Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street
Casper, WY 82605
307-265-8900
www.energyfuels.com

December 18, 2015

Attn: Document Control Desk
Director, Office of Federal and State Materials and
Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate
Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Protection
Mail Stop T-8F5
11545 Rockville Pike
Two White Flint North
Rockville, MD 20852-2738

RE: Uranerz Energy Corporation, Nichols Ranch Project, Source Materials License SUA-1597, Docket No. 040-09067, License Condition 11.2

Dear Mr. Persinko,

In accordance with License SUA- 1597, Condition 11.2, Uranerz Energy Corporation (Uranerz) is submitting the results of the annual review of the radiation protection program content and implementation performed in accordance with 10 CFR 20.1101(c). Additionally, the analysis of the dose to public (consistent with 10 CFR 20.1301 and 10 CFR 20.1302) is included.

An ALARA audit was conducted on September 15 through September 17, 2015 for the operating period of April 2014 through August 2015. Uranerz had indicated in the last semi-annual submitted under cover letter dated October 23, 2015 that scheduling constraints with a qualified auditor delayed an audit date. The ALARA audit report is enclosed.

If you have any questions regarding the provided information, please contact Dawn Kolkman at 307-265-8900 or by email at dkolkman@energyfuels.com.

Sincerely,

William P. Goranson, P.E.
Executive Vice President ISR Operations
Uranerz Energy Corporation (an Energy Fuels Company)

NMSSLD

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street
Casper, WY 82605
307-265-8900
www.energyfuels.com

WG/dk

Attachments: ALARA Report

cc: Ron Linton, NRC Project Manager (via email),
Dorran Larner, WDEQ-LQD Project Manager (via email)

ALARA AUDIT REPORT
FOR THE OPERATIONS PERIOD
APRIL 2014 THROUH AUGUST 2015

URANERZ ENERGY CORPORATION
NICHOLS RANCH ISR PROJECT

December 17, 2015

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Nichols Ranch ISR Project
ALARA REPORT
For the Operating Period of April 2014 through August 2015
Conducted September 15 - 17, 2015

1.0 INTRODUCTION

License condition 11.2 of the Nichols Ranch ("NR") In-Situ Recovery ("ISR") Project United States Nuclear Regulatory Commission ("NRC") Materials License Number SUA-1597 (the "License") requires that Uranerz Energy Corporation ("Uranerz"), as Licensee, perform an annual review of the radiation protection program at NR. As part of the annual review, an As Low As Reasonable Achievable ("ALARA") audit was conducted in accordance with NRC Regulatory Guide 8.31 ("Reg. Guide 8.31"). The NR ALARA program (RAD-SOP-02, Revision 2, dated April 24, 2014) (the "ALARA Program") also requires that an annual ALARA audit be performed (see specifically, Procedure Section 2). Procedure Section 2.1 of the ALARA Program requires that the results of this audit be summarized in an annual ALARA Report.

The ALARA Audit for the operating period of April 2014 through August 2015 was conducted at NR from September 15 to September 17, 2015. This ALARA Report has been prepared by the ALARA audit team and summarizes the conclusions and recommendations arising from the audit for the period reviewed.

This ALARA audit report is prepared for, and reviewed by, NR Management, which considers the conclusions and recommendations in the Report to further improve conditions to ALARA.

1.1 Audit Dates/Audit Team

The ALARA audit involved a site visit on September 15, through 17, 2015 and additional reviews of documentation during, prior to and following the site visit dates.

The audit team was comprised of Kathy Weinel, Quality Assurance Manager, Jaime Massey Regulatory Compliance Specialist and David Turk Energy Fuels Resources (USA) Inc.'s ("EFRI's") Manager, Environmental Health and Safety and Radiation Safety Officer ("RSO") at the White Mesa Mill. Aaron Linard, the NR RSO, accompanied and assisted the audit team, but was not a member of the team.

2.0 PERSONNEL EXPOSURE RECORDS

Individual employee exposures are determined for each employee using results of radiological monitoring and surveys of airborne gross alpha activity, airborne uranium, radon progeny, and external dose rate measurements in various areas of the site, and adjusting these results by the amount of time each worker spends in the various areas of the site. Exposure records for employees of the NR site were completed in early 2015 for 2014 after the fourth quarter OSL results were available. As noted below, exposure records were calculated annually for 2014.

Because exposures have not been calculated for 2015, the audit team reviewed the 2014 exposure records. The results of the review of the 2014 records are noted below. One Suggestion for Improvement ("SFI") was noted during this audit. The SFI suggests the calculation of personnel exposures monthly as suggested by Reg. Guide Paragraph 2.3.1 for inclusion in the monthly reports and for real-time assessment of trends. Additional discussion of this SFI is included in Section 4.4 of this report.

The exposure information provides fundamental data for calculating the Total Effective Dose Equivalent ("TEDE") for all NR personnel. The TEDE dose and the contributions from internal (uranium air particulate and radon progeny) and external (gamma) exposure pathways for 2014 are summarized in Table 2.5-1.

2.1 Personnel Exposure to Airborne Uranium

2.1.1 Review of DACs Used

Uranium air particulate exposures are determined by measuring the gross alpha activity concentration an employee may have inhaled while working in an area for a known amount of time. The employee's exposure is based on these measurements and the radionuclide content of the material the employee was exposed to. The conventional Derived Area Concentration ("DACs") are listed in 10 CFR Part 20, Appendix B.

The DACs employed during 2014 provided an appropriate basis for estimating doses to the radioactive material processed at the facility.

2.1.2 Average Exposure Rates for Air Particulate

Uranium air particulate exposures are determined by measuring the gross alpha activity concentration an employee may have inhaled while working in an area for a known amount of time.

Area airborne samples are supplemented by breathing zone ("BZ") samples collected for a known period of time on select individuals performing particular job tasks.

The uranium air particulate exposures for 2014 were low. Due to the first year of activity, there was no comparison to other years. This will start with the audit of the 2015 data. One SFI was noted for the average exposure rates for air particulate. The SFI is that exposure rates from air particulate should also include any potential respirator device credit. There were no such credits given for respirator usage, even though respirators had been issued during the calendar year of 2014.

2.2 Personnel Exposure to Radon Progeny

Personnel exposure to radon progeny (daughters) is determined on a time weighted exposure assessment. The results are expressed in rems, which are calculated by dividing the Working Levels ("WLs") in each area by 0.33 and multiplying by the time spent in each such area. Radon

progeny was measured throughout the site and various work activities.

During 2014, the average exposure to radon progeny was approximately 0.054 rem with a maximum value of 0.154 rem. The majority of the exposures received at NR were due to radon progeny.

The radon working levels for 2014 are low. Due to the first year of activity, there was no comparison to other years. This will start with the audit of the 2015 data. As a result, at this time there are no additional ALARA practices identified.

2.3 Committed Effective Dose Equivalent

The sum of the exposures to uranium air particulates and radon progeny are expressed as an employee's Committed Effective Dose Equivalent ("CEDE"). The CEDE dose is summarized in Table 2.5-1. The average CEDE for all workers in 2014 was approximately 0.006 rem with the highest value approximately 0.018.

2.4 External Radiation (Beta/Gamma)

Whole body external radiation doses were measured using personal Optically Stimulated Luminescence ("OSL") dosimeter badges. Quality assurance/quality control comparison of an individual's exposure to external radiation can be determined using a time weighted exposure assessment based on data collected in locations that are equipped with environmental OSL badges. In addition, field survey measurements of the site are performed using portable survey equipment. Personnel OSL measurements of external radiation doses accumulated during 2014 were low with an average of about 0.047 rem (47 mrem) and a maximum of about 0.151 rem (151 mrem).

The external radiation levels for 2014 are well below the NRC regulatory limits. This is the first year of data and because of this, there has been no trending established. There are no additional ALARA practices to recommend at this point to further reduce exposures. After the establishment of the uranium packaging circuit, NR will need to address the increased external radiation exposure to their personnel.

2.5 Total Effective Dose Equivalent

The TEDE dose is a summation of the doses arising from internal uranium air particulate and radon progeny (CEDE) and external (gamma) exposures (Deep Dose Equivalent ("DDE")) converted to a common metric (rem) and summed. Table 2.5-1 is summarizes the average and maximum individual worker CEDE, external gamma and TEDE doses for 2014.

The maximum TEDE for 2014 was approximately 0.321 rem (321 mrem) with an average TEDE of approximately 0.109 rem (109 mrem). The TEDE results are low, compared to the ALARA goal of 1.25 rem (1,250 mrem) per year. There were no practical ALARA practices, which would further reduce overall exposures.

3.0 BIOASSAY RESULTS

The site performs bioassays in accordance with NRC Regulatory Guide 8.22, "Bioassays at Uranium Mills", which states that frequent bioassays are to be performed for employees who are routinely exposed to yellowcake dust, uranium ore dust, or involved in maintenance tasks in which potential yellowcake exposure may occur. Urinalysis measurements are performed in accordance with the recommendations contained in Regulatory Guide 8.22. The recommendations in Regulatory Guide 8.22 require corrective actions based on the bioassay results. The detection limit for uranium bioassays is 5 µg/l. No investigations or corrective actions are required for bioassay results below 15 µg/l. If results exceed 15 µg/l investigations into the potential cause(s) for the elevated bioassay are required, and if appropriate, corrective actions are to be implemented to reduce additional positive bioassays and assumed uranium exposure.

All bioassay results for 2014 through August 2015 were nondetect as shown on Table 2.6-1. There were no issues observed and all spike results were within tolerance ranges.

4.0 INSPECTION LOG ENTRIES AND SUMMARY REPORTS OF DAILY, WEEKLY AND MONTHLY INSPECTIONS

Exposures are reduced through routine audits, inspections of work areas, and associated worker health protection practices.

This report serves as the annual ALARA audit of the radiation safety program at NR in accordance with Reg. Guide 8.31 Section 2.3.3.

Daily, weekly, and monthly inspection, reporting, and monitoring are required by Reg. Guide 8.31 Sections 2.3.1 and 2.3.2. The routine NR inspections, monitoring and reporting are discussed below.

4.1 Responsibility to Perform

The RSO and Radiation Safety Technicians ("RSTs") are responsible for performing all routine and special radiation surveys in accordance with NRC Regulatory Guide 8.30 (Health Physics Surveys in Uranium Mills) and Reg. Guide 8.31.

4.2 Daily Inspections

Paragraph 2.3.1 of Reg. Guide 8.31 provides that the RSO or designated RST should conduct a daily walk-through (visual) inspection of all work and storage areas to ensure proper implementation of good radiation safety procedures, including good housekeeping that would minimize unnecessary contamination. In addition, as noted in License Amendment 4 dated August 28, 2015, the licensee may identify qualified designees to perform daily inspections in the absence of the RSO or RSTs specifically on weekends and holidays when the RSO(s) and RST(s) are not present. The number of consecutive days per week that a designate may perform the daily inspection is limited in this License condition. These inspections are documented and

on file in the radiation safety department. If an issue is identified on any inspection, the person performing the inspection is expected to advise radiation safety and operations/maintenance staff as appropriate.

4.3 Weekly Inspections

Paragraph 2.3.1 of Reg. Guide 8.31 provides that the RSO and facility foreman (Nichols Ranch equivalent position is the Operations Supervisor) should conduct a weekly inspection of all facility areas to observe general radiation control practices and review required changes in procedures and equipment. Particular attention is to be focused on areas where potential exposures to personnel might exist and in areas of operation or locations where contamination is evident.

A weekly inspection is conducted by the RSO. A Weekly Inspection form is completed and kept on file in the radiation safety department. The results of the weekly reports are transmitted to the Mine Manager for implementation of corrective actions for items identified during the weekly inspection.

Section 2.3.2 of the ALARA Program provides that the RSO or his designee review the daily work order and shift logs on a regular basis to determine that all jobs and operations having a potential for exposing personnel to radiation are evaluated, either through a properly completed Radiation Work Permit ("RWP") or authorized written Standard Operating Procedure ("SOP"), prior to initiation of work. This requirement is satisfied through daily meetings with operations and maintenance personnel and the RSO. The RSO identifies any potential issues and determines any safety precautions that are required prior to the work being performed. In addition, the RSO reviews all RWPs before and after the completion of work.

The RSO reviews all violations of radiation safety procedures or other potentially hazardous problems with the Mine Manager or other employees who have authority to correct the problem, as required by Section 2.3.1 of Reg. Guide 8.31. In addition, all issues identified in violations are discussed with the employees in the daily and weekly meetings as noted on the weekly meeting minutes.

4.4 Monthly Reports

Reg. Guide 8.31 provides that at least monthly, the RSO should review the results of daily and weekly inspections, including a review of all monitoring and exposure data for the month and provides to the Mine Manager a monthly report containing a written summary of the month's significant worker protection activities. Paragraph 2.3.2 of Reg. Guide 8.31 states that the Monthly Report should contain, at a minimum, the following information:

a. a summary of the most recent personnel exposure data, including bioassays and time-weighted calculations;

b. a summary of all pertinent radiation survey records;

c. a discussion of any trends or deviation from the radiation protection and ALARA program, including an evaluation of the adequacy of the implementation of license conditions regarding radiation protection and ALARA; and

d. a description of unresolved problems and the proposed corrective measures.

One SFI was noted during the review of the monthly reports. The SFI suggests that the time-weighted exposure calculations be completed monthly and be provided to the Mine Manager. All of the other Reg. Guide 8.31 suggested items are included in the monthly reports. Spreadsheets and calculation tools for use in calculating the time-weighted exposures monthly have been provided by the audit team.

5.0 DOCUMENTED TRAINING PROGRAM ACTIVITES

5.1 Hazard and Radiation Training for New Employees

All new employees receive hazard training in accordance with the NR training plan for new hires. The training plans are detailed in TRN-SOP-01 and Rad-SOP-02. The outline for hazard and radiation training for new hires is included as Addendum A to the Rad-SOP-02. All new employees are trained by means of an established course on the inherent risks of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs. The topics listed in 2.5(1) to (6) of Reg. Guide 8.31 are covered in that training.

Written or oral tests with questions directly relevant to the principles of radiation safety and health protection and respiratory protection are covered in the training course given to each worker. Based on requirements in the NR SOPs and in the License application, the instructor reviews the test results with each worker. Workers who fail the test are retested after items of confusion are discussed. The tests and results are maintained on file. The audit team reviewed tests and confirmed that failed tests were retaken and passed.

Based on a spot check of NR records, it appears that NR new hires received the required training, and copies of the signed training logs and tests were readily available on site for review.

5.2 Radiation Safety Refresher Training

All NR employees received annual refresher training during the audit operational period. This training included a review of radiation safety training, including relevant information that became available during the past year, a review of safety problems that arose during the year, changes in regulations and license conditions, exposure trends and other current topics. NR conducts annual refresher training for all employees on the same schedule for consistency and tracking. Training was being conducted at the time of the audit, and the audit team was told that annual environmental refresher training was scheduled to take place in October 2015.

Retraining is tracked via a database for each employee. The database indicates the annual refresher training date and whether or not the employee passed the required test. Additionally,

the database tracks which specialty training each employee has completed. The database report for the annual refresher trainings was complete, up-to-date and a useful way for NR staff to track training throughout the year.

5.3 Specialized Instruction

All new workers, including supervisors, are given specialized instruction on the health and safety and radiation safety aspect of the specific job they will perform. All employees receive the initial radiation and safety training, as applicable, when first employed. In addition, when the employees get to their jobs, their supervisors give them specific on-the-job training using SOPs. On-the-job training and the associated SOPs specifically focus on non-radiologic activities. The radiologic aspects of each task are addressed in separate SOPs, which are cross-referenced in the job-specific SOPs.

If specific radiation protection issues arise for any particular job or new job, such issues will be reviewed and a new procedure (for routine tasks) or RWP (for non-routine task) will be completed. The RSO will determine any new radiation procedures or actions that are required in order to ensure that radiation protection is ALARA. If the job is a one-time or short duration type of job, then an RWP will typically be employed. If the job is to be a recurring job, then SOP training will be utilized. The audit team reviewed the specialized training records for all NR personnel. NR has an extensive SOP program and the audit team was impressed by the knowledge and use of SOPs by NR personnel.

5.4 Contractor Training

Contractors who provide services on a long-term or short-term basis are given the same training as full-time NR employees. They are given basic radiation and safety training and are required to pass the training quizzes. The contractor training outline and requirements can be found in SFT-SOP-29. Job specific training is conducted on a case-by-case basis. Signed acknowledgements, in the form set out in the SFT-SOP-29, are on file for numerous contractors who have performed work at NR during 2014 and 2015. A review of the contractor training forms identified that all of the forms were completed correctly.

NR personnel stated that for contractors who frequently performed work on-site, a separate file was maintained for easy access and quick review to ensure all contractor personnel were current in their training. These records were reviewed during the ALARA audit.

5.5 Visitors

All visitors who have not received training are escorted by someone properly trained and knowledgeable about the hazards at NR. In addition, the RSO or a member of his staff will also provide a short safety briefing about possible hazards that exist at NR before any visitor is permitted to enter NR's restricted area.

5.5.1 Occasional Corporate Visitors

Corporate EFRI personnel visit NR occasionally. Such visitors are accompanied by the RSO or designee during any tour of the NR operating areas. Based on the purpose and duration of the corporate personnel's visit, the RSO has the flexibility to issue a badge at his discretion in order to calculate a gamma dose for the corporate visitor if needed.

6.0 RADIATION SAFETY MEETINGS

NR conducts monthly meetings that all employees are required to attend. The meetings cover a variety of topics related to safety, regulatory/environmental, land, HR/accounting, and site wide updates and priorities. Each monthly meeting is videotaped to ensure all employees have the opportunity to participate. Employees sign a log sheet documenting their attendance at the meeting. The audit team reviewed the monthly sign off sheets and they appear to be complete.

Additionally, there are weekly meetings for supervisors to discuss operational priorities and review safety incidents. NR has an impressive culture of communication throughout the site and the main Casper office.

7.0 RADIOLOGICAL SURVEY DATA

Radiological surveys were performed at frequencies and locations equivalent to those detailed in the NR SOPs through August 2015, as summarized below.

7.1 Airborne Particulate Sampling

The highest air particulate sample was noted in September 2014. That sample was collected in the Lamella Unit and was 1.36% of the DAC. The air particulate data are shown on Table 7.1-1.

The airborne particulate levels in normally occupied areas are low and indicate that the ALARA goals are being met.

7.1.1 Annual 8-Hour Area Airborne Concentrations

License condition 10.14, requires that the Licensee shall conduct radiological characterization of airborne samples for U, Th-230, Ra-226, Po-210, and Pb-210 for each restricted area particulate sampling location at a frequency of once every 6 months for the first 2 years, and annually thereafter. Per the RSO, the NRC has granted an extension until October 2015 on the provision of the License to conduct radiological characterization of airborne samples.

7.1.2 Other Airborne Particulate Sampling

All activities are being conducted according to NR SOPs. There were no ALARA concerns noted.

A review of the air particulate monitoring data shows that concentrations of uranium are well below the applicable DACs at all areas.

No ALARA practices were identified which would further reduce exposures.

7.2 Surveys of Radon Progeny

During 2014, radon samples were collected and exposures are determined by the Modified Kusnetz method and expressed as WLs. Radon Progeny samples were also collected during work activities.

The highest reading during the audit period was in August 2014 at 0.0565 WL or 17.1% of the DAC. The radon data are shown on Table 7.2-1.

No ALARA practices were identified which would further reduce exposures.

7.3 Area Gamma

Survey measurements of the Restricted Area were conducted using portable survey equipment. All areas with dose rates greater than 2.0 mrem/hr are located within restricted areas as required by License Condition 10.13. These gamma numbers are expected with the start-up operations and the absence of uranium drying operations at the site.

No ALARA practices were identified which would further reduce exposures.

7.4 Weekly Contamination Surveys

Weekly contamination surveys were conducted as required.

No ALARA practices were identified which would further reduce exposures.

7.5 Monthly Contamination Survey

Monthly contamination surveys were conducted as required.

No ALARA practices were identified which would further reduce exposures.

7.6 Conclusion

All airborne, radon progeny, and gamma measurements in routinely occupied areas at the NR facility were ALARA. Personnel are aware of the benefits of good housekeeping practices, as evidenced by the fact that areas, such as the Central Control Room ("CCR") that have shown levels of alpha contamination readings are typically cleaned the same day once the situation has been identified. The NR staff has self-identified this and has a working relationship with Operations to curb potential contamination issue and as a result, there were no other practical ALARA practices, which would further reduce exposures.

One SFI is to include on all forms information that will allow for recalculation from the data provided on the form. For example, include in the legends of the survey forms the source information (dpm), serial number and reading as well as the efficiency factor that is being used and what background has been determined.

7.7 Surveys of Material Released From the Restricted Area

7.7.1 Release of Product and Intermodal Containers

During the audit, product is released from NR in the form of uranium loaded resin ("ULR") via trailer trucks and sent to the Smith Ranch Facility for processing. Additionally, beginning in mid-2015, intermodal containers ("IMCs") containing 11e.(2) byproduct material were released from NR and sent to the White Mesa Mill for disposal. The ULR trailer trucks and IMCs are released from NR after they are decontaminated and surveyed for contamination levels. If a ULR truck or IMC is designated for return and reuse, only the exterior of the outside package is measured using the U.S. Department of Transportation ("DOT") criteria for acceptable release during transport.

If a ULR truck or IMC is released for unrestricted use, the interior and exterior surfaces are measured for contamination levels using the criteria contained in Policy and Guidance Directive 85-23, "Guidelines for Decontamination of Facilities and Equipment Prior To Release For Unrestricted Use Or Termination Of Licenses for Byproduct, Source, or Special Nuclear Material", May 1987 Revision. The sheets documenting the scans for either form of release are maintained in the NR files.

An audit team member observed the release of a resin trailer truck during the audit. The NR RSO was observed following the release procedure and demonstrated a thorough understanding of the release requirements. No additional or special decontamination efforts were needed in connection with any of the ULR trucks or IMCs released from the NR site during the audit.

7.7.2 Surveys of Employees Leaving the Restricted Area

Employees leaving the restricted area are required to be monitored for alpha radiation contamination. The audit team conducted a review of the employee scan log sheets. The review noted that the log sheets were consistently initialed by each employee each time he or she scans prior to leaving the restricted area. In addition, there was good notation from employees who did not pass the initial scan in criteria, the actions taken to clean the material not passing the scan criteria (usually an article of clothing), and then the final scan prior to leaving the restricted area. The log sheets are collected by the RSOs occasionally for evaluation and filing.

The instruments used to conduct the surveys were calibrated at the required frequency and the alarm point set at approximately 240 counts per minute. The instruments are checked daily for functionality by the RSOs and NR staff.

8.0 OPERATING PROCEDURES

8.1 Standard Operating Procedures Established

The audit team is satisfied that written SOPs and RWPs have been established for all activities that involve handling, processing, or storing radioactive materials, as well as health physics monitoring, sampling, analysis and instrument calibration.

8.1.1 Review of Applicable SOPS

The audit team reviewed the radiation safety and environmental SOPs provided.

The Audit team concluded that overall, the SOPs for activities involving the handling, processing or storing of radioactive materials and associated health physics activities (e.g., monitoring, sampling, analysis and instrument calibration) have been developed and are appropriately documented.

The audit team is satisfied that the foregoing procedures, together with the RWPs are adequate for the protection from radiation and consistent with ALARA.

8.1.2 Up-to-Date Copy of All Procedures Kept Accessible

An up-to-date copy of each written procedure, including accident response, and radiological, and fire protection plans, has been kept accessible to all employees. All employees have access to the electronic versions of the most recent revision of all SOPs on the facility network. When computer access is unavailable, hardcopies are available at the front desk (Administration Office) and in the control room of the plant.

8.1.3 Review by RSO and Documentation of Revisions

In accordance with Section 2.2 of Reg. Guide 8.31, all written SOPs for both operational and non-operational activities should be reviewed annually and approved in writing by the RSO before implementation and whenever a change in procedure is proposed to ensure that proper radiation protection principles are being applied.

The RSO stated that the SOPs are reviewed annually as required. A memo documenting the annual RSO review was inspected during the audit. It appears that the SOPs are reviewed annually.

All written procedures involving radioactive material control have been compiled in a manner that allows documentation of each revision and its date. All written procedures are reviewed by the RSO, as a member of the SERP, before being implemented and whenever a change in a procedure is proposed.

8.2 Radiation Work Permits

A Job Safety Analysis ("JSA") is used for all work not covered by a SOP. The JSA initially determines the potential for exposure to radioactive materials. A RWP is generated in conjunction with the JSA and is designed to provide a job procedure plan to prevent excessive exposure to radioactive materials when non-routine work that is not covered by an existing SOP is performed. RWPs are issued for non-routine work tasks where exposure potential may exist at levels undetermined or at levels known to be elevated. Unless the RSO or designee determines it is not necessary, an RWP is issued to keep potential exposures ALARA. When a RWP is issued, it is numbered and logged and the location, date issued and other relevant information are listed to help track permits and maintain exposure ALARA.

When RWP's are issued, NR maintains employee exposure ALARA through engineering controls and established management practices. Verification of the effectiveness of these practices is monitored through various radiological surveys, including breathing zone sampling, area airborne sampling, etc.

During the audit review period, 18 RWPs were issued. All of the RWPs were reviewed during the audit. The NR RSO noted that RWPs are good for a period of one week. After one week, a new RWP is generated.

The RWPs were signed by the RSO or his designate. The RWPs were fully completed.

On a review of the RWP file, the audit team concluded that the RWP program is comprehensive and appears to be used on all non-routine maintenance jobs where the potential for worker exposure to radioactive material exists and for which no SOP exists. In general, the RWPs appear to appropriately describe:

- The details of the job to be performed;
- Any precautions necessary to reduce exposure to uranium and its daughters;
- The radiological monitoring and sampling necessary before, during, and following completion of the job; and
- Each RWP appears to be adequately protective.

Overall, the review of these RWPs indicated that the health physics controls, use of personnel protective equipment and surveillance sampling identified in the RWPs were considered prudent and consistent with ALARA.

9.0 TRENDS IN PERSONNEL EXPOSURES

Based on the personnel data reviewed during the audit, it appears that personnel exposures are ALARA.

A significant consideration for an ALARA program is the assessment of trends in exposures to employees. At the time of the ALARA audit, trending of exposures had not been completed due to the short operational time and minimal data. Graphical presentations of trends would not be

useful due to the small quantity of data collected to date. One SFI is that since NR is reaching the point where adequate data are now available for trend analysis, trending tools should be developed and implemented. Significant ALARA program aspects should be considered for inclusion in the trend analysis TEDE, CEDE, gamma monitoring, etc. Examples and spreadsheet templates that are used at other facilities have been provided by the audit team. Graphical representations of data are an easy way to review data quickly and allow for faster corrective actions.

10.0 EQUIPMENT FOR EXPOSURE CONTROL

10.1 Calibration

All equipment used to conduct Health Physics surveys is calibrated within the required frequency for each instrument. All portable and stationary air sampling equipment (high volume air pumps, BZ and radon), are calibrated internally monthly. All other radiation detection equipment including portable alpha and beta/gamma instruments are sent to an outside calibration laboratory annually.

10.2 Respiratory Protection Program

Paragraph 2.7 of Reg. Guide 8.31 provides that the RSO is responsible for maintenance of a respiratory protection program and that there should be adequate supplies of respiratory devices to enable issuing a device to each individual who enters an airborne radioactivity area. The RSO stated that NR has approximately 10 full-face respirators and 12 half-face respirators. Paragraph 2.7 of Reg. Guide 8.31 also provides that additional respiratory protection devices should be located near access points of airborne radioactivity areas. Currently there are no airborne radioactivity areas and therefore the requirement to have respirators located throughout the facility is unnecessary.

Paragraph 2.7 of Reg. Guide 8.31 also provides that routine medical evaluations should be performed for all those individuals who will use respirators. These evaluations are performed when the employee first commences employment and are repeated annually. On a spot check of personnel files, it was observed that each current employee checked had undergone the required medical evaluations as well as an annual fit test.

The audit team is satisfied that all equipment for exposure control at NR is being properly used, maintained and inspected.

11.0 DOSE TO THE PUBLIC

License condition 11.2 requires the completion of an annual review of the radiation program content and implementation and an annual assessment of dose to individual members of the public.

This audit serves as the annual review of the radiation program content and implementation. The calculation of dose to the individual members of the public was in progress at the time of the

audit and an assessment of that process was not completed during the audit. Future audits will review and assess the dose to the public as required by License Condition 11.2.

12.0 RECOMMENDATIONS

The audit team is satisfied that appropriate ALARA principles are being followed.

Recommendations for continued ALARA performance and for future ALARA audits include:

- A significant consideration for an ALARA program is the assessment of trends in exposures to employees. At the time of the ALARA audit, trending of exposures had not been completed due to the short operational time and minimal data. Graphical presentations of trends would not be useful due to the small quantity of data collected to date. Since NR is reaching the point where adequate data are now available for trend analysis, trending tools should be developed and implemented. Significant ALARA program aspects should be considered for inclusion in the trend analysis TEDE, CEDE, gamma monitoring, etc.). Examples and spreadsheet templates that are used at other facilities have been provided by the audit team. Graphical representations of data are an easy way to review data quickly and allow for faster corrective actions.

- After the establishment of the uranium packaging circuit, NR will need to address the increased external radiation exposure to their personnel.

Specific SFIs resulting from the audit are provided in Table 12-1.

LIST OF ACRONYMS

ALARA	As Low as Reasonably Achievable
BZ	Breathing Zone
CEDE	Committed Effective Dose Equivalent
CCR	Central Control Room
CPP	Central Processing Plant
DAC	Derived Area Concentrations
DDE	Deep Dose Equivalent
DOT	United States Department of Transportation
EFRI	Energy Fuels Resources (USA) Inc.
ISR	In-Situ Recovery
JSA	Job Safety Analysis
License	Radioactive Materials License
NR	Nichols Ranch
NRC	United States Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescence
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
RWP	Radiation Work Plan
SFI	Suggestion for Improvement
SOP	Standard Operating Procedure
TEDE	Total Effective Dose Equivalent
ULR	Uranium Loaded Resin
Uranerz	Uranerz Energy Corporation
WL	Working Level

TABLES

TABLES

Table 2.5-1 Summary of Individual Dose for 2014 by Exposure

Exposure Type	Average Worker Exposure (rem)	Maximum Individual Exposure (rem)
Radon	0.054	0.154
CEDE	0.006	0.018
External	0.047	0.151
TEDE	0.109	0.321

Table 2.6-1 Summary of Bioassay Results 2014 and 2015

Month	Number of Samples Above 5 ug/L	Number of Samples Above 15 ug/L	Number of Samples Above 35 ug/L
April 2014	ND	ND	ND
May 2014	ND	ND	ND
June 2014	ND	ND	ND
July 2014	ND	ND	ND
August 2014	ND	ND	ND
September 2014	ND	ND	ND
October 2014	ND	ND	ND
November 2014	ND	ND	ND
December 2014	ND	ND	ND
January 2015	ND	ND	ND
February 2015	ND	ND	ND
March 2015	ND	ND	ND
April 2015	ND	ND	ND
May 2015	ND	ND	ND
June 2015	ND	ND	ND
July 2015	ND	ND	ND
August 2015	ND	ND	ND

Table 7.1-1 Uranium Particulates - Maximum Percent of DAC for Each Month

Date	Location	Maximum (% of DAC)
April 2014	Sand/POD Filters	0.28
May 2014	RO	0.81
June 2014	Hallway Offices	0.38
July 2014	Warehouse	1.17
August 2014	RO	1.01
September 2014	Lamella	1.36
October 2014	Trailer Bay	0.51
November 2014	Control Room	0.97
December 2014	Wellfield 11e.(2)	0.65
January 2015	HH-2	0.27
February 2015	HH-1	1.12
March 2015	11e.(2) Area	0.67
April	Lunch Room/DDW-4	0.32
May 2015	Control Room	0.30
June 2015	RO/IX/CCR/Trailer Bay	0.58
July 2015	Warehouse	1.04
August 2015	*	*

* Not collected. A letter was written to file noting the cessation of monthly monitoring due to previous year's low sample results.

Table 7.2-1 Maximum and Mean Radon Levels (WL/%DAC) for each Month

Date	Maximum Working Level	Maximum %DAC	Average Working Level
April 2014	0.0053	1.6	0.0023
May 2014	0.0080	2.4	0.0025
June 2014	0.0244	7.4	0.0050
July 2014	0.0029	0.2	0.0009
August 2014	0.0565	17.1	0.0066
September 2014	0.0021	0.6	0.0009
October 2014	0.0145	4.4	0.0034
November 2014	0.0263	8.0	0.0065
December 2014	0.0029	0.9	0.0009
January 2015	0.0028	0.9	0.0008
February 2015	0.0067	2.0	0.0029
March 2015	0.0032	1.0	0.0012
April	0.0052	1.6	0.0021
May 2015	0.0038	1.2	0.0013
June 2015	0.0052	1.6	0.0020
July 2015	0.0054	1.6	0.0020
August 2015	0.0100	3.0	0.0050

* Sampling had not been conducted for September 2015 at the time of the audit.

Table 12-1 ALARA SUGGESTIONS FOR IMPROVEMENT

Reference Section in Report	Suggestion for Improvement	Recommended Action		Responsibility	Timeline
Suggestions for Improvement					
AAR 2.1.3	The uranium air particulate exposures for 2014 were low. There were no credits given for respirator usage, even though respirators had been issued during the calendar year of 2014.	Include the respirator device credits as appropriate in average exposure rate calculations.			
AAR 2.0, 4.4	During the review of the monthly reports it was noted that the suggested monthly time-weighted exposure calculations were not completed	Complete the time-weighted calculations monthly and provide the results to the Mine Manager.			
AAR 7.6	Include on all radiological survey forms information that will allow for back calculation from the data provided.	Include in the legends the source information (dpm), serial number and reading as well as the efficiency factor that is being used and what background has been determined.			
AAR 9.0	A significant consideration for an ALARA program is the assessment of trends in exposures to employees. At the time of the ALARA audit, trending of exposures had not been completed due to the short operational time and minimal data. Graphical presentations of trends would not be useful due to the small quantity of data collected to date. One SFI is that since NR is reaching the point where adequate data are now available for trend analysis, trending tools should be developed and implemented.	Significant ALARA program aspects should be considered for inclusion in the trend analysis TEDE, CEDE, gamma monitoring, etc. Graphical representations of data would be an easy way to review data quickly and allow for faster corrective actions.			

Dose to Public
Uranerz Energy Corporation
Nichols Ranch ISR Project

Assigning of Public Dose

This is a report describing the process for assigning dose to members of the public for the calendar year in 2014. The dose was evaluated as required in 10 CFR 20.1301 in accordance with 10 CFR 20.1302. Three separate exposure routes were evaluated including exposures to external radiation, airborne uranium, and radon with daughters present. The following sections will describe how each exposure route was calculated and the assumptions made for the dose calculation.

External Radiation

In order to determine compliance with 10 CFR 20.1301 for the 2014 calendar year, an Optically Stimulated Luminescent Dosimeter (OSL) was placed at the monitoring station labeled CBM Well NESW 17. A copy of Figure 2-25, illustrating the monitoring locations from the license application is attached. This station is located on the Central Processing Plant (CPP) controlled area fenced boundary. The doses from the second through the fourth quarter of 2014 were summed. The first quarter was not evaluated since the start of operations did not commence until the middle of April, after the beginning of the second quarter. Any doses above the background location during the first quarter are considered exposures to naturally occurring radioactive materials (NORM). Once the exposures from the second quarter through the rest of the year are summed, the background station (NR-4) is subtracted from the total. This difference is the resulting exposure that a member of the public, with an occupancy factor of 100%, would receive just outside of the controlled area boundary. Below is the calculation with the result which demonstrates compliance with 10 CFR 20.1302 Section 2(ii).

$$External\ Radiation\ (mrem) = (sum\ of\ NCBM - 2\ doses\ in\ mrem) - (sum\ of\ NR - 4\ doses\ in\ mrem)$$

$$External\ Radiation\ (mrem) = (36.4 + 47.6 + 52.3) - (40.4 + 40.5 + 42.3) = 13.1\ mrem$$

Airborne Long Lived Particulates

In order to determine compliance with 10 CFR 20.1301 for the 2014 calendar year, measurements were made at air sampling station NA-6. This station is co-located with station NR-4. The sum of each isotope from the second quarter through the fourth quarter was calculated and then the background station was subtracted from the total. If a value was reported as non-detectable (ND), then the reporting limit was used in the calculation (See below for the calculation and final concentrations for natural uranium (U-nat), Th-230, Ra-226, and Pb-210.). The concentrations were compared with the values in 10 CFR 20 Appendix B Table 2 effluent

concentration limits, and the most conservative value was used. Since all values are less than the effluent concentrations, this demonstrates compliance with 10 CFR 20.1302 Section 2(i).

$$Average\ Airborne\ Long\ Lived\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (Sum\ of\ NA-6\ concentrations) - (Sum\ of\ NA-4\ concentrations)$$

$Airborne\ U-nat\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (1.0E-16+1.1E-16+1.8\,E-16)-(5.1E-15+2.6E-16+1.0E-16) =$ -5.33E-15 uCi/ml < 9.0E-14 uCi/ml

$Airborne\ Th-230\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (1.0E-16+1.0E-16+1.0E-16)-(1.0E-16+1.0E-16+1.0E-16) = 0.0\ uCi/ml$ < 2E-14 uCi/ml

$Airborne\ Ra-226\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (3.5E-16+3.2E-16+1.4E-16)-(1.0E-16+1.3E-16+1.8E-16) =$ 4.0E-16 uCi/ml < 9.0E-13 uCi/ml

$Airborne\ Pb-210\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (1.5E-14+1.5E-14+2.5E-14)-(1.4E-14+5.0E-14+1.2E-14) = -2.1E-14$ uCi/ml < 6.0E-13 uCi/ml

Radon with Daughters Present

To determine compliance with 10 CFR 20.1301 for the 2014 calendar year, measurements were made with radon track etch detectors at eight different location surrounding the CPP on the fence boundary of the controlled area. There were no detectable additional exposures to radon and its daughters from spills of process solutions in the wellfield. For all calculations it is assumed that Radon-222 is in equilibrium with its associated progeny. The CPP was chosen as the primary source for radon emissions during the calendar 2014 period as demonstrated in the semi-annual report submitted in April 2015 where the CPP accounted for over 98% of all radon effluents generated at the Nichols Ranch facility. The detectors were changed semi-annually and ran from April 2014 through end of September 2014 and from October 2014 through the end of March 2015. Since there was no way to distinguish between the concentration difference between the fourth quarter 2014 and the first quarter 2015, it was assumed that the background radon emissions at the plant could be compared with an average of the two background (NR-4) samples taken during the six month time period. The eight track etch detectors were averaged for the two, six month periods, and then an average background concentration was calculated and subtracted off (See below for the calculation and final concentration above background.). This average concentration was compared with the value in 10 CFR 20 Appendix B Table 2 effluent concentration limit for Radon-222 with Daughters Present which demonstrates compliance with 10 CFR 20.1302 Section 2(i).

$$Average\ Radon\ with\ Daughters\ Present\ Concentration\ (WL) = \left(\frac{(CPP\ Q2 - Q3) + (CPP\ Q4 - Q1)}{2}\right) - \left(\frac{(NR5q2 + NR5q3 + NR5q4 + NR5q1)}{4}\right)$$

Where:

CPP Q2-Q3 = Average concentration in WL of CPP fence line track etch detectors for quarters 2 through 3 of 2014.

CPPQ4-Q1 = Average concentration in WL of CPP fence line track etch detectors for quarters 4 2014 through 1 of 2015.

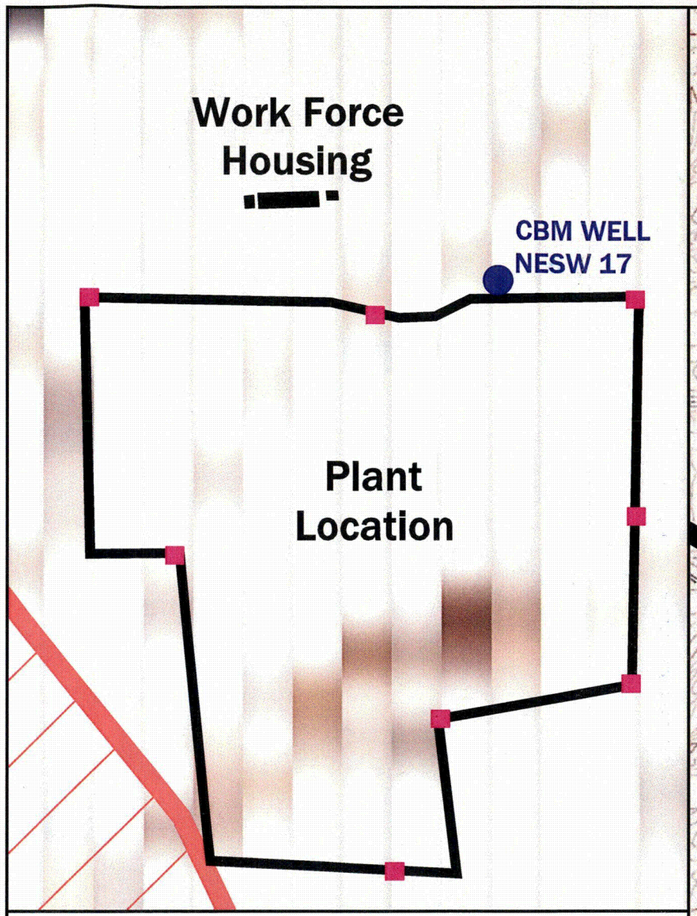
NR5q2 = Concentration of track etch detector located at background location NR-5 for quarter 2 2014.

NR5q3 = Concentration of track etch detector located at background location NR-5 for quarter 3 2014.

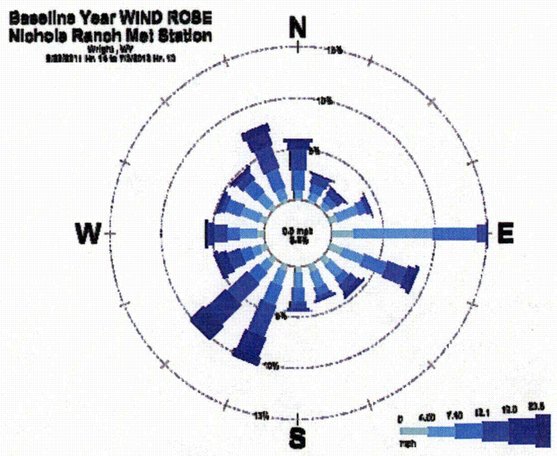
NR5q4 = Concentration of track etch detector located at background location NR-5 for quarter 4 2014.

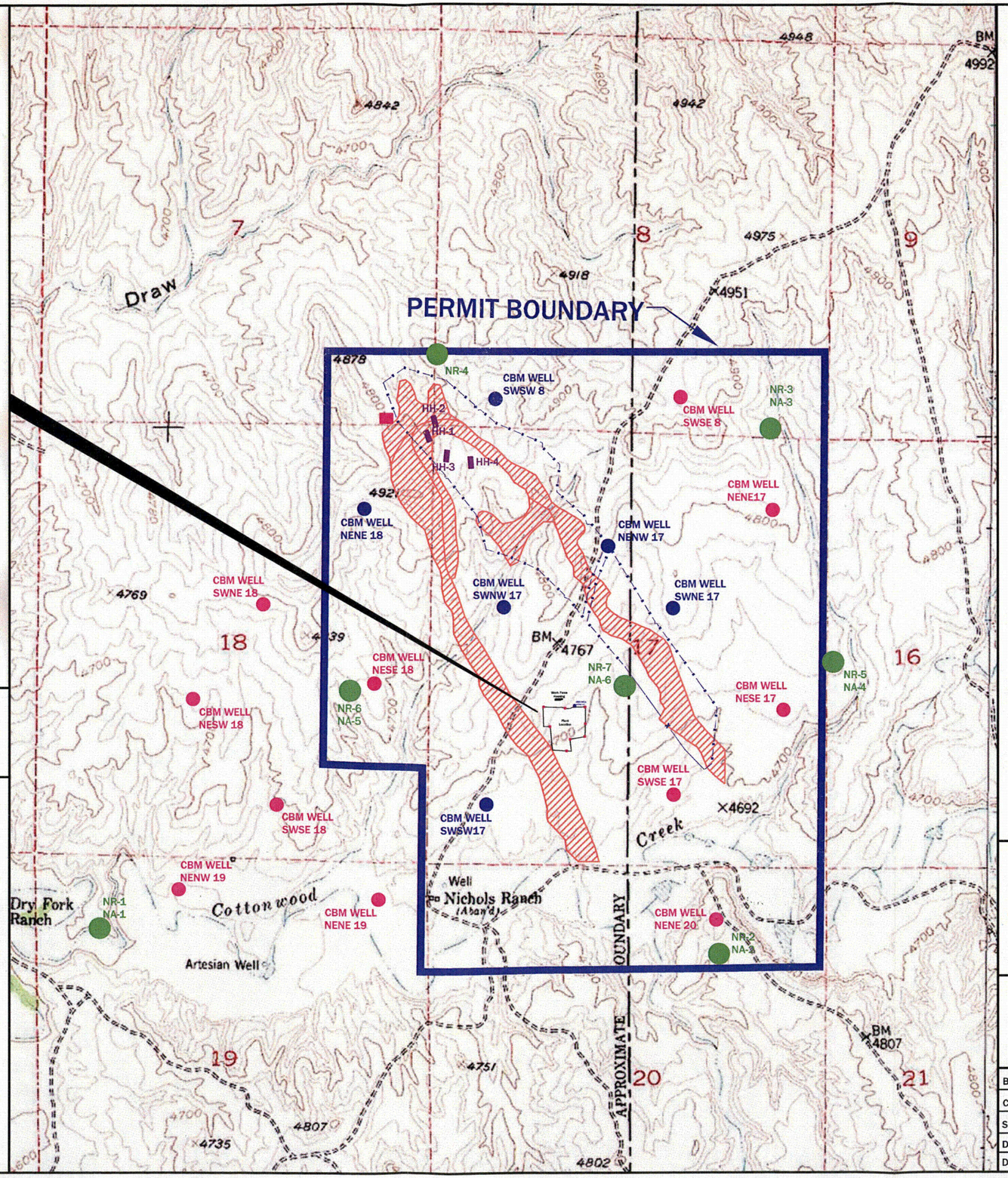
NR5q1 = Concentration of track etch detector located at background location NR-5 for quarter 1 2015.

$Average\ Radon\ with\ Daughters\ Present\ Concentration\ (WL) = \left(\frac{0.6+0.6}{2}\right) - \left(\frac{0.7+0.7+0.3+0.7}{4}\right) = 0.0\ WL < 0.0011$ WL



SCALE: NOT TO SCALE





SCALE: 1"=1500'

0 1000 1500' feet

LEGEND

- PROJECTED WELLFIELD
- EXISTING ROADS
- ENVIRONMENTAL MONITOR STATIONS
- PROPOSED RADON TRACK-ETCH
- RADON/GAMMA
- CBM WELLS
- HEADER HOUSE LOCATIONS

Uranerz ENERGY CORPORATION
1701 East "E" Street
P.O. Box 50850
Casper, Wyoming
USA 82605-0850

NICHOLS RANCH ISR PROJECT
FIGURE 2-25
NICHOLS RANCH UNIT
RADON/GAMMA/AIR
PARTICULATE MONITORING LOCATIONS

By: DALTON TIMM	Date: 12/02/2008
Contour Interval: 20 FEET	Revision Date: 02/21/2014
Scale: 1"=1500'	Revision #: 03
DATUM: NAD 27 UTM 13	Notes:
Dwg: T:\IT\Drafting\Nichols Ranch\Permitting-Licensing	