UNITED STATES

NUCLEAR REGULATORY COMMISSION

REGION IV

URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

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MEMORANDUM FOR: Docket File No. 40-8502

FROM: Gary R. Konwinski, Project Manager
Licensing Branch 1
Uranium Recovery Field Office, Region IV

SUBJECT: SAFETY EVALUATION REPORT (SER) FOR MALAPAI RESOURCES, CHRISTENSEN RANCH IN SITU LEACH SATELLITE OPERATION

Attached is the Safety Evaluation Report (SER) prepared in support of a major license amendment to Source Material License SUA-1341 for Malapai Resources Company, Christensen Ranch Satellite Operation located in Campbell and Johnson Counties, Wyoming.

Gary R. Konwinski, Project Manager
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Approved by: Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office, Region IV

Attachment: Christensen Ranch In Situ Leach Operation (SER)

8502/110R/GRK/88/08/22/M

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UNITED STATES NUCLEAR REGULATORY COMMISSION

SAFETY EVALUATION REPORT

BY THE

URANIUM RECOVERY FIELD OFFICE

IN CONSIDERATION OF A MAJOR AMENDMENT TO

SOURCE MATERIAL LICENSE SUA-1341

FOR

MALAPAI RESOURCES COMPANY

CHRISTENSEN RANCH IN SITU LEACH SATELLITE OPERATION

JOHNSON AND CAMPBELL COUNTIES, WYOMING

DOCKET NO. 40-8502

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1.0 INTRODUCTION

1.1 Description of the Proposed Action

By letter dated January 5, 1988, Malapai Resources Company (Malapai) submitted an amendment application to Source Material License SUA-1341. The application involves utilizing the existing Malapai facilities located at the Irigaray Mine as a processing site for resins loaded at the Christensen Ranch Satellite Operation. Due to this, the proposed well fields and ion exchange columns located at Christensen Ranch will be commercial scale, but will lack the processing components necessary to produce a marketable product. The Christensen Ranch Satellite Facility will represent a location at which resins will be loaded. Following loading the resins will be trucked to the Irigaray site for final processing.

1.2 Background Information

The Christensen Ranch Satellite Operation consists of about 14,000 acres, located within the southern portion of the Powder River Basin in Johnson and Campbell Counties, Wyoming. The acreage is located 30 miles north-northeast of the town of Midwest, Wyoming, and 50 miles southwest of Gillette, Wyoming (Figure 1.2.01). Land ownership within the Christensen Ranch Satellite Operation is divided equally between private ownership and Federal or State ownership. Malapai maintains 866 unpatented lode mining claims and two State mining leases within and around the satellite operation area.

Malapai proposes to in situ leach uranium contained in a basal sandstone member of the Wasatch Formation. The operation will consist of four mining phases, covering a well field area of approximately 14,000 acres. Within the Christensen Ranch Satellite Operation area, the Wasatch Formation has been divided into three uranium bearing fluvial systems. Each of these systems will be, to some extent, mined under the proposal.

During the extraction process, an aqueous solution consisting of either carbon dioxide gas or sodium bicarbonate/carbonate, using gaseous oxygen as an oxidant, will be injected into and then recovered from the uranium bearing strata. Primarily, five-spot patterns will be utilized. Spacing between corner injection wells will range from 50 to 100 feet, however the majority of the wells will be on 70 foot spacing. Extracted fluids will be pumped to one of four planned satellite operations containing ion exchange columns at a rate of approximately 2500 gpm, where ion exchange will take place. During the ion exchange process, uranium and vanadium will be extracted onto the ion exchange resin. The loaded resins will then be trucked approximately 13 miles to the existing Irigaray facility for further processing.

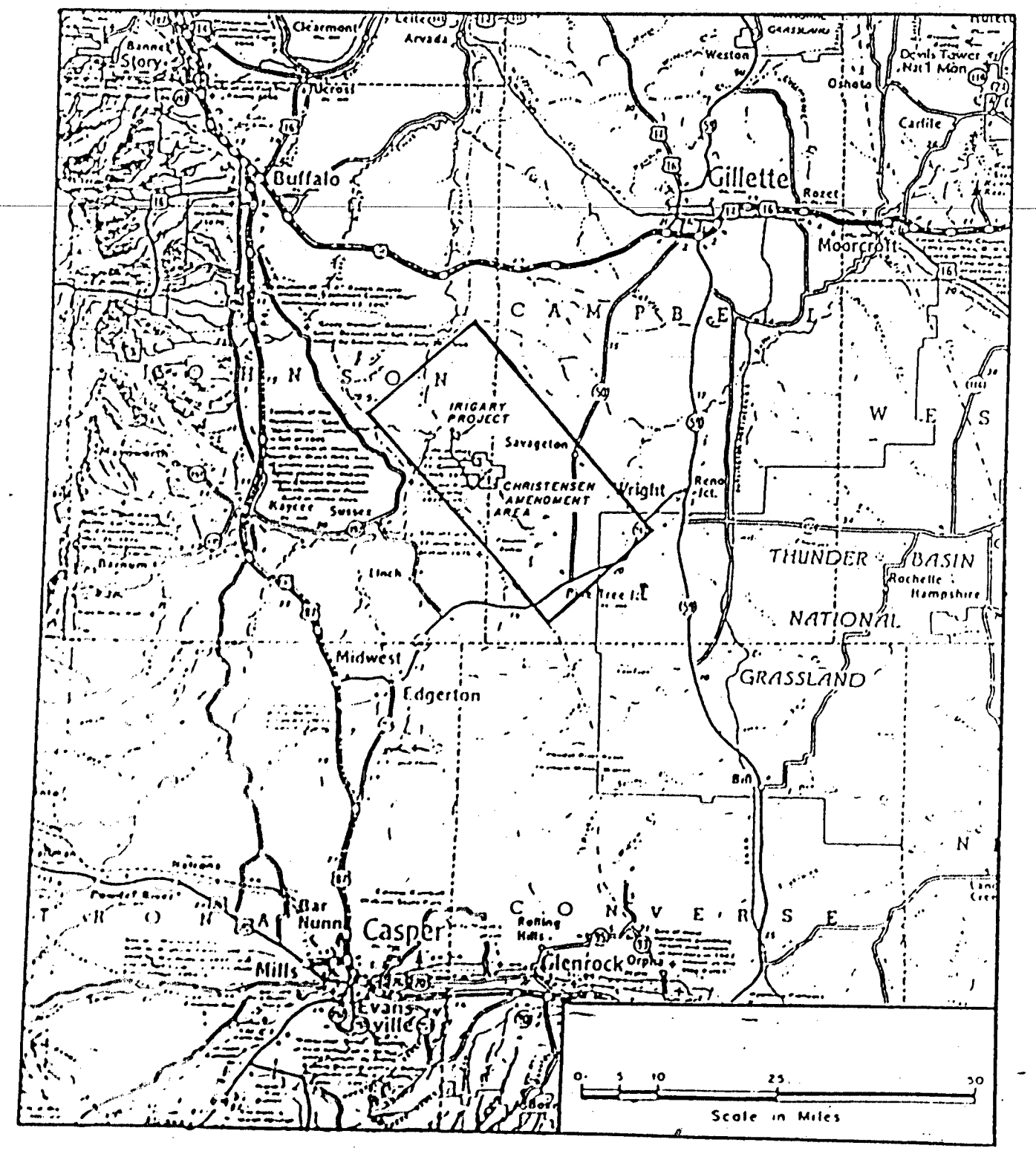


Figure 1.2.01 - General Location of the Christensen Ranch Staellite Operation and the existing Irigaray Facility

Following the uranium recovery operation, Malapai will restore the ground water. Their restoration method will involve ground-water sweep, reverse osmosis with permeate injection, use of a reductant and well-field recirculation. It is estimated that 8 to 15 pore volumes of solution will be treated to achieve the primary goal of restoration, which is to return ground water to baseline conditions.

In order to adequately evaluate the licensee's application, an Environmental Assessment (EA) has been prepared in accordance with 10 CFR Part 51. In addition to this environmental overview of the project, this Safety Evaluation Report is being prepared to evaluate radiological safety associated with the proposed amendment.

1.3 Review Scope

This Safety Evaluation Report (SER) details the staff's review of the in-plant radiological safety program, environmental monitoring program and emergency procedures as proposed in the amendment application submitted by cover letter dated January 5, 1988. In addition to reviewing the amendment application, process design, inplant monitoring, and radiological programs associated with the Irigaray facility were evaluated.

2.0 AUTHORIZED ACTIVITIES

The proposed license amendment will authorize Malapai to in situ leach uranium from a low-grade orebody at a maximum extraction rate of 2500 gallons per minute. The uranium bearing solution will be extracted and loaded onto resins contained in ion exchange columns located at the satellite processing facility. Fully loaded resins will then be trucked to the existing Irigaray facility for further processing of the uranium as well as separation of vanadium.

2.1 Facility Description

The project area is located along the Campbell-Johnson County boundary about 30 miles north-northeast of the town of Midwest, Wyoming, and 50 miles southwest of Gillette, Wyoming (Figure 1.2.01).

The total surface area affected by the proposed amendment area would be approximately 1,701 acres. These acres will be occupied by monitor and mining wells, four satellite extraction plants, evaporation ponds, well fields and access roads. This acreage is only 12.1 percent of the 14,000 acres proposed to be mined. The majority of the area will consist of five-spot patterns on 70 foot spacing.

2.2 Operations

Four satellite facilities will eventually be constructed for uranium recovery at the proposed Christensen Ranch Satellite Operation. All facilities will be constructed, operated and maintained in essentially the same fashion. A 2,500 gallon per minute satellite uranium in situ leach processing plant will consist of a 100 ft X 100 ft prefabricated building which will house an ion exchange circuit, a lixiviant makeup system and a water treatment system for management of waste waters. An adjoining 57 ft X 60 ft prefabricated building will house the restoration equipment. It will consist of an ion exchange circuit which will have four IX trains, with each train having three fixed-bed IX columns connected in series. The columns are designed to process 2,500 gallons per minute of well field recovery solutions. The size of the columns and the number of trains used are based on the mining results of the Christensen Ranch Research and Development Operation. Figure 2.2.01 shows a general arrangement drawing of the satellite extraction facility.

The lixiviant makeup system will consist of chemical mixing tanks as well as outside storage containers for solid chemicals such as soda ash. The bleedstream from the ion exchange columns will be circulated through a 50 gallon per minute reverse osmosis unit, thereby producing 40 gallons per minute of high quality permeate for use in lixiviant makeup and restoration, plus 10 gallons per minute of brine. The 10 gallons per minute of concentrated brine produced may be recycled back to the injection stream, thereby reducing the chemicals required for lixiviant makeup and the waste volumes requiring pondage. If CO_2 alone is used as the lixiviant, the lixiviant makeup system may be bypassed. During this operation, CO_2 will be added directly into the injection stream prior to leaving the plant.

A high-quality permeate will be produced as a result of reverse osmosis processing. Approximately one percent of the permeate will be bled off to maintain mining solution flow into the well field. This permeate will be stored in two unlined storage ponds for use in aquifer restoration. Lined evaporation ponds equipped with leak detection systems will be utilized for the retention of brine waste from the process. The general configuration of the permeate and brine storage ponds is shown in Figure 2.2.02.

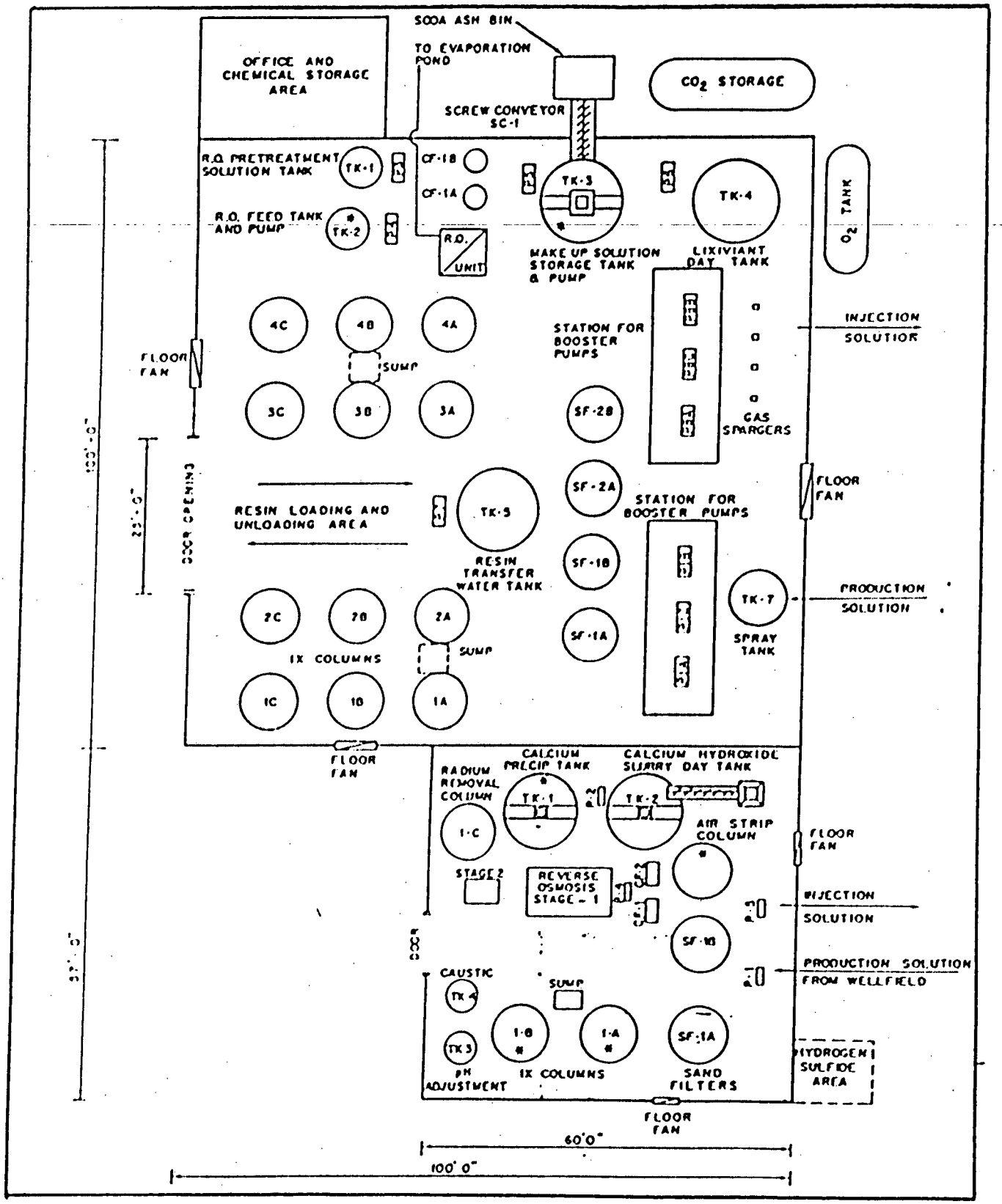


Figure 2.2.01 - Satellite Facility Process Plant

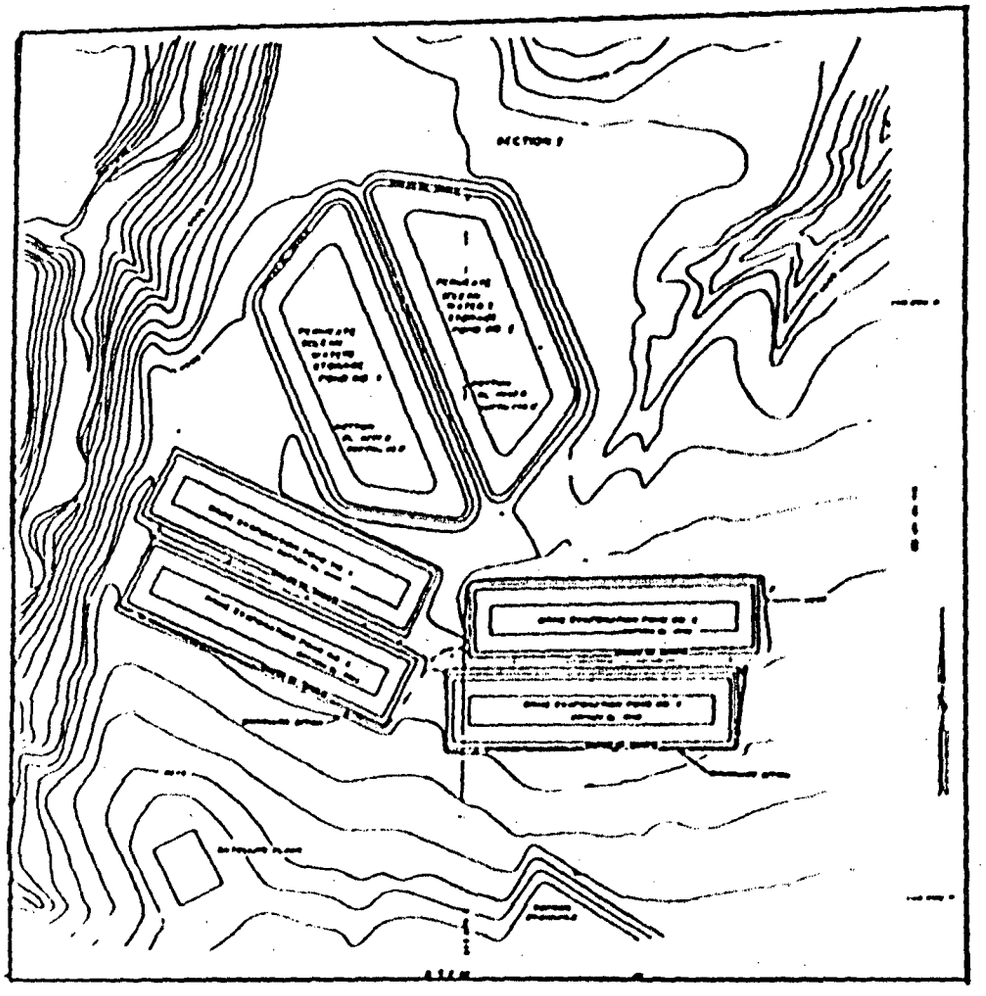


Figure 2.2.02 - Configuration of Permeate and Brine Storage Ponds

The permeate storage ponds will consist of two earthen-lined ponds with identical inside dimensions. The permeate storage ponds will be utilized to store "clean" water which will ultimately be used in mining zone restoration. These ponds will not require synthetic lining or leak detection systems since they will only be used to store the reverse osmosis permeate which will meet NPDES water quality requirements. Although Malapai has an NPDES discharge permit, current plans do not call for discharge from the site.

Initially, two brine storage ponds will be constructed; as required, two additional ponds will be built. The brine storage pond will be lined with 36 mil reinforced Hypalon, coupled with a monitored leak detection system. The Environmental Assessment prepared for this project provides a complete description of the solution storage ponds and the leak detection systems.

The proposed mining area is divided into four phases: Willow Creek, Heldt Draw, North Prong and Table Mountain. Each of these phases is designed to have a similar amount of reserves as well as a geographical unit which will allow for efficient placement of the four satellite facilities. Spacing of injection and recovery wells in each of the mining areas will range between 50 and 100 feet, in five-spot patterns. Typically, the wells will be on 70-foot spacing. There will be approximately 4,000 wells completed in each of the mining phases.

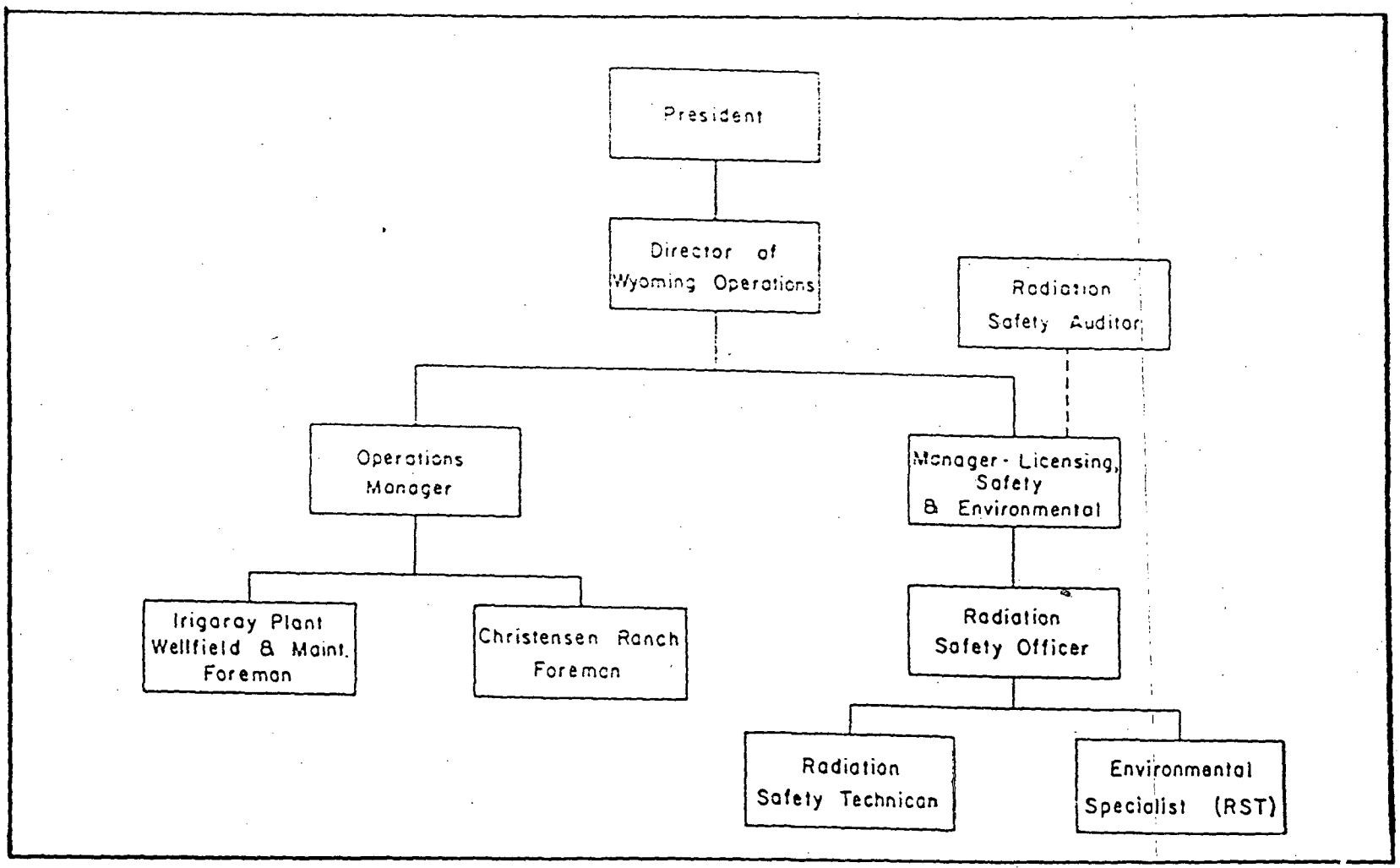
3.0 FACILITY ORGANIZATION AND AUMINISTRATIVE PROCEDURES

3.1 Organization

Figure 3.1.01 shows the proposed project organization for the Christensen Ranch Satellite and Irigaray facilities. The radiation safety staff as well as other project supervision will share the responsibility for the Christensen Ranch and Irigaray facilities. The personnel identified are responsible for development, review, approval and implementation of the radiation safety program. The President and Director of Wyoming Operations have overall responsibility for the corporate direction of the project. This includes production of yellowcake as well as all aspects of radiation safety and environmental protection. Reporting to the Director of Wyoming Operations are the Operations Manager and the Manager of Licensing, Safety and Environmental Services.

The Operations Manager is responsible for all operational aspects of the Irigaray and Christensen Ranch sites. These aspects include the development, review and implementation of all operating procedures and the implementation of safety programs, associated quality assurance programs as well as routine and non-routine maintenance activities. Additionally, the Operations Manager has the authority

Figure 3.1.01 - Proposed Project Organization for the Christensen Ranch Satellite and Irigaray Facilities



to terminate immediately any portion of the project that has been determined to be a threat to health or property as indicated in reports from the Radiation Safety Officer, Radiation Safety Technician, Environmental Specialist or Manager of Licensing, Safety and Environmental Services. The Process Engineer, Operations Foremen and maintenance personnel report directly to the Operations Manager. The Operations Manager reports to the Director of Wyoming Operations.

The Manager of Licensing, Safety and Environmental Services has responsibility for the development, review, approval, implementation and adherence to radiation safety programs, industrial safety programs, environmental and ground-water monitoring programs and associated quality assurance programs for the Irigaray and Christensen Ranch sites. Additional responsibilities include the implementation of and adherence to all license requirements and reporting requirements. Site environmental and radiation protection matters are supervised by the Radiation Safety Officer; however, final decision making authority in these matters is the responsibility of the Manager of Licensing, Safety and Environmental Services. The Manager of Licensing, Safety and Environmental Services reports directly to the Director of Wyoming Operations. The Radiation Safety Officer, Radiation Safety Technician and Environmental Specialist report directly to the Manager of Licensing, Safety and Environmental Services.

3.2 Radiation Safety Staff and Responsibilities

Malapai provided a detailed description of the authority and responsibilities of the radiation safety personnel. The Operations Manager and the Manager of Licensing Safety and Environmental Services will provide program, review, guidance and assistance as well as audit radiation safety activities at the site in order to assure that exposures are as low as reasonably achievable (ALARA).

The purpose of a radiation safety program at the Christensen Ranch Satellite facility is to maintain radiation exposures ALARA for all employees, contractors, visitors and members of the general public. Therefore, the implementation of a successful ALARA program becomes the responsibility of everyone concerned with the uranium recovery operation. Responsibility for achieving ALARA is shared by licensee management, the Radiation Safety Officer, the Operations Manager and the Manager of Licensing Safety and Environmental Services.

Radiation safety at the satellite facilities will build upon the existing radiation safety program for the Irigaray facility. Data for the Irigaray facility indicates that the site has little or no uranium particulates. This is primarily due to the solution

processing that takes place as well as the lack of product drying. The satellite operations will also produce a wet product; therefore, radon gas will be the primary radiological health issue. The employees responsible for the various radiation safety tasks are currently employed by Malapai and working at the Irigaray facility. Due to this, they are ideally suited to understand the work environment which will be created.

The on-site radiation safety staff will consist of a Radiation Safety Officer (RSO), a Radiation Safety Technician and an Environmental Specialist. The RSO has complete control of the radiation safety staff as well as the in-plant radiation safety program. Although the RSO is under the supervision of the Manager of Licensing, Safety and Environmental Affairs, he does have the authority to immediately suspend operations at the site in case of a radiological situation which would warrant such action.

The RSO has responsibility for the implementation of all radiation and safety protection procedures, equipment and controls, as well as emergency procedures for the Irigaray and Christensen Ranch sites. The RSO conducts routine training programs for the supervisors and employees with regard to the proper application of radiation protection, industrial safety and environmental control procedures. The RSO, with assistance from the Radiation Safety Technician (RST), personally inspects the facilities to verify compliance with all applicable health physics and radiation safety requirements. Inspections by the radiation safety staff take place daily on a walkthrough level and less frequently when surveying is performed. Survey records to date indicate that existing radiation safety programs are sufficient to maintain the site in a clean and radiologically safe environment.

3.3 Minimum Technical Qualifications for Radiation Safety Staff

Malapai has proposed the following minimal qualifications and experience for personnel that will be assigned the responsibility of developing, conducting and administering the Irigaray and Christensen Ranch Satellite Operation radiation safety program:

Radiation Safety Officer (RSO) - This position requires a minimum of a Bachelor's Degree in the physical sciences, industrial hygiene or engineering from an accredited college or university. Additionally, a minimum of 1 year of relevant work experience related to health physics, radiation protection or industrial hygiene is required; as is the successful completion of a formalized health physics training course.

Radiation Safety Technician (RST) - This position requires a minimum of an associate degree or 2 years of study in the physical sciences, engineering or health related field. Additionally, at least 4 weeks

of generalized training in radiation health protection and 1 year of work experience utilizing applicable sampling equipment and analytical laboratory procedures is required.

The RSO and RST will conduct the day-to-day radiation safety program at the Irigaray and Christensen Ranch Satellite facilities. The RSO and RST will be officed at the Irigaray facility, but due to the close proximity of the satellite operation to the Irigaray site, frequent visits will be conducted.

3.4 Administrative and Operation Procedures

Malapai currently has written operating procedures for all production activities involving radioactive materials and also for nonradiological environmental monitoring activities. These procedures were originally developed for the previous commercial scale activities at the Irigaray facility. Since that time, all operating procedures have been updated to coincide with the current operation of the site. For the most part, these operating procedures will have applicability to the Christensen Ranch Satellite Operation. There will, however, be some portions of the satellite facilities which will be unique and will therefore require new operating procedures. These procedures will be developed for all standard operations. Maintenance and service tasks which do not have operating procedures will be performed under radiation work permits. As is currently the practice at the Irigaray facility, a current approved copy of the appropriate standard operating procedure will be kept in the areas of the satellite facility where they are used. The licensee will also have all operational and nonoperational activities reviewed and approved in writing by the RSO prior to implementation, and at least annually thereafter.

For work on nonroutine maintenance jobs to be performed where the potential for radiation exposure exists and for which written operating procedures have not been prepared, a radiation work permit (RWP) will be utilized. The permit will describe the necessary precautions, equipment and monitoring required for performing the job. RWPs, as stated in an operating procedure, must be obtained from the RSO or an individual trained to act in his behalf, prior to performing the task. The RWP acts as a tracking device to follow individual exposures for the nonroutine tasks which are performed. The tracking involves utilization of a breathing zone air sample or applicable area air sample to determine the exposure associated with the non-routine task.

3.5 Audits and Inspections

3.5.1 Inspections and Monthly Audit

Malapai has committed, in their application materials, to performing weekly inspections by the RSO or RST of process

areas to observe general radiation safety control practices. Additionally, equipment will be observed and operating procedures checked to determine if any changes are necessary to avoid items of noncompliance. Any areas of concern will be reviewed with the Operations Manager.

On a monthly frequency, the RSO will furnish the Operations Manager as well as the Manager of Licensing, Safety and Environmental Services a written summary of the month's radiological activities at the Christensen Ranch and Irigaray facilities. The report will include a review of monitoring and exposure data for the month, a summary of worker protection activities, a summary of all pertinent radiation survey records, a discussion of any trends in the ALARA program and a review the degree of compliance with license conditions.

This inspection and audit frequency has been ongoing at the Irigaray facility for several months and has proven to be an efficient method of observing radiological activities. Additionally, the RSO or his designee will be required to perform a daily walkthrough of all process facilities to observe general housekeeping in the process areas.

3.5.2 ALARA Audit

On an annual basis, an audit of the radiation protection and ALARA program will be conducted. Following the audit, a written report of the results will be submitted to corporate management. The audit team will consist of the outside radiation safety auditor identified in Figure 3.1.01, the Manager of Licensing, Safety and Environmental Services and the Operations Manager. The RSO may accompany the audit team, but will not be considered a member of the team.

The annual ALARA audit report will summarize the following data:

- Employee exposure records
- Bioassay results
- Inspection log entries and summary reports of mine and process inspections
- Documented training program activities
- Applicable safety meeting reports
- Radiological survey and sampling data
- Reports on any overexposure of workers
- Operating procedures that were reviewed during this time period.

The ALARA audit report will specifically discuss the following:

- Trends in personnel exposures

- Proper use, maintenance and inspection of equipment used for exposure control
- Recommendations on ways to further reduce personnel exposures from uranium and its daughters

The ALARA audit report will be submitted to the Director of Wyoming Operations. A joint review will be performed by this individual as well as the ALARA audit team. Implementation of means to further reduce employee exposures as well as improvements to the ALARA program will be considered by Management following the joint review process.

Additionally, an audit of the Quality Assurance/Quality Control (QA/QC) program will be conducted on an annual frequency. The audit will be performed by an individual qualified in analytical and monitoring techniques who does not have direct responsibilities in the areas being audited. The results of the QA/QC audit will be reported to the Manager of Licensing, Safety and Environmental Services and the Operations Manager. The Manager of Licensing, Safety and Environmental Services and the RSO have the primary responsibility for the implementation of the QA/QC programs at the Irigaray and Christensen Ranch Satellite facilities.

3.6 Radiation Safety Training

All site employees will receive training on radioactive material handing as well as radiological emergency procedures. This training will be administered in keeping with standard radiological protection guidelines.

Prior to commencement of work, all site employees will receive instruction in plant and personal safety, including personal radiation protection procedures to minimize radiation exposures. Training will be conducted by the RSO. Annually, refresher training will be given to all operating and other appropriate site personnel. This training will review standard radiation safety principals and incorporate pertinent radiological safety updates. Training records will be maintained for all process employees. The training program will incorporate the following topics:

- General theory of radiation, types of radiation and the fundamental principles of radiation protection, including the ALARA concept and risks associated with occupational exposure.

- Proper handling procedures, hygienic practices and access/security measures to minimize contamination with uranium product streams.

- The proper use of personnel monitoring equipment, respirator usage, radiological protection equipment and decontamination procedures.

- Emergency procedures for personnel exposure, ingestion or inhalation situations, and other emergency situations.

- Facility provided protection, including cleanliness, safety design features of process equipment/ventilation and effluent controls; written operating procedures; procedures for transfer of contaminated equipment across controlled area boundaries.

- Supplemental training for women regarding prenatal exposure risk.

- Radiation protection regulations including regulatory authority of USNRC, MSHA and State of Wyoming; employee rights (10 CFR 19); and applicable provisions of USNRC regulations and license conditions.

In addition to the training detailed above, all employees will be given on-the-job training regarding the radiation health and safety aspects of their jobs. As part of the employee training program, each employee will be issued a copy of Malapai's "Radiation Safety Training Manual," prepared specifically for in-situ solution mining operations. Additionally, all contracted personnel when present at the facility, will be administered a training program on radioactive material handling and radiological emergency procedures.

4.0 RADIATION SAFETY CONTROLS AND MONITORING

4.1 Ventilation and Effluent Control

Radon gas will be the primary radioactive airborne effluent associated with the Christensen Ranch Satellite Operation. Radon gas will, for the most part, remain in solution due to the majority of the plant flow being in a continuously pressurized system. Some radon gas will, however, be released as a result of the diversion of the process bleed stream into the reverse osmosis feed tank and, to a lesser degree, from the lixiviant makeup tank. These unpressurized tanks will be vented directly to the atmosphere outside of the plant building to minimize personnel exposures. Radon may also be released during resin transfer from a loaded IX column to the resin trailer. During this process, the IX column will also be vented to the atmosphere directly outside of the plant building. The current design calls for six vents to the atmosphere.

The venting of unpressurized tanks outside of the plant building is designed to minimize exposure to radon gas. Additionally, the plant building will be equipped with five area exhaust fans which will provide a minimum of three air exchanges per hour. Each of these fans will be mounted at floor level in close association with those process components likely to produce radon gas. A similar configuration has been utilized at the Irigaray facility and has proved to be very effective in limiting exposure to radon gas.

Airborne radionuclides in particulate form should not be an issue at any of the satellite processing facilities. This form of radionuclide is associated with ore grinding and yellowcake drying. Neither of these processes will taken place at the satellite facilities. The loading and transferring of resins is a wet process and, therefore, is incapable of producing particulates. Similarly, particulates of the Irigaray site will not be an issue; however, monthly sampling for particulates will be conducted to verify the situation.

Transferring the loaded resins to the Irigaray facility has the potential to produce additional radon within the processing plant. This additional radon was treated as a production related source term during the renewal effort associated with the existing Irigaray facility; therefore, although additional radon will potentially be released to the environment, the environmental consequences associated with this release have been evaluated. There will, however, be a need to observe the existing radon monitoring program for the Irigaray site to determine if radon levels are increasing. The current plan that is active at the Irigaray site is sufficient to make this determination.

4.2 In-Plant Monitoring Data

Malapai has proposed a monitoring plan for the satellite facilities which consists of air monitoring, contamination surveys and radiation surveys. The various monitoring locations are shown in Figure 4.2.01. Air monitoring will consist of a single air particulate survey location. The sampling location is adjacent to the resin transfer area, where the potential for spilled solutions is the greatest. This is also a primary worker occupied location. Although particulates are not considered an issue with a solution operation, sampling for airborne uranium particulates will be performed monthly at a single location to verify the absence of uranium in the air.

Sample volumes will be adequate to achieve lower limits of detection for radionuclides in air. An action level of 25 percent of MPC will be established; if an airborne radionuclide sample exceeds 25 percent of MPC, an investigation will be performed to determine the cause of the problem. If the airborne uranium concentration

exceed MPC (1 X $10E^{-10}$ uCi/l) or 25 percent of MPC averaged over the number of hours in any 1 week in which individuals are present in such an area, sampling frequency will increase to weekly in that area.

Additionally, radon daughters will be surveyed at six locations. Each of these locations is closely associated with a process component that has the potential to produce radon gas. Radon daughter surveys will be conducted on a monthly basis at worker occupied locations as shown in Figure 4.2.01. An action level of 25 percent MPC or 0.08 working levels will be established; if a radon daughter sample exceeds 0.08 working levels, an investigation will be performed to identify the cause of the problem and sampling frequency will be increased to weekly until levels do not exceed the action level. Radon daughter analysis will be performed using standard procedures such as the modified Kusnetz method.

Should 25 percent of MPC be reached for any monitored radionuclide the RSO will conduct an investigation to determine the cause. Following the investigation the RSO will conduct a corrective action program to reduce the concentrations of radionuclides to levels which are as low as reasonably achievable.

Due to the increase in uranium production at the Irigaray facility, Malapai has proposed to utilize the existing monitoring stations for radon monitoring. Additionally, two uranium particulate monitoring stations have been added. The monitoring stations associated with the Christensen Ranch resin process are shown in Figure 4.2.02.

4.3 Personnel Monitoring Data

Malapai provided details on the manner in which worker exposures due to the inhalation and ingestion of airborne radon or its daughters and radioactive particulates of uranium would be determined. The regulations within 10 CFR 20.103(a)(1) and (2) require the control and assessment of exposure to radon and its daughters on a calendar year basis; whereas, the soluble form of uranium (yellowcake) must be evaluated and controlled on the basis of a 40-hour work week. Therefore, to assure that these regulatory objectives are met, Malapai will survey for natural uranium and radon daughters on a monthly frequency. If the concentrations of uranium or radon daughters are found to be 25 percent of MPC, the sampling frequency will be changed to weekly.

A semiannual time study, based upon data collected from time cards, will be conducted at the Christensen Ranch Satellite facility to determine worker locations and occupancy times. A semiannual time study is also conducted at the Irigaray facility for the same purpose. A compilation of these time studies will be utilized as a guide in calculating employee exposures.

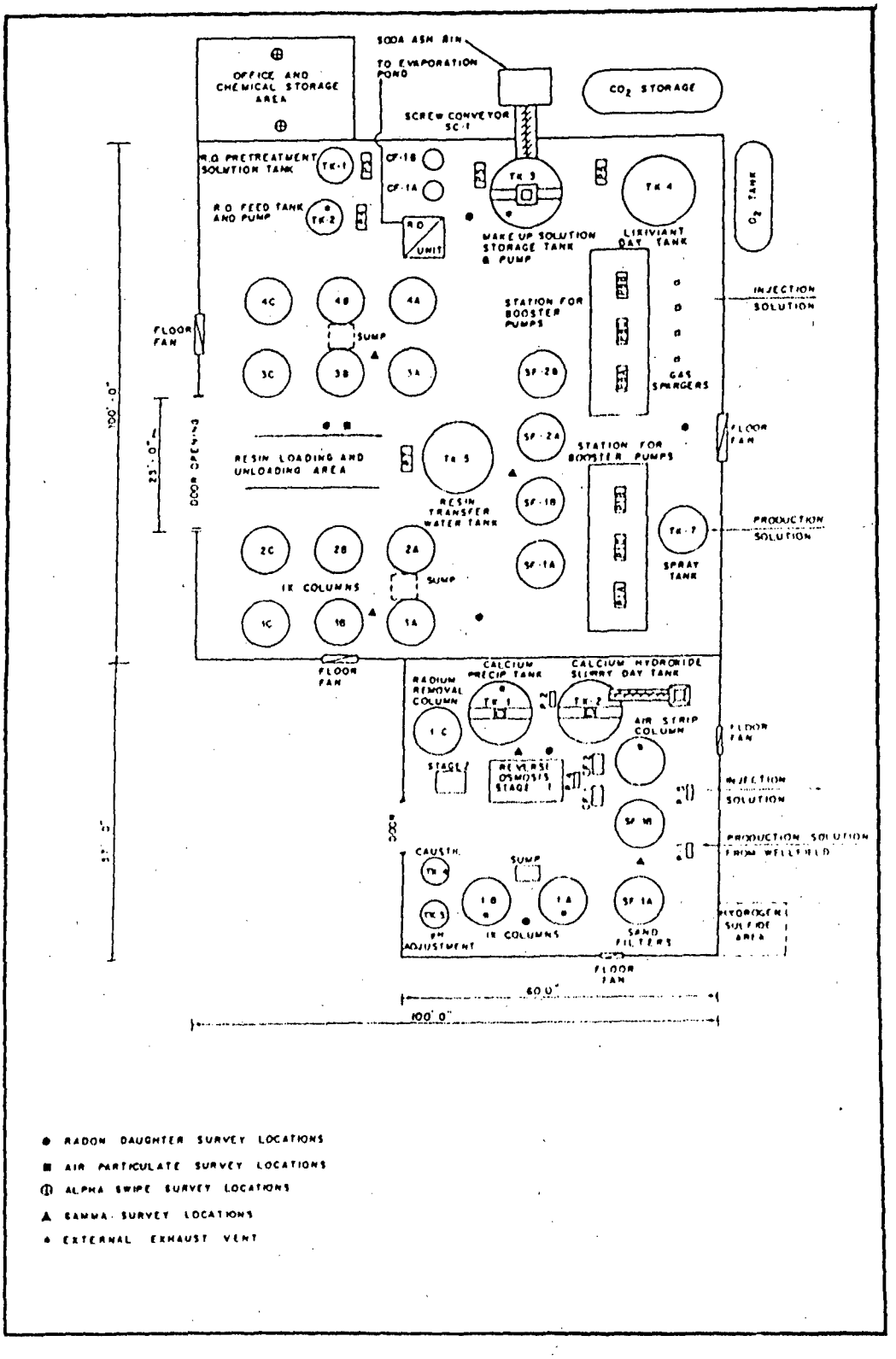
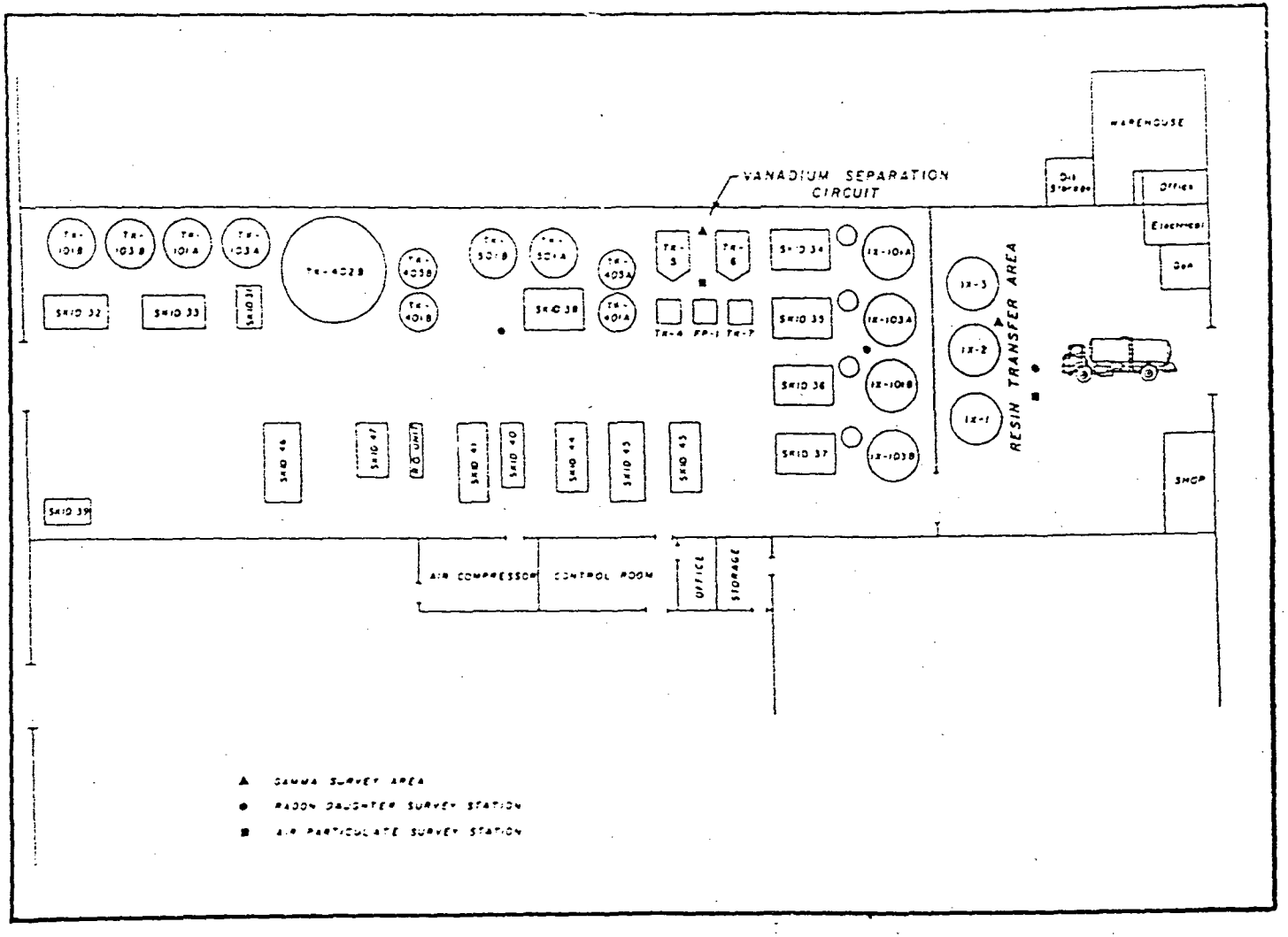


Figure 4.2.01 - Christensen Ranch Satellite Facility, Inplant Radiological Monitoring Locations

Figure 4.2.02 - Irigaray Recovery Facility Radiological Monitoring Locations for the Christensen Ranch Resin Processing



Employees assigned to the Christensen Ranch Satellite facility will have their exposures calculated on the basis of the Christensen Ranch air monitoring program and time study. Personnel such as those who operate the resin transfer from the Christensen Satellite plant to the Irigaray plant, and vice versa, will have their exposures calculated based upon the airborne levels, occupancy time and location at each facility, as identified from the Christensen and Irigaray semiannual time studies.

In addition to the routine exposure calculation, exposures from nonroutine maintenance, or other activities covered under a radiation work permit, will be calculated and utilized in determining the total employee dose. Exposures will be reviewed each quarter to assure that no employee exceeds the regulatory limits of 520 MPC-hours in a quarter for yellowcake intake. An additional review will be performed on an annual basis to assure that no employee exceeds the regulatory limit of 2080 MPC-hours per calendar year. Because airborne material is soluble, weekly determinations will be conducted to assure that the weekly soluble uranium limit has not been exceeded for any employee.

The cumulative total of the employee exposure will be based upon the MPC-hour method. For airborne uranium particulate, the results from the monthly samples will be used to determine the quarterly employee intake. Intake of radon daughters will also be calculated with the same MPC-hour method. Because the uranium particulate at Christensen Ranch Satellite Operation will be soluble, weekly intakes will be calculated, as necessary, by the Intake Method (Regulatory Guide 8.30). When an assessment of an individual's intake of airborne radioactive materials is such that the intake would be less than 25 percent of MPC, based on a time-weighted exposure, exposure calculations will not be determined.

4.4 External Radiation Control Program

4.4.1 External Radiation Surveys

External gamma radiation surveys will be performed routinely on a semiannual basis within the satellite plant facility. In addition, a gamma radiation survey will be done throughout the plant facility shortly after initial plant operations begin to identify any potential sources of gamma radiation. These surveys will be conducted at worker occupied locations as shown on Figure 4.2.01. Previous experience with this type of uranium recovery operation indicates that the potential sources of gamma radiation are the ion exchange columns and the sand filters.

Malapai will establish a gamma dose rate administrative action level of 1.0 mR/hr for the worker occupied stations. If the action level is exceeded at any survey location, an

investigation will be performed to determine the probable cause. Records will be kept of each investigation and any corrective actions taken. If the results of the gamma survey indicate radiation levels which constitute a "radiation area," according to 10 CFR 20.202, the area will be posted and access restricted. In addition, survey frequency in a radiation area will increase to at least quarterly.

4.4.2 Exposure to External Radiation

To determine employee exposure to external radiation, all employees assigned to the Christensen Ranch Satellite Operation will be issued thermoluminescent dosimeters (TLDs). The TLDs will be exchanged and read on a quarterly frequency. A control badge will be maintained in the RSO's office for determination of background levels of gamma radiation.

When the results of personnel dosimeters indicate a gamma dose in excess of 25 percent of 1.25 rem in any calendar quarter, an investigation to determine the source of the exposure will be performed by the RSO. Additional gamma exposure rate surveys may be conducted to determine the potential cause of the elevated levels of external radiation.

4.5 Internal Radiation Control Program

4.5.1 Airborne Radioactivity Surveys

Malapai has proposed to perform monthly sampling for radon daughters and uranium particulates at the Christensen Ranch Satellite facility. Previous operational data collected from similar operations indicate that this is an appropriate frequency from which to determine employee exposures.

As previously discussed, the process building is vented by way of individual tank vents, as well as floor fans. These measures should control the levels of airborne radionuclides within the satellite facilities. Operational data from similar process components at the Irigaray facility indicate that such control methods are adequate to control airborne radionuclides.

4.5.2 Exposure to Internal Radiation

Radiation exposures at the various worker stations are primarily a function of the time spent at the station and the concentration of uranium and radon or its daughters. As previously discussed, the licensee has provided venting of

tanks and floor fans for the facility to limit the amount of radionuclides contained in the various enclosed areas. Malapai proposes to sample airborne and radon daughters on a monthly frequency. Should sampling indicate that radionuclide concentrations in air exceed 25 percent of the applicable MPC, the sampling frequency will be increased to weekly.

Worker occupied stations are the sites to be monitored. Additional sampling for radon daughters and particulates will accompany radiation work permits. This sampling methodology will adequately characterize the concentrations of radionuclides in the air from which to determine employee exposures.

4.5.3 Respiratory Protection Program

Although airborne radioactive material concentrations are anticipated to be quite low at the Christensen Ranch Satellite facility, situations may arise where it is necessary to utilize respirators. These occasions could include a tank entry, cutting or grinding, or other equipment maintenance. Due to the potential for these situations, Malapai has proposed to adopt the approved respiratory protection program and associated procedures currently in place at the Irigaray facility.

4.6 Bioassay

A. Urinalysis

The purpose of the bioassay program is to confirm the effectiveness of the radiation protection programs and to verify the results of the calculated exposures. Malapai has proposed to collect baseline urine samples from all employees assigned to work at the site. Additionally, urine samples will be collected from all process area employees on a monthly frequency. The samples will be analyzed by a contract laboratory capable of reaching a detection limit of 5 micrograms of uranium per liter (µgU/l). For quality control purposes, blank and spiked samples will be submitted to the contract laboratory.

A 15 µgU/l action level will be established for the urinalysis program. Anytime this action level is exceeded, the licensee will investigate the cause and institute corrective actions.

Additional action levels and reporting requirements associated with the existing Irigaray bioassay program will be applied to the bioassay program at the Christensen Ranch Satellite facility.

B. In Vivo Analysis

In vivo counting is only required as confirmation analysis in reaction to sustained elevated urinalysis results. This is the current program at the Irigaray facility and will also be the program at the satellite facility.

4.7 Contamination Control

4.7.1 Personnel Contamination

Due to the lack of a precipitation and the absence of yellowcake, surface contamination should pose few problems at the Christensen Ranch facility. Good housekeeping practices, routine washdowns and washdowns after solution spills will keep any surface contamination to a minimum. To confirm these assumptions as well as control the spread of surface contamination, employees will be required to either shower or self-monitor for alpha contamination prior to leaving the restricted area. Where monitoring is performed, an action level of 1000 DPM/100 cm^2 will be established. If the action level is exceeded, employees will be required to wash and remonitor themselves to verify that alpha contamination levels are below the 1000 DPM/100 cm^2 action limit. Protective clothing will be available at all times and will be required for certain operational procedures. This will further control the spread of contamination.

4.7.2 Surface Contamination

The satellite plant office area is not included in the proposed restricted area; therefore, workers will not be required to survey prior to leaving this location. Office, change room/rest room and chemical supply areas will be surveyed for surface contamination on a weekly basis. Alpha swipe survey locations are shown on Figure 4.2.01. Should the surveys indicate that removable alpha contamination exceeds 1000 DPM/100 cm^2, the area will be decontaminated. A similar program will be utilized in the production areas.

4.7.3 Disposal of Contaminated Equipment

The licensee has proposed to survey any equipment leaving the site. Their procedure cites applicable safety considerations. The procedure will assure that equipment released from the restricted area will not exceed an action level of 1000 DPM removable alpha per 100 cm^2 and 5000 DPM average total alpha per 100 cm^2 with a maximum of 15,000 DPM total alpha per 100 cm^2. Additionally, gamma surveys will be performed of those items where internal surfaces could contain levels of contamination undetectable with alpha instruments.

4.8 Quality Assurance and Calibration

Malapai has an existing quality assurance program as well as a calibration interval and procedure at the Irigaray facility. These methods will be utilized at the Christensen Ranch Satellite Operation.

5.0 RESTRICTED AREA MARKINGS AND ACCESS CONTROL

The satellite facilities and the brine solution evaporation ponds will be posted in accordance with 10 CFR.203(3). Signs reading "CAUTION - RADIOACTIVE MATERIALS" will be maintained along the solution pond fences as well as at entrances to the satellite facilities.

Security for the site is provided by personnel working at the facility. Considering the remote location of the site and the private access road leading to it, such security measures are adequate.

6.0 EMERGENCY PROCEDURES AND PREVENTATIVE MEASURES

Malapai has established emergency procedures for rupture of well field trunklines, fluid leaks in the plant, fires or explosions, transportation accidents and general categories of other accidents. The procedures specify appropriate individuals to contact, health and decontamination procedures as well as area clean up methods.

Ruptures of fluid and trunklines are not expected to result in an emergency-type situation. A failure of a trunkline will be noted due to the decrease of flow in the satellite facility. Furthermore, the radionuclide content of such a solution spill will be minimal and take place within the fenced well field area. A spill or pipeline rupture within the process building will be detected almost immediately. Any solution resulting from this type of failure will be diverted to process solution sumps, contained and then recycled into the process.

Transportation accidents may result in a release of radioactive materials outside of the control of the facility. The staff review of the Malapai procedure discussing these types of accidents indicates a thorough and complete chain of command and notification procedures.

The potential for the release of radioactive materials as a result of adverse weather phenomena or earthquakes is extremely low since tornadoes are few and the facility is located in a low seismic activity area.

7.0 EVAPORATION POND EVALUATION

As previously stated, the licensee has proposed to construct up to six evaporation ponds. Those ponds which will be utilized to store brine solutions will have synthetic liners and leak detection systems. The ponds that will be utilized to store reverse osmosis permeate will not be lined because these waters will meet NPDES discharge requirements. Although, the water will meet NPDES discharge requirements there currently are no plans to discharge the solution.

The ponds will be designed to acceptable engineering standards and constructed in accordance with them. Additionally, each pond has an operating freeboard capacity associated with it to ensure that they do not overtop.

8.0 DECOMMISSIONING AND RECLAMATION

Malapai has proposed to decommission and reclaim the site to appropriate radiation protection standards. Additionally, the well fields will be abandoned in accordance with the State of Wyoming standards. Additional site reclamation and aquifer restoration information is contained in the accompanying Environmental Assessment.

9.0 SURETY REQUIREMENTS

Malapai has proposed to maintain a surety for the site. The surety will cover the costs associated with reclamation, restoring and decommissioning of the site by a third party contractor. The surety vehicle will be annually updated to account for changes in the operations, as well as economic factors.

10.0 COMPLIANCE INSPECTION HISTORY

There is no inspection history associated with Christensen Ranch Satellite Operation because it has not been constructed. Malapai as an operator of the Irigaray facility which will process the Christensen Ranch Satellite product has had an inspection history. A chronological listing of Malapai's compliance history since the 1987 renewal is shown below:

July 21 to 23, 1987 Inspection

One item of noncompliance was identified. The item of noncompliance and the licensee's response and corrective action are as follows:

Violation 1

Failure to obtain a breathing zone air sample or an applicable area air sample during work requiring a radiation work permit.

Corrective Action

The licensee retrained all workers in the need to utilize appropriate breathing zone sampling as well as observe procedures on the issuance of radiation work permits.

November 10, 11 and 13, 1987 Inspection

Two items of noncompliance were identified. The items of noncompliance and the licensee's responses and corrective actions are as follows:

Violation 1

Failure to utilize a radiation work permit for pump dismantling work.

Corrective Action

The licensee administered additional training on the work situations which require radiation work permits.

Violation 2

Failure to document a daily inspection requirement on an evaporation impoundment.

Corrective Action

The licensee updated their procedure detailing pond inspection frequencies and the tasks to be completed during such inspections.

11.0 CONCLUSIONS

Upon completion of the safety review of Malapai's Christensen Ranch amendment application, the staff has concluded that the combined operation of the Irigaray and Christensen Ranch facilities, in accordance with the modified Irigaray license, will be protective of health and safety and fulfills the requirements of 10 CFR Part 20.