ITEMS 9 THROUGH 14 OF THE APPLICATION FOR SOURCE MATERIAL LICENSE

Items 9 through 14 of the Application for Source Material License (Form AEC-2) are presented below in the format suggested by the Nuclear Regulatory Commission's Guide 3.5 (2/9/73). Much of the information requested in the application has been presented in Plateau Resources Limited's (PRL) environmental report on the Shootering Canyon uranium project dated May, 1978. To avoid repetition in the following discussion, this information is referenced where it is applicable.

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A general discussion of the proposed processing activites is provided in Section 1.0, pages 1-1 through 1-6, of the environmental report.

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2.0

SITE DESCRIPTION

2.1 Geography and Demography

2.1.1 Geography. A geographic description of the project area is provided in Section 2.1, pages 2-1 through 2-9, of the environmental report.

2.1.2 Demography. A demographic description of the project area is provided in Section 2.2, pages 2-11 to 2-17, of the environmental report.

2.2 Meteorology

Meteorological data pertinent to the project site are presented in Section 2.7, pages 2-112 through 2-134, of the environmental report.

2.3 Hydrology

2.3.1 Groundwater. A description of regional and local groundwater aquifers, including a discussion of permeability in the vicinity of the plant, is provided in Section 2.6, pages 2-99 through 2-104, of the environmental report. Wells and springs in the vicinity of the plant are shown in Figure 2.6-2, page 2-81.

2.3.2 Surface Water. A description of the hydrological characteristics of surface waters in the project area is provided in Section 2.6, pages 2-83 to 2-89, of the environmental report. Figure 2.6-1, page 2-79, shows surface water features in the vicinity of the plant.

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2.4 Geology and Seismology

2.4.1 Geology. Regional and site-specific geological characteristics are discussed in Section 2.4, pages 2-42 to 2-63, of the environmental report.

2.4.2 Seismology. A discussion of the seismicity of the project region, including historical earthquakes and regional tectonics, is provided in Section 2.5, pages 2-71 through 2-77, of the environmental report. A regional earthquake epicenter map is presented in Figure 2.5-1, page 2-73.

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3.0

FACILITY DESIGN AND CONSTRUCTION

3.1 Mill Process

A generalized flow sheet of the plant process is provided in Figure 3.2-1, page 3-11, of the environmental report. Quantitative flow diagrams of the various mill circuits are presented in the following figures from Appendix G of the environmental report:

Figure	Page	Description
G-2	G-2	General Process Crushing and Grinding Flowsheet
G-3	G-3	General Process Grinding and Leaching Flowsheet
G-4	G-4	General Process CCS and Tailings Flowsheet
G-5	G-5	General Process Solvent Extraction Flowsheet
G-6	G-6	General Process Concentrate Product Flowsheet

3.2 Major Equipment

A description of major mill process equipment and operating specifications for this equipment is provided in Section 3.2, pages 3-8 through 3-18, of the environmental report. A description of the general mill layout is provided in Section 3.1, pages 3-1 through 3-7. Figure 3.1-1, page 3-3, shows the general arrangement of process facilities and includes the locations of point sources of mill emissions. The exit flow rate, temperature, and concentration of these emissions are provided in Table 3.3-1, page 3-20. More detailed drawings of the process equipment are provided in Figures G-7 through G-14, pages G-7 through G-14, Appendix G, of the environmental report.

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3.3 Instrumentation

The most effective instrumentation currently available will be used to monitor plant operations, plant personnel, and the environment. Automated safety instrumentation will be used in areas of the plant where conditions warrant.

Radiation Safety Instrumentation

Various types of radiation detection instruments will be used in the personnel and restricted area monitoring program. These instruments are described in Section 6.2, page 6-10, paragraphs 4 and 5, page 6-13, paragraphs 2 and 4, and page 6-15, paragraph 3, of the environmental report.

Industrial Safety Instrumentation

Instrumentation for both safety and control of operations will be installed on nine control panels in the plant. Panels will be arranged with diagrammatic visual displays for the crushing and sampling, grinding and leaching, thickening, solvent extraction, and precipitation circuits. The parameters monitored will include conductivity [illegible], oxidation potential, temperature, density, flow, and tank levels.

Density gauges are likely to employ 200 mCi cesium-137 sources stored in shielded containers equipped with lockable rotary shutters. Specific information on each source will be provided as an addendum to this application prior to purchase and will be licensed if required prior to its use. Leak testing of nuclear sources will be in accordance with the license requirements.

Tank levels for the kerosene and fuel oil storage tanks will be

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monitored with float-operated sensors and external indicators.

Ultrasonic-type level monitors will be used to provide remote indication of level in ore bins. Ultrasonic, capacitance, or differential pressure gauges will be used for level measurements in sodium chlorate mixing tanks, sulfuric acid tanks, uranium-bearing aqueous holding tanks, raffinate holding tanks, organic mix tanks, and for other tanks and sumps requiring level measurements for safe and efficient control of operations.

Flow measurements will be by differential pressure gauges in air, steam, or gaseous lines. Vortex, magnetic, or ultrasonic flowmeters will be used to measure flow in liquid lines. Magnetic, sonic, or ultrasonic flowmeters will be used to measure flow in slurry lines.

All field-mounted instrument devices will be premium quality industrial grade and will have enclosures approved for the area in which it is installed.

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4.1 Gaseous

Sections 3.3 and 3.5 of the environmental report provide a detailed discussion of the gaseous emissions form the plant. The locations of exhaust stacks are shown in Figure 3.1-1, page 3-3. A summary of emission control equipment and the efficiency of this equipment, as well as stack height and diameter, and the nature of emissions from each stack is provided in Table 3.3-1, page 3-20. A discussion of emissions and control procedures is provided in the following paragraphs:

Source	Location in Environmental Report
Ore stockpiles	Paragraphs 2 and 4, page 3-21, Paragraphs 4 and 5, page 3-22 Paragraph 1, page 3-23
Fine ore crushing	Paragraph 2, page 3-23 Paragraphs 2 and 3, page 3-24
Leaching	Paragraph 3, page 3-25
Countercurrent decantation thickening	Paragraph 4, page 3-25 Paragraph 1, page 26 Paragraphs 3 and 4, page 27
Solvent extraction	Paragraphs 3 and 4, page 3-28 Paragraph 1, page 3-29

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Source	Location in Environmental Report
Precipitation	Paragraphs 4 and 5, page 3-29
Drying and packaging	Paragraphs 1, 2, and 4, page 3-30
Analytical and metallurgical laboratories	Paragraph 2, page 3-36
Boiler	Paragraph 2, page 3-37 Table 3.5-1, page 3-38
Power	Paragraph 3, page 3-37 Table 3.5-2, page 3-38

A comparison of expected emissions with current air quality standards is provided in Section 3.3, paragraphs 5 and 6, page 3-30, paragraph 1, page 3-31, Section 4.0, page 4-23, paragraph 2, and Section 5.0, page 5-20, paragraph 1.

The inspection and maintenance of pollution control equipment such as stack scrubbers and bag filters will follow the manufacturer's recommended procedures.

4.2 Liquids and Solids

A general description of the tailings disposal system is provided in Section 3.4, pages 3-32 through 3-35, of the environmental report. A more detailed description of the preliminary design of the system is provided in Preliminary Geotechnical Engineering Report, Shootering Canyon Uranium Project, Garfield County, Utah (Woodward-Clyde Consultants, 1978) forwarded with this application. The tailings management plan for the facility will be forwarded to the NRC shortly upon its completion.

The effects of potential accidental releases of materials from the tailings impoundment are discussed in Section 7.0, pages 7-5 through 7-10, of the environmental report.

Financial arrangements to provide for implementation of the reclamation plan are discussed in Section 9.0, page 9-9, of the environmental report. Provisions for acquiring ownership of the tailings impoundment and plans for providing long-term maintenance and control over the tailings are discussed on page 9-10.

4.3 Contaminated Equipment

Contaminated solid wastes, such as filters, filter presses, and obsolete or worn-out equipment, will be placed in the tailings impoundment.

5.0

OPERATIONS

5.1 Corporate Organization

Figure 5-1 shows the corporate organization of Plateau Resources Limited. The management organization for the construction and operation phases of the Shootering Canyon project are presented in Figures 5-2 and 5-3, respectively.

The Vice President and General Manager of PRL (Figure 5-1) has the responsibility for all production and support operations. He has the full authority to deal with all problems related to the operation of the Shootering Canyon processing facility. He is responsible for assuring the implementation of the quality control and quality assurance programs for the facility. The operational responsibilities and authorities of the Vice President and General Manager in respect to quality assurance, and operations, maintenance, environmental and radiological health, and quality control are delegated to the Program Manager and the Manager of Operations, respectively (Figure 5-1). Also reporting to the Vice President and General Manager is the Manager of Exploration, who is responsible for the mineral property exploration and acquisition program.

The Process Manager, Mine Manager, Project Manager, Licensing Coordinator, Townsite Coordinator and Personnel Director report directly to the Manager of Operations (Figures 5-1, 5-2 and 5-3). The Process Manager is responsible for operation of all processing facilities as well as ore purchases. The Project Manager is responsible for the engineering and construction of the processing facility and is charged, through the Vice President and General Manager and Manager of Operations, with the responsibility and authority to implement and conduct the quality control program. During the engineering and construction phase of the processing facility, the Project Manager is assisted in performance of the responsibilities by the Technical Superintendent and the construction

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5.1 Corporate Organization

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The Process Manager, Mine Manager, Project Manager, and Personnel Director report directly to the Manager of Operations (Figures 5-1, 5-2, and 5-3). The Project Manager is responsible for the design and construction of all processing facilities. The Process Manager is responsible for the operation of all processing facilities as well as ore purchases. The Program Manager is charged, through the Vice President and General Manager,

5.0
OPERATIONS

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The process Manager, Mine Manager, and Personnel Director report directly to the Manager of Operations (Figures 5-1, 5-2, and 5-3). The Process Manager is responsible for the design, construction, and operation of all processing facilities, as well as ore purchases. The Process Manager is also charged, through the Manager of Operations and

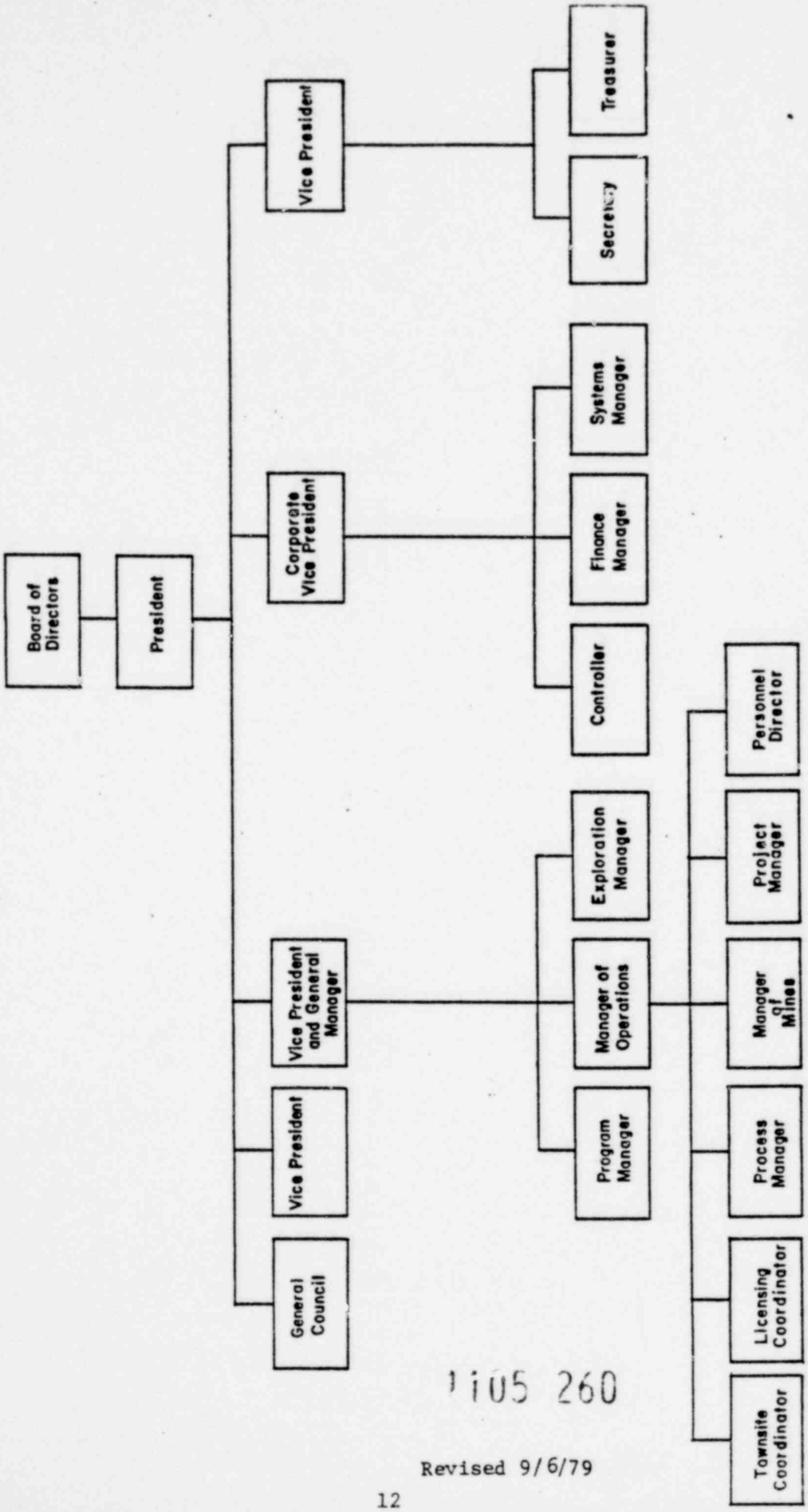

Figure 5-1. CHART OF ORGANIZATION - **PLATEAU RESOURCES LIMITED**

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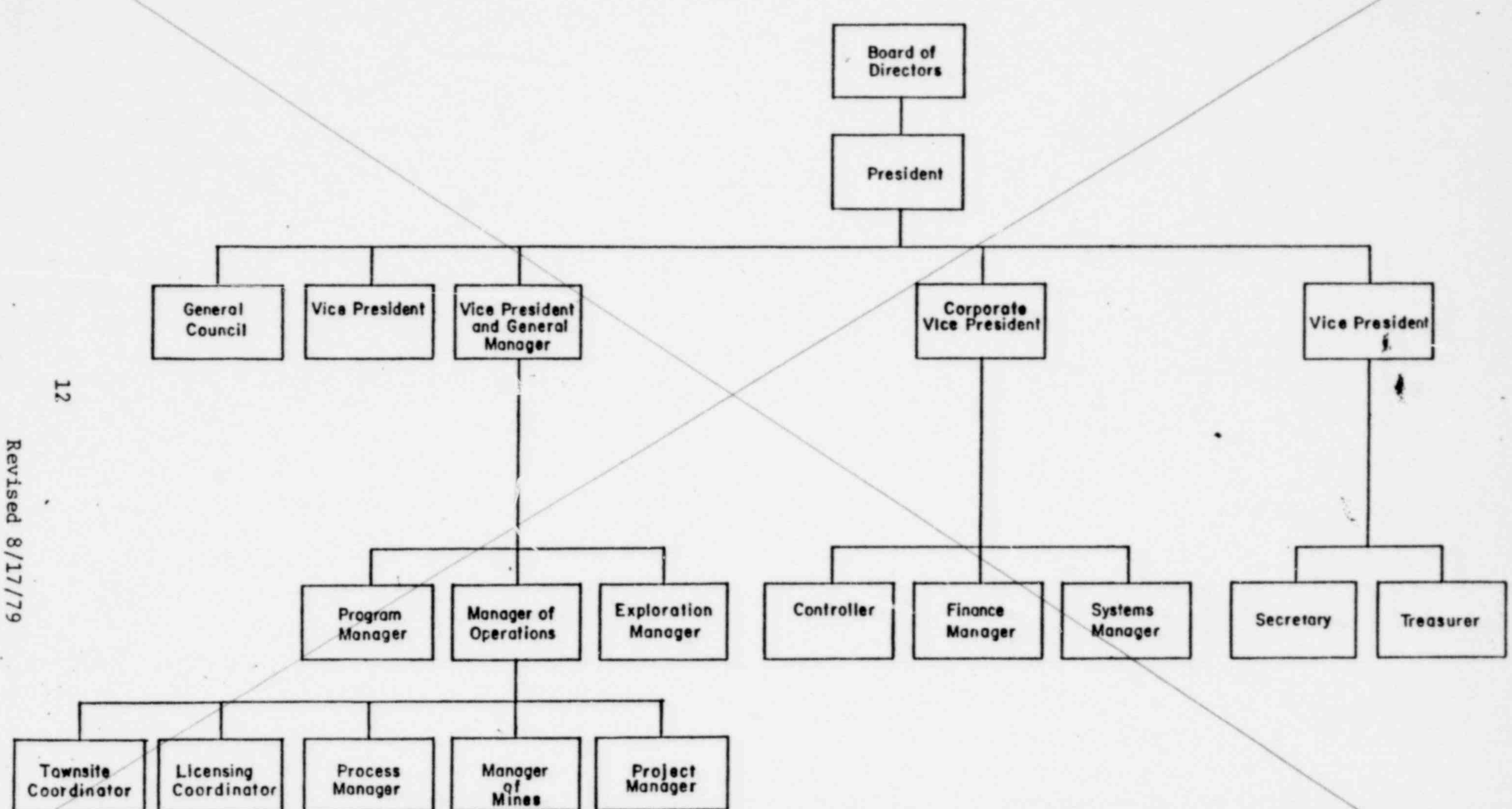

Figure 5-1. CHART OF ORGANIZATION - PLATEAU RESOURCES LIMITED

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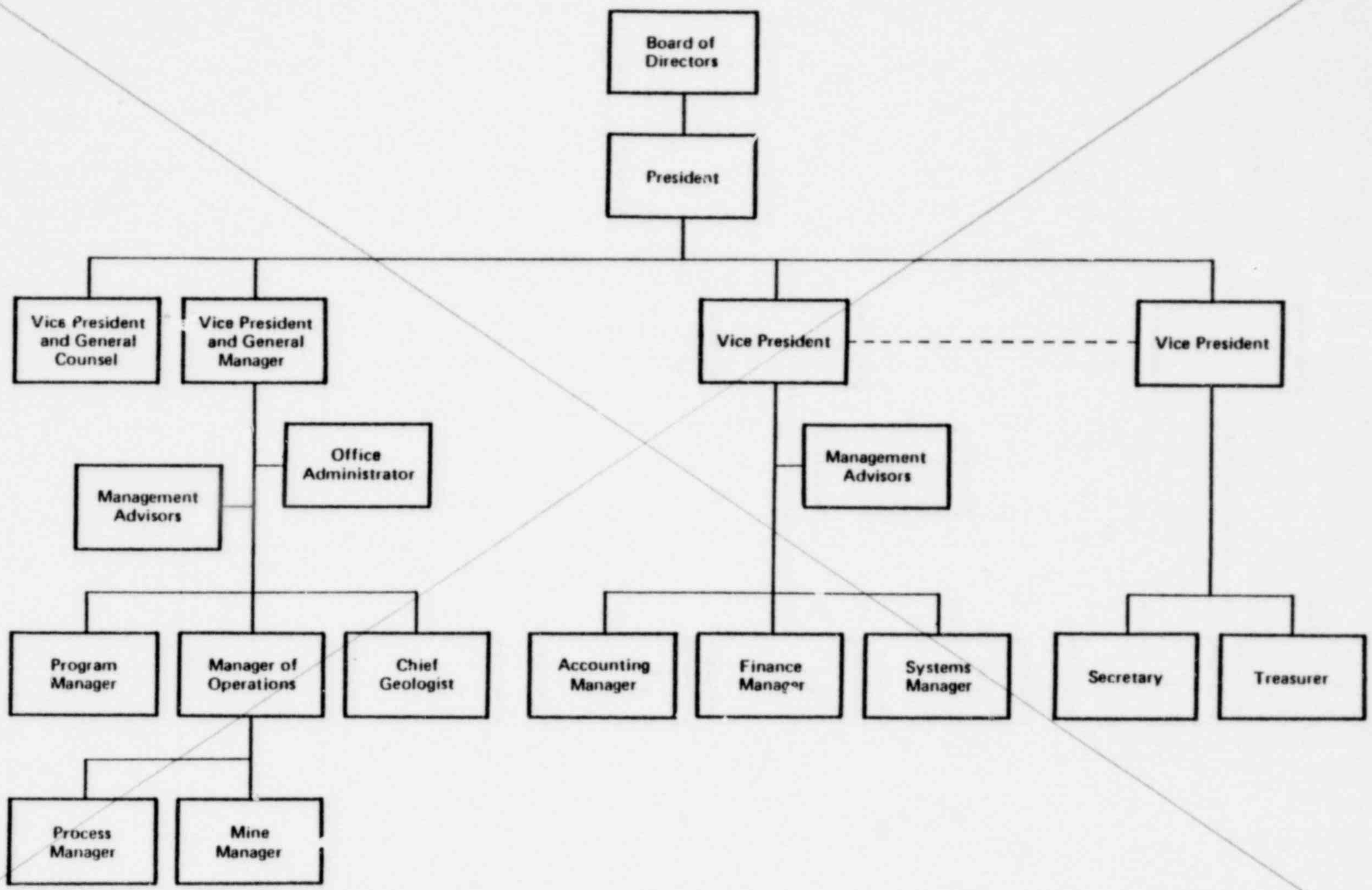

Figure 5-1. CHART OF ORGANIZATION – PLATEAU RESOURCES LIMITED

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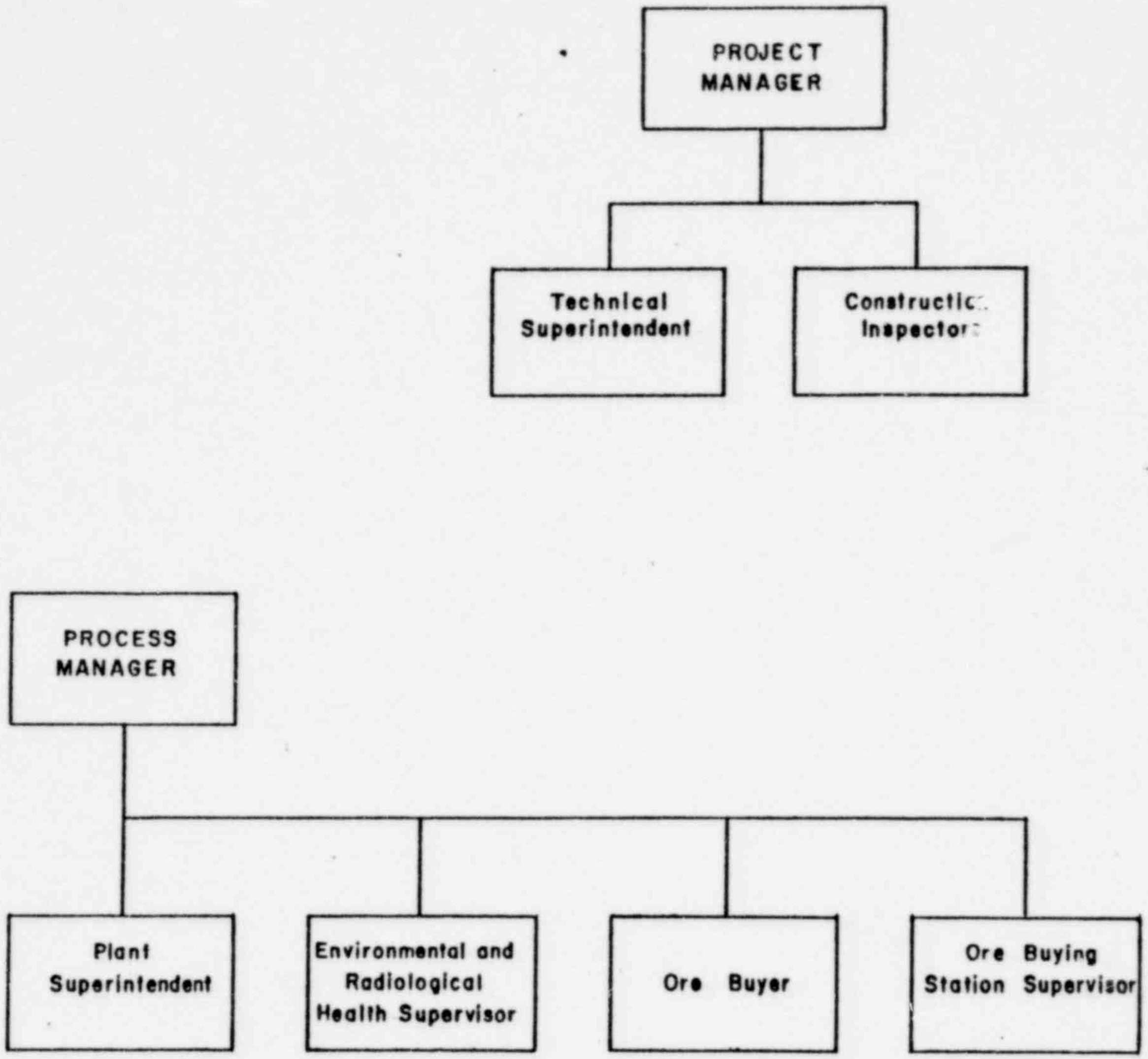

Figure 5-2. CHART OF ORGANIZATION - SHOOTERING CANYON PROCESSING FACILITY, ENGINEERING AND CONSTRUCTION PHASE

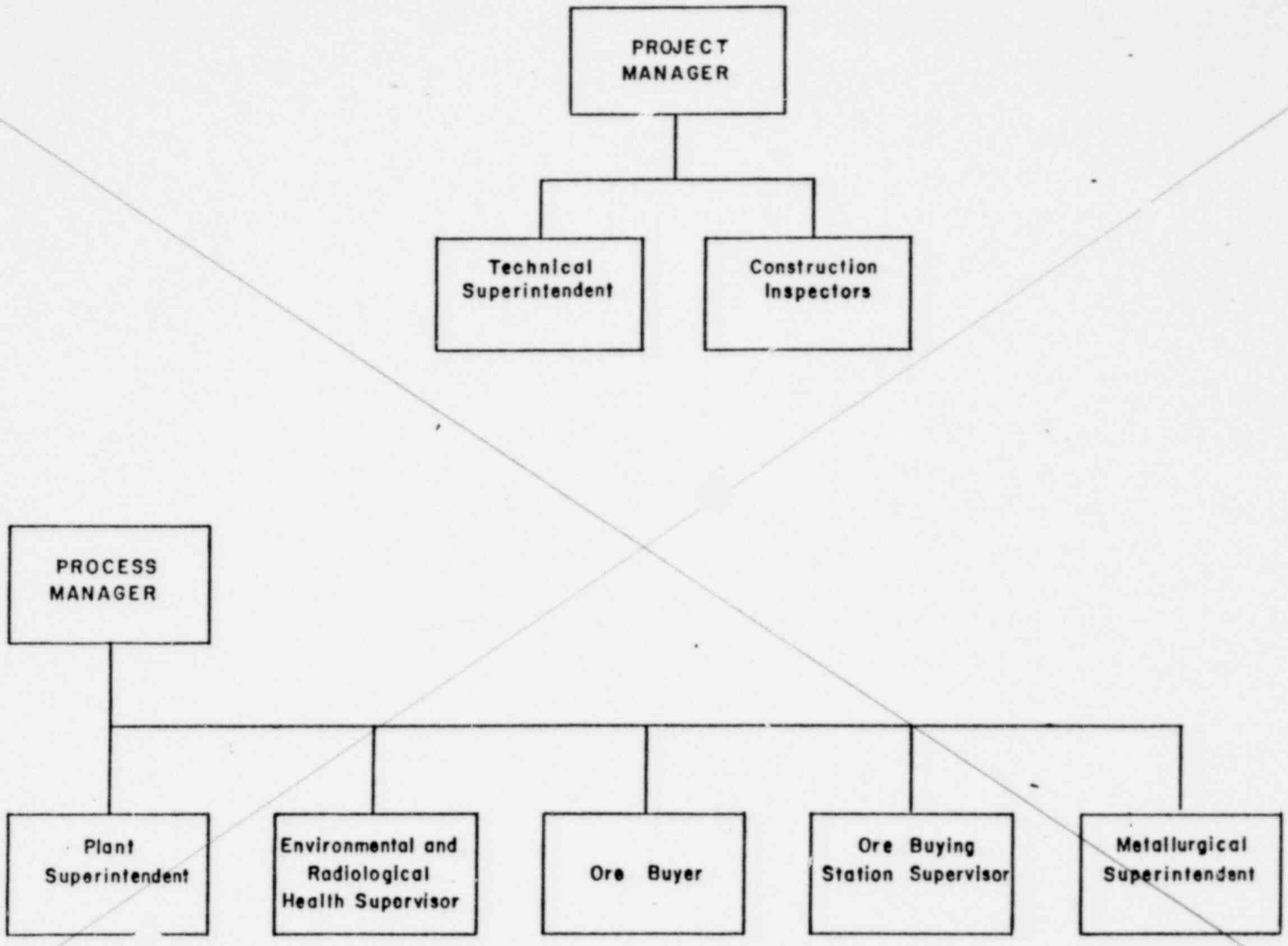

Figure 5-2. CHART OF ORGANIZATION - SHOOTERING CANYON PROCESSING FACILITY, ENGINEERING AND CONSTRUCTION PHASE

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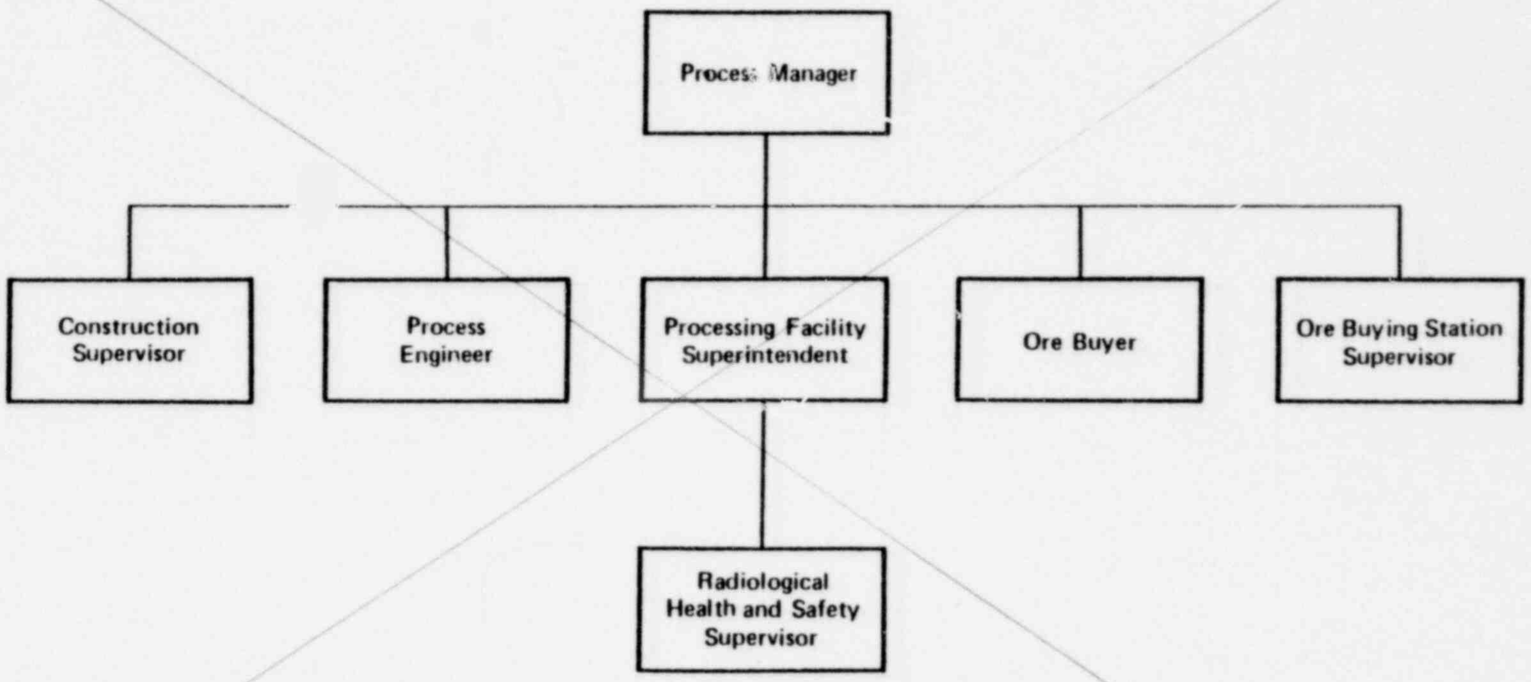

Figure 5-2. CHART OF ORGANIZATION – SHOOTERING CANYON PROCESSING FACILITY, ENGINEERING AND CONSTRUCTION PHASE

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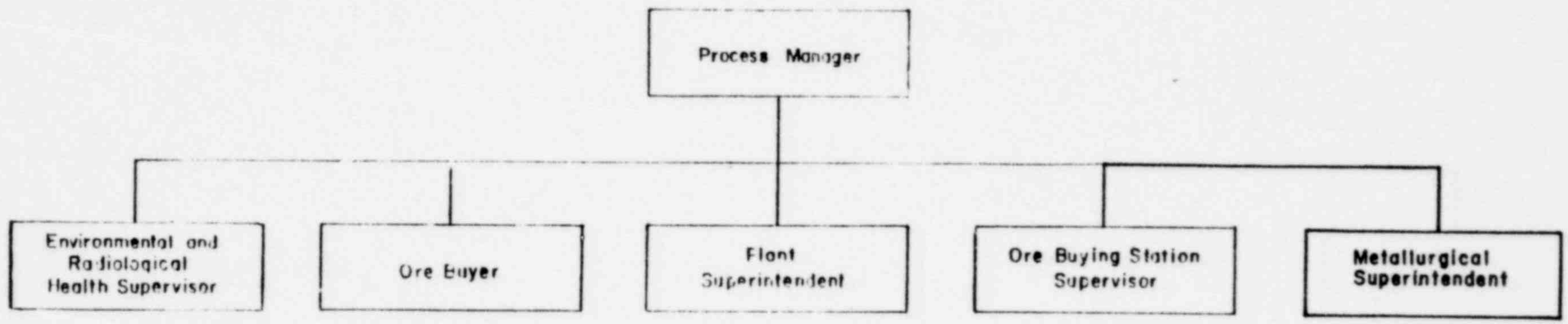

Figure 5-3. CHART OF ORGANIZATION - SHOOTERING CANYON PROCESSING FACILITY, OPERATIONS PHASE

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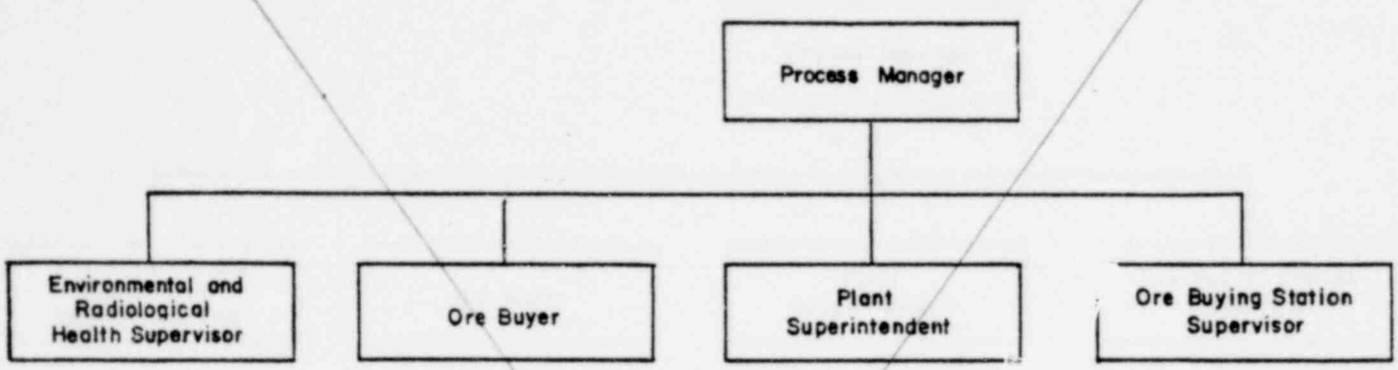

Figure 5-3. CHART OF ORGANIZATION - SHOOTERING CANYON PROCESSING FACILITY, OPERATIONS PHASE

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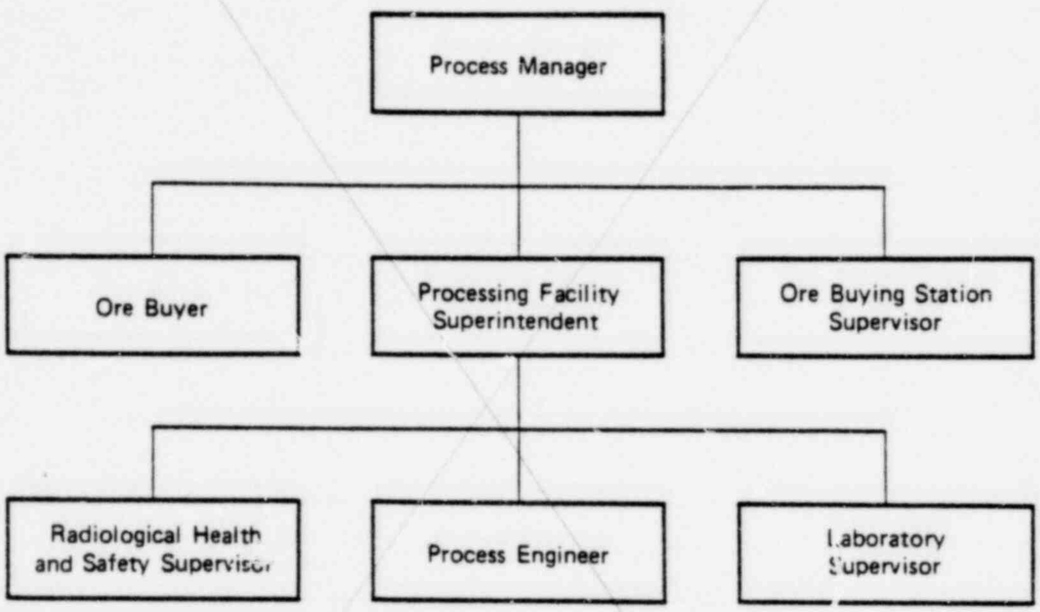

Figure 5-3. CHART OF ORGANIZATION – SHOOTERING CANYON PROCESSING FACILITY, OPERATIONS PHASE

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inspectors, who all report directly to the Project Manager (Figure 5-2). During the operation of the facility, the Plant Superintendent reports directly to the Process Manager and has the authority to conduct plant operations, maintenance and the quality control program. He is also responsible for the development, review, implementation and adherence to operating procedures and routine and non-routine maintenance activities. He has the authority to approve and make changes in these procedures and programs. The Plant Superintendent is also responsible for adherence to the environmental and radiation health procedures. The Plant Superintendent is assisted by the Laboratory Supervisor and the Technical Superintendent. The Environmental and Radiological Health Supervisor also reports directly to the Process Manager and has the responsibility and authority to develop and implement the environmental and radiological health and safety programs including preparation and maintenance of written operating procedures specifically for the radiation safety and environmental monitoring and control programs. He supervises all facility radiation protection and environmental survey, sampling and monitoring programs, maintenance of radiation exposure and survey records. He has the authority to cancel, postpone or modify any plant operation or activity upon detection of unusual radiological hazards.

The management control program is described in Section 7.0 of this application. This program contains provisions to ensure that all routine operational activities are conducted in accordance with written procedures that have been reviewed and approved by the environmental and radiological health staff. These operating procedures will be reviewed at intervals not to exceed one year. The program also includes a work order system covering non-routine functions, such as maintenance activities, that are not covered by operating procedures. All work orders are required to be reviewed and approved by the environmental and radiological health staff prior to their implementation.

The management audit and internal inspection program, including types and scopes of reviews, audits, and inspections, and individual responsibilities, is described in Section 7.0 of this application. PRL is committed to maintaining as low as reasonably achievable (ALARA) exposures for personnel and ALARA effluent releases. One of the primary objectives of the plant design (refer to Section 3.0 of the with the responsibility and authority to implement and conduct the quality control program. During the engineering and construction phase of the processing facility, the Project Manager is assisted in performance of these responsibilities by the Technical Superintendent, and the construction inspectors, who all report directly to the Project Manager (Figure 5-2). During the operation of the facility, the Plant Superintendent reports directly to the Process Manager and has the authority to conduct plant operations, maintenance, and the quality control program. The Environmental and Radiological Health Supervisor reports directly to the Process Manager and is responsible for the radiological health and safety program. The Plant Superintendent is responsible for the development, review, implementation, and adherence to operating procedures, environmental and radiation health programs, and routine and non-routine maintenance activities. He has the authority to approve and make changes in these procedures and programs. The Plant Superintendent is assisted by the following members of the staff: the Environmental and Radiological Health Supervisor, the Laboratory Supervisor, and the Technical Superintendent.

The Management control program is described in Section 7.0 of this application. This program contains provisions to ensure that all routine operational activities are conducted in accordance with written procedures that have been reviewed and approved by the environmental and radiological health staff. These operating procedures will be reviewed at intervals not to exceed two years. The program also includes a work order system covering non-routine functions, such as maintenance activities, that are not covered by operating procedures. All work orders are required to be reviewed and approved by the environmental and radiological health staff prior to their implementation.

The management audit and internal inspection program, including types and scopes of reviews, audits, and inspections, and individual responsibilities, is described in Section 7.0 of this application. PRL is committed to maintaining as low as reasonably achievable (ALARA) exposures for personnel and ALARA effluent releases. One of the primary objectives of the plant design (refer to Section 3.0 of the

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Vice President and General Manager, with the responsibility and authority to implement and conduct the quality control program. During the engineering and construction phase of the processing facility, the Processing Manager is assisted in performance of these responsibilities by the Construction Supervisor, the Process Engineer, and the Processing Facility Superintendent, who all report directly to the Process Manager (Figure 5-2). During the operation of the facility, the Processing Facility Superintendent continues to report directly to the Process Manager and has the authority to conduct plant operations, maintenance, the radiological health and safety program, and the quality control program. The Processing Facility Superintendent is responsible for the development, review, implementation, and adherence to operating procedures, radiation safety programs, and routine and non-routine maintenance activities. He has the authority to approve and make changes in these procedures and programs. The Processing Facility Superintendent is assisted by the following members of the staff: the Radiological Health Supervisor, the Laboratory Supervisor, and the Process Engineer.

The management control program is described in Section 7.0 of this application. This program contains provisions to ensure that all routine operational activities are conducted in accordance with written procedures that have been reviewed and approved by the radiological health and safety staff. These operating procedures will be reviewed at intervals not to exceed two years. The program also includes a work order system covering nonroutine functions, such as maintenance activities, that are not covered by operating procedures. All work orders are required to be reviewed and approved by the radiological health and safety staff prior to their implementation.

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environmental report) has been to minimize effluent releases. Maintaining ALARA personnel exposures is a function of equipment reliability and performance, personnel training, and job planning. Every attempt will be made to purchase equipment that is reliable and performs to specifications. Personnel training programs will be implemented as described in Section 5.3 of this application. In addition, periodic reviews of operating procedures and routine reviews of work orders by the environmental and radiological health staff will have the specific objective of keeping personnel exposures as low as reasonably achievable. In addition, a Radiation Health Physics Specialist will inspect, review, and approve the project health physics safety programs and records and ALARA philosophy on at least an annual basis.

5.2 Qualification

The Environmental and Radiological Health Supervisor and Radiological Technician are required to have the following qualifications.

A. Environmental and Radiological Health Supervisor
   1. B.S. Degree in the physical sciences, mathematics or engineering from an accredited college or university or a combination of at least four years of relevant experience and education.
   2. Training and/or experience in radiation safety.
   3. Working knowledge of equipment used in radiation and environmental monitoring.
   4. Working knowledge of analytical procedures, both chemical and mathematical.

B. Radiological Technician
   1. High School Diploma - two years of college preferred, with a strong emphasis in math, chemistry, physics.
   2. Training in radiological health.
   3. Knowledge of equipment used in radiation and environmental monitoring.

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The management audit and internal inspection program, including types and scopes of reviews, audits, and inspections, and individual responsibilities, is described in Section 7.0 of this application. PRL is committed to maintaining as low as reasonably achievable (ALARA) exposures for personnel and ALARA effluent releases. One of the primary objectives of the plant design (refer to Section 3.0 of the environmental report) has been to minimize effluent releases. Maintaining ALARA personnel exposures is a function of equipment reliability and performance, personnel training, and job planning. Every attempt will be made to purchase equipment that is reliable and performs to specifications. Personnel training programs will be implemented as described in Section 5.3 of this application. In addition, periodic reviews of operating procedures and routine reviews of work orders by the radiological health and safety staff will have the specific objective of keeping personnel exposures as low as resonably achievable.

5.2 Qualification

The Radiological Health and Safety Supervisor is required to have a high school diploma, or higher level of education, and specialized training in radiation protection. He must also have the following qualifications.

- Experience in conducting training courses, preferably in radiation protection.

- Good communicative skills to prepare both written and oral reports.

- Experience in processing operations and/or underground mining.

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A resume of the individual who is currently the Radiological Health and Safety Supervisor is provided in Appendix A of this application.

5.3 Training

The employee radiological protection training program will consist of the following phases:

- Initial briefing on basic radiation safety, NRC regulations and documents, exposure abatement, and basic decontamination.

- Continuing on-the-job training by supervisors and the Radiological Health and Safety Supervisor.

- Monthly safety meetings to keep employees informed on the latest developments in radiological protection practices. These meetings will also allow employees to take an active part in amending and implementing the radiological protection program.

Initial Briefing

All employees will receive a copy of the radiation safety handbook. Current copies of the following documents will also be available for their examination: 1) 10 CFR Parts 19 and 20; 2) the license, license conditions, or documents incorporated into the license by reference, and amendments to the license; 3) any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order issued pursuant to Subpart B of Part 2 of 10 CFR Part 19, and any response from the licensee; and 4) form NRC-3, "Notice to Employees." In addition, new employees will be required to read and sign a form explaining the potential hazards of working in the plant. A copy of

this form is provided in Appendix B. Employees will be allocated adequate time to examine the documents described above, followed by a question and answer period for further clarification. The initial briefing will include a plant walk-through with particular emphasis on the employee's specific work area.

Exposure Abatement

Exposure abatement is a two-fold problem; i.e., external and internal. Employees will be instructed in proper work scheduling in order to minimize the time spent in any area which poses a significant external radiation dose. Minimizing exposure to significant concentrations of airborne radioactive material will be the most detailed portion of the training program. Employees will be instructed on the modes of entry of radioactive materials into the body; i.e., ingestion, inhalation, absorption through the skin, and absorption directly in the bloodstream.

To limit ingestion, mouth pipetting is prohibited. The consumption of cigarettes and foodstuffs is not allowed in areas where radioactive materials are handled or stored. In addition, a thorough washing is required after handling any radioactive substance.

To limit exposure by inhalation, all employees will be supplied with an approved respirator as required. Those individuals assigned to areas requiring the use of a respirator must be deemed physically able to perform the work and use the respiratory protective equipment. A physician is to make this determination prior to assignment of the worker and is to review the medical status of each respirator user at least annually.

Respiratory protection will be required to be used by all personnel working in the yellowcake drying and packaging areas.

Respirator protection will be required for employees if airborne levels are likely to exceed 25 percent of MPC. PRL's respiratory protection program is based on Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection" and NUREG-0041, "Manual on Respiratory Protection Against Airborne Radioactive Materials." This program will be directed by the ERHS.

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Exposure Abatement

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Respirator protection will be required for employees if airborne levels are likely to exceed 25 percent of MPC. PRL's respiratory protection program is based on Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection" and NUREG-0041, "Manual on Respiratory Protection Against Airborne Radioactive Materials." This program will be directed by the RSO.

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Exposure abatement

Exposure abatement is a two-fold problem; i.e., external and internal. Employees will be instructed in proper work scheduling in order to minimize the time spent in any area which poses a significant external radiation dose. Minimizing exposure to significant concentrations of airborne radioactive material will be the most detailed portion of the training program. Employees will be instructed on the modes of entry of radioactive materials into the body; i.e., ingestion, inhalation, absorption through the skin, and absorption directly in the bloodstream.

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To limit exposure by inhalation, all employees will be supplied with an approved respirator as required. Those individuals assigned to areas requiring the use of a respirator must be deemed physically able to perform the work and use the respiratory protective equipment. A physician is to make this determination prior to assignment of the worker and is to review the medical status of each respirator user at least annually.

Standard procedures will be developed for respirator use. These procedures will include all information and guidance necessary for

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Standard procedures will be developed for respirator use. These procedures will include all information and guidance necessary for their proper selection, use, and care. Random inspections will be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

Each respirator wearer will receive fitting instructions including demonstrations in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators will not be worn when conditions prevent a good face seal. Such conditions may include growth of a beard, sideburns, a skull cap that projects under the face piece, or temple pieces on glasses. To assure proper protection, the respirator fit will be checked by the wearer each time it is worn. This may be done by following the manufacturer's instructions.

Routinely used respirators will be collected, inspected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Each worker will be briefed on the cleaning procedure and be assured that he will always receive a clean and disinfected respirator.

After inspection, cleaning, and necessary repair, respirators will be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Routinely used respirators will not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

Work areas requiring the use of respirators will be minimized through the proper operation of pollution control equipment and ventilation systems. All employees responsible for the operation of this equipment, and employees assigned to areas where this equipment is utilized, will be instructed in efficient operation of pollution control and ventilation equipment. Baghouse filtration systems will not discharge filtered solids into the atmosphere. In addition, any baghouse developing their proper selection, use, and care. Random inspections will be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

Each respirator wearer will receive fitting instructions including demonstrations in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators will not be worn when conditions prevent a good face seal. Such conditions may include growth of beard, sideburns, a skull cap that projects under the face piece, or temple pieces on glasses. To assure proper protection, the respirator fit will be checked by the wearer each time it is worn. This may be done by following the manufacturer's instructions.

Routinely used respirators will be collected, inspected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Each worker will be briefed on the cleaning procedure and be assured that he will always receive a clean and disinfected respirator.

After inspection, cleaning, and necessary repair, respirators will be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators will not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

Work areas requiring the use of respirators will be minimized through the proper operation of pollution control equipment and ventilation systems. All employees responsible for the operation of this equipment, and employees assigned to areas where this equipment is utilized, will be instructed in efficient operation of pollution control and ventilation equipment. Baghouse filtration systems will not discharge filtered solids into the atmosphere. In addition, any baghouse developing

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excessive back pressure will be shut down for maintenance. Baghouses will be checked daily for discharge of visible dust and for air leakage. They will be checked weekly for tears, holes, and proper fastening of bags. Exposure by inhalation will be further reduced by control of fugitive dust from ore piles, transport operations, and tailings by water sprinkling and chemical stabilization.

Good housekeeping

Employees will be instructed in proper cleaning methods for removing spills and other potentially airborne radioactive material. Only wet or vacuum cleaning methods will be employed in cleaning up spills.

Employees will be supplied with, and instructed in, the proper use of protective clothing, as required, to minimize skin contact with solutions containing radioactive materials. Employees having abrasions, cuts, or punctures of the skin will not be allowed to work in areas where radioactive materials are handled if the injury cannot be adequately protected.

Employees will be instructed to assure that all surfaces are free of dust and contamination prior to painting. If a doubt exists, the Radiological Health Supervisor will verify decontamination by survey (refer to Section 5.5 of this application).

Employees will be instructed to release equipment or packages from the restricted area only in accordance with Annex A, Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material (NRC, 1976). In addition, employees will be instructed in methods to ascertain conformity with this document.

On-The-Job Training

The continuing on-the-job training will be carried out informally, primarily by the workers' immediate supervisor, but supported by the Radiological Health Supervisor. This training will be very specific for the job the particular worker has been assigned. It will generally cover the same training as the initial briefing, but will also include emergency procedures.

Safety Meetings

Monthly radiological safety meetings lasting at least 30 minutes will be attended by all workers and supervisors. These meetings will generally consist of a film or other educational aid followed by open discussion. The use of films and other aids will facilitate the training of all employees in recent advancements in radiological health protection. The open discussion will allow employees to voice ideas, questions, and grievances concerning radiological health protection; thereby involving all levels of the company in maintaining a viable and safe radiological safety program.

5.4 Security

The boundary limits of the processing facility will be posted and enclosed by a fence restricting the area to people and large animals, such as cattle. The process plant, run-of-mine ore lay-down patio, ancilliary facilities (such as laboratory, office building, warehouse and maintenance facilities, electrical power distribution, reagent storage, and water wells), and the entire tailings disposal area will be located within the boundary limits of the facility. Gates will control the designated points of access to the facility. Posted signs strategically located, will state "Keep Out - Restricted Area," for such areas as the tailings impoundment. Similar warning or information signs will be posted in pertinent locations.

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The continuing on-the-job training will be carried out informally, primarily by the workers' immediate supervisor, but supported by the Radiological Health Supervisor. This training will be very specific for the job the particular worker has been assigned. It will generally cover the same training as the initial briefing, but will also include emergency procedures.

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Access to all areas except the general office building, employee parking, visitor parking, the run-of-mine ore lay-down patio, and the crusher dump pocket will be further controlled by chain link fencing, gates, and a manned security station. Warning and information signs will also be posted. The security station will be manned continuously.

All gates will be kept closed except for those providing access to employee parking and the general office building during normal business hours or at shift change. Supervisory and security personnel will be provided building keys. All fenching and gates will be inspected daily by security personnel or other responsible employees to insure system integrity. The results of the inspections will be recorded in a log.

Visitors to the plant will be admitted only by permission from a supervisory employee. Each visitor will be checked in and out on a visitor's register and will be escorted while in the secured area. Visitors having work assignments, such as an equipment manufacturer repair man, may be given security, safety, and radiation protection orientation and subsequently allowed to perform their duties without escort.

5.5 Radiation Safety

A discussion of the radiological health and safety monitoring program is provided in Section 6.2, pages 6-9 to 6-15, of the environmental report. This discussion includes the personnel and restricted-area monitoring programs. Details of radiological analytical procedures are provided in Appendix C of this application.

Plateau Resources Limited has planned a program for monitoring releases of radioactive materials from the plant in accordance with the requirements of proposed NRC Regulatory Guide 4.14 (June, 1977). This program is provided in Section 6.2, pages 6-15 to 6-23, of the environmental report. The locations of sample sites are shown on Figures 6.2-1, page 6-17, and 2.7-2, page 2-115.

The following items will be sampled and analyzed to measure the impact of the processing facility on the environment.

Ionizing Radiation

Nine TLD sampling stations will be established outside the plant security fence. These dosimeters will be exchanged and the accumulated dose measured quarterly.

Airborne

Airborne particulates, chemicals, and radionuclides will be measured at the boundary of the exclusion area and at the nearest residence.

Surface Water

No liquid effluents will be released to surface drainages.

Groundwater

Groundwater will be sampled from at least four wells in the vicinity of the plant. Samples will be analyzed for radionuclides on a quarterly basis. Water levels will be measured monthly. Other water quality constituents will be analyzed semiannually.

Ecology

Impact of airborne effluents will be measured by sampling soils, vegetation, and animals for radionuclides on an annual basis downwind of the plant.

It is expected that prior to, and during the life of the plant, additional federal, state, and perhaps local requirements will cause modification to the monitoring plans described in Section 6.2 of the environmental report. Modifications will comply with revised regulations. The program may also be modified as the result of initial monitoring results.

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6.0

ACCIDENTS

Potential accidents are discussed in Section 7.0 of the environmental report.

A vehicular ambulance will be maintained at the plant for medical emergencies requiring off-site attention. If more immediate transport is required, airborne ambulance service can be brought to the Bullfrog Basin Marina airstrip.

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7.0

QUALITY ASSURANCE

Management Control Program

It is the policy of Plateau Resources Limited that all activities conducted at the Shootering Canyon uranium ore processing facility (processing facility) be conducted in full accordance with all regulations applicable to the protection of the health and safety of the general public and the operating personnel of the facility. The program described herein is intended to supply the basis of assuring that this policy is implemented. Essential features of this program are written procedures which represent the implementation of the program and the assignment of specific responsibilities for all aspects of the program.

The objective of this program is to provide careful control of all work performed which might reasonably be expected to have an impact on the health and safety of the general public and the facility operating personnel (hereinafter referred to as critical components and activities) in connection with the design, construction and operation of the processing facility. This control to accomplish the above objective is accomplished through (i) periodic routine inspection of critical component design, construction, and operation, (ii) inspection and/or certification of critical components, (iii) radiation monitoring, (iv) control of measurements of radiation and radioactive materials, (v) training programs related to critical activities, and (vi) procedures for evaluation of and correction of critical component and activity deficiencies. This control as described in this paragraph is hereinafter referred to as quality control.

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An essential feature of any program is periodic evaluation of the adequacy of the program and of its implementation at the processing facility. The program provides for periodic audits of the operation of the quality control program and for audits and/or evaluations of the effectiveness of the program itself. These audit functions may be carried out by members of the staff of Plateau or by outside personnel, or by a combination of these. Where outside personnel are used in any phase of this audit and evaluation, the same criteria for performance of the quality related functions will be applied as required by the Plateau Program. The portion of the program described in this paragraph is hereinafter referred to as quality assurance.

Organization and Responsibilities

Organizational responsibilities and authorities are described in section 5.1, pages 11-16 of this application.

The Program Manager will review the quality control program to assure that it complies with the objectives of this plan. Differences of opinion between the Program Manager and the Manager of Operations' staff will be resolved by the Vice President and General Manager. The Program Manager may receive assistance from members of the operations organization in the discharge of his responsibilities in the quality assurance program related to health and safety activities. In the event the Program Manager obtains such assistance in connection with audit, inspection and evaluation activities, in no case shall any operations employee participate in an inspection, audit or evaluation of activities which are directly under his supervision or which he performed.

Quality Control Responsibilities

Responsibilities relating to the Quality Control Program are assigned as follows.

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An essential feature of any program is periodic evaluation of the adequacy of the program and of its implementation at the processing facility. The program provides for periodic audits of the operation of the quality control program and for audits and/or evaluations of the effectiveness of the program itself. These audit functions may be carried out by members of the staff of Plateau or by outside personnel, or by a combination of these. Where outside personnel are used in any phase of this audit and evaluation, the same criteria for performance of the quality related functions will be applied as required by the Plateau Program. The portion of the program described in this paragraph is hereinafter referred to as quality assurance.

Organization and Responsibilities

The table of organization of Plateau Resources Limited is set forth in Figures 5-1, 5-2, and 5-3. The Vice President and General Manager has the responsibility for all production and support operations. He has the full authority to deal with all problems related to the operation of the processing facility, including the quality control and quality assurance programs associated therewith. He is responsible for assuring the implementation of the quality control and quality assurance programs outlined herein. The operational responsibilities and authorities of the Vice President and General Manager, in respect to quality assurance and quality control set forth herein, are delegated to the Program Manager and the Manager of Operations, respectively. Also reporting to the Vice President and General Manager is the Chief Geologist, who is responsible for the mineral property exploration and acquisition program.

The Process Manager, Mine Manager, and Personnel Director report directly to the Manager of Operations. The Project Manager is responsible for the design and construction of all processing facilities. The Process Manager is responsible for the operation of all processing facilities as well as ore purchases. The Process Manager is also charged,

An essential feature of any program is periodic evaluation of the adequacy of the program and of its implementation at the processing facility. The program provides for periodic audits of the operation of the quality control program and for audits and/or evaluations of the effectiveness of the program itself. These audit functions may be carried out by members of the staff of Plateau or by outside personnel, or by a combination of these. Where outside personnel are used in any phase of this audit and evaluation, the same criteria for performance of the quality related functions will be applied as required by the Plateau Program. The portion of the program described in this paragraph is hereinafter referred to as quality assurance.

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The Process Manager, Mine Manager, and Personnel Director report directly to the Manager of Operations. The Process Manager is responsible for the design, construction, and operation of all processing facilities, as well as ore purchases. The Process Manager is also charged,

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through the Manager of Operations and Vice President and General Manager, with the responsibility and authority to implement and conduct the quality control program. During the engineering and construction phase of the processing facility, the Project Manager will be assisted in performance of these responsibilities by the Technical Superintendent and the Plant Superintendent, who report directly to the Project Manager. During the operations phase, the Plant Superintendent reports directly to the Process Manager and has the authority to conduct the quality control program. The Plant Superintendent will be assisted by the following members of the staff: the Environmental and Radiological Health Supervisor the Laboratory Supervisor, and the Technical Superintendent, in the conduct of the quality control program during the operations phase.

The Program Manager will review the quality control program to assure that it complies with the objectives of this plan. Differences of opinion between the Program Manager and the Manager of Operations' staff will be resolved by the Vice President and General Manager. The Program Manager may receive assistance from members of the operations organization in the discharge of his responsibilities in the quality assurance program related to health and safety activities. In the event the Program Manager obtains such assistance in connection with audit, inspection and evaluation activities, in no case shall any operations employee participate in an inspection, audit or evaluation of activities which are directly under his supervision or which he performed.

Quality Control Responsibilities

Responsibilities relating to the Quality Control Program are assigned as follows.

through the Manager of Operations and Vice President and General Manager, with the responsibility and authority to implement and conduct the quality control program. During the engineering and construction phase of the processing facility, the Process Manager will be assisted in performance of these responsibilities by the Construction Supervisor, the Process Engineer and the Processing Facility Superintendent, who all report directly to the Process Manager. During the operations phase, the Processing Facility Superintendent continues to report directly to the Process Manager and has the authority to conduct the quality control program. The Processing Facility Superintendent will be assisted by the following members of the staff: the Radiological Health Supervisor, the Laboratory Supervisor, and the Process Engineer, in the conduct of the quality control program during the operations phase.

The Program Manager will review the quality control program to assure that it complies with the objectives of this plan. Differences of opinion between the Program Manager and the Manager of Operations' staff will be resolved by the Vice President and General Manager. The Program Manager may receive assistance from members of the operations organization in the discharge of his responsibilities in the quality assurance program related to health and safety activities. In the event the Program Manager obtains such assistance in connection with audit, inspection and evaluation activities, in no case shall any operations employee participate in an inspection, audit or evaluation of activities which are directly under his supervision or which he performed.

Quality Control Responsibilities

Responsibilities relating to the Quality Control Program are assigned as follows.

Design and Engineering Phase

During design and engineering, the Project Manager will be responsible for assuring that design documents are reviewed for conformance with design criteria. Special attention will be directed to the suitability of design and/or specifications related to the following:

- The proper control of dusting through the use of dust collectors, enclosure of equipment, etc., particularly in operations involving 1) ore handling, grinding, sampling, and storage and 2) ammonium diuranate calcination and yellowcake crushing and packaging.

- The proper control of ventilation to minimize release of radon-222 to working areas and to otherwise minimize the dusting of radioactive materials.

- The proper design of the tailings impoundment dam, particularly those features impacting on dam height and integrity, and resistence to wave action and erosion.

- The proper design and location of sampling wells around the tailings impoundment to permit the detection of leakage of radioactive materials from the impoundment.

- The proper design of tailings stabilization when the tailings impoundment is relegated to an inactive status.

- The general integrity of facility equipment design involved in the processing or storage of radioactive materials to minimize or prevent leakage of radioactive solids or liquids.

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Design and Engineering Phase

During design and engineering, the Process Engineer will be responsible for assuring that design documents are reviewed for conformance with design criteria. Special attention will be directed to the suitability of design and/or specifications related to the following:

- The proper control of dusting through the use of dust collectors, enclosure of equipment, etc., particularly in operations involving 1) ore handling, grinding, sampling, and storage and 2) ammonium diuranate calcination and yellowcake crushing and packaging.

- The proper control of ventilation to minimize release of radon-222 to working areas and to otherwise minimize the dusting of radioactive materials.

- The proper design of the tailings impoundment dam, particularly those features impacting on dam height and integrity, and resistance to wave action and erosion.

- The proper design and location of sampling wells around the tailings impoundment to permit the detection of leakage of radioactive materials from the impoundment.

- The proper design of tailings stabilization when the tailings impoundment is relegated to an inactive status.

- The general integrity of facility equipment design involved involved in the processing or storage of radioactive materials to minimize or prevent leakage of radioactive solids or liquids.

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Construction Control

Inspection of Construction. During construction of the processing facility, the Project Manager or his delegate will be responsible for the following:

- Reviewing and approving procedures and material specifications.
- Implementing controls to prevent inadvertent issue and use of unapproved design documents.
- Reviewing, approving, and documenting design changes.
- Implementing a receiving inspection system to assure that materials and components are inspected for conformance to specifications and that nonconforming items are identified and controlled to prevent inadvertent use.
- Implementing a program of independent or vendor-certified testing of materials and components to verify conformance with specifications.
- Performing and documenting overchecks to verify that final installations meet required standards.
- Inspection of construction of the tailings dam, lining of the pond, and other pond related construction activities for concurrence with the plans and specifications.

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Construction Control

Inspection of Construction. During construction of the processing facility, the Construction Supervisor or his delegate will be responsible for the following:

- Reviewing and approving procedures and material specifications.
- Implementing controls to prevent inadvertent issue and use of unapproved design documents.
- Reviewing, approving, and documenting design changes.
- Implementing a receiving inspection system to assure that materials and components are inspected for conformance to specifications and that nonconforming items are identified and controlled to prevent inadvertent use.
- Implementing a program of independent or vendor-certified testing of materials and components to verify conformance with specifications.
- Performing and documenting overchecks to verify that final installations meet required standards.
- Inspection of construction of the tailings dam, lining of the pond, and other pond related construction activities for concurrence with the plans and specifications.

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Start-Up. Prior to facility operations, the Plant Superintendent will verify or cause to have verified:

- Proper operation of level indicators.
- Leak-tightness of process piping system.
- Separation of sanitary and process water system.
- Proper routing of drains.
- Operability of remote actuation valves.
- Proper function of the ventilation systems and air cleaning equipment.

Prior to facility operation, the environmental and Radiological Health Supervisor will verify:

- Operability of air monitors.
- Readiness of emergency equipment.

Operational Control

The Environmental and Radiological Health Supervisor will be responsible for radiation protection and environmental monitoring. He and/or his staff will:

- Develop and implement a radiation protection orientation and training program for all employees.
- Establish a program for training the radiation protection specialist(s).
- Perform annual reviews of training documentation to verify the adequacy of course content and training records.

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- Proper operation of level indicators.
- Leak-tightness of process piping system.
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Prior to facility operation, the environmental and Radiological Health Supervisor will verify:

- Operability of air monitors.
- Readiness of emergency equipment.

Operational Control

The Environmental and Radiological Health Supervisor will be responsible for radiation protection and environmental monitoring. He will:

- Develop and implement a radiation protection orientation and training program for all employees.

- Establish a program for training the radiation protection specialist(s).

- Perform annual reviews of training documentation to verify the adequacy of course content and training records.

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<u>Start-Up</u>. Prior to facility operations, the Processing Facility Superintendent will verify or cause to have verified:

- Proper operation of level indicators.
- Leak-tightness of process piping system.
- Separation of sanitary and process water systems.
- Proper routing of drains.
- Operability of remote actuation valves.
- Proper function of the ventilation systems and air cleaning equipment.

Prior to facility operation, the Radiological Health Supervisor will verify:

- Operability of air monitors.
- Readiness of emergency equipment.

<u>Operational Control</u>

The Radiological Health Supervisor will be responsible for radiation protection and environmental monitoring. He will:

- Develop and implement a radiation protection orientation and training program for all employees.

- Establish a program for training the radiation protection specialist(s).

- Perform annual reviews of training documentation to verify the adequacy of course content and training records.

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- Develop sampling and surveying procedures for radiation protection and environmental impact considerations.

- Review and approve procurement of radiation protection and environmental monitoring instruments and calibration standards.

- A weekly documented inspection of all work and storage areas with a report to the ERHS of any items of non-compliance affecting radiological safety.

- Perform monthly inspections of work and storage areas and practices with respect to radiation safety and perform monthly reviews of all monitoring and exposure data to ensure completeness, detection of abnormal conditions and adequacy of followup actions as well as to detect trends and/or deviations from the ALAR philosophy. The results of this review will be reported to the Process Manager.

- Quarterly review of the radiation instrument calibration records and procedures.

- Establish and maintain an overcheck program utilizing independent laboratories to verify sample analysis accuracy.

- Quarterly review of the overcheck program records to insure the detection and correction of discrepancies.

- Report semiannually by written report to the Manager of Operations, the Process Manager and the Plant Superintendent address any upward trends in monitoring or survey data, abnormal emissions, items of regulatory non-compliance and recommendations for necessary corrective actions. This report will also include an evaluation of the adequacy of implementation of the license conditions and ALARA philosophy.

The Plant Superintendent will cause the following to be performed:

- A documented visual inspection each shift of the tailings impoundment system.

- A daily documented visual surveillance of all mill areas by an operations foreman to ensure implementation of required radiation safety practices.

- Develop sampling and surveying procedures for radiation protection and environmental impact considerations.

- Review and approve procurement of radiation protection and environmental monitoring instruments and calibration standards.

- Perform monthly reviews of survey records to insure completeness, detection of abnormal conditons, and adequacy of followup actions.

- Quarterly review of the radiation instrument calibration records and procedures.

- Establish and maintain an overcheck program utilizing independent laboratories to verify sample analysis accuracy.

- Quarterly review of the overcheck program records to insure the detection and correction of discrepancies.

- Annually review radiation exposures and radiation survey records for adherence to AIARA philosophy.

Deviations and Corrective Actions

If and whenever the Process Manager receives a communication identifying a problem or prospective problem in the milling facility which might be reasonably expected to create an unacceptable radiological safety condition in the facility or to increase the risk of off-site consequences of the plant's activities, he will immediately initiate an investigation designed to develop a plan for corrective action.

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Deviations and Corrective Actions

If and whenever the Process Manager receives a communication identifying a problem or prospective problem in the milling facility which might be reasonably expected to create an unacceptable radiological safety condition in the facility or to increase the risk of off-site consequences of the plant's activities, he will immediately initiate an investigation designed to develop a plan for corrective action.

Records and Reports

Records will be maintained to provide documentation of all quality control and quality assurance activities related to the environmental and radiological health program for a minimum of five years. The records will include the results of sampling, analyses, surveys, monitoring, and equipment calibration and training, reports of inspections and audits, subsequent reviews and investigations and corrective actions.

The Program Manager has the assigned responsibility of developing and maintaining an appropriate system for the collection, verification, filing and retention of all such records.

Training

A training program will be established by the Environmental and Radiological Health Supervisor for all plant personnel which will include:

- principles of radiation safety
- radiological monitoring and analytical procedures
- radiation safety program of plant.

Personnel will be required to complete this training program prior to being assigned to work requiring minimum supervision.

A training program will be established by the Program Manager for all persons assigned to conduct inspections, audits and surveillance activities which will include:

- objectives of the inspection and radiological monitoring programs

- review of applicable regulations and Plateau Resources Limited license conditions inspection procedures

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Records and Reports

Records will be maintained to provide documentation of all quality control and quality assurance activities related to the radiological safety program.

The Program Manager has the assigned responsibility of developing and maintaining and appropriate system for the collection, verification, filing and retention of all such records.

Training

A training program will be established by the Radiological Health Supervisor for all plant personnel which will include:

- principles of radiation safety
- radiological monitoring and analytical procedures
- radiation safety program of plant.

Personnel will be required to complete this training program prior to being assigned to work requiring minimum supervision.

A training program will be established by the Program Manager for all persons assigned to conduct inspections, audits and surveillance activities which will include:

- objectives of the inspection and radiological monitoring programs

- review of applicable regulations and Plateau Resources Limited license conditions inspection procedures

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- audit principles, as they are applicable to the responsibilities of the particular individuals involved.

Personnel will be required to complete the training programs prior to initiating any inspection, audit, or surveillance activity.

Audits

A system of planned and documented audits is intended to assure continuing compliance with the quality assurance program described herein for controlling the quality of work related to radiological safety in the facility. The responsibility for conducting, reporting and following up on these audits is assigned to the Program Manager and his staff. The audits will be conducted in accordance with a predetermined schedule using a check list covering the elements of the system which are to be audited.

Two categories of audits will be conducted: audits of the operations of the quality control plan and quality assurance system audits. The objective of the audits for the quality control plan is to evaluate the extent of compliance of the operating organization to the requirements of the plan. The audits will involve a review of the following:

- adherence to established procedures
- measurement quality control program
- inspection activities
- sample evaluation program
- measurement results
- nature of identified deficiencies and corrective actions taken in connectection with these deficiencies
- adequacy of documentation
- training programs
- radiological health and safety program.

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- audit principles, as they are applicable to the responsibilities of the particular individuals involved.

Personnel will be required to complete the training programs prior to initiating any inspection, audit, or surveillance activity.

Audits

A system of planned and documented audits is intended to assure continuing compliance with the quality assurance program described herein for controlling the quality of work related to radiological safety in the facility. The responsibility for conducting, reporting and following up on these audits is assigned to the Program Manager and his staff. The audits will be conducted in accordance with a predetermined schedule using a check list covering the elements of the system which are to be audited.

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- taken in connectection with these deficiencies
- adequacy of documentation
- training programs
- radiological safety program

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- audit principles, as they are applicable to the responsibilities of the particular individuals involved.

Personnel will be required to complete the training programs prior to initiating any inspection, audit, or surveillance activity.

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A system of planned and documented audits is intended to assure continuing compliance with the quality assurance program described herein for controlling the quality of work related to radiological safety in the facility. The responsibility for conducting, reporting and following up on these audits is assigned to the Program Manager and his staff. The audits will be conducted in accordance with a predetermined schedule using a check list covering the elements of the system which are to be audited.

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- measurement quality control program
- inspection activities
- sample evaluation program
- measurement results
- nature of identified deficiencies and corrective actions taken in connection with these deficiencies
- adequacy of documentation
- training programs

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The radiological safety audit will be conducted in two parts. The first part will be conducted semiannually by the Program Manager's office with internal assistance as required and will include a review of operating procedures, exposure records, monthly inspection reports, training programs and reports of safety meetings. The second part will be conducted annually by an outside consultant Radiation Health Physics Specialist who will inspect, review and evaluate the facility records, the program performance and adherence to the ALARA philosophy. One inspection will be conducted prior to start-up. Other audits will be conducted every six months during the first year of operations and annually thereafter. Quality assurance system audits will provide a biannual evaluation of the effectiveness and adequacy of the quality assurance system.

All audits will be documented and reported to the Vice President and General Manager, the Manager of Operations, and the Process Manager for review and initiation of corrective action on any deficiencies discovered during the audit.

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These audits will be conducted every six months during the first year of operation and annually thereafter. Quality assurance system audits will provide a biannual evaluation of the effectiveness and adequacy of the quality assurance system.

All audits will be documented and reported to the Vice President and General Manager, the Manager of Operations, and the Process Manager for review and initiation of corrective action on any deficiencies discovered during the audit.

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8.0
EVALUATION OF ALTERNATIVES

The alternatives considered in designing the proposed mill are described in Section 10.0 of the environmental report. The economic and social effects of mill construction and operation (both costs and benefits) are discussed in Section 8.0 of the report. A benefit-cost analysis of the entire project (mining and milling) is presented in Section 11.0 of the report.

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Appendix A

RESUME
RADIOLOGICAL HEALTH
AND
SAFETY SUPERVISOR

NAME: Jay W. Davis

EDUCATION:

Green River High, Green River, Utah (1965-1967) - course of study General.

Northeast Missouri State University, Kirksville, Missouri (summer 1966) - course of study Mathematics (went on a Grant, accredited course sponsored by National Science Foundation).

University of Nevada, Reno, Nevada (1967-1969) - course of study Geology and Chemistry.

Evaluation of Visible Emissions (February 1978), Utah State Division of Health, Bureau of Air Quality. Certificate received.

Environmental Protection Agency (March 1978), Seminar entitled "Clean Air Act" in Denver, Colorado.

Radiological Health Physics Course (June 1978), Lowell University, Lowell, Massachusetts. Certificate Received.

Radiation Monitoring and Control (February 1979), Mine Safety and Health Administration. Certificate received.

Rocky Mountain Center for Occupational and Environmental Health post graduate course "Park City Environmental Health Conference" in Park City, Utah (April 1979).

I have attended the State wide hearings in Utah on the State Implementation Plan to the Clean Air Act since the beginning of 1978.

Practical training in radiation safety at mine and leach facility for nine months.

I have pursued, on a personal basis, intensive studies of all phases of radiological health, particularly internal dosimetry as relates to uranium mining and processing.

I am currently pursuing a BS in chemistry from the University of Utah.

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MEMBERSHIPS: Regular Membership - American Public Health Association

CERTIFICATIONS: Instructor Surface and Instructor Underground, all phases of MSHA required training (January 1979) Mine Safety and Health Administration. Certificate Received.

EXPERIENCE: HYDRO-JET SERVICES* Green River, Utah, (3/1/78 through present) Environmental and Radiological Health Supervisor. Duties include the following: 1) Establish complete radiological and environmental programs for Blanding Ore Buying Station, R&D mill and mines; also, safety at the Blanding Ore Buying Station; safety program for the Ore Buying Station; 2) Select and/or develop all sampling, analytical calculations, calculations for radiological exposure control, decontamination, quality control, employee training and documentation procedures, establish industrial hygene monitoring methods; 3) Select all equipment, sources, outside laboratories, etc. for 2. above; 4) Perform the above; 5) Review all operational procedures to verify that they are radiologically and environmentally safe; 6) Assist in and review design of ventilation systems for the Ore Buying Station and the proposed Shootering Canyon Uranium Processing facility; 7) Make routine and non-routine reports required within the company and with State and Federal regulating bodies; 8) Assist in developing the environmental report and subsequent documents for the full term ore buying station source material license and the proposed Shootering Canyon Uranium Processing Facility; 9) Assist in developing pre-operational monitoring programs for the proposed Shootering Canyon Uranium Processing Facility; 10) Implement the pre-operational monitoring program for the proposed Shootering Canyon Uranium Processing Facility; 11) Review the Ore Buying Station design to verify that it is radiologically and environmentally safe.

URANIUM ORE BUYING STATION (5/1/77 through 3/1/78) Analytical Chemist. Duties included: 1) Set up and equip laboratory for analyses of ore buying station process samples, metallurgical samples and radiological and environmental samples; 2) Select and/or develop procedures for the above analyses; 3) Perform the above analyses; 4) Establish and maintain quality control program as pertains to the above.

R&D URANIUM MILL (1/1/76 through 5/1/77) Lab Supervisor. Duties included: 1) Supervise analyses of mill process, metallurgical, radiological and environmental samples; 2) Select and/or develop procedures for the above; 3) Supervise metallurgical testing relating to mill process; 4) Maintain quality control program.

*Hydro-Jet operations purchased 5/77 ; employment continued with Plateau Resources Limited.

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EXPERIENCE: (Cont.)

R&D URANIUM MILL (8/15/75 through 1/1/76) Chemist. Duties included: 1) Routine and non-routine mill process and metallurgical sample analyses; 2) Routine and non-routine radiological and environmental sample analyses; 3) Perform metallurgical balance calculations and maintain process records; 4) Establish and maintain quality control program.

CELESCO INDUSTRIES, INC., Green River, Utah, (6/1/73 to 2/15/75) Electrical/Mechanical Technician in Operations Department.

UNITED CAMPGROUNDS, Green River, Utah (2/1/73 to 6/15/73), surveying and earth moving.

CELESCO INDUSTRICES, INC., Costa Mesa, California (1972 & 1973), aerospace electrical work; missile electronic assembly - trouble shooting; circuit testing; pre-flight electronics check-out.

SELF-EMPLOYED, Service Station Lessor (1970 & 1971) had five employees.

McCABE DRILLING, grouting contractor on dam construction. Had six employees.

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Appendix A
RESUME
RADIOLOGICAL HEALTH
AND
SAFETY SUPERVISOR

Name:	Jay W. Davis
High School:	Green River High, Green River, Utah 1955-1967 Course of Study - General
College:	University of Nevada, Reno, Nevada 1967-1969 Course of Study - Geology and Chemistry
Other:	Northeast Missouri State University, Kirksville, Missouri 1966 Course of Study -Mathematics
Classes:	College Chemistry (minor)
	Practical training in radiation safety at mine and leaching facility for nine months
	Will attend Lowell University for Radiation Safety from May 9 to June 9, 1978
Experience:	Hydro-Jet Services, Great River, Utah, Uranium Leaching Facility Department: Laboratory From: 9/15/75 to 4/31/77 Laboratory Supervisor/Laboratory Technician
	Celesco Industries, Inc., Green River, Utah Department: Operations From: 6/1/73 to 2/15/75 Electrical/Mechanical Technician
	United Campgrounds, Green River, Utah Department: Construction From: 2/1/73 to 6/15/73 Surveying and earth moving

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Appendix B

EMPLOYEE INDOCTRINATION ON RADIATION

The natural radiation associated with uranium ore processing could be hazardous to personnel at this project if established safety rules and procedures are not followed. Understanding what the potential dangers are and how to lessen the effects of these possible hazards will provide the best method for prevention of harmful exposure to radiation.

Radiation exposure may be internal or external - that is, it may come from within or from outside the body. Harmful levels of radiation must come from a source. The sources of external radiation are monitored, and if they are significant in contributing to exposure, they are identified by an appropriate symbol. Sources of internal radiation may enter the body by a person's breathing or swallowing, by coming through breaks or cuts in the skin, or by absorption through the skin. Protection from these sources should be considered according to the type of radiation.

PROTECTION FROM EXTERNAL RADIATION

Minimum exposure to radiation will be obtained if you follow these guidelines:

1. Stay away from posted areas of high radiation unless your duties require you to work there.

2. When you are required to work in high radiation areas, work as efficiently as possible to minimize the time of exposure.

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3. Personal attention should be paid to keeping radioactive materials off of your clothing and your body. This will decrease your exposure from the standpoints of both time and distance.

PROTECTION FROM INTERNAL RADIATION

Protection from internal radiation is based upon preventing sources from entering the body. The following guidelines will minimize your exposure to sources of internal radiation.

1. Maintain good housekeeping techniques and practices. Wash down dusty material. Keep maintenance and control areas clean.

2. Don't smoke in areas where radioactive materials are being handled. The transfer of hazardous material into the mouth, nose, and lungs can easily occur by handling and smoking a cigarette in an area containing radioactive materials.

3. Wash carefully before eating, and eat only in authorized lunchrooms or other approved areas.

4. Wear a respirator or gas mask when required.

5. Wear coveralls when handling radioactive materials, and see that these coveralls are clean when you put them on.

6. Use the change and shower facilities provided to prevent exposure to the radioactive materials.

Following these guidelines and the company procedures and regulations will make your job safe and healthful and will make your exposure to radiation as low as possible. If you have any questions about radiation hazards or safety procedures, ask your supervisor for an explantion.

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Appendix C

AIRBORNE RADIONUCLIDE SAMPLING METHODOLOGY

ANALYSIS FOR URANIUM, THORIUM-230, AND RADIUM-226 IN AIR DUST

Air Dust Sampling

High volume sampler, such as Sierra Model No. 305 or similar equipment, will be used to collect air dust samples. The sampler is equipped with the constant flow controller, with a flow rate range from 20 to 60 cfm. The air dust will be collected on 8" x 10" filter paper.

ANALYSIS

Principle

A scheme is described for the sequential analysis of total uranium, Ra-226, and Th-230 in air dust.

The barium carrier is added and the sample is dissolved in a mixture of perchloric and nitric acids. Uranium is determined fluorimetrically from an aliquot of the original solution. Radium is separated from thorium by precipitation in strong nitric acid. Thorium is purified by ion exchange procedures and collected, filtered, and mounted as the sulfate. The nitrate of radium is dissolved and collected as sulfate.

Sample Preparation

1. Transfer the filter paper to a 150 ml beaker and add 75 ml of HNO_3 and 10 ml of $HClO_4$. Add 1 ml of barium carrier.

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Evaporate with repeated additions of HNO_3 until organic material is destroyed. Continue heating until perchloric acid fumes are evolved.

2. Transfer the residue to a platinum crucible with 1:1 HNO_3, add 10 ml of HF and 10 ml of $HClO_4$ and evaporate to dryness. Repeat additions until solution is clear.

3. Add 10 ml of HNO_3, and evaporate to near dryness.

4. Transfer the solution to a 10 ml volumetric flask with three 1 ml portions of HNO_3. Wash the crucible with water and add the washings to the flask. Dilute to volume with water.

DETERMINATION

Uranium

1. Pipette a 1/10 aliquot of the sample into a 250 ml beaker.

2. Evaporate to near dryness. Add 50 ml of HCl and repeat the evaporation. Pick up with 150 ml of 7N HCl.

3. Pass the sample through a prepared (see Note) ion-exchange column at a low rate of 2 ml/minute. Discard the effluent.

4. Wash the column with 400 ml of 9N HCl. Discard the washings.

5. Elute with 200 ml of 1N HCl at a flow rate not to exceed 2 ml/minute into a 250 ml beaker.

6. Evaporate the eluate to dryness. Pick up with 5 ml of H_2SO_4 and evaporate to dryness. Do not bake the residue.

7. Pick up with 50 ml of 0.3<u>M</u> H_2SO_4 and heat to boiling. Cool, add 20 ml of reagent grade, triple distilled mercury. Electrolyze on a mercury cathode unit for hour at about 1 milliampere.

8. Filter the sample by gravity through a 9 cm Whatman #41 filter paper into a 150 ml beaker and evaporate to dryness.

9. Add 25 ml of HNO_3 and evaporate to dryness. Do not bake. Pick up with 2-3 ml of HNO_3 and transfer to a 10 ml volumetric flask. Dilute to volume with water.

10. Analyze for uranium by fluorometric method.

11. Correct value obtained for the one-tenth aliquot used.

NOTE: Prepare the column by inserting a wad of glass wool and pouring in 10 ml of prepared wet settled Dowex 1 x 4 (100-200 mesh) resin. Condition with 500 ml of 7<u>N</u> HCl.

<u>Radium and Thorium</u>

1. Transfer the remaining 9/10 of the sample solution to a 90 ml centrifuge tube. Add 25 ml of water and 3 ml of H_3PO_4.

2. Adjust the pH to 8 with 1:1 NH_4OH. Digest for 30 minutes in a hot water bath at 90°C. Cool, centrifuge, and discard the supernate.

3. Dissolve the precipitate in HNO_3 with heating.

4. Transfer to a 150 ml beaker with 1:1 HNO_3. Evaoporate to 5-10 ml. Add 90 ml of 90% HNO_3 and stir mechanically for 30 minutes.

5. Cool in a cold water bath. Filter with suction on a glass fiber filter into a 150 ml beaker. Wash to precipitate with cold 90% HNO_3. Reserve the filtrate and washings for thorium analysis.

6. Dissolve the precipitate from the filter paper into a 40 ml short cone, heavy wall centrifuge tube with water and dilute to about 25 ml. Add 3 ml of H_2SO_4 and stir. Centrifuge, decant, and discard the supernate.

7. Add 4 ml of 1:3 H_2SO_4, centrifuge, decant, and discard the washings.

8. Suspend $BaRaSO_4$ in water and filter on a tared Whatman #42 filter paper. Dry in an oven at about 150°C for at least 2 hours.

9. Cool, weigh, mount with a ring and disc, and cover with alpha phosphor and Mylar. Count the Ra-226 activity immediately and after 30 days. (See Note 1)

10. Evaporate the HNO_3 filtrate, containing the thorium reserved in step 5, to dryness. Pick up with 50 ml of 8<u>N</u> HNO_3.

11. Pass the sample through a prepared (see Note 2) ion-exchange column at a flow rate of about 2 ml/minute. Wash the colume with 100 ml of 8<u>N</u> HNO_3. Discard the effluent and washings.

12. Elute with 100 ml of 1:1 HCl and collect in a 150 ml beaker. The flow rate should not exceed 2 ml/minute.

13. Add 1 ml of barium carrier solution and add 1:1 H_2SO_4 dropwise until precipitation is complete. Filter on a tared Whatman #42 filter paper.

14. Dry in an oven at about 150°C for at least 2 hours.

15. Cool, weigh and mount with a ring and disc, and cover with alpha phosphor and Mylar.

16. Count the Th-230 activity in an alpha scintillation counter.

NOTES:

1. The loss of radon from the precipitate is negligible. After 30 days, Ra-226, Rn-22, Po-218 and Po-214 are in radioactive equilibrium.

2. Prepare the column by inserting a wad of glass wool and pouring in 15 ml of prepared wet settled Dowex 1 x 4 (100-200 mesh). Condition with 150 ml of 8N HNO_3.

Calculations

The gross counting data obtained for Ra-226 and Th-230 must be corrected to give the proper disintegration rates. The corrections for Ra-226 include those for build-up or decay, self absorption, chemical yield, and counter background and efficiency. The same corrections are applicable to Th-230 less those of build-up or decay. Note that a nine-tenths aliquot of the sample is used for these two nuclides.

To assay the overall efficiency of this procudure, reagent blanks and standards are prepared and run concurrently with the samples to check the chemistry.

Gravimetric Yield

The sulfate precipitates of radium and thorium are filtered on tared filter paper. Gravimetric yield is based on recovery of barium.

FLUORIMETRIC DETERMINATION OF URANIUM

Principle

Uranium is determined by the fluorescence produced when fused with sodium fluoride and exposed to ultra-violet light.

Scope

This method was developed for urine specimens, however it may be used for other materials after the uranium has been sufficiently isolated from the matrix.

Special Apparatus

1. A 5 ml hypodermic syringe connected by plastic tubing to an 0.5 ml Mohr (graduated in 0.01 ml) pipette which is mounted on a ring stand.

2. Platinum fluorimeter dishes. These are fabricated from 0.015 inch thick, 1 inch diameter blanks. A circular depression 0.50 inch in diameter and 0.150 inch deep is formed at the center.

3. A booster pump (Model #2 NF 10 Gast pump) with a regulator (Fisher Bovenor Company Diaphram Regulator) to obtain 45 cm Hg gas pressure is required in order to attain fusion in 25-30 seconds.

4. Uranium fluorimeter (HASL or Harrell-Ash).

5. A pellet dispenser made by cutting a 1 ml hypodermic syringe to leave the full bore open. The plunger is fitted with a stop so that the maximum open_ g will contain 100 $\pm$ 10 mg of sodium fluoride.

6. Platinum loop dish holders made of 2 mm platinum rod. These are mounted on a ring stand so that the dishes are held in the zone of maximum flame temperature.

7. Low temperature hot plate covered with 1/4" Transite. The Tran ite has three rows of 1/2" circular cutouts for holding dishes for evaporation.

8. Transite racks to hold nine samples. These are fitted with legs for stacking.

Special Reagents

1. Reagent grade sodium fluoride. Several lots from different manufacturers should be tested to obtain material with a minimum blank reading and high uranium sensitivity. Sufficient reagent from the best lot should be obtained to last for several years.

Instrument Standardization

Prior to initial use, allow the fluorimeter to warm up for 15 minutes. A permanent glass standard is used for daily adjustment of the instrument and for stability checks after reading each sample. A 0.6 microgram uranium standard is adjusted to 6000 divisions and the prepared glass standard is read. This reading is recorded and in subsequent use of the instrument the meter is set at this value by adjusting the phototube voltage. The glass standard prepared at HASL is equivalent to 0.27 micrograms of uranium and gives an instrument response of 2700 divisions.

DETERMINATION

1. Analyze all samples in triplicate.
2. Rinse pipette with water and the sample before taking the aliquots.
3. Pipette 0.1 ml of sample onto each of three platinum dishes.
4. Evaporate to dryness on the low heat hot plate.
5. Ignite the residue over a Meker burner.
6. Cool and add 100 ± 10 mg of sodium fluoride.
7. Fuse completely over a Meker burner with gas at 45 cm Hg. The temperature of the flame should be such the complete fushion takes place with 25-30 seconds.
8. Cool by holding dish in air, with platinum tipped forceps, for a few seconds. Place in a Transite rack to cool completely.

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9. Read the fluorescence of each sample.

10. Calculate the uranium from a calibration factor or calibration curve.

Cleaning Platinum Dishes

Dishes are cleaned daily, sufficient platinum being available for a full day's analyses. After the samples have been read, remove the bead by washing with hot water. Allow the dishes to stand in hot 1:1 HNO_3 for at least 15 minutes and preferably overnight.

If samples read greater than 50 divisions, the platinum dishes are separated from those less than 50 for special cleaning. These dishes are fushed with a small amount of potassium bisulfate, washed in tap water and then placed in 1:1 HNO_3 as above.

When ready to use the dishes, rinse with tap water, then distilled water and dry over a flame. Select three dishes at random and run blank determinations. If one or more show a reading above a normal blank, re-clean the entire batch.

Standard Solutions

Stock solution "A" (500 μg/ml) - Dissolve 58.9 mg of pure U_3O_8 in 2 ml of HNO_3 and evaporate to dryness. Take up with water containing 10 drops of HNO_3, transfer to a 100 ml Pyrex columetric flash, and dilute to volume.

Standard solution "B" (50 μg/ml) - Transfer 10 ml of solution "A" to a 100 ml Pyrex volumetric flask. Add 10 drops of HNO_3 and dilute to volume.

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Standard solution "C" (5 μg/ml) - Transfer 1 ml of solution "A" to a 50 ml Pyrex volumetric flask, add 5 drops of HNO_3, and dilute to volume.

It is important that the standard solutions be slightly acid to prevent hydrolysis and adsorption of uranium. They should be stored in polyethylene bottles.

The quantity of uranium in the samples is determined from a calibration curve or a calibration factor (micrograms per liter per meter division). The standards are prepared by pipetting suitable portions of standard uranium solutions onto platinum dishes and treating as described for samples. A new calibration is run each time a fresh bottle of sodium fluoride is put into use. For calibration, four standard are used in each instrument range. The median net meter readings from triplicate aliquots are plotted against the quantity of uranium to give the calibration curve, or the slope of the straight line obtained is used as a calibration factor for sample analyses.

Calculations

The net median value of the triplicate results is used to determine the micrograms of uranium in the sample. The uranium values corresponding to the meter readings are calculated using the standardization factors for the instrument.

The following equation is used for calculating the μg/l.

$$(D\ R - B)\ F = \mu g/l$$

Where: D = meter deflection of the sample

R = meter range (1, 10, or 100)

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B = meter deflection of the blank (always on the 1 scale).
F = factor in μg U/l per unit deflection for the meter range used.

Since the fluorimeter is set to a fixed value for the glass standard (27 on the 100 scale for 2700 μg U/l), F is normally unity. This may vary slightly time to time on the 1 and 10 scales.

NOTES:

1. The sodium fluoride should not be allowed to stand open to the air since it is hygroscopic.

2. Tongs should not be used to hold the dishes in the flame as the flux tends to run toward the cold spot. Using the loop, a uniform bead confined to the depression will be produced.

3. After fusion allow the dish to cool for at least 10 minutes and not more than 30 minutes before reading.

Status

The fluorimeter will measure from 1 to 10,000 micrograms of uranium per liter of sample. Background fluorescence reduces the accuracy of the analysis at very low concentrations (1-10 μg/l). High concentrations (over 1000 μg) are usually diluted prior to analysis to prevent saturation of the fluorescence in the bead.

The whole problem of quenching is one that has not been satisfactorily explained or investigated particulary at extremely low levels of uranium concentration. It is known that colored ions will produce quenching but the degree must be determined on each sample. Experimentally there appears to be no quenching in samples and quenching in general is minimized when pure NaF flux is used rather than mixtures.

Calculations for Ra-226

The Ra-226 disintegration rate is obtained from the countin rate of the equilibrated radium fraction through the following calculation:

$$dpm - R_s \quad YTCE$$

Where: R_s = net counting rate of the sample
Y = recovery facter
T = self-absorption correction
E = counter efficiency factor
C = theoretical conversion from total alpha activity to Ra-226 alpha activity

Chemical Recovery, Y, is obtained by weighing the final barium sulfate precipitate. The calculation of the recovery factor is:

$$Y = \frac{x}{(w-t)\ f}$$

Where: x = weight of barium added as carrier
w = total weight of the final precipitate and filter paper
t = weight of the filter paper
f = gravimetric factor which equals 0.588 mg barium per mg of barium sulfate.

Self-Absorption Correction, T, is used to normalize the self-absorption of the Ra-226, Rn-22, Po-218 and Po-214 alpha activities in samples and standards to a common thickness (mg/cm^2). T is obtained by counting representative alpha emitters over the energy range of 4.8 to 8.8 Mev in precipitates of varying sample thicknesses. The correction is taken as the ratio of counting rates at an arbitrary minimum thickness to other thicknesses over the range of probable sample recoveries.

Theoretical Activity Conversion Factor, C, equals 0.25 after 30 days of buildup, when the three alpha emitting daughters are in secular equilibrium with Ra-226. However, the ratio of Ra-226 to total alpha activity at any time after the separation of radium may be calculated from the Bateman equation for buildup of Rn-222.

Efficiency Factor, E, is determined by alpha counting a known quantity of Ra-226 under sample conditions. The correction is taken as the ratio of the theoretical activity to the observed counting rate. The calculation is expressed as:

$$E = \frac{A}{R_s' \, T' \, C'}$$

Where: A = theoretical activity of the standard

R_s' = net counting rate of the standard

T' = self absorption correction for the standard

C' = theoretical ratio of Ra-226 total alpha activity in the standard

References: HASL Procedures Manual, HASL-300, U.S. Atomic Energy Commission, Edited by John H. Harley, 1972

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