



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
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Cheyenne, WY 82009



In Reply Refer To:
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Paul Michalak, Chief
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Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Mr. Michalak:

We have reviewed the "*Final Highland Pit Lake Ecological Assessment: Tetra Tech, Inc. and Redente Ecological Consultants, LLC, January 2011*" (Ecological Assessment) and "*Highland Uranium Mine and Millsite Request for Amendment to Radioactive Materials License SUA-1139, Application to Amend Existing Concentration Limits*" (Amendment Request) downloaded from your website (<http://www.nrc.gov/reading-rm/adams.html>). We are providing comments concerning migratory birds and other wildlife in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, the Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq.*, and the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742a-742j.

Following a review of the Ecological Assessment, the Amendment Request, and related documents, we have the following concerns.

- The Ecological Assessment does not adequately evaluate the selenium risk to migratory birds and does not support the conclusion of "insignificant effects" to migratory birds.
- The assessment of corrective action alternatives does not adequately evaluate the effectiveness of in-situ treatment of the pit lake water through the addition of organic materials to induce reducing conditions to lower uranium and selenium concentrations in the water.

- Data provided in the Ecological Assessment, the Amendment Request, and related documents do not support the preferred corrective action limited to institutional controls (durable control of access to the pit lake) as the “as low as reasonably achievable” (ALARA) alternative to protect the environment.

Based on the above concerns the Service recommends that the Nuclear Regulatory Commission (NRC) hold ExxonMobil’s license amendment application in abeyance until our concerns are satisfied. Specifically, the NRC should require ExxonMobil to do the following.

- Reevaluate the use of in-situ treatment of the pit lake water through the addition of organic materials (molasses, and methanol) to induce reducing conditions to lower uranium and selenium concentrations in the water.
- Reassess the selenium toxicity risk to migratory birds using the pit lake.

The in-situ treatment of the pit lake water through the addition of organic materials (molasses, and methanol) to induce reducing conditions to lower selenium concentrations in the water was implemented at the Sweetwater uranium mine pit lake in Sweetwater County, Wyoming (Harrington 2002) and the Anchor Hill pit lake in South Dakota (Harrington et. al. 2004) with reported significant decreases in selenium concentrations. Selenium at the Sweetwater uranium pit lake was reduced from a concentration of 526 ug/L in October 1999 to 10 ug/L posttreatment. Selenium in the Sweetwater uranium mine pit lake has remained at or slightly below 10 ug/L since 2004. In 2006, the Wyoming Department of Environmental Quality released the bond for the Sweetwater uranium mine pit lake due to the success of the remediation (M. Bautz, Wyoming Department of Environmental Quality, Lander, Wyoming, personal communications, November 2, 2011).

The pit lake should be re-sampled for water column-dwelling aquatic invertebrates using techniques that would more adequately allow the determination of biomass (aquatic macroinvertebrates) available to aquatic migratory birds. Bird eggs or bird livers should also be analyzed for selenium to assess the risk of reproductive impairment in birds nesting at the pit lake. The following specific comments support our recommendations.

Ecological Assessment

Page 3: The Ecological Assessment states that Box Creek drains into the Cheyenne River and then the North Platte. Box Creek drains into Lightning Creek and is in the Cheyenne River watershed. The Cheyenne River is a tributary of the Missouri River and not the North Platte River.

Page 9, Figure 2.1: The Conceptual Site Model (CSM) is inadequate as it does not include all the receptors. The incidental ingestion of soil by mule deer and pronghorn should be included in the CSM or an explanation of why this pathway was excluded. Additionally, the CSM does not include aquatic birds nor aerial insectivore birds (cliff swallows) as ecological receptors. This should be included in the CSM.

Page 10: The “new EPA regulations” for selenium (7.9 mg/kg maximum tissue concentration for the protection of birds and fish) are draft and have not been finalized by the U.S. Environmental Protection Agency.

Page 12: The Ecological Assessment states “high selenium or uranium concentration in benthic invertebrates becomes relatively unimportant if benthic invertebrate biomass production is low and provides a very limited potential food supply to organisms that consume benthic invertebrates.” This assumes that the quantification of aquatic invertebrate biomass was adequate. Aquatic biomass was probably underestimated as water column aquatic invertebrates such as Hemiptera and Odonata were sampled using an Ekman dredge (page 32). Although sediment grabs with an Ekman dredge can be used to sample benthic invertebrates, such as Chironomids, which live in the mud, light traps as described by Espinoza and Clark (1972) are typically more effective in sampling water column invertebrates such as Hemiptera and Odonata and would provide a better estimate of the potential food source for waterfowl using the pit lake.

Rather than assuming that birds using the pit lake are not consuming “significant” amounts of selenium-contaminated aquatic invertebrates, a better and more reliable approach to quantifying the risk is to sample and analyze the livers or eggs of birds using the pit lake.

Page 13, Table 2.3: The measurement endpoint for the protection of waterfowl and other birds using the pit lake includes “observations on nesting success.” The observations, however, were limited to visual observations of blue-winged teal ducklings and cliff swallows nesting on the vertical walls next to the pit lake. The Ecological Assessment provides no quantification of nesting success or hatching success. Nesting studies should have been conducted to determine nesting success and to determine if selenium is causing impaired reproduction. Sampling and analyzing bird eggs for selenium are important in assessing the risk of selenium toxicity to migratory birds (Lemly 2002).

Page 27: Table 3.2 shows that benthic invertebrates were sampled in February 2005; March 2005, and June 2005 for biomass estimates. Assuming that the aquatic invertebrate collections were made at the same time as other field collections and surveys, the aquatic invertebrate collections were probably made between February 21-24, 2005; March 23-24; and June 2, 9, 17, and 22, 2005. The dates are important as aquatic invertebrate collections conducted in February and March could yield lower numbers. Additionally, no aquatic invertebrate samples were collected during periods of greater bird use as shown in Table 3.10 (page 36): July through October. Bird surveys conducted in ponds and lakes in Wyoming by our Environmental Contaminants Specialists have shown significantly higher numbers of bird use from late July through September (See et. al. 1992, Ramirez 2008).

Page 32: Aquatic macroinvertebrates were sampled using an Ekman dredge. The relative abundance of water column aquatic invertebrates such as Hemiptera and Odonata was probably underestimated using this sampling technique. Although sediment grabs with an Ekman dredge can be used to sample sediment-dwelling invertebrates, such as Chironomids, light traps as described by Espinoza and Clark (1972) are typically more effective in sampling water column aquatic invertebrates such as Hemiptera and Odonata and would provide a better estimate of biomass. Rosenberg and Resh (1993) point out that “seasonal variations in abundance and distribution may create sampling problems or may pose problems in comparing samples taken in

different seasons." Rosenberg and Resh (1993) also point out that "drift behavior in lotic waters can carry macroinvertebrates into areas in which they do not normally occur." Floating emergence traps could be used to collect aquatic insects as they emerge from the pit lake water when they transition from larvae to adults (Boyle 1978, Morgan et. al. 1963). Emerging adult insects are of interest since they will be prey for insectivorous birds such as the cliff swallows that nest adjacent to the pit lake. Dip nets could also be used to sample water column insects from shallow water areas and within the emergent cattails to obtain better estimates of food sources available to migratory birds using the pit lake.

Page 34: Although cliff swallows were observed nesting in the vertical walls adjacent to the pit lake insectivorous birds are not included in the CSM. Insectivorous birds should be included in the CSM. Blue-winged teal were observed nesting at the pit lake and as pointed out in the Ecological Assessment "only two young were produced." Although this is only one observation, this raises the question of impaired reproduction due to embryo mortality as blue-winged teal typically lay clutches of 10 eggs (Rohwer et. al. 2002) and have broods of 8 (Bellrose 1980). Sampling and analyzing bird eggs for selenium are important in assessing the risk of selenium toxicity to migratory birds (Lemly 2002). According to Lemly (2002), aquatic birds bioaccumulate selenium ingested in the diet and the selenium is transferred from the parent bird to developing eggs. Elevated selenium in bird eggs can cause teratogenic deformities and embryo mortality. Even though the Ecological Assessment states that "Blue-winged Teal produced two young that were alive two weeks after hatching" and "Cliff Swallows appeared to be successful in raising young at the Pit Lake," reproductive failure can be occurring even though no toxic effects were observed in the adults.

Page 38: The Ecological Assessment states that "in the absence of T&E species, the primary endpoint goal was to ensure protection of exposed populations rather than individuals." The MBTA protects individual birds and is not limited to the protection of populations. Thus if the ecological risk assessment is limited to the protection of populations, impaired reproduction (embryo mortality) due to selenium toxicity could occur and result in liability under the MBTA. The MBTA prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..."

Page 42: Table 4.2 shows a study by Llobet et. al. (1991) as the reference for the Toxicity Reference Value (TRV) protective of birds. The referenced study was performed on mice. Unfortunately, according to Hinck et. al. (2010) there is no empirical data on the chemical toxicity of uranium to birds; therefore, either toxicity studies on uranium should be conducted to determine the risk to migratory birds or the precautionary principle should be taken to "do no harm." Additionally, the Llobet et. al. (1991) reference is also applied to the selenium TRV for birds.

Page 53: The Ecological Assessment states that "when evaluated against the assumptions of chronic consumption of Pit Lake benthic invertebrates and year round occupancy, risks to waterfowl and shorebirds to both selenium and uranium, is judged to be insignificant." Year

round occupancy of selenium-contaminated habitat is not a requisite for selenium bioaccumulation and toxicity. Selenium studies conducted by our Environmental Contaminants Specialists have documented bioaccumulation and toxicity in migratory birds inhabiting selenium-contaminated habitats from late spring through the summer (See et. al. 1992, Skorupa 1998). Additionally, waterfowl using the pit lake are probably consuming water column aquatic invertebrates as well as benthic invertebrates.

Pages 54 and 55: The Ecological Assessment states that benthic invertebrates are confined to a small area (2 acres) of the 130 acre lake and the low benthic invertebrate standing crop of 40 kg is too low to support one duck for a year. Although benthic invertebrates are confined to a small area (2 acres) of the 130 acre lake, the Ecological Assessment does not account for water column macroinvertebrates inhabiting other areas of the lake that could be consumed by aquatic migratory birds. Additionally, even though the area is a small portion of the lake, it is still providing a selenium-contaminated food source to aquatic birds. As pointed out in previous comments, year round occupancy of selenium-contaminated habitat is not a requisite for selenium bioaccumulation and toxicity.

Page 55: The Ecological Assessment states that “low benthic invertebrate and copepod productivity likely explains why none of the 45,000 fish stocked in the lake survived. Given the high levels of selenium in the pit lake, it is possible that fish survival was affected by water quality. Hermanutz et al. (1992) exposed adult bluegill sunfish (*Lepomis macrochirus*) to selenium in experimental streams with waterborne selenium concentrations of 10 and 30 µg/L. The experimental streams were dosed with selenite. Hermanutz et. al. (1992) reported 100 percent fish mortality in the stream with 30 µg/L selenium. Selenium concentrations in the pit lake are reported at 110 µg/L, over three times higher than the level reported by Hermanutz et. al. (1992) to cause mortality in adult fish. Hinck et. al. (2010) reviewed literature on the chemical toxicity of uranium and they reference fathead minnow (*Pimephales promelas*) mortality in hard water (hardness=210 mg/L) with a uranium concentration of 3 mg/L.

Page 56: The Ecological Assessment states that “aquatic organisms that currently live in the lake are tolerant of the chemical conditions in the lake.” Although macroinvertebrates are able to exist in the selenium-contaminated lake, they serve as a conduit for selenium bioaccumulation and potential toxicity to aquatic migratory birds inhabiting the pit lake. The Ecological Assessment also states that current concentrations of selenium and uranium in water, sediment, soils, and aquatic and terrestrial biota “have not been detrimental” to biota “based on their existence at the lake.” The Ecological Assessment does not provide data to support this conclusion. According to the Ecological Assessment, invertebrates that could be consumed by migratory birds had selenium concentrations ranging from 6 to 287 µg/g (parts per million). A dietary selenium concentration greater than 3 µg/g is known to cause adverse effects such as impaired reproduction on sensitive species of aquatic migratory birds (Lemly 1993). Chronic effects of selenium toxicity to sensitive species of aquatic migratory birds are subtle and not readily observed. Chronic effects manifest themselves in immune suppression to birds (Fairbrother et al. 1994) which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa 1998, Ohlendorf 2002). Impaired reproduction could be occurring in swallows and waterfowl nesting at the pit lake. Heinz et.al. (1990) found that at a dietary exposure of 10 ug/g, mallard livers

reached 95% of their peak selenium concentration in 7.8 days. It is reasonable to assume that less than a week of exposure would be sufficient to induce adverse effects among sensitive aquatic migratory birds such as Canada geese and ducks. Given that selenium concentrations in aquatic invertebrates were several orders of magnitude above 10 ug/g, aquatic migratory birds remaining on the pit lake and feeding for 1 or 2 days could be sufficient to cause adverse effects.

Page 56: The Ecological Assessment states that the lack of habitat and low biological productivity (*i.e.* benthic invertebrates and copepods) “provide a very small potential for transfer of Pit Lake selenium and uranium” to aquatic migratory birds. The Ecological Assessment does not provide any data on selenium concentrations in aquatic migratory birds to support this statement. Additionally, cliff swallows are not included in the assessment.

Page 58 and 59, Conclusions: Although the Hazard Quotients for selenium were greater than 1 (potential for adverse effects to occur) (Selenium HQ’s ranging from 1.9 to 120 in Table 4.7), the risk to migratory birds is dismissed as low or insignificant. Although shallow water habitat is limited at the pit lake, data presented in the Ecological Assessment are not adequate to support the conclusion that selenium risks are “insignificant.” Bird use at the Highland pit lake may be underestimated as bird surveys were limited to as few as one survey per month to three or four consecutive days per month. Additionally, surveys were not intensified during the fall migration in 2005. Our environmental contaminants specialists have conducted weekly bird surveys to determine bird use in several contaminants studies and have found that bird species and numbers can vary dramatically from one week to the next. Regarding “year round occupancy” as a requisite for selenium bioaccumulation and toxicity, selenium studies conducted by our Environmental Contaminants Specialists have documented bioaccumulation and toxicity in migratory birds inhabiting selenium-contaminated habitats from late spring through the summer (See et. al. 1992).

Amendment Request

Page iii, Executive Summary: The Amendment Request states that institutional controls are the only practicable corrective action for the pit lake that will provide adequate reasonable assurance of protection of the environment. The only institutional control that we could find in the Amendment Request is restricted access to the groundwater system between the tailings and the pit lake and the pit lake as a drinking water source. While this institutional control may protect public health and safety, it is not protective of migratory birds.

Page 2-28: The Amendment Request states that “Toxicity Reference Values were used to represent conditions that were protective of populations of organisms instead of individuals.” Migratory birds are protected by the MBTA as individuals.

Page 3-3, Description and Assessment of Alternative Corrective Actions: According to the Amendment Request, the following Corrective Action alternatives were considered for the pit lake: backfilling the pit lake; ex-situ treatment using ion exchange, and in-situ Redox manipulation.

A May 4, 2011 letter from ExxonMobil Environmental Services Company to the NRC discounts the effectiveness of reducing uranium and selenium concentrations (in-situ redox manipulation) in the pit lake through the addition of organic material. A May 4, 2011 letter from ExxonMobil Environmental Services Company to the NRC references a pilot-scale study conducted in a uranium pit lake in Saskatchewan, Canada (Dessouki et. al. 2005) that indicated no effect on selenium concentrations as a result of adding fertilizer (potassium phosphate) to the pit lake. The treatment referenced in the May 4, 2011 letter involved only the addition of potassium phosphate to the pit lake and is different from the treatment described in Appendix E (the addition of molasses and methanol as described by Harrington (2002). Harrington (2002) reported a reduction of selenium (from 450 ug/L to <50 ug/L) in the Sweetwater uranium mine pit lake in the Gas Hills area of Wyoming through the application of lime, molasses, and methanol. The October 31, 2005 Annual Report for the WDEQ/LQD Permit to Mine #481 (Sweetwater Uranium Project) reports a reduction in selenium at the Sweetwater uranium pit lake from 526 ug/L in October 1999 to 10 ug/L in August 2005 (M. Bautz, Wyoming Department of Environmental Quality, Lander, Wyoming, personal communications, November 2, 2011). Selenium in the Sweetwater uranium mine pit lake has remained at or slightly below 10 ug/L since 2005 (The October 27, 2011 Annual Report for the WDEQ/LQD Permit to Mine #481 (Sweetwater Uranium Project).

We would like to review any documents reassessing ecological risk and corrective action alternatives for the pit lake. For our internal tracking purposes, the Service would also appreciate notification of any decision made on this project (such as issuance of a license, permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Pedro 'Pete' Ramirez of my office at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,



R. Mark Sattelberg
Field Supervisor
Wyoming Field Office

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)
WDEQ, Land Quality Division, Cheyenne, WY (L. Spackman)

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