UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 25, 1998

MEMORANDUM TO: Docket File 40-6659

FROM: Mohammad Haque, Project Manager
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

SUBJECT: ENVIRONMENTAL ASSESSMENT REGARDING ALTERNATE CONCENTRATION LIMITS FOR GROUNDWATER FOR THE PETROTOMICS COMPANY SHIRLEY BASIN, WYOMING, SITE

Petrotomics Company (Petrotomics), in its submittal by letter dated September 10, 1996, requested U.S. Nuclear Regulatory Commission (NRC) approval of a license amendment for Source Material License SUA-551, for alternate concentration limits (ACLs) for groundwater at its Shirley Basin uranium mill site located in Carbon County, Wyoming. In response to the NRC staff comments on the submittal, Petrotomics provided additional information by its letters dated December 20, 1996; June 20, October 30, and December 4, 1997; and March 9, and 19, 1998. Based on its review of the information provided by Petrotomics, the NRC staff determined that, in accordance with 10 CFR 51.22, an environmental assessment (EA) was required to document its review of Petrotomics' request. The EA prepared by the staff is provided as an attachment to this memorandum to be placed in the licensee's docket file.

Docket No.: 40-6659
TAC No.: L51455

Attachment: As stated

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ENVIRONMENTAL ASSESSMENT
FOR
PETROTOMICS COMPANY SHIRLEY BASIN SITE
CARBON COUNTY, WYOMING

IN CONSIDERATION OF AN AMENDMENT TO SOURCE MATERIAL LICENSE SUA-551 FOR ALTERNATE CONCENTRATION LIMITS FOR GROUNDWATER

PREPARED BY

THE U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF WASTE MANAGEMENT
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

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ENVIRONMENTAL ASSESSMENT
FOR
PETROTOMICS COMPANY SHIRLEY BASIN, WYOMING, URANIUM MILL SITE
IN CONSIDERATION OF AN AMENDMENT TO SOURCE MATERIAL LICENSE SUA-551 FOR
ALTERNATE CONCENTRATION LIMITS FOR GROUNDWATER

1.0 INTRODUCTION

1.1 Background

The Petrotomics Company (Petrotomics) conducted uranium milling operations at its Shirley Basin facility from 1962, until 1974. Mill operations resumed in 1978, and continued until 1985, when mining and milling operations were terminated and the mill was decommissioned. Uranium was extracted from the ore at this site by a conventional acid leach and solvent extraction process. Chemical reagents used in the process included sulfuric acid, sodium chlorate, sodium chloride, and ammonia. Approximately 6.3 million tons of ore were processed at the mill, and the tailings wastes were disposed in an onsite, 130-acre impoundment. These wastes included approximately 14.7 million tons of acidic mill liquids that were discharged into the tailings impoundment. The U.S. Nuclear Regulatory Commission (NRC) staff, before granting renewal of Petrotomics' license SUA-551, in 1975, prepared an evaluation of the environmental assessment of the applicant's proposed activities. That evaluation concluded that the environmental impact created by the renewal of the license was not of a magnitude warranting an environmental impact statement for the proposed action.

Based on the information gathered from its groundwater monitoring program for the site, Petrotomics identified elevated levels of hazardous contaminants in the site groundwater underlying the tailings, and implemented a corrective action program (CAP) for groundwater cleanup in 1988. The groundwater CAP at the Shirley Basin site has been in continuous operation since its implementation.

1.2 Proposed Action

Petrotomics, by letter dated September 10, 1996, requested that Source Material License SUA-551, be amended to allow alternate concentration limits (ACLs) for groundwater constituents, cadmium, chromium, nickel, Ra-226, Ra-228, thorium-230, selenium, and uranium, at its Shirley Basin, Wyoming, uranium mill site. Based on review of Petrotomics' application of September 10, 1996, and the additional information provided by letters dated December 20, 1996; June 20, October 30, and December 4, 1997; and March 9, and March 19, 1998, the NRC staff concludes that the ACLs proposed by Petrotomics for the parameters listed above are acceptable.

1.3 Review Scope

In accordance with Title 10, Code of Federal Regulations (CFR), Part 51, this Environmental Assessment (EA) serves to:

(i) present information and analysis for determining whether to issue a finding of no significant impact (FONSI) or to prepare an environmental impact statement (EIS);

(ii) fulfill the NRC's compliance with the National Environmental Policy Act (NEPA) when no EIS is necessary; and

(iii) facilitate preparation of an EIS when one is necessary. Should the NRC issue a FONSI, no EIS would be prepared and the source material license, or amendment thereof, would be granted subject to operating conditions contained in the existing source and byproduct material license.

1.4 Federal/State Jurisdiction

As a result of the concurrent jurisdiction allowed under the Uranium Mill Tailings Radiation Control Act of 1978, Petrotomics' Shirley Basin site is also regulated by the Wyoming Department of Environmental Quality (WDEQ). There are certain parameters for which the WDEQ is preempted from jurisdiction; some parameters are under joint NRC and WDEQ jurisdiction; and some parameters are solely under the jurisdiction of the WDEQ. Furthermore, unlike NRC, the present WDEQ ground-water standards have no risk-based provision such as ACLs. This EA only covers impacts for parameters regulated by the NRC and does not assess impacts for parameters regulated solely by the WDEQ.

2.0 SITE CHARACTERISTICS

The Petrotomics facility and associated tailings at Shirley Basin are located in Carbon County in southeastern Wyoming, approximately 120 miles west of the Nebraska border and 100 miles north of the Colorado border. The nearest major city, Casper is at approximately 48 miles to the north. All facility locations and site characteristics remain unchanged since the Petrotomics mill was initially authorized to operate. These characteristics were reviewed by the NRC staff and documented in its original EIS published in 1975.

The site is underlain by interbedded sandstones, siltstones, and claystones of the Wind River Formation. The Wind River Formation contains three aquifers; Upper Sand, Main Sand, and Lower Sand. The Upper Sand aquifer outcrops immediately south of the tailings area. Chemical constituents in tailings water are introduced into the Upper Sand aquifer by gravity-driven seepage from the onsite tailings impoundment used for disposal of processed uranium ore and milling liquids. The Upper Sand aquifer is generally separated from the Main Sand aquifer by a claystone aquitard that varies from zero to more than 40 ft in thickness in the tailings area. Concentrations of the site-derived constituents in the Main Sand aquifer are highest beneath the northern tip of the tailings impoundment, indicating a hydraulic connection between the Upper Sand and the Main Sand aquifers in this area. The Lower Sand aquifer is separated from the Main Sand aquifer by an aquitard more than 50 ft thick and has not been affected by site-derived constituents.

Historically, water in the area has been used for mining, recreation, and livestock grazing. Climatological extremes and sparse vegetation indicate that future use of groundwater is likely

to be limited to seasonal livestock (e.g., cattle) and wildlife (e.g., pronghorn antelope) watering. Domestic use of groundwater at the site is highly unlikely.

3.0 OPERATIONS

Petrotomics conducted uranium milling operations at its Shirley Basin facility from 1962, until 1974. Mill operations resumed in 1978, and continued until 1985. The site has been under reclamation since ceasing operations in 1985. The mill has been decommissioned and mill tailings have been reclaimed and covered with an interim radon barrier. Final radon barrier will be placed after NRC's conclusion that the groundwater will meet acceptable standards at the points of compliance (POCs) and that the evaporation ponds are no longer needed for the groundwater CAP. The pumped water and tailings liquid were evaporated in clay lined evaporation ponds on top of the tailings pile.

4.0 ENVIRONMENTAL EFFECTS

The Petrotomics Shirley Basin site is licensed by the NRC under Source Material License SUA-551, to possess byproduct material in the form of uranium waste tailings as well as other radioactive wastes generated by past milling operations. The milling at the site involved extraction of uranium from the ore by a conventional acid leach and solvent extraction process. Chemical reagents used in the process included sulfuric acid, sodium chlorate, sodium chloride, and ammonia. A groundwater CAP was implemented in 1988, and has been in continuous operation at the site since. Currently, all concentrations of groundwater hazardous constituents of concern to NRC meet the proposed groundwater ACLs for the site at the POC wells.

The Petrotomics' Shirley Basin site is underlain by interbedded sandstones, siltstones, and claystones of the Wind River Formation. The Wind River Formation contains three aquifers; Upper Sand, Main Sand, and Lower Sand. The Upper Sand aquifer crops out immediately south of the tailings area. Chemical constituents in tailings water are introduced into the Upper Sand aquifer by gravity-driven seepage from the impoundment. The Upper Sand aquifer is separated from the Main Sand aquifer by a claystone aquitard that varies from zero to more than 40 ft in thickness in the tailings area. Concentrations of site-derived constituents in the Main Sand aquifer are highest beneath the northern tip of the tailings impoundment, indicating a hydraulic connection between the Upper and the Main Sand aquifers in this area. The Lower Sand aquifer is separated from the Main Sand aquifer by an aquitard more than 50 ft thick throughout the site. There is no evidence that the Lower Sand aquifer has been affected by site-derived constituents.

Shallow groundwater in the Upper and Main Sand aquifers has been contaminated by acidic seepage from the onsite tailings impoundment. Hazardous contaminants in site groundwater that are of concern to NRC include the radiological constituents uranium, radium-226, radium-228, thorium-230, and the hazardous metals cadmium, chromium, selenium, nickel, and lead. Petrotomics has concluded that the CAP has reduced hazardous constituent concentrations in site groundwater to values that are as low as reasonably achievable (ALARA) and that continuation of the CAP is unlikely to result in achieving current site standards for many of the constituents of concern. As a result of its review, the NRC staff finds that the licensee's submittals demonstrate with reasonable assurance that the ACL values proposed by

Petrotomics will not pose substantial present or potential hazards to human health and the environment, and that the proposed ACLs are ALARA, considering practicable corrective actions. The NRC staff's review is being documented in detail in the staff Technical Evaluation Report.

The results of groundwater flow and transport modeling suggest that the extent of the plume with sulphate concentrations less than 6000 mg/l and uranium concentration less than 0.1 mg/l will remain inside the proposed long-term care area boundary (LCAB) during the 1,000-yr period of regulatory concern. The groundwater flow model was calibrated for the period 1981–1985 and verified for the period 1993–1997 using actual head measurements for wells. The comparison of the groundwater flow and transport model prediction for the period 1993–1997 suggests that the model predictions are conservative; that is, the extent and concentration of contaminant plume predicted by the model is larger than the actual extent of the contaminant plume based on well measurements. The contaminant transport modeling was performed for sulphate and uranium only, using the velocity field provided by the groundwater flow model.

Geochemical modeling performed by the licensee indicates that the site groundwater is saturated with gypsum. At neutral and alkaline conditions ($pH \geq 7$), it is predicted that the removal of tailings-derived metals and radionuclides from groundwater will be controlled by mechanisms such as sorption and precipitation. An analysis of well monitoring data shows that hazardous constituent concentrations in the site groundwater are generally low if the pH is above 4 and the sulfate concentration is less than 6,000 mg/l. This analysis indicates that the site aquifers have the attenuation capacity to remove tailings-derived metals and radionuclides from solution. Furthermore, geochemical modeling that simulated reactions between tailings seepage constituents and aquifer minerals indicates that site aquifers have adequate neutralizing capacity to restrict the migration of low pH groundwater to inside the revised Petrotomics LCAB.

Transport simulations indicate that sulfate will not exceed 6,000 mg/l at the point of exposure (POE) locations over the period of regulatory concern (i.e., 1,000 yr). Based on the analysis of well monitoring data discussed previously, it follows that the concentration of other site-derived constituents should be low at the POEs over the 1,000 yr closure period. Therefore, with the exception of uranium, the sulfate concentration in the site groundwater was used as the basis for predicting the concentration and risk posed by other site-derived constituents. For risk assessment calculations, the potential concentration for each constituent of concern at the POEs was modeled by calculating the upper 95 percent confidence limit of well monitoring data where the pH was greater than 4 and the sulfate concentration was less than 6,000 mg/l.

The Petrotomics' risk assessment for the proposed ACL levels considered demographics and historic use of water in the vicinity of the site to select likely exposure scenarios. Historically, surface water in the area has been used for mining, recreation, and livestock grazing. Climatological extremes and sparse vegetation indicate that future use of groundwater is likely to be limited to seasonal livestock (e.g., cattle) and wildlife (e.g., pronghorn antelope) watering. Domestic use of groundwater at the site is highly unlikely. However, if a future domestic water source is needed, the Lower Sand aquifer, which has not been affected by site-derived contamination and is suitable for drinking, would be a more reasonable source.

The exposure scenarios considered in the risk assessment were (i) occasional human ingestion of affected groundwater, (ii) occasional human ingestion of affected surface water, (iii) ingestion of affected groundwater by livestock and wildlife, and (iv) human ingestion of meat from affected livestock. The results of these scenarios indicate that present and potential hazardous constituent concentrations at the specified POEs will not pose significant risks to human health and the environment.

5.0 ALTERNATIVES

The action that the NRC is considering is approval of the licensee's request to amend the source material license issued pursuant to 10 CFR Part 40. The alternatives available to the NRC are to:

(i) approve the license amendment request;

(ii) establish other standards than those proposed; or

(iii) deny the request.

Based on its review of the request, the NRC staff has concluded that there are no significant environmental impacts associated with the proposed action. Therefore, alternatives with equal or greater impacts need not be evaluated.

The licensee provided an evaluation that considers other practicable corrective actions, as required for ACL proposals by Criterion 5B(6) of 10 CFR Part 40, Appendix A. The licensee's evaluation of various options, including continuation of the CAP, construction of passive reactive barriers, pump and treat with reverse osmosis and re-injection of the treated solution, and fresh water injection, resulted in a conclusion that the net reduction of constituent concentrations would not be significant.

Since the licensee has demonstrated that the proposed ACL values will not pose substantial present or potential hazards to human health and the environment, and that the proposed ACLs are ALARA, considering practicable corrective actions, establishing other standards more stringent than the proposed ACLS was not evaluated.

The alternative to the proposed action would be to deny the requested action and require the licensee to continue operation of the existing CAP or implement some alternative corrective action. Based on its review, the NRC staff has determined that the environmental impacts of the proposed action and the alternatives considered by the licensee will be similar in outcome, because the alternatives will result in little net reduction of constituent concentrations.

6.0 SUMMARY AND CONCLUSIONS

Based on an evaluation of the radiological impacts of the Petrotomics amendment request, the NRC staff has determined that the proper action is to issue a FONSI in the Federal Register. The following statements support the FONSI and summarize the conclusions from the EA.

(i) Currently, all concentrations of hazardous constituents of concern to NRC meet the proposed groundwater ACLs for the site at the POC wells.

(ii) Present and potential health risks were assessed for various exposure scenarios, using conservative approaches. The result of these assessments indicates that present and potential future hazardous constituent concentrations at the specified POEs will not pose significant risks to human health and the environment. The POEs are located within or at the long-term care area boundary which will be maintained for long-term care by the U.S. Department of Energy following termination of the Petrotomics license.

(iii) Climatological extremes and sparse vegetation indicate that future use of groundwater is likely to be limited to seasonal livestock (e.g., cattle) and wildlife (e.g., pronghorn antelope) watering. Domestic use of groundwater at the site is highly unlikely. However, if a future domestic water source is needed, the Lower Sand aquifer, which has not been affected by site-derived contamination and is suitable for drinking, would be a more reasonable source.

(iv) Additional corrective action will have little effect on the net reduction of constituent concentrations of concern to the NRC and, therefore, will have little impact on groundwater quality.

Because the staff has determined that there will be no significant impacts associated with approval of the amendment request, there can be no disproportionately high and adverse effects or impacts on minority and low-income populations. Except in special cases, these impacts need not be addressed for EAs in which a FONSI is made. Special cases may include regulatory actions that have substantial public interest, decommissioning cases involving onsite disposal in accordance with 10 CFR 20.2002, decommissioning/decontamination cases which allow residual radioactivity in excess of release criteria, or cases where environmental justice issues have been previously raised. Consequently, further evaluation of 'Environmental Justice' concerns, as outlined in NRC's Office of Nuclear Material Safety and Safeguards Policy and Procedures Letter 1-50, Rev.1, is not warranted.

7.0 CONSULTATION AND SOURCE INFORMATION

In completing this action, the NRC staff solicited WDEQ's comments on the draft EA (WDEQ, 1998), and highlighted in Section 1.4 WDEQ's authority in implementing its groundwater standards at the site. In addition, the NRC staff participated in several meetings held among the WDEQ staff and the Petrotomics staff to discuss and resolve various issues related to the groundwater CAP. The most recent meeting was held on August 13, 1998, at Cheyenne, Wyoming.

For public participation opportunities, the NRC announced the receipt of the Petrotomics ACL application in a Federal Register Notice (FRN) dated November 1, 1996. Also in that FRN, the NRC provided members of the public an opportunity for hearing under the informal hearing procedures contained in 10 CFR Part 2, Subpart L. No petitions for intervention were received within the 30-day time period specified in the Notice.

8.0 REFERENCES

U.S. Nuclear Regulatory Commission (NRC), 1996, "Staff Technical Position Alternate Concentration Limits for Title II Uranium Mills - Standard Format and Content Guide and Standard Review Plan for Alternate Concentration Limit Applications."

NRC, 1996, Letter from NRC dated October 24, 1996, transmitting Issues on Acceptance Review of Alternate Concentration Limits Application for Source Material License SUA-551.

NRC, 1997a, Letter from NRC dated April 18, 1997, requesting additional information.

NRC, 1997b, Letter from NRC dated July 31, 1997, requesting additional information.

Petrotomics Company (Petrotomics), 1996a, Letter from Petrotomics dated September 10, 1996, transmitting Petrotomics Tailings Facility Application for Alternate Concentration Limits to amend Source Material License SUA-551 (prepared by Shepherd Miller, Inc. (SMI)).

Petrotomics, 1996b, Letter from Petrotomics dated December 20, 1996, transmitting Addendum 1, Acceptance Review Issues 1-5 (prepared by SMI).

Petrotomics, 1996c, Letter from Petrotomics dated December 20, 1996, transmitting Addendum No. 2, Land Transfer Commitment Acceptance Review Issue 6.

Petrotomics, 1997a, Letter from Petrotomics dated June 20, 1997, transmitting Response to NRC Comments (prepared by SMI).

Petrotomics, 1997b, Letter from Petrotomics dated October 30, 1997, transmitting Response to NRC Open Issues 1, 4, and 5, revising ACLs (prepared by SMI).

Petrotomics, 1997c, Letter from Petrotomics dated October 30, 1997, transmitting Corrections Revising Table 3-10, and Figure 2-51b of the ACL Application package.

Petrotomics, 1997d, Letter from Petrotomics dated December 4, 1997, transmitting Response to Question Concerning Thorium-230.

Petrotomics, 1998a, Letter from Petrotomics dated March 9, 1998, transmitting Addendum to Response to NRC Open Issue 5/Model Verification (prepared by SMI).

Petrotomics, 1998b, Letter from Petrotomics dated March 19, 1998, transmitting Revised Proposed Restricted Area Boundary.

Wyoming Department of Environmental Quality (WDEQ), 1998, Letter from WDEQ dated May 12, 1998, to NRC, transmitting its comments on the draft EA related to the Petrotomics ACL application.

9.0 BIBLIOGRAPHY

Federal Register Notice dated November 1, 1996, announcing receipt of the Petrotomics ACL application and providing members of the public ar opportunity for hearing.

Wyoming Department of Environmental Quality's letter dated September 15, 1997, transmitting its comments on the ACL application to Petrotomics.

Wyoming Outdoor Council's letter dated March 4, 1998, to NRC, requesting information related to Petrotomics ACL application.