WASTE WM-35

PREOPERATIONAL ENVIRONMENTAL DATA COLLECTION PROGRAM

AURORA JOINT VENTURE PROJECT

PLACER AMEX INC.
Suite 2500
One California Street
San Francisco, California 94111

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SAMPLE POINT DESIGNATION KEY

The maps (Figures 1 and 2) included after the text of this document show the tentative locations of sample points and general study areas. A uniform system of sample point designations has been used in the data collection programs to provide for continuity between the disciplines. The system of sample point designation is described below, and should be referred to when reviewing the programs both in the narrative and Tables 1 through 6. The following codes have been used:

Non-Radiological Sample Codes

SWD* - QC	= Surface Water Drainage - Flow and Chemistry
SWD* - SM	= Surface Water Drainage - Bed Material
GWT - QC	= Ground Water Tailings, Flow and Chemistry
GWM - QC	= Ground Water Mine, Flow and Chemistry
GWS - C	= Surface Water Impoundments Chemistry
AU1 - AQ	= Aurora Air Quality
AU1 - MET	= Aurora Meteorology
SSC -	= Surface Soil Chemistry
SBSC -	= Subsurface Soil Chemistry
SWD* - AB	= Surface Water Drainage - Aquatic Biology

Radiological Sample Codes

SWD* - QR	= Surface Water Flow and Radiology
SWD* - BMR	= Surface Water Bed Material Radiology
GWT- QR	= Ground Water Tailings, Flow and Radiology
GWS - R	= Surface Water Impoundments Radiology
APR -	= Air Particulates Radiology
RN -	= Radon
RDF -	= Radon Flux
GDR -	= Gamma Dose Rate
SSR -	= Surface Soil Radiology
SBSR -	= Subsurface Soil Radiology
SWD* -ABR	= Aquatic Biology Radiology
OR - VSL	= Oregon Vegetation Above Ground (Stems and Leaves)
OR - VR	= Oregon Vegetation Below Ground (Roots)
ALF -	= Alfalfa
CTL -	= Cattle

SWD* - See numbered Surface Water Drainages in accompanying list

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Surface Water Drainages

	Sample Designation (SWD* -)	Location
1.	BM1	Bretz mine drainage above Aurora Mine, OR
2.	BM2	Bretz mine drainage below Aurora Mine, OR
3.	CC3	Cottonwood Creek above confluence to Indian Creek, OR
4.	IC4	Indian Creek above Cottonwood Creek, OR
5.	IC5	Indian Creek at mouth, below Cottonwood Creek, OR
6.	MC6	McDermitt Creek above Indian Creek, OR
7.	MC7	McDermitt Creek (at USGS station), NV
8.	AC8	"A" drainage below tailings area, OR
9.	PC9	"P" drainage below plant site, OR
10.	QR16	Quinn River near Hoppin Ranch, NV
11.	OC19	Oregon Canyon Creek above McDermitt Creek diversion, OR

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SECTION I

INTRODUCTION

1.1 General

This document provides a summary of Placer Amex Inc.'s plans for implementing an integrated environmental baseline data collection program for the Aurora Joint Venture in Malheur County, Oregon. The Aurora Joint Venture will incorporate an acid leach uranium milling operation for the production of yellowcake. Preliminary planning indicates that a mill processing rate of approximately 3,000 TPD will be utilized. The uranium ore is low grade (containing approximately 0.05% U_3O_8) and will be mined by open-pit methods from uranium mineralization that occurs at or near the volcanic-lakebed contact of the McDermitt Caldera. Field data collection for the environmental baseline activities were initiated in the second quarter of 1979 and will continue as necessary to acquire a minimum of one year of baseline information.

1.2 Purpose

This program-planning document has been prepared by Placer Amex Inc., and their consultant, VTN Consolidated, Inc., for the purpose of informing and advising all Federal, State and local agencies with jurisdiction by law or special expertise of the nature and scope of the baseline data activities proposed to be undertaken in the Aurora project area, and to solicit their comments, suggestions and cooperation on the proposed environmental data collection program. The program designs, as proposed herein, are subject to modification and revisions, where appropriate, as additional data becomes available from initial investigations.

This planning document is specifically directed toward environmental baseline data collection activities related to mill and tailing impoundment licensing requirements. As such it does not include those other geological and engineering investigations which must, of necessity, be conducted to fully define the mineral resources of the area and determine the technical and economic feasibility of developing those resources.

1.3 Program Objectives

The primary objective of the program described herein is to develop a comprehensive synoptic and representative picture of environmental conditions that exist at the Aurora project area prior to any development. This baseline data collection program is designed to obtain a body of information representative of the site at the time of study, and will be conducted by techniques reproducible in precision and accuracy in future studies. The data collection and environmental monitoring activities will be conducted through at least an initial one year period.

The program to be conducted includes:

(i) Preliminary Environmental Investigations

(ii) Environmental Baseline Data Collection Program, comprised of the following elements:

- o Surface Water Hydrology and Quality
- o Ground Water Hydrology and Quality
- o Meteorology and Air Quality
- o Land: Geology and Soils
  Land Use and Demographic Surveys
  Ecology
- o Radiological Surveys
- o Cultural and Paleontological Resources

The program will provide a baseline for:

(i) documentation of the existing environmental conditions.

(ii) a continuing verification of compliance with provisions of permits and applicable environmental protection and pollution control requirements;

(iii) detection of any project-related detrimental effects and conditions requiring correction.

The proposed Environmental Baseline Data Collection Program may be supplemented or modified in instances where analyses of data indicate such changes would be desirable.

1.4 Permits and Approvals

All necessary permits and approvals will be obtained to conduct the proposed environmental program. These include any necessary special use permits as well as approvals for disposal of any solid wastes or debris; monitoring site preparation, restoration of disturbed areas; biological collecting, and archaeological and paleontological survey activities. All necessary applications will be made and appropriate approvals will be obtained from Federal, State and local agencies as applicable to the proposed baseline data collection activities.

SECTION II

PROJECT LOCATION AND DESCRIPTION

2.1 Project Location

The Aurora Joint Venture area is located in the extreme southern portion of Malheur County, Oregon, approximately 10 miles west of the town of McDermitt, Nevada. Specifically, the project area includes all or portions of sections 3, 4, 9, 10, 15, 16, 21 and 22 of T. 41 S., R. 41 E. The location of the site in relation to the surrounding area is indicated in Figure 1.

2.2 Project Area

The general boundaries of the project area of interest, with relation to the proposed environmental baseline program, include portions of the Cottonwood, Indian and McDermitt Creeks, as well as the Quinn River drainage. The proposed environmental program will focus primarily on the above-named areas, as well as the nearby town of McDermitt. The initial study area boundaries may possibly be expanded or contracted as the study effort proceeds and additional information becomes available. A detailed topographic map showing site specific monitoring locations is included as Figure.2.

SECTION III

PREOPERATIONAL ENVIRONMENTAL PROGRAMS

In developing the Aurora Joint Venture site specific environmental programs, the U.S. Nuclear Regulatory Commission's Regulatory Guide 3.8, Preparation of Environmental Reports for Uranium Mills, was followed as a framework for the presentation. The U.S. Nuclear Regulatory Commission Draft Generic Environmental Impact Statement (NUREG-0511) and other appropriate NRC and EPA regulatory guides were consulted in developing all disciplinary programs contained herein.

3.1 Surface Water

The data from the hydrologic program will be utilized in estimating the general flow contributions of streams in the region. The data obtained will be sufficient to characterize the seasonal quality and distribution of flows in the streams that might be affected by any proposed development at the site. In addition, the data will define and quantify the existing surface water resources in the project area prior to any development and will provide data pertinent to the stream carrying capacities and the design of waste retention structures that might ultimately be required.

3.1.1 Surface Water Hydrology

The surface water preoperational program will consist of both hydrologic and water quality programs.

The surface hydrology program proposes that stream flow data be acquired on principal streams (both perennial and ephemeral) which drain areas that could be affected by development of the project.

The existing USGS streamflow gaging station on McDermitt Creek will provide hydrologic data on the McDermitt Creek drainage. A simultaneous hydrologic gaging program will be conducted above the USGS station, as well as at the Indian and Cottonwood Creeks which are perennial in nature. The data that will be acquired at the stations shown in Figures 1 and 2 will augment the existing data base.

All data collected will be used to 1) describe the surface hydrology regime in the project area and provide data useful for facilities design, 2) interface the surface water program with the proposed aquatic biological program and 3) provide a means of correlating drainage characteristics throughout the project study area.

3.1.2 Surface Water Quality

The existing non-radiological and radiological water chemistry (soluble), bed material radiological and chemical composition, and suspended sediment loads of the local perennial and ephemeral streams will be defined. Consideration will be given to existing fisheries and agricultural use of waters which might be affected by the proposed activities, as required by the U.S. NRC's Regulatory Guide 3.8.

The objectives of the surface water quality program will be to characterize both the non-radiological and radiological (see Tables 1 and 2) chemistries of streams, and to define the seasonal variations in response to changing flow conditions during a one-year period. The non-radiological constituents to be determined include the common list of major parameter groups which include trace metals important to the aquatic habitat (see Table 3). Bed material samples will be collected and analyzed for lightly adsorbed constituents (see Table 4).

Water quality samples will be collected and analyzed monthly for radiological parameters. Samples will be collected and analyzed quarterly for non-radiological constituents. All samples will be preserved and

transported to appropriate laboratories as rapidly as possible to assure accurate and representative analysis. Sampling locations are shown on Figures 1 and 2.

Because the streams are subject to seasonal high flows the chemical and sediment sampling program has been timed to coincide with those events as closely as possible. Bed material samples will be collected from selected monitoring locations (see Figures 1 and 2) twice during the one-year program coinciding with high and low flow periods. The bed material samples will be analyzed for both non-radiological (see Tables 1 and 4) and radiological (see Table 2) constituents.

3.2 Ground Water

The location of ground water with respect to proposed milling and tailing disposal activities is important for the assessment of impacts on water quality and quantity within potentially affected aquifers.

The preoperational ground water program will include both regional and site specific investigations. Regionally, identification of the location, nature and quantities of ground water will be established. Present and future uses of ground water within ten miles will be assessed.

A description of the major aquifers will include water level contour maps, hydraulic gradients, storage coefficients and other applicable hydrogeologic parameters.

Within the project site area a description of local aquifers will include the above-mentioned parameters as well as definition of depth to ground water, potential recharge areas, ground water gradients, seasonal variation of water levels, chemical and radiological properties, and identification of ground water users in the area.

Samples will be withdrawn from an array of existing and proposed ground water monitoring wells as well as stock watering tanks within the immediate area. Samples will be analyzed for both chemical and radiological parameters as detailed in Tables 1 and 2, respectively.

3.3 Air

3.3.1 Meteorology/Air Quality

The non-radiological air/meteorology preoperational program will consist of a continuous mechanical weather station in close association wih a high volume air sampler. This station will record detailed information (wind speed, wind direction, temperature and barometric pressure) necessary to assess air movements as well as document suspended particulate baseline conditions in the site vicinity.

Climatic conditions at the site will be determined to predict the air quality impacts associated with the project operation and also for use as data input for modeling of site emissions, if the U.S. EPA Prevention of Significant Deterioration of Air Quality (PSD) regulations apply to the project.

Precipitation data will be collected from current and past records of the McDermitt Cooperative Weather Station located at elevation 4527'. Upper air data as well as barometric pressure and relative humidity data will be gathered from current and past records of the Winnemucca weather station located approximately 80 miles due south of McDermitt at an elevation of 4297'.

Non-radiological air quality data will also be collected at the Aurora location on the EPA-prescribed every sixth day schedule throughout the year (see Table 1).

The radiological air quality program will consist of an array of Lo-Volume air samplers, gaseous radon monitors, and radon-flux sampling stations. The particulate air samplers will measure ambient concentrations of airborne particulate radionuclides and the radon monitors will establish baseline concentrations of gaseous radon in the atmosphere. Additionally, flux measurements will further detail the soil/atmosphere interface concentrations of radon.

Radiological air particulate data will be collected continuously in conformance with NRC preoperational requirements (see Table 2).

3.4 Land

3.4.1 Geology and Soils

The preoperational regional geology data program will include collection of data necessary to describe the major geologic aspects of the site and its environs in terms of stratigraphy, structure, tectonic history, regional continuity of strata, and will also include an inventory of economically important minerals and energy-related deposits, if any, within 10 miles of the site area.

The preoperational site specific geology data program will include a description of detailed stratigraphy, structure and tectonics based on borehole information and present the data on a surface geologic map and appropriate cross-sections.

The preoperational site specific soil data program will include identification of surface soil types and subsoil profiles. The non-radiological samples will be collected by soil series and will be analyzed for organic and inorganic parameters (Tables 1 and 6).

The radiological surface soil sampling (Table 2) will cover the general vicinity of the mill and tailings disposal areas. Surface soil

sampling will be conducted in 300 meter intervals in eight directions from the center of the activity areas and cover the entire site vicinity. In addition, surface soil samples will be taken at air particulate sample locations. Subsoil profiles are to be sampled at 750 meter intervals in four directions from the center of the activity area.

3.4.2 Land Use and Demographic Surveys

The preoperational data gathering program for this discipline will be performed to assess the community impacts associated with the operation and to provide a planning tool to minimize adverse impacts of both a primary and secondary nature.

One of the principal data sources for the socioeconomic baseline study is the 1970 Census of Population and Housing. The Census reports from which data has been obtained for the baseline study include:

- o 1970 Census of Population: Number of Inhabitants
- o 1970 Census of Population: General Population Characteristics
- o 1970 Census of Population: General Social and Economic Characteristics
- o 1970 Census of Population: General Housing Characteristics
- o 1970 Census of Population: Detailed Housing Characteristics

Census data collection efforts will center on the communities of Winnemucca, Orovada and McDermitt since they may be most affected by the project. The information withdrawn from the census reports includes data for the States of Nevada and Oregon, Humboldt and Malheur Counties and the rural farm and non-farm population in both counties. Identifying the differing characteristics of the rural farm and non-farm population is essential to the study because these people comprise the population of the town of McDermitt and surrounding areas. The socioeconomic variables to be addressed include:

Population	Housing
Employment--status occupation industry	Value
Income	Rents
Poverty	Structure--type
Age	Structure--age
Sex	Year moved in
Race	Tenure
Residency	Size of unit
Place of Work	Household size
Education	Crowding
	Condition

Because census data is nine years old, state and local agencies in Oregon and Nevada will be contacted to compare the 1970 data with social conditions which currently exist.

Information describing economic conditions in Malheur and Humboldt Counties will also be obtained. The sources for this information are as follows:

1974 Census of Agriculture
1976 County Business Patterns
Oregon and Nevada Employment Security Departments
- Economic Update
- Labor Force Summaries
- County Establishment Based Industrial Employment

1979 Malheur and Humboldt Counties Datafile

The project's location near the Oregon-Nevada border indicates that its economic impacts will probably occur in both Malheur County, Oregon and Humboldt County, Nevada. Therefore, comparable data will be collected for these two counties and the two states. Basically, the data will provide a basis for making an assessment of the contribution different industrial activities make in the local communities (by employment and wages). The agricultural census uses both 1969 and 1974 data to identify significant changes that have occurred in the agricultural industry of the region, especially in Humboldt County.

Another set of information that will be collected for the project includes reports which have outlined existing social conditions on the Fort McDermitt Indian Reservation. These reports include:

Department of the Interior, Bureau of Indian Affairs
Information Profiles of Indian Reservations in Arizona, Nevada and Utah
Department of Commerce
Federal and State Indian Reservations and Indian Trust Areas

The remainder of the information needed to complete the socioeconomic data collection study are data to be obtained in the field by interview. This information includes updating community social characteristics, identifying social problems, and fully describing existing public facilities and services and economic conditions. Information will be solicited from local industry and community leaders as well as appropriate local officials.

3.4.3 Ecological Parameters

The overall objective of the ecological studies is to identify important plant and animal species in the project area and to describe their distribution and ecological relationships with particular attention to food web interactions.

Samples will be taken of gamefish, cattle, and alfalfa grown locally in the project area for radiological analysis (see Table 2). Emphasis will be placed on those plant and animal species which directly or indirectly are associated with man's diet.

Information on the vegetation and wildlife of the project area will be gathered through literature review, discussions with agencies and other knowledgeable parties, and field surveys. Literature review will

identify and examine pertinent information currently available on the project area and on the important project area plant and animal species. The Oregon Department of Fish and Wildlife, the Nevada Department of Fish and Game, the U.S. Bureau of Land Management and U.S. Fish and Wildlife Service (USFWS) offices in both states will be contacted for information on plant and animal species, livestock use, forage value and habitat condition in the project area.

Non-radiological vegetation and wildlife field studies will be conducted in both Oregon and Nevada (see Table 1). The studies will concentrate on the following activities:

- Inventory plant species on and adjacent to mine and potential mill sites
- Survey for endangered or threatened (USFWS) plant species on and adjacent to project site
- Perform quantitative vegetation studies (species abundance and percent cover) on and adjacent to the project site
- Make ecological observations of vegetation condition, stage of succession, and historic disturbance in the project area
- Map major vegetation communities in the project area
- Map areas of crops in the vicinity (5 km) of the project area
- Inventory wildlife species, including fish, and identify important species, including endangered, threatened or unique species

- Conduct seasonal observations on habitat utilization, distribution and relative abundance of wildlife species, including fish

- Make ecological observations on wildlife habitat quality, including stage of succession, historical disturbance and other pertinent conditions (this will be done in conjunction with vegetation studies)

- Map fish and wildlife habitat and/or important use areas

- Map use areas and distribution of livestock and terrestrial game species

3.5 Radiological Surveys

The radiological program will consist of multidisciplinary surveys and monitoring to establish baseline radionuclide conditions in the project site environment. Baseline data collection programs in each discipline will be conducted to identify the various potential pathways to man associated with project operations. Table 2 represents the complete radiological sampling program.

In association with each of the disciplines previously described (Sections 3.1 through 3.4), the preoperational program will consist of simultaneous measurements taken to determine the concentrations of radionuclides in indicator biota, soils, air and surface and ground waters. Additionally, radon flux and direct gamma radiation surveys will be made to establish baseline for mill and tailings decommissioning.

The radiological program design has been developed in general accordance with the U.S. Nuclear Regulatory Commission "Preoperational Radiological Environmental Monitoring programs for Uranium Mills" as presented in the Draft Generic Environmental Impact Statement.

Radiological exposure pathways will be analysed. Exposure pathways to man will be emphasized since no guidelines concerning exposure have been established for the protection of species other than man and because limits for humans are also conservative for other species. Potential exposure pathways which will be monitored are:

Pathway	Monitoring
Inhalation	Particulate, radon
External exposure	Gamma survey, soil
Food	Vegetation, cattle (red meat), surface and ground water

3.6 Cultural and Paleontological Resources

Investigations will be conducted to inventory and evaluate cultural and paleontological resources which may be adversely impacted by the proposed project as required by Federal antiquities laws and NRC Regulatory Guide 3.8 (Section 2.3). These resources will be described according to their current status in, or eligibility for inclusion in, federal and state inventories of historic sites or landmarks and their educational/research values.

The cultural and paleontological resource investigations will consist of an archival review and an on-the-ground survey. An archival review was performed during the reconnaissance investigations. No sites currently listed in the National Register of Historic Places (NRHP), the National Register of Natural Landmarks (NRNL) or catalogued site files of the Oregon Archaeological Survey, U.S. Bureau of Land Management or the Museum of Paleontology, University of California, Berkeley (paleontological research consultant), are located in the project area. These sources will be reviewed during the site investigation for any new listings.

The survey will be performed by field personnel, spaced 30 meters apart, walking transects until the project has been completely inspected. Any locations with a concentraton of artifacts or fossils will be recorded on standard survey forms and photographed. The areal extent and/or features will be plotted on 1" = 1000' project maps. Isolated finds will be noted and plotted on maps.

During the laboratory phase, any located resources will be compared with previous research findings to assess their heritage/educational values. NRHP or NRNL nomination recommendations will be made, if warranted.

SECTION IV

QUALITY ASSURANCE/CONTROL

4.1 Methods of Sampling and Analysis

Samples will be collected, preserved and stored according to well-established and reliable techniques, reflecting the latest state-of-the art in the individual programs proposed.

The radiological and non-radiological analyses will be run in accordance with the NRC and EPA requirements respectively as shown in Appendix A. Qualified laboratories with well-established and reproducible methodologies, quality assurance/quality control programs, instrumentation capabilities, and relevant experience will be chosen to perform both the radiological and non-radiological analyses.

4.2 Lower Limits of Detection

The radiological laboratory will base its methodology on the following lower limits of detection (LLD):

LOWER LIMITS OF DETECTION (LLD)
FOR RADIOLOGICAL ANALYSIS

Sample Matrix	Parameter	NRC Recommendation (6/14/79)
Water	U-238	0.2 pCi/l
	Th-230	0.2 pCi/l
	Ra-226	0.2 pCi/l
	Po-210	1.0 pCi/l
	Pb-210	1.0 pCi/l
Vegetation, Food, Fish (Wet)	U-238	0.2 pCi/kg
	Th-230	0.2 pCi/kg
	Ra-226	0.05 pCi/kg
	Po-210	1.0 pCi/kg
	Pb-210	1.0 pCi/kg

Sample Matrix	Parameter	NRC Recommendation (5/14/79)
Air Particulates	U-238	1×10^{-4} pCi/m^3
	Th-230	1×10^{-4} pCi/m^3
	Ra-226	1×10^{-4} pCi/m^3
	Pb-210	2×10^{-3} pCi/m^3
	Po-210	0.2 pCi/l
Soil* and Sediment	U-238	0.2 pCi/g
	Th-230	0.2 pCi/g
	Ra-226	0.2 pCi/g
	Pb-210	0.2 pCi/g

* Applies to surface and subsurface fractions

The non-radiological laboratory will base its methodologies on the following lower limits of detection (LLD):

NON-RADIOLOGICAL WET CHEMICAL
LOWER LIMITS OF DETECTION

Parameter	Detection Limit (mg/l)
pH	full range
Suspended Solids	1.0
Total Dissolved Solids	5.0
Color	1.0 C.U.
Alkalinity	0.1
Acidity	0.1
Calcium	0.1
Magnesium	0.1
Sodium	0.01
Potassium	0.01
Chloride	0.1
Fluoride	0.01
Sulfate	5.0
Silica	0.01
Total Kjeldahl Nitrogen	0.1
Nitrate Nitrogen	0.1
Nitrite Nitrogen	0.1
Total Phosphate (as P)	0.1
Ortho Phosphate (as P)	0.1
Biological Oxygen Demand (B.O.D.)	1.0

Parameter	Detection Limit (mg/l)
Chemical Oxygen Demadn (C.O.D.)	0.1
Total Organic Carbon (T.O.C.)	1.0
Arsenic	0.01
Barium	0.1
Beryllium	0.001
Cadmium	0.001
Chromium	0.001
Copper	0.001
Iron	0.01
Lead	0.001
Manganese	0.001
Mercury	0.0004
Molybdenum	0.001
Nickel	0.01
Selenium	0.01
Silver	0.01
Zinc	0.01
Bismuth	0.001
Cobalt	0.01
Gallium	0.1
Germanium	0.1
Lithium	0.01
Strontium	0.1
Tin	0.1
Titanium	0.01
Vanadium	0.01
Zirconium	1.0
Total Coliform	1.0 Colony/100 ml
Fecal Coliform	1.0 Colony/100 ml

APPENDIX A

Wet Chemical Non-Radiological Analyses Including Soils:

1. U.S. Public Health Service, "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Washington, D.C., 1975.

2. U.S. Environmental Protection Agency, "Methods for Chemical Analyses of Water and Wastes," Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 1978.

3. U.S. Environmental Protection Agency, "Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants," Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, April 1977.

4. U.S. Environmental Protection Agency, "Method for the Low Level Determination of Total Organic Carbon, "Environmental Monitoring and Support Laboratory, April 1978.

5. U.S. Department of Agriculture, "Laboratory Methods Recommended for Chemical Analysis of Mixed-Land Spoils and Overburden in Western United States," Handbook 525, 1-31 (April 1978).

Radiological Analyses:

1. References listed in the Bibliography in Regulatory Guide 4.14 on "Measuring, Evaluating and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Airborne Effluents from Uranium Mills."

2. Regulatory Guide 4.5, "Measurements of Radionuclides in the Environment, Sampling and Analysis of Plutonium in Soil (May 1974).

3. "A Guide for Environmental Radiological Surveillance at ERDA Installations," ERDA 77-24, Department of Energy, Washington, D.C. (March 1977).

4. "Environmental Surveillance for Fuel Fabrication Plants," BNWL-1723, Battelle Pacific Northwest Laboratories, Richland, Washington (April 1973.

5. "Environmental Radioactivity Surveillance Guide," ORP-SID-72-2, U.S. Environmental Protection Agency, Washington, D.C. (June 1972)

TABLE 1
PREOPERATIONAL NON-RADIOLOGICAL MONITORING PROGRAM FOR AURORA JOINT VENTURE

Type of Sample/ Equipment	Number	Sample Point Designations	Location	Type	Frequency	Parameters	Remarks
LAND							
Surface Water Flow	Eleven	BM1-QC, BM2-QC, CC3-QC, IC4-QC, IC5-QC, MC6-QC, NC7-QC, AC8-QC, PC9-QC, QR10-QC, QC19-QC	Potentially affected surface water drainage areas				Flow is ephemeral at stations BM1-QC, BM2-QC, AC8-QC, PC9-QC, and QC19-QC, therefore, field measurements at these stations will be made when possible
- Crest Gages				Continuous	Continuous	Level	
- Price/Pygmy Current Meters Earphone/Headset/Digital Counter Top Set Wading Rod				Field Measurement	Monthly & Quarterly	Flow	
Surface Water Quality	Eleven	Same as above	Same as above	Grab	Quarterly	pH, dissolved oxygen, turbidity, conductivity, air & water temperature	Same as above
- Horiba Model U-7 Water Quality Checker Horiba Instruments Corp.							
- Hach Model Alkalinity Kit (Colorimetric)						Alkalinity	
- Nuclepore Pressurized Filter Set-up, 2.2 l capacity, w/ 0.45-um filters 110 mm in dia.						See Table 3	Analysis of initial data may modify parameter list as shown in Table 3 for future sample analyses

TABLE 1 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Location	Type	Frequency	Parameters	Remarks
WATER (cont.)							
Stream Bed Material - Polyethylene trowel	Eleven	BM1-BM, BM2-BM, CC3-BM, IC4-BM, IC5-BM, MC6-BM, MC7-BM, AC8-BM, PC9-BM, QR16-BM, QC19-BM	Up and downstream of offsite surface waters which may be subject to direct runoff from potentially contaminated areas	Grab	Semi-annually	See Table 4	The extraction of "lightly" adsorbed phase will be performed in accordance with USGS method I-5485-77
Groundwater Flow - Water level meter with 500' of electrical line on cylindrical reel, Fisher Research Lab, Model M500 - Additional water level measuring instrument (tape measure and weighted bail), Knox Industrial Supplies	Six	GWT1-C, GWT2-C, GWT3-C, GWT4-C, GWT5-C, GWT6-C	Wells located around future tailings disposal area. Three (3) wells hydrologically down-gradient of disposal area. Three (3) located on other sides of tailings disposal area including one located hydrologically up-gradient to serve as background location	Level	Quarterly	Gradient	Mill and tailings area well locations are tentative. Final locations are dependent on geo-hydrologic investigations and engineering design

TABLE 1 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Location	Type	Frequency	Parameters	Remarks
Groundwater Quality	Six	GWT1-C, GWT2-C, GWT3-C, GWT4-C, GWT5-C, GWT6-C	Wells located around future tailings disposal area. Three wells hydrologically down-gradient of disposal area. Three located on other sides of tailings disposal area including one located hydrologically up-gradient to serve as background location	Level	Quarterly	See Table 5	Mill and tailings area well locations are tentative. Final locations are dependent on geohydrologic investigations. Analysis of initial data may modify parameter list as shown in Table 5
- Kemmerer water well sampler (1-1/2"x27" cylinder) Wahl Scientific Instrument Corp.							
- Fogstadt Pressurized Filter Set-up, 2.2 l capacity w/0.45 um filters, 110 mm in diameter	Four						
- Horiba Model U-7 Water Quality Checker, Horiba Instruments Corp.							
- Hach Alkalinity Kit (colorimetric)							
Surface Water Impoundments	Three	GWS11-C, GWS12-C, GWS13-C	Stock tanks in tailings disposal area which are used for watering of livestock	Grab	Quarterly		Analysis of initial data may modify parameter list as shown in Table 4.
- Horiba Model U-7 Water Quality Checker, Horiba Instruments Corp.						pH, dissolved oxygen, turbidity, conductivity, air and water temperature	
- Hach Alkalinity Kit (colorimetric)						Alkalinity	
- Fogstadt Pressurized Filter Set up, 2.2 l capacity w/0.45 um filters 110 mm in diameter						See Table 4	

TABLE 1 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Location	Type	Frequency	Parameters	Remarks
AIR							
Air quality - General Metal Works, Model GMWAM (Hi-vol Sampler)	One	AUI-AQ	Near the site in proximity to meteorological data collection	Continuous (24 hrs.)	Every 6th day	Total suspended particulates (TSP)	Following development of the site, AUI-AQ will be moved from any disturbed areas to a downwind location
Meteorology - Mech. weather station (MRI M 1071 and 1074-2 wind speed and direction sensors) - AUI-MET, 10 m tower	One	AUI-MET	Near the site in an area where acquisition of met. data will be representative of site conditions for air quality modeling	Continuous	Continuous	Wind speed, wind direction, and temperature	Existing McDermitt precipitation data will be used (25-year record) Existing Winnemucca barometric pressure and relative humidity data will be used (108-year record)
SOILS & SOILS							
Surface Soils - Hand collection	To be determined by soil series	SSC-to be determined	To be determined based on soil mapping	Grab	Once	See Table 6	To be sampled at mid-soil boundary of each soil series

TABLE 1 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Location	Type	Frequency	Parameters	Remarks
D. ECOLOGICAL							
(1) Wildlife - Standard field collecting equipment	To be determined by field observations	None	Survey of entire project site by habitat type	Observation	4 seasonal inventories	Biota	Samples observed for taxonomic characterizations and relative abundance determination of threatened or endangered species
(2) Vegetation - Standard field collecting equipment	Same as above	Same as above	Same as above	Same as above	Three times during growing season	Same as above	Samples collected for taxonomic characterization, relative abundance and vegetation mapping. Determination of threatened or endangered species
(3) Aquatic Biology - Electrofishing equipment	Same as above	MC6-AB, MC7-AB, QR15-QB, QR16-AB	Streams in the site environs which may be subject to seepage or direct surface runoff from potentially affected areas	Grab	Twice	Fish, peripyton and benthic macroinvertebrates	Same as above

TABLE 2

PREOPERATIONAL RADIOLOGICAL MONITORING PROGRAM FOR AURORA JOINT VENTURE

Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection			Sample Measurement Frequency/ Type of Measurement	Remarks
			Location	Type	Frequency		
A. WATER							
(1) Surface Water Quality - Lopstadt Pressurized Filter Setup, 2.2 l capacity, w/0.45 um filters 110 mm in diameter	Eleven	BM1-QR, BM2-QR, CC3-QR, IC4-QR, IC5-QR, MC6-QR, MC7-QR, AC8-QR, PC9-QR, QR16-QR, OC19-QR	Surface waters passing through the site or offsite surface waters which may be subject to drainage from potentially contaminated areas or which could be affected by a tailing impoundment failure	Grab	Monthly	Monthly for dissolved natural uranium, Ra-226, Th-230, and suspended solids	Surface water samples to be analyzed for dissolved phase. Samples will be filtered if possible following collection through a membrane filter (<0.45 um)
						Quarterly for dissolved natural uranium, Ra-226 and Th-230	Natural drainage systems (dry washes) which carry surface runoff from the site following a precipitation event will be sampled when possible
						Semi-annually for dissolved Pb-210 and Po-210	

TABLE 2 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection: Location	Sample Collection: Type	Sample Collection: Frequency	Sample Measurement Frequency/ Type of Measurement	Remarks
WATER (cont.)							
(2) Ground Water Quality - Engstadt Pressurized Filter Setup, [illegible] l capacity, w/0.45 um filters 142 mm in diameter	Six	GWT1-QR, GWT2-QR, GWT3-QR, GWT4-QR, GWT5-QR, GWT6-QR	Wells located around future tailings disposal area. Three (3) wells hydrologically down-gradient of disposal area. Three (3) located on other sides of tailings disposal area, including one (1) located hydrologically up-gradient to serve as background location	Grab	Quarterly	Quarterly for dissolved natural uranium, Ra-226 and Th-230 Semi-annually for dissolved Pb-210 and Po-210 Quarterly for dissolved natural uranium, Ra-226 and Th-230 Semi-annually for dissolved Pb-210, Po-210	If the sample contains appreciable suspended material, it will be filtered as soon as possible following collection through a (<0.45 um) membrane filter The location of the ground water sampling wells will be determined by a hydrological analyses of the potential movement of seepage from the tailings disposal area. In general, the objective is to place monitor wells in all directions around the tailings area with the emphasis on the down gradient locations
		GWS11-R, GWS12-R, GWS13-R	Stock tanks in tailings disposal area which are used for watering of livestock				

TABLE 2 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection: Location	Sample Collection: Type	Sample Collection: Frequency	Sample Measurement Frequency/ Type of Measurement	Remarks
B. AIR							
(1) Particulates - Hi Vol Air Sampler, Tracerline Model RAS-2	Three	APR 1 through APR 3	Near the site boundaries in different sectors, which will have the highest predicted airborne radionuclide concentrations during milling operations	Continuous	Weekly filter change or more frequently as required by dust loading	Quarterly composites of weekly samples for natural uranium, Ra-226, Th-230 and Pb-210	Continuous collection means continuous sampler operation with filter change weekly or as needed
	One	APR 4	At or close to the nearest residence(s) or occupied offsite structure(s) (if within 10 km of site)	Same as above	Same as above	Same as above	The term "nearest" means the areas with the highest predicted airborne radionuclide concentrations projected for milling operations
	One	APR 5	At a control or background location remote from site	Same as above	Same as above	Same as above	Care will be taken in selection of the control
(2) Radon - EPA Radon Sampler w/ Radar Air Pump - Rad Scaler, Tracerline Model RS-2 - Scintillator Tracerline Model SA-85 - Scintillation Cells, Tracerline Model SC-6	Four or more	RN 1 through RN 5	Same locations as for air particulates	Continuous for one week/ month representing about the same period each month	Samples collected for 48-hr. intervals	Each 48-hr. sample for Rn-222	Sampling type and frequency refers to continuous collection of a gaseous air sample with samples being changed about every 48 hours for a one week period. Other approved method, and/or equipment such as passive radon monitors or continuous samplers may be used.

TABLE 2 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection: Location	Sample Collection: Type	Sample Collection: Frequency	Sample Measurement Frequency/ Type of Measurement	Remarks
C. Soil							
(1) Surface Soil - Trowel, collection bags	Five	SSR-1 through SSR-5	At same locations as for collection of radiological air particulate samples	Grab	Once prior to site construction	Natural uranium, Ra-226, Th-230 and Pb-210	Surface soil samples will be collected to a depth of 5 cm
	Up to forty	SSR-6 through SSR-45	300 meter intervals to a distance of 1500 meters in each of 8 directions from center of milling area or at point equidistant from milling area and tailings disposal area	Grab	Once prior to site construction	All samples for Ra-226, 10% of samples natural uranium, Th-230 and Pb-210	
	Up to six	To be designated following initial sampling	300 meter intervals in both a horizontal and vertical traverse across the milling area	Grab	Once following excavation, leveling or contouring of milling area	Ra-226 (all samples), natural uranium, Th-230 and Pb-210 (one sample)	
(2) Sub Surface Soil Profile - Standard Soil Auger, 6"x3-1/2"	Five	SBSR 1 through SBSR-5	At center reference location and at distances of 750 meters in each of 4 directions	Grab	Once prior to site construction	Ra-226 (all samples), natural uranium, Th-230 and Pb-210 (one set of samples)	Sub-surface soil profile samples will be collected to a depth of three feet. Samples will be divided into one foot sections for analysis
	One	SBSR 6	At center of mill building area	Grab	Once following excavation, leveling or contouring	Natural uranium, Ra-226, Th-230 and Pb-210	

TABLE 2 (continued)

	Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection: Location	Sample Collection: Type	Sample Collection: Frequency	Sample Measurement Frequency/ Type of Measurement	Remarks
	Silt (cont.)							
(j)	Sediment (Streambed material) - Polyethylene trowel	Two from each stream	BM1-BMR, BM2-BMR, CC3-BMR, IC4-BMR, IC5-BMR, MC6-BMR, MC7-BMR, AC8-BMR, PC9-BMR, QR16-BMR, QC19-BMR	Up and downstream of offsite surface waters which may be subject to direct runoff from potentially contaminated areas	Grab	Once following spring runoff and late summer following period of extended low flow	Natural uranium, Ra-226, Th-230 and Pb-210	Several samples will be collected at each location and composited for a representative sample
B.	ECOLOGICAL							
(1)	Game fish Electrofishing equipment	Four	MC6-ABR, MC7-ABR, QR15-ABR, QR16-ABR	Collection of game fish (if any) from rivers and streams in the site environs which may be subject to seepage or direct surface runoff from potentially contaminated areas	Grab	Semi-annually	Natural uranium, Ra-226, Th-230, Pb-210 and Po-210	Whole body analysis
(2)	Vegetation (forage)	Three	QR1-VSL,VR; QR2-VSL, VR, QR3-VSL, VR	Grazing areas near the site in areas which will have the highest predicted air particulate concentrations during milling operations	Grab	Three times during grazing season	Natural uranium, Ra-226, Th-230, Pb-210 and	First sampling will include both above and below ground fractions. All subsequent samples will be analyzed for above ground fraction only
(3)	Food	Three of each type	Points not shown on map	Alfalfa and livestock, raised in general area	Grab	Time of harvest or slaughter	Natural uranium, Ra-226, Th-230, Pb-210 and Po-210	Above ground sample from alfalfa Red meat sample from cattle

TABLE 2 (continued)

Type of Sample/ Equipment	Number	Sample Point Designations	Sample Collection: Location	Sample Collection: Type	Sample Collection: Frequency	Sample Measurement Frequency/ Type of Measurement	Remarks
E. SITE SURVEY							
(1) Gamma Dose Rate	Five	GDR1 through GDR 5	At same locations as used for collection of particulate samples	Direct readout	Once prior to site construction	Once direct readout	The milling area refers to the area which includes ore storage pads, mill buildings and other processing areas.
- Pressurized Ionization Chamber (PIC)	Forty to eighty	GDR 6 through GDR 85	150 meter intervals to a distance of 1500 meters in each of 8 directions from center of the milling area and tailings disposal area	Same as above	Same as above	Same as above	Other approved methods and/or equipment such as scintillometers or TLDS may be used.
	Forty to eighty	To be designated following initial sampling	150 meter intervals in both horizontal and vertical traverses across milling area	Same as above	Once following excavation, leveling or contouring of milling area	Same as above	
(2) Radon-222 Flux	Up to ten	RNF1 through RNF10	At center reference location and at distances of 750 and 1500 meters in each of 4 directions	2-3 day period	One sample during each of three months	Each sample for Radon-222 flux	
- EPI Radon Sampler w/ Tedlar Bags							
- Mini-scaler, Eberline Model MS-2							
- Scintillator Eberline Model SAC-RS							
- Scintillator Cells, Eberline Model SC-6							

TABLE 3

Surface Water Quality Parameters--Non-Radiological

Physico-chemical Group

pH
Suspended Solids
TDS (@ 180°C) - Total Dissolved Solids
TDS (sum of constituents)
Color

Alkalinity (bicarbonate, carbonate, hydroxide)
Acidity

Calcium - dissolved*
Magnesium - dissolved
Sodium - dissolved
Potassium - dissolved
Chloride - dissolved
Fluoride - dissolved
Sulfate - dissolved
Silica - dissolved
Cation-Anion Balance, calc.

Nutrients Group

Total Kjeldahl Nitrogen (ORG-N, Organic, and NH_3-N, Ammonia) - total and dissolved
Nitrate (NO_3-N) - total
Nitrite (NO_2-N) - total

Total Phosphate (T - PO_4^{3-}) - total and dissolved
Ortho Phosphate (O - PO_4^{3-}) - total and dissolved

Organics Loading Group

BOD - Biological Oxygen Demand
COD - Chemical Oxygen Demand
TOC - Total Organic Carbon

90003 34

Trace Metals Group A

Arsenic
Barium
Beryllium
Cadmium
Chromium

* $\leq$ 0.45-um phase

TABLE 3 (continued)

Trace Metals Group A (continued)

Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Zinc

Trace Metals Group B

Bismuth
Cobalt
Gallium
Germanium
Lithium
Strontium
Tin
Titanium
Vanadium
Zirconium

Bacteriology

Total Coliform
Fecal Coliform

90003,35

TABLE 4

Bed Material (Sediment)--Non-Radiological

Lightly Adsorbed Trace Metals

Arsenic
Barium
Beryllium
Cadmium
Chromium
Copper
Iron
Manganese
Mercury
Molybenum
Nickel
Selenium
Silver
Zinc

90003036

TABLE 5

Groundwater Quality Parameters--Non-Radiological

Physico-chemical Group

pH
TDS (@ 180°C) - Total Dissolved Solids
TDS (sum of constituents)

Alkalinity (bicarbonate, carbonate, hydroxide)
Acidity

Calcium - dissolved*
Magnesium - dissolved
Sodium - dissolved
Potassium - dissolved
Chloride - dissolved
Fluoride - dissolved
Sulfate - dissolved
Silica - dissolved
Cation-Anion Balance, calc.

Nutrients Group

Total Kjeldahl Nitrogen (ORG-N, Organic, and NH_3-N, Ammonia) - total and dissolved
Nitrate (NO_3-N) - total
Nitrite (NO_2-N) - total

Total Phosphate (T - PO_4^{3-}) - total and dissolved
Ortho Phosphate (O - PO_4^{3-}) - total and dissolved

Trace Metals Group A (Dissolved Phase)

Arsenic
Barium
Beryllium
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Zinc

90003 37

* $\leq$ 0.45-um phase

TABLE 5 (continued)

Trace Metals Group B

Bismuth
Cobalt
Gallim
Germanium
Lithium
Strontium
Tin
Titanium
Vanadium
Zirconium

TABLE 6

Surface Soil Chemistry Parameters--Non-Radiological

Physico-chemical Group

pH
Conductivity
Saturation Percentage
Calcium
Sodium
Magnesium
Sodium Adsorption Ratio
Particle Size Distribution
Phosphorus
Potassium
Organic Matter
Cation Exchange Capacity

Trace Metals Group

Copper
Zinc
Lead
Chromium
Iron
Molybdenum
Sulfate
Selenium