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BARRICK RESOURCES (USA), INC.

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MAY 07 1992
DIVISION OF
OIL GAS & MINING

April 30, 1992

Mr. Don A. Ostler, P.E.
Director
Division of Water Quality
Utah Department of Environmental Quality
288 North 1460 West
Salt Lake City, UT 84114-4870

Dear Mr. Ostler,

Subject: October 7, 1991 Diesel Fuel Release at Barrick-Mercur Facility

As referenced in Barrick's April 10, 1992 submittal of the Remedial Investigation Report and the Corrective Action Plan for the above noted diesel release, please find attached a third party evaluation of the data collected from the tank farm containment area, for natural degradation of diesel fuel. The report was prepared by Brian W. Buck of JBR Consultants Group, Salt Lake City.

As stated in the report, the capacity of the soil and rock fill that makes up the containment area exceeds the known quantity of released diesel, indicating that all of the released diesel fuel could be contained within this material, affording natural degradation to occur. The data also indicate that a reduction of 82 percent of the released quantity has occurred between October 7, 1991 (release date) and March 20, 1992 (drilling/sampling date). At this degradation rate, it is anticipated that only a negligible amount of diesel fuel remains in the containment area at this time.

The attached report completes the reporting requirements as set by the division's April 2, 1992 remediation schedule.

Barrick Mercur Gold Mine
P.O. Box 838, Tooele, Utah 84074 Telephone (801) 268-4447 FAX (801) 266-4296

Please contact me at extension 335 should you have any questions.

Respectfully,

David P. Beatty

David P. Beatty
Environmental/Occupational Health Coordinator

Attachment

cc: F. D. Wicks
C. L. Landa
G. M. Eurick
M. S. Staheli
L. Braxton (DOGM)
B. Buck (JBR Consultants)
R. Credille (Utah Attorney General's Office)
D. Frederick (DWQ)
L. Jenkins (Parsons, Behle, & Latimer)
F. Pehrson (DWQ)
V. Rolfe (Tooele County)
G. Shelley (Utah County)

CONSULTANTS GROUP

GEOLOGY ENGINEERING ENVIRONMENT HYDROLOGY

May 1, 1992

Mr. Dave Beatty
Barrick Resources (USA) Inc.
Mercur Gold Mine
P.O. Box 838
Tooele, UT 84074

RE: Diesel Spill

Dear Dave:

This is in response to your request for a review and interpretation of the field data obtained from the tank farm area at the Mercur Mine. The information I reviewed included an account of the spill which occurred on October 7, 1991. According to this information, the spill occurred over about seven hours at a rate of about 50 GPM during which time, a total of about 24,366 gallons of No.2 fuel oil (diesel) were released into the secondary containment area. The fuel soaked into the ground under the containment area but about 1,000 gallons of free product were able to be recovered from the pool of contained diesel immediately after the spill. Some fuel was later observed leaking through the containment berm on the northwest portion of the tank farm. The oil-soaked soil outside the containment berm was excavated, sampled, and disposed of in the tailings pond. It was later calculated from the analyses of this soil that about 4,200 gallons of fuel were contained in it. The remaining spilled fuel, about 19,166 gallons, apparently soaked into the ground within the containment area.

Shallow auger drilling within the containment area conducted over a month later on November 19, 1991 delineated TPH contamination of the soil and rock fill under the containment area. Estimates of the diesel contained in the soils were made by Barrick from analyses obtained from the drilling and indicated that approximately 19,600 gallons of diesel were still present in the soils. Another, more detailed, round of drilling was conducted on March 20, 1992 using a small, skid-mounted air drill. The air drill was used because it was small enough to gain access to most locations in the containment, other drills that were available were too large. Estimates of the diesel fuel contained within the soils and rock fill under the containment area obtained from the analyses of these later samples indicated that approximately 1,769 gallons of fuel were present. The difference in the indicated amounts of fuel contained in the soil under the spill area was attributed by Barrick to natural degradation. The purpose of this letter is to review and expand on this interpretation.

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801 942 1852

Before we could discuss the natural degradation of the fuel, we reviewed the previous methods used to arrive at the residual fuel content in the soil and rock fill of the site. The first drilling consisted of five shallow (3-foot deep) auger holes which did fully penetrate the soil layer but not the rock fill layer underlying the site. Using selected data from the sample analyses averaged over the entire containment area and down to an assumed fill depth of 6.0 feet, a total of 19,604 gallons of diesel were calculated by Barrick.

The second subsurface investigation was very detailed with over 31 holes being drilled through the entire soil and rock fill thickness all through the containment area. The degree of location and depth coverage for this drilling is very good. However, the samples were obtained from the air-lifted cuttings which would be expected to artificially reduce the TPH content (especially the volatile fraction thereof) of the samples during the sampling process. The detailed calculations by Barrick for the contained TPH in all the samples are well documented and indicate that only 1,769 gallons of oil remain. However, this number is probably too low due to the air-lift drilling. Thus the actual value of the end point for the observed amount of natural degradation is probably too low.

Because of the above described questions regarding the true amount of natural degradation that has occurred in the soils and rock fill under the spill site, we have chosen to calculate the potential residual fuel content of these materials using published estimating techniques. We first used the detailed drill hole information provided by Barrick for the thickness and volume of soil and rock fill under the containment area. Disregarding the polygons that actually lie outside the containment berm, we calculated that a total volume of 385 CY of soil and 1,174 CY of rock fill underlie the containment area. Using a transformation of a formula published by Dragun (1988) we calculated the residual fuel containment capacity of the soil and rock by:

$$Vhc = \frac{P \times RS \times Vs}{0.2}$$

where:

Vhc = Volume of residual hydrocarbon absorbed in the material (barrels)
P = Material Porosity (0.5 for the clay soil and 0.35 for rock fill)
RS = residual saturation capacity (0.15 for diesel with moist soil)
Vs = Volume of the soil (CY)

Using this method, we calculated the potential residual (free drained) capacity of the soil to be 6,354 gallons, and that for the rock fill to be 13,561 gallons, for a total of 19,915 gallons. This represents the maximum amount of fuel the soil and rock fill could contain in an unsaturated, free-drained condition. This volume of residual fuel is essentially the same as was originally estimated by Barrick from the November 1991 drilling data. This capacity is also greater than the 19,166 gallons that apparently soaked into the soil and rock fill in the containment area indicating that the spilled fuel could be held in the soil and rock fill above the bedrock where volatilization and bio-degradation could occur.

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It is not certain how much air stripping of the samples occurred during the second subsurface investigation due to air drilling. A correction for the March data is necessary, based on the fact that about 50% of typical diesel consists of volatile aromatics and N-Alkenes which could have been lost to air-stripping during drilling. Even if the fuel contaminant values reported by Barrick for the second round of drilling were understated by a factor of 100%, the actual fuel content of the soil and rock under the spill site in March 1992 may have been about 3,500 gallons. The corrected volume of 3,500 gallons would be about 18% of the original spill volume that soaked into the ground under the containment area, indicating that about 82% of the spill had been degraded over a period of about 150 days. The question is whether this amount of degradation is reasonable.

There has been much published about the composition of diesel fuel and its degradation in soils (Kostecki and Calibrese, 1990). The exact composition of diesel is somewhat variable from different refineries but the following approximate TPH composition and listing of observed total (volatilization and bio-degradation) degradation rates has been published for a typical diesel formulation:

Component	% Composition	Observed Degradation Rate (per day)
N - Alkenes	37.6	0.014
Iso & Cyclo Alkenes	37.6	0.005
Isoprenes 1)	3.5	0.002
Aromatics 2)	20.2	0.012
Polars 3)	1.1	0.014

1) Pristane and phytane and other highly-branched iso-alkanes
2) Water-soluble hydrocarbons, including benzenes, napthalenes, hydrindenes, phenanthrenes, and fluorenes
3) Water-soluble sulfur, nitrogen, and oxygen

The degradation rates listed in the table are for surface treatment of diesel contaminated soils by aeration and bio-degradation. Although the Barrick case does not include surface treatment of the soils, the above-listed degradation rates are indicative of the maximum potential volatilization and bio-degradation for the site. From the table, it can be seen that the N-Alkenes, aromatics, and polar fractions of typical diesel-contaminated soils, making up about 60% of the total TPH, can be naturally degraded in about 83 days or less. The iso.& cyclo alkenes can degrade in about 200 days. Assuming the spilled fuel at Barrick had a composition like that listed above, after a period of about 150 days, about 12% of the original spilled volume would be left, or approximately 2,300 gallons, which compares well with the calculated and adjusted residual oil estimates for March of between 1,769 and 3,500 gallons. The adjusted volume of fuel estimated to be in the soil and rock fill (3,500 gallons) is higher than anticipated from the published degradation rates (2,300 gallons) which is

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expected because of the winter temperatures and in-situ conditions. Winter temperatures reduce volatilization and microbiological activity. Oxygen is less available in in-situ conditions which limits the rate of microbiological activity.

In summary, the amount of fuel that entered the soil and rock fill in the containment area could be held in unsaturated conditions within this material where natural degradation would occur. The data obtained from the Barrick containment area indicate that the TPH content of the containment area reduced from 19,166 gallons to about 3,500 gallons (82% reduction) in 150 days which is similar to the published degradation rates and indicates that natural degradation is active under the containment area.

Sincerely,

Brian W. Buck
Vice President

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