Department of Public Health & Environment

Colorado Discharge Permit System (CDPS)
Fact Sheet To Permit Number CO0047554
UNION PACIFIC RAILROAD, MOFFAT TUNNEL WEST PORTAL, GRAND County

Andrea Stucky
8/31/2018

TABLE OF CONTENTS

I. TYPE OF PERMIT

A. Permit Type: Renewal

B. Discharge To: Surface Water

II. FACILITY INFORMATION

A. SIC Code: 4011 Railroads, line haul operating

B. Facility Location: Union Pacific Railroad Moffat Tunnel West Portal,
Latitude: 39.88750°N, Longitude: 105.76222°W

C. Permitted Feature: 001A, after treatment and prior to entering the Fraser River
39.88750° N, 105.76222° W

The location(s) provided above will serve as the point(s) of compliance for this permit and are appropriate as they are located after all treatment and prior to discharge to the receiving water.

D. Facility Flows: 0.5 MGD

E. Major Changes From Last Renewal:

- This permit renewal only contains the West Portal. The East Portal is permitted under individual permit CO0048986.
- Continuous Effluent Temperature monitoring has been added.
- EC and SAR requirements are added.
- The TSS variance is no longer in place for this facility.

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John W. Hickenlooper, Governor | Larry Wolk, MD, MSPH, Executive Director and Chief Medical Officer

- Continuous influent turbidity monitoring and a contingent TSS requirement has been added to the permit. See the text for additional information.
- Diesel range organics and total petroleum hydrocarbons have been added to the permit with a report requirement.
- Submission of a best management practices plan has been added to the permit to describe normal operations, tunnel cleaning operations and maintenance activities.

Since the division has no record that the facility received notice of their permit being available for the first public comment period, the permit went to public notice as a second draft. The first public comment period was from May 13, 2016 through June 24, 2016. Comments were received by Grand County and East Grand Water Quality Board in response to the first public comment period.

The second public notice period for the second draft was from August 12 to September 12, 2016. Comments were received from Union Pacific, Grand County, and East Grand Water Quality Board. These comment were incorporated into the third draft. After the second public notice period, the tunnel had additional cleaning and repair operations in September 2016 resulting in additional releases of discolored water into the Fraser River. As a result, the division will implement an influent turbidity limitation of 175 NTU. If the facility exceeds the influent turbidity limit, a contingent TSS sampling and monitoring event (in addition to the Reg. 62 monthly requirement) will be required. TSS monitoring must continue at two-hour intervals until the influent turbidity decreases below the limitation. Additionally, monitoring for diesel range organics (DRO) and total petroleum hydrocarbons (TPH) have been added to Limit Set A. These were added after the division learned about the maintenance and cleaning activities. Based on the changes in monitoring requirements to the permit after the second public notice period, the division has developed this third draft permit.

III. RECEIVING STREAM

A. Waterbody Identification: COUCUC10a, the Fraser River

B. Water Quality Assessment:

An assessment of the stream standards, low flow data, and ambient stream data has been performed to determine the assimilative capacities for the Fraser River for potential pollutants of concern. This information, which is contained in the Water Quality Assessment (WQA) for this receiving stream(s), also includes an antidegradation review, where appropriate. The Division's Permits Section has reviewed the assimilative capacities to determine the appropriate water quality-based effluent limitations as well as potential limits based on the antidegradation evaluation, where applicable. The limitations based on the assessment and other evaluations conducted as part of this fact sheet can be found in Part I.A of the permit.

Permitted Feature 001A will be the authorized discharge point to the receiving stream.

IV. FACILITY DESCRIPTION

A. Industry Description

This facility is a railroad tunnel owned by the Moffat Tunnel Improvement District which is administrated by the Colorado Department of Local Affairs in accordance with C.R.S. 32-8-101. The right of way for the tunnel and approaches were permitted by the federal government to the District in the 1920's. Union Pacific Railroad (UPRR) conducts railroad operation through the tunnel under a 1926 lease from the District, which is currently scheduled to expire in 2025. This lease includes conditions where the operator "agrees to assume and pay all claims, damages, demands, and liabilities which may arise or be incurred…resulting from or connected with the operation, maintenance or repair of said railroad tunnel." UPRR does not agree or concede that this "operation and maintenance" clause of the lease obligates UPRR to be responsible for groundwater drainage from the tunnel during the term of the lease, but UPRR has agreed to assume such responsibility solely for purposes of and during the term of this permit.

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John W. Hickenlooper, Governor | Larry Wolk, MD, MSPH, Executive Director and Chief Medical Officer

The building of the Moffat Tunnel by the District has resulted in an alteration to the natural groundwater flow in this area, by creating a void through the rock that altered the natural hydrogeologic system. The result of this is groundwater seepage into the tunnel that must be discharged as a point source to state waters. This discharge contains natural concentrations of metals, suspended solids that were created as a result of building processes, suspended solids from coal fines from the railroad operations, and any metals that are attached to those coal fines. No train or vehicle fueling, maintenance, or equipment cleaning is conducted at the tunnel. Groundwater seepage into the tunnel runs down the sides of the tunnel to the track ballast, and is collected in a buried drainage system. This system drains to both the West and East Portals. The East Portal is permitted under a different individual permit. Note that the discharge from the tunnel has been ongoing since its creation in 1927.

B. Sources to the Treatment Plant

Sources include groundwater seepage into the tunnel which is collected through a drainage system and discharged to surface water at either the West or East Portal. UPRR conducts periodic tunnel maintenance and cleaning operations that has resulted in slugs of discolored water.

C. Chemical Usage

The permittee stated in the 2015 Compliance Schedule Progress Report that the new wastewater treatment plant will utilize four chemicals in their treatment process. The MSDS sheets have been reviewed and the following chemicals have been approved for use and are summarized in the following table.

Table IV-1 - Chemical Additives

Chemical Name	Purpose	Constituents of Concern
Aluminum chloro-hydrate	Coagulant	Aluminum
Sodium hypochlorite	Membrane cleaning	Chlorine
Citric acid	Membrane cleaning	pH
Caustic soda	Membrane cleaning	Sodium hydroxide

Chemicals deemed acceptable for use in waters that will or may be discharged to waters of the State are acceptable only when used in accordance with all state and federal regulations, and in strict accordance with the manufacturer's site-specific instructions.

D. Wastewater Treatment Description

UPRR constructed a wastewater treatment facility on the West Portal Outfall, which was completed in April 2017. The constructed treatment plant consists of a coagulation process and membrane microfiltration followed by an ion exchange process. For solids, a sludge thickening process and a centrifuge will be used for final dewatering. The dewatered sludge will be transported to an approved landfill approximately once per month.

Pursuant to Section 100.5.2 of the Water and Wastewater Facility Operator Certification Requirements, this facility will require a certified operator. If the facility has a question on the level of the certified operator it needs then the facility will need to contact the Facility Operator Certification Program of the Division.

4300 Cherry Creek Drive S., Denver, CO 80246-1530 P 303-692-2000 www.colorado.gov/cdphe/wqcd
John W. Hickenlooper, Governor | Larry Wolk, MD, MSPH, Executive Director and Chief Medical Officer

Exhibit 20

BUILDING AMERICA®

April 22, 2016

Eric Oppelt
Colorado Department of Public Health and Environment
WQCD-WQP-B2
4300 Cherry Creek Dr S
Denver CO 80246-1530

Subject: 2016 Compliance Report for Moffat Tunnel Permit CO-0047554

Dear Mr. Oppelt:

Union Pacific Railroad (UPRR) would like to submit this memorandum to satisfy the requirements of the compliance schedule under permit CO-0047554 which covers discharges from Moffat Tunnel to South Boulder Creek and the Fraser River. The current permit includes the following compliance schedule in part A.3. Through a permit modification in 2011, the compliance schedule was extended through 2017 to accommodate further studies and evaluations in order to find the most appropriate solution(s) for the conditions at Moffat Tunnel. The modified compliance schedule has been summarized below with status information included for reference:

- **Facility Evaluation Plan** – UPRR submitted this document to meet the initial requirement of a report that provided details on the progress UPRR had made toward determining the feasibility and potential percent reductions associated with a number of control measures (**April 30, 2012**)
- **Facility Evaluation Plan** – UPRR submitted this memorandum that further detailed the feasibility and potential percent reductions that UPRR had associated with control measures that were investigated to date (**April 30, 2013**)
- **Implementation Schedule** – UPRR submitted this initial report that outlines the chosen option(s) to meet the final effluent limitations (**April 30, 2014**)
- **Status/Progress Report** – UPRR submitted a report showing the progress made toward implementing the chosen option(s) (**April 30, 2015**)
- **Status/Progress Report** – UPRR is submitting this report showing the progress made toward compliance with the final effluent limitations (**April 30, 2016**)

UNION PACIFIC RAILROAD
1400 Douglas Street
Omaha, Nebraska 68179

Section 1
Introduction

1.1 Background

The Moffat Tunnel was built in the 1920s through a public-private funding partnership with the Moffat Tunnel Improvement Commission to connect traffic east and west of the Continental Divide, under James Peak, and allow for a more direct avenue for interstate commerce. The train tunnel is owned by the State of Colorado and through the years has been operated by the Denver Rio Grande Railroad (1920s-1980s), Southern Pacific Railroad (1980s-1990s), and is currently operated by Union Pacific Railroad (UPRR). UPRR uses the tunnel solely for mixed freight train traffic with approximately 10 trains passing through the tunnel daily as of 2016 (including UPRR, Burlington Northern Santa Fe Railway, and Amtrak). No other industrial activity occurs at the site. UPRR operates the tunnel under a lease from the Colorado Division of Local Affairs (DOLA). The lease is set to expire in 2025.

West Portal


East Portal

Figure 1-1 shows the location of the Moffat Tunnel. The East Portal of the tunnel is located 50 miles west of Denver and approximately 10 miles west of the town of Rollinsville. The East Portal is located at an elevation of approximately 9,200 feet and conditions at the East Portal are those associated with high mountain terrain and access is often difficult during winter months. UPRR staff working at Moffat Tunnel (typically one to two people) are located on the east side of the tunnel; there are currently no occupied facilities located at the West Portal.

The Moffat Tunnel runs under the Continental Divide for 6.2 miles. Water enters the tunnel through several mechanisms, including groundwater seepage along the floor and walls of the tunnel and precipitation (rain/snow melt) through weepholes near the East Portal. The water that enters the tunnel drains via gravity to channels that run parallel to, or directly underneath, the track structure. The drains were incorporated into the original tunnel construction to move water away from the track structure. Because the tunnel has an apex, water drains to both the East and West Portals. At the East Portal, water is discharged from the tunnel through a sedimentation pond and into South Boulder Creek. At the West Portal, water is discharged from the tunnel to the Fraser River.

Water has been draining from the tunnel at relatively consistent natural rates since the time it was built in the 1920s. Flows from the West Portal are higher than those from the East Portal and are also more consistent over the course of the year due to significantly less infiltration from precipitation events and snowmelt at the West Portal.

In October of 2014, UPRR submitted a request to CDPHE for calculation of preliminary effluent limits (PELs) for the future East Portal CDPS permit. The request included information and relevant data regarding updated regulatory low flow calculations for South Boulder Creek as well as additional ambient and effluent water quality data. CDPHE agreed that the regulatory low flow calculations should be updated to more accurately reflect the flow regime in the receiving water and subsequently include updated regulatory low flows in the PEL calculations they provided in a letter to UPRR dated February 23, 2015. Updated flow analyses reflecting the perennial nature of South Boulder Creek were also included in the 2016 WQA and subsequently, the Draft Permit for the East Portal was published in March 11, 2016 (CO-0048986).

Due to the seasonal influence of snowmelt and stormwater runoff on the flow rates in the East Portal discharge, UPRR submitted a request for seasonal effluent limits be included in the forthcoming East Portal permit using seasonal high and low flow design flow discharge rates that more accurately represent the discharge scenarios in the East Portal. The PEL and WQA calculations performed by CDPHE leading up to the issuance of Draft Permit CO-0048986 incorporated the suggested seasonal flow values for the East Portal and resulted in seasonal effluent limits.

The revised data inputs in the PEL and WQA calculations result in the draft effluent limits set forth in the draft East Portal discharge permit (CO-0048986) differing considerably from the effluent limits for the East Portal outfall in the current CDPS permit. Changes in applicable water quality standards and procedural guidelines also impacted the effluent limit calculations and resulted in inclusion of effluent limits or reporting requirements for several parameters not included in the current CDPS permit (aluminum, uranium, molybdenum). UPRR and CDPHE are continuing to review data in an attempt to establish appropriate and scientifically-sound limits for the East Portal.

As a result of the addition of seasonal effluent limits and the overall differences in effluent limits for the East Portal from the current permit to the draft permit CO-0048986, a variety of additional potential treatment options may now be available. While the draft permit CO-0048986 included the same compliance schedule included in the current 2013 permit, UPRR provided comment to the draft permit requesting issuance of a compliance schedule that allows adequate time to develop treatment options that, similar to the treatment options already being implemented for the West Portal outfall, allow for the most effective and efficient means of meeting the effluent limitations provided in the draft permit. A five year timeline for development of future treatment options more typical of a newly issued CDPS permit was suggested in the comment letter provided by UPRR.

2.2 West Portal Water Treatment

As described in the 2015 Annual Compliance Report (CDM Smith 2015), UPRR is proceeding with the installation of a water treatment system at the West Portal to attain compliance with the final effluent limitations by April 30, 2017. The treatment process is based on filtering/precipitating the total and dissolved metal ions present in the drainage water that exceed the discharge limits to the Fraser River. The precipitates are then removed using an ultrafiltration (UF) process that removes suspended solids in the drainage water.

Micro and ultra-membrane filters are able to capture particles that are approximately 0.1 micron and 0.01 micron or greater in size, respectively, and reduce the need to add excess coagulants to remove the precipitated metals. A microfiltration system was tested at the East Portal in October of 2010 and an ultrafiltration system was recently tested at the West Portal in 2016 to verify that the dissolved

metals could be precipitated and removed from the drainage water along with the turbidity associated with coal dust and sediment flushed from the ballast by the drainage water.

Turbidity levels in the water from the West Portal's drainage channel can exceed 500 NTU, and are comprised of fine suspended solids originating from historical build-up of fine solids associated with train traffic, as well as silt, sand, and products of ballast erosion. The drainage water also contains metals such as lead, cadmium, zinc, copper, iron, manganese, mercury, and uranium. The flow rates and total suspended solids (TSS) of the drainage waters are given in **Table 2-1**.

Table 2-1. Treatment Design Criteria

Parameter	West Portal Value
Average Daily Maximum Flow Rate (gpm)	210
Maximum Flow Rate (gpm)	300
Average TSS (mg/L)	45
Maximum TSS (mg/L)	140

2.2.1 Treatment Plant Design

Based on the results of the pilot testing, a treatment system using coagulation and membrane filtration was selected for treatment of the drainage water at the West Portal. The pilot study confirmed that a coagulation process followed by microfiltration was more effective than conventional media filtration for reducing the dissolved metals included in the discharge permit to near the detection limits. This approach was able to reduce all contaminants of interest to below permit limits. The design of the treatment facility includes an optional ion exchange process (IX) as a future polishing step to further remove the naturally occurring uranium, if necessary. The design also includes a solid waste dewatering process using sludge thickening via a dissolved air flotation (DAF) system and a centrifuge for final dewatering. Clarified liquids generated by the solids dewatering processes are recycled to the raw water or backwash equalization tank in the treatment process. Figures for the design layout of the water treatment facility as well as a process flow diagram are included in **Appendix A**.

The treatment facility has been designed to be fully automated but operator oversight is recommended for safety and routine checks and adjustments of equipment. An operator would be required to be on-call, and able to reach the facility within 24 hours in the event of equipment failure or process upset. The sludge dewatering system is a centrifuge batch process that will be automated but because of the batch nature of the process and mechanical components, this system is expected to require at least weekly operator attention. The system is designed to send an alarm signal if operator intervention is required. A sludge storage tank located at the West Portal will provide 2 to 4 days of sludge storage (approximately 2,300gallons) to give the on-call operator time to put the centrifuge back in service. The overall treatment system will be equipped with a supervisory control and data acquisition (SCADA) system to allow for remote monitoring and control of the plant.

The dewatered solids from the treatment process will be transported to an approved landfill approximately once per month via a 10-15 yard roll-off dumpster. Chemicals will be delivered approximately once per month. The proposed coagulation chemical is aluminum chloro-hydrate (ACH). Other potential chemicals include sodium hypochlorite (commercial strength bleach), sodium bisulfite, and citric acid, and caustic soda which will be used for scheduled periodic membrane cleaning events and an anionic polymer to assist with sludge thickening and dewatering characteristics. Water quality sampling and analysis is expected to be conducted once per month during chemical restocking and sludge haul-off. IX resin will be replaced (by the IX system supplier) at an approximate frequency of once to twice per year, if necessary. There will be a maintenance contract with the IX system supplier to dispose of the spent resin, which would contain high levels of uranium.

Exhibit 21

AGREEMENT
BETWEEN THE
UNITED STATES NUCLEAR REGULATORY COMMISSION
AND THE
STATE OF UTAH
FOR
DISCONTINUANCE OF CERTAIN COMMISSION REGULATORY AUTHORITY AND RESPONSIBILITY WITHIN THE STATE PURSUANT TO SECTION 274 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED

WHEREAS, The United States Nuclear Regulatory Commission (hereinafter referred to as the Commission) is authorized under section 274 of the Atomic Energy Act of 1954, as amended (hereinafter referred to as the Act), to enter into agreements with the Governor of any State providing for discontinuance of the regulatory authority of the Commission within the State under Chapters 6, 7, and 8, and section 161 of the Act with respect to byproduct materials as defined in sections lle.(1) and (2) of the Act, source materials, and special nuclear materials in quantities not sufficient to form a critical mass; and

WHEREAS, The Governor of the State of Utah is authorized under Utah Code Annotated 26-1-29 to enter into this Agreement with the Commission; and

WHEREAS, The Governor of the State of Utah certified on November 14, 1983, that the State of Utah (hereinafter referred to as the State) has a program for the control of radiation hazards adequate to protect the public health and safety with respect to the materials within the State covered by this Agreement, and that the State desires to assume regulatory responsibility for such materials; and

WHEREAS, The Commission found on March 12, 1984, that the program of the State for the regulation of the materials covered by this Agreement is compatible

with the Commission's program for the regulation of such materials and is adequate to protect the public health and safety; and

WHEREAS, The State and the Commission recognize the desirability and importance of cooperation between the commission and the State in the formulation of standards for protection against hazards of radiation and in assuring that State and Commission programs for protection against hazards of radiation will be coordinated and compatible; and

WHEREAS, The Commission and the State recognize the desirability of reciprocal recognition of licenses and exemptions from licensing of those materials subject to this Agreement; and

WHEREAS, This Agreement is entered into pursuant to the provisions of the Atomic Energy Act of 1954, as amended;

NOW, THEREFORE, It is hereby agreed between the Commission and the Governor of the State, acting in behalf of the State, as follows:

ARTICLE I

Subject to the exceptions provided in Articles II, IV, and V, the Commission shall discontinue, as of the effective date of this Agreement, the regulatory authority of the Commission in the State under Chapters 6, 7, and 8, and Section 161 of the Act with respect to the following materials:

A. Byproduct materials as defined in section lle.(1) of the Act;

B. Source materials; and

C. Special nuclear materials in quantities not sufficient to form a critical mass.

ARTICLE II

This Agreement does not provide for discontinuance of any authority and the Commission shall retain authority and responsibility with respect to regulation of:

A. The construction and operation of any production or utilization facility;

B. The export from or import into the United States of byproduct, source, or special nuclear material, of any production or utilization facility;

C. The disposal into the ocean or sea of byproduct, source, or special nuclear waste materials as defined in regulations or orders of the Commission;

D. The disposal of such other byproduct, source, or special nuclear material as the Commission from time to time determines by regulation or order should, because of the hazards or potential hazards thereof, not be so disposed of without a license from the Commission;

E. The land disposal of source, byproduct and special nuclear material received from other persons; and

F. The extraction or concentration of source material from source material ore and the management and disposal of the resulting byproduct material.

ARTICLE III

This Agreement may be amended, upon application by the State and approval by the Commission, to include the additional area(s) specified in Article II, paragraph E or F, whereby the State can exert regulatory control over the materials stated therein.

ARTICLE IV

Notwithstanding this Agreement, the Commission may from time to time by rule, regulation, or order, require that the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing source, byproduct, or special nuclear material shall not transfer possession or control of such product except pursuant to a license or an exemption from licensing issued by the Commission.

ARTICLE V

This Agreement shall not affect the authority of the Commission under subsection 161 b. or i. of the Act to issue rules, regulations, or orders to protect the common defense and security, to protect restricted data or to guard against the loss or diversion of special nuclear material.

ARTICLE VI

The Commission will use its best efforts to cooperate with the State and other agreement States in the formulation of standards and regulatory programs of the State and the Commission for protection against hazards of radiation and to assure that State and Commission programs for protection against hazards of radiation will

be coordinated and compatible. The State will use its best efforts to cooperate with the Commission and other agreement States in the formulation of standards and regulatory program of the State and the Commission for protection against hazards of radiation and to assure that the State's program will continue to be compatible with the program of the Commission for the regulation of like materials. The State and the Commission will use their best efforts to keep each other informed of proposed changes in their respective rules and regulations and licensing, inspection and enforcement policies and criteria, and to obtain the comments and assistance of the other party thereon.

ARTICLE VII

The Commission and the State agree that it is desirable to provide for reciprocal recognition of licenses for the materials listed in Article I licensed by the other party or by any Agreement State. Accordingly, the Commission and the State agree to use their best effort to develop appropriate rules, regulations, and procedures by which such reciprocity will be accorded.

ARTICLE VIII

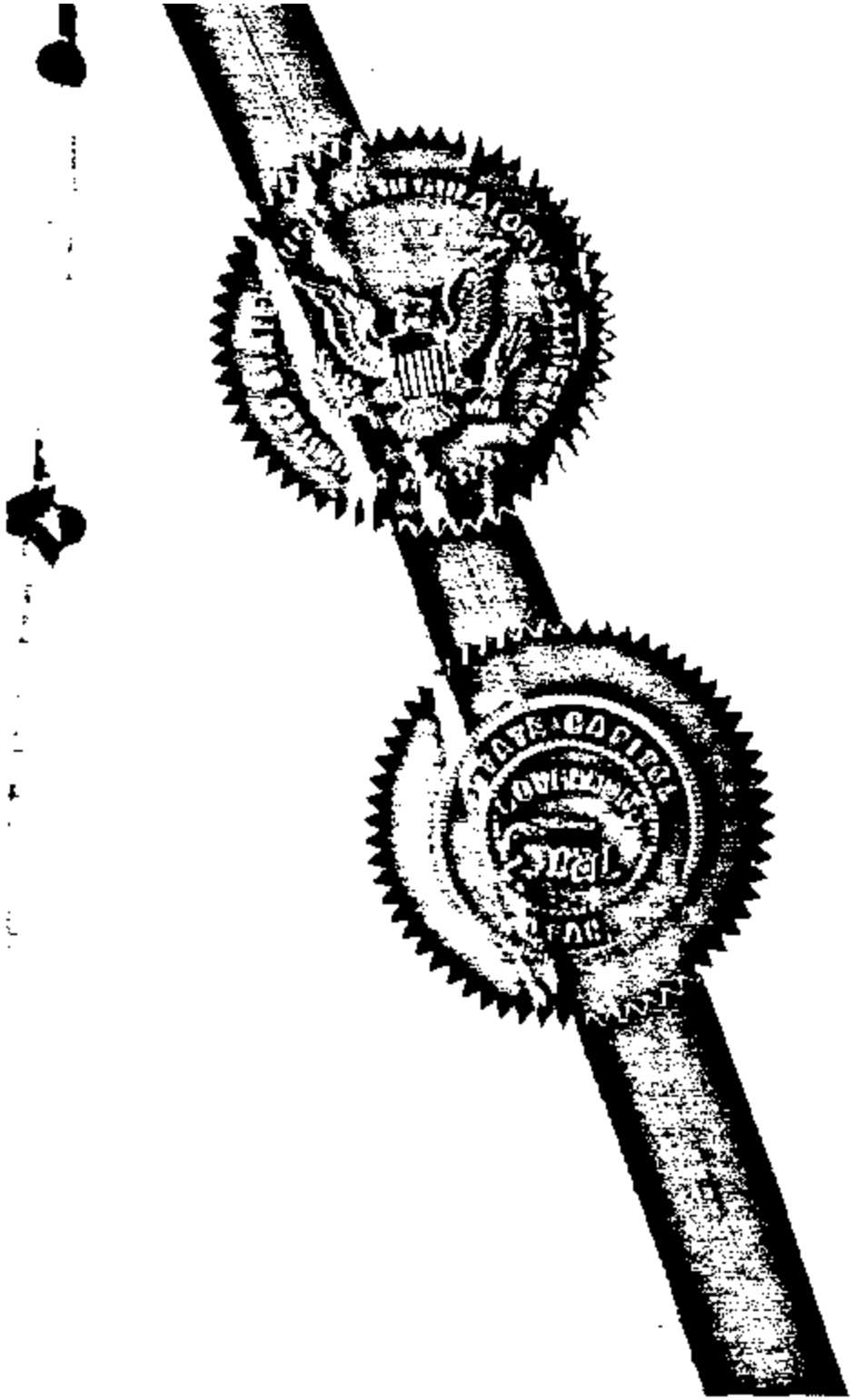
The Commission, upon its own initiative after reasonable notice and opportunity for hearing to the State, or upon request of the Governor of the State, may terminate or suspend all or part of this Agreement and reassert the licensing and regulatory authority vested in it under the Act if the Commission finds that (1) such termination or suspension is required to protect the public health and safety, or (2) the State has not complied with one or more of the requirements of section 274 of the Act. The Commission may also, pursuant to section 274j of the Act,

temporarily suspend all or part of this agreement if, in the judgement of the Commission, an emergency situation exists requiring immediate action to protect public health and safety and the State has failed to take necessary steps. The Commission shall periodically review this Agreement and actions taken by the State under this Agreement to ensure compliance with section 274 of the Act.

ARTICLE IX

This Agreement shall become effective on April 1, 1984, and shall remain in effect unless, and until such time as it is terminated pursuant to Article VIII.

Done at Salt Lake City, in triplicate, this 29th day of March, 1984.



FOR THE UNITED STATES
NUCLEAR REGULATORY COMMISSION

Nunzio J. Palladino, Chairman

FOR THE STATE OF UTAH

Scott M. Matheson, Governor

Exhibit 22

"*Elements of a Utah Agreement State Program for Uranium Mills Regulation*",
Divisions of Radiation Control and Water Quality
Utah Department of Environmental Quality

August 26, 2000

Policy Statement

The State of Utah recognizes the importance of and supports the uranium mining and milling industry. The State recognizes that to remain viable at this time, uranium mills must be able to engage in activities other than milling conventional mined uranium ores, such as processing alternate feed materials for the recovery of uranium alone or together with other minerals. The State also recognizes its responsibility to ensure that all such activities are accomplished in a manner that is protective of human health and the environment. It has been a long-standing policy for the State to seek primacy for environmental programs. In this regard, the State believes that a cooperative uranium mills and tailings regulatory program will be of benefit to both the regulated community and Utah citizens. The advantages that the State can offer over the current Nuclear Regulatory Commission program include better communication with and participation of the public in uranium recovery issues, elimination of duplicative regulatory responsibilities, providing a more cost effective program for the regulated community, and establishing control of materials not currently being regulated (e.g. Pre-1978 uranium mill tailings), while maintaining a regulatory program that is adequate and compatible with existing and future NRC regulations and policy. The elements within this discussion paper provide the framework for how the State of Utah would regulate uranium mills and tailings as an Agreement State.

Statutory Changes

The Radiation Control Act would be amended to allow the Radiation Control Board to establish rules for the licensing, operation, decontamination, decommissioning, and reclamation of sites, structures, and equipment used in conjunction with possession, use, transfer, or delivery of source and byproduct material and the disposal of byproduct material(uranium or thorium mill tailings and related wastes).

The Radiation Control Act would be amended to add a representative of the uranium milling industry to the Radiation Control Board.

Rulemaking

The Division of Radiation Control (DRC) will adopt 10 CFR Part 40 and new Part 41, if and when promulgated, by reference with necessary changes to reflect primacy of the Utah program (e.g., recognition of the Executive Secretary, etc.). With the adoption by reference of the NRC regulatory program, it is recognized that guidance has been published that is intended to provide

clarification to the various regulatory elements. The Division will follow the published NRC guidance unless doing so will compromise protection of human health and the environment.

DRC recognizes that it cannot make a fundamental change to an Atomic Energy Act provision (e.g., the definition of byproduct material). DRC further recognizes that pursuant to provisions of the Radiation Control Act (19-3-104 (6) and (7)), it can adopt rules more stringent than federal law only after a public hearing and a written finding based on evidence in the record that the federal regulations are not adequate to protect public health and the environment.

DRC will reach agreement with impacted mills, outside of rulemaking, desiring to process alternate feed on an acceptable uranium content level. Productive discussions in this regard are underway. Any agreement would be "approved" by the Utah Radiation Control Board, enforced by incorporation into a license condition.

The State of Utah will clarify during rulemaking that there is no distinction between pre and post-1978 uranium and thorium tailings and wastes that would otherwise satisfy the definition of 11e.(2) byproduct material.

Funding

DRC will use a combination of annual operating fees and review fees. There will be no "inspection fees" as part of the review fees. The Division or Department will not seek a change to "radioactive waste disposal fees" either in the Radiation Control Act or in the Department of Environmental Quality fees schedule to fund the program. The costs of developing the State programs and developing guidance and regulations from time to time will not be passed on to the licensees as part of the annual operating fees or review fees or otherwise.

Staffing

Staffing will consist of the establishment of four new positions within the Division. Staffing utilized for the licensing and oversight of the Envirocare site will be drawn from existing oversight staff for that facility. A health physicist position will be established with the responsibility for radiation safety inspections of the mills and inspection of all radioactive material licensees in Southern Utah (some 28 licensees). An engineer position will be established to assist in the inspection and licensing of new facilities, upgrade of existing facilities, and closing facilities. A groundwater hydrologist position will be established to provide for inspection and licensing review relating to groundwater monitoring and corrective actions for the mills. Administrative support to the section will be provided by an Office Technician III. Management of the mill team will be under the responsibility of the Environmental Monitoring and Low-Level Waste Section. The Section name will be changed to Environmental Monitoring, Uranium Recovery, and Waste Management Section.

Inspection program

There will be at least four facilities that will require inspection: Lisbon (Rio Algom), White Mesa (International Uranium), Shootaring Canyon (Plateau Resources), and Clive (Envirocare of Utah). There will also be the possibility of inspection responsibilities for the Moab Mill Reclamation Site if cleanup responsibility has not yet been transferred to the Department of Energy. Currently, Envirocare of Utah in Tooele County is subject to quarterly inspections by the NRC using staff from offices in Arlington, Texas sometimes supplemented by NRC Headquarters staff from Rockville, Maryland. Envirocare inspections would be assigned to the "Envirocare team" and incorporated into the overall oversight and inspection schedule now in use for low-level radioactive waste.

A health physicist will be hired to inspect each of the mills at least on a quarterly basis. The mill inspection frequency schedule will be reviewed regularly and adjusted as needed for different circumstances (e.g., good compliance, standby not operating, etc.) The health physicist will be housed in the DRC offices in Salt Lake City but will travel to Southern Utah at least one week per month to accomplish both regular (quarterly) and oversight inspections. This health physicist will also be responsible for the inspection of 28 other radioactive material licensees in Southeast and Southwest Utah. The engineer and groundwater hydrologist will provide inspection support as needed to the health physicist in such areas as groundwater sampling evaluations, split groundwater sampling, oversight of new engineering construction, or oversight of closing facilities.

The State inspection program would incorporate all the elements of the current radioactive materials inspection program relevant to Part 40 uranium recovery facilities which is subject to periodic program review by the NRC. Enforcement actions will be in accordance with the Utah Radiation Control Rules and existing enforcement guidance (used for the radioactive materials and low-level waste program). All enforcement actions can be appealed to the Utah Radiation Control Board and thereafter to the appropriate court.

Licensing program

The licensing process would follow the elements of the current radioactive materials program which is subject to periodic program review by the NRC. License renewal, amendments, reclamation plans or revisions to reclamation plans or new licenses may be subject to public comment and/or public hearing. Criteria of R313-17-1 through 4 would apply. DRC would follow current policy as to the differentiation between minor and major amendments and the need for public comment.

Existing NRC licenses will be transferred to the State upon program relinquishment by the NRC and they will be converted into a "state license" which will include appropriate Utah regulatory citations in lieu of "Part 40" language and will incorporate the Utah administrative process (e.g., Executive Secretary) where necessary. The license conditions will remain unchanged except for the above until a license amendment request or license renewal. The current expiration date of the license will remain the same. The license transfer will not give rise to a requirement to make

any changes to existing facilities.

The State will recognize already established performance-based license conditions for uranium mills and tailings. The State is willing to consider future performance-based license conditions on a case by case basis with each licensee. An issue that will need to be addressed is the appropriate method for substantive involvement of the public while still achieving the operational objectives of performance based licensing.

Groundwater Authority

The Division of Radiation Control should continue to administer both groundwater permitting and radioactive materials licensing for disposal facilities and uranium mills. This process can be streamlined and made more effective by utilizing existing provisions of the Utah Water Quality Act which we believe would allow the Water Quality Board and Executive Director to designate the Director of the Division of Radiation Control as an Executive Secretary to administer provisions of this Act for the identified facilities (see UCA 19-5-106 and 19-5-104 (1),(k). This option offers several advantages including no statutory changes to the Radiation Control Act would be required, the DRC Director would be designated as an Executive Secretary of the Water Quality Board and given legal authority to issue, administer and enforce specific groundwater permits under the Utah Water Quality Act, and no separate involvement of the Division of Water Quality staff would be required although they would remain available to consult with the DRC Director regarding interpretation of rules and any other technical or procedural matters.

Additional advantages include that it would be more clear to the regulatory community regarding which agency and individuals they must deal with, thus eliminating dual involvement, permits would be issued under the current groundwater rules and policies adopted by the Water Quality Board to insure consistency with other entities regulated for the protection of groundwater by the Board, and the Division of Radiation Control would not need to undertake a separate rule making to define a groundwater protection program for these specific facilities.

Finally, appeals of permit or enforcement decisions will be conducted in accordance with the Water Quality Act through the Water Quality Board or the Executive Director of DEQ as specified in the Statute. This will insure consistency with other facilities and groundwater protection actions. Mining representation and expertise is already established in statute for the Board. This approach insures consistency with the radioactive materials licensing because the same staff will be doing both. The DRC Director will need to be careful to insure that the proper signature authority is used for the various actions that might be taken. This approach prevents fragmentation of the state groundwater protection program and maintains consistency.

Task Force Recommendation to the Department of Environmental Quality

The following motion, proposed by Bill Sinclair, was moved for a vote by David Bird, seconded by George Hellstrom.

We, the members of the Department of Environmental Quality Groundwater Authority Agreement State task force support the State of Utah in pursuing Agreement State status for uranium recovery regulation on the terms established in the revised "Elements of a Utah Agreement State Program for Uranium Mills Regulation, Divisions of Radiation Control and Water Quality, agreed to at the July 26, 2000 meeting of the task force.

Unanimously supported by task force members:
Paul Goranson, Rio Algom
Fred Craft, Plateau Resources
George Hellstrom, Envirocare of Utah, Inc.
David Bird, Utah Mining Association
David Frydenlund, International Uranium
Harvey Merrell, Grand County Council
Teryl Hunsaker, Tooele County Commission
Stephen Nelson, Utah Radiation Control Board
William J. Sinclair, Division of Radiation Control, UDEQ
Don Ostler, Division of Water Quality, UDEQ

Exhibit 23

AMENDMENT TO AGREEMENT BETWEEN THE UNITED STATES NUCLEAR REGULATORY COMMISSION AND THE STATE OF UTAH FOR DISCONTINUANCE OF CERTAIN COMMISSION REGULATORY AUTHORITY AND RESPONSIBILITY WITHIN THE STATE PURSUANT TO SECTION 274 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED

WHEREAS, the United States Nuclear Regulatory Commission (hereinafter referred to as the Commission) entered into an Agreement on March 29, 1984 (hereinafter referred to as the Agreement of March 29, 1984) with the State of Utah under Section 274 of the Atomic Energy Act of 1954, as amended (hereafter referred to as the Act) which became effective on April 1, 1984, providing for discontinuance of the regulatory authority of the Commission within the State under Chapters 6, 7, and 8 and Section 161 of the Act with respect to byproduct materials as defined in Section 11e.(1) of the Act, source materials, and special nuclear materials in quantities not sufficient to form a critical mass; and,

WHEREAS, the Commission entered into an amendment to the Agreement of March 29, 1984 (hereinafter referred to as the Agreement of March 29, 1984, as amended) pursuant to the Act providing for discontinuance of regulatory authority of the Commission with respect to the land disposal of source, byproduct, and special nuclear material received from other persons which became effective on May 9, 1990; and,

WHEREAS, the Governor of the State of Utah requested, and the Commission agreed, that the Commission reassert Commission authority for the evaluation of radiation safety information for sealed sources or devices containing byproduct, source or special nuclear materials and the registration of the sealed sources or devices for distribution, as provided for in regulations or orders of the Commission; and,

WHEREAS, the Governor of the State of Utah is authorized under Utah Code Annotated 19-3-113 to enter into this amendment to the Agreement of March 29, 1984, as amended, between the Commission and the State of Utah; and,

WHEREAS, the Governor of the State of Utah has requested this amendment in accordance with Section 274 of the Act by certifying on January 2, 2003 that the State of Utah (hereinafter referred to as the State) has a program for the control of radiological and non-radiological hazards adequate to protect the public health and safety and the environment with respect to byproduct material as defined in Section 11e.(2) of the Act and facilities that generate this material and that the State desires to assume regulatory responsibility for such material; and,

WHEREAS, the Commission found on August 4, 2004, that the program of the State for the regulation of materials covered by this Amendment is in accordance with the requirements of the Act and in all other respects compatible with the Commission's program for the regulation of byproduct material as defined in Section 11e.(2) of the Act and is adequate to protect public health and safety; and,

WHEREAS, the State and the Commission recognize the desirability and importance of cooperation between the Commission and the State in the formulation of standards for protection against hazards of radiation and in assuring that the State and the Commission programs for protection against hazards of radiation will be coordinated and compatible; and,

WHEREAS, this Amendment to the Agreement of March 29, 1984, as amended, is entered into pursuant to the provisions of the Act.

NOW, THEREFORE, it is hereby agreed between the Commission and the Governor of the State, acting on behalf of the State, as follows:

Section 1. Article I of the Agreement of March 29, 1984, as amended, is amended by adding a new paragraph B and renumbering paragraphs B through D as paragraphs C through E. Paragraph B will read as follows:

"B. Byproduct materials as defined in Section 11e.(2) of the Act;"

Section 2. Article II of the Agreement of March 29, 1984, as amended, is amended by deleting paragraph E and inserting a new paragraph E to implement the reassertion of Commission authority over sealed sources and devices to read:

"E. The evaluation of radiation safety information on sealed sources or devices containing byproduct, source, or special nuclear materials and the registration of the sealed sources or devices for distribution, as provided for in regulations or orders of the Commission."

Section 3. Article II of the Agreement of March 29, 1984, as amended, is amended by numbering the current Article as "A" by placing an A in front of the current Article language. The subsequent paragraphs A through E are renumbered as paragraphs 1 through 5. After the current amended language, the following new Paragraph B is added to read:

"B. Notwithstanding this Agreement, the Commission retains the following authorities pertaining to byproduct material as defined in Section 11e.(2) of the Act:

1. Prior to the termination of a State license for such byproduct material, or for any activity that resulted in the production of such material, the Commission shall have made a determination that all applicable standards and requirements pertaining to such material have been met;

2. The Commission reserves the authority to establish minimum standards governing reclamation, long-term surveillance or maintenance, and ownership of such byproduct material and of land used as a disposal site for such material. Such reserved authority includes:

   a. The authority to establish terms and conditions as the Commission determines necessary to assure that, prior to termination of any license for such byproduct material, or for any activity that results in the production of such material, the licensee shall comply with decontamination, decommissioning, and reclamation standards prescribed by the Commission; and with ownership requirements for such materials and its disposal site;

   b. The authority to require that prior to termination of any license for such byproduct material or for any activity that results in the production of such material, title to such byproduct material and its disposal site be transferred to the United States or the State of Utah at the option of the State (provided such option is exercised prior to termination of the license);

c. The authority to permit use of the surface or subsurface estates, or both, of the land transferred to the United States or the State pursuant to 2.b. in this Section in a manner consistent with the provisions of the Uranium Mill Tailings Radiation Control Act of 1978, as amended, provided that the Commission determines that such use would not endanger public health, safety, welfare, or the environment;

d. The authority to require, in the case of a license for any activity that produces such byproduct material (which license was in effect on November 8, 1981), transfer of land and material pursuant to paragraph 2.b. in this Section taking into consideration the status of such material and land and interests therein, and the ability of the licensee to transfer title and custody thereof to the United States or the State;

e. The authority to require the Secretary of the Department of Energy, other Federal agency, or State, whichever has custody of such byproduct material and its disposal site, to undertake such monitoring, maintenance, and emergency measures as are necessary to protect public health and safety, and other actions as the Commission deems necessary; and

f. The authority to enter into arrangements as may be appropriate to assure Federal long-term surveillance or maintenance of such byproduct material and its disposal site on land held in trust by the United States for any Indian Tribe or land owned by an Indian Tribe and subject to a restriction against alienation imposed by the United States."

Section 4. Article IX of the 1984 Agreement, as amended, is renumbered as Article X and a new Article IX is inserted to read:

"ARTICLE IX

In the licensing and regulation of byproduct material as defined in Section 11e.(2) of the Act, or of any activity which results in the production of such byproduct material, the State shall comply with the provisions of Section 274o of the Act. If in such licensing and regulation, the State requires financial surety arrangements for reclamation or long-term surveillance and maintenance of such byproduct material:

A. The total amount of funds the State collects for such purposes shall be transferred to the United States if custody of such byproduct material and its disposal site is transferred to the United States upon termination of the State license for such byproduct material or any activity that results in the production of such byproduct material. Such funds include, but are not limited to, sums collected for long-term surveillance or maintenance. Such funds do not, however, include monies held as surety where no default has occurred and the reclamation or other bonded activity has been performed; and

B. Such surety or other financial requirements must be sufficient to ensure compliance with those standards established by the Commission pertaining to bonds, sureties, and financial arrangements to ensure adequate reclamation and long-term management of such byproduct material and its disposal site."

This amendment shall become effective on August 15, 2004, and shall remain in effect unless and until such time as it is terminated pursuant to Article VIII of the Agreement of March 29, 1984, as amended.

Done at Rockville, Maryland, in triplicate, this 10th day of August 2004.

FOR THE UNITED STATES
NUCLEAR REGULATORY COMMISSION

Nils J. Diaz, Chairman

Done at Salt Lake City, Utah, in triplicate, this 16th day of August 2004.

FOR THE STATE OF UTAH

Olene S. Walker, Governor

Exhibit 24

Freight Calculator: Air and Sea Shipping Costs

Instant international freight rate estimates for shipping by sea, air, and truck.

Get an estimate from the world's largest database of freight rates with
our freight calculator and then join Freightos to compare, book, and manage your upcoming shipments.

Freightos Marketplace Estimates

Search again

Total Shipment: 1 Container 20'
From: EETLL - Tallinn **To:** USHOU - Houston, TX

FCL	$1,718 - $2,832	Get exact quotes
18-22 days		

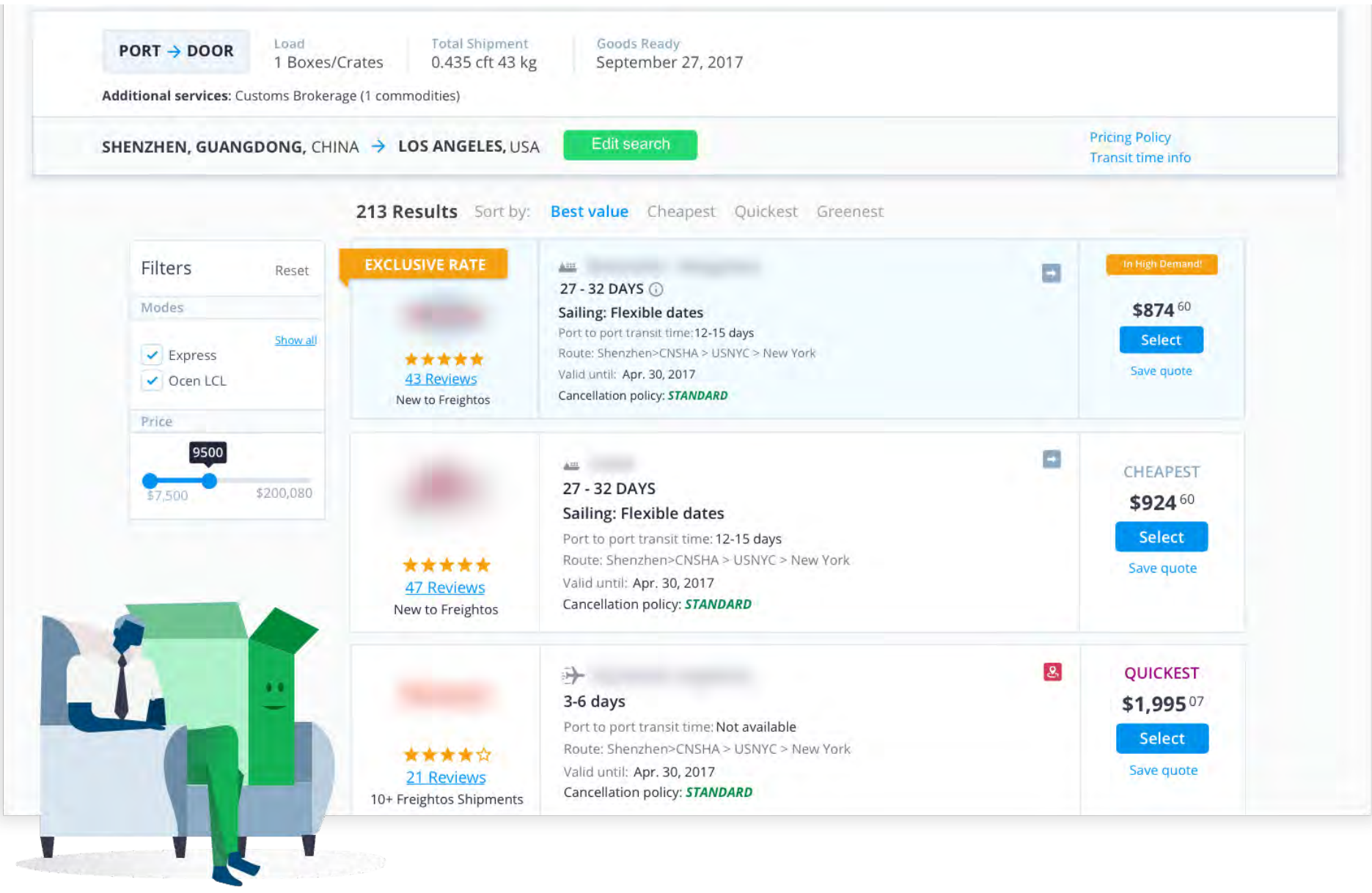
Compare, book and manage freight seamlessly across 75+ providers

Sign up to compare quotes

Freightos - The world's digital freight platform

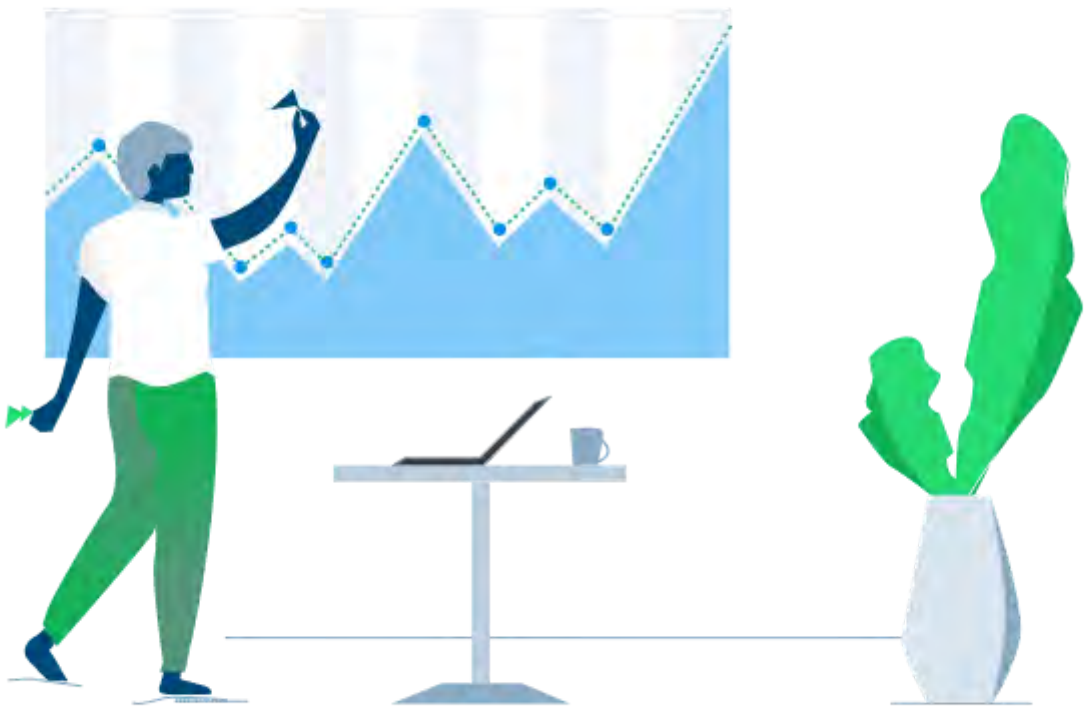
Compare and book | Manage and track | Live expert support

Instantly compare air, ocean & sea cargo, and trucking freight quotes from 75+ providers with the perfect balance of price and transit time.



Behind the International Freight Rate Calculator

Freightos' international freight calculator uses the world's largest freight rate database, enabling accurate, freight forwarding cost estimates.



Over 1.5 billion data points

Powered by the Freightos Baltic Index and backed by the Singapore Exchange.

Hundreds of global providers

Based on live freight rates from hundreds of international freight forwarders and carriers.

Reliable freight data

How To Calculate Freight Rates & Shipping Costs with the Freight Calculator

Follow these step-by-step instructions to calculate your shipping cost estimate using the freight rate calculator.

1. Select whether you are shipping full containers or boxes/pallets.

2. Enter your load dimensions, weight, quantities, origin, and destination.

3. Search!

4. Want to book? Select the “Get live quotes” button.

Other Freightos Guides and Tools

Forwarder selection guide

Get started selecting a freight forwarder or just learn what a freight forwarder does.

Amazon FBA shipping guide

Shipping to Amazon? Check out The Complete Amazon FBA Shipment Strategy Guide.

Compare International Freight in Seconds

JOIN NOW

Exhibit 25

Freight Calculator

Get Instant, Free, Container Shipping Estimates, as well as Break Bulk, Bulk, and Project Cargo, from anywhere to anywhere in the World. We provide International Air shipment estimates, as well as Trucking Estimates in North America and the European Union (exclusive of the Scandinavian countries). WFR can help you or your business send anything from individual packages, boxes, or pallets, up to full containerloads, and more.

1. SELECT METHOD OF SHIPPING

Containerized | Break Bulk | Project Cargo/ Heavy Lift | Truck | Air

2. SELECT LOCATIONS

Tallinn, Estonia

Houston, United States

Minerals & Metallurgy

Before entering the Commodity Value, please select the Load Type of either FCL or LCL.

$1,000

3. SELECT LOAD

(•) FCL

Container Type 20 FT

( ) LCL

[ ] Refrigerated

4. ACCESSORIAL CHARGES

[x] Hazardous

[ ] Add Insurance

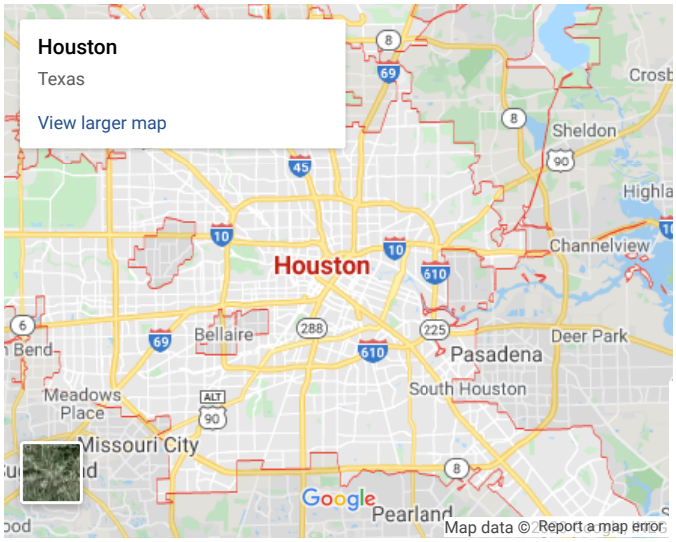
GET RATE

Current Market Rate Estimate

$2,352.19 – $2,599.79

Subject to additional fees such as taxes, duties, etc..

View Larger Map



View Larger Map

Exhibit 26

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1888

Environmental Impact Statement for the Reclamation of the Sequoyah Fuels Corporation Site in Gore, Oklahoma

Final Report

Office of Federal and State Materials and Environmental Management Programs

APPENDIX F

COST ANALYSIS

Table F-1 No Action Alternative

Activity/Cost Element	Direct Cost ($000s)	Notes/Assumptions/Parameters			
1. Long term site control fund[1]	$18,420				
		Derivation of Long-term Annual Maintenance Costs			
		Staff	No.		**2007[2]**
		Manager/Engineer	0.25	FTE	$31,276
		Technicians	2	FTE	$72,978
		Security Guards	2	FTE	$83,404
		Administration	0.25	FTE	$10,425
		O&M			
		Utilities			$10,425
		Analytical Cost			$52,127
		Materials, supplies			$52,127
		NRC fees			$52,127
		Mowing			
		6 mowings (96 h @ $36.5)	96	$36.49	$3,503
		Total:			$368,394
2. Long-term Groundwater Recovery and Treatment	$1,355	13 yrs. @ $104,250/yr. (undiscounted)			
Total Cost	**$19,775**				

Standard construction work units of measurement used in all tables

Notes:

[1] The long-term site control fund represents the capitalized value of the annual long-term maintenance cost of $368,394. The value of the fund size was calculated by dividing the annual amount by a 2% discount rate ($368,394 / 0.02 =$18,419,700). The annual long-term maintenance costs include annual sampling of 25 monitoring wells and analysis for uranium, nitrate and arsenic, preparation of an annual report, and mowing six times per year.

[2] 2007$ updated using November 2007 Consumer Price Index, U.S. Bureau of Labor Statistics.

Table F-2 Alternative 1: On-Site Disposal of Contaminated Materials (the Licensee's Proposed Action)

Estimated Costs for On-Site Disposal		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor Mobilization and demobilization	$694	5% of lines, 4, 5, 6, 7, 8, 9 and 11.
4. Monitoring Well Removal and Replacement	$–	Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Cost for Placing Super Sacks in Disposal Cell	$50	
7. Other Sludge, Removal, Treatment and On-Site Disposal	$3,122	See note (4)
8. Soil Remediation	$1,716	See Table F-2b
9. Building and Equipment Demolition	$3,994	See note (5)
10. Termination Survey	$391	See note (6)
11. Site Restoration	$1,931	See note (7)
12. Groundwater Remediation	$1,199	See note (8)
13. Engineering Construction Management	$2,246	15% of lines 3 through 11.
14. Post-Closure Monitoring Program	$84	See note (9)
15. SFC Staff	$7,612	See note (10)
16. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
17. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Subtotal:	$29,623	
Contingency (@ 10% of direct costs)	$2,962	
Grand Total:	**$32,585**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement of other sludges in the cell (1,433,015 cu-ft @ $2.179/cu-ft.). Sum of non-raffinate sludge and sediments from Material Characteristics Table F-2a.

(5) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(6) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(7) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(8) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(9) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(10) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-2a Material Characteristics Sheet

Description	Volume (cubic feet)	In Cell Volume (cubic feet)	Density g/cm^3	Total Weight (lbs)	Total Weight (tons)
Sludges and Sediments					
Raffinate sludge	1,064,000	247,009	1.360	2.10E+07	10,478
Pond 2 residual materials	635,000	762,000	1.710	8.13E+07	40,640
Emergency basin sediment	14,600	14,600	1.511	1.38E+06	688
North ditch sediment	20,770	20,770	1.511	1.96E+06	979
Sanitary lagoon sediment	10,365	10,365	1.511	9.77E+05	488
Fluoride holding basin #1	171,400	171,400	1.540	1.65E+07	8,233
Fluoride holding basin #2	186,000	186,000	1.540	1.79E+07	8,934
Fluoride settling basins and clarifier	114,300	114,300	1.540	1.10E+07	5,490
Buried calcium fluoride	96,380	96,380	1.540	9.26E+06	4,629
Buried fluoride holding basin #1	57,200	57,200	1.540	5.49E+06	2,747
subtotal:	**2,370,015**	**1,680,024**	**15**	**166,613,236**	**83,307**
Liner Soils and Subsoils					
Clarifier liners	332,400	332,400	1.760	3.65E+07	18,247
Calcium fluoride basin liner	95,285	95,285	1.760	1.05E+07	5,231
Emergency basin soils	162,500	162,500	1.760	1.78E+07	8,920
North Ditch soils	87,500	87,500	1.760	9.61E+06	4,803
Sanitary Lagoon liner	56,356	56,356	1.760	6.19E+06	3,094
subtotal:	**734,041**	**734,041**	**9**	**80,588,001**	**40,294**
Buried Material/Drums					
Pond 1 spoils pile	437,400	437,400	1.760	4.80E+07	24,010
Interim storage cell	154,887	154,887	1.760	1.70E+07	8,502
Solid waste burials (No. 1)	43,000	43,000	1.760	4.72E+06	2,360
Solid waste burials (No. 2)	8,100	8,100	1.760	8.89E+05	445
DUF4 drummed container trash	2,200	2,200	0.545	7.48E+04	37
Other drummed container trash	5000	5000	0.545	1.70E+05	85
Empty contam. Drum	2,000	2,000	0.883	1.10E+05	55
subtotal:	**652,587**	**652,587**	**9**	**70,990,325**	**35,495**
Structural Materials[1]					
Main process building	2,178,000	436,600	3.204	8.73E+07	43,630
Solvent extraction building	180,000	36,000	3.204	7.20E+06	3,598
DUF4 building	281,000	56,200	3.204	1.12E+07	5,616
ADU/Misc digestion building	75,000	2,500	3.204	5.00E+05	250
Laundry building	12,500	3,000	3.204	6.00E+05	300
Centrifuge building	15,000	6,000	3.204	1.20E+06	600

Table F-2a Material Characteristics Sheet

Description	Volume (cubic feet)	In Cell Volume (cubic feet)	Density g/cm^3	Total Weight (lbs)	Total Weight (tons)
Bechtel building	27,000	5,400	3.204	1.08E+06	540
Solid waste building	18,000	3,600	3.204	7.20E+05	360
Cooling tower	30,000	6,000	3.204	1.20E+06	600
RCC evaporator	18,750	3,750	3.204	7.49E+05	375
Incinerator	7,500	1,500	3.204	3.00E+05	150
Concrete and asphalt	511,795	511,795	3.204	1.02E+08	51,144
Scrap metal	100,000	50,000	0.883	2.75E+06	1,377
Chippel Pallets	3,000	3,000	0.300	5.61E+04	28
subtotal:	**3,457,545**	**1,125,345**	**40**	**217,131,023**	**108,566**
Subsoils and Bedrock					
Contaminated materials	811,685	811,685	1.760	89,112,285.89	44,556
TOTAL	**8,025,873**	**5,003,682**		**624,434,871.35**	**312,217.44**

Standard construction work units of measurement used in all tables

Notes;

[1] Existing volume values are for existing building volumes. In-cell volumes are estimated at 20% of built structure.

Table F-2b Soil Remediation and Consolidated Debris Cost (Alternatives 1 and 3)

Derivation of Soil Remediation and Consolidated Debris Costs			
Waste Element	**Cubic Feet of Material**	**Unit Cost per cubic foot 2007 $**	**Total Cost**
Contaminated Subsoils & Bedrock	811,685	$0.782	$634,663
DUF4 Trash Drums	2,200	$12.511	$27,523
CaF2 Basin Clay Liners	95,290	$0.688	$65,567
Solid Waste Burials	51,100	$1.522	$77,780
Pond 1 Spoils Pile	437,000	$0.688	$300,691
Interim Soils Storage Cell	154,887	$0.688	$106,575
Clarifier Clay Liners	332,400	$0.688	$228,718
Drummed LLW	5,000	$12.511	$62,553
Sanitary Lagoon Soil	56,400	$0.688	$38,808
Emergency Basin Soil	162,500	$0.688	$111,813
North Ditch Soil	87,500	$0.688	$60,207
Crushed Drums	2,000	$0.688	$1,376
Total	2,197,962		$1,716,273

Table F-3 Alternative 2, Option 1: Off-Site Disposal of All Contaminated Materials

Transport of all materials by rail to EnergySolutions (Clive, Utah)

Estimated Direct Costs for Off-Site Disposal to EnergySolutions (Alternative 2-1)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$569	5% of lines, 4, 5, 6, 7, 8, 9 and 11.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure		Not required for the off-site disposal option
6. Dewater Raffinate Sludge		Task Complete
7. Other Sludge, Removal & Treatment & Loading for Transport	$3,122	See note (3)
8. Soil Remediation	$3,877	See Table F-3a
9. Building and Equipment Demolition	$3,994	See note (4)
10. Shipping and Off-Site Disposal	$177,191	See note (5)
11. Termination Survey	$391	See note (6)
12. Site Restoration	$1,931	See note (7)
13. Groundwater Remediation	$1,199	See note (8)
14. Engineering Construction Management	$28,661	15% of lines 3 through 12.
15. SFC Staff	$7,612	See note (9)
16. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$231,258	
Contingency (@ 10% of direct costs)	$23,126	
Grand Total:	**$254,384**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Volume 1,433,015 cu-ft @ $2.179/cu-ft (sum of non-raffinate sludge and sediments from Material Characteristics Table F-2a).

(4) From SFC Environmental Report.

(5) Calculated by multiplying 463,850 tons times $382/ton (cost quote EnergySolutions 2007).

(6) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(7) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(8) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(9) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-3a Soil Remediation and Consolidated Debris Costs (Alternative 2)

Derivation of Soil Remediation and Consolidated Debris Costs			
Waste Element	**Cubic Feet of Material**	**Unit Cost/ cubic foot 2007 $**	**Total Cost**
DUF4 Trash Drums	2,200	$12.563	$27,638
Subsoils and Bedrock	3,574,000	$0.782	$2,794,541
CaF2 Basin Clay Liners	95,290	$0.688	$65,567
Solid Waste Burials	51,100	$1.522	$77,780
Pond 1 Spoils Pile	437,000	$0.688	$300,691
Interim Soils Storage Cell	154,887	$0.688	$106,575
Clarifier Clay Liners	332,400	$0.688	$228,718
Drummed LLW	5,000	$12.563	$62,813
Sanitary Lagoon Soil	56,400	$0.688	$38,808
Emergency Basin Soil	162,500	$0.688	$111,813
North Ditch Soil	87,500	$0.688	$60,207
Crushed Drums	2,000	$0.688	$1,376
Total	4,960,277		3,876,526

Table F-4 Alternative 2, Option 2: Off-Site Disposal of All Contaminated Materials

Transport of all materials by rail to WCS (Andrews, Texas)

Estimated Direct Costs for the Off-Site Disposal to WCS (Alternative 2-2)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$569	5% of lines, 4, 5, 6, 7, 8, 9 and 11.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure		Not required for the off-site disposal option
6. Dewater Raffinate Sludge		Task Complete
7. Other Sludge, Removal & Treatment & Loading for Transport	$3,122	See note (3)
8. Soil Remediation	$3,877	See Table F-3a
9. Building and Equipment Demolition	$3,994	See note (4)
10. Shipping and Off-Site Disposal	$89,253	See note (5)
11. Termination Survey	$391	See note (6)
12. Site Restoration	$1,931	See note (7)
13. Groundwater Remediation	$1,199	See note (8)
14. Engineering Construction Management	$15,471	15% of lines 3 through 12.
15. SFC Staff	$7,612	See note (9)
16. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$130,130	
Contingency (@ 10% of direct costs)	$13,013	
Grand Total:	**$143,143**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS

(3) Volume 1,433,015 cu-ft @ $2.179/cu-ft (sum of non-raffinate sludge and sediments from Material Characteristics Table F-2a).

(4) From SFC Environmental Report.

(5) Calculated based on scaling the EnergySolutions price quote by the relative rail distances between WCS and EnergySolutions, Inc. Calculated using the ratio of the WCS rail distance (km) to the EnergySolutions rail distance (km); equal to: (1221 km / 2424 km) x (382/ton) x (463,850 tons).

(6) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(7) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(8) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(9) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-5 Alternative 3, Option 1-1: Partial Off-site Disposal of Contaminated Materials

Raffinate sludge transported by truck to White Mesa (Blanding, Utah) and other sludges and sediments transported by truck to Pathfinder Mines Corp. (PMC, Mills, Wyoming).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-1-1)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport of raffinate sludge to White Mesa	$1,985	See note (5)
8b. Raffinate sludge processing cost at White Mesa	$1,310	= [10,478 tons x $125/ton processing cost].
8c. Transport of other sludges and sediments to PMC	$407	See note (6)
8d. Disposal of other sludges and sediments at PMC	$455	= [2155 tons x $210.9/ton PMC disposal cost]
8e. Recovered Materials Rebate (-) Raffinate Sludge	$(738)	See note (7)
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (8)
11. Termination Survey	$391	See note (9)
12. Site Restoration	$1,931	See note (10)
13. Groundwater Remediation	$1,199	See note (11)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (12)
16. SFC Staff	$7,612	See note (13)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
19. White Mesa license amendment	$100	
Total Direct Cost:	$32,961	
Contingency (@ 10% of direct costs)	$3,296	
Grand Total:	**$36,257**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier transport price quotes in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean transport price quote of $189.4/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier transport price quote in $/ton by final destination. Table value = 2,155 tons of sediment (includes Emergency Basin + North Ditch + Sanitary Lagoon) going 1675 km using $189/ton. Mean transport price reflects quotes received from seven carriers.

(7) Reflects potential rebate provided by mill for market value of recovered uranium constituents using March 2008 price for uranium. See Table F-18.

(8) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(9) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(10) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(11) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(12) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(13) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-6 Alternative 3, Option 1-2: Partial Off-site Disposal of Contaminated Materials
Raffinate sludge transported by truck to White Mesa (Blanding, Utah) and other sludges and sediments transported by truck to EnergySolutions (Clive, Utah).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-1-2)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport raffinate sludge to White Mesa	$1,985	See note (5)
8b. Raffinate sludge processing cost at White Mesa	$1,310	Value = [10,478 tons of raffinate sludge x $125/ton processing cost].
8c. Transport other sludges and sediments to EnergySolutions	$517	See note (6)
8d. Disposal of other sludges and sediments at EnergySolutions	$493	= $228.9/ton disposal cost x 2155 tons
8e. Recovered Materials Rebate (-) Raffinate Sludge	$(738)	See note (7)
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (8)
11. Termination Survey	$391	See note (9)
12. Site Restoration	$1,931	See note (10)
13. Groundwater Remediation	$1,199	See note (11)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12.(less 8)
15. Post-Closure Monitoring Program	$84	See note (12)
16. SFC Staff	$7,612	See note (13)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
19. White Mesa license amendment	$100	
Total Direct Cost:	$33,109	
Contingency (@ 10% of direct costs)	$3,311	
Grand Total:	**$36,420**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier transport price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean price quote of $189.4/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier transport price quote in $/ton by final destination. Table value = 2,155 tons of sediment (includes Emergency Basin + North Ditch + Sanitary Lagoon) going 2190 km multiplied times $239.9/ton. Mean transport price reflects quotes received from seven carriers.

(7) Reflects potential rebate provided by mill for market value of recovered uranium constituents using March 2008 price for uranium. See Table F-18

(8) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(9) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(10) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(11) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(12) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(13) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-7 Alternative 3, Option 1-3: Partial Off-site Disposal of Contaminated Materials

Raffinate sludge transported by truck to White Mesa (Blanding, Utah) and other sludges and sediments transported by truck to WCS (Andrews, Texas).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-1-3)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport raffinate sludge to White Mesa	$1,985	See note (5)
8b. Raffinate sludge processing cost at White Mesa	$1,310	= [10,478 tons x $125/ton processing cost]
8c. Transport other sludges and sediments to WCS	$284	See note (6)
8d. Disposal of other sludges and sediments at WCS	$231	= $107/ton disposal cost x 2155 tons.
8e. Recovered Materials Rebate (-) Raffinate Sludge	$(738)	See note (7)
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (8)
11. Termination Survey	$391	See note (9)
12. Site Restoration	$1,931	See note (10)
13. Groundwater Remediation	$1,199	See note (11)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8)
15. Post-Closure Monitoring Program	$84	See note (12)
16. SFC Staff	$7,612	See note (13)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
19. White Mesa license amendment	$100	
Total Direct Cost:	$32,613	
Contingency (@ 10% of direct costs)	$3,261	
Grand Total:	**$35,875**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean transport price quote of $189.4/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [2155 tons of raffinate sludge x mean transport price quote of $131.6/ton]. Mean transport price reflects quotes received from seven carriers.

(7) Reflects potential rebate provided by mill for market value of recovered uranium constituents using March 2008 price for uranium. See Table F-18

(8) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(9) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(10) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(11) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater as necessary.

(12) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(13) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-8 Alternative 3, Option 2-1: Partial Off-Site Disposal of Contaminated Materials

Raffinate sludge transported by truck to Rio Algom (Grants, New Mexico) and other sludges and sediments transported by truck to Pathfinder Mines Corp. (Mills, Wyoming).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-2-1)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport of raffinate sludge to Rio Algom	$1,638	See note (5)
8b. Disposal of raffinate sludge at Rio Algom	$2,096	= [10,478 x $200/ton disposal cost]
8c. Transport of other sludges and sediments to PMC	$407	See note (6)
8d. Disposal of other sludges and sediments at PMC	$455	= $210.9/ton disposal cost x 2155 tons
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (7)
11. Termination Survey	$391	See note (8)
12. Site Restoration	$1,931	See note (9)
13. Groundwater Remediation	$1,199	See note (10)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (11)
16. SFC Staff	$7,612	See note (12)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$34,038	
Contingency (@ 10% of direct costs)	$3,404	
Grand Total:	**$37,441**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean price quote of $156.3/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Value = 2,155 tons of sediment (includes Emergency Basin + North Ditch + Sanitary Lagoon) going 1675 km using $189/ton. Mean transport price reflects quotes received from seven carriers.

(7) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(8) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(9) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(10) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater as necessary.

(11) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(12) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-9 Alternative 3, Option 2-2: Partial Off-Site Disposal of Contaminated Materials

Raffinate sludge transported by truck to Rio Algom (Grants, New Mexico) and other sludges and sediments transported by truck to EnergySolutions (Clive, Utah).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-2-2)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport raffinate sludge to Rio Algom	$1,638	See note (5)
8b. Disposal of raffinate sludge at Rio Algom	$2,096	= [10,478 x $200/ton disposal cost]
8c. Transport other sludges and sediments to EnergySolutions	$517	See note (6)
8d. Disposal of other sludges and sediments at EnergySolutions	$493	= $228.9/ton disposal cost x 2155 tons.
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (7)
11. Termination Survey	$391	See note (8)
12. Site Restoration	$1,931	See note (9)
13. Groundwater Remediation	$1,199	See note (10)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (11)
16. SFC Staff	$7,612	See note (12)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$34,186	
Contingency (@ 10% of direct costs)	$3,419	
Grand Total:	**$37,605**	

Standard construction work units of measurement used in all tables

Notes: details may not add exactly to grand total due to independent rounding.

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean price quote of $156.3/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = 2,155 tons of sediment (includes Emergency Basin + North Ditch + Sanitary Lagoon) going 2190 km using $239.9/ton. Mean transport price reflects quotes received from seven carriers.

(7) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(8) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(9) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(10) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(11) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(12) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-10 Alternative 3, Option 2-3: Partial Off-Site Disposal of Contaminated Materials

Raffinate sludge transported by truck to Rio Algom (Grants, New Mexico) and other sludges and sediments transported by truck to WCS (Andrews, Texas).

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-2-3)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport raffinate sludge to Rio Algom	$1,638	See note (5)
8b. Disposal of raffinate sludge at Rio Algom	$2,096	= [10,478 x $200/ton disposal cost]
8c. Transport other sludges and sediments to WCS	$284	See note (6)
8d. Disposal of other sludges and sediments at WCS	$231	= $107/ton disposal cost x 2155 tons.
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (7)
11. Termination Survey	$391	See note (8)
12. Site Restoration	$1,931	See note (9)
13. Groundwater Remediation	$1,199	See note (10)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (11)
16. SFC Staff	$7,612	See note (12)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$33,690	
Contingency (@ 10% of direct costs)	$3,369	
Grand Total:	**$37,059**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge x mean price quote of $156.3/ton]. Mean transport price reflects quotes received from seven carriers.

(6) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = 2,155 tons of sediment (includes Emergency Basin + North Ditch + Sanitary Lagoon) going 1038 km using $131.6/ton. Mean reflects quotes received from seven carriers.

(7) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(8) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(9) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(10) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(11) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(12) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-11 Alternative 3, Option 3-1: Partial Off-Site Disposal of Contaminated Materials

Transport raffinate sludge and other sludges and sediments via truck to EnergySolutions (Clive, Utah)

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-3-1)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport of raffinate sludge and other sludges and sediments to EnergySolutions	$3,030	See note (5)
8b. Disposal of raffinate sludge and other sludges and sediments at EnergySolutions	$2,891	= [10,478+2155] x $228.9/ton disposal cost
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (6)
11. Termination Survey	$391	See note (7)
12. Site Restoration	$1,931	See note (8)
13. Groundwater Remediation	$1,199	See note (9)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (10)
16. SFC Staff	$7,612	See note (11)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$35,364	
Contingency (@ 10% of direct costs)	$3,536	
Grand Total:	**$38,900**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge + 2155 tons of sediment] x mean price quote of $239.9/ton]. Mean transport price reflects quotes received from seven carriers.

(6) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(7) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(8) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(9) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(10) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(11) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-12 Alternative 3, Option 3-2: Partial Off-Site Disposal of Contaminated Materials

Transport raffinate sludge and other sludges and sediments via truck to WCS (Andrews, Texas)

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-3-2)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport of raffinate sludge and other sludges and sediments to WCS	$1,662	See note (5)
8b. Disposal of raffinate sludge and other sludges and sediments at WCS	$1,351	= [10,478+2155] x $107/ton disposal cost
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (6)
11. Termination Survey	$391	See note (7)
12. Site Restoration	$1,931	See note (8)
13. Groundwater Remediation	$1,199	See note (9)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (10)
16. SFC Staff	$7,612	See note (11)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @$104,250/year
Total Direct Cost:	$32,456	
Contingency (@ 10% of direct costs)	$3,246	
Grand Total:	**$35,701**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge + 2155 tons of sediment] x mean price quote of $131.6/ton]. Mean transport price reflects quotes received from seven carriers.

(6) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(7) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(8) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(9) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(10) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(11) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-13 Alternative 3, Option 3-3: Partial Off-Site Disposal of Contaminated Materials

Transport raffinate sludge and other sludges and sediments via truck to Pathfinder Mines Corp. (PMC, Mills, Wyoming)

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-3-3)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport of raffinate sludge and other sludges and sediments to PMC	$2,388	See note (5)
8b. Disposal of raffinate sludge and other sludges and sediments at PMC	$2,665	= [10,478+2155] x $210.9/ton disposal cost
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (6)
11. Termination Survey	$391	See note (7)
12. Site Restoration	$1,931	See note (8)
13. Groundwater Remediation	$1,199	See note (9)
14. Engineering Construction Management	$2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (10)
16. SFC Staff	$7,612	See note (11)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
Total Direct Cost:	$34,495	
Contingency (@ 10% of direct costs)	$3,449	
Grand Total:	**$37,944**	

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge + 2155 tons of sediment] x mean price quote of $189/ton]. Mean transport price reflects quotes received from seven carriers.

(6) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(7) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment/NRC confirmation.

(8) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(9) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(10) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(11) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-14 Alternative 3, Option 4: Partial Off-Site Disposal of Contaminated Materials
Transport both raffinate sludge and other sludges and sediments via truck to White Mesa (Blanding, Utah)

Estimated Direct Costs for the Partial Off-Site Disposal Alternative (Alternative 3-4)		
Activity/Cost Element	**2007 $ (000s)**	**Note/Comment**
1. Complete Reclamation Plan and Supporting Documents	$457	See note (1)
2. NRC Charges for Reclamation Plan Review, EIS Preparation	$900	See note (2)
3. Contractor mobilization and demobilization	$687	5% of lines, 4, 5, 6, 7, 9, 10 and 12.
4. Monitoring Well Removal and Replacement		Task Complete
5. Disposal Cell Construction / Closure	$3,073	See note (3)
6. Other Sludge, Removal, Treatment and On-Site Disposal	$3,023	See note (4)
7. Dewater raffinate sludge		Task Complete
8a. Transport raffinate sludge and other sludges and sediments to White Mesa	$2,393	See note (5)
8b. Raffinate sludge and other sludges and sediments processing cost at White Mesa	$1,579	= [10,478 + 2155] x $125/ton processing cost
8c. Recovered Materials Rebate (-) Raffinate Sludge + Other	$(773)	See note (6)
9. Soil Remediation and On-Site Disposal	$1,716	See Table F-2b
10. Building and Equipment Demolition	$3,994	See note (7)
11. Termination Survey	$391	See note (8)
12. Site Restoration	$1,931	See note (9)
13. Groundwater Remediation	$1,199	See note (10)
14. Engineering Construction Management	2,222	15% of lines 3 through 12 (less 8).
15. Post-Closure Monitoring Program	$84	See note (11)
16. SFC Staff	$7,612	See note (12)
17. Long-Term Site Control Fund	$798	Per 10 CFR 40, Appendix A, Criterion 10 ($250K, 1978 escalated to 2007 $).
18. Long-term Groundwater Recovery and Treatment	$1,355	13 years @ $104,250/year
19. White Mesa License Amendment	$100	
Total Direct Cost:	$32,741	
Contingency (@ 10% of direct costs)	$3,274	
Grand Total:	**$36,015**	

Standard construction work units of measurement used in all tables

Notes:

(1) Includes responses to RAIs and revisions to the Reclamation Plan, groundwater Corrective Action Plan and preparation of an Alternate Concentration Limit Application.

(2) Includes review and approval of Reclamation Plan and groundwater Corrective Action Plan and completion of EIS.

(3) Cell design included in 2006 Reclamation Plan.

(4) Excavation, treatment and placement in the cell of sludges not being shipped off-site (1,387,280 cu-ft @ $2.179/cu-ft, see Materials Characteristics Table F-2a).

(5) See Appendix F Table F-17 for mean carrier price quote in $/ton by final destination. Table value = [10,478 tons of raffinate sludge + 2155 tons of sediment] x mean price quote of $189.4/ton]. Mean transport price reflects quotes received from seven carriers.

(6) Reflects potential rebate provided by mill for market value of recovered uranium constituents using current price for uranium. See Table F-19. Includes uranium recovered from both raffinate sludge and other sediments and sludge

(7) Source: SFC Environmental Report 2006, includes demolition and placement in cell.

(8) 2000 soil samples @ $100 each, plus gamma walkover survey 500 hours @ $50/hr, plus $150K assessment / NRC confirmation.

(9) Cost to grade, place topsoil and re-vegetate excavations and other affected areas. Based on dozing approximately 17,500,000 cu-ft of dike material into impoundments at $0.074 per cu-ft, grading 83 acres @ $3128/acre, applying 6 inches of topsoil to 124 acres (2,701,000 cu-ft at $0.115/cu-ft) and seeding 124 acres at $534/acre.

(10) $100,000 per year for 7 years plus $100,000 for recovery systems installation plus $350,000 for intercept trench expansion. Includes treatment of storm water and wastewater, as necessary.

(11) Post-closure monitoring includes the cost of purging, sampling and analysis for 25 wells for an additional sampling event for the first 3 to 5 years after cell closure, cell settlement monitoring, radon emission measurement and cell cover inspection and repair.

(12) SFC at current level of six employees plus management augmentation during decommissioning.

Table F-15 Alternative 3, Comparison of Total Transport Costs per Load

Carrier	Total Cost Per Load [1]				
	White Mesa Blanding, UT	Energy Solutions Clive, UT	WCS Andrews, TX	PMC, Mills, WY	Rio Algom, Grants, NM
Carrier 1	$4,942	$6,055	$4,505	$4,610	$4,572
Carrier 2	$2,889	$3,864	$1,679	$2,943	$2,153
Carrier 3	$3,473	$4,569	$2,187	$3,775	$2,552
Carrier 4	$4,783	$6,246	$2,930	$4,796	$3,589
Carrier 5	$2,800	$3,000	$2,150	$2,800	$2,600
Carrier 6	$3,360	$4,464	$2,799	$3,404	$3,307
Carrier 7	$5,289	$6,612	$2,910	$5,122	$3,945
Minimum	$2,800	$3,000	$1,679	$2,800	$2,153
Mean	$3,934	$4,973	$2,737	$3,921	$3,245
Maximum	$5,289	$6,612	$4,505	$5,122	$4,572
Standard Deviation	$1,040	$1,355	$910	$930	$862

Notes:
[1] Price quotes reflect actual quotes received from licensed carriers based on material specifications for the transport of a combined 12,633 tons of raffinate sludge and other sludges and sediments. Rates include base rate and fuel charges.

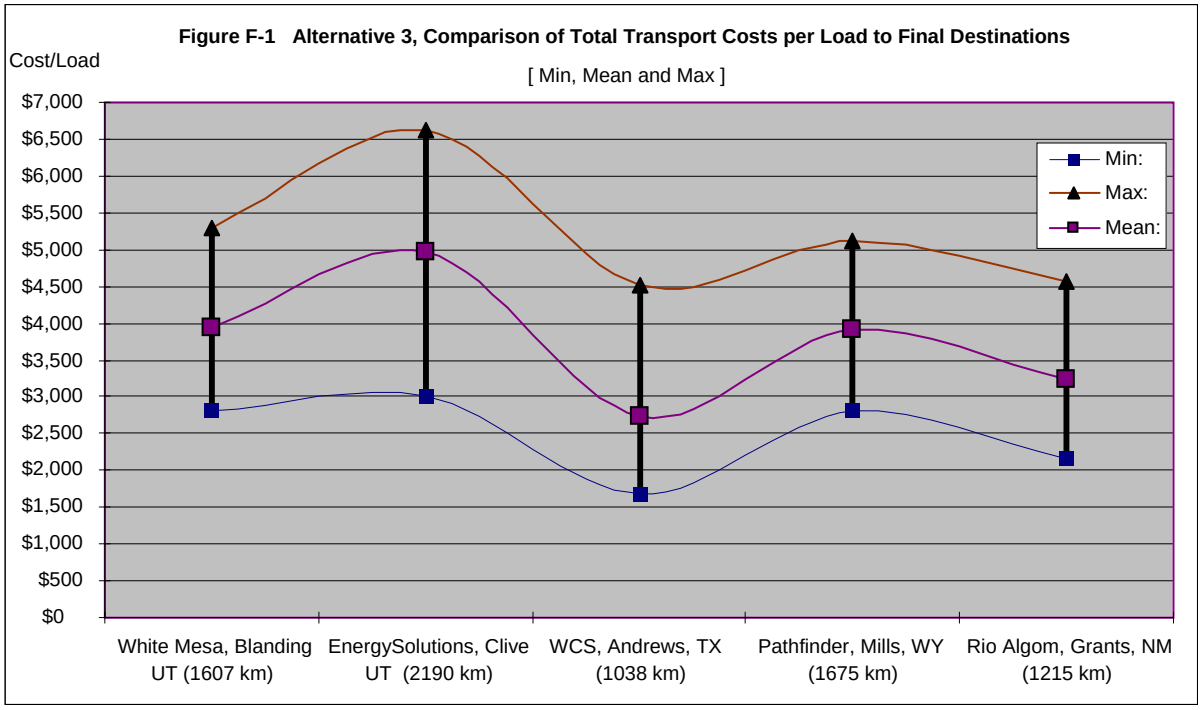


Table F-16 Alternative 3, Total Estimated Transport Costs by Final Destination – Based on One Final Destination – Does Not Reflect Blended Costs of Shipping to Multiple Destinations

Carrier	Maximum Weight/ Payload[1] (lbs)	Tons of Waste/ Payload[2] (tons)	Estim. No. Truck Loads[3]	Total Costs				
				White Mesa Blanding, UT	Energy Solutions Clive, UT	WCS Andrews, TX	PMC, Mills, WY	Rio Algom Grants, NM
1	46,000	22	574	$2,837,889	$3,477,085	$2,587,154	$2,647,189	$2,625,294
2	45,000	22	588	$1,697,215	$2,270,426	$986,306	$1,729,238	$1,264,906
3	43,500	21	609	$2,114,675	$2,781,501	$1,331,613	$2,298,168	$1,553,888
4	42,500	20	624	$2,983,859	$3,896,547	$1,827,871	$2,991,969	$2,238,986
5	45,500	22	581	$1,626,304	$1,742,469	$1,248,769	$1,626,304	$1,510,140
6	40,000	19	665	$2,233,948	$2,967,800	$1,861,225	$2,263,363	$2,198,842
7	43,000	21	616	$3,259,130	$4,074,384	$1,793,198	$3,156,435	$2,431,255
			Min:	$1,626,304	$1,742,469	$986,306	$1,626,304	$1,264,906
			Mean:	$2,393,289	$3,030,030	$1,662,305	$2,387,524	$1,974,759
			Max:	$3,259,130	$4,074,384	$2,587,154	$3,156,435	$2,625,294
			Std Dev:	$669,524	$906,496	$368,483	$629,529	$480,579

Notes and Assumptions:

Assumed Tonnages:
Raffinate sludge 10,478 tons and other sludges and sediments 2,155 tons: Total 12,633 tons

1 Includes industry estimate of 2,000 lbs for ancillary equipment/pallets, etc.
2 Tons of Waste = maximum weight per payload less 2,000 lbs for ancillary equipment/pallets, etc. divided by 2,000 lbs per ton.
3 Total tons of waste (12,633 tons) divided by tons of waste per payload.

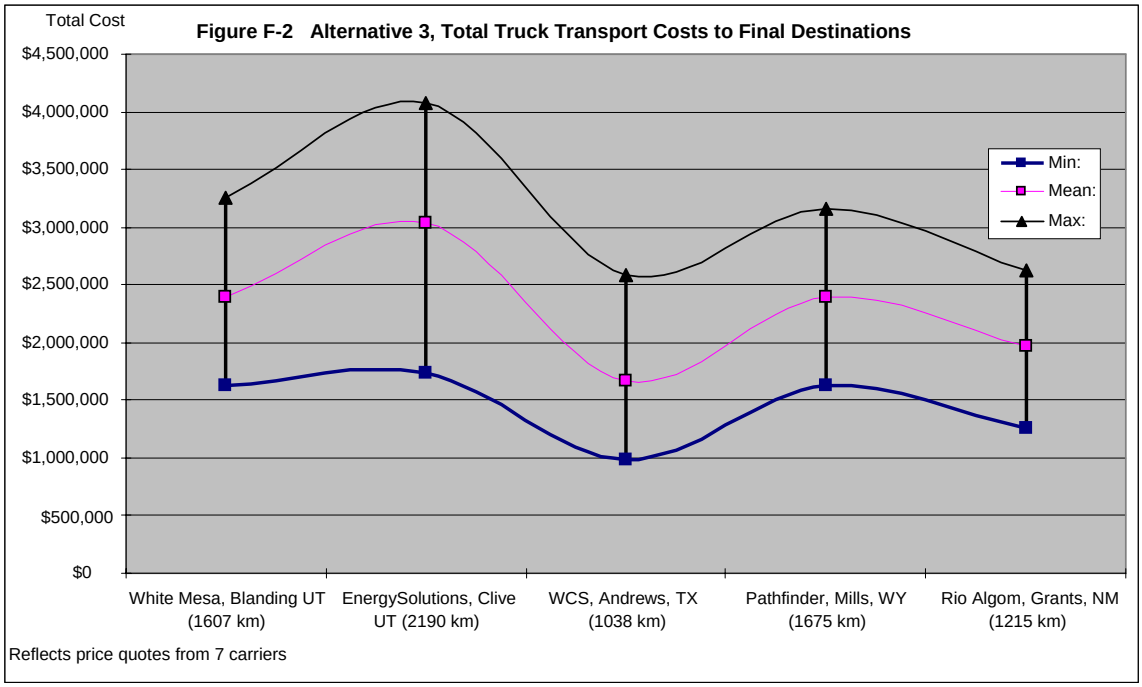
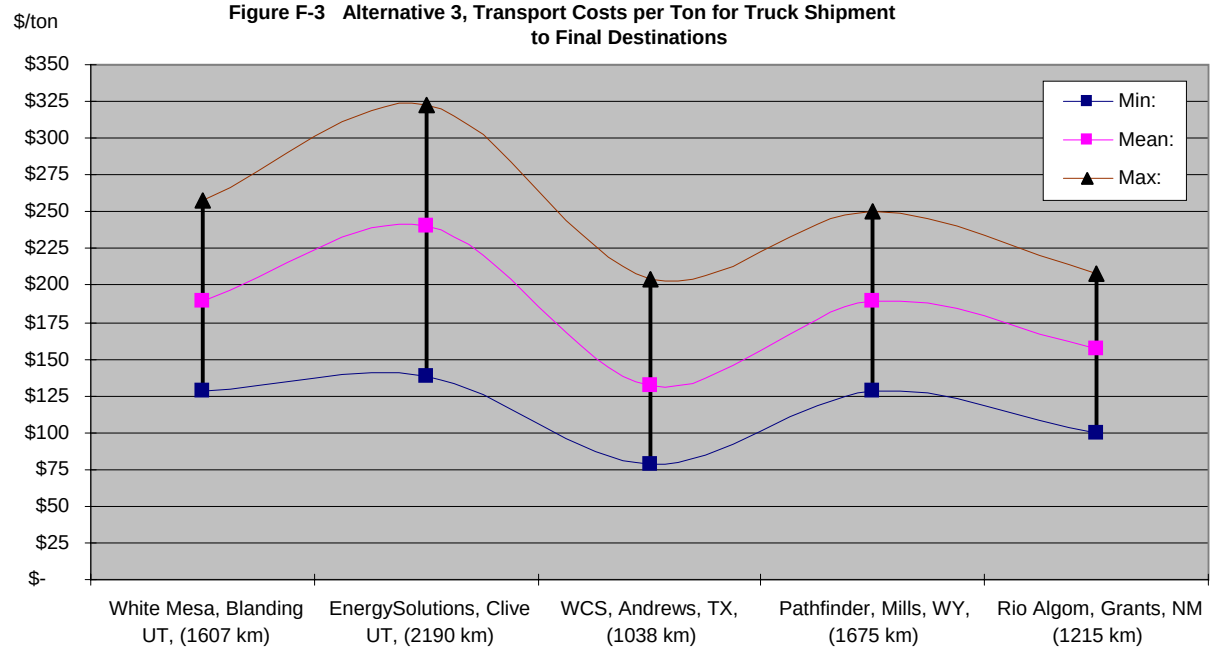


Figure F-2 Alternative 3, Total Truck Transport Costs to Final Destinations

Table F-17 Alternative 3, Comparison of Total Transport Costs per Ton of Waste

Carrier	Total Cost per Ton of Waste				
	White Mesa Blanding, UT	Energy Solutions Clive, UT	WCS Andrews, TX	PMC, Mills, WY	Rio Algom Grants, NM
Carrier 1	$225	$275	$205	$210	$208
Carrier 2	$134	$180	$78	$137	$100
Carrier 3	$167	$220	$105	$182	$123
Carrier 4	$236	$308	$145	$237	$177
Carrier 5	$129	$138	$99	$129	$120
Carrier 6	$177	$235	$147	$179	$174
Carrier 7	$258	$323	$142	$250	$192
Minimum:	$129	$138	$78	$129	$100
Mean:	$189	$240	$132	$189	$156
Maximum:	$258	$323	$205	$250	$208
Standard Deviation:	$51	$67	$42	$46	$41

Figure F-3 Alternative 3, Transport Costs per Ton for Truck Shipment to Final Destinations



Reflects price quotes from 7 carriers

Table F-18 Estimated Potential Rebate for Uranium Recovery from Raffinate Sludge

	Rebate Calculation Elements:	Value	Unit	Source/notes:
A	**Estimated Uranium Content of Sludge**			
1	Estimated tons of raffinate sludge	10,478	tons	Materials volumes and radionuclides 4-11-2007.xls.
2	Uranium content of dewatered raffinate sludge	95,232	lbs	[SFC RAI Response 01_08.pdf], 12/26/07, RE:0752-A, "Raffinate Uranium Content Based on Composite Sample from Each Storage Cell"
3	Estimated Recovery Percentage	75%	%	NRC, 1/23/08, record of Telcon, 9/24/07
4	Recovered uranium from raffinate sludge	71,424	lbs	= row 2 x row 3
5	Recovery rate (in lbs per ton of total feed stock)	6.82	lbs/ton	= row 4 / row 1
B	**Price Assumptions [1]**			See Note 1
6	Weekly Spot Ux U3O8 Price as of March 18, 2008	$70.00	$/lb	http://www.uxc.com/review/uxc_Prices.aspx
7	Estimated lower boundary price	$50.00	$/lb	" ", The Ux Consulting Company, LLC
C	**Revenue Estimate**			
8	Total estimated recoverable uranium x Weekly Spot Price (3/18/08)	$4,999,655	$	= row 4 x row 6
9	Total estimated recoverable uranium x estimated lower boundary price	$3,571,182	$	= row 4 x row 7
D	**Cost Estimate**			
10	Unit processing cost per ton of feed stock	$125	$/ton	NRC, 1/23/08
11	Estimated processing cost	$1,309,750	$	= row 1 x row 10
D	**Estimated Rebate @ 20% of Net Revenue (Net Revenue=Revenue less Processing Costs)**			
12	Estimated rebate using current spot price	$737,981	$	= [row 8 – row 11] x .20. The 20% rebate assumption is based on an industry standard, see Record of Telcon, 9/24/07
13	Estimated rebate using lower boundary price	$452,286	$	= [row 9 – row 11] x .20. The 20% rebate assumption is based on an industry standard, see Record of Telcon, 9/24/07

Notes:

[1] The Ux U3O8 Price is one of only two weekly uranium price indicators that are accepted by the uranium industry, as witnessed by their inclusion in most "market price" sales contracts, i.e., sales contracts with pricing provisions that call for the future uranium delivery price to be equal to the market price at or around the time of delivery.

Table F-19 Estimated Potential Rebate for Uranium Recovery from Raffinate Sludge and Other Sludges and Sediments

	Rebate Calculation Elements:	Value	Unit	Source/notes:
A	**Estimated Uranium Content of Raffinate Sludge**			
1	Estimated tons of raffinate sludge	10,478	tons	Materials volumes and radionuclides 4-11-2007.xls.
2	Uranium content of dewatered raffinate sludge	95,232	lbs	[SFC RAI Response 01_08.pdf], 12/26/07, RE:0752-A, "Raffinate Uranium Content Based on Composite Sample from Each Storage Cell"
3	Estimated Recovery Percentage	75%	%	NRC, 1/23/08, record of Telcon, 9/24/07
4	Recovered uranium from raffinate sludge	71,424	lbs	= row 2 x row 3
5	Recovery rate (in lbs per ton of total feed stock)	6.82	lbs/ton	= row 4 / row 1
	Uranium content of Other Sludges and Sediments			
6	Emergency Basin Sediment + North Ditch Sediment + Sanitary Lagoon sludges and sediments	3,862	U-kg	Materials volumes and radionuclides 4-11-2007.xls.
7	Emergency Basin Sediment + North Ditch Sediment + Sanitary Lagoon sludges and sediments	8,514	lbs	Converted to pounds using 2.2046 lbs/kg.
8	Estimated recovered uranium from sludges and sediments (75% of total)	6,386	lbs	75% of row 7
9	Raw tons of other sludges and sediments	2155	tons	Tons to be processed to extract estimated U-kg
B	**Price Assumptions [1]**			See Note 1
10	Weekly Spot Ux U3O8 Price as of March 18, 2008	$70.00	$/lb	http://www.uxc.com/review/uxc_Prices.aspx
11	Estimated lower boundary price	$50.00	$/lb	" ", The Ux Consulting Company, LLC
C	**Revenue Estimate**			
12	Total estimated recoverable Uranium x Weekly Spot Price (3/18/08)	$5,446,653	$	= [row 4 + row 8] x row 10
13	Total estimated recoverable Uranium x Est. lower boundary price	$3,890,466	$	= [row 4 + row 8] x row 11
D	**Cost Estimate**			
14	Unit processing cost per ton of feed stock	$125	$/ton	NRC, 1/23/08
15	Estimated total processing cost	$1,579,170	$	= [row 1 + row 9] x row 14
D	**Estimated Rebate @ 20% of Net Revenue (Net Revenue=Revenue less Processing Costs)**			
16	Estimated rebate using current spot price	$773,497	$	= [row 12 – row 15] x .20. The 20% rebate assumption is based on an industry standard, see Record of Telcon, 9/24/07
17	Estimated rebate using lower boundary price	$462,259	$	= [row 13 – row 15] x .20. The 20% rebate assumption is based on an industry standard, see Record of Telcon, 9/24/07

Notes:

[1] The Ux U3O8 Price is one of only two weekly uranium price indicators that are accepted by the uranium industry, as witnessed by their inclusion in most "market price" sales contracts, i.e., sales contracts with pricing provisions that call for the future uranium delivery price to be equal to the market price at or around the time of delivery.

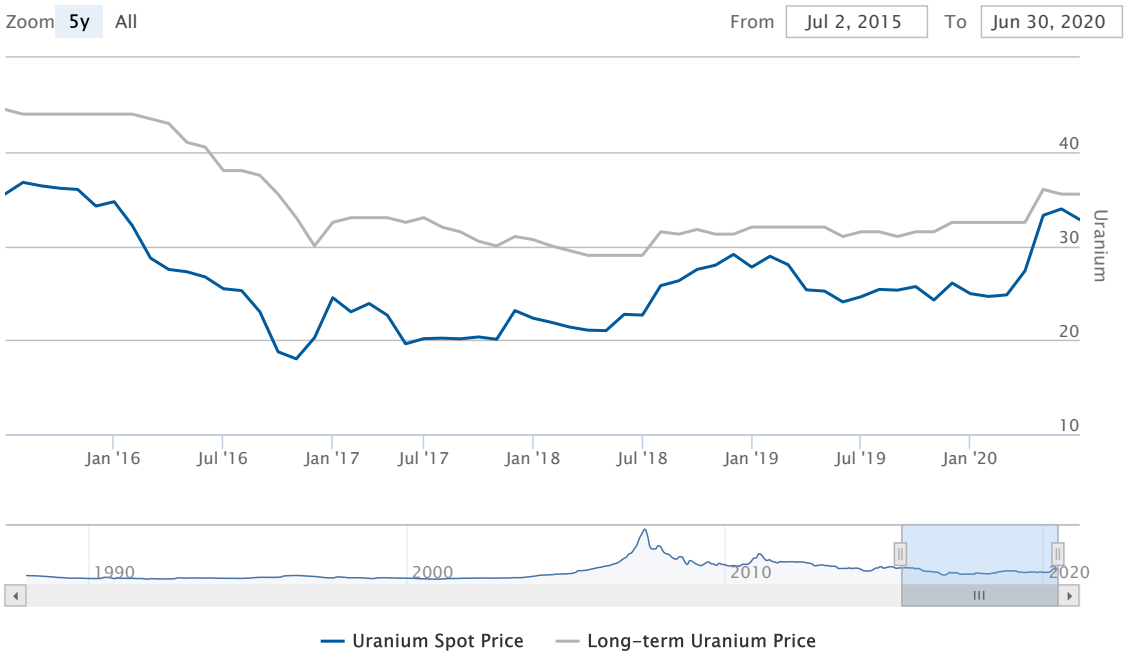
Exhibit 27

Uranium Price

Uranium does not trade on an open market like other commodities. Buyers and sellers negotiate contracts privately. Prices are published by independent market consultants UxC, LLC (UxC) and TradeTech.

TradeTech
$33.25 US$/lb June 29, 2020

UxC*
$32.80 US$/lb June 22, 2020



Spot Price

	2016	2017	2018	2019	2020
Jan	34.70	24.50	21.88	28.90	24.63
Feb	32.15	23.00	21.38	28.00	24.80
Mar	28.70	23.88	21.05	25.33	27.35
Apr	27.50	22.63	21.00	25.20	33.25
May	27.25	19.60	22.73	24.05	33.93
Jun	26.70	20.15	22.65	24.60	32.80
Jul	25.45	20.20	25.78	25.38	-
Aug	25.25	20.13	26.30	25.30	-
Sep	23.00	20.33	27.50	25.68	-
Oct	18.75	20.08	27.95	24.25	-

Nov	18.00	23.13	29.10	26.05	-
Dec	20.25	22.32	27.75	24.93	-

Long-term Price

	2016	2017	2018	2019	2020
Jan	44.00	32.50	30.00	32.00	32.50
Feb	44.00	33.00	29.50	32.00	32.50
Mar	43.50	33.00	29.00	32.00	32.50
Apr	43.00	33.00	29.00	32.00	36.00
May	41.00	32.50	29.00	31.00	35.50
Jun	40.50	33.00	29.00	31.50	35.50
Jul	38.00	32.00	31.50	31.50	-
Aug	38.00	31.50	31.25	31.00	-
Sep	37.50	30.50	31.75	31.50	-
Oct	35.50	30.00	31.25	31.50	-
Nov	33.00	31.00	31.25	32.50	-
Dec	30.00	30.67	32.00	32.50	-

Cameco calculates industry average prices from the month-end prices published by UxC and TradeTech.

Cameco calculates long-term industry average prices from the month-end prices published by UxC and TradeTech. Long-term prices prior to May 2004 are not industry-averages, but from TradeTech only.

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