PETROTOMICS COMPANY

QUALITY ASSURANCE
FOR
RADIOLOGICAL MONITORING PROGRAMS

JULY 10, 1980

Petrotomics Company recognizes the need of quality assurance in effluent and environmental monitoring. To assure that radiological monitoring measurements are reasonably valid, we have found it necessary to establish quality assurance programs. These programs are needed for the following reasons:

(1) To identify deficiencies in the sampling and measurement processes so that corrective action can be taken, and,

(2) To obtain a measure of confidence in the results of the monitoring programs in order to assure the regulatory agencies and the public that the results are valid.

The program makes use of standard sampling and analytical procedures whenever possible. All phases of sample collection, preparation, analysis, and reporting are documented. A general description of our quality assurance program follows. Specific detailed information is kept on file in our office should more information be required.

QUALIFICATIONS OF PERSONNEL

All personnel performing any work on a sample, either collection or analysis, are instructed in the proper procedures to use. At the same time, quality on all work is stressed and is tested on a regular basis.

OPERATING PROCEDURES AND INSTRUCTIONS

Written procedures have been prepared for all aspects of the monitoring program. They are readily available for all personnel conducting work in the program.

RECORDS

Records are kept on every aspect of the monitoring program. Log books are maintained for all instrument checks, all spikes and blanks run on a particular analysis, and all balance checks. Date sheets are maintained on all analyses performed and on all standard solutions prepared.

SAMPLING PROCEDURES

a. Air Particulate Sampling
Low volume air samplers by General Metal Works are used for continuous monitoring at our specified sites. Filters are changed on a weekly basis and composited quarterly.

b. Radon Sampling
Sampling is conducted for at least one week per month with a continuous monitor, Eberline's RGM-2, at all sites. Two sites, the townsite and the motel rooms, are monitored throughout the month.

c. Groundwater Sampling
A grab sample is obtained from all locations. A bail type water sampler is used for the five tailings wells. At the townsite and mine shop, a sample is obtained from the raw water spigot at the pump house.

d. Surface Water
A grab sample is obtained from all sites. The sample is taken from the most accessible point. In the winter some of these samples cannot be obtained as the entire body of water is frozen.

e. Vegetation
A representative grab sample is obtained for all sites. A square meter is marked out at the site and some of all the major vegetative forms are composited for the sample.

f. Soil
A grab sample, consisting of ten composited cores, from a depth of 6" is taken from each site.

g. Sediments
The same procedure is used for sediment collection as for soil collection.

h. Direct Radiation
Direct radiation is being measured by Eberline's TLD spheres. These are suspended on a chain on each monitoring station.

MAINTENANCE OF SAMPLE INTEGRITY

a. Filters
All filters are maintained in envelopes to prevent them from damage until they are analyzed.

b. Water Samples
Water samples are acidified with HNO_3 acid to preserve the sample. A portion of each water sample is removed before acidification and sent to a contract lab for measurement of non-radiological parameters.

c. Vegetation
Vegetation samples are weighed to obtain a wet weight and then frozen until used.

RADIONUCLIDE REFERENCE STANDARDS

All standards used for calibration or quality control are NBS traceable with certificates of assurance on file. The preparation of all working standards is recorded and kept on file.

PERFORMANCE CHECKS ON RADIATION MEASUREMENT SYSTEMS

a. The atomic absorption unit used for measuring several of the non-radiological parameters is calibrated with known standards every time it is used and every time the operating lamp is changed.

b. Cesium-137 and Polonium-210 sources are used to calibrate the low background proportional counter. It is checked each day with the sources for instrument malfunction. Cross-talks and efficiencies are checked weekly for plateau shifts. Background is checked a minimum of weekly.

c. A radium-radon source will be used in checking the scintillation systems. Instrument response will be checked daily with the plateau being rerun at least quarterly.

d. The Lucas' cells used for radium and radon counting will be checked for efficiency monthly.

e. The alpha-gamma spectroscopy system will be checked periodically for gain and other major adjustments. Channel calibration is checked every time the instrument is used.

INTRALABORATORY ANALYSES

With every set of samples analyzed for a particular radionuclide there is at least one blank and one spiked or replicate sample run. At certain times an unknown spiked sample will be analyzed in the lab.

INTERLABORATORY ANALYSIS

Periodically samples will be taken in duplicate or split to be submitted to independent laboratories. This will serve as a cross-check on our results as well as evaluating the quality of the independent lab.

Our laboratory is also participating in the EPA's Environmental Radioactivity Laboratory Intercomparison Studies Program. This will serve as an objective measure of the quality of our analyses for the radionuclides the program covers.

Q.C. FOR CONTINUOUS EFFLUENT MONITORING SYSTEMS

a. Air Samplers will receive a minimum of quarterly calibration. Calibration will be performed as per instructions received from General Metal Works.

b. The RGM-2 systems will be calibrated as per instructions received from Eberline.

c. TLD's used for direct radiation measurements will be analyzed by Eberline. Therefore, calibration will be conducted by Eberline or by us if so instructed.

AUDITS

Internal periodic audits will be conducted on all work. In addition an annual audit will be conducted by an independent knowledgable source.

LABORATORY METHODS

a. Non-Radiological Constituents
Non-radiological constituents will be analyzed according to procedures listed in Standard Methods for the Examination of Water and Wastewater, 14th Edition or procedures otherwise approved by the EPA.

b. Uranium-fluorometric
The sample will be dried and fused with a sodium-lithium fluoride flux agent. The pellet formed will then be read in a fluorometer and the amount of uranium determined from a line graph.

c. Uranium - UA-3 Scintrex
The sample is placed in a cuvette, mixed with a buffer and readings are obtained. The data is used in a proportional type equation to calculate the amount of uranium present.

d. Uranium-colorimetric
A bromo-PADAP coloring reagent is mixed with the sample in the preparation stage. The readings taken from the colorimeter are applied to a straight line graph to obtain the amount of uranium.

e. Radium-226
The radon emanation technique is used to obtain Ra-226 readings. With a few modifications the procedure is that listed in the NTIS publication PB-253 258, Interim Radiochemical Methodology for Drinking Water.

f. Thorium-230
Throium-230 is analyzed for in methodology adapted from Claude Sills. The sample is concentrated, extracted with an Aliquat-336 mixture, clarified and electroplated on stainless steel discs. It is then counted in an alpha spectroscopy system and calculated.

g. Lead-210
Lead is concentrated, extracted in an Aliquat-336 mixture, separated from bismuth-210, decayed to bismuth-210 over a known time span and filtered. The bismuth-210 on the filter is counted in a proportional counter and back calculated to the amount of lead-210 present. The procedure is adapted from the HASL manual.

h. Polonium-210
Polonium is analyzed for following the procedure listed in the HASL manual. The sample is counted in the proportional counter.

i. Sample Preparation
All sample preparations for solid samples, filters, soils, vegetations, involve known leaching and digesting techniques. They all use a combination of acids with nitric acid being of primary importance. After digestion, leaching and/or filtration, the liquid is diluted to a known volume for analysis.

LOWER LIMITS OF DETECTION

At this time our laboratory is not yet operational. Because of this several key factors used in calculating LLD values are not known for our circumstances. We would, therefore, like to defer submitting actual LLD values until we become operational. There are no problems anticipated in being able to meet the LLD values listed in Regulatory Guide 4.14, Revision 1, "Radiological Effluent and Environmental Monitoring at Uranium Mills."

CONTRACT LABORATORIES

At the present time Petrotomics contracts with laboratories for stack sampling and analysis of samples for non-radiological parameters, such as iron, arsenic and selenium. Enclosed are copies of the procedures and quality assurance programs both laboratories maintain. Kumpe and Associates, P.C. performs stack sampling and Environmental Assays Laboratory (now Energy Analytical Laboratory) performs analysis for non-radiological parameters.

ENVIRONMENTAL ASSAYS LABORATORY

826 East A Street
Casper, Wyoming

ENVIRONMENTAL ASSAYS QUALITY ASSURANCE PROGRAM

Environmental Assays Laboratory analyzes samples in accordance with the accepted methods as presented in Standard Methods for the Examination of Water and Wastewater, 14th edition, 1975, APHA, AWWA; Methods for Chemical Analysis of Water and Wastes, 1979, USEPA; and ASTM Standards, part 31, water, American Society for Testing and Materials. Environmental Assays employs only recognized soil science techniques such as those approved by the American Society of Agronomy.

Environmental Assays Quality Assurance Program is designed to comply with the criteria set forth in the Handbook for Analytical Quality Control in Water and Wastewater Laboratories, USEPA, 1979, in order to assure that accurate and reliable results are obtained in the laboratory during the sample analysis procedure.

All instruments used in analysis have a daily maintenance and calibration schedule. A current service contract is in effect on our Mettler HL-32 balance as well as our IL-257 Atomic Absorption Spectrophotometer. Chemicals are dated upon receipt of shipment and replaced as needed or before shelf life has been exceeded. All instruments are standardized and optimized whenever any analytical measurement is made.

Quality control checks for each analytical run include:

1) A calibration curve composed of a minimum of a reagent blank and three standards. Subsequent calibration curves must be verified by use of at least a reagent blank and one standard at or near the highest calibration standard. Daily checks must be within $\pm$ 5% of the original curve.
2) A known reference sample supplied by the EPA is analyzed daily for the parameter measured. The measured value should be within the control limits previously established for that parameter. If problems arise, they are corrected and a followup preformance sample is analyzed.
3) At least one duplicate sample is run every 10 samples or with each set of samples to verify precision of the method. In addition at least one spiked sample is run every 10 samples to determine the % recovery of the method.

4) Quality control charts or a tabulation of mean and standard deviation are used to document validity of data on a daily bases.

Environmental Assays Laboratory is recognized and certified by the USEPA and Welcomes this opportunity to serve you and invites your audit and inspection of its facilities.

ENVIRONMENTAL ASSAYS LABORATORY

Bill Betters

W.L. Betters, Owner

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July 8, 1980

Kumpe and Associates, P. C. maintains a Quality Assurance Program that meets or exceeds the standards set by the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3, Stationary Source Specific Methods of the U. S. Environmental Protection Agency, EPA-600/4-77-027B, August 1977.

All methods, procedures, calibration records and logs, laboratory logs, and analysis of samples follow the procedures outlined in the Quality Assurance Handbook, which was published by the U. S. Environmental Protection Agency. A copy is on file at our office at 341 East "E" Street, Suite 185, Casper, Wyoming.

Source sampling procedures and methods are followed according to Title 40, Part 60, Methods 1 - 5 for Source Sampling for Stationary Sources.

Bruce A. Hinchey
Vice President - Air Quality
Kumpe and Associates, P. C.

Part 25 B.2

The rational for selection of the locations, depth, and perforated zone for wells RTH 4 and RTH 5 is essentially to monitor the groundwater south of the mill. A report dated May 5, 1977 from Petrotomics Company to Mr. L. C. Rouse, NRC, with cover letter dated May 6, 1977, discusses groundwater and monitor wells. A portion of this report is attached.

In a letter dated 10 May 1977 from J. N. Coombes, Corps of Engineers, to Mr. J. D. Kane, NRC Site Technology, the monitor wells are again mentioned.

"Since the groundwater flows southward, need for observation wells to monitor radioactivity in groundwater to the south of the reservoir should be investigated."

Finally, in a letter dated September 2, 1977 from Getty Oil to Mr. L. C. Rouse, NRC, the location of RTH 4 and RTH 5 was finalized. Copies of this letter are attached. The locations referenced in comment 1. c) are the present locations of RTH 4 and RTH 5 and appear to have been agreed upon by Getty, Corps of Engineers and NRC.

C. UPSTREAM PROTECTION

The proposed increase in the height and size of the dam does not include upstream rip rap or other protection because the prevailing winds and corresponding wave action are directed against the impounded tailings to the east and not against the impounding structure. Fourteen years of history have shown no problems in this area. The proposed structure will also be of such mass relative to the erosional effects of wave action that ample time will be available for corrective action if results from the monitoring program should indicate there is a problem in this area.

D. GROUNDWATER DISCUSSION

The data gathered to date for determining the water table in the immediate site area substantiate the general data presented by Harshman.[1] The three existing monitor wells show the water table to be at an elevation of 6960 feet. This depth places the water table approximately 65 feet beneath the lowest point in the site area.

The additional data that will be developed with the proposed new monitor wells will further aid the knowledge of the water table elevation in the site area.

The underground flow direction of the aquifer is generally south, possibly southwest at the immediate site and turning back to the south-southeast near the Petrotomics property boundary.

E. MONITOR WELLS

The existing three monitor wells will be maintained. Two new wells placed near the south property line will substantiate the water quality that is shown in the permeability section. (See Section I, Part K)

The site area is approximately one mile northeast of the closest Petrotomics property line. (See property map, Figure 2)

The total of five monitor wells should provide an adequate system for analysis and warning of any impending problems.

The procedures for sampling and measuring the monitor wells will be the same as in Part IV, "Tailings Effluents Monitor Wells", as described in our Source Material License. The procedures are as follows:

a. Equipment: Solution sample containers of approximately one gallon capacity. Solution sampling bomb. Windup reel of sash cord.

(1) U.S.G.S. Professional Paper 745, 1972.

b. Measurements: None available for volume or flow excepting possible depth to solution at seepage areas and geological reports. Assays sought for radium 226, thorium 230, and natural uranium.

c. Location: Samples are collected from seepage wells placed at geologically strategic points around tailings disposal area.

d. Frequency: Samples are collected semi-annually within each yearly period.

e. Justification: Determination of possible radioactive contamination of tailings effluents leaving restricted area via underground seepage.

f. MPC: Radium 226 3 uc x 10^{-8}/ml.
Thorium 230 2 uc x 10^{-6}/ml.
Natural Uranium 3 uc x 10^{-5}/ml.

g. License: CFR 10, Part 20, Section 20.105, 20.106, 20.302, and 20.303.

h. Corrective Measures: If MPC is exceeded, correction should be to immediately locate the source of seepage and seal with bentonite or other suitable material. Other measures may be necessary dependent on the situation.

F. LIQUID EFFLUENT QUANTITY DETERMINATION

The historic average quantity of water released into the tailings retention system was 275 GPM for a nominal 1100 TPD operation. The planned 1500 TPD operation will release about 375 GPM into the system. This amount calculates to 564 acre-ft/year.

The estimated quantity of liquid recycled in the past has been 20 GPM average, which is equivalent to 30 acre-ft/year. No allowance has been made for the possible increase in quantity of recycled liquid concurrent with the increased mill capacity.

The table on page 1 of Section I detailed the year by year liquid storage volumes and elevations, allowing for evaporation and recycling.

G. SOLID WASTE VOLUME

The nominal 1500 TPD production rate will require storage of 1653 acre-ft. total in 7 years, based upon nominal designed operating capacity and a tonnage factor of 1.65 tons/cu. yd. The surface area above the 7085 ft. elevation is 26 acres and will store 650 acre-ft. of solid wastes when deposited an average of 25 ft. in depth. The remainder will raise the pool elevation by 3.3 ft. at the end of five years. (These figures are based upon a sealed system with no leaks and a conservative evaporation rate.)