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KAISER ALUMINUM
CORPORATE ENVIRONMENTAL

July 10, 2000
Project No. 5427A-06

Mr. Frank L. Durham
Environmental Compliance Specialist
City of Tulsa, Oklahoma
4818 South Elwood Avenue
Tulsa, OK 74107

Groundwater Analytical Results
Adjacent Land Area Remediation Project
Kaiser Aluminum & Chemical Corporation Site
Tulsa, Oklahoma

Dear Mr. Durham:

This letter is intended as a follow up to our recent discussions regarding the possibility of discharging certain water encountered in excavations to the City of Tulsa's sanitary sewer system. As previously described, plans are being developed to remediate land adjacent to the Kaiser Aluminum & Chemical Corporation (Kaiser) plant located at 7311 East 41st Street in Tulsa, Oklahoma. During plant operations, slightly radioactive metal dross containing low concentrations of thorium was permitted to be placed on Kaiser property under the existing Atomic Energy Commission license. This practice has long been discontinued; however, some contamination now exists on the property which abuts the Kaiser facility. Kaiser will remediate this off-site contamination. It is anticipated that this project will begin in mid August and run through approximately mid December to early January, depending on actual conditions encountered. This work is being performed under a plan approved by the Nuclear Regulatory Commission (NRC).

The remediation will progress by excavating contaminated soil, surveying it with field radiological detectors, and stockpiling the contaminated material on plant property. When field surveys indicate that the material remaining in the excavation is at or near the unrestricted release limits, as established by the NRC, a sample will be taken and submitted for rapid laboratory analysis. When laboratory results confirm that remediation is complete, the excavation will be backfilled. This process is expected to take 2 weeks for each excavation.

Affected areas are shown in Figure 1. The adjacent areas have been gridded into 10-meter-by-10-meter squares, surveyed, and characterized with boreholes as shown. Although most affected areas show only shallow contamination to depths of 4 feet or less, six excavations to depths of 4.5 to 15 feet are expected. The depth to the groundwater table in this area fluctuates between 5 to 10 feet below ground surface. Groundwater is expected to enter the deeper excavations and will require removal to allow successful remediation.

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During our meeting of June 21, 2000, disposing of this water into the City of Tulsa's sanitary sewer system was discussed. A requirement for excavation water disposal was to provide analytical data on the metal content of groundwater wells proximate to the excavation areas: P-3, P-5, and MWS-5. Samples were collected on June 22, 2000 and analyzed. Results are presented in the enclosed Table 1, along with the City of Tulsa's standards for discharge to sewers. The data indicate that heavy metal concentrations in the site groundwater were not detected or are significantly below the city's specifications for discharge.

Table 2 is provided to document the NRC disposal criteria for radionuclides to sewers and typical concentrations of radiological contaminants in the Kaiser site's groundwater. The NRC limits are taken from 10 Code of Federal Regulations Part 20, *Standards for Protection Against Radiation, Appendix B – Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage.* Table 2 also presents analytical data from recent quarterly groundwater monitoring for comparison. The NRC values are stated as monthly average not-to-exceed concentrations. Note that one well, MWS-5, yielding the highest concentrations of radionuclides, is screened in an interval containing the contaminated thorium dross and is probably more representative of the contamination zone than groundwater likely to be encountered in the excavations. For one sampling event, it exceeded the radium concentration standards. Thorium and radium concentrations in wells not penetrating zones of dross decrease significantly and indicate the relatively insoluble nature of thorium.

The volume of groundwater requiring disposal is estimated at 71,000 gallons, by using Darcy's Law to calculate discharge into the excavation using site-specific data for hydraulic conductivity and groundwater gradient. The rate of inflow at a point then is extrapolated to the total surface area of the excavation's four walls, lying below an assumed depth to groundwater of 4.0 feet. Selected values for hydraulic conductivity (2.12×10^{-3} centimeter per second), groundwater gradient (0.033), and minimum depth to groundwater (4 feet below ground surface) lead to the highest and most conservative estimates of groundwater inflow. In general, groundwater discharge is calculated at 0.2003 foot per day. Table 3 shows the calculations for daily inflow given the surface areas of the final excavations and a cumulative daily sum assuming all excavations are opened simultaneously. Excavations will fill at this rate until the excavation water reaches the groundwater elevation. For deeper excavations, some are not expected to fill up completely.

The total volume for discharge is estimated assuming that each gird will take 1 full day to excavate, survey, and sample, during which time the excavation must be kept relatively free of standing water. Once sampling is complete, a maximum 14-day wait is expected before the excavation is backfilled. At that point, another day is required to pump the excavation dry to fill in the material. Thus, a 16-day time period is used to calculate the approximate 71,000-gallon figure. Note that the excavation, waiting, and backfilling time will be spread out over the course of the project to allow for efficient equipment and manpower use and to conserve on the number of frac tanks required for holding, then discharging pumped groundwater. More rapid filling of the excavations may result from rainfall or snowmelt running off into the excavation and should be expected.

Kaiser is requiring contractors bidding on the current work to pump the groundwater into 20,000-gallon frac tanks, both during excavation and prior to backfilling. When filled, the stored water will be held in this tank for 1 to 2 days prior to discharge to the sewer system to allow soil particles to settle out. Residual soil particles left in the tank will be removed and incorporated into the contaminated stockpiles on Kaiser property.

We trust that this letter provides you with the information necessary to approve discharging the groundwater to the sewers. Please send the letter of authorization directly to me. If you have any questions or require additional information, please contact me.

Respectfully submitted,

Bill Vinzant

J. W. (Bill) Vinzant, P.E.
Regional Environmental Manager

Cc: Mr. John Buckley – United States Nuclear Regulatory Commission
Mr. Louis Carson II – United States Nuclear Regulatory Commission
Ms. Pamela Bishop – Oklahoma Department of Environmental Quality
Mr. Stephen L. Jantzen – State of Oklahoma
Dr. Max Scott – ADA Consultants
John Donnan – Houston
Chuck Bendixen – Tulsa
Dave Tourdot – Earth Sciences

Tables

Table 1, Comparison of Allowable Discharge Concentrations vs. Groundwater Heavy Metal Content, Kaiser Aluminum & Chemical Corp., 7311 East 41 St., Tulsa, OK.

Toxic Analyte	City of Tulsa, Allowable Sewer Discharge Concentrations (mg/l)	P-3, Filtered (mg/l)	P-3, Unfiltered (mg/l)	P-5, Filtered (mg/l)	P-5, Unfiltered (mg/l)	MWS-5, Filtered (mg/l)	MWS-5, Unfiltered (mg/l)
Arsenic	1	0.009	0.009	0.008	0.012	0.009	0.01
Cadmium	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	3.45	<0.01	<0.01	0.011	<0.01	<0.01	<0.01
Copper	1.45	0.048	0.055	0.047	0.064	0.041	0.032
Lead	0.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	2.9	0.009	0.009	<0.005	0.015	<0.005	<0.005
Silver	0.3	<0.01	<0.01	<0.01	0.01	<0.01	0.01
Zinc	3	0.008	0.01	<0.005	0.005	0.012	0.075

Stated Less-Than (<) values are below the analytical method's detection limits.

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Table 2, NRC Allowable Thorium and Radium Concentrations to Sewers and Maximum Kaiser Groundwater Concentrations per Well.

Radiological Analyte	10 CRF 20, Appendix B, Table 3 - Avg. Monthly Concentration- Sewage Disposal (pCi/l)	Piezometer P-3, Concentration (pCi/l) / Sample Date	Piezometer P-5, Concentration (pCi/l) / Sample Date	Well MWS-5, (Unfiltered) Concentration (pCi/l) / Sample Date	Well MWS-5, (Filtered) Concentration (pCi/l) / Sample Date
Ra-226	600	0.817 / 12-99	1.08 / 12-99	22.4 / 10-97	16.1 / 9-99
Ra-228	600	2.19 / 9-99	74.5 / 9-99	265 / 10-97	***625*** / 9-99
Th-228	2,000	0.208 / 9-99	1.32 / 3-00	27.2 / 10-97	4.78 / 12-99
Th-230	1,000	0.876 / 9-99	1.72 / 9-99	104 / 10-97	10.1 / 12-99
Th-232	300	0.12 / 9-99	0.345 / 12-99	26.0 / 10-97	2.83 / 12-99

Bold indicates exceedences of 10 CRF 20, Appendix B, Table 3 Standards.

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Table 3 - Calculated Inflow into Deeper Remediated Excavations, Kaiser Adjacent Area Remediation

Grid	Hydraulic Conductivity, K (ft/day)	Hydraulic Gradient, I	Excavation Surface Area, A (ft^2)	Discharge into Excavation, Q (ft^3/day)	Discharge into Excavation, Q (gal/day)	Trench Volume below Ground-water Table (ft^3)
Trench 1-3	6.009	0.0333333	1459.900	292	2187	9,010.20
Trench 9	6.009	0.0333333	65.6000	13	98	268.9
Trench 23	6.009	0.0333333	295.2000	59	442	1210.3
Trench 44-45	6.009	0.0333333	590.4000	118	885	3,227.50
Trench 40-41	6.009	0.0333333	513.6	103	769	2,936
Trench 61D	6.009	0.0333333	32.8	7	49	134.5
			Total	592	4431	16,787.50

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Figure

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: 5427A404:FIGURE 1 SITE PLAN, REMEDIATION EXCAVATION GRIDS AND KEY GROUNDWATER MONITORING WELLS ADJACENT LAND AREA REMEDIATION KAISER ALUMINUM TULSA, OKLAHOMA

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: 5427A404

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