United States Department of Agriculture **Forest Service** **Gallatin National Forest**

Supervisor's Office
10 East Babcock
P.O. Box 130
Bozeman, MT 59771

File Code: 2160
Date: March 14, 2002

John Koerth
Project Coordinator
Department of Environmental Quality
Mine Waste Cleanup Bureau
P.O. Box 200901
Helena, MT 59602-0901

Dear Mr. Koerth:

This letter transmits five (5) copies of the above referenced report. In accordance with Section 75-5-312 (10), Montana Codes Annotated (MCA), the U.S. Department of Agriculture Forest Service is providing this report to DEQ to fulfill its responsibilities before the Board of Environmental Review (BER) for the rule adopting temporary standards on portions of Fisher Creek, Daisy Creek, and the Stillwater River.

We believe the enclosed Progress Report accurately states water quality conditions on the streams affected by the temporary standards. In addition to fulfilling the rules and regulations governing the temporary standards, we also provided the information you requested in your letter to Mary Beth Marks dated February 22, 2002.

We look forward to assisting the DEQ and BER through the review process. If you have any questions, please contact Mary Beth Marks, On-Scene Coordinator for the project at (406) 587-6709.

Sincerely,

/s/ Richard H. Inman (for)
REBECCA HEATH
Forest Supervisor

Enclosures
Cc: Mary Beth Marks

TECHNICAL MEMORANDUM

DATE: April 12, 2002

TO: Bob Kirkpatrick, USDA Forest Service, Region 1
Mary Beth Marks, On-Scene Coordinator, Gallatin National Forest

FROM: Michael Cormier, Project Coordinator
Aaron Shewman, P.E., Project Engineer

SUBJECT: Sump Water Non-Degradation Calculations For Surface and Groundwater
Selective Source Response Action Repository
New World Mining District Response and Restoration Project

Maxim Technologies, Inc. ® (Maxim) has performed non-degradation calculations for on-site disposal of water contained in the repository sump at the Selective Source Response Action repository site. These calculations were performed to demonstrate that the water contained in the repository sump can be made into snow during April 2002, land applied, and then be allowed to melt naturally during the months of April, May and June. Based on the attached calculations, this land-applied sump water will not adversely affect selected constituent concentrations in surface water runoff measured at the nearest surface water monitoring station (SBT-6) or in groundwater beneath the land application area. The land application would consist of using the sump water to make artificial snow that would be sprayed onto the southeast-facing hillside west of the repository. The distance from the proposed application area to the nearest surface water body (i.e. the unnamed, perennial drainage east of the repository) is about 500 meters. The proposed land application area is shown on Figure 1 in Attachment A.

Loading to surface water downstream of the repository and groundwater beneath the land application area was calculated according to procedures described in the Administrative Rules of Montana (ARM) 17.30.517 to determine if the site is eligible for a standard mixing zone. Loading calculations are included as Attachment B. Laboratory reports and historic database reports are contained in Attachment C. Data and assumptions used to complete the calculations are summarized below.

SURFACE WATER NON-DEGRADATION CALCULATION

Existing Surface Water Flow and Load

The volume of water expected to flow into Soda Butte Creek from the basin where the repository is located was determined using average monthly flow data collected during 1975 at surface water monitoring station SB4-4. The total of these monthly flows was then converted to an average daily flow. The existing loading at the surface water monitoring station (SBT-6) located in the unnamed, perennial drainage downgradient from the repository was calculated using results for a sample collected on 10/20/2001. Because the concentrations of aluminum, barium, manganese, selenium, silver, chloride and potassium measured in the sample collected from SBT-6 were below the laboratory practical quantitation limit (PQL), these concentrations were assumed to be one-half the PQL reported

for historic samples collected from Soda Butte Creek. These data were then multiplied by the average daily flow value to determine the existing loading at SBT-6.

Sump Water Load

The volume of water contained in the sump was calculated to be approximately 42,500 liters (11,250) gallons according to the water level measured on March 28, 2002. The sump water load at surface water monitoring station SBT-6 was calculated using this volume and laboratory data for a sump water sample collected January 15, 2002. The entire volume of sump water would be applied to the southeast-facing hillside west of the repository as snow using snowmaking machines during April 2002. It was assumed that this artificial snow and the natural snow contained within the basin would melt during April, May and June 2002, and would result in surface water runoff. The average daily flow for the snowmelt was determined by dividing the total sump volume by the number of days in the three-month snowmelt period (91 days). These data were then multiplied by 90% of the average daily flow value to determine the sump loading to surface water. The remaining 10% was assumed to infiltrate and become part of the groundwater loading described below.

Calculated Rate and Load

Calculated concentrations in surface water after mixing are tabulated below along with the lowest applicable surface water standards.

**CALCULATED CONCENTRATIONS IN SURFACE WATER AFTER COMPLETE MIXING
SELECTIVE SOURCE RESPONSE ACTION REPOSITORY SUMP WATER DISPOSAL
NEW WORLD MINING DISTRICT**

Metal	Initial Concentration (mg/l)	Final Concentration (mg/l)	Change in Concentration (mg/l)	Trigger Value (mg/l)	Exceeded ?
Aluminum	5.00E-02	5.00E-02	1.25E-05	0.03	NO
Barium	5.00E-02	5.00E-02	-1.66E-06	0.002	NO
Iron	2.10E-01	2.10E-01	5.66E-05	NA	NO
Manganese	1.50E-03	1.67E-03	1.66E-04	NA	NO
Selenium	3.50E-03	3.50E-03	-4.16E-08	0.0006	NO
Silver	3.80E-04	3.80E-04	4.26E-07	0.0002	NO
Chloride	2.00E+00	2.00E+00	8.32E-04	NA	NO
Sulfate	1.20E+01	1.21E+01	1.42E-01	NA	NO
Calcium	4.50E+01	4.50E+01	3.83E-02	NA	NO
Potassium	5.00E-01	5.01E-01	1.46E-03	NA	NO
Sodium	5.00E-01	5.18E-01	1.83E-02	NA	NO
Magnesium	7.00E+00	7.02E+00	1.57E-02	NA	NO

Note: Concentrations of iron, manganese must not reach values that interfere with the uses specified in the surface and groundwater standards. Secondary Maximum Contaminant Levels (300 micrograms per liter for iron and 50 micrograms per liter for manganese) that are based on aesthetic properties such as taste, odor, and staining may be considered as guidance to determine the levels that will interfere with the specified uses.

Sump water sample conductivity and pH results were within the range of natural waters.

According to ARM 17.30.715, discharges containing toxic parameters or nutrients are "not significant" if the resulting ***change*** in concentration does not exceed the trigger value published in WQB-7. Therefore, from review of data tabulated above, the calculated discharge from the repository sump will result in "non-significant" changes in surface water quality.

GROUNDWATER NON-DEGRADATION CALCULATION
Existing Groundwater Flux and Load

The volume of water moving beneath the proposed land application area was calculated using Darcy's Law:

$$Q = (K)*(i)*(A)$$

Where: Q = volume of flow per unit time
K = hydraulic conductivity
i = hydraulic gradient
A = aquifer cross-sectional area

Loads in the receiving water (glacial till unit) were assumed to be equivalent to historic results reported for samples collected from monitoring wells SB-22, SB-23 and SB-24, which are located in the vicinity of the repository. The concentrations of manganese, sulfate, calcium, potassium, sodium and magnesium were calculated using the average of the historic results for samples obtained from the monitoring wells. Because the concentrations of aluminum, barium, iron, selenium, and silver were not measured in any of the samples collected from the monitoring wells, these concentrations were assumed to be one-half the PQL reported in either the sump water laboratory report (aluminum and iron), or the historic results (barium, selenium and silver).

Hydraulic conductivity and gradient values were the same values used for the non-degradation calculation reported by Maxim in a technical memorandum to the USFS dated January 31, 2001. The calculations in that memorandum modeled the potential release of leachate from the selective source response action repository. The cross-sectional area of the aquifer used to determine the potential affect of land applying the sump water as artificial snow was determined by using the same aquifer thickness value (5 meters) used to model the potential release of leachate in the memorandum dated January 31, 2001, and the width of the proposed land application area measured perpendicular to the assumed groundwater flow.

Sump Water Rate and Load

A sump water discharge rate to receiving groundwater of 5.42E-04 liters per second (l/sec) was based on the assumption that 10% of the sump water infiltrated into the soil and became groundwater over the three-month period of April, May and June.

Calculated Rate and Load

Calculated concentrations in groundwater after mixing are tabulated below along with lowest applicable groundwater standards.

CALCULATED CONCENTRATIONS IN GROUNDWATER AFTER COMPLETE MIXING SELECTIVE SOURCE RESPONSE ACTION REPOSITORY SUMP WATER DISPOSAL NEW WORLD MINING DISTRICT

Metal	Initial Concentration (mg/l)	Final Concentration (mg/l)	Change in Concentration (mg/l)	Trigger Value (mg/l)	Exceeded ?
Aluminum	5.00E-02	5.20E-02	2.03E-03	0.03	NO
Barium	5.00E-02	4.97E-02	-2.70E-04	0.002	NO
Iron	5.00E-03	1.69E-02	1.19E-02	NA	NO
Manganese	1.70E-01	1.95E-01	2.46E-02	NA	NO
Selenium	2.50E-04	2.87E-04	3.71E-05	0.0006	NO
Silver	2.50E-04	3.21E-04	7.09E-05	0.0002	NO
Sulfate	2.52E+01	4.81E+01	2.29E+01	NA	NO
Calcium	3.88E+01	4.51E+01	6.29E+00	NA	NO
Potassium	3.20E+00	3.40E+00	2.00E-01	NA	NO
Sodium	1.04E+01	1.32E+01	2.83E+00	NA	NO
Magnesium	1.74E+01	1.98E+01	2.40E+00	NA	NO

(1) Concentrations of iron and manganese must not reach values that interfere with the uses specified in the surface and groundwater standards. Secondary Maximum Contaminant Levels (300 micrograms per liter for iron and 50 micrograms per liter for manganese) that are based on aesthetic properties such as taste, odor, and staining may be considered as guidance to determine the levels that will interfere with the specified uses.

According to ARM 17.30.715, discharges containing toxic parameters or nutrients are “not significant” if the resulting ***change*** in concentration does not exceed the trigger value published in WQB-7. Therefore, from review of data tabulated above, the calculated discharge from the repository sump will result in “non-significant” changes in groundwater quality.

ATTACHMENT A
FIGURES
New World Mining District Response and Restoration Project

newworld\cadpro\reposit\LAD.dwg

SB-105 SB-105T

Abandoned SB-106T

SB-106 Abandoned

SB-104 Abandoned

REPOSITORY

Sump

SB-107T SB-107

SB-108 SB-108T

8350

8300

8325.3

8343.4

8376.1

8278.7

SB-101TD SB-101TS

SB-101 SB-101TDD

8350

8250

8200

SB-23 SB-23TS SB-23TD

SB4-4

SB-103TD SB-103TS SB-103

SB-22 SB-22TS SB-22TD

SB-102T SB-102

SB-24T SB-24

SBT-6

8150

N

0 Feet 200

- Bedrock Monitoring Well
- Surface Water Monitoring Location
- Proposed Land Application Area

MAXIM 9902245-322

April 2002

Proposed Land Application Area
Selective Source Response Action Repository Site
New World Mining District Response and Restoration Project
Cooke City Area, Montana
FIGURE 1

ATTACHMENT B
REPOSITORY SUMP WATER NON-DEGRADATION CALCULATIONS
New World Mining District Response and Restoration Project

Selective Source Response Action Repository Sump Water
Non-Degradation Calculations

SURFACE WATER NON-DEGRADATION CALCULATION

These calculations were performed based on the assumption that 90% of the artificial snow melts and becomes surface water flow, and 10% infiltrates and becomes groundwater.

Existing Surface Water Flow

Data Source: Selective Source Response Action Final EE/CA for the New World Mining District Response and Restoration Project, January 2001

Assume average flow in basin measured at SB4-4 during the months of April, May and June in 1975 is the existing flow.

Average Monthly Flow Volumes - Soda Butte Creek Station SB4-4 (m^3)

April	4,121	
May	42,579	
June	418,666	
Total Flow =	465,366	
Average Daily Flow (Q_{avgd}) =	5058.33	m^3/day
	0.06	m^3/sec
	58.55	l/sec

Existing Surface Water Load

Data Source: Selective Source Response Action Final EE/CA for the New World Mining District Response and Restoration Project, January 2001

Metals Conc. in a Surface Water Sample Collected at SBT-6 (Sample Collected 10/20/01)			Existing Metals Load (Q x Conc.)
Aluminum	5.00E-02 mg/l	1/2 PQL	2.93E+00 mg/sec
Barium	5.00E-02 mg/l	1/2 PQL*	2.93E+00 mg/sec
Iron	2.10E-01 mg/l	lab report value	1.23E+01 mg/sec
Manganese	1.50E-03 mg/l	1/2 PQL	8.78E-02 mg/sec
Selenium	3.50E-03 mg/l	1/2 PQL*	2.05E-01 mg/sec
Silver	3.80E-04 mg/l	1/2 PQL*	2.22E-02 mg/sec
Chloride	2.00E+00 mg/l	1/2 PQL	1.17E+02 mg/sec
Sulfate	1.20E+01 mg/l	lab report value	7.03E+02 mg/sec
Calcium	4.50E+01 mg/l	lab report value	2.63E+03 mg/sec
Potassium	5.00E-01 mg/l	1/2 PQL	2.93E+01 mg/sec
Sodium	5.00E-01 mg/l	lab report value	2.93E+01 mg/sec
Magnesium	7.00E+00 mg/l	lab report value	4.10E+02 mg/sec

*1/2 PQL is an average of historic surface water sample data for samples collected from Soda Butte Creek (SBC-1, SBC-2, SBC-3, and SBC-4).

Sump Water Load

Estimated fluid volume in the sump as of March 28, 2002 = 42,580 liters (11,250 gallons)

Snowmelt Flow (Q) = 0.0054 liters/sec Adjusted Snowmelt Flow (Q_{adj})= 0.00487408 liters/sec

Snowmelt flow was calculated using the estimated total capacity of the sump and assuming 90% snowmelt became surface water flow by releasing it over the three month period April, May and June (91 days).

Metals Conc. in Sump Water (Sample Collected 1/15/2002)			Sump Load (Q x Conc.)
Aluminum	2.00E-01 mg/l	lab report value	9.75E-04 mg/sec
Barium	3.00E-02 mg/l	lab report value	1.46E-04 mg/sec
Iron	8.90E-01 mg/l	lab report value	4.34E-03 mg/sec
Manganese	1.99E+00 mg/l	lab report value	9.70E-03 mg/sec
Selenium	3.00E-03 mg/l	lab report value	1.46E-05 mg/sec
Silver	5.50E-03 mg/l	lab report value	2.68E-05 mg/sec
Chloride	1.20E+01 mg/l	lab report value	5.85E-02 mg/sec
Sulfate	1.72E+03 mg/l	lab report value	8.38E+00 mg/sec
Calcium	5.05E+02 mg/l	lab report value	2.46E+00 mg/sec
Potassium	1.80E+01 mg/l	lab report value	8.77E-02 mg/sec
Sodium	2.20E+02 mg/l	lab report value	1.07E+00 mg/sec
Magnesium	1.95E+02 mg/l	lab report value	9.50E-01 mg/sec

Total Load Existing Surface Water Load + Sump Water Load

Total Flow (Q) = 58.55 liters/sec **Resultant Concentration (Total Load/Total Flow)**

Aluminum	2.93E+00 mg/sec	5.00E-02 mg/l
Barium	2.93E+00 mg/sec	5.00E-02 mg/l
Iron	1.23E+01 mg/sec	2.10E-01 mg/l
Manganese	9.75E-02 mg/sec	1.67E-03 mg/l
Selenium	2.05E-01 mg/sec	3.50E-03 mg/l
Silver	2.23E-02 mg/sec	3.80E-04 mg/l
Chloride	1.17E+02 mg/sec	2.00E+00 mg/l
Sulfate	7.11E+02 mg/sec	1.21E+01 mg/l
Calcium	2.64E+03 mg/sec	4.50E+01 mg/l
Potassium	2.94E+01 mg/sec	5.01E-01 mg/l
Sodium	3.03E+01 mg/sec	5.18E-01 mg/l
Magnesium	4.11E+02 mg/sec	7.02E+00 mg/l

Metal	Initial Concentration (mg/l)	Final Concentration (mg/l)	Change in Concentration (mg/l)	Trigger Value (mg/l)	Exceeded ?
Aluminum	5.00E-02	5.00E-02	1.25E-05	0.03	NO
Barium	5.00E-02	5.00E-02	-1.66E-06	0.002	NO
Iron	2.10E-01	2.10E-01	5.66E-05	NA	NO
Manganese	1.50E-03	1.67E-03	1.66E-04	NA	NO
Selenium	3.50E-03	3.50E-03	-4.16E-08	0.0006	NO
Silver	3.80E-04	3.80E-04	4.26E-07	0.0002	NO
Chloride	2.00E+00	2.00E+00	8.32E-04	NA	NO
Sulfate	1.20E+01	1.21E+01	1.42E-01	NA	NO
Calcium	4.50E+01	4.50E+01	3.83E-02	NA	NO
Potassium	5.00E-01	5.01E-01	1.46E-03	NA	NO
Sodium	5.00E-01	5.18E-01	1.83E-02	NA	NO
Magnesium	7.00E+00	7.02E+00	1.57E-02	NA	NO

GROUNDWATER NON-DEGRADATION CALCULATION

Existing Groundwater Flux

Q=KiA

K =	3.10E-07	m/sec	Assumed to be the same as the repository (SB-4B) hydraulic conductivity
i =	0.138		Assumed to be the same as the repository (SB-4B) groundwater gradient
A =	925	m^2	The length of land application area perpendicular to groundwater flow x aquifer thickness
Q=	3.9572E-05	m^3/sec	
Q=	3.9572E-02	l/sec	

Existing Groundwater Load

	Metals Conc. in Till Wells			Existing Groundwater Load (Q x Conc.)
Aluminum	5.00E-02	mg/l	1/2 PQL*	1.98E-03 mg/sec
Barium	5.00E-02	mg/l	1/2 PQL**	1.98E-03 mg/sec
Iron	5.00E-03	mg/l	1/2 PQL*	1.98E-04 mg/sec
Manganese	1.70E-01	mg/l	Avg. of Hist. Data***	6.73E-03 mg/sec
Selenium	2.50E-04	mg/l	1/2 PQL**	9.89E-06 mg/sec
Silver	2.50E-04	mg/l	1/2 PQL**	9.89E-06 mg/sec
Sulfate	2.52E+01	mg/l	Avg. of Hist. Data***	9.97E-01 mg/sec
Calcium	3.88E+01	mg/l	Avg. of Hist. Data***	1.54E+00 mg/sec
Potassium	3.20E+00	mg/l	Avg. of Hist. Data***	1.27E-01 mg/sec
Sodium	1.04E+01	mg/l	Avg. of Hist. Data***	4.12E-01 mg/sec
Magnesium	1.74E+01	mg/l	Avg. of Hist. Data***	6.89E-01 mg/sec

* 1/2 PQL obtained from the sump water sample laboratory data report.

** Groundwater samples collected from the area were not analyzed for the respective constituent, so the PQL was obtained from the historic average detection limit for dissolved metals analyses conducted on samples collected from wells SB-22, SB-23 and SB-24.

*** Average of historical dissolved metals data reported for samples collected from wells SB-22, SB-23 and SB-24.

Sump Water Load

Estimated fluid volume in the sump as of March 28, 2002 = 42,580 liters (11,250 gallons)

Snowmelt Flow (Q) = 0.0054 liters/sec Adjusted Snowmelt Flow (Q_{adj})= 0.00054156 liters/sec

Snowmelt infiltration was calculated using the estimated total capacity of the sump and assuming 10% snowmelt infiltrates over the three month period April, May and June (91 days).

Metals Conc. in Sump Water (Sample Collected 1/15/2002)				Sump Load (Q x Conc.)
Aluminum	2.00E-01	mg/l	lab report value	1.08E-04 mg/sec
Barium	3.00E-02	mg/l	lab report value	1.62E-05 mg/sec
Iron	8.90E-01	mg/l	lab report value	4.82E-04 mg/sec
Manganese	1.99E+00	mg/l	lab report value	1.08E-03 mg/sec
Selenium	3.00E-03	mg/l	lab report value	1.62E-06 mg/sec
Silver	5.50E-03	mg/l	lab report value	2.98E-06 mg/sec
Sulfate	1.72E+03	mg/l	lab report value	9.31E-01 mg/sec
Calcium	5.05E+02	mg/l	lab report value	2.73E-01 mg/sec
Potassium	1.80E+01	mg/l	lab report value	9.75E-03 mg/sec
Sodium	2.20E+02	mg/l	lab report value	1.19E-01 mg/sec
Magnesium	1.95E+02	mg/l	lab report value	1.06E-01 mg/sec

Total Load Existing Groundwater Load + Sump Water Load

Total Q = 4.0113E-02 liters/sec **Resultant Concentration (Total Load/Total Flow)**

Aluminum	2.09E-03 mg/sec	5.20E-02 mg/l
Barium	1.99E-03 mg/sec	4.97E-02 mg/l
Iron	6.80E-04 mg/sec	1.69E-02 mg/l
Manganese	7.80E-03 mg/sec	1.95E-01 mg/l
Selenium	1.15E-05 mg/sec	2.87E-04 mg/l
Silver	1.29E-05 mg/sec	3.21E-04 mg/l
Sulfate	1.93E+00 mg/sec	4.81E+01 mg/l
Calcium	1.81E+00 mg/sec	4.51E+01 mg/l
Potassium	1.36E-01 mg/sec	3.40E+00 mg/l
Sodium	5.31E-01 mg/sec	1.32E+01 mg/l
Magnesium	7.94E-01 mg/sec	1.98E+01 mg/l

Metal	Initial Concentration (mg/l)	Final Concentration (mg/l)	Change in Concentration (mg/l)	Trigger Value (mg/l)	Exceeded ?
Aluminum	5.00E-02	5.20E-02	2.03E-03	0.03	NO
Barium	5.00E-02	4.97E-02	-2.70E-04	0.002	NO
Iron	5.00E-03	1.69E-02	1.19E-02	NA	NO
Manganese	1.70E-01	1.95E-01	2.46E-02	NA	NO
Selenium	2.50E-04	2.87E-04	3.71E-05	0.0006	NO
Silver	2.50E-04	3.21E-04	7.09E-05	0.0002	NO
Sulfate	2.52E+01	4.81E+01	2.29E+01	NA	NO
Calcium	3.88E+01	4.51E+01	6.29E+00	NA	NO
Potassium	3.20E+00	3.40E+00	2.00E-01	NA	NO
Sodium	1.04E+01	1.32E+01	2.83E+00	NA	NO
Magnesium	1.74E+01	1.98E+01	2.40E+00	NA	NO

ATTACHMENT C
SUMP WATER LABORATORY AND HISTORIC DATABASE REPORTS
New World Mining District Response and Restoration Project