5.0 OPERATIONS

Operations at the Nichols Ranch ISR Project site and facilities are conducted in conformance with applicable laws, regulations and requirements of the various Federal and State regulatory agencies. The organization and management controls described below are established to ensure compliance and further implement the company's policy for providing a safe working environment including the philosophy of maintaining radiation exposures as low as is reasonably achievable (ALARA).

5.1 ORGANIZATION

The management structure and responsibilities of the Uranerz Energy Corporation (Uranerz) organization are described in the following section. The organization function is to provide for development, review, approval, implementation, and adherence to operating procedures, radiation safety programs, environmental and groundwater monitoring programs, quality assurance programs, routine and non-routine maintenance activities, and changes to any of these programs or activities.

5.1.1 Management

The Uranerz organization management structure is shown in Figure 5-1 (see map pocket). The structure is applicable to site construction and site management. The structure is applicable to the central processing facility and the satellite facility. The responsibilities and authorities are described below for these management positions.

A Safety and Environmental Review Panel (SERP) will be established, in whole or part, from these management positions. The SERP is described in Section 5.2.

President

The President has the overall responsibility and authority for the radiation safety and environmental compliance programs. He is responsible for ensuring that operations are

compliant with applicable regulations and permit/license conditions. The President is also responsible for maintenance of the license. The President provides for direct supervision of the Executive Vice President in this capacity.

Executive Vice President

The Executive Vice President reports to the President and is directly responsible for ensuring that operations personnel comply with radiation safety and environmental protection programs. The Executive Vice President is also responsible for compliance with all federal and state regulations, license conditions, and reporting requirements. The Executive Vice President has the responsibility and authority to terminate immediately any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations. The Executive Vice President directly supervises the functional area managers.

Production Manager

The Production Manager reports directly to the Executive Vice President. The Production Manager is responsible for all production activity at the site. In addition to production activities, the Production Manager is also responsible for implementation of industrial and radiation safety, and environmental protection programs associated with operations. All site operations, maintenance, construction, environmental health and safety, and support groups report to the Production Manager. The Production Manager is authorized to implement immediately any action to correct or prevent hazards. The Production Manager has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations. The Production Manager cannot unilaterally override a decision for suspension, postponement, or modification if that decision is made by senior management, the Environmental, Safety, and Health Manager, or the Radiation Safety Officer. The Production Manager directly supervises the Mine Superintendent.

Mine Superintendent

The Mine Superintendent reports directly to the Production Manager. The Mine Superintendent is responsible for day-to-day operation and management of construction and production activities

at the site. The Mine Superintendent is also responsible for implementation of industrial and radiation safety, and environmental protection programs associated with construction and plant management. The Mine Superintendent has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or a potential violation of state or federal regulations. The Mine Superintendent oversees the line management for the functional areas of construction, administration, operations, maintenance, and support.

Line Management

Line management reports directly to the Mine Superintendent. Line management is responsible for management oversight and direct supervision of activities including construction, operations, maintenance, and support for the respective functional area. Line management is responsible for line implementation of industrial and radiation safety, and environmental protection program requirements associated with the respective functional area. Line management is responsible for line conduct and enforcing compliance with management controls (e.g. operating procedures, radiation work permits, and ALARA requirements within the respective functional area. Line management has the authority to stop any activity, immediately if necessary, that is determined to be a threat to employee or public health, the environment, or a potential violation of state or federal regulations. Line management oversees all wellfield, production, and lab personnel.

ES&H Manager

The Environmental, Safety, and Health Manager, reports directly to the Executive Vice President. The Manager ESH is responsible for all radiation protection, health and safety, and environmental programs, and for ensuring compliance with all applicable regulatory requirements. The Manager ESH also has the responsibility to advise senior management on matters involving radiation safety and to implement changes and/or corrective actions involving radiation safety authorized by senior management. The Manager ESH is tasked to ensure that the radiation safety and environmental monitoring and protection programs are conducted in a manner consistent with regulatory requirements. This position assists in the development and review of radiological and environmental sampling and analysis procedures and is responsible for routine auditing of the programs. The Manager ESH has no production-related

responsibilities. The Manager Environment, Safety, and Health, supervises the Radiation Safety Officer.

Radiation Safety Officer

The Radiation Safety Officer (RSO) reports directly to the Manager Environment, Safety, and Health. The RSO is responsible for conducting the radiation safety program and for providing assistance in ensuring compliance with NRC regulations and license conditions applicable to worker health protection. The RSO is responsible for overseeing the day-to-day operation of the radiation safety program and for ensuring that records required by NRC are maintained. The RSO has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations, including the ALARA program. The RSO has no production-related responsibilities. The RSO supervises the Radiation Safety Technician(s).

Environmental and Radiation Safety Technicians

The Environmental and Radiation Safety technicians report directly to the Manager ESH and the RSO, respectively. The Environmental and Radiation Safety technicians assist the Manager ESH and the RSO with the implementation of the environmental monitoring and radiation safety programs. The Environmental and Radiation Safety technicians are responsible for the orderly collection and recording of all data from environmental and radiological safety programs. The Environmental and Radiation Safety technicians have no production-related responsibilities.

5.1.2 ALARA

The radiation safety and environmental programs at the Nichols Ranch ISR Project site will be implemented in the context of keeping personnel and environmental exposure to radiation and radioactive material as low as is reasonably achievable (ALARA).

5.1.2.1 Philosophy

The considered purpose of the radiation safety and environmental protection programs at the Nichols Ranch ISR Project site are to maintain exposure to radiation and radioactive materials ALARA for all employees, contractors, visitors, and the environment. The implementation and effectiveness of a successful ALARA program is the responsibility of everyone involved in conducting operations at the site.

5.1.2.2 Responsibilities

Responsibilities for implementation of the ALARA philosophy are shared by management, the RSO, and all workers at the Nichols Ranch ISR Project site.

Management

Management is responsible for developing, implementing, and enforcing the policies and procedures necessary for effective radiation safety, environmental protection, and ALARA programs to ensure the health and safety of workers and visitors, and protection of the environment.

Management will provide the following:

1. A strong commitment to and continuing support for the development and implementation of the radiation safety, environmental protection, and ALARA programs;
2. Information and policy statements to employees, contractors, and visitors.
3. Periodic management review of operational and procedural efforts to maintain ALARA;
4. Continuing management evaluation of the radiation safety and environmental protection programs including staffing, and allocations of space and funding; and
5. Appropriate briefings and training in radiation safety, environmental protection, and ALARA concepts for all employees, and, when appropriate, for contractors and visitors.

Manager ESH and RSO

The Manager ESH and the RSO have primary responsibility for the technical adequacy and correctness of an ALARA application for the environmental protection and radiation safety programs. Each has continuing responsibility for surveillance and supervisory action in the enforcement of the ALARA program.

The Manager ESH and the RSO will be assigned the following:

1. Major responsibility for the development and administration of the environmental protection, radiation safety, and ALARA programs;
2. Sufficient authority to enforce regulations and administrative policies that affect any aspect of the environmental protection and radiation safety;
3. Responsibility to review and approve plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the environmental protection and radiation safety programs; and
4. Adequate equipment and facilities to monitor relative attainment of the ALARA objective.

Workers

Environmental protection, radiation safety, and ALARA programs are only as effective as the workers' adherence to the program. All workers at the Nichols Ranch ISR Project site will be responsible for the following:

1. Adhering to all policies, operating procedures, and instruction for environmental protection and radiation safety as established by management;
2. Reporting promptly to management equipment malfunctions or violations of standard practices or procedures that could result in increased radiological hazard;
3. Suggesting improvements for the environmental protection, radiation safety, and ALARA programs.

5.2 MANAGEMENT CONTROL PROGRAM

Activities will be conducted in a manner to protect the health and safety of employees, the public, and the environment. Management controls are provided to implement this policy.

5.2.1 Administrative Procedures

Activities that may affect health, safety, and the environment, including compliance with license commitments or conditions, will be conducted in accordance with written procedures or instructions.

5.2.1.1 Operating Procedures

Written operating procedures or instructions (procedures) will be established for all activities that involve handling, processing, or storing radioactive materials. These procedures will include consideration of pertinent radiation safety practices. Written procedures will also be established document control, record keeping, corrective action system, quality assurance, operations, industrial and radiation safety, workplace and environmental monitoring, and emergency response.

Procedures, new and revised, for activities involving radioactive material will include review and approval by the RSO. Approval and training will occur before implementation. A current copy of each procedure will be accessible to all employees. The procedures will include documentation of revision and date. Procedures will be reviewed annually by RSO.

5.2.1.2 Radiation Work Permits

Activities not covered by a written operating procedure but involving radioactive material will be conducted in accordance with requirements of a radiation work permit (RWP). The RWP will describe the job to be performed; precautions necessary to reduce exposure to radioactive

materials; and monitoring and sampling requirements before, during, and after completion of the job.

The RWP will be completed in accordance with a written operating procedure. The RSO or RST will indicate approval of the RWP by signature. Those working under the RWP will acknowledge in writing that they understand the requirements.

5.2.1.3 Record Keeping

Records will be maintained of receipt, transfer, and disposal of source or byproduct material processed or produced at the site. Records will also be maintained of the radiation safety and environmental monitoring programs to include surveys, sampling, and calibrations. These records will be maintained for the period described by regulation or license.

The following records will be permanently maintained and retained until license termination:

- Records of deep well injection.
- Records containing information important to decommissioning and reclamation, including:
    - Descriptions of spills, contamination events and associated corrective actions.
    - Information related to site and aquifer characterization, and background radiation and radioactivity levels.
    - As built drawings of structures, equipment, restricted areas, wellfields, radioactive material storage, and any modifications showing the locations of these structures and systems through time.
    - Drawings of areas of possible inaccessible contamination, including features such as buried pipes or pipelines.
- Occupational exposure history of employees and contractors including:
    - Results of exposure rate measurements used for personnel monitoring and dose calculations.
    - Results of air sampling used for personnel monitoring and dose calculations.
    - Bioassay results.

- NRC Form 5 or equivalent.
- Records of environmental monitoring.

Records will be maintained with safeguards against tampering and loss. Records will be maintained as hardcopy originals and/or electronic copy of same by scanning. Records will be readily retrievable for inspection at the site.

5.2.1.4 Reporting

Spills, leaks, or excursions will be reported in accordance with 10 CFR 40.60. Personnel and environmental monitoring will be reported in accordance with 10 CFR 20 Subpart M.

5.2.2 Safety and Environmental Review Panel

A Safety and Environmental Review Panel (SERP) will be established. The purpose of the SERP is to review proposed changes, tests, or new activities with respect to whether they first require a license amendment.

5.2.2.1 Organization

The SERP will consist of at least three members. One member will have management authority for implementing managerial and financial changes. One member will have expertise in operations and/or construction and will have responsibility for implementing any operational changes. One member will be the RSO, or designee, with responsibility for assuring that changes conform to radiation safety and environmental requirements. Additional members may be included in the SERP, as appropriate, to address specific issues or disciplines. Additional members may serve temporarily and may be consultants.

5.2.2.2 SERP Procedures

The SERP will function in accordance with a written operating procedure(s). The procedure(s) will ensure that approvals of changes in the facility, license, operating procedures, or conduct of tests or experiments are appropriately documented and reported. These approvals may be effected without obtaining a license amendment pursuant to 10 CFR 40.44, so long as the approved activity does not:

- Create a possibility for an accident of a different type than previously evaluated in the license application (as updated).
- Create a possibility for a malfunction of a structure, system, or control with a different result than previously evaluated in the license application (as updated).
- Result in a departure from the method of evaluation described in the license application (as updated) used in establishing the final safety evaluation report or the environmental assessment or technical evaluation reports or other analyses and evaluations for license amendments.

Absent approval by the SERP, a proposed activity may not occur without revision subsequently allowing SERP approval, or approval by NRC.

The RSO will not approve self-proposed changes to radiation safety and environmental requirements. A designee satisfying the qualification requirements of the RSO will serve as a SERP member in these cases.

5.2.2.3 SERP Records

The SERP records will include written safety and environmental evaluations that provide the basis(s) for determining whether changes satisfy the procedural requirements described previously. These records will be permanently maintained and retained until license termination and otherwise in conformance with previous description of record keeping requirements.

5.2.2.4 SERP Reports

An annual report will be submitted to the NRC that includes the results of the annual audit of the radiation safety and ALARA programs required at Section 5.3, land use survey, monitoring data, corrective action program report, one of the semiannual effluent and environmental monitoring reports, and description of activities approved by the SERP. Revised pages of the license application will be included with the report as applicable; each revised license application page will have a change indicator for the area changed and a page change indication.

5.2.3 Cultural Resource Inventory

Uranerz will administer a cultural resources inventory before engaging in any development activity not previously assessed by NRC. Any disturbances to be associated with such development will be completed in compliance with the National Historic Preservation Act, the Archeological Resources Protection Act, and their implementing regulations. Uranerz will cease any work resulting in the discovery of previously unknown cultural artifacts to ensure that no unapproved disturbance occurs. Any such artifacts will be inventoried and evaluated, and no further disturbance will occur until the licensee has received authorization from the NRC to proceed.

5.3 MANAGEMENT AUDIT AND INSPECTION PROGRAM

5.3.1 Audit

An audit will be completed annually of the content and implementation of radiation safety and ALARA programs. The scope of the review will be consistent with NRC Regulatory Guide 8.31 "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Mills Will Be As Low As Is Reasonably Achievable." Revision 1, 2002. A written report of the audit will be submitted to corporate and site management. A written report of the audit will be provided to the Safety and Environmental Review Panel for action as applicable.

5.3.2 Inspections

Inspections will be conducted periodically, as described below, of the wellfield and process areas. The purpose of the inspections will be to ensure that radiation protection, monitoring, and safety requirements are being followed and/or are properly functioning. The inspections will be performed and documented in accordance with a written procedure.

Daily

An ES&H staff representative will conduct a daily walkthrough inspection of the process and storage areas. The inspection will provide for a visual survey of proper implementation of procedures, housekeeping, and contamination control.

Weekly

The ES&H staff will complete a weekly inspection of the site. The scope of the inspection will include radiation safety practices, procedural compliance, environmental monitoring, and environmental conditions at the site.

Monthly

The ES&H manager will provide to site management a written summary of the conditions of radiation safety and environmental monitoring. The report will include summaries of personnel monitoring, radiation and contamination surveys, trends important to ALARA considerations, a general assessment of compliance, and a description of problems with recommendations for corrective action.

5.4 QUALIFICATIONS FOR PERSONNEL CONDUCTING THE RADIATION SAFETY PROGRAM

The qualifications are described below for personnel assigned responsibility for developing, conducting, and administering the radiation safety program. The qualifications will be consistent with NRC Regulatory Guide 8.31, "Information Relevant to Ensuring that

Occupational Radiation Exposures at Uranium Mills Will Be As Low As Is Reasonably Achievable," Revision 1, 2002 at Section 2.4.

Radiation Safety Officer

The RSO should have the following education, training, and experience:

Education: A bachelor's degree in the physical sciences, industrial hygiene, or engineering from an accredited college or university, or an equivalent combination of training and relevant experience in radiation safety. Two years of relevant experience may be considered equivalent to one year of academic study.

Radiation Safety Experience: At least one year of work experience relevant to uranium recovery operations in applied radiation safety, industrial hygiene, or similar work. This experience should involve actually working with radiation detection and measurement equipment, and administrative duties.

Specialized Training: At least four weeks of specialized classroom training in radiation safety applicable to uranium recovery. Refresher training on relevant radiation safety matters should be completed every two years.

Specialized Knowledge: Knowledge of the proper application and use of all radiation safety equipment used at the facility, the analytical procedures used for radiological sampling and monitoring, methodologies used to calculate personnel exposure to uranium and its daughters, an understanding of the processes and equipment used at the facility, and how the radiation hazards are generated and controlled.

Radiation Safety Technician

The radiation safety technician should have one of the following combinations of education, training, and experience:

Education: An associate degree or two or more years of study in the physical sciences, engineering, or a health-related field;

Training: At least four weeks of generalized training (up to two weeks may be on-the-job training) in radiation safety applicable to uranium recovery facilities;

Experience: One year of work experience using sampling and analytical laboratory procedures that involve radiation safety, industrial hygiene, or industrial safety measures to be applied at a uranium recovery facility;

Or

Education: A high school diploma;

Training: A total of three months of specialized training (up to one month may be on-the-job training) in radiation safety relevant to uranium recovery facilities;
Experience: Two years of relevant work experience in applied radiation safety.

The radiation safety technician should demonstrate a working knowledge of the proper operation of radiation safety instruments used in the facility, surveying and sampling techniques, and personnel dosimetry requirements.

5.5 RADIATION SAFETY TRAINING

All personnel will be provided training before entering controlled areas or beginning their jobs. The scope of the training will be based on access requirements to the facility and potential for exposure to radiation and radioactive materials. The scope of training will initially be determined with respect to whether the individual is a visitor, or an employee or contractor. Training of visitors will be applicable to newly hired employees and contractors, and visitors who will not or have not completed other site-specific training (e.g. as described below). All visitors to the facility will receive instruction on what they should do to avoid possible

radiological and nonradiological hazards in the areas of the facility they will be visiting, escort requirement, and actions to take during an emergency.

All new employees and contractors will be instructed by means of an established course in the inherent risk of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs. The training will be commensurate with the risks and hazards associated with their requirements for access to the site. Those personnel who need unescorted access to the wellfield and process area will be provided a course of instruction covering those topics identified in NRC Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable," Revision 1, 2002 at Section 2.5. The instruction will be consistent with NRC Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure," Revision 1, 1996 and NRC Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure," Revision 3, 1999.

Those employees and contractors who will work in the wellfield or process area (i.e. working around radiation and/or with radioactive materials) will be provided additional training. The additional training will include more depth on the previously identified topics, particular instruction on the health and radiation safety aspects and nonradiological hazards of tasks, and the requirements of procedures and instructions pertaining to radiation safety.

A written or oral test will be given to each individual. The test will cover radiation safety and health protection principles and requirements as applicable to the Nichols Ranch ISR Project site. The test will be reviewed with the individual(s), including discussion of wrong answers. Individuals who fail the test will be provided additional training and successfully retested if the intention remains to place them in the wellfield or process area.

Employees and contractors will be provided refresher training annually. The refresher training will be an abbreviated form of the original training. Refresher training will also include relevant information available since the previous training, review of safety issues since the previous training, applicable changes in regulations and license conditions, and personnel exposure trends.

Training will be documented to include individuals name and employer, topic, date, and identification of instructor. Records will be maintained of this documentation and test results.

5.6 SECURITY

Security measures will be provided to prevent unauthorized entry to controlled areas and unauthorized access to licensed material in storage. The security measures will be comprised of passive and active controls. Passive controls will include fencing of wellfields and the process area:wellfield fence will be a typical 3-strand livestock fence to prevent livestock from entering the wellfield, and the process area fence will be a typical chain link fence with minimum the height of six feet to prevent inadvertent animal or human intrusion. Passive controls will also include postings indicating that radioactive material may be present and that permission is required for entry. Active controls will also include capability to lock gates and doors. Visitors will not be allowed inside the wellfields or process area without an escort.

5.7 RADIATION SAFETY CONTROLS AND MONITORING

A corporate commitment to and support for the implementation of the radiation safety program has been established for the Nichols Ranch ISR Project sites. This commitment and support incorporates the ALARA philosophy into the environmental protection and radiation safety controls and monitoring programs described in the following sections.

5.7.1 Effluent Control Techniques

This section describes effluent control techniques designed to minimize in-plant and environmental emissions at each step of the process where release might occur.

5.7.1.1 Airborne Radioactive Effluents

The potential airborne radioactive effluents include radioactive particulates and radon gas.

5.7.1.1.1 Particulate

The potential for airborne radioactive particulate emissions is associated with the drying and packaging of the recovered uranium. These activities will occur in a closed system under vacuum. The use of vacuum drying and packaging equipment is briefly described in Section 4.1. This type equipment has been shown to eliminate particulate releases from drying and packaging activities at ISR uranium processing facilities.

Additionally, the vacuum drying and packaging will occur in a dedicated room or enclosure as depicted in Figure 4-1 (see map pocket). This will provide for confinement of releases associated with these activities.

The dryer room is a single room containing the drying and packaging equipment and operations. Preliminary design dimensions of the dryer room will be 60' L x 60' W x 30' H. The dryer room will be ventilated by the emission control system of the dryer (see also Section 4.1.2). The dryer room will be maintained at a negative pressure during drying and packaging operations. The room will be ventilated to satisfy the criteria in the Technical Report at sections 4.1 GASEOUS AND AIRBORNE PARTICULATES, and 5.7.3 Airborne Radiation Monitoring Program.

The potential release points of uranium in the dryer room are during filling of the dryer and filling of the yellowcake packaging. Spill during fill of the dryer would not be expected to create significant airborne radioactive material due to the high moisture content of the yellowcake at this point (50% or greater), allowing the yellowcake to behave like a sludge. During filling of the yellowcake packaging, local ventilation from the emission control system will prevent significant airborne release during normal operation. A dead-man switch on the fill mechanism will prevent unintended flow of yellowcake when filling packaging.

The dryer room will not normally be accessible from the main process area or the YC (yellowcake) Drum Storage. The dryer room will include a conveyor system for moving the filled yellowcake packages into the adjacent YC Drum Storage.

A process flow diagram of the yellowcake dryer is provided in Figure 5-1a.

5.7.1.1.2 Radon

The potential for radon gas emission is associated with emanation from process solutions. Radon gas mobilization occurs from recovery solutions at process locations where systems allow venting. Control of radon gas will be achieved by using passive and mechanical ventilation in buildings where radon gas venting is expected. The application of ventilation is briefly described in Section 4.1. This type of control has been shown to be effective in reducing and controlling radon gas levels at ISR uranium processing facilities.

5.7.1.2 Liquid Radioactive Effluents

The major liquid effluents include well development water, pumping test water, process bleed, process solutions, wash-down water, and restoration water.

The primary control techniques are application of the systems and methods described in Section 4.2. Otherwise, general contamination control techniques of confinement, containment, isolation, and decontamination will be implemented by operating procedures to affect effluent control.

Nichols Ranch ISR Project will not release liquids into surface waters.

5.7.1.2.1 Contingency for Unplanned Releases

Administrative and engineering controls will be established to prevent both surface and subsurface releases to the environment and to mitigate the effects should a release occur. These controls, including response actions, will be implemented by operating procedures.

Releases can be of two primary types at an in situ uranium recovery facility: surface releases such as vessel failure, piping failure, etc.; and subsurface releases such as well excursion or piping failure.

5.7.1.3 Surface Releases

Vessel failure – Releases may occur from leaks or ruptures of process vessels. These releases will initially be confined within the building by curbing and/or sloped flooring. The entire building will drain to a sump that will contain the solutions until transfer for appropriate management.

Piping failure – Releases may occur from leaks or breaks within the above ground segments of the piping system that transfers fluids between the wellfield and the process area. These are expected to be small and of short duration due to visual inspections and engineering controls that detect pressure changes in the piping systems subsequently alerting the plant operators through system alarms. Surface piping will be protected from vehicle traffic. All process solution pipelines will be pressure tested prior to use.

5.7.1.3.1 Subsurface Releases

Well excursion – Extraction fluids are normally maintained in the production aquifer within the immediate vicinity of the wellfield. The function of the encircling monitor well ring is to detect any extraction solutions migrating from the production area due to fluid pressure imbalance. This system has been proven to function satisfactorily over many years of operating experience with uranium in situ uranium recovery operations.

A ring of perimeter monitor wells located no further than 500 ft from the wellfield and screened in the ore-bearing aquifer will surround all wellfields. Additionally, shallow and deep monitor wells will be placed in the first overlying and first underlying aquifer above each wellfield segment. These wells will be sampled biweekly for the presence of leach solution. The total effect of the close proximity of the monitor wells, the low flow rate from the well patterns, and

over-production of leach fluids (production bleed) makes the likelihood of an undetected excursion extremely remote.

Migration of fluids to overlying and underlying aquifers has also been considered. Several controls are in place to prevent this. All current and future exploration holes will be plugged to prevent commingling of aquifers and to isolate the mineralized zone. In addition, prior to placing a well in service, a well mechanical integrity test will be performed. This requirement ensures that all wells are constructed properly and capable of maintaining pressure without leakage.

Piping failure – Releases may occur from leaks or breaks within the underground segments of the piping system that transfers fluids between the wellfield and the process area. These are expected to be small and of short duration due to engineering controls that detect pressure changes and flow rates in the piping systems subsequently alerting the plant operators through system alarms. All process solution pipelines will be pressure tested prior to use.

5.7.2 External Radiation Exposure Monitoring Program

Monitoring, surveys, instrumentation, and equipment will be provided to determine exposures of employees to external radiation during routine and non-routine operations, maintenance, and cleanup activities.

5.7.2.1 Personnel Monitoring

Employees requiring unescorted access to restricted areas to work around radiation and/or radioactive materials will be provided individual monitoring devices for external occupational dose.

External exposure monitoring will be accomplished using thermoluminescent or optically stimulated luminescent dosimeters. These dosimeters have a lower limit of detection of one mrem and an upper limit of approximately 1,000 rem. The dosimeters will be processed at least quarterly by a vendor accredited by the National Voluntary Laboratory Accreditation

Program. Corrective action will be implemented for any worker reaching 25% of the annual limits of 10 CFR 20.

The program for external exposure monitoring and determining doses from external exposure will be conducted in accordance with or equivalent to NRC Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses," 1992.

Documentation of these monitoring results will be completed consistent with NRC Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data," Revision 1, 1992.

5.7.2.2 Exposure Rate Surveys

Exposure rate surveys will be performed on at least a quarterly frequency in the process areas. Surveys will be performed at normally and periodically occupied locations and areas of potential gamma sources such as process vessels, filter press, dryer, and yellowcake storage. The frequency of exposure rate surveys in the process areas will be increased to monthly for normally occupied areas exceeding 5 mrem/h. The cause and corrective actions will be documented for these cases. Routine survey locations are shown on Figure 5-2a and 5-2b (see map pocket).

Exposure rate surveys will also be performed on at least a quarterly frequency in controlled and unrestricted areas to include wellfields, eating areas, change rooms, and office space. The frequency of exposure rate surveys in controlled and unrestricted areas will be increased to monthly for areas exceeding two mrem/h. The cause and corrective actions will be documented for these cases.

The surveys will be performed with instrumentation that, individually or in combination, covers a range of approximately 0.010 mrem per hour to five mrem per hour. The survey instruments will be portable and hand-held. The instruments will be calibrated at least annually. The instruments will be calibrated and operated in accordance with manufacturers' instructions. The instruments will satisfactorily complete a performance check each day of use.

The results of these surveys will be used to establish postings in accordance with requirements of 10 CFR 20. The results of these surveys may be used to supplement personnel monitoring when work is being performed where workers are required to be monitored.

Exposure rate surveys will be made consistent with NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills," Revision 1, 2002.

5.7.3 Airborne Radiation Monitoring Program

A program will be implemented at the Nichols Ranch ISR Project sites for determination of concentrations of uranium and radon daughters in air. The scope of the program will include routine and non-routine operations, maintenance, and cleanup. Results of the program will be used for personnel exposure calculations, and to implement ALARA with respect to airborne radiation exposures and airborne radioactive releases. The airborne radiation monitoring program will be implemented in conjunction with the respiratory protection program.

The routine airborne radioactivity sampling locations are shown in Figures 5-2a and 5-2b (see map pocket).

Air sampling will be conducted in accordance with or equivalent to NRC Regulatory Guide 8.25, "Air Sampling in the Workplace," 1992. The program will be implemented consistent with NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Recovery Facilities," Revision 1, 2002.

5.7.3.1 Airborne Uranium Particulate Monitoring

Airborne uranium particulate monitoring will include both breathing zone (e.g. lapel air sampler worn by worker) and area sampling (e.g. fixed location or portable air sampler). The samples will be collected under known physical conditions. Typically, the air filter will be glass fiber or paper, flow rate will be 2 to 5 liters per minute for breathing zone and 20 to 50 liters per minute for area, and start and stop time will be recorded. The flow meters will be calibrated after repair

or modification, but at least annually. The samples will be analyzed onsite for gross alpha count rate. The resulting airborne radioactivity concentration will be interpreted as total uranium to support the calculations described in Section 5.7.4.

5.7.3.1.1 Breathing Zone

Breathing zone air samples will be a method used to monitor the worker's intake of uranium.

Breathing zone air samples will be used routinely for drying and packaging activities. Breathing zone air samples will be used for non-routine operations, maintenance, and cleanup as required by operating procedure and/or RWP.

5.7.3.1.2 Area

Air samples will also be collected for general and/or local areas when and/or where there is potential for generation of airborne radioactive material.

Area air samples will be used to verify that confinement or containment is effective, and provide warning of elevated concentrations for planning or response actions. In each case, the sampling point will be located considering airflow patterns and to provide the most reasonable representation of the work environment.

Area air sampling will be used routinely for drying and packaging activities. Area air sampling will be used for non-routine operations, maintenance, and cleanup as required by operating procedure and/or RWP.

Area air sampling frequency will be conducted in accordance to NRC Regulatory Guide 8.30 "Health Physics Surveys for Uranium Mills," Revision 1, 2002, at Section 2.3.

5.7.3.1.3 Action Level and Limit

An administrative action level will be established for breathing zone and area air samples of 0.25 derived air concentration (DAC) described in Section 5.7.4; air sample results greater than this administrative action level will be reported to the RSO. An administrative limit will be established for air samples used to monitor intake of 12 DAC-hours per week; individual exposure greater than this limit will require the individual to be restricted from work involving potential exposure to airborne radioactive material unless approved by the RSO.

5.7.3.2 Radon

Radon monitoring will be conducted of the general work areas. The radon detectors will be of the track-etch type. The detection limit will be at least 0.33 pCi/l per 90 days of exposure. The radon detector will be exchanged quarterly. The detectors will be analyzed for total radon.

5.7.3.3 Radon Daughter Concentration Monitoring

The airborne concentration of radon daughters will be determined using the modified Kusnetz method. The flow meters will be calibrated after repair or modification, but at least annually. The air sample result will support the calculations described in Section 5.7.4.

Radon daughter concentration sampling will be made of the process areas. The sampling frequencies and actions levels will be as described in NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Recovery Facilities," Revision 1, 2002 at Section 2.3.

5.7.3.4 Respiratory Protection Program

Respiratory protection equipment will be used when other means are not available or sufficient to control a worker's exposure to airborne radioactivity. Respiratory protection will routinely be used for drying and packaging activities. Respiratory protection will be used when airborne radioactivity levels are known or expected to exceed one DAC as described in Section 5.7.4, and

when removable alpha surface contamination levels are known or suspected to exceed 220,000 dpm/100 m^2. Respiratory protection will be used for nonroutine operations, maintenance, and cleanup as required by operating procedure and/or RWP.

The respiratory protection program will be conducted in accordance with or equivalent to NRC Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," Revision 1, 1999.

5.7.4 Internal Dose Calculations

Assessment of internal dose to determine compliance with occupational dose equivalent limits will be in accordance with 10 CFR 20.1204. Determination of intake will be based on (1 concentrations of radioactive materials in air (air sampling), or (2) quantities of radionuclides excreted form the body (bioassay), or (3) combinations of these measurements. The air sampling program is described in Section 5.7.3. The bioassay program is described in Section 5.7.5.

Internal dose will be determined for routine operations, non-routine operations, maintenance, and cleanup activities. Internal dose calculations will be equivalent to the methodologies provided in NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities, 2002, Section 3; NRC Regulatory Guide 8.34, Monitoring Criteria and Methods to Calculate Occupational Radiation Doses, 1992, Section C; or a combination of these methodologies.

Intake will be determined for actual exposure time. Exposure time will be determined from interview, the radiation work permit, other record of work, or a combination. Intake calculations will be equivalent to NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities, 2002, Equation A.1; NUREG/CR-4884 Interpretation of Bioassay Measurements; or a combination of these methodologies.

5.7.4.1 Uranium

The intake or concentration or radioactive material in air will be compared to the annual limit on Intake or the Derived Air Concentration value, respectively, of 10 CFR 20, Appendix B, Table 1,

Column 3, Uranium-natural. A solubility classification "D" will be assigned to all uranium at the Nichols Ranch ISR Project sites.[1] Account will be made for use of respiratory protection according to 10 CFR 20 at paragraph 1703(i) and Appendix A.

The resulting intakes will also be compiled to allow comparison to the weekly intake limit for soluble uranium of 10 CFR 20.1201(e).

The resulting intakes and doses are recorded onto each worker's occupational exposure record.

5.7.4.2 Radon Daughters

Concentration of radon daughters in air in terms of working level (WL) will be compared to the Derived Air Concentration value of 10 CFR 20, Appendix B, Table 1, Column 3, Radon-222, as WL. A classification "with daughters present" will be assigned to all radon daughter sample results at the Nichols Ranch ISR Project sites. Account will be made for use of respiratory protection according to 10 CFR 20at paragraph 1703(i) and Appendix A.

The resulting dose is included in each worker's occupational exposure record.

5.7.4.3 Prenatal and Fetal Radiation Exposure

The dose equivalent to the embryo/fetus will be controlled in accordance with the requirements of 10 CFR 20.1208.

The dose equivalent to the embryo/fetus will be determined by monitoring the declared pregnant woman. The declared pregnant woman will be monitored in accordance with the requirements of 10 CFR 20.1502.

[1] U.S. NRC Regulatory Guide 8.30 . Health Physics Surveys in Uranium Recovery Facilities. March 2002, Section 2.2.

The dose equivalent to the embryo/fetus will be determined if the dose to the declared pregnant woman exceeds 0.1 rem from deep dose equivalent, committed effective dose equivalent, or a combination of these.

The dose to the embryo/fetus will be estimated for the case in which the declared pregnant woman was not monitored prior to declaration of pregnancy. The dose estimate for the unmonitored period will be developed from the available combination of radiation surveys, air monitoring, and bioassay results.

The calculations of dose to the embryo/fetus will be performed in accordance with the guidance of NRC Regulatory Guide 8.36 "Radiation Dose to the Embryo/Fetus", 1992. The following conditions are applicable:

- The deep dose equivalent to the embryo/fetus will be assumed equivalent to the deep dose equivalent of the declared pregnant woman during the gestation period. The deep dose equivalent will be based on monitoring methods described in Section 5.7.2 and will consider all occupational exposure of the declared pregnant woman since the declared date of pregnancy.
- The internal dose to the embryo/fetus will be determined from radionuclides in the declared pregnant woman's body from occupational intakes occurring prior to and during pregnancy. The intake will be based on the methods described previously in this section.

5.7.4.4 Recording Radiation Dose

The radiation dose assigned to a worker as a result of internal dose calculations described here will be recorded in conformance with NRC Regulatory Guide 8.7 "Instructions for Recording and Reporting Occupational Radiation Exposure Data," 1992.

5.7.5 Bioassay Program

A bioassay program will be provided to confirm results of the airborne radioactivity monitoring program; confirmation will be in accordance with NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills," 1988, Table 1, column "Interpretation". The bioassay program will be

applicable to all workers routinely or potentially exposed to airborne uranium. The type of bioassay will be urinalysis.

The program will include baseline samples from all new employees. Bioassay samples will be collected at least once per month from those workers involved with uranium extracted into solution from ion exchange through final packaging, and those who conduct regular maintenance on drying and ventilation/filtration equipment. Additional bioassay samples may be collected with respect to specific activities, as described on a Radiation Work Permit, or when air sampling data are not available. Random sampling of other personnel will be conducted on the same monthly schedule. The program will include exit samples from all employees upon termination of employment.

Corrective actions (action levels and actions) for bioassay results will be those described in Table 1 of NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills," 1988.

The bioassay program, including time of sample collection, availability of results, method of sample collection, measurement sensitivity, and quality control will be implemented consistent with the NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills," 1988.

5.7.6 Contamination Control Program

A contamination control program will be established to prevent contaminated employees and equipment from entering clean areas or from leaving the site. The contamination control program will be implemented considering the guidance of NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills," Revision 1, 2002.

5.7.6.1 Surveys for Surface Contamination in Restricted Area

Inspection of the drying and packaging areas for visible yellowcake on surfaces will be made at least once per shift when these areas are in use. Inspection will be made daily in the other process areas for visible yellowcake on surfaces. Visible yellowcake will be cleaned up

promptly, but not later than the end of the shift or workday. Spills will be cleaned up before the yellowcake dries so that re-suspension during cleanup will be lessened.

A survey for removable contamination will be made daily of the drying and packaging area when these areas are in use. An area will be promptly cleaned if removable alpha surface contamination levels exceed 220,000 dpm/100cm^2.

A survey for removable surface contamination will be made weekly in rooms within the process area where work with uranium is not performed, such as break rooms, change rooms, control rooms, and offices. An area will be promptly cleaned if surface contamination levels exceed 1000 dpm/100cm^2.

5.7.6.2 Surveys for Surface Contamination in Controlled Areas

A survey for total alpha contamination will be made monthly in controlled areas (e.g. wellfields) to include personnel and equipment. The total alpha contamination limit for these surveys is 1000 dpm/100cm^2.

5.7.6.3 Surveys for Contamination of Skin and Personal Clothing

All personnel leaving the restricted area will be required to survey the soles of their shoes. The total alpha contamination limit for these surveys is 5000 dpm/100cm^2.

Employees working in the precipitation, drying and packaging areas, as well as those involved in process equipment maintenance or repair are provided appropriate protective clothing and equipment. Protective clothing is laundered on site or, if a disposable type, is disposed of in a facility licensed to accept such wastes.

All employees with potential exposure to yellowcake dust can shower and change clothes each day prior to leaving the site. An employee is considered uncontaminated after showering and changing clothes. In lieu of showering, employees are required to survey their clothing, shoes,

hands, face and hair with an alpha survey instrument prior to leaving the site. The alpha contamination limit for these surveys is 1000 dpm/100cm^2.

The RSO or designee will perform an unannounced spot survey for alpha contamination on selected yellowcake workers leaving facility each quarter.

5.7.6.4 Surveys of Equipment Prior to Release to Unrestricted Areas

Personnel will conduct contamination monitoring of small, hand-carried items for use in wellfield and controlled areas as long as all surfaces can be reached and the item does not originate in yellowcake areas. The total alpha contamination limit for these surveys is 1000 dpm/100cm^2. Requirements for contamination control of equipment and materials released for unrestricted use are otherwise described in Section 4.3.

5.7.6.5 Surveys for Contamination on Respirators

Respiratory protection equipment will be surveyed for alpha contamination by a standard wipe or smear technique. Removable alpha contamination levels will be less than 100 dpm/100 cm^2 prior to reuse of the equipment.

5.7.6.6 Instrumentation

The direct alpha surveys will be performed using a scaler/ratermeter with ZnS type probe. The removable alpha surveys will be performed using a standard cloth smear and a scaler/ratermeter with ZnS type probe. The survey instruments will be portable and/or hand-held. The instruments will be calibrated at least annually. The instruments will be calibrated and operated in accordance with manufacturers' instructions. The instruments will satisfactorily complete a performance check each day of use.

5.7.6.7 Survey Record

The following information will be recorded for each contamination survey:

- Date of survey
- Identification of the person, area, or item surveyed. This identification will be unique for persons, respiratory protection equipment, and as reasonable for other areas and items.
- Identification of the person performing the survey.
- Unique identification of the instrument(s) used to complete the survey.
- The results of the survey.

5.7.7 Airborne Effluent and Environmental Monitoring

A program will be established for measuring concentrations and quantities of radioactive materials released to and in the environment surrounding the facility. This program will be implemented consistent with NRC Regulatory Guide 4.14 "Radiological Effluent and Environmental Monitoring at Uranium Mills," Revision 1, 1980.

The sampling and measurement locations of the program are shown in Exhibit 5-1 (see map pocket).

5.7.7.1 Stack Sampling

The operational characteristics of the vacuum drying process preclude collection of air samples from the respective exhaust. No air samples will be collected from the yellowcake dryer exhaust since there are no emissions and no exhaust.

5.7.7.2 Air Samples

Radon samples will be collected continuously at the same locations as the pre-operational radon sampling. The radon samples will be collected by use of track-etch type detectors, effectively

equivalent to those provided for area monitoring of the workplace. The detectors will be changed once per calendar quarter. The detectors will be analyzed for total radon.

5.7.7.3 Water Samples

Samples are collected from both surface water and groundwater to support the environmental monitoring program.

5.7.7.3.1 Surface Water

Surface water samples will be collected annually or on a quarterly basis, if water is present, at the same locations as the used for the pre-operational surface water sampling. The surface water samples will be a grab sample or will be collected by self samplers. The surface water samples will be analyzed for total uranium, Th-230, Ra-226, and Pb-210.

Addendum 5A contains the standard operation procedure (SOP) the Uranerz Energy Corporation personnel have and will use in collecting surface water samples. Exhibit 5-1 also contains the locations of where surface water self samplers are located.

5.7.7.3.2 Groundwater

The groundwater monitoring program is described in Section 5.7.8.

5.7.7.4 Vegetation, Food, and Fish Samples

No sampling will be made of vegetation, food, or fish. The evaluation described in Section 7.3 indicates the ingestion pathway to be insignificant; i.e. the predicted dose to an individual will be less than five percent of the applicable radiation protection standard.

5.7.7.5 Soil and Sediment Samples

Surface soil samples will be collected annually at the same locations as the radon sampling. The surface soil samples will be a grab sample of 0" - 6." The surface soil samples will be analyzed for total uranium, Th-230, Ra-226, and Pb-210.

Sediment samples will be collected annually at the same locations as those used for the pre-operational sediment sampling. The sediment samples will be a grab sample. The sediment samples will be analyzed for total uranium, Th-230, Ra-226, and Pb-210.

5.7.7.6 Direct Radiation

Gamma measurements will be made continuously at the same locations as the radon sampling. The gamma measurements will be made with passive integrating detectors, effectively equivalent to those provided for personnel monitoring. The detectors will be changed once per calendar quarter.

5.7.8 Groundwater Monitoring Program

The groundwater monitoring program for the Nichols Ranch ISR Project will be based on information obtained from pre-mining baseline geologic and hydrologic information, wellfield testing, and wellfield groundwater baseline sampling. The purpose of the groundwater monitoring program is to detect potential excursions of lixiviant outside of the production wellfield area or excursions of lixiviant into the overlying and/or underlying aquifers.

5.7.8.1 Pre-Operational Wellfield Assessment

The groundwater monitoring program for the Nichols Ranch ISR Project will begin with pre-operation wellfield testing. These tests are conducted using the baseline geologic and hydrologic information that was collected and assembled for Nichols Ranch ISR Project.

Volume V, Appendix D5 and Volume VI, Appendix D6 of this application contain the baseline geologic and hydrologic information.

By using the detailed geologic and hydrologic information, monitoring zones can be defined, geologic and hydrologic parameters quantified, wellfields planned, hydrologic monitoring programs developed, and baseline water quality sufficiently determined. This is all accomplished by conducting a very capital intensive multi-step program that includes interaction with the WDEQ-LQD.

5.7.8.2 Monitor Well Spacing

The density and spacing of monitor wells for the Nichols Ranch Unit and the Hank Unit is determined during the geologic and hydrologic assessment of a proposed wellfield. Monitor wells will be installed in the ore zone at a density of one monitoring well per four acres in the proposed wellfield. These wells will be used to obtain baseline water quality data for the proposed wellfield to determine groundwater Restoration Target Values (RTV's).

Horizontal monitor wells will also be installed on the edge of the wellfield in the same zone as the ore zone. This "ring" of monitor wells will be used to obtain baseline water quality data in the area outside of the wellfield, determine groundwater flow paths, and to ensure that recovery solutions do not migrate outside of the ore zones. Upper Control Limits (UCL's) will be determined for these wells from the baseline water quality data that are collected. The distance between these wells and the wellfield is approximately 500 ft. The distance from horizontal monitor well to horizontal monitor well is also 500 ft. These distances were determined using a groundwater flow model, WELFLO (found in Addendum 3A of the Technical Report), and estimated hydrologic properties for the proposed wellfield. This distance also takes into consideration that if an excursion were to occur, processing fluids could be controlled within 60 days as required by the Wyoming Department of Environmental Quality.

Vertical monitor wells will also be installed in the overlying and underlying aquifers at a density of one underlying and one overlying well per every four acres of wellfield. These wells will be

used to collect baseline water data that will be used to determine UCL's for the overlying and underlying aquifers. If the immediate overlying or underlying aquifers in the wellfield are non-existent, or the confining unit (aquitard) is thin (less than five feet in thickness) within the proposed wellfield or section of the wellfield, then monitor well spacing and density will be determined in consultation with the regulatory agencies. In the case of the wellfield becoming very narrow where a line drive pattern may be utilized, overlying and underlying aquifer monitor wells will not be more than approximately 1,000 ft apart from one another.

5.7.8.3 Production Area Pump Test

When a proposed wellfield has been found to be feasible to be mined using the ISR method, the wellfield becomes a production area. A Production Area Pump Test is then developed to determine information about the hydrologic characteristics of the production area and the underlying and overlying aquifers within the production area. The information to be determined during the Production Area Pump Test includes: hydrologic characteristics of the ore zone aquifer, determination of any hydrologic communication between the ore zone aquifer and the overlying and underlying aquifers, the presence or absence of any hydrologic boundaries in the ore zone aquifer, determination of the degree of hydrologic communication between the ore zone and the monitor well ring, determination of groundwater flow paths, and the vertical permeability of the overlying and underlying confining units that have not all ready been tested.

Before conducting the Production Area Pump Test, the test plan will be submitted to the WDEQ for review and comment. Standard Operating Procedures (SOP's) will also be developed that will detail the procedures of the Production Area Pump Test.

5.7.8.4 Production Area Pump Test Document

After the completion of the Production Area Pump Test field data collection, a Production Area Pump Test Document will be assembled and submitted to the WDEQ and NRC for review and approval. Additionally the document will be reviewed by the Safety and Environmental Review Panel (SERP) to verify that the results of the production area hydrologic testing and the planned

production area activities are in compliance with NRC technical requirements. A written evaluation by the SERP will evaluate any safety and environmental concerns. The evaluation will also address compliance with applicable NRC requirements. The written evaluation will be located at the Uranerz Energy Corporation offices.

Details to be contained in the Production Area Pump Test document are as follows:

1. A description of the location, extent, etc. of the production area.
2. Map(s) showing the proposed production area (production patterns) and location of all monitoring wells. This includes the monitor well ring, underlying, overlying, and ore zone wells.
3. Geologic cross-sections maps.
4. Isopach maps of the ore zone, underlying, and overlying confining units.
5. Discussion on pump test methods including well completion reports.
6. Discussion of the results and conclusions of the production area pump test including pumping data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown map, and directional transmissivity data and graphs.
7. Data showing that the monitor well ring and the ore zone are in communication with the production patterns.
8. Any other information that is pertinent to the production area being tested.

5.7.8.5 Baseline Water Quality Determination

The importance of properly defining the baseline groundwater quality for individual production areas cannot be overemphasized as the data collected will be used to establish the Upper Control Limits (UCL's) and the restoration target values that will be used in groundwater restoration. Standard Operating Procedures (SOP) will be developed that will detail acceptable water quality sampling and handling procedures, as well as the statistical assessment of the groundwater data.

5.7.8.5.1 Data Collection

Water quality samples will be collected and analyzed from all monitor wells to establish baseline groundwater quality for the ore zone, ore zone aquifer, underlying aquifer, and the overlying aquifer. The sampling of the monitor wells will be in accordance to all sampling, preservation, and analysis procedures. Addendum 5A details the standard operating procedure that is and will be utilized by Uranerz Energy Corporation personnel while conducting baselining and operational sampling. The number of samples collected and the parameters that the samples will be tested for are as follows:

1. Ore Zone (Production Pattern) Wells (MP Wells) – All ore zone monitoring wells in a production area will be sampled four times, with a minimum of two weeks between sampling, during baseline groundwater quality determination. The first and second sampling events shall be analyzed for all parameters found in WDEQ-LQD Guideline No. 8 including uranium parameters. The third and fourth sample events can be analyzed for a reduced list of parameters. The parameters that can be deleted from analysis are those that were not detected during the first and second sampling events.
2. Ore Zone Monitoring Ring Wells (MR Wells) – Monitoring ring wells will be sampled four times, with at least two weeks between sampling, during the baseline characterization. The first monitor well ring sampling will include the analyses for the parameters listed in WDEQ-LQD Guideline No. 8 including uranium parameters. The remaining three samples will be tested for the potential Upper Control Limits (UCL's) parameters chloride, total alkalinity, and conductivity.
3. Overlying Aquifer Wells (MO Wells) and Underlying Aquifer Wells (MU Wells) – The overlying and underlying aquifer monitoring wells will be sampled four times with at least two weeks between sampling events. The first and second sampling events will be analyzed for the parameters listed in Table 5-1. The third and fourth sampling events will be analyzed for the possible UCL parameters chloride, total alkalinity, and conductivity.

Table 5-1 Restoration Target Values Parameters.

Parameter	Lower Detection Limit*
Alkalinity	0.1
Ammonium	0.05
Arsenic	1
Barium	0.1
Bicarbonate	0.1
Boron	0.1
Cadmium	0.01
Calcium	0.05
Carbonate	0.1
Chloride	0.1
Chromium	0.05
Copper	0.01
Electrical Conductivity@ 25 degrees° C	1 uohm
Fluoride	0.1
Iron	0.05
Lead	0.05
Magnesium	0.01
Manganese	0.01
Mercury	0.0005
Molybdenum	0.05
Nickel	0.05
Nitrate	0.01
pH	0-14 s.u.
Potassium	0.1
Radium-226	0.1 pCi/L
Selenium	0.001
Sodium	0.05
Sulfate	0.5
Total Dissolved Solids	1
Uranium	0.001
Vanadium	0.1

*mg/L unless specified otherwise

5.7.8.6 Statistical Assessment of Baseline Water Quality Data

Baseline water quality for the overlying, underlying, ore zone, and monitoring ring wells will be determined by averaging the data collected for each parameter analyzed. In addition to calculating the average of the data, the variability of the data will also be calculated. Outliers will be determined by using the methods outlined in WDEQ-LQD Guideline No. 4 or other accepted methods. Any value determined to be an outlier will not be used in baseline calculations.

Average data from wells that are not uniformly distributed will be calculated by weighting the data according to the fraction of area, or water volume, represented by the data. Baseline conditions will be calculated as follows:

1 Ore Zone Wells (MP Wells) – Baseline water quality will be calculated by using the average of each parameter that is analyzed. If the data collected shows that water from the entire production area is that of waters of different under-groundwater classes, the data then will not be averaged together, but separated into sub-zones. Data within the sub-zones will then be averaged. The boundaries of the sub-zones, where required, will be delineated at halfway between the sets of sampled wells that define the sub-zones.

2. Monitoring Ring Wells (MR Wells) – Baseline water quality will be calculated by averaging each parameter that is analyzed. As with the ore zone wells, if sub-zones are present that have different classes of water, data in the sub-zones will be averaged separately.

3. Overlying and Underlying Aquifer Wells (MO and MU Wells) – The baseline water quality will be calculated by using the average of each parameter that is analyzed.

5.7.8.7 Restoration Target Values

The Restoration Target Values (RTV's) are calculated from the baseline water quality data collected from the ore zone monitoring wells. The RTV's are used in determining and assessing the effectiveness of groundwater restoration within a production area. Baseline water quality averages for the parameters sampled for the ore zone wells constitute the RTV's. If sub-zones exist in the ore zone, the RTV's will be determined for each sub-zone. The Restoration Target Value Parameters are listed in Table 5-1.

5.7.8.8 Upper Control Limits

Upper Control Limits (UCL's) are used to define excursions at monitoring wells. Through the installation of the monitoring ring wells, and the overlying and underlying aquifer monitoring wells, tracking of the lixiviant and processing fluids can be accomplished to ensure that the fluids are not leaving the defined ore zone. The process bleed or wellfield purge in combination with the production area pumping and injection rates assist in keeping all processing fluids within the ore zone.

An excursion occurs when the production area processing fluids reach a monitoring ring or overlying/underlying monitor well. This will cause the UCL's to be exceeded. If an excursion is determined to have occurred, operational changes will be implemented to reverse the flow of the processing fluids so that they are retrieved back to the ore zone and the affected monitor well(s) is no longer in a excursion status. UCL's for the monitor wells are determined from the collection of the baseline water quality data. For the Nichols Ranch ISR Project, the parameters to be used for UCL's will be chloride, conductivity, and total alkalinity.

5.7.8.9 Calculation of Upper Control Limits

The UCL's are based on the baseline water quality data and calculated as follows:

1. Chloride UCL – The chloride UCL will be calculated by taking the baseline mean plus five standard deviations or by taking the baseline mean plus 15 mg/L, whichever is greater. The chloride UCL will be expressed in mg/L.
2. Total Alkalinity UCL – The total alkalinity UCL will be calculated by taking the baseline mean plus five standard deviations. The total alkalinity UCL will be expressed in mg/L $CaCO_3$.
3. Conductivity UCL – The conductivity UCL will be calculated by taking the baseline mean plus five standard deviations. The conductivity UCL will be expressed in umhos/cm at 25°C.

5.7.8.10 Operational Groundwater Monitoring Program

The groundwater in a production area will be monitored during operation to detect and correct for any condition that could lead to an excursion. Process variables such as flow rates and operating pressures of each individual operating well will be monitored in addition to the flow rates and operating pressures of the main pipelines going to and from the plants.

5.7.8.10.1 Monitoring Frequency and Reporting

The ore zone, overlying aquifer, and underlying aquifer monitor wells will be sampled twice per month at intervals of approximately two weeks. The samples will be analyzed for and compared against the UCL parameters of conductivity, chloride, and total alkalinity. Static water levels will also be collected and recorded prior to the sampling event (but are not used as an excursion indicator). All static water levels and analytical monitoring data for the monitoring wells will be kept by Uranerz Energy Corporation and submitted to the WDEQ-LQD on a quarterly basis. These data will also be available to the NRC for review.

Any private wells within one kilometer of the wellfield area boundary will be sampled on a quarterly basis. Groundwater samples will be analyzed for natural uranium and radium-226.

5.7.8.10.2 Water Quality Sampling and Analysis Procedures

Water quality samples will be obtained for the monitor wells through permanently installed submersible pumps. Initially the monitor wells will have three casing volumes discharged before sampling to ensure that the water in the well is formation water. As operations continue, the monitor wells will be pumped for a determined amount of time, with a minimum of one casing volume removed, based on the particular monitor well's performance. Each individual monitor well will have its static water level recorded prior to pumping. Conductivity, pH, and temperature will be measured in the field and recorded in periodic intervals prior to sampling. This is done to demonstrate that the water quality conditions in the monitor wells have stabilized and that formation water is being sampled. All collected water quality data for each monitor well will be periodically reviewed to ensure that sampling and analytical procedures are adequate.

All water quality samples from the monitor wells will be analyzed at the Nichols Ranch Unit laboratory for chlorides, total alkalinity, and conductivity within 48 hours of the sample being collected. All samples will be analyzed in accordance with accepted methods. Standard Operating Procedures (SOP's) will be developed that will detail all water sampling and laboratory analysis procedures. The SOP that Uranerz will utilize for sampling of monitor wells can be found in Addendum 5A.

5.7.8.10.3 Excursions

If any two of the three UCL excursion parameters (chloride, total alkalinity, or conductivity) are exceeded, an excursion is suspected to have occurred. Within 24 hours of the first analysis, a second verification sample will be taken and analyzed to determine that two of the three excursion parameters have been exceeded. The verification sample is then split and analyzed in duplicate to assess any analytical error. If two of the three UCL's are exceeded, an excursion is then verified. During an excursion event, all monitoring wells that are placed on excursion status will be sampled at least every seven days for the UCL parameters.

If an excursion is verified, the WDEQ-LQD and NRC Project Manager will be verbally notified within 24 hours. The WDEQ-LQD and NRC Project Manager will also be notified in writing within seven days of a verified excursion. Corrective actions such as changes in the injection and recovery flow rates in the affected area will be implemented as soon as practical. The corrective actions will continue until the excursion is mitigated. A written report describing the excursion event, corrective actions, and the corrective action results must also be submitted to the NRC Project Manager within 60 days of the excursion confirmation.

In the event that the concentration of the UCL parameters that were detected in the monitor well(s) do not begin to decline within 60 days after the verification of an excursion, all injection into the ore zone (production zone) adjacent to the excursion will be suspended to further increase the amount of net water withdrawal from the excursion area. Injection will be suspended until such time that a declining trend in the UCL parameters concentration is established. If a declining trend is not established in a reasonable time period, additional measures will be implemented. When a significant declining trend is established, normal operations will resume with injection and/or production rates monitored such that net water withdrawals for the excursion area will continue. The declining trend will be maintained until such time that the concentrations of excursion parameters in the affected monitor well(s) has returned to concentrations less than the established UCL's.

5.7.9 Quality Assurance

A quality assurance program will be established to provide a measure of the completeness and accuracy of sampling and measurement results. The results of the quality assurance program will demonstrate effectiveness of implemented programs or allow for identification of deficiencies so that corrective action can be taken. The quality assurance program will be applied to all radiological, effluent, and environmental programs.

5.7.9.1 Organization

The organizational structure described in Section 5.1 will be responsible for implementation of the quality assurance program.

5.7.9.2 Procedures

The quality assurance program will be implemented in accordance with written operating procedures as described in Section 5.2. These procedures will include consideration of quality assurance and quality control for activities of measurement, sampling, sample analysis, calibration, calculation techniques, data evaluation, and data reporting.

5.7.9.3 Records

Records will be maintained to document the activities performed in the program. The records will be specified in the applicable operating procedure. These records will include field logs, chain-of-custody, measurement results, instrument performance checks, calibration, data reduction, and data review and approval.

Record keeping will be in conformance with Section 5.3.2.

5.7.9.4 Quality Control in Sampling

Quality control for sample and measurement collection will be included in the respective operating procedure. Requirements will be designed to ensure that the sample or measurement is representative of actual conditions. Chain-of-custody records will be maintained for samples in accordance with an operating procedure.

5.7.9.5 Quality Control in Laboratory

Quality control of laboratory measurements and analyses will be included in the respective operating procedure, or a supporting operating procedure or instruction.

5.7.9.5.1 Calibration

Requirements will include use of calibration standards or sources traceable to National Institute of Standards and Technology.

5.7.9.5.2 Performance Checks

Determination of the background counting rate and the response of radiation detection systems to appropriate check sources will be performed on a scheduled basis for systems in routine use. The results of these measurements will be recorded and monitored. Investigative and corrective action will be taken when the performance check falls outside a predetermined control value.

5.7.9.5.3 Quality Control Samples

Quality control samples will be collected to assess field activities, intralaboratory, and interlaboratory analyses. Control values will be established for evaluation of these results. Investigative and corrective action will be taken when the results fall outside a predetermined control value.

Quality control for field activities will include replicates and blanks. Intralaboratory quality control will be accomplished by use of duplicate samples. Interlaboratory quality control will include use of replicates or duplicates to different contract laboratories and/or will be made by reference to a contract laboratory's participation in an independent verification program; e.g. EPA or state qualifications or certifications.

5.7.9.6 Computational Checks

Computations of the concentration of radioactive materials will include the independent verification of a fraction of the results of the computation or of the calculation method or both by a person other than the one performing the original computation.

5.7.9.7 Review and Analysis of Data

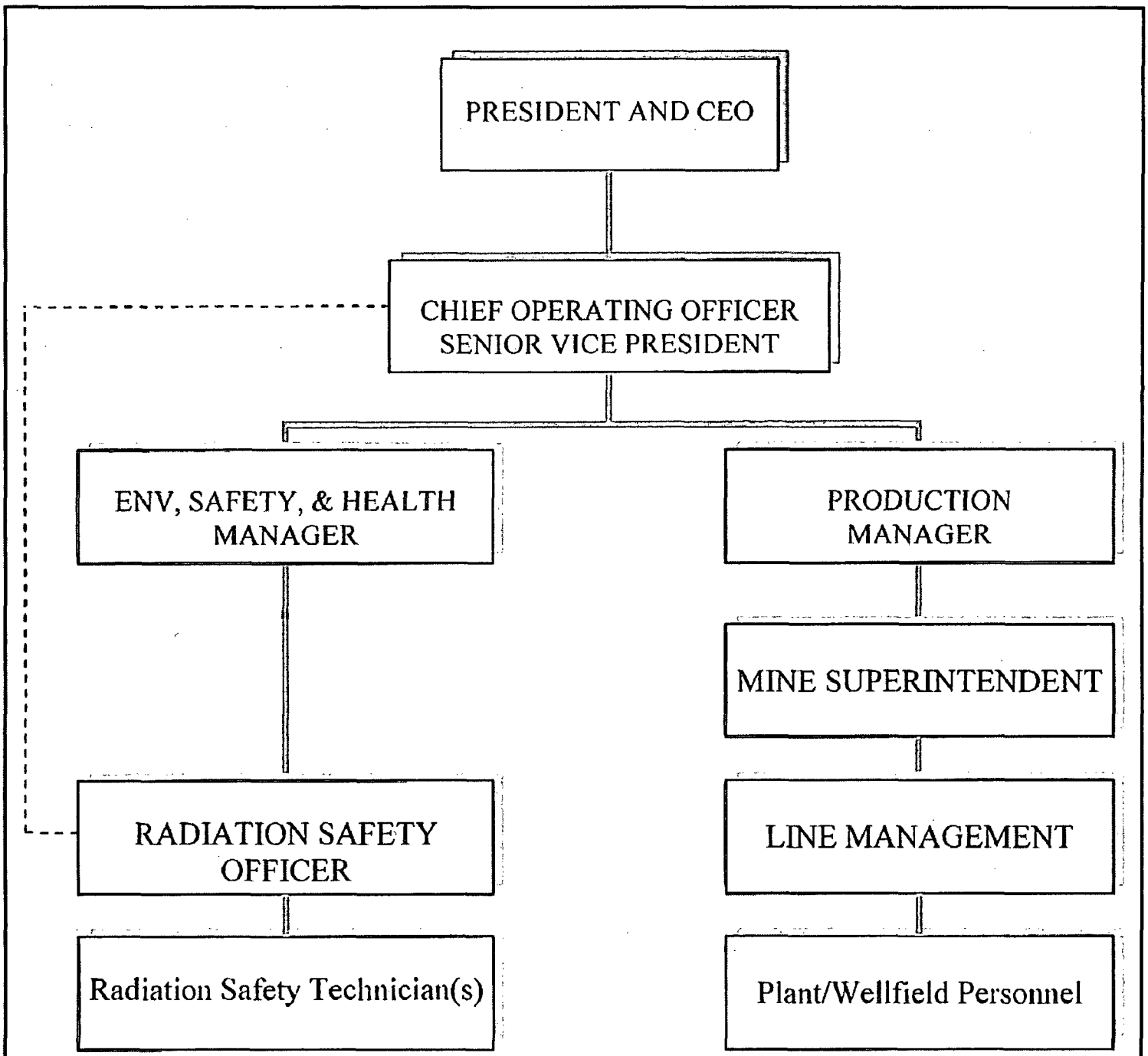
Requirements for review and analysis of data will be included within operating procedure or instructions governing collection and analysis of samples and measurements. These requirements will cover examination of data from actual samples and from quality-control activities for reasonableness, completeness, and consistency. Provisions will be made for investigation and correction of recognized deficiencies and for documentation of these actions.

5.7.9.8 Review of Quality Assurance Program

Reviews will be made to verify implementation of the quality assurance program. The audits will be performed by individuals qualified in the respective techniques who do not have direct responsibilities in the areas being reviewed.

Results will be documented and provided to the Safety and Environmental Review Panel (SERP). Follow-up action, including additional review of deficient areas, will be taken upon recommendation of the SERP.

The quality assurance program will be implemented consistent with NRC Regulatory Guide 4.15 "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," Revision 1, 1979.



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NICHOLS RANCH ISR PROJECT

FIGURE 5-1
URANERZ ORGANIZATION

By: SMF	Date: 12-5-2008
Datum: N/A	Revision Date:
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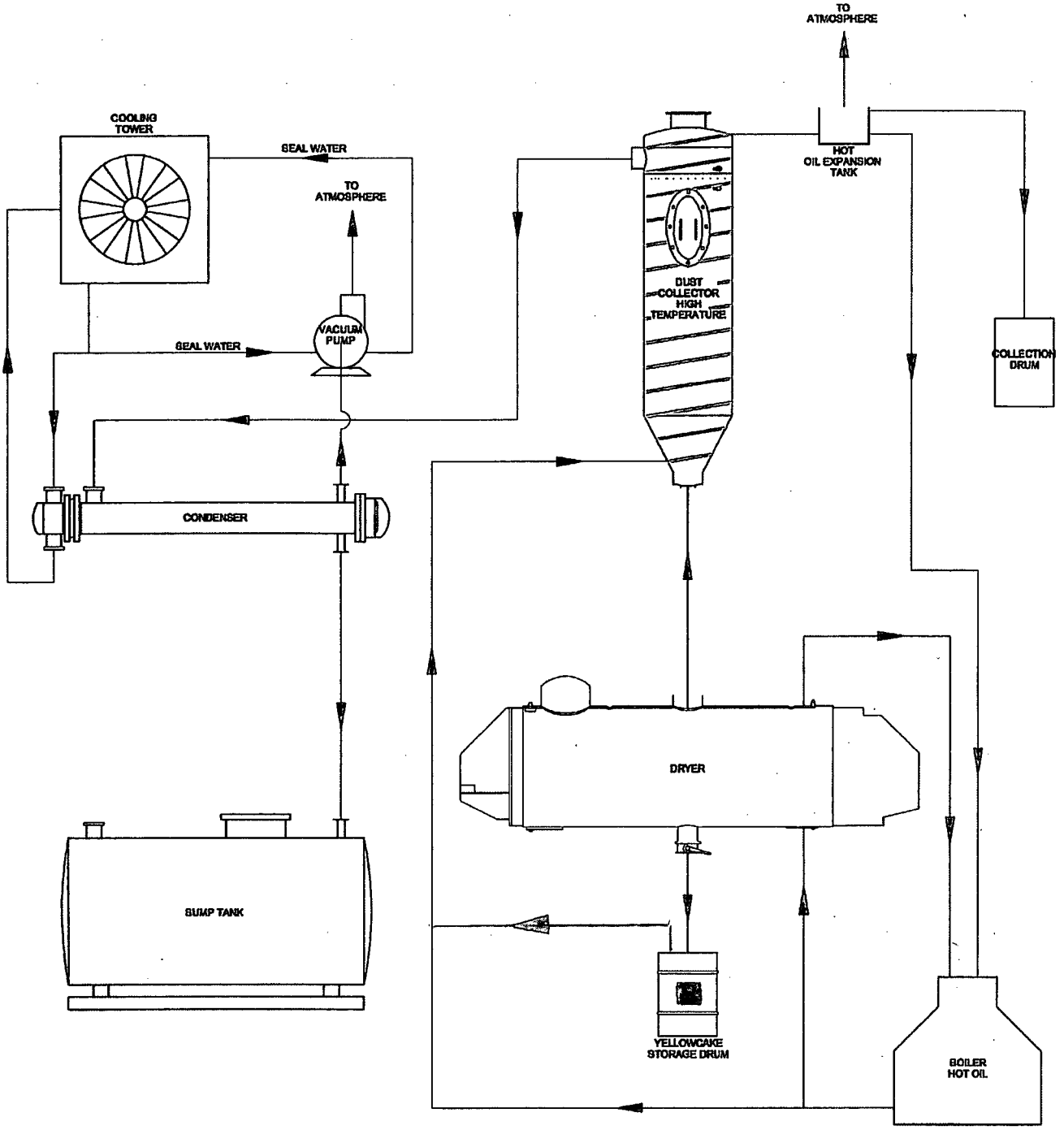

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NICHOLS RANCH ISR PROJECT
FIGURE 5-1a
DRYER PROCESS FLOW DIAGRAM

By: SMF	Date: 2-6-2009
Datum: N/A	Revision Date:
Scale: N/A	Dwg #: figure 5-1a