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February 4, 2011

Mr. Keith I. McConnell, Deputy Director
Decommissioning & Uranium Recovery Licensing Directorate
Division of Waste Management & Environmental Protection
Office of Federal & State Materials & Environmental Management Programs
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Mail Stop T7-E18
Rockville, Maryland 20852-2738

Re: Irigaray and Christensen Ranch Uranium Project
License Amendment Request
Materials License No. SUA-1341
Docket No. 40-8502

Dear Mr. McConnell:

Uranium One USA, Inc. (Uranium One) requests an amendment of materials license SUA-1341 for the Irigaray and Christensen Ranch (jointly referred to as Willow Creek) Uranium Project. The purpose of this amendment request is to change two provisions of the license:

1. The first request is for NRC to allow the use of sulfuric acid in place of hydrochloric acid in the yellowcake precipitation process at Uranium One's Irigaray Central Processing Plant. This request is in response to NRC correspondence dated December 17, 2010 authorizing the restart of in-situ uranium recovery operations at Uranium One's Irigaray and Christensen Ranch Facilities. In this letter the NRC expressed disagreement with a conclusion reached by Uranium One's Safety and Environmental Review Panel (SERP) regarding the use of sulfuric acid for pH control in the precipitation process. NRC staff concluded that the use of sulfuric acid was in conflict with License Condition 9.4(b) and that sulfuric acid could not be

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used in place of hydrochloric acid until the NRC received and approved a license amendment request. The technical basis for this requested change and an analysis of potential impacts are attached.

2. The second request is for a clarification of the necessary technical qualifications for the Radiation Safety Technician (RST). NRC Regulatory Guide 8.31, Position 2.4.2 specifies the education, training, and experience that NRC staff finds acceptable for an RST and provides for two options (Regulatory Positions 2.4.2(1) and 2.4.2(2)). The approved license renewal application (Section 5.4) inadvertently did not include the second option contained in Regulatory Position 2.4.2(2), which applies to RSTs with a high school diploma. This amendment request asks that this second option for technical qualifications for an RST be approved for use at Irigaray and Christensen Ranch. The technical basis for this requested clarification is attached.

Uranium One proposes that SUA-1341, License Condition 9.3 be amended to read as follows:

> The licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the January 5, 1996, license renewal application submittal as revised by the September 3, 1997, "Responses to NRC comments on the License Renewal Application for Source Materials License SUA-1341," as supplemented by the December 13, 1996, submittal, requesting a performance based license condition for approval of the startup of new well fields, including standard operating procedures, <u>and supplemented by the February 4, 2011, submittal requesting approval for the use of sulfuric acid in the yellowcake precipitation process and clarification of radiation safety technician qualifications</u>, hereinafter referred to as the "approved license application." The approved license application is hereby incorporated by reference except where superseded by license conditions below.

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SUA-1341 is currently in timely renewal and NRC staff is completing their review of a license renewal application (LRA) submitted by letter dated May 30, 2008. The 2008 LRA was amended by a formal response and corresponding page replacements in October 2010 that addressed Open Issues identified by NRC staff. Additionally, on November 19, 2010 Uranium One submitted a substantial page replacement package for the 2008 LRA addressing the change of ownership of the Irigaray/Christensen Ranch Facilities from COGEMA Mining, Inc. to Uranium One USA, Inc. and addressing a number of key improvements and modifications to operations. This submission included modifications that specifically allow the use of sulfuric acid in the precipitation process and clarify that the second option for RST qualifications from Regulatory Guide 8.31 is acceptable.

Uranium One recognizes that the NRC staff is currently working on a significant number of licensing actions and that action on the renewal of SUA-1341 may not be a high priority for the available staff resources. However, approval of the use of sulfuric acid in the precipitation circuit and the acceptable technical qualifications for an RST are issues that Uranium One considers of sufficient importance to request an amendment to SUA-1341 before action on the renewal application.

Enclosed please find a completed NRC Form 313, a technical discussion detailing the requested amendment, and appropriate page replacements (text changes underlined) for the 1996 LRA in support of this amendment request. If you have any questions regarding this submittal, please contact me at (307) 234-8235 ext. 331 or by email at Jon.Winter@Uranium1.com.

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Sincerely,

Jon Winter
Manager- Wyoming Environmental and Regulatory Affairs

Enclosures:
1. NRC Form 313
2. Technical and Impact Analysis
3. SUA-1341 January 5, 1996 LRA page replace directions
4. Revised January 5, 1996 LRA page vii - Table of figures
5. Revised January 5, 1996 LRA pages 3-25, 3-27, 3-30, 5-7, and new page insertion 5-7a
6. Revised January 5, 1996 LRA Figures 3.9 & 3.10

cc: Ron Linton w/enclosures

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NRC FORM 313 (3-2009) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE

APPROVED BY OMB: NO. 3150-0120 **EXPIRES: 3/31/2012**

Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

OFFICE OF FEDERAL & STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS
DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
612 E. LAMAR BOULEVARD, SUITE 400
ARLINGTON, TX 76011-4125

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - [ ] A. NEW LICENSE
   - [x] B. AMENDMENT TO LICENSE NUMBER **SUA-1341**
   - [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

Uranium One USA, Inc.
907 N. Poplar Street, Suite 260
Casper, Wyoming
82601

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Irigaray Plant Facility
2751 Irigaray Rd., Johnson County, WY
Christensen Ranch Satellite Facility
932 Black & Yellow Rd., Johnson County, WY

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Jon Winter

TELEPHONE NUMBER

(307) 234-8235

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
   a. Element and mass number; b. chemical and/or physical form; and c. maiximum amount which will be possessed at any one time.
6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.
8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9. FACILITIES AND EQUIPMENT.
10. RADIATION SAFETY PROGRAM.
11. WASTE MANAGEMENT.
12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)*
    FEE CATEGORY **Full Cost** AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
Donna Wichers -- Senior Vice President, ISR Operations	Donna L. Wichers	01-31-11

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

IRIGARAY/CHRISTENSEN RANCH URANIUM PROJECT
SUA-1341 SOURCE MATERIALS LICENSE AMENDMENT REQUEST

NRC Form 313 Attachment
Items 5 Through 11

<u>Applicant</u>

Uranium One USA, Inc.
907 N. Poplar Street, Suite 260
Casper, WY
82601

5. **Radioactive Material**:

a) Element and Mass Number:

Uranium- Unat (U_{238}, U_{234}, and U_{235})

b) Chemical and/or Physical Form:

Chemical form is U3O8
Solution of 0 to 50 grams/liter
Dried Yellowcake- 50% to 80% U

c) Maximum Amount Which will be possessed at any one time:

Unlimited

6. PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED:

Fuel for electricity generation from nuclear power plants.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE:

Individual: Larry Arbogast
Radiation Safety Officer
Uranium One USA, Inc.
Irigaray/Christensen Ranch Project

Training: Radiation Safety Officer for SUA-1341 from 2005 to present
Radiation Safety Technician for SUA-1341 from 2001 through 2005
Thirty-four(+) years of ISR uranium mining experience

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS:

This information is provided in detail in Section 5 of the approved January 5, 1996 SUA-1341 License Renewal Application and supplemental submissions.

9. FACLITIES AND EQUIPMENT:

This information is provided in detail in Section 3 of the approved January 5, 1996 SUA-1341 License Renewal Application and supplemental submissions.

10. RADIATION SAFETY PROGRAM:

This information is provided in detail in Section 5 of the approved January 5, 1996 SUA-1341 License Renewal Application and supplemental submissions.

11. WASTE MANAGEMENT:

This information is provided in detail in Section 4 of the approved January 5, 1996 SUA-1341 License Renewal Application and supplemental submissions.

MATERIALS LICENSE SUA-1341 LICENSE AMENDMENT REQUEST TECHNICAL AND IMPACT ANALYSIS

1) Use of Sulfuric Acid with Hydrogen Peroxide Precipitation

Proposed Change

In Section 3.4.1.3 of the approved 1996 License Renewal Application (LRA), COGEMA Mining, Inc. (COGEMA) described the elution and precipitation circuit. In the LRA the precipitation process is summarized as follows:

> *The eluate from the resin elution circuit is then routed to the precipitation circuit. To initiate the precipitation cycle, hydrochloric acid is added to the uranium bearing solution to break down the uranyl carbonate present in the solution. Hydrogen peroxide is then added to the eluate to effect precipitation of the uranium. The last step of the precipitation process is to add caustic soda to neutralize the remaining acid in solution.*

The purpose of the addition of acid during the precipitation process is to lower the pH and break down the uranyl carbonate. From a process standpoint, although not specified in the approved LRA, hydrochloric and sulfuric acid are both acceptable. The current precipitation system uses industrial grade 35.2 wt % hydrochloric acid (22° Baume) for decarbonization of the uranyl carbonate. Uranium One requests approval to use either hydrochloric acid or sulfuric acid. This request is primarily due to the potentially significant operational cost savings and the flexibility to change the type of acid used should availability become an issue. The sulfuric acid will likely be commercial grade 93 wt % but could also possibly be 98 wt % if 93 wt % becomes unavailable.

Part of the potential cost savings is a result of sulfuric acid having two hydrogen atoms versus hydrochloric acid having only one hydrogen atom, therefore making the volumetric consumption of sulfuric acid significantly less. In addition, since the concentration of the sulfuric acid is approximately three times that of the hydrochloric acid, the volume of sulfuric acid required is further reduced when compared with hydrochloric acid. Approximately 600 to 650 gallons of hydrochloric acid were used per elution for the existing precipitation system. It is anticipated that the sulfuric acid usage for precipitation will be 300 to 350 gallons per elution. The use of hydrochloric acid (elution circuit) will continue for the acid strip in the elution circuit.

The following sections describe the precipitation process and discuss the technical justification for the use of sulfuric acid as a substitute for hydrochloric acid.

Process Description

<u>Elution</u>

Elution (stripping) of uranium dicarbonate anions from the anion ion exchange resin is accomplished with an alkaline solution of sodium carbonate and sodium chloride. Concentrations of these two reagents are nominally 2.0 grams per liter Na_2CO_3 and 9.0 grams per liter NaCl. The precise concentration of each may vary slightly as dictated by site specific conditions. The pH of this fresh eluate is approximately 10.4, controlled by the presence of sodium carbonate.

The elution process is described by the following reaction where R signifies an active site on the ion exchange resin.

$$R_2 - UO_2(CO_3)_2^{-2} + 2\,Cl^- + 2\,Na^+ = 2\,R\text{-}Cl + UO_2(CO_3)_2^{-2} + 2\,Na^+ \qquad \text{eqn. 1}$$

$$UO_2(CO_3)_2^{-2} + 2\,Na^+ + CO_3^{-2} = UO_2(CO_3)_3^{-4} + 2\,Na+ \qquad \text{eqn. 2}$$

The resulting rich eluate containing uranyl tricarbonate at a pH above 10 is the feed stock for the precipitation circuit.

Precipitation

The first step in precipitation is to acidify the rich eluate. This breaks the bond between the uranyl cation, UO_2^{+2}, and the three carbonate anions. Acidification can be accomplished using either hydrochloric or sulfuric acid as shown below in equations 3a and 3b.

$$UO_2(CO_3)_3^{-4} + 6HCl = UO_2^{+2} + 3CO_2 + 3H_2O + 6Cl^- \qquad \text{eqn. 3a}$$

$$UO_2(CO_3)_3^{-4} + 3H_2SO_4 = UO_2^{+2} + 3CO_2 + 3H_2O + 3SO_4^{-2} \qquad \text{eqn. 3b}$$

Comparison between the two equations indicates that twice as much hydrochloric acid is required on a molar basis as sulfuric acid. This reflects the divalent nature of sulfuric acid.

In its simplest form, the reaction of hydrogen peroxide with uranium can be written as:

$$UO_2^{+2} + H_2O_2 + XH_2O = UO_4 + XH_20 + 2H^+ \qquad \text{eqn. 4}$$

From this reaction, it is apparent that raising the pH or increasing the peroxide added will promote the formation of uranyl peroxide.

Uranium can form complexes with anions such as chloride and sulfate which will inhibit the formation of uranyl peroxide by decreasing the concentration of free uranyl ion. However, these interferences were well studied and characterized in peer reviewed literature during the late 1970's. As evident from examination of equation 4, the impact of excessive chloride or sulfate concentrations is overcome by increasing the pH and the hydrogen peroxide concentration. These actions offset the reduced free uranyl concentration and serve to drive the reaction to the right. By effectively reducing the free uranyl concentration via equation 4, these adjustments further reduce the impact of the competing uranyl chloride and sulfate complexation reactions by driving both these reversible reactions to the left.

Selection Factors and Potential Process Impacts

The choice of hydrochloric or sulfuric acid is normally based on economics and availability. In some regions of the United States, hydrochloric acid has historically been more available and far cheaper than sulfuric acid. This was long the case in south Texas where hydrochloric acid was readily procured as a by-product from Dupont's Freon plant at Ingleside, Texas. In contrast, sulfuric acid is readily available in most western states as a by-product from conventional smelting of sulfur containing ores. One example is Kennecott's Bingham Canyon copper smelter outside Salt Lake City, Utah.

The hydronium ion is the key component of the acid. Sulfate or chloride is merely an electro-neutrality carrier. With the hydrogen peroxide precipitation process, the resulting uranyl peroxide solid is an exceptionally pure, large crystal. Neither the chloride nor sulfate anion is included within the uranyl peroxide crystalline structure. This is quite different from the situation with ammonium or sodium diuranate wherein both chloride and sulfate may be included (trapped or bonded) within the crystalline or amorphous structure of the product solid. With hydrogen peroxide, chloride and sulfate ions remain in the liquid phase and, as a result, are contained in the thickener overflow and filter press wash water, all of which is sent to the liquid waste system. Any chloride or sulfate which remains with the uranyl peroxide solid is contained solely in the liquid phase as the result of imperfect washing.

If poorly washed slurry is then dried, these ions would remain with the solid as the water is evaporated. In this situation, some fraction, albeit small, of the chloride or sulfate would accompany the uranyl peroxide solid to the conversion facility. A concentration of such contaminates may or may not exceed the converter purity specification and potentially could subject the supplier to purity penalties. The volume of wash water employed is an economic decision based on a trade off in potential product purity penalties at the converter versus increased water consumption and associated waste water disposal costs.

Potential Safety Impacts

Although not specifically assessed by NRC in the 1998 Safety Evaluation Report (SER), a potential safety aspect of the use of sulfuric acid as a replacement for hydrochloric acid involves the potential generation of acid fumes in the precipitation plant area. The following values represent the vapor pressure of the two acids and the static pressure of a new vent fan that was installed.

Vapor pressure 93% H_2SO_4 ($pH_2SO_4 + pH_2O$) 20°C:	0.000019337 psi
Vapor pressure 36% HCl ($pHCl + pH_2O$) 20°C:	2.17556607 psi
Static Pressure of Vent Fan:	0.126445 psi

The vapor pressure of sulfuric acid is significantly less than the hydrochloric acid vapor pressure, which should reduce the potential for acid fumes in the area. Any pressurization inside the precipitation tank by acid vapors will cause fumes to flow through the opening on the top of the precipitation tank. Assuming the tank is full of sulfuric acid and the vent fan is running, the tank pressurization from the sulfuric acid vapors will be offset by the static pressure of the vent fan, thus a vacuum will always be maintained in the tank and no sulfuric acid vapors will escape the opening on top of the tank. Based on these factors, no new acid fume risks are being introduced to the process by replacing hydrochloric acid with sulfuric acid. In fact, acid fumes should decrease by using an acid with a lower vapor pressure.

Chemical Storage Impacts

Sections 3.4 and 4.2 of the approved LRA addressed the use and storage of sulfuric acid at Irigaray. Although sulfuric acid was not used in the precipitation process, it has been historically stored and used on site and the safety and environmental impacts of this use have been reviewed and approved by NRC in the approved application. Specifically, sulfuric acid was historically used during the restoration stage for pH adjustment. The proposed change represents a process change in the precipitation cycle but does not introduce a new chemical to the Irigaray site that has not been previously assessed by NRC staff.

The sulfuric acid storage tank is a 6,500 gallon volume capacity, double-walled tank for secondary containment concerns constructed of polyethylene plastic material for sulfuric acid compatibility. The tank is set on the foundation that previously held the hydrogen peroxide tank. The foundation has been evaluated by a structural engineering firm to confirm that it is adequate to support the double-walled sulfuric acid tank. Process piping from the storage tank is 316 stainless steel due to the low flow rate of 3-5 gallons per minute. A pump constructed of 316 stainless steel is dedicated for sulfuric acid use.

Liquid Waste Impacts

As noted above, the chloride and sulfate ions remain in the liquid phase and are disposed with the liquid waste stream. At Irigaray the approved liquid disposal method is discharge to a lined evaporation ponds (approved LRA Section 4.2.2). In the proposed change, the use of sulfuric acid during precipitation would result in increased concentrations of sulfate ions that would replace some of the chloride ions currently present in the liquid waste stream. The substitution of sulfate ions for some of the chloride ions present in the liquid waste stream will not have an effect on the lined evaporation ponds. Sulfuric acid was previously used to lower the pH prior to RO treatment in the restoration cycle at Irigaray. The RO brine containing sulfate ions was routinely discharged to the lined evaporation ponds during restoration with no effects to the pond liner integrity.

Transportation Impacts

As previously discussed, one benefit of the use of sulfuric acid for pH adjustment during the precipitation process is that twice as much hydrochloric acid is required on a molar basis as sulfuric acid. The safety and environmental analysis completed by NRC staff during the 1996 renewal did not quantify the transportation impacts related to process chemical shipments. However, the proposed use of sulfuric acid in the precipitation process should result in a reduced number of acid shipments, which should reduce the actual and potential transportation impacts associated with these shipments.

Previous NRC Evaluations

In Section 2.2 of the SER issued in 1998 supporting the renewal of SUA-1341, NRC staff described the precipitation process employed and noted the use of hydrochloric acid in the process. However, the SER did not provide any further discussion of the safety aspects of the use of acid on site.

In Section 3.1 of the Environmental Assessment (EA) prepared by NRC in June 1998 the EA provides a process description and notes that hydrochloric acid is used for precipitation. Section 3.4 of the EA provides further details on the uranium recovery process and states that "*...when a sufficient volume of pregnant eluant is held in storage, it is acidified to break down the uranyl carbonate complex ion that has been created*". The detailed process description in Section 3.4 of the EA does not specify the type of acid used for the precipitation process.

In NUREG-1910, NRC recognized and analyzed the potential for the use of either hydrochloric or sulfuric acid to adjust pH during he precipitation process. Section 2.4.2.3 states that "*(i)n the precipitation and drying circuit, the pregnant eluant is typically acidified using hydrochloric or sulfuric acid to destroy the uranyl carbonate complex*".

2) Technical Qualifications of Radiation Safety Technician

Regulatory Position 2.4 of NRC Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable", Revision 1, May 2002 contains the regulatory position of the NRC staff on acceptable technical qualifications for the radiation safety staff at a uranium recovery facility. Regulatory Position 2.4.2 addresses the technical qualifications for a Radiation Safety Technician (RST)[1] and provides for two options:

2.4.2(1) *Education: An associate degree or 2 or more years of study in the physical sciences, engineering, or a health-related field;*

Training: At least a total of 4 weeks of generalized training (up to 2 weeks may be on the job training) in radiation health protection applicable to UR facilities;

Experience: One year of work experience using sampling and analytical laboratory procedures that involve health physics, industrial hygiene, or industrial safety measures to be applied in a UR facility;

or

2.4.2(2) *Education: A high school diploma;*

Training: A total of at least 3 months of specialized training (up to 1 month may be on the job training) in radiation health protection relevant to UR facilities;

Experience: Two years of relevant work experience in applied radiation protection.

Section 5.4 of the approved LRA describes the technical qualifications that COGEMA proposed for the RST. While COGEMA did not specifically reference Regulatory Guide 8.31[2] as the source of the technical qualification requirements for the RSO or RST, the proposed requirements reflect those contained in Regulatory Position 2.4.2. For reasons unknown to Uranium One, COGEMA did not request NRC approval of the alternative requirements for an RST contained in Regulatory Position 2.4.2(2).

In the Safety Evaluation Report (SER) issued in 1998 supporting the renewal of SUA-1341, NRC staff noted the following in reference to the proposed RST technical qualifications:

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[1] Note that Regulatory Position 2.4.2 actually refers to a Health Physics Technician. This position is synonymous with a Radiation Safety Technician in the radiation safety organization approved in SUA-1341. The NRC-approved title of Radiation Safety Technician is used in this analysis.

[2] Note that at the time the approved license renewal application was submitted revision 1 to Regulatory Guide 8.31 had not been issued by NRC staff. However, the contents of Regulatory Position 2.4.2 were not changed in the May 2002 revision.

As with the required qualifications for the RSO, the combinations identified by COGEMA are consistent with the staff's recommended combinations of education, training, and experience for RSTs in Regulatory Guide 8.31 (NRC, 1983a).

NRC staff finds the above qualifications for the RSO and the RST to meet the recommendations in Regulatory Guide 8.31 and, therefore, to be acceptable.

Uranium One requests that the NRC amend SUA-1341 to allow the option of meeting the technical qualifications recommendations for an RST using the combination of education, training, and experience delineated in Regulatory Position 2.4.2(2). Uranium One requests that this option be in addition to those currently specified in the approved LRA. This will provide Uranium One with some additional flexibility in meeting these the staffing requirements for this important position. Uranium One believes that this change merits approval because NRC staff has found these same technical qualifications to be acceptable for RST's at other uranium recovery projects. Furthermore, these new technical qualifications will continue to meet the criteria used by NRC in the 1998 SER (i.e., conformance to Regulatory Guide 8.31).

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SUA-1341 January 5, 1996 License Renewal Application
February 4, 2011 Amendment Request
Page Replacement Directions

Page(s) Removed	Page(s) Inserted	Description of Change
vii	vii	Table of Figures - Renames Figure 3.10
3-25	3-25	Section 3.4.1.1 - Adds text to first paragraph to account for chemical transfer pumps in the "main plant" at Irigaray. Removes text referencing equipment that no longer exists in the Irigaray Main Plant.
3-26	3-26	New Figure 3.9 Irigaray General Arrangement
3-27	3-27	Section 3.4.1.3 - Adds reference to sulfuric acid in second paragraph.
3-30	3-30	Section 3.4.1.6 - Removes "Material Balance" from title and reference to "material balance" in the first paragraph.
3-31	3-31	New Figure 3.10 Irigaray Process Flow Diagram
5-7	5-7 followed by 5-7a	Section 5.4 - Adds the second combination of education, training, and experience for the Radiation Safety Technician as listed in NRC Regulatory Guide 8.31, 2.4.2(2)

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Casper, Wyoming 82601
www.uranium1.com

LIST OF FIGURES

storage and the capability to package and ship either slurry or dried uranium product. The elution, precipitation and packaging/shipping portions of the Irigaray operation are used to also process Christensen Ranch uranium-laden resin and uranium product. The Irigaray plant, therefore, serves as the central plant for the Christensen Ranch satellite plant. Additionally, the plant is equipped to receive, store and dry yellowcake slurry from other ISL operations.

Restoration operations are conducted using the ion exchange and sand filtration units within the central plant, plus ion exchange and reverse osmosis circuits located within the restoration building, located adjacent to Units 1 through 5. Resin from the restoration uranium removal process is processed on a batch basis similar to that for resin received from the Christensen Ranch satellite.

A description of each process at the Irigaray plant is provided as follows.

3.4.1.1 General Arrangement

Figure 3.9 depicts the general arrangement of the Irigaray central plant. When the Irigaray plant was first constructed in 1977, the main plant contained a 1,600 gpm up-flow capacity ion exchange circuit (operated at 800 gpm) with accompanying resin transfer and elution columns, precipitation system, calcium clarifiers, lixiviant make-up and the multi-hearth calciner for drying. In 1988, additional processing equipment was installed in the annex to the main plant, consisting of a 2,400 gpm ion exchange circuit, elution circuit, precipitation circuit, and yellowcake dewatering capability (uranium thickeners and filter press). At the same time, the Christensen resin transfer and elution systems were installed in the annex. The portion of the plant termed "main plant" has not been used since 1982, and now houses only the transfer water holding tank and the chemical transfer pumps for sulfuric acid and hydrogen peroxide. The hydrochloric acid pump is located outside the main plant. The old portion of the plant is also used for storage of byproduct material, and will be used for a vanadium removal circuit, if deemed necessary in the future.

3.4.1.2 Ion Exchange/Lixiviant Makeup Circuit

When the uranium-bearing solution from the Irigaray well fields reaches the process plant, it first passes through the ion exchange vessels that contain solid resin beads which preferentially removes the uranium from the solution. While the solution and resin beads are in contact, the uranium anionic complex is exchanged on the resin for chloride. This is the principal source of chloride ions in the circulating groundwater. The chemical equation for the reaction is:

$$2R(Cl) + Na_2 \cdot UO_2(CO_3)_2 = R_2 \cdot UO_2(CO_3)_2 + 2NaCl$$

where R is the active resin ion exchange site. After uranium extraction, the mining solution leaving the IX unit is refortified with bicarbonate (in the form of CO_2 or soda ash). Gaseous oxygen, or hydrogen peroxide, is then added to the solutions at the plant, or in the well field, prior to reinjection into the well field to repeat the leach cycle. In the case of restoration solutions, the solutions are then either transferred to the restoration storage pond or to the restoration building for further processing. The ion exchange circuit at Irigaray is capable of processing a flow rate of 2,400 gpm.

3.4.1.3 Elution and Precipitation Circuit

After the resin in one of the ion exchange vessels is essentially loaded with uranium, it is either transferred to another vessel, or is isolated from the normal process flow for further processing. The uranium is then stripped from the resin by a process called elution. In the elution process, the ion exchange resin is contacted with a strong sodium chloride (salt) solution which exchanges for the uranium and regenerates the resin in a process very similar to a home water softener. Sodium bicarbonate is then used to rinse the resin to keep the stripped uranium from precipitating in the vessel. The stripping solution concentrates the uranium to between 8 and 20 grams per liter, at which level it can be precipitated as a yellowcake product. After elution, the resin is placed back in service for additional uranium recovery.

The eluate from the resin elution circuit is then routed to the precipitation circuit. To initiate the precipitation cycle, sulfuric or hydrochloric acid is added to the uranium bearing solution to break down the uranyl carbonate present in the solution. Hydrogen peroxide is then added to the eluate to effect precipitation of the uranium. The last step of the precipitation process is to add caustic soda to neutralize the remaining acid in solution.

Resin from the Christensen Ranch site is first received in the annex on the west side of the building through large overhead doors. The resin trailer is backed into the building next to one resin elution column. The resin is then transferred from the trailer into the column via a flexible hose. The column of "loaded" resin is then eluted in place, such as described above. Once the resin is stripped of its uranium, it is then reconstituted using the above process. The resin is then transferred from the elution column back to an empty trailer for transport back to the Christensen Ranch facility.

3.4.1.4 Yellowcake Dewatering, Drying and Packaging Circuit

After precipitation, the yellowcake solution is then washed, filtered and allowed to settle prior to entering the drying and product packaging circuit. The yellowcake solution is first processed through a filter press where it is washed, to remove excess chlorides and other soluble contaminants, and then dewatered to a thickened slurry. The slurry is then stored in a yellowcake thickener, or other cone-bottomed tank. At this time the yellowcake slurry, approximately 30 to 50% solids, is either shipped offindicated that vanadium will co-leach with uranium during the mining process of portions of the Christensen Ranch ore body. Vanadium is also extracted onto the IX resin during the recovery solution processing. Vanadium is an undesirable constituent in the yellowcake product, therefore, it may become necessary to remove the vanadium prior to drying the Christensen Ranch yellowcake. This will only become necessary if the vanadium content reaches a level where the uranium refineries will penalize the product due to excessive levels of vanadium.

If vanadium removal from the Christensen Ranch product is necessary, a specialized circuit will be installed at the Irigaray central plant. Equipment required for the vanadium separation will consist of two precipitation tanks, two smaller tanks for chemical additions and solution overflow and a vanadium filter press. The vanadium separation equipment will be located in the old plant area next to one of the clarifier units used for yellowcake storage. The vanadium separation area is shown on the Irigaray general arrangement diagram provided as Figure 3.9.

The vanadium removal process is very similar to that used for uranium processing. After elution of the Christensen resin, the high pregnant solution will be discharged from the elution unit to a high pregnant surge tank. The solutions would then be transferred to a tank where uranium will initially be precipitated and vanadium will be separated through a series of chemical additions to reduce the amount of vanadium in the uranium precipitate. Following the initial uranium precipitation, overflow solutions will enter another tank for vanadium precipitation.

Vanadium will be precipitated as a calcium vanadate product. The vanadium product will then be filtered in a pressure filter press to make a filter cake which can be marketed for its vanadium value. The vanadium product will be drummed for storage and shipped on a batch basis. Removing the vanadium allows recycle of the remaining solution (supernate) to the fresh eluant makeup tank; a small portion of the solution may be sent to the evaporation pond.

Based upon vanadium levels present in the yellowcake product from the Christensen Ranch it is anticipated that approximately 60,000 pounds of vanadium product could be produced per year from Christensen Ranch solutions.

3.4.1.6 Flow Process

The process flow diagram for the Irigaray central recovery plant is provided as Figure 3.10. The figure assumes a 2400 gpm recovery flow from operating mine units. A 1% bleed rate from the well field is used, which is taken from the processing of 50 gpm of barren lixiviant through a reverse osmosis unit, with a resultant 25 gpm brine flow to disposal (1% bleed) and 25 gpm of high quality permeate, which is used for lixiviant makeup.

5.4 QUALIFICATIONS

COGEMA Mining, Inc. project staff are highly experienced in the management of uranium development, mining and operations. The following minimum personnel specifications and qualifications are strictly adhered to.

The minimum qualifications for the Radiation Safety Officer (RSO) are as follows:

1. Education - A Bachelor's Degree or an Associate Degree in the physical sciences, industrial hygiene, environmental technology or engineering from an accredited college or university or an equivalent combination of training and relevant experience in uranium mill/solution mining radiation protection.

2. Health Physics Experience - A minimum of 1 year of work experience relevant to uranium mill/solution mining operations in applied health physics, radiation protection, industrial hygiene or similar work.

3. Specialized Training - A formalized, specialized course(s) in health physics specifically applicable to uranium milling/solution mining operations, of at least 4 weeks duration. The RSO attends refresher training on radiation health physics every two years.

4. Specialized Knowledge - The RSO, through classroom training and on-the-job experience, possesses a thorough knowledge of the proper application and use of all health physics equipment used in the operation, the procedures used for radiological sampling and monitoring, methods used to calculate personnel exposures to uranium and its daughters, and a thorough understanding of the solution mining process and equipment used and how hazards are generated and controlled during the process.

The Radiation Safety Technician (RST) will have one of the following combinations of education, training and experience:

1. Education - An associate degree or 2 years or more of study in the physical sciences, engineering or a health-related field.

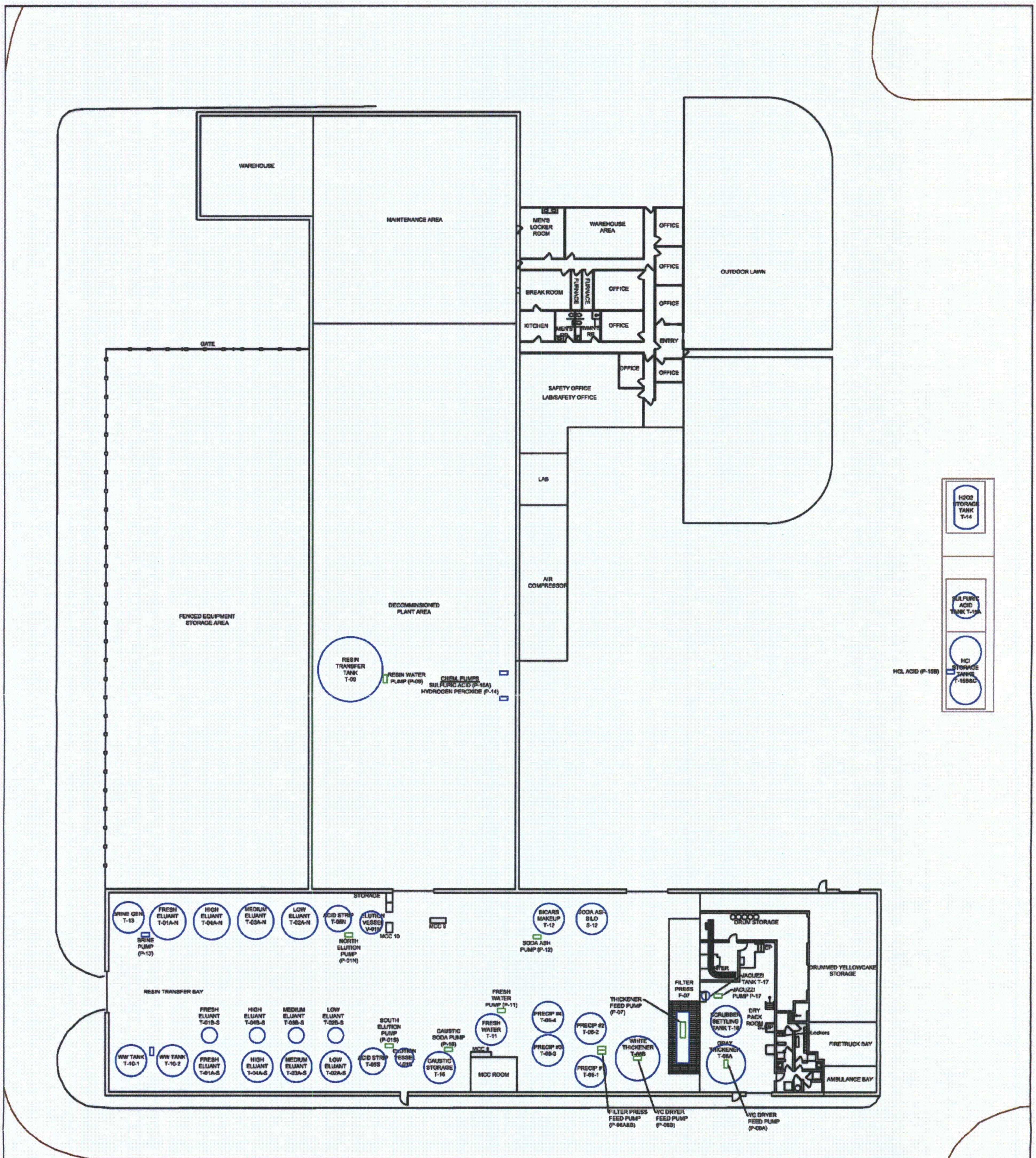
   Training - At least a total of 4 weeks of generalized training in radiation health protection applicable to uranium mills/solution mining operations.

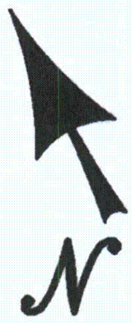
   Experience - One year of work experience using sampling and analytical laboratory procedures that involve health physics, industrial hygiene, or industrial safety measures to be applied in a uranium mill/solution mining operation.

2. <u>Education - A high school diploma.</u>

<u>Training - A total of at least 3 months of specialized training (up to 1 month may be on the-job training) in radiation health protection relevant to UR facilities.</u>

<u>Experience - Two years of relevant work experience in applied radiation protection.</u>





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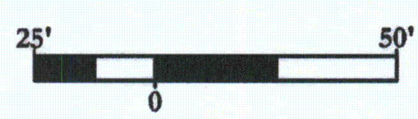
106° 02' 20.16" W

Elevation:
4,649 ft



VERIFY SCALE

SCALE : 1" = 50'

uranium one™
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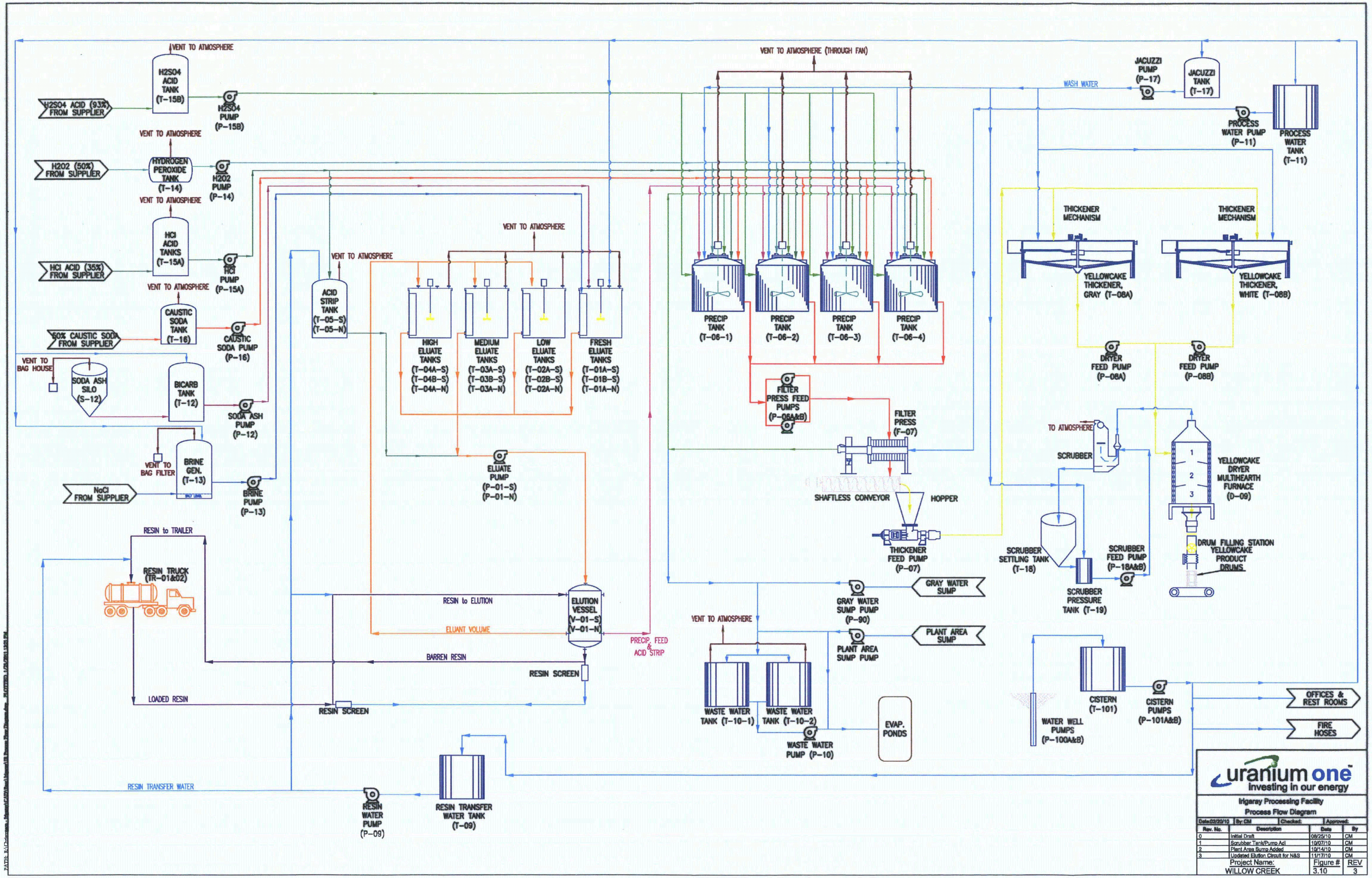
Irigaray Processing Facility
General Plant Arrangement

Date:10/25/10	By:CM	Checked:	Approved:

Rev. No.	Description	Date	By
0	Initial Draft	10/25/10	CM
1	Moved HCl Pump	11/15/10	CM

Project Name:	Figure #	REV
WILLOW CREEK	3.9	1



(Revision, February 2011)