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SUNNYSIDE COGENERATION ASSOCIATES
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August 6, 1993

Ms. Pamela Grubaugh-Littig
Permit Supervisor
Division of Oil, Gas and Mining
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ACT/007/035 #2
Copy PGM (all) and Susan (all)

Dear Pam,

Attached is the revised Permit Condition No. 6 Response for Sunnyside Cogeneration Associates.

The revised Permit Condition No. 6 Response includes references for the literature cited and discussions of existing conditions at the seep with regard to iron and TDS.

Please note that the original Stipulation 6 did not request a discussion pertaining to; (1) tolerable limits of TDS on macroinvertebrates and, (2) the issue that the "finding of some metals in the solution may and probably does indicate that more detrimental metals are present." Therefore, we have not included such in the revised Stipulation 6.

Should you have any questions please feel free to call me.

Sincerely,

AEB for
David Pearce
Authorized Member, Management Committee

Alane E. Boyd
Alane E. Boyd, P.E.
Senior Engineer

Enclosure

cc: Brian Burnett, Callister, Duncan and Nebeker

AEB:hp
c:\ss\let-aug6

R645-301-330 (SW)

DISCUSSION ON TOLERABLE LIMITS OF IRON AND TDS IN WATER FOR PLANTS LIVESTOCK, WILDLIFE, AND FISH.

Iron

Iron is common in many rocks and is an important component of many soils. Iron is an essential trace element for both plant and animal life. The primary forms of Iron which occur in an aquatic environment are ferric (Fe+++) and ferrous (Fe++). Whereas the ferric form is insoluble, ferrous iron readily dissolves in water. The ferrous form occurs in environments void of oxygen and therefore may be present in waters which originate from underground mines.

The State of Utah has set the standard for iron for the protection of aquatic life at 1 mg/l. Iron concentrations greater than 1 mg/l have been found to have detrimental effects on fish. An iron concentration of 1.75 mg/l was shown to be toxic to brook trout (2). The European Inland Fisheries Advisory Commission recommended that iron concentrations not exceed 1 mg/l in waters to be managed for aquatic life.

In the presence of oxygen, ferrous iron may be precipitated as either hydroxide ($Fe(OH)_3$) or ferric oxide (Fe_2O_3). Both of these precipitates form as gels or flocs which could be detrimental when suspended in water to fish and other aquatic life. They can also settle out and cover stream bottoms thereby destroying habitat for bottom-dwelling invertebrates and plants as well as eliminating spawning grounds for fish.

In aerated soils iron is not toxic to plants. In alkaline soils iron may be so insoluble as to be deficient as a trace element and result in chlorosis, a plant nutrient deficiency disease. The National Academy Of Science established a 5 mg/l limit for iron for waters to be used for agricultural irrigation.

Standards for iron for the protection of wildlife and livestock apparently do not exist. The daily human nutritional requirement for iron is 1 to 2 mg, but significantly larger quantities are needed to actually obtain this requirement because of poor absorption. The average human diet contains 16 mg/l of iron every day. One study conducted by the National Academy of Sciences in 1974 determined that iron at exceedingly high concentrations was toxic to livestock.

Iron is present in waters emanating from the Course Refuse Seep. Total iron concentration from the source of the seep between 1986 and 1992 ranged from 0.2 to 35.6 mg/l. As the waters of the seep become oxygenated, iron converts from the soluble ferrous form to the highly insoluble ferric form and settles out. The reddish color of the sediments along the water course is evidence that this is occurring. In general, the iron concentration at the boundary is significantly less than that at the source. However, anomalies to this pattern do exist; some of the samples taken at the boundary actually have a higher iron concentration than samples taken from the source on the same date. Iron concentration for both the boundary and the source for the years 1986 and 1987 are presented in figures 1 and 2, respectfully.

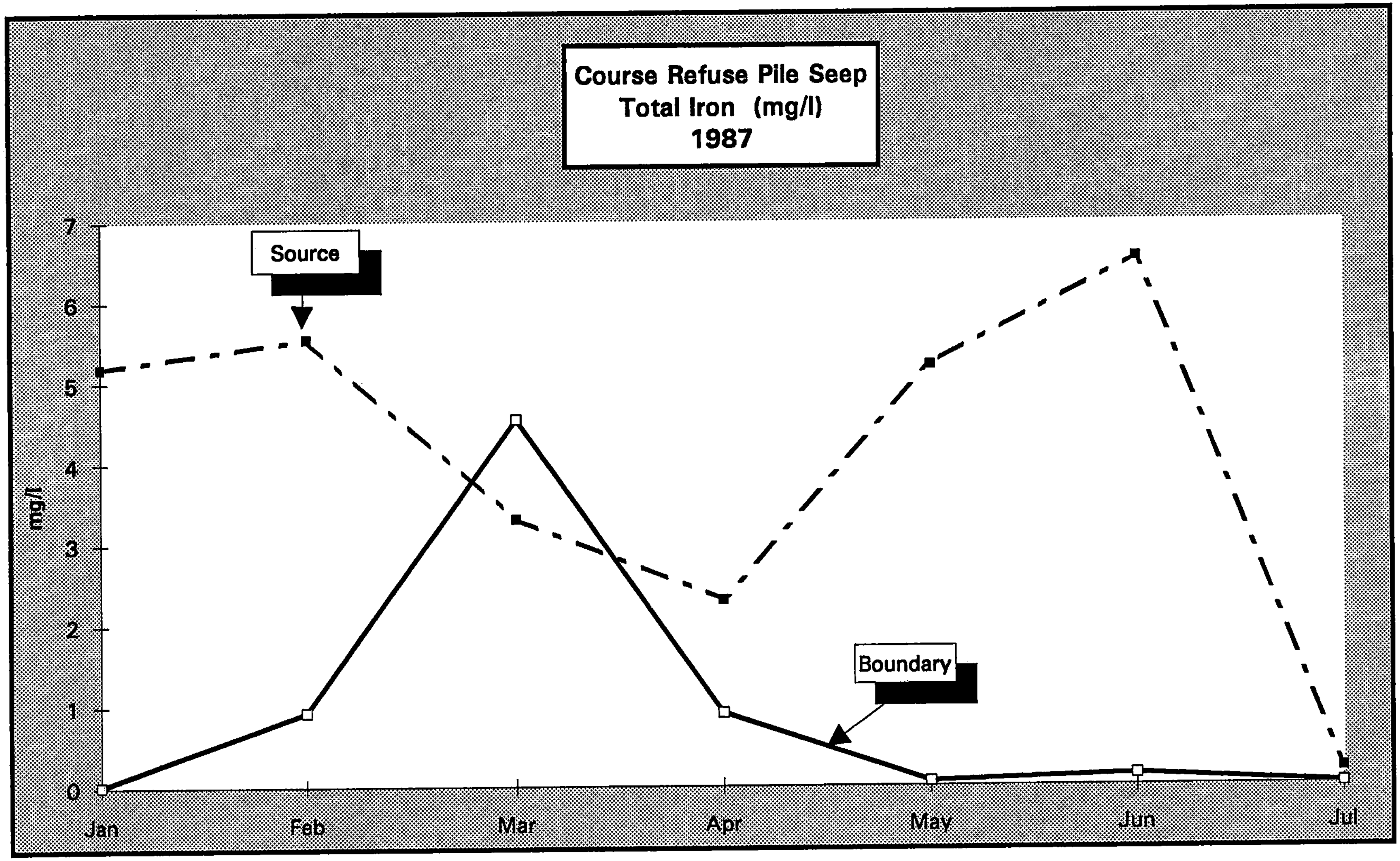
Vegetation in the area of the seep and along its water course is lush. Consequently the levels of iron existing in the seep can not be viewed as being toxic to the vegetative species adapted to the immediate area. Toxicity to wildlife would be difficult to determine, however the gully is utilized by wildlife (including a small herd of deer) without any apparent adverse effects. As documented in this report, an iron concentration greater than 1 mg/l, which is evident 100% of the time at the source and approximately 50% of the time at the boundary, could be toxic to fish.

Total Dissolved Solids

Total Dissolved Solids (TDS) consist of inorganic salts, dissolved metals and small amounts of organic matter. Salinity, although not precisely the same as TDS, is related to it. For most purposes, the terms TDS and salinity are equivalent. The principal inorganic anions dissolved in water include the carbonates, chlorides, sulfates and nitrates; the principal cations are sodium, potassium, calcium and magnesium.

All species of fish and aquatic life will tolerate a range of TDS concentrations in order to survive

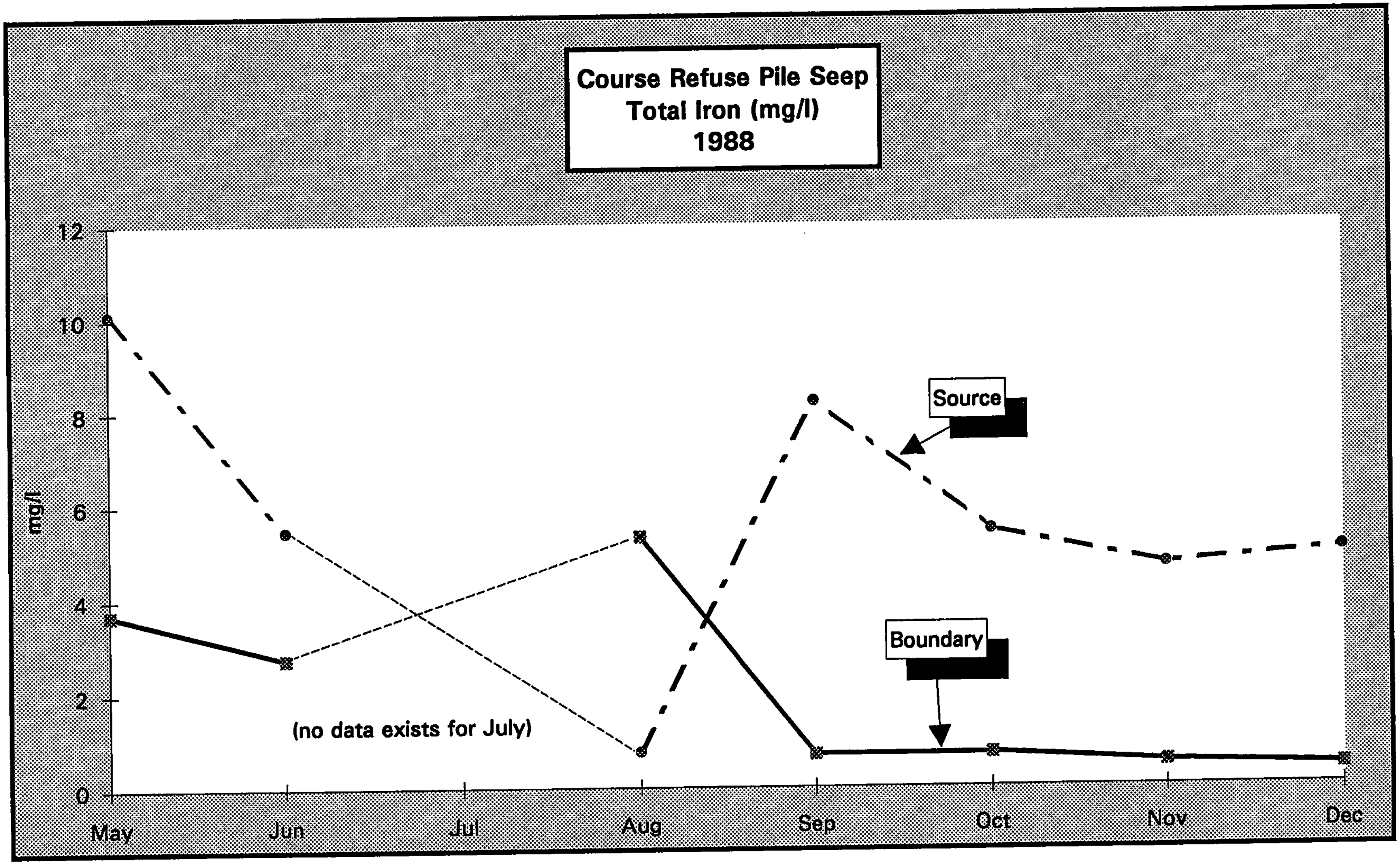
FIGURE 1



SUNDATA1.XLS Chart 1

ECKHOFF, WATSON and PREATOR ENGINEERING

FIGURE 2



SUNDATA1.XLS Chart 2

ECKOFF, WATSON and PREATOR ENGINEERING

in natural conditions. Past studies indicate that whitefish and perch will survive TDS concentrations of 15,000 mg/l, while the stickleback will survive concentrations of 20,000 mg/l.

The National Academy Of Science has determined that 2500 mg/l TDS is a median value for irrigation water for crops with a moderate salt tolerance. The State of Utah has set a Standard for TDS for waters designated for agricultural use at 1200 mg/l with the stipulation that limits may be adjusted on a case by case basis.

The amount of sodium and the percentage of sodium in relation to other cations is important. Sodium is toxic to certain plants, and frequently causes problems in soil structure, infiltration and permeability rates. A high percentage of exchangeable sodium in soils containing clays that swell when wet can cause a soil condition adverse to water movement and plant growth. The exchangeable sodium percentage (ESP) is an index of the sodium content of soils. An ESP of 10% to 15% is considered excessive if a high percentage of swelling clay material is present. The sodium adsorption ratio (SAR) tolerance for general crops and forages is in a range from 8 to 18.

Range cattle in the western United States may get accustomed to highly mineralized water and can be seen in some places drinking water which contains nearly 10,000 mg/l of dissolved solids (3). To be used in such high concentrations these waters must contain mostly sodium and chloride. Waters containing salts of sulfates, potassium or magnesium are much less desirable. Some investigators have established an upper limit of 5,000 mg/l TDS for water to be used for livestock (3).

TDS at the seep's source falls in the range of 5000 - 6000 mg/l. TDS at the boundary is essentially the same. This level of TDS has not had an apparent adverse effect on the wildlife and vegetation species adapted to the area. TDS in the range of 5000 - 6000 mg/l is well below the 15,000 mg/l level determined to be survivable by whitefish and perch.

Coarse Refuse Seep

The water emerging from the base of the coarse refuse pile has two possible sources. Water trapped in the alluvium under Grassy Trail Creek could be flowing over the Mancos Shale and through faults, cracks, joints or other pipes to emerge under the refuse pile. The other source could be water from the east slurry cell infiltrating through fill material to the coarse refuse pile.

SCA has proposed to accomplish the following to help control the waters associated with the seep:

1. The use of the east slurry cell as a slurry dewatering pond will be discontinued to try and dry-up the seep.

2. A sediment pond will be designed and constructed and polymer flocculents will be used to aid in the settlement of solids. Design of the sediment basin and water treatment methods will be approved by DOGM prior to construction.

Bibliography

1. American Water Works Association, Volume 4: Introduction to Water Quality Analyses, Principles and Practices of Water Supply Operations: *Denver, CO, 1982.*

2. *Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,* U.S. Department of the Interior Bureau of Reclamation, September, 1981.

3. Hem, John D., Study and Interpretation of the Chemical Characteristics of Natural Water Second Edition, Geological Survey Water-Supply Paper 1473, United States Government Printing Office, Washington, 1970.

4. United States Department of the Interior, Bureau of Mines, "Volume I: Mine Water and Mine Waste," *Mine Drainage and Surface Mine Reclamation:* Pennsylvania, 1988.

5. United States Environmental Protection Agency, Office of Water Planning and Standards, Dissolved Solids: Water Quality Standards Criteria Digest, A Compilation of State/Federal Criteria, Washington, 1979.

6. U.S. Federal Water Pollution Control Administration, 1968 Report of the committee on water quality criteria: Washington D.C., p. 234.

7. Utah Water Pollution Control Committee, Wastewater Dipsoal Regulations, Part II, Standards of Quality for Waters of the State, State of Utah Department of Health, Division of Environmental Health, Utah 1988.