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November 19, 2010

Mr. Ron Linton
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Mail Stop T8F5
Rockville, Maryland 20852-2738

Re: Docket No. 40-8502, License No. SUA-1341

Dear Mr. Linton:

Enclosed please find five sets of replacement pages for insertion into the License Renewal Application (LRA) dated May, 2008 for the above referenced license. The revised pages address a number of key improvements and modifications to the document including:

- Responses to NRC Open Issues that were transmitted to Uranium One USA, Inc. (Uranium One) in a letter dated February 18, 2010. Formal responses to the February 2010, Open Issues were submitted on October, 21, 2010 with corresponding page replacements. This submittal and corresponding page replacements supersede the October submittal and include all the changes presented in the October response package.
- The revised pages also represent modifications made to the renewal application reflecting changes made as a result of the change of control and change of name from COGEMA Mining Inc. to Uranium One USA., Inc.
- Modifications made to site facilities by Cogema after the original LRA submittal of May 2008 and changes made by Uranium One after the Change of Control in preparation of restart of ISR operations.
- Improvements to the renewal application to reflect NRC comments on the Moore Ranch License Application and,
- Changes made to the document to reflect synergies between SUA-1341 and Moore Ranch (SUA-1596) as well as the pending Ludeman Amendment Application to SUA-1341.

Uranium One USA, Inc.
A Member of the Uranium One Inc. Group of Companies
tel +1 307-234-8235 • **fax** +1 307-237-8235
907 N. Poplar Street, Suite 260
Casper, Wyoming 82601
www.uranium1.com

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This submittal package includes five sets of replacement pages for text and figures in Sections 1.0, 3.0, 4.0, 5.0, 6.0 and 7.0. Each set also includes an index of page changes identifying:

- The Section where the change is located – identified in the footer.
- The page (by page number) to be removed from the October updated version of the LRA.
- The page (by page number) to be replaced in the October updated version of the LRA and
- A description of the nature of the change.

The LRA will now show in the footers throughout the document five revision dates of the original submittal of May 2008. These include July 2008, October 2008, July 2009, October 2010 and November 2010. It should be noted that all the revisions represented in the October 2010 Open Issue responses and page replacements are included in this submittal. Thus after the page replacements are inserted from this package, there will be no footers with the October 2010 date.

If you or your staff should have any questions regarding this submittal, please contact me at (307) 234-8235 ext. 331 or by email: Jon.Winter@Uranium1.com.

Sincerely,

Jon Winter
Manager- Wyoming Environmental and Regulatory Affairs

Enclosures: Five sets of page replacements for SUA-1341 License Renewal Application – May 2008.

Uranium One USA, Inc.
A Member of the Uranium One Inc. Group of Companies
tel +1 307-234-8235 • **fax** +1 307-237-8235
907 N. Poplar Street, Suite 260
Casper, Wyoming 82601
www.uranium1.com

From: Origin ID: CPRA (307) 234-8235
Jon Winter, SHE Wyo. Mgr.
Uranium One Americas, Inc.
907 North Poplar Street
Suite 260
Casper, WY 82601

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Ron Linton-Waste Mgmt.
U.S. Nuclear Regulatory Commission
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Page(s) Removed	Page(s) Inserted	Description of Change
ii	ii followed by iia	Revises Table of Contents
vi & vii	vi & vii	Revises Table of Contents

Page(s) Removed	Page(s) Inserted	Description of Change
1-1 through 1-6	1-1 through 1-6	Section 1 - Pertinent parts of section have been revised to reflect the current developmental, operational and ownership status of the Irigaray/Christensen Ranch Project. Although not all information has changed, due to the short length of this section, all pages have been replaced.
1-1	1-1	Section 1.1 - Adds paragraph to reflect the purchase of Cogema by Uranium One and change of control. Replaces "COGEMA" with "Uranium One" in paragraph five.
1-2	1-2	Paragraph three - Removes last sentence referring to Cogema's Mills office. Revises paragraph four.
1-3	1-3	Replaces Cogema with Uranium One in paragraph one.
1-4	1-4	Text has shifted.
1-5	1-5	Revises paragraph two to reflect current status of Irigaray evaporation ponds. Removes paragraph referencing "The recovery of the uranium market ... of that amendment request" Revises paragraph three (previously paragraph four) to reflect the approval of the MU 7 wellfield data package. Revises paragraph four to reflect current production timeline and replaces "COGEMA" with "Uranium One"
1-6	1-6	Revises paragraphs 1, 2, 3, and 5 to reflect current project status.

Page(s) Removed	Page(s) Inserted	Description of Change
3-1	3-1	Changes Irigaray pipeline removed from 60% to 80% in the second paragraph. Removes MU7 operations will resume "subject to LQD approval" in the last paragraph.
3-2	3-2	Section 3.1.1 - Revises first paragraph to reflect relining of ponds at Irigaray.
3-3	3-3	Section 3.1.2 - Adds text to the end of the first paragraph indicating that MU7 development has restarted.
3-8	3-8	Last paragraph, changes number of Christensen Ranch wells from 853P and 1,125i to 897P and 1,231i to reflect number in 2010 surety update. Changes the ratio upper range from 1.3 to 1.4.
3-10	3-10	Paragraph 1 - Changes ratio of producers to injectors from 1:1.32 to 1:1.37
3-11	3-11	Corrects spelling of "stratigraphic in the first paragraph.
3-12	3-12	Rewords last paragraph (pozzolan additive), and adds "may be" in reference to using a wiper plug.
3-29	3-29	Adds text to first paragraph to account for chemical transfer pumps in the "main plant" at Irigaray.
3-30	3-30	New Figure 3.10 "Irigaray Processing Facility General Arrangement Diagram"
3-31	3-31	In the first paragraph of Section 3.4.1.3 adds specific reference to Christensen Ranch and Irigaray; adds sodium carbonate reference; deletes sentence referring to sodium bicarbonate being used to prevent the stripped uranium from precipitating; and raises amount of uranium in solution from 20 to 25 grams per liter. Adds sulfuric acid to second paragraph. Adds solids "by volume" to first paragraph of Section 3.4.1.4.
3-34	3-34	Section 3.4.1.6 - Removes "Material Balance" from title and reference to "material balance" in the first paragraph. Section 3.4.1.7 - Revises first paragraph of to reflect relining of decommissioned ponds at Irigaray.

Page(s) Removed	Page(s) Inserted	Description of Change
3-35	3-35	New Figure 3.11 "Irigaray Processing Facility Process Flow Diagram"
3-36	3-36	Section 3.4.1.8 – Adds sentence to paragraph one discussing equipment list. Adds new Section 3.4.1.9 Chemical Storage Facilities.
N/a	3-36a following page 3-36	Continues Section 3.4.1.9 Chemical Storage Facilities.
N/a	3-36b following page 3-36a	Continues Section 3.4.1.9 Chemical Storage Facilities
3-37 & 3-38	3-37 & 3-38	Updates Table 3.3 "Irigaray Plant Equipment List"
N/a	3-38a following 3-38	Continues update of Table 3.3 "Irigaray Plant Equipment List"
3-39	3-39	Updates the individual IX column capacity from 600 to 1,200 gpm in first paragraph of Section 3.4.2.2
3-40	3-40	Deletes operated "manually", reference to "day tank" and "pH instrumentation in the makeup tank" in paragraph three. Adds reference to "sulfuric acid storage tank" and revises text in last paragraph.
3-41	3-41	New Figure 3.12 Christensen Ranch Facility General Arrangement Diagram.
3-42	3-42	Section 3.4.2.3 - Removes "Material Balance" from title and reference to "material balance" in the first paragraph Adds bag filter to last sentence of Section 3.4.2.3.
3-43	3-43	New Figure 3.13 Christensen Ranch Satellite Process Flow Diagram.
3-44	3-44	In section 3.4.2.4 corrects spelling of "makup" to "makeup" and changes "currently" to "may be" stored in reference to permeate storage.

Page(s) Removed	Page(s) Inserted	Description of Change
3-45	3-45	Section 3.4.2.5 – Adds sentence to paragraph one discussing equipment list; revises paragraph four to indicate that the water used to transfer resin to the tanker trailers will be supplied from the backwash/resin transfer water storage pond. Adds "or automatically" to lixiviant makeup activities in paragraph four.
3-46 & 3-47	3-46 & 3-47	Updates Table 3.4 "Christensen Ranch Operations Equipment List"
N/a	3-47a following 3-47	Adds Section 3.4.2.6 Chemical Storage Facilities.
N/a	3-47b following 3-47a	Continues Section 3.4.2.6 Chemical Storage Facilities
3-50	3-50	Updates Figure 3.14 "Life of Mine" in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 6.1.3.1

Page(s) Removed	Page(s) Inserted	Description of Change
4-1	4-1	Section 4.1.1 - First paragraph, removes "lixiviant" makeup tank and adds "soda ash" and "soda ash mix tanks"; revises sentence on radon venting from the tanks. Revises paragraph four to reflect a soda ash baghouse efficiency of 99.99%, reducing estimated particulate emissions for twenty-one shipments to 7.5 lbs/shipment.
4-2	4-2	First paragraph - Changes "thirty" shipments to "twenty-one" in sentence one. Adds paragraph two, discussion of radon releases in header houses, in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 4.1.
4-2a	4-2a	Text spill over from page 4-2. Revises paragraphs one and two of "Process Facility" to reflect changes at the Irigaray.
4-9	4-9	Adds text to paragraph one referencing the placement of a new HDPE liner over the existing Hypalon liner. Corrects spelling of "makup" to "makeup" in paragraph four.
4-10	4-10	Adds "design" in place of "system" in paragraph one. Section 4.2.1.4 - Replaces "COGEMA" with "Uranium One"
4-11	4-11	Section 4.2.1.5 - Replaces "COGEMA" with "Uranium One"
4-12	4-12	Revises paragraph two to reflect the re-installation of liners in ponds D and RA at Irigaray.
4-13	4-13	Revises pond capacity tables and revises/deletes table footers to reflect the re-installation of liners in ponds D and RA at Irigaray. Updates Section 4.2.2.2.
4-14	4-14	Section 4.2.2.4 - Replaces "COGEMA" with "Uranium One" in sentence one and rephrases sentence two. Section 4.2.2.5 - Rephrases sentence three of paragraph one and replaces "COGEMA" with "Uranium One"
N/a	4-16	New Figure 4-2A Irigaray Processing Plant Pond D Detail
N/a	4-17	New Figure 4-2B Irigaray Processing Plant Pond RA Detail

Page(s) Removed	Page(s) Inserted	Description of Change
5-1	5-1	Section 5.0 - Adds Uranium One as operator, Section 5.1 adds Uranium One organization & administrative procedures. Section 5.1.1 - Adds Senior Vice President, ISR operations description Both in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.1
5-2	5-2	Section 5.1.2 - changes title and description from Operations Manager to Site/Construction Manager, changes title and description of Section 5.1.3 to Manager, Environmental and Regulatory Affairs Wyoming Both in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.1
5-3	5-3	Changes Figure 5.1 to reflect current titles and reporting chain on organization chart in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.1
5-4	5-4	Replaces reference to Operations Manager with Site/Construction Manager in paragraph one.
5-6	5-6	Replaces "Operations Manager or General Manager" with Site/Construction Manager in paragraph three. Replaces "Operations Manager" with "Site Construction Manager" in paragraph five. Both in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.1
5-7	5-7	Replaces Reference to "General Manager" with "Senior Vice President, ISR Operations"
5-8	5-8	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
N/a	5-8a following 5-8	Text spill over from page 5-8.
5-9	5-9	Deletes SOP reference, second set of numbers # 5 (HP-1) and # 6 (HP-21)
5-10	5-10	Deletes all SOP references in Section 5.5.3 (HP-2,3,5,6,7,8,10,11,13,14,15,16, 22 & 24)

Page(s) Removed	Page(s) Inserted	Description of Change
5-11	5-11	Deletes SOP reference in Section 5.6.1 (HP-24) and Section 5.6.2 (HP-24) and adds reference to SUA-1341. Section 5.6.1 - Replaces "are" with "is" in last sentence.
5-14	5-14	References SUA-1341 in #3; deletes SOP reference, (E-11), revises text under #5.
5-16	5-16	Deletes SOP reference (HP-2 & HP-14) in last paragraph, revises text to reference Reguide 8.30 & SUA-1341.
5-18	5-18	Updates Figure 5.2 Christensen Ranch Radiological Monitoring Locations
5-19	5-19	Updates Figure 5.3 Irigaray Radiological Monitoring Locations
5-20	5-20	Section 5.7.2.2 - Adds OSL/revises paragraph one. Paragraphs three and four - deletes SOP reference (HP-5 & HP-9), revises text and adds reference to Reguide 8.30.
5-22	5-22	Revises text in first paragraph of Area Sampling to clarify calibration frequency. Adds further discussion on the determination of uranium concentrations to Area Sampling in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.7.3 Comment B.
5-22a	5-22a	Continues further discussion on the determination of uranium concentrations to Area Sampling in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.7.3 Comment B.
5-22b	5-22b	Adds Table 5.2a in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.7.3 Comment B.
5-23	5-23	Paragraphs four and five - Deletes SOP references (HP-6, 13, 15, 18 & 26), adds reference to SUA-1341.
5-25	5-25	Updates Figure 5.4 Irigaray Dry Pack Level Air Sample Locations.

Page(s) Removed	Page(s) Inserted	Description of Change
5-26	5-26	First and fifth paragraphs - Revises calibration frequency from 6 months to annually as per SUA-1341. Last paragraph deletes SOP reference (HP-7 & 15) in and clarifies, revises text. Adds last sentence in reference to February 18, 2010 Open Issues Related to the NRC's Safety Review: 4.1 Comment A.
5-31 & 5-31a	5-31 & 5-31a	Deletes SOP reference (HP-5) in first paragraph Inserts discussion on Prenatal and Fetal Exposure in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.7.4.
5-34	5-34	Deletes SOP reference (HP-5).
5-36	5-36	Moves Table 5.8 from pg 5-37 to 5-36.
5-37	5-37	Text spills over from section 5.7.5.
5-39	5-39	Deletes SOP reference (HP-4) under bioassay program.
5-41	5-41	Deletes all SOP references (HP-1, 3, 10, 14 & 31) in section titled Proposed Contamination Control Program and revises text. Adds discussion on beta analysis in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.7.6.
5-44	5-44	Deletes SOP reference (ENV-7) under Radon.
5-46	5-46	Corrects spelling of Christensen.
5-50	5-50	Deletes SOP reference (ENV-8). Replaces “is” with “are” under headings Soil and Vegetation.
5-55	5-55	Deletes SOP reference (ENV-6).

Page(s) Removed	Page(s) Inserted	Description of Change
5-61 to 5-69	5-61 to 5-69	Moves Section 5.8.2.2 from page 5-61 and 5-62 to page 5-69. This moves Tables 5-23 & 5-24 up one page.
N/a	5-67 & 5-68	Reformats Table 5.24 in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.8.2.2 Comment B.
N/a	5-69	Changes density of overlying (shallow zone) and underlying (deep zone) monitoring well requirements from 3.5 to 4 acres to be consistent with WDEQ-LQD requirements. This will require a change to License SUA-1341 Condition 10.3.
5-70	5-70	For consistency with Table 5.24, changes baseline sampling period from 4 quarterly samples to 4 samples "at least two weeks apart" in paragraphs one and two; relating to February 18, 2010 Open Issues Related to the NRC's Safety Review: 5.8.2.2.
5-73	5-73	Last paragraph was modified to reflect current status of the MU 7 Data Package approval by the WDEQ-LQD.
5-81	5-81	Removes reference to ponds D and RA at Irigaray in first sentence.
5-83	5-83	Deletes SOP reference (ENV-11) from first paragraph.
5-85	5-85	Deletes SOP reference (PBL-2) following bullets.

Page(s) Removed	Page(s) Inserted	Description of Change
6-2	6-2	Section 6.1.2 – Removes text "and planned for the future," and corrects wording to indicate "four" rather than "three" phases in sentence one.
6-3	6-3	Section 6.1.2.1 – Deletes text in last sentence of paragraph one, and adds last paragraph.
6-7	6-7	Replaces "Cogema" with "Uranium One" in paragraph one. Section 6.1.2.3 – Revises discussion of recirculation. Section 6.1.2.4 – Changes post-restoration stabilization monitoring period from "nine" to "twelve" months for future mine units and removes text indicating a total of "four samples" for designated restoration wells. Section 6.1.2.4 – Changes sampling frequency for monitor wells from "quarterly" to "every 60 days" in last sentence. Section 6.1.3 – Adds text to first sentence, relating to February 18, 2010 Open Issues Related to the NRC's Safety Review: 3.1.2 Comment B.
6-8	6-8	Adds "Up to" for PVD Volume. Replaces "Treatment: Recirculation" with "Treatment: Circulation of 1 PV of Hydrogen Sulfide Gas Reductant" Changes stabilization monitoring period from 9 to 12 months. Replaces Cogema with Uranium One in last paragraph. Adds text to last paragraph stating that the "equivalent of a one percent bleed will be maintained" in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 6.1.3.1 Comment C.
6-8a	6-8a	Replaces Cogema with Uranium One in first and last paragraph. Removes (recirculation) from "e." Replaces "Avoiding" with "Conducting" in "f."
6-9	6-9	Section 6.1.3.3 – Adds paragraph two stating the restoration report will include piezometric maps in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 6.1.

Page(s) Removed	Page(s) Inserted	Description of Change
6-10 & 6-11	6-10 & 6-11	Adds water level to analytical parameters in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 6.1. Changes restoration sampling for monitor wells from monthly to 60 days. Changes stabilization sampling frequency from "Four Times (Beginning, quarterly, and the end)" to "Beginning, Middle and End" for designated restoration wells and from "Quarterly" to "Every 60 days" for monitor wells.
6-12& 6-12a	6-12	Adds language to section 6.2 stating decommissioning of wellfields will be initiated after groundwater restoration approval in response to February 18, 2010 Open Issues Related to the NRC's Safety Review: 6.2.
6-13	6-13	Section 6.4.1 – Adds/removes text to reference latest surety update.
6-14	6-14	Section 6.4.2 – Updates letter of credit information.

Page(s) Removed	Page(s) Inserted	Description of Change
7-19	7-19	Corrects Uranium-228 to U-238 as part of miscellaneous changes in response to February 18, 2010 Open Issues Related to the NRC's Safety Review General Comments.
7-20	7-20	Deletes SOP reference (E-1) in last sentence of Section 7.5.1.1.
7-21	7-21	Deletes SOP reference (E-2) in last sentence of paragraph two.
7-23	7-23	Deletes SOP reference (E-11), revises text in second paragraph.
7-24	7-24	Deletes SOP reference (SPCC-1 & 2) in last sentence of Section 7.5.3.

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LIST OF FIGURES

1.0 PROPOSED ACTIVITIES

1.1 LICENSING ACTION REQUESTED

This application was made by COGEMA Mining, Inc. (COGEMA) for renewal the United States Nuclear Regulatory Commission (USNRC) Source Material License No. SUA-1341 for the continuation of in situ mining operations at the Irigaray/Christensen Ranch facilities located in Johnson and Campbell counties, Wyoming. The revisions reflected in this document are also being forwarded to the Wyoming Department of Environmental Quality (WDEQ) as an update to Permit to Mine No. 478, Amendment No. 2.

An amendment application was submitted to the NRC on September 18, 2009 by Cogema and Uranium One USA, Inc. (Uranium One) entitled "*Notice of Change of Control and Ownership Information: Material License SUA-1341: COGEMA Mining, Inc., Irigaray & Christensen Ranch Facilities, Johnson & Campbell Counties, Wyoming*" (ML092660641). The application was supplemented by submissions dated October 23, 2009 (ML093090468), November 18, 2009, (ML093290146 and ML093360303), and December 3, 2009 (ML093420030). On December 17, 2009 the NRC approved the License Amendment for change and control and issued License Amendment No. 15 to SUA-1341. On January 25, 2010 Uranium One USA., Inc. purchased COGEMA Mining, Inc. On January 27, 2010 Uranium One submitted an amendment application request to the NRC for SUA-1341 for change of name from COGEMA Mining, Inc. to Uranium One USA., Inc. The US NRC approved the change on August 13, 2010 and issued Amendment No.17 to License SUA -1341.

The renewal application has been prepared using suggested guidelines and standard formats from both state and federal agencies. The application is primarily structured in the USNRC format of Regulatory Guideline No. 3.46.

This renewal application essentially updates the Irigaray and Christensen Ranch commercial ISL uranium mining operations since 1998, the time of the last USNRC license renewal. This introductory section briefly summarizes the project ownership history and the projects themselves.

Uranium One requests that the license be re-issued for a ten year period, rather than a five year period, as it will be a performance based license which allows updating of the application for certain operations on an annual basis.

1.2 PROJECT AND OWNERSHIP HISTORY

1.2.1 PROJECT OWNERSHIP HISTORY

The Irigaray project was licensed for commercial ISL uranium operation in August 1978.

The project was then owned and operated by Wyoming Mineral Corporation, a subsidiary of Westinghouse Electric Corporation. The Irigaray project was licensed to operate at an 800 gallon per minute (gpm) flow rate, using an ammonium bicarbonate lixiviant. Due to the difficulties with restoring formations mined with ammonia, the lixiviant was changed to sodium bicarbonate in 1980. The uranium (yellowcake) dryer at the Irigaray facility was operated non-continuously during 1980. Additionally, the use of sodium bicarbonate was discontinued in the uranium precipitation cycle in the processing plant in favor of precipitation with hydrogen peroxide. In 1982, operations ceased at the Irigaray plant and wellfields, and the facility was placed on standby status pending improvements in the uranium market.

In June of 1987, Malapai Resources Company (a subsidiary of Arizona Public Service) purchased the Irigaray site from Westinghouse and resumed operations. In 1988, Malapai amended the WDEQ Permit 478 and USNRC SUA-1341 Irigaray permits and license to include the Christensen Ranch satellite ion exchange plant and associated mine units. The Irigaray process was then upgraded to include facilities for processing ion exchange resin from Christensen Ranch, and the flow rate of the Irigaray recovery plant was increased to a 2,400 gpm capacity. Although the dryer unit was available for processing the uranium, Malapai chose to ship a slurry product for economic reasons. Malapai Resources Company continued operations through February of 1990. Due to financial difficulties within Arizona Public Service, Malapai Resources Company was sold to Electricite de France (EdF), the French Nuclear utility, in September 1990. EdF chose not to operate the Irigaray site themselves, and selected another French company, Total Minerals Corporation (TOMIN), to be the operator of the Irigaray and Christensen Ranch projects. Effective September 20, 1990, all State and Federal permits and licenses formerly held by Malapai were transferred to TOMIN. TOMIN resumed operations of the Malapai properties in 1991.

In April 1993, a large stock exchange occurred in France between COGEMA and TOTAL (parent of Total Minerals Corporation), in which TOTAL acquired 10% of COGEMA stock and, in return, COGEMA acquired all of TOTAL's uranium properties in the world, plus stock in TOTAL. As a result, COGEMA acquired the operatorship of the EdF Malapai properties in Wyoming and Texas. The exchange was formalized in July, 1993, and in November, 1993 the name of Total Minerals Corporation was changed to COGEMA Mining, Inc. (COGEMA).

Production with lixiviant injection ended in June, 2000, and activities were concentrated on well field restoration and site decommissioning (see section 1.2.3). The recent resurgence of the uranium mining industry led to COGEMA's decision to request a license amendment from the NRC to change the license from a decommissioning status to an operational status. That amendment request was submitted to the NRC in April, 2007, and granted on September 30, 2009, as amendment No.13 to License SUA-1341.

Any future mine development at Irigaray likely would be a minimum of ten years from the point of operations restart at Christensen Ranch. Because of the uncertainty of future mine development at Irigaray and the need for a major plant re-construction to accommodate mining at Irigaray, future mine development at Irigaray is beyond the scope of activities addressed in this document. If further Irigaray development were placed on a faster track than currently anticipated, Uranium One would submit a license/permit revision to address the change.

1.2.2 LOCATION AND LAND OWNERSHIP

The Irigaray/Christensen Ranch project is an in-situ leach (ISL) uranium mining operation located approximately 55 miles southeast of Buffalo, Wyoming, and 51 miles northeast of Midwest, Wyoming. The project is actually composed of two distinct areas. The first area, generally referred to as the Irigaray site or the Irigaray central plant, is located in southeast Johnson County, Wyoming. The uranium deposit is one of many located in the Powder River Basin in northeast Wyoming. The property consists of approximately twenty-eight square miles within Townships 45, 46, 47 North, Ranges 77 and 78 West. The current mine site is located within Sections 5, 8, 9 and 16 of Township 45 North, Range 77 West.

Lands which make up the approximately 21,100 acres of leases and Federal unpatented lode mining claims located in the Irigaray property are owned by the following:

TABLE 1.1
IRIGARAY LAND OWNERSHIP

SURFACE OWNERSHIP	MINERAL OWNERSHIP
L. Brubaker, et al.	Irigaray and BLM
Bureau of Land Management	Bureau of Land Management (BLM)
State of Wyoming	State of Wyoming
Streeter	BLM and Streeter

Land or mineral ownership of the Irigaray area has not changed significantly since the issuance of the Final Environmental Statement for the Irigaray Site, NUREG-0481, in 1978, nor are any future changes foreseen at this time. Maps of the surface and mineral ownership are discussed in Chapter 2.0, Section 2.1, "Site Location and Layout", of this renewal application.

The second area is the Christensen Ranch wellfield and satellite operation (ion exchange plant), which is located approximately 13 miles southeast of the Irigaray site. The

Christensen Ranch operations consist of approximately 14,000 acres in Townships 44 and 45 North, Ranges 76 and 77 West in Johnson and Campbell Counties, Wyoming. COGEMA maintains approximately 600 unpatented lode mining claims and two State mining leases within and surrounding the Christensen Ranch area. Ownership of the property is as follows:

TABLE 1.2
CHRISTENSEN RANCH LAND OWNERSHIP

SURFACE OWNERSHIP	MINERAL OWNERSHIP
Bureau of Land Management (BLM)	BLM
State of Wyoming	State of Wyoming
John O. Christensen	John O. Christensen, et al. and BLM

1.2.3 DESCRIPTION OF EXISTING FACILITIES AND SITE STATUS

Roll-front uranium mineralization is present at the both the Irigaray and Christensen Ranch properties in the Wasatch formation. Remaining reserves on the entire Irigaray property controlled by COGEMA are approximately seven million pounds. Economic reserves remaining on the Christensen Ranch property are approximately nine million pounds in today's uranium market.

Previous mining operations at the Irigaray Site were conducted in twelve acres of wellfield (Production Units 1 through 5) in 1978 through 1981 by Westinghouse. Production Units 6 through 9 were operated by Malapai in 1987 through 1990, in addition to continued operations in Units 1 through 5. Restoration of Units 1 through 3 began in 1990 and stabilization monitoring ended at the beginning of 1994. Restoration in Units 4 and 5 began in 1992, was temporarily suspended in 1994, and resumed in April, 1995 in combination with restoration in Units 6 through 9. Restoration of all units was completed by late 2001. The final *Wellfield Restoration Report, Irigaray Mine*, July, 2004, was submitted to WDEQ on July 26, 2004. The Irigaray wellfields restoration was approved by WDEQ in 2005 (WDEQ/LQD letter, November 1, 2005), and subsequently approved by the NRC in 2006 (USNRC letter, September 20, 2006).

Operations at Christensen Ranch began in April, 1989 in Mine Unit 3. Operations were suspended in February, 1990 with the sale of the company. Operations in Mine Unit 3 resumed in 1992, and mining started in MU 2. MU 4 came on line in 1994, and MU 5 in 1995. MU 6 went into production in early 1997. All mining (lixiviant injection) ended by June, 2000. MUs 2, 3, and 4 went into restoration in 1997, and MUs 5 and 6 went into restoration in 2000. The restoration of all existing Christensen Ranch wellfields (including stability monitoring) was completed by 2006. The *Wellfield Restoration Report, Christensen Ranch Project, Wyoming*, March 5, 2008, was submitted to WDEQ and the NRC on April 8, 2008.

Plugging and abandonment of wells at Irigaray is 99% complete, and much of the decommissioning of the Irigaray wellfields surface facilities has been completed. The facilities in the Irigaray main plant building have been decommissioned (there remains only one tank used to hold waste water prior to transfer to an evaporation pond). The sand filter tanks and restoration IX columns have been removed from the Irigaray annex building. Five of seven evaporation ponds at Irigaray were decommissioned (liners, leak detection systems, and contaminated underlying soil removed). However, ponds RA and D have been subsequently relined with leak detection systems in 2010. These ponds will be put back into service when operations restart. All decommissioning activities that have been accomplished to date have been consistent with the approved Decommissioning Plan referenced in Condition 9.3 of license SUA-1341.

Recently, various maintenance tasks have been completed on the remaining plant facilities at Irigaray and at the Christensen Ranch satellite ion exchange plant. These maintenance tasks have been accomplished in anticipation of a restart of operations. A resumption of mining would focus on Christensen Ranch with the transport of loaded resin to Irigaray for elution, precipitation, and yellowcake drying and packaging. Operations at Christensen Ranch will include completion of MU 7, and the sequential development of MUs 8 through 12. COGEMA had submitted a baseline wellfield data package for MU 7 to WDEQ (COGEMA, June, 2007). Approval by the Wyoming Department of Environmental Quality – Land Quality Division, District III office for the Mine Unit 7 wellfield data package was issued to Uranium One on September 13, 2010. MUs 8 through 12 will each entail installation of monitor wells, baseline data collection, and submittal of a wellfield data package. Future operations also might include production from MU 5 and possibly 6 (entailing re-entry to these previously restored well fields).

Initial restart activity will focus on well field drilling beginning in the spring of 2010, and with an anticipated commencement of lixiviant injection by the fourth quarter of 2010.Production is scheduled to run for eleven years from the Christensen Ranch wellfields. Wellfield restoration is scheduled to occur in sequence as production from each wellfield is completed. Restoration of the final produced wellfield will be completed within three years of the end of production. Overall, remaining Christensen project life is about fifteen years. As noted above, any future development of remaining reserves at Irigaray would require expansion of the Irigaray plant to replace the decommissioned circuits that previously supported mining at Irigaray. Uranium One would submit to the NRC and WDEQ a plan revision for such a facilities renovation well in advance of any work. Additional mining at Irigaray would require additional development work, environmental baseline data collection and an amendment application to include the areas to be mined in the current permit and license area. If remaining reserves at Irigaray were developed, the overall project life could be extended an additional eight years. A life of mine schedule is presented in Section 3 of this submittal.

Currently, processing facilities include the central plant at Irigaray which consists of an area to receive loaded resin from Christensen Ranch or other satellite facilities, and circuits such as elution, precipitation and drying/packaging. The Christensen Ranch satellite extraction plant consists of an ion exchange circuit which will be operated at a flow rate of 4,000 gpm on an annual average, and a lixiviant makeup circuit. Water treatment processes such as reverse osmosis are used to clean well field bleed water for use in future restoration and lixiviant makeup. Uranium-laden resin from the ion exchange columns will periodically be transferred to a tanker trailer and trucked to the Irigaray central plant for elution, final uranium precipitation, and drying.

Drying capability at the Irigaray plant is equivalent to approximately 2.5 million pounds throughput per year, exceeding projected wellfields production at Christensen Ranch. However, toll processing of loaded resins from other Uranium One satellite locations or other licensees, may be considered in the future. Toll processing would effectively utilize the projected excess dryer capacity.

Wastewater disposal capability includes evaporation in lined ponds, storage of clean water (reverse osmosis permeate) in clay lined ponds, treatment and disposal via surface discharge under a WYPDES permit, and deep well injection. Application has been made to WDEQ for additional deep injection wells for waste disposal at Irigaray, but no action has been taken to date on the request. Solid wastes (non-radioactive) are transported to an industrial landfill, and byproduct materials are transported to Pathfinder Mines Corporation's Shirley Basin tailings facility for final burial.

A restoration/decommissioning/reclamation surety for the overall project is maintained in the form of a letter-of-credit in favor of the State of Wyoming and the Department of Interior (BLM). The amount of the surety is re-calculated in August of each year, based on the status of the project. The last estimate submitted in August 2010 included the decommissioning cost for a completed MU 7, and other refurbishments undertaken to the Christensen Ranch Satellite and Irigaray Processing Plant since the last reporting period; thus covering the initial activity involved in a restart planned for the fourth quarter of 2010.

3.0 DESCRIPTION OF PROPOSED OPERATIONS

In the past, COGEMA Mining, Inc. has operated the Irigaray central processing facility and associated well fields plus a satellite ion exchange plant and well fields located at the Christensen site. All existing well fields at the Irigaray site have been mined out and have undergone aquifer restoration. The "Wellfield Restoration Report, Irigaray Mine, July 2004" was submitted to WDEQ/LQD on July 26, 2004. DEQ issued in a letter to COGEMA dated November 1, 2005, a determination that the groundwater, as a whole, had been returned to its premining class of use, and authorized the abandonment of wells within the wellfields. The NRC concurred with DEQ's determination in a letter to COGEMA dated September 20, 2006. Mining and aquifer restoration have been completed in Mine Units 2 through 6 at the Christensen satellite operation. The "Wellfield Restoration Report, Christensen Ranch Project, Wyoming, March 5, 2008" was submitted to WDEQ/LQD and the NRC on April 8, 2008. Even though the recently submitted restoration report documents the restoration of MU 5 at Christensen Ranch, COGEMA is continuing to evaluate the potential for additional mining in MU 5.

Over 99% of the wells at Irigaray have been plugged and abandoned subsequent to the DEQ/LQD approval of the aquifer restoration for Irigaray. Over 80% of the pipelines that serviced the Irigaray well fields have been removed. Major components of the Irigaray processing plant have also been decommissioned and removed. At this juncture the only operable portions of the Irigaray plant consist of the elution, precipitation, drying, and packaging components. Future operations at Irigaray will consist of the continuation of plant activities for the processing of the Christensen ion exchange resins (elution), uranium precipitation, yellowcake drying, packaging and shipping. Eventually, additional mining is possible (but is not currently scheduled) at the Irigaray site within the current permit boundary plus areas to the north and south of the permit boundary. The Irigaray plant would require a major refurbishment to support any future Irigaray mining. The timing of the possible resumption of mining at Irigaray is discussed in more detail later within this chapter.

Future operations at Christensen will consist of continued well field installation and operation. In the original plan for Christensen, four satellite plants were anticipated for installation and operation. It is now planned that the entire Christensen ore body will be mined through the use of the one existing satellite plant connected to the various well fields by injection and recovery trunklines. This system worked well during operations in Mine Units 2 through 6. Booster pump stations are necessary along the trunklines to help move the solutions over the distance to and from the satellite plant. The current annual average capacity of the satellite plant is 4,000 gpm.

Mining operations at Christensen will continue with Mine Unit 7 located in the North Prong geographical area of the Christensen permit boundary, and with a possible re-entry into Mine Unit 5. After Mine Unit 7, well fields will progress to either the Heldt Draw or Table Mountain geographical areas for Mine Units 8 through 12. The development schedule is discussed in more detail later within this chapter. The major components of the combined Irigaray and Christensen Ranch in-situ mining operations are: 1) the orebody; 2) the well fields; 3) the lixiviant injection circuit; 4) the uranium extraction circuit; 4) uranium precipitation, drying and packaging (Irigaray only); 6) wastewater management systems; and 7) aquifer restoration and surface reclamation. The physical descriptions and operating characteristics of these components and processes are provided in detail in the following sections. Wastewater management systems and aquifer restoration/surface reclamation are described in detail in Sections 4.0 and 6.0, respectively.

3.1 SITE DESCRIPTION AND FACILITIES LAYOUT

3.1.1 IRIGARAY SITE

The Irigaray site is located in Johnson County, approximately 90 miles NNE of Casper, Wyoming. The current operation consists of a 30-acre wellfield (undergoing decommissioning), uranium recovery plant with dryer and a well field restoration building. In addition there are five evaporation ponds for wastewater disposal. Liners and any underlying contaminated soil were removed from four of these ponds. In 2010 a liner system was installed in one of the ponds therefore two of the evaporation ponds are currently lined. There are two restoration water storage ponds. The liner and any underlying contaminated soil was removed from one of the ponds. In 2010 a liner system was installed in that pond. During Operations, the ponds will be used as evaporation ponds for wastewater disposal rather than as restoration water storage ponds. The original pilot scale operation (5I7 test site) has been entirely decommissioned and the site reclaimed. The estimate of total acreage disturbed to-date by the Irigaray operations is approximately 133 acres.

The Irigaray portion of the WDEQ Permit No. 478 boundary encompasses 671.19 acres. The Irigaray property (mining claims, leases, etc.) consists of approximately three square miles within T45N, R77W and T46N R77W. The current mine permit area is located in portions of Sections 5, 8, 9 and 16 of T45N, R77W. Primary access roads are located in Sections 19, 29, 30 and 32, T46N, R77W as well as Sections 4, 5 and 9 of T45N, R77W.

The Irigaray processing plant will continue to serve as the uranium recovery plant for the Christensen Ranch satellite facility. The Irigaray Mine site is located about 13 road miles from the Christensen Ranch satellite plant location. The Irigaray plant site is located in Section 9 of Township 45 North, Range 77 West, Johnson County, Wyoming. The location of the Irigaray plant site in relation to the Christensen Ranch permit area, satellite plant site and the access road connecting the two facilities is shown on Figure 3.1 (in pocket). Figure 3.2 (in pocket) provides a facilities location map of the Irigaray permit area.

3.1.2 CHRISTENSEN RANCH SITE

The Christensen Ranch permitted area is an irregular shaped but contiguous land unit which encompasses 14,035.19 acres in Townships 44 and 45 North, Ranges 76 and 77 West in Johnson and Campbell Counties, Wyoming. Originally, the permit area was divided into four phases for the purposes of mine planning, with a satellite operation planned in each phase. This is no longer the case, as all well field development areas can be reached from the current satellite plant through trunkline connections. Existing facilities at Christensen include the satellite ion exchange plant and restoration facility, four lined brine evaporation ponds, one unlined permeate storage pond, two deep injection disposal wells and well fields consisting of Mine Units 2, 3, 4, 5, and 6, an office building, and warehouse. A second permeate storage pond is licensed, but not currently scheduled for construction. A number of wells had been installed in planned Mine Unit 7 in the mid 1990's. Mine Unit 7 development restarted in 2010.

Figure 3.1 shows the location of the Christensen Ranch permit area, in relation to the Irigaray site. The well field development areas shown in Figure 3.1 consist of the North Prong geographical area (Mine Unit 6 and future Mine Unit 7), the Heldt Draw area (future Mine Units 8 and 9) and the Table Mountain area (future Mine Units 10, 11 and 12). Existing Mine Units 2, 3, 4 and 5 are located in the Willow Creek geographical area. The development sequences for these areas are described in more detail in Section 3.7 of this chapter.

Figure 3.3 (in pocket) shows a detailed location map of all existing facilities at Christensen. The total estimate of acreage disturbed by existing operations is 454 acres. This acreage consists of approximately 19 acres for the plant and pond facilities, 274 acres of well field, pipeline corridors and staging areas, 36 acres of access roads, 10 acres of soil stockpiles (topsoil and subsoil), and 115 acres relating to future mine units delineation drilling and other miscellaneous facilities. Table 3.1 summarizes the potential disturbances for the remainder of the Christensen Ranch development areas.

In summary, the new estimate of lands to be disturbed during all mining operations within the Christensen Ranch area totals approximately 974 acres. The total disturbance is only 7% of the 14,035.19 acres within the entire permit area. The size and configuration of the permitted area is necessary to encompass access roads, monitoring locations and mining claims for potential development areas.

Newer mine units, such as Units 4, 5, and 6 at Christensen Ranch, and future mine units are designed to recover approximately 1,000,000 pounds of uranium each. Final boundaries of future mine units will be verified during the actual well field installation.

When designing a well field, development holes are drilled perpendicular to the strike of mineralization. Ore grade and thickness are determined by gamma logging. Data from the development holes is then evaluated to determine minable areas. Development holes are then completed as either injection or recovery wells. Any sub-economic grade holes are sealed with abandonment mud or cement slurry.

Mine units consist of groups of cells or well patterns installed to correspond to the geometry of the orebody. Well patterns include five-spot patterns, alternating line drives and staggered line drives depending on the size and shape of the deposit. The tendency of the roll fronts to change direction abruptly typically result in irregularity of the pattern shapes.

A single five-spot pattern is roughly rectangular and consists of four injection wells surrounding one center recovery well. Spacing between the corner injection wells is typically 85 feet although it ranges from 50 to 100 feet depending upon the topography and ore characteristics.

Alternating line drives are used in areas where very narrow portions of the roll fronts occur. An alternating line drive is simply a line of wells spaced along the strike of the ore. One well will be an injector, the next a recovery well, the next an injector, etc. The well function may be reversed or changed at appropriate times to improve mining or restoration efficiency. A staggered line drive is used where a roll front is too wide for an alternating line drive. Essentially, the injection wells are on one side of the roll front, and midway between them, on the opposite side of the front, are the recovery wells. Well functions are reversed at appropriate times.

The typical five-spot pattern, alternating and staggered line drive patterns and examples of their corresponding flow lines are shown in Figure 3.4.

In the late 1970's, the Irigaray well fields were developed using a seven-spot pattern (one producing well with six injection wells, in roughly a hexagonal pattern). These patterns were later converted to five-spot patterns during operations in the 1980's and 1990's. Future development at Irigaray and Christensen Ranch will use a combination of the above patterns.

Through the use of a combination of the above patterns, a typical ratio of production wells to injection wells ranges from 1:1.2 to 1:1.4. To date, this has resulted in the completion of 897 production wells and 1,231 injection wells in the Christensen Ranch

Mine Units 2, 3, 4, 5, and 6, providing a ratio of 1:1.37 (producers to injectors). At Irigaray, the number of producers compared to injectors was lower (424 and 640, respectively), thus providing a ratio of 1:1.51, largely due to the installation of seven-spot patterns.

3.3.1.2 Monitor Wells - Past and Current

After delineation of the mine unit boundaries, monitor wells are installed around the perimeter of the well pattern areas to detect any horizontal migrations of injection solutions, or excursions, during operations. At Irigaray, monitor wells were located at a distance of 400 feet from the edge of the well pattern areas and were spaced 400 to 600 feet apart. As more operational data was collected over the years, monitor well spacing on the perimeters of the well pattern areas has become more sophisticated, and is now based on hydrologic parameters of the mining formation, including gradient and transmissivities, and the ability to retrieve excursions within a 60 day regulatory time frame.

Based upon detailed studies of the hydrologic characteristics of the mining aquifers at both the Irigaray and Christensen Ranch sites, perimeter ore zone monitor wells will be located as follows:

1. Downgradient from the well field, where the well field orientation with the groundwater flow direction forms an angle greater than 45 degrees: 300 feet from the well field edge, spaced 300 feet apart.

2. Upgradient from the well field, where the well field orientation with the groundwater flow direction forms an angle greater than 45 degrees: 500 feet from the well field edge, spaced 500 feet apart.

3. Sides of the well field, which form angles with the flow direction of less than 45 degrees: 500 feet from the well field edge, spaced 500 feet apart.

Perimeter ore zone monitor wells within the trend of the orebody will eventually be abandoned or incorporated into the well field pattern as mining progresses. Ore zone monitor wells will have a completion interval which encompasses the same completed intervals of the adjacent mine unit wells.

Monitor wells are also installed within the mine unit boundaries to monitor for potential excursions to the aquifers overlying and underlying the host ore aquifer. Shallow monitor wells are completed in the first continuous overlying aquifer above the ore aquifer that exhibits at least 10 feet of thickness and a permeability that will allow the production of enough water for sampling. At the Irigaray site, the shallow aquifer is designated as the "Unit 1 Sand"; at the Christensen Ranch site, the "J" sandstone unit of the stratigraphic column is typically the shallow monitor zone. Deep monitor wells are completed in the first continuous underlying aquifer that exhibits at least 10 feet of thickness and a permeability that will allow the production of enough water for sampling. These are termed the lower Irigaray sandstone and the "L" sandstone unit at the Christensen Ranch site. If there is no appropriate aquifer to monitor below 50 feet of the top of the confining shale underlying the production zone, deep monitor wells will not be installed. One shallow and one deep monitor well will be installed within the mine unit boundaries for each three and one-half (3.5) acres of installed pattern area, where an appropriate monitor zone exists.

In the past, due to problems with improperly sealed exploration drill holes and poor well casing integrity, shallow excursions occurred at the Irigaray site. As a result, shallow monitor wells were installed within the existing well fields at a spacing of approximately one well per acre, or greater in some areas. However, in future Irigaray mine units (if further development occurs), it is proposed to complete these wells at the same frequency as at Christensen Ranch, or one well for each 3.5 acres of installed pattern area. This is now possible due to the superior well casing integrity testing procedures now in use, and the company's practice of sealing all exploration and delineation holes prior to operations.

Although not anticipated, if areas within any proposed mine units are encountered which exhibit very thin or absent confining layers, the company will evaluate the situation and may adjust the monitoring program accordingly. These adjustments may include the expansion of perimeter monitor well completion intervals to detect movement of lixiviant into areas not bounded by a confining layer (if the layer within the well field pinches out, for example) or the placement of overlying/underlying monitor wells in different stratigraphic horizons within the same well field. Additional operational controls may be instituted in the absence of a confining layer such as increased rates of over-recovery or decreased injection pressures.

3.3.2 WELL CONSTRUCTION AND COMPLETION TECHNIQUES

3.3.2.1 Well Completion Techniques

The vertical confinement of the injected fluids underground are controlled by the integrity of the overlying and underlying confining layers, the vertical permeability of the ore-bearing sands and the integrity of wells themselves. Descriptions of the well completion methods for recovery, injection and monitor wells are given below.

Injection and recovery wells are drilled and completed to similar specifications. This allows for alternating the well function as necessary to improve mining or restoration efficiency. The completed interval in the injection and recovery wells is limited either to the intercepted mineralized zones or to the uppermost and lowermost depths of the ore in adjacent injection wells. An example of a uranium roll front deposit showing the typical completion intervals of injection and recovery wells is provided as Figure 3.5.

Wells are typically drilled with a rotary drill or similar technology such as reverse circulation drilling. A nominal 5" diameter pilot hole is first drilled from the surface through the ore zone and then logged with geophysical borehole logging equipment to provide a gamma ray log, resistivity log and self-potential log. If sufficient mineralization is not encountered to warrant well completion, the hole is plugged with cement slurry or abandonment gel over its entire depth. If abandonment muds are used, the hole is then capped with either a poured concrete plug at the top, terminating approximately two feet below the surface, or by placing a tapered cement cone at about the same depth. Each hole is then marked at the surface for identification.

If the hole meets the economic criteria, it is completed as a well by reaming to an approximate diameter of 9" (10" for nominal 6" casing) prior to casing installation. Injection and recovery wells are cased with nominal 5.6" O.D. (5.0" I.D.) or 6.6" O.D. (5.8" I.D.) SDR 17 polyvinylchloride (PVC) pipe. Past operational experience and numerous mechanical integrity tests have demonstrated the compatibility between injection fluids, formation fluids, process by-products, recovery fluids, and the glue used to join sections of PVC casing at Irigaray and Christensen Ranch.

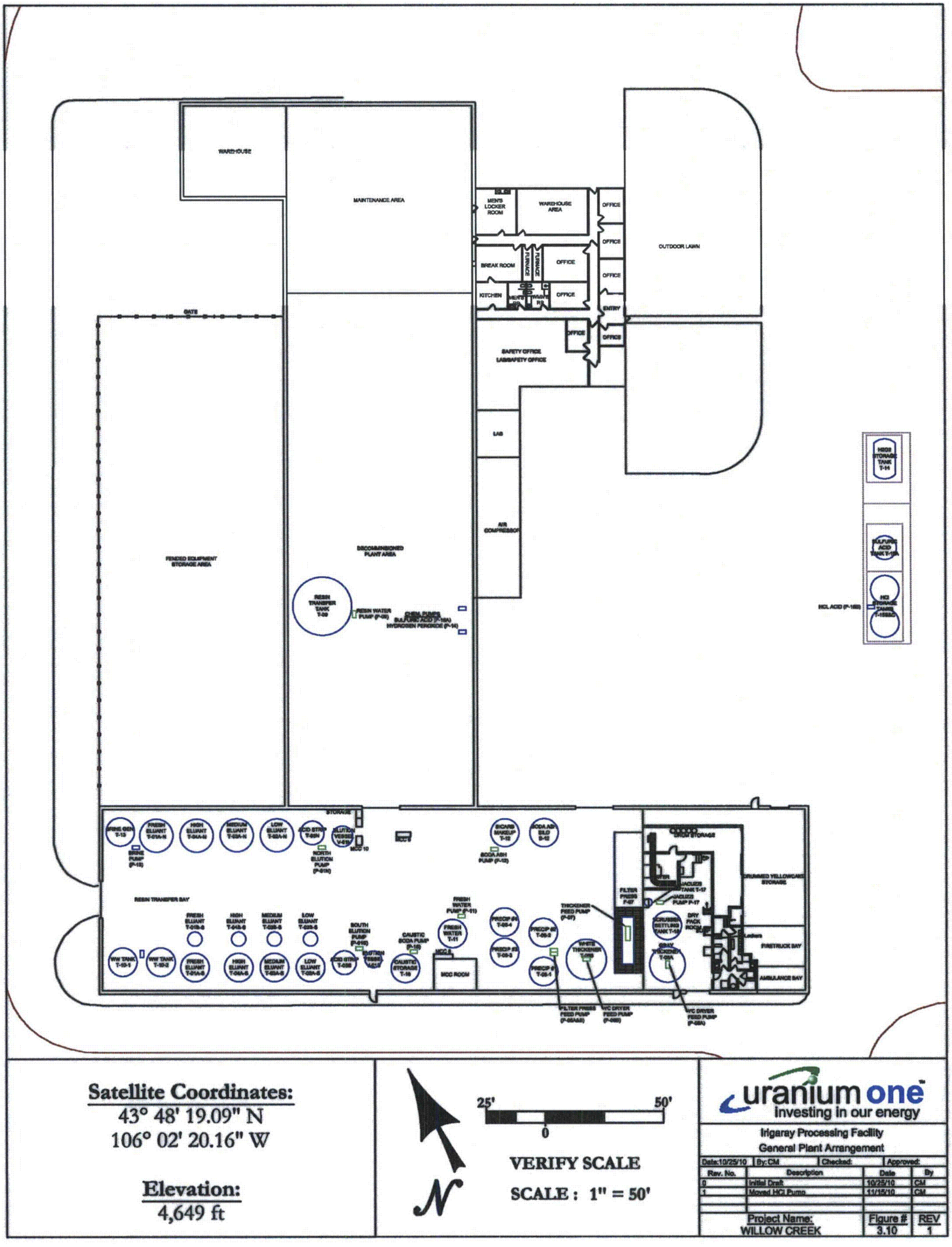
The well casing is emplaced with PVC centralizers on the top and bottom casing sections and with additional centralizers uniformly spaced at maximum 40' intervals to keep the casing away from the side walls. Although the bottom of the casing can be left open for cementing, the more common practice is to attach a cap on the bottom joint of casing and drill 3/4" diameter weep holes a few inches above the cap.

Cementing is done with a drill rig or cementing unit. A calculated volume of neat mixture of Type I/II or III sulfate resistant cement is first placed in the casing. It can be mixed with a pozzolan additive (with up to 4% bentonite). The cement has a weight of up to approximately 15 lbs. per gallon to provide sufficient fluidity to fill the annular space. The cement slurry is then forced up the casing annulus between the casing and the borehole wall by a calculated amount of displacement water. A wiper plug may be used between the cement and the displacement water. When cement return is observed at the surface, the well is shut in to allow setting and curing (approximately 24 hours). Depending on conditions, additives may be used to hasten or extend cement setting time. Additional cement is then added to the well annular space at the surface to top off any void areas caused by the cement settling during curing.

the transfer water holding tank and the chemical transfer pumps for sulfuric acid, hydrochloric acid, and hydrogen peroxide. The old portion of the plant is also used for storage of byproduct material, and will be used for a vanadium removal circuit or additional elution circuit facilities, if deemed necessary in the future.

3.4.1.2 Ion Exchange/Lixiviant Makeup Circuit

This circuit has been decommissioned at Irigaray.



WAREHOUSE
MAINTENANCE AREA
OFFICE
OUTDOOR LAWN
BREAK ROOM
KITCHEN
ENTRY
LAB
DECOMMISSIONED PLANT AREA
FENCED EQUIPMENT STORAGE AREA
GATE
RESIN TRANSFER BAY
MCC ROOM
Satellite Coordinates:
43° 48' 19.09" N
106° 02' 20.16" W
Elevation:
4,649 ft
25'
50'
0
VERIFY SCALE
SCALE : 1" = 50'
N
uranium one
investing in our energy
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:
WILLOW CREEK
Figure #
3.10
REV
1

3.4.1.3 Elution and Precipitation Circuit

After the resin in one of the Christensen Ranch ion exchange vessels is essentially loaded with uranium, it is either transferred to another vessel, or is isolated from the normal process flow and transferred to Irigaray for 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) and sodium carbonate solution which exchanges for the uranium and regenerates the resin in a process very similar to a home water softener. The stripping solution concentrates the uranium to between 8 and 25 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 by volume, is either shipped off-site to a uranium refinery via a tanker trailer, or dried on-site.

When drying, the settled yellowcake slurry in the thickener or storage tank is then fed into the propane-fired multi-hearth dryer. There the slurry is dried at a low temperature (approximately 750° F) to a $UO_4 \cdot 2\ H_2O$ (uranate of peroxide) product. After cooling, 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.

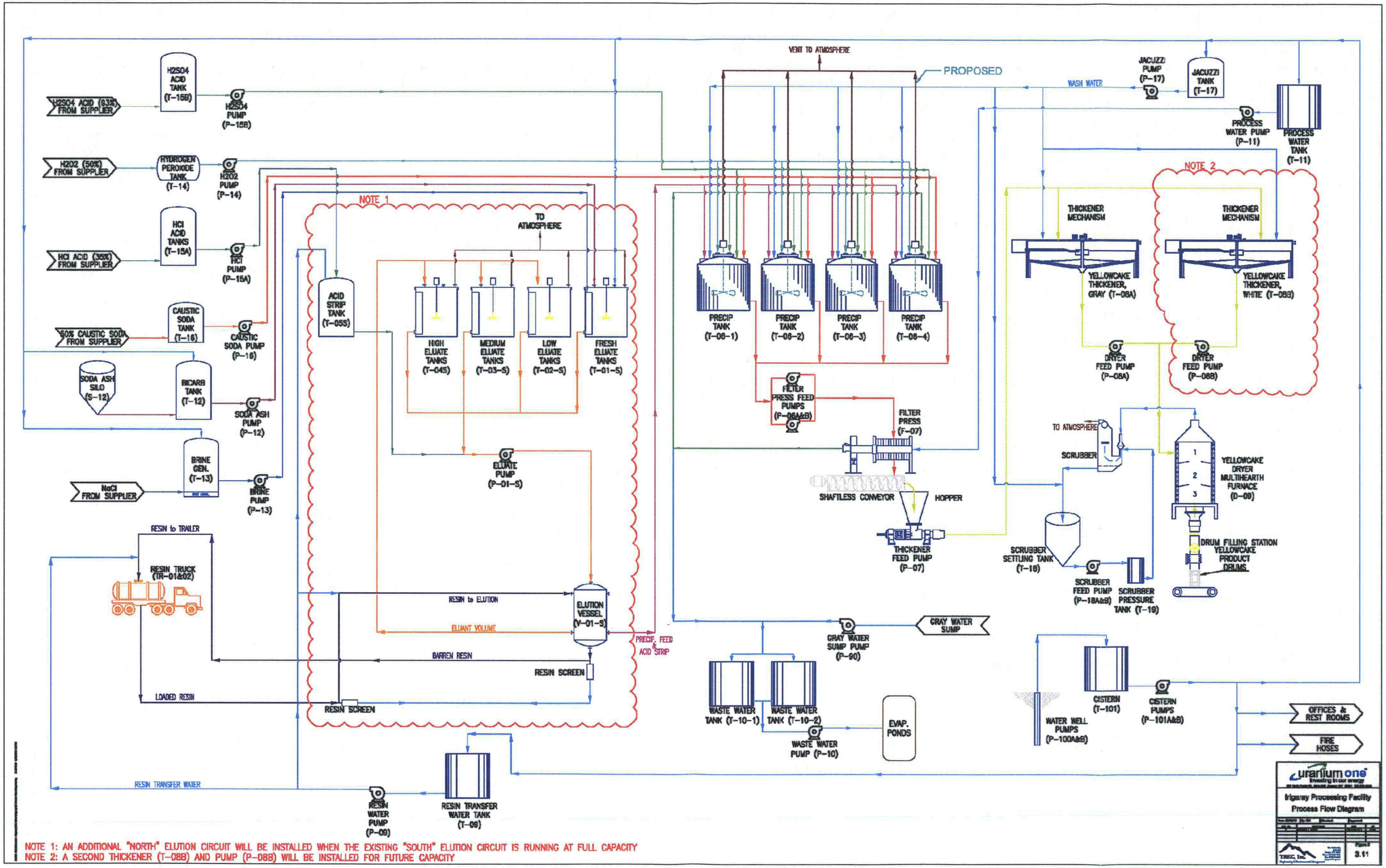
3.4.1.6 Flow Process

Figure 3.11 includes the process flow diagram for the Irigaray elution and precipitation circuits. As noted previously, the Irigaray mining-related facilities (injection solution handling and ion exchange circuits) have been decommissioned. Any future mining at Irigaray will require re-construction of those facilities. Restoration flows are addressed in Section 6.0 of this document.

3.4.1.7 Wastewater Management

Wastewater management at the Irigaray site is through evaporation in lined ponds. Currently, there are a total of seven ponds and four of them are lined. Five of the seven ponds had the liners and underlying contaminated soil removed. In 2010 liner systems were installed in two of the ponds. The three remaining unlined ponds are currently not in use. If future waste water storage needs require it, the three remaining decommissioned ponds could be placed back into service after re-construction (leak detection systems and liners installation). The four lined ponds are available for other miscellaneous minor bleeds from the process plant, including resin wash water, yellowcake wash water, plant wash downs, etc. Details regarding the evaporation ponds are contained in Section 4.0 of this document.

Two deep disposal wells are licensed for construction at the Irigaray site (Permit UIC 91-247). To date, construction of neither well for additional wastewater disposal has been necessary. Permits for the wells will be maintained, in the case that the wells are deemed necessary.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H2SO4 ACID TANK (T-15B)
H2SO4 PUMP (P-15B)
H2O2 (50%) FROM SUPPLIER
HYDROGEN PEROXIDE TANK (T-14)
H2O2 PUMP (P-14)
HCl ACID (35%) FROM SUPPLIER
HCl ACID TANKS (T-15A)
HCl PUMP (P-15A)
50% CAUSTIC SODA FROM SUPPLIER
CAUSTIC SODA TANK (T-16)
CAUSTIC SODA PUMP (P-16)
SODA ASH SILO (S-12)
BICARB TANK (T-12)
SODA ASH PUMP (P-12)
NaCl FROM SUPPLIER
BRINE GEN. (T-13)
BRINE PUMP (P-13)
NOTE 1
TO ATMOSPHERE
ACID STRIP TANK (T-05S)
HIGH ELUATE TANKS (T-04S)
MEDIUM ELUATE TANKS (T-03-S)
LOW ELUATE TANKS (T-02-S)
FRESH ELUATE TANKS (T-01-S)
ELUATE PUMP (P-01-S)
RESIN to TRAILER
RESIN TRUCK (TR-01&02)
RESIN to ELUTION
ELUTION VESSEL (V-01-S)
ELUANT VOLUME
BARREN RESIN
RESIN SCREEN
LOADED RESIN
RESIN SCREEN
PRECIP. FEED & ACID STRIP
RESIN TRANSFER WATER
RESIN WATER PUMP (P-09)
RESIN TRANSFER WATER TANK (T-09)
VENT TO ATMOSPHERE
PROPOSED
PRECIP TANK (T-06-1)
PRECIP TANK (T-06-2)
PRECIP TANK (T-06-3)
PRECIP TANK (T-06-4)
FILTER PRESS FEED PUMPS (P-06A&B)
FILTER PRESS (F-07)
SHAFTLESS CONVEYOR
HOPPER
THICKENER FEED PUMP (P-07)
GRAY WATER SUMP
GRAY WATER SUMP PUMP (P-90)
WASTE WATER TANK (T-10-1)
WASTE WATER TANK (T-10-2)
WASTE WATER PUMP (P-10)
EVAP. PONDS
WASH WATER
JACUZZI PUMP (P-17)
JACUZZI TANK (T-17)
PROCESS WATER PUMP (P-11)
PROCESS WATER TANK (T-11)
NOTE 2
THICKENER MECHANISM
YELLOWCAKE THICKENER, GRAY (T-08A)
THICKENER MECHANISM
YELLOWCAKE THICKENER, WHITE (T-08B)
DRYER FEED PUMP (P-08A)
DRYER FEED PUMP (P-08B)
TO ATMOSPHERE
SCRUBBER
YELLOWCAKE DRYER MULTIHEARTH FURNACE (D-09)
SCRUBBER SETTLING TANK (T-18)
SCRUBBER FEED PUMP (P-18A&B)
SCRUBBER PRESSURE TANK (T-19)
DRUM FILLING STATION YELLOWCAKE PRODUCT DRUMS
WATER WELL PUMPS (P-100A&B)
CISTERN (T-101)
CISTERN PUMPS (P-101A&B)
OFFICES & REST ROOMS
FIRE HOSES
uranium one
Irigaray Processing Facility
Process Flow Diagram
3.11
NOTE 1: AN ADDITIONAL "NORTH" ELUTION CIRCUIT WILL BE INSTALLED WHEN THE EXISTING "SOUTH" ELUTION CIRCUIT IS RUNNING AT FULL CAPACITY
NOTE 2: A SECOND THICKENER (T-08B) AND PUMP (P-08B) WILL BE INSTALLED FOR FUTURE CAPACITY

3.4.1.8 Equipment, Instrumentation and Control

A list of major equipment located at the Irigaray central recovery plant is presented in Table 3.3. This list represents the current equipment on site and is subject to change with future modifications in operations. The process plant is simplified in design to operate with minimal operator coverage.

Instrumentation is provided in the Irigaray plant to measure the following processes:

- wastewater output to the lined evaporation ponds
- high/low flow indicator alarms
- pressure indicators (including pressure gauges and controllers on injection flow lines)
- pH indicators
- tank level indicators
- flow indicators

The instrumentation is used to monitor the operational efficiency of the process.

Alarm systems are built into a number of plant circuits to alert personnel of high or low flow situations, abnormalities in the dryer area, etc. A listing of the alarms in the Irigaray process are as follows (all are audible with the exception of the computer flagging system):

- elution pump (when pump stops)
- dryer: drum high level, scrubber (high and low recirculation flow), scrubber (water level), scrubber (air pressure), combustion air failure, shaft cooling failure, main fuel (off), delumper high-low torque, burner flame failure, shaft (stopped), shaft (high temperature), furnace (low temperature)

3.4.1.9 Chemical Storage Facilities

Chemical storage facilities at the Irigaray plant include both hazardous and non-hazardous material storage areas. Bulk hazardous materials, which have the potential to impact radiological safety, are segregated from areas where licensed materials are processed and stored. Process-related chemicals stored in bulk at the Irigaray Plant include sodium hydroxide, hydrochloric acid and/or sulfuric acid, and hydrogen peroxide. Risk assessments completed by the NRC in NUREG-6733 for in situ recovery facilities identified anhydrous ammonia and bulk acid (sulfuric and hydrochloric) storage as the most hazardous chemicals with the greatest potential for impacts to chemical and radiological safety.

Sodium Hydroxide

Sodium hydroxide (caustic soda) is used to raise the pH levels during the precipitation phase of the process. The sodium hydroxide solution is stored in a bulk tank located within the processing plant for use in the precipitation circuit. The 50% sodium hydroxide solution will be stored in a 10,000 gallon fiberglass tank. The Sodium hydroxide will be transported using conventional PVC piping from the fiberglass storage vessel into the precipitation tanks. Sodium hydroxide reacts vigorously with sulfuric and hydrochloric acid, one of which will also be present in the precipitation circuit. Sodium hydroxide is subject to the following regulatory program:

- Reportable Quantities (RQs) for spills from the Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) in 40 CFR § 302.4 for spills in excess of 1,000 pounds.

As discussed, the Irigaray plant includes a sodium hydroxide tank with a capacity of 10,000 gallons. Based on this design capacity, Uranium One is subject to the aforementioned regulatory program.

Sulfuric and Hydrochloric Acid

The 93-98% sulfuric acid storage tank and distribution system at the Irigaray plant have a capacity of approximately 6,500 gallons. The sulfuric acid is stored outside the Irigaray plant in a double-walled polyethylene tank vented to the atmosphere. Distribution piping is constructed of seamless 316 stainless steel.

The 35.2% hydrochloric acid dual storage tanks and distribution system at the Irigaray plant have a total capacity of approximately 27,000 gallons. Distribution piping is constructed of conventional schedule 40 & 80 PVC.

Strict unloading procedures are utilized to ensure that safety controls are in place during the transfer of these acids. Process safety controls are also in place at the Irigaray plant where sulfuric or hydrochloric acid is added to the elution and precipitation circuits. The use of sulfuric and hydrochloric acid is subject to the following regulatory programs:

- The use of sulfuric acid is subject to Threshold Planning Quantities (TPQs) contained in 40 CFR Part 355, Emergency Response Plans for threshold quantities (TQs) in excess of 1,000 pounds. As discussed, the Irigaray plant includes a sulfuric acid tank with a capacity of 6,500 gallons or approximately 100,000 pounds. Based on the design capacity, Uranium One will be subject to the Emergency Response Plan requirements.

- The use of hydrochloric acid is subject to Reporting Quantities (RQs) contained in 40 CFR Part 302.4 for quantities in excess of 5,000 pounds. As discussed, the Irigaray plant includes dual hydrochloric acid tanks with a total capacity of 27,000 gallons or approximately 266,000 pounds. Based on the design capacity, Uranium One will be subject to the Reporting Quantities.

- The acid storage (33,500 gallons) exceeds the screening threshold (11,250 lbs) contained in Appendix A of 6 CFR 27, Chemical Facility Anti-terrorism Final Interim Standards, Department of Homeland Security. As a result, Uranium One will be obligated to undergo initial screening requirements for sulfuric and hydrochloric acids as required by the rule at that time.

Hydrogen Peroxide

Hydrogen peroxide is stored outside in a 7,000-gallon tank constructed of 5254 aluminum alloy. The storage tank is stored away from flammable sources, organic materials, and incompatible chemicals to avoid adverse chemical reactions. The use of hydrogen peroxide at concentrations greater than 52 percent is subject to the following regulatory programs:

- Process Safety Management of Highly Hazardous Chemicals standard contained in 29 CFR §1910.119 for TQs in excess of 7,500 pounds; and
- Threshold Planning Quantities (TPQs) contained in 40 CFR Part 355, Emergency Response Plans for threshold quantities (TQs) in excess of 1,000 pounds.

The Irigaray plant includes the use of hydrogen peroxide at a concentration of 50 percent contained in a hydrogen peroxide tank with an initial capacity of 7,000 gallons or approximately 69,000 pounds. With the design hydrogen peroxide concentration, Uranium One is not subject to the aforementioned regulatory programs.

Salt and Soda Ash

Salt and soda ash are also stored and used within the Irigaray plant and are considered non-hazardous materials. Salt is stored in a conventional brine generator fiberglass tank with a capacity of 70,000 lbs of salt and approximately 10,000 gallons of water. Soda ash is stored in a conventional steel epoxy coated interior silo as bulk dry product as well as in a fiberglass mix tank as a solution. The silo has a capacity of approximately 1,000 cubic feet (approx. 70,000 pounds) with a conventional baghouse and the mix tank has a capacity of approximately 9,000 gallons.

Process related chemicals can be potential sources of non-radiological fumes or gases. The area within the Irigaray plant with the greatest potential to generate non-radiological fumes or gases is the precipitation area. The primary chemicals used in the precipitation area are sulfuric or hydrochloric acid and hydrogen peroxide. Fumes from sulfuric or hydrochloric acid and hydrogen peroxide may be generated from leaks in piping and process tanks in the precipitation area. Preventive/mitigation measures include construction of all storage tanks, piping, and associated appurtenances in accordance with current industry standards, the use of enclosed tanks to limit the amount of vapors that can escape to the atmosphere, and daily shift inspections of plant and chemical storage facilities. Monitoring may be conducted using colorimetric tubes if it is believed that acid fumes may be present in an area.

TABLE 3.3
IRIGARAY PLANT EQUIPMENT LIST

Tanks, Vessels and Equip.			
Tank	Equip #	Diameter (ft)	Height (ft)
Main Plant			
Resin Transfer Water Tank	T-09	25	12
Expansion Building			
South Acid Strip	T-05-S	10	8
South Low Eluant	T-02A-S	12	12
South Medium Eluant	T-03A-S	12	12
South High Eluant	T-04A-S	12	12
South Fresh Eluant	T-01A-S	12	12
South Low Eluant (Pup Tank)	T-02B-S	6	12
South Medium Eluant (Pup Tank)	T-03B-S	6	12
South High Eluant (Pup Tank)	T-04B-S	6	12
South Fresh Eluant (Pup Tank)	T-01B-S	6	12
South Elution Vessel	V-01S	7	10
Waste Tank # 1	T-10-1	12	16.5
Waste Tank # 2	T-10-2	12	16.5
Brine Generator	T-13	12	17
North Fresh Tank	T-01A-N	14	16
North Low Eluant	T-02A-N	14	16
North Medium	T-03A-N	14	16
North High Eluant	T-04A-N	14	16
North Acid Strip	T-05N	10	8
North Elution Vessel	V-01N	8.75	10
Fresh Water Tank	T-11	12	12.5
Caustic Soda Tank	T-16	12	12.5
Precip Tank # 1	T-06-1	12	13.5
Precip Tank # 2	T-06-2	12	13.5
Precip Tank # 3	T-06-3	12	14
Precip Tank # 4	T-06-4	12	14
Jacuzzi Tank	T-17	3.25	3.33
Scrubber Settling Tank	T-18	11.83	15.16
Scrubber Feed Pressure Tank	T-19	4	4
Soda Ash Silo	S-12	12	17
Bicarb Tank	T-12	11.83	11.33
White Thickener	T-08B	17	12
Gray Thickener	T-08A	15.33	7.58
Exterior			
H2SO4 Storage Tank	T-15A	10	16.67
HCl Storage Tank	T-15B	12	16.66
HCl Storage Tank	T-15C	12	16.66
Hydrogen Peroxide Tank	T-14	9	13.25

TABLE 3.3
IRIGARAY PLANT EQUIPMENT LIST

Tank	Equip #	Volume
Diesel Fuel Tank	T-50A	2500 gal
Gasoline Fuel Tank	T-50B	4000 gal
Propane Tank	T-51	30,000 gal
Cistern	T-101	4500 gal

Pumps

Pump	Equip #	Feed Rate (gpm)	Motor Size (HP)
Main Plant			
Hydrogen Peroxide Pump	P-14	10	0.75
Sulfuric Acid Pump	P-15A	5	5
Resin Transfer Water Pump	P-09	450	40
Expansion Building			
Caustic Soda Pump	P-16	4	0.5
Soda Ash Pump	P-12	80	7.5
Brine Pump	P-13	80	7.5
South Eluate Pump	P-01S	80	7.5
North Eluate Pump	*P-01N*	-	-
Filter Press Feed Pump - A	P-06A	120	20
Filter Press Feed Pump - B	P-06B	120	20
Thickener Feed Pump	P-07	30	3
Waste Water Pump	P-10	120	20
Dryer Feed Pump (Gray Thick.)	P-08A	30	5
Dryer Feed Pump (White Thick.)	*P-08B*	-	-
Fresh Water Pump	P-11	100	15
Scrubber Feed Pump	P-18A	28	3
Scrubber Feed Pump	P-18B	28	3
Gray Water Sump Pump	P-90	-	-
Hot PPT Sump Pump	P-91	30	7.5
Dry Pack Hot Sump	P-92	30	5
Jacuzzi Pump	P-17	30	3
Exterior			
Hydrochloric Acid Pump	P-15B	20	2
Cistern Pump	P-101A	30	5
Cistern Pump	P-101B	30	5
Water Well Pump	P-100A	30	5
Water Well Pump	P-100B	30	5

Miscellaneous

Type	Dimension	Size	Units
Main Plant			
Air Compressor	4 x 6 x 8	192	cubic feet
Air Compressor Controls	6 x 6 x 6	216	cubic feet
Air Compressor Gas Heater	2 x 2 x 2	8	cubic feet

TABLE 3.3
IRIGARAY PLANT EQUIPMENT LIST

Type	Dimension	Size	Units
Air Compressor Tank			
Building Footer - Concrete	218' x 80' (3.66cf/lf)	2181.4	cubic feet
Building Foundation - Concrete	218' x 80' x 6"	8720	cubic feet
Steel Building	178' x 80' x 24'		
Steel Building	40' x 80' x 40'		
Expansion Building			
Hot Water Heater	3' dia x 5'	200	gal
Building Footer - Concrete	230' x 80' (3.66cf/lf)	2269.2	cubic feet
Building Foundation - Concrete	230' x 80' x 6"	9200	cubic feet
Steel Building	228' x 80' x 24'		
Steel Building	70' x 80' x 35'		
Masonry Walls	593lf x 12'h x 8"		

3.4.2 CHRISTENSEN RANCH SATELLITE PLANT

3.4.2.1 General Arrangement

The Christensen Ranch satellite plant is an ion exchange (IX) uranium extraction plant with capabilities for lixiviant make-up and water treatment. Figure 3.12 is the general arrangement diagram of the satellite plant. Solutions from the well field at Christensen are routed through the satellite plant IX system and stripped of uranium then refortified with lixiviant and sent back to the well field. When the resin in the lead IX column is fully-loaded with uranium, it is withdrawn from the column and placed in a specially designed low-profile tanker trailer for transport to the Irigaray central plant. A receiving elution column is located within the annex of the Irigaray plant into which the resin is unloaded. The uranium is then stripped from the resin using the standard eluant process described previously in Section 3.4.1.3. The stripped resin is then reloaded into the tanker trailer and transported back to the satellite extraction plant.

At the satellite plant, the stripped resin is transferred from the tanker trailer into the empty IX column. Resin is then extracted from the next loaded column and the process cycle is repeated. The number of resin hauls per 24-hour day ranges from one to two during full scale operations. Descriptions of the individual processes described above are addressed in the following sections.

3.4.2.2 Ion Exchange/Lixiviant Makeup Circuit

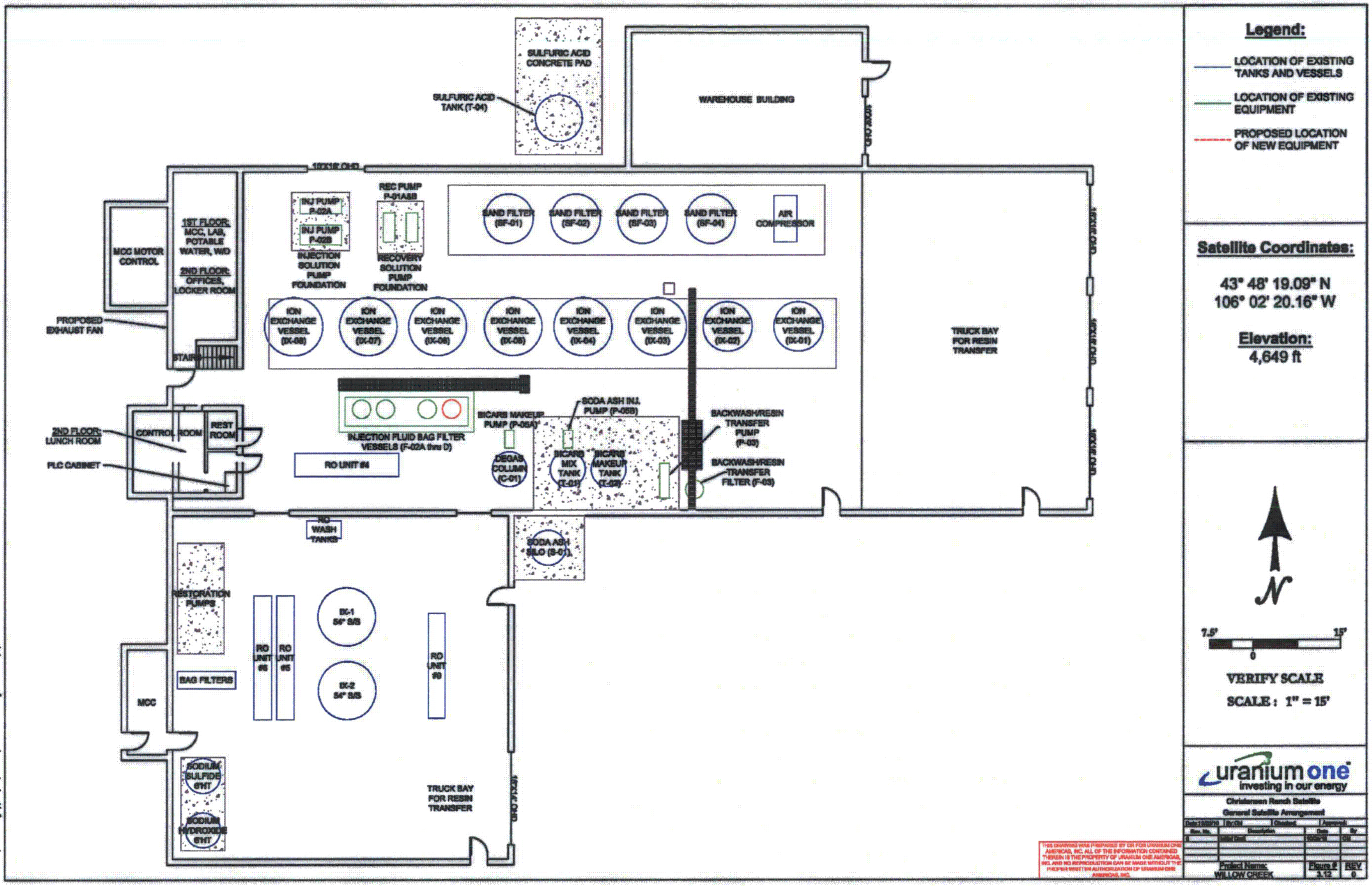
The satellite plant contains four IX trains (sets of columns) with each train having two fixed-bed columns connected in series. The columns in each train have individual capacities of approximately 1,200 gpm, thus providing a maximum 4,800 gpm capacity of the system. The plant will be operated at an annual maximum flow rate of 4,000 gpm. The columns are designed to process well field solutions containing 100 parts per million (ppm) of uranium as U_3O_8 over a period of two days without incurring high uranium tailings losses into the injected well field solutions. Since the concentration of uranium in the well field will realistically average approximately 60 ppm, and the plant will be operated at an average flow rate less than 4,000 gpm, some conservatism is built into the design and the plant should be able to operate without transportation of resin for two or more days in the event that winter weather limits access to the site.

A portion of the effluent from the IX circuit is withdrawn to ultimately provide the 1% bleed from the well field for lixiviant migration control and clean water for lixiviant makeup and resin transfer. Up to 160 gpm of barren effluent from the IX circuit is passed through a 160 gpm reverse osmosis (RO) unit. The concentrated salts or brine from the RO process (up to 40 gpm) will be sent to lined ponds for evaporation, or to the deep disposal well. Approximately 120 gpm of the clean product water or permeate will be used for lixiviant makeup and resin transfer or recycled to the injection stream and sent back to the well field. The 40 gpm brine portion will constitute the 1% bleed from the well field for lixiviant migration control. A radium-226 adsorption column may be included in the line which will feed permeate to the unlined storage pond, for further radium-226 removal, if necessary.

The benefits of using RO treatment of the IX tails bleed are that pure water is recycled into the production stream and problems with calcium buildup during lixiviant makeup are avoided. This results in a cleaner plant operation with reduced solids generation.

The lixiviant makeup system consists of chemical mixing tankage and an outside storage silo for solid soda ash. Up to 120 gpm of permeate discussed above is used to mix the lixiviant. The lixiviant makeup system is operated by filling the makeup tank with permeate and adding sodium bicarbonate from the external silo. The pH of the resulting solution is lowered by adding carbon dioxide gas and the resulting mixture is then pumped into the injection stream. If CO_2 alone is used as the lixiviant, the lixiviant makeup system will be bypassed and the CO_2 gas will be added to the injection stream immediately prior to entry to the well field.

Chemicals utilized and stored at the satellite plant site consist of carbon dioxide gas, gaseous oxygen, hydrochloric acid and sulfuric acid (small quantities), solid soda ash or sodium bicarbonate and sodium chloride crystals. Propane for heating, as well as gasoline and diesel fuel, are also present on site. The sulfuric acid storage tank outside of the plant building is bermed to contain the tank volume in the case of a tank rupture.

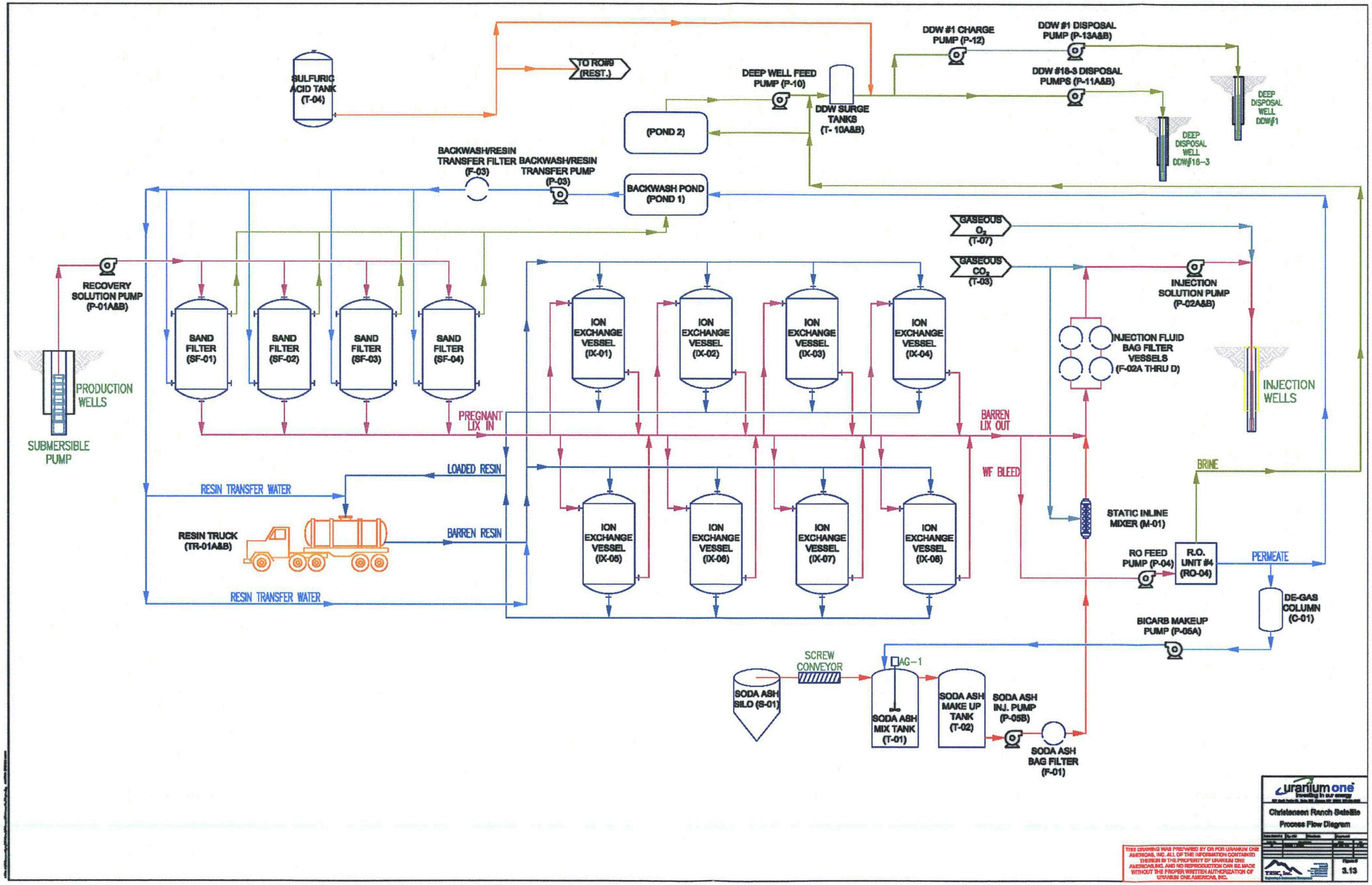


Legend:
LOCATION OF EXISTING TANKS AND VESSELS
LOCATION OF EXISTING EQUIPMENT
PROPOSED LOCATION OF NEW EQUIPMENT
Satellite Coordinates:
43° 48' 19.09" N
106° 02' 20.16" W
Elevation:
4,649 ft
VERIFY SCALE
SCALE : 1" = 15'
uranium one
investing in our energy
Christensen Ranch Satellite
General Satellite Arrangement
Project Name:
WILLOW CREEK
Figure #
3.12
REV
0
SULFURIC ACID CONCRETE PAD
SULFURIC ACID TANK (T-04)
WAREHOUSE BUILDING
1ST FLOOR: MCC, LAB, POTABLE WATER, W/D
2ND FLOOR: OFFICES, LOCKER ROOM
MCC MOTOR CONTROL
PROPOSED EXHAUST FAN
INJ PUMP P-02A
INJ PUMP P-02B
INJECTION SOLUTION PUMP FOUNDATION
REC PUMP P-01A&B
RECOVERY SOLUTION PUMP FOUNDATION
SAND FILTER (SF-01)
SAND FILTER (SF-02)
SAND FILTER (SF-03)
SAND FILTER (SF-04)
AIR COMPRESSOR
ION EXCHANGE VESSEL (IX-08)
ION EXCHANGE VESSEL (IX-07)
ION EXCHANGE VESSEL (IX-06)
ION EXCHANGE VESSEL (IX-05)
ION EXCHANGE VESSEL (IX-04)
ION EXCHANGE VESSEL (IX-03)
ION EXCHANGE VESSEL (IX-02)
ION EXCHANGE VESSEL (IX-01)
TRUCK BAY FOR RESIN TRANSFER
STAIRS
2ND FLOOR: LUNCH ROOM
CONTROL ROOM
REST ROOM
PLC CABINET
INJECTION FLUID BAG FILTER VESSELS (F-02A thru D)
RO UNIT #4
BICARB MAKEUP PUMP (P-06A)
SODA ASH INJ. PUMP (P-05B)
DEGAS COLUMN (C-01)
BICARB MIX TANK (T-01)
BICARB MAKEUP TANK (T-02)
BACKWASH/RESIN TRANSFER PUMP (P-03)
BACKWASH/RESIN TRANSFER FILTER (F-03)
RO WASH TANKS
SODA ASH SILO (S-01)
RESTORATION PUMPS
BAG FILTERS
MCC
RO UNIT #6
RO UNIT #5
IX-1 54" S/S
IX-2 54" S/S
RO UNIT #3
SODIUM SULFIDE 6HT
SODIUM HYDROXIDE 6HT
TRUCK BAY FOR RESIN TRANSFER

3.4.2.3 Process Flow

The process flow diagram for the satellite extraction process is presented in Figure 3.13. Solutions from the well field first enter the backwash sand filters for removal of any loose sand/sediment particles or debris. Well field solutions are then piped into the four trains of IX columns. Solutions then flow through the IX columns where the uranium is adsorbed onto the resin beads. Loaded resin is shipped to the Irigaray central plant for further processing.

After uranium adsorption and lixiviant makeup, gaseous oxygen and carbon dioxide are added prior to reinjection into the well field. Additional filtering may be required prior to lixiviant injection in the form of bag, cartridge or sand filters and is, therefore, noted as optional.


SULFURIC ACID TANK (T-04)
TO RO#9 (REST.)
DEEP WELL FEED PUMP (P-10)
DDW SURGE TANKS (T- 10A&B)
(POND 2)
DDW #1 CHARGE PUMP (P-12)
DDW #1 DISPOSAL PUMP (P-13A&B)
DDW #18-3 DISPOSAL PUMPS (P-11A&B)
DEEP DISPOSAL WELL DDW#1
DEEP DISPOSAL WELL DDW#18-3
BACKWASH/RESIN TRANSFER FILTER (F-03)
BACKWASH/RESIN TRANSFER PUMP (P-03)
BACKWASH POND (POND 1)
GASEOUS O_2 (T-07)
GASEOUS CO_2 (T-03)
RECOVERY SOLUTION PUMP (P-01A&B)
SAND FILTER (SF-01)
SAND FILTER (SF-02)
SAND FILTER (SF-03)
SAND FILTER (SF-04)
ION EXCHANGE VESSEL (IX-01)
ION EXCHANGE VESSEL (IX-02)
ION EXCHANGE VESSEL (IX-03)
ION EXCHANGE VESSEL (IX-04)
INJECTION SOLUTION PUMP (P-02A&B)
INJECTION FLUID BAG FILTER VESSELS (F-02A THRU D)
INJECTION WELLS
PRODUCTION WELLS
SUBMERSIBLE PUMP
PREGNANT LIX IN
BARREN LIX OUT
LOADED RESIN
RESIN TRANSFER WATER
WF BLEED
BRINE
RESIN TRUCK (TR-01A&B)
BARREN RESIN
ION EXCHANGE VESSEL (IX-05)
ION EXCHANGE VESSEL (IX-06)
ION EXCHANGE VESSEL (IX-07)
ION EXCHANGE VESSEL (IX-08)
STATIC INLINE MIXER (M-01)
RO FEED PUMP (P-04)
R.O. UNIT #4 (RO-04)
PERMEATE
DE-GAS COLUMN (C-01)
BICARB MAKEUP PUMP (P-05A)
RESIN TRANSFER WATER
SCREW CONVEYOR
AG-1
SODA ASH SILO (S-01)
SODA ASH MIX TANK (T-01)
SODA ASH MAKE UP TANK (T-02)
SODA ASH INJ. PUMP (P-05B)
SODA ASH BAG FILTER (F-01)
uranium one
Christensen Ranch Satellite
Process Flow Diagram
3.13

3.4.2.4 Wastewater Management

Two liquid waste streams are produced during the mining operations. The first stream is the 1% bleed taken in the plant for lixiviant control in the well field. The 40 gpm stream consists of the brine from the RO unit discussed above in the ion exchange/lixiviant makeup circuit section. The 40 gpm of brine (less than two percent of the total injection flow) will be sent to a lined evaporation pond or disposed via deep well injection. The permeate not used for lixiviant makeup or process stream recycle, may be stored in a compacted clay-bottomed pond adjacent to the plant site (a second pond is licensed, but not yet installed). Synthetic liners and leak detection systems are not necessary for the permeate storage ponds due to the good quality of the water; uranium and radium will meet NPDES surface discharge criteria for uranium mines after treatment through the IX systems, reverse osmosis unit and, if necessary, radium removal resin in the plant. Additionally, because the water source is process water, NRC standards in 10 CFR 20, Appendix B, Table 2 values for uranium and radium will be met for discharge into the pond. Anticipated water quality concentration ranges of the permeate storage pond solutions are:

	(All data in mg/l)
Bicarbonate	35 - 100
Chloride	15 - 45
Sulfate	1.5 - 10
Sodium	25 - 75
TDS	60 - 200
pH	6.0 - 8.0
Uranium	<0.10 - 2.0
Radium-226 (pCi/l)	<1.0 - 3.0

Design criteria for the permeate storage ponds are provided in Section 4.2.

The second stream produced during mining operations consists of sand filter backwash solutions, resin wash water, plant washdown waters and, on occasion, brine from the RO unit. This wastestream ranges from approximately 5 gpm up to 62.5 gpm (very short term basis) and is diverted to the lined brine ponds for evaporation. There are four lined brine evaporation ponds at the Christensen Ranch site. Two deep disposal wells are also available. Anticipated waste/brine concentration ranges are:

	(All data in mg/l)
Bicarbonate	1500 - 7500
Chloride	150 - 1200
Sulfate	450 - 12000
Sodium	800 - 7500
TDS	2000 - 25000
pH	6.0 - 9.8

Uranium	<0.10 - 15
Radium-226 (pCi/l)	<1.0 - 1500

3.4.2.5 Satellite Plant Equipment, Instrumentation and Control

A list of the major equipment and instrumentation for the Christensen Ranch satellite plant is given in Table 3.4. This list represents the current equipment on site and is subject to change with future modifications in operations. The plant operates with minimal operator coverage.

Except for the lixiviant makeup system, the satellite plant has no tanks which can overtop or spill. The flow of solutions through the sand filters and IX columns is controlled by ratio controllers responding to flow elements from the recovery pumps. Flow to the plant is essentially maintained by the downhole submersible pumps in the wellfields, plus booster pumps along the main trunkline. The two recovery booster pumps in the plant are available to boost the solutions through the satellite plant.

The tails solution from the IX columns which is barren of uranium is piped into the inlet of two injection booster pumps which raise the pressure of the solution being injected into the well field. Lixiviant is introduced into the inlet of the booster pump to provide mixing. The lixiviant is piped into the line using a metering pump. Carbon dioxide and gaseous oxygen (or hydrogen peroxide) are added to the injection solution downstream of the injection booster pumps for in-line pH control and oxidation of the uranium ore. A pH probe controls the amount of carbon dioxide gas added to the injection solution. Operation and instrumentation for the lixiviant makeup system was discussed above in Section 3.4.2.2.

Transfer of resin from the IX columns to the tanker trailers is accomplished by an eductor system and water stored in the backwash/resin transfer water storage pond outside the plant.

All lixiviant makeup activities are performed either manually or automatically except for the filling of tanks with permeate. In the event of a spill, this solution is collected in the plant sump which discharges to the lined brine evaporation ponds. Instrumentation in the satellite plant is very simple. The plant is equipped with the following processes:

- high and low pressure indicator and alarm on the recovery and injection lines to and from the well fields
- high/low pressure indicator and alarm on the wastewater output to the lined evaporation ponds
- high pH alarm on the bicarbonate mix system (lixiviant makeup)
- other pH indicators
- tank level indicators
- flow indicators

TABLE 3.4
CHRISTENSEN RANCH OPERATIONS EQUIPMENT LIST

Tanks, Vessels and Equip.			
Tank	Equip #	Diameter (ft)	Height (ft)
Processing Plant			
IX Vessel 1	IX-01	8.5	10
IX Vessel 2	IX-02	8.5	10
IX Vessel 3	IX-03	10	4.5
IX Vessel 4	IX-04	10	4.5
IX Vessel 5	IX-05	10	4.5
IX Vessel 6	IX-06	10	4.5
IX Vessel 7	IX-07	10	4.5
IX Vessel 8	IX-08	10	4.5
Sand Filter 1	SF-01	8.5	10
Sand Filter 2	SF-02	8.5	10
Sand Filter 3	SF-03	8.5	10
Sand Filter 4	SF-04	8.5	10
De-Gas Column	C-01	6	16
Soda Ash Mix Tank	T-01	6	6
Soda Ash Makeup Tank	T-02	6	6
RO Unit #4	RO-04		
Injection Fluid Bag Filter Vessel	F-02A	3.5	5
Injection Fluid Bag Filter Vessel	F-02B	3.5	5
Injection Fluid Bag Filter Vessel	F-02C	3.5	5
Backwash/Resin Transfer Filter Vessel	F-03	3.5	5
Soda Ash Bag Filter	F-01		
Restoration Plant			
IX Restoration Vessel 1	IX-09	10	4.5
IX Restoration Vessel 2	IX-10	10	4.5
RO Unit #5	RO-05		
RO Unit #6	RO-06		
RO Wash Tank		4' x 2' x 2'	
RO Wash Tank		3	4
Exterior			
Soda Ash Silo	S-01		
Sulfuric Acid Tank	T-04	8	10
Carbon Dioxide Tank	T-03		

TABLE 3.4
CHRISTENSEN RANCH OPERATIONS EQUIPMENT LIST

Pumps			
Pump	Equip #	Feed Rate (gpm)	Motor Size (HP)
Processing Plant			
Backwash/Resin Transfer	P-03	1200	40
Recovery Solution Pump	P-01A	4000	350
Recovery Solution Pump	P-01B	4000	350
Injection Solution Pump	P-02A	2000	200
Injection Solution Pump	P-02B	4000	350
Soda Ash Pump	P-05B	30	15
Bicarb Makeup Pump	P-05A	100	15
RO #4 Feed Pump	P-04	50-200	50
Miscellaneous			
Type	Dimension	Size	Units
Onan Generator	10' x 4' x 7'		
Caterpillar Generator	12' x 5' x 8'		
Process Plant Footer - Concrete	120' x 80' (3.66cf/lf)	1347	cubic feet
Process Plant Foundation - Concrete	120' x 80' x 6"	4800	cubic feet
Warehouse Footer - Concrete	44' x 30' (3.66cf/lf)	542	cubic feet
Warehouse Foundation - Concrete	44' x 30' x 6"	660	cubic feet
Loading Area Foundation - Concrete	35' x 60' x 2'	4200	cubic feet
Restoration Building Footer - Concrete	60' x 61' (3.66cf/lf)	886	cubic feet
Restoration Building Foundation - Concrete	60' x 61' x 6"	1830	cubic feet
Process Plant Steel Building	120' x 64'	7680	square feet
Warehouse Steel Building	44' x 30'	1320	square feet
Restoration Steel Building	60' x 61' x 22'	3660	square feet

3.4.2.6 Chemical Storage Facilities

Chemical storage facilities at the Christensen Ranch satellite include both hazardous and non-hazardous materials. Bulk hazardous materials that have the potential to impact radiological safety are stored outside and segregated from areas where licensed materials are processed and stored.

Process-related chemicals stored in bulk at the Christensen Ranch plant include carbon dioxide, oxygen, and sodium sulfide.

Carbon Dioxide

Carbon dioxide is stored adjacent to the plant where it is added to the lixiviant prior to leaving the plant. The carbon dioxide storage system will consist of one 50-ton bulk liquid carbon dioxide horizontal pressure vessel tank with condenser supplied and maintained by the carbon dioxide supplier. The tank will be located outdoors and outside the main plant. All carbon dioxide deliveries and tank fillings will be performed by the supplier.

Oxygen

Oxygen is typically stored near the plant or within wellfield areas, where it is centrally located for addition to the injection stream in each headerhouse. Since oxygen readily supports combustion, fire and explosion are the principal hazards that must be controlled. The oxygen storage system will consist of one 11,000 gallon 30-ton bulk vertical liquid oxygen pressure vessel. The tank will be supplied and maintained by the liquid oxygen supplier. All oxygen deliveries and tank fillings are performed by the tank supplier. The oxygen storage facility is located a safe distance from the plant and other chemical storage areas for isolation. The storage facility is designed to meet industry standards in NFPA-50.

Oxygen service pipelines and components must be clean of oil and grease since gaseous oxygen will cause these substances to burn if ignited. All components intended for use with the oxygen distribution system will be properly cleaned using recommended methods in CGA G-4.1. The design and installation of oxygen distribution systems is based on CGA-4.4.

Sulfuric Acid

The existing 93-98% sulfuric acid storage tank and distribution system at the Christensen Ranch plant have a capacity of approximately 3,500 gallons. The sulfuric acid is stored outside the Christensen plant in a 316 stainless steel vertical pressure vessel vented to the atmosphere. Distribution piping is constructed of seamless 316 stainless steel. Strict unloading procedures are utilized to ensure that safety controls are in place during the transfer of the acid. Process safety controls are also in place at the Christensen plant where sulfuric acid is added to the reverse osmosis circuits. The use of sulfuric acid is

- The use of sulfuric acid is subject to Threshold Planning Quantities (TPQs) contained in 40 CFR Part 355, Emergency Response Plans for threshold quantities (TQs) in excess of 1,000 pounds. As discussed, the Christensen plant includes a sulfuric acid tank with a capacity of 3,500 gallons or approximately 54,000 pounds. Based on the design capacity, Uranium One will be subject to the Emergency Response Plan requirements.

- The total acid storage (3,500 gallons) does exceed the screening threshold (11,250 lbs) contained in Appendix A of 6 CFR 27, Chemical Facility Anti-terrorism Final Interim Standards, Department of Homeland Security. As a result, Uranium One will be obligated to undergo initial screening requirements for sulfuric acid as required by the rule at that time.

<u>Soda Ash</u>

Soda ash is stored and used at the Christensen plant and is considered a non-hazardous material. Soda ash is stored outside in a conventional steel epoxy coated interior silo as bulk dry product as well as in two fiberglass mix tanks as a solution inside the plant. The silo has a capacity of approximately 1,604 cubic feet (approx. 112,280 pounds) with a conventional baghouse and the mix tanks have a capacity of approximately 1,000 gallons per tank.

- Chemical Reductants

Hazardous materials typically used during groundwater restoration activities include the addition of a chemical reductant (i.e., sodium sulfide or hydrogen sulfide gas). To minimize the potential for accidents involving process chemicals to impact areas where licensed material is handled, these materials are stored outside of process areas. Sodium sulfide may be used as a chemical reductant during groundwater restoration. The material consists of a dry flaked product and is typically purchased on pallets of 55-pound bags or super sacks of 1,000 pounds. The bulk inventory will be stored outside of process areas in a cool, dry, clean environment to prevent contact with any acid, oxidizer, or other material that may react with the product. Hydrogen sulfide gas has been used at the site in the past under a chemical safety plan developed and submitted to NRC.

CHRISTENSEN and IRIGARAY
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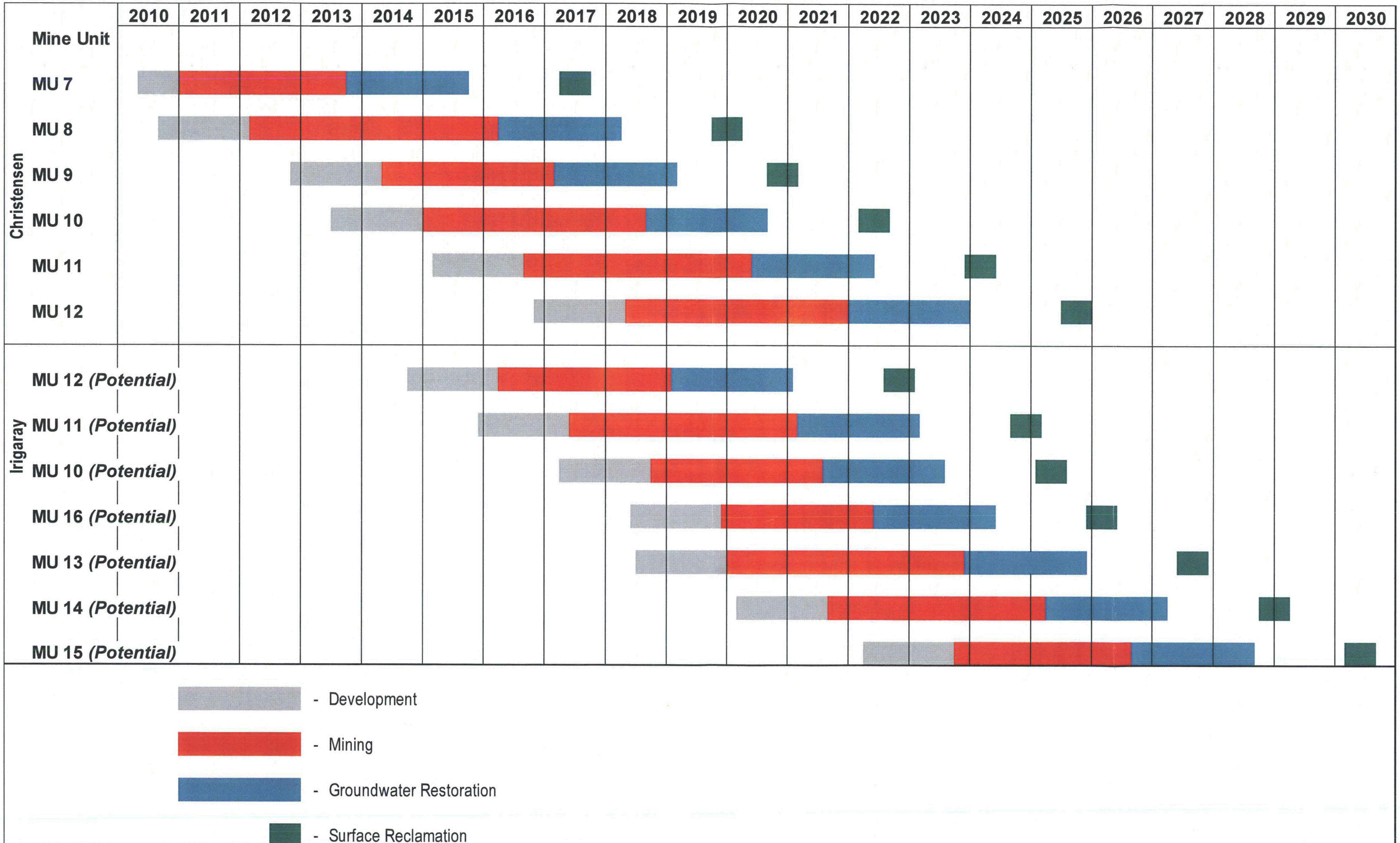


4.0 EFFLUENT CONTROL SYSTEMS

4.1 GASEOUS AND AIRBORNE PARTICULATES

Historically, emissions from ISL mining operations are significantly lower than conventional mining and milling operations. The primary source of emissions from ISL operations are from the process plant and associated equipment. Because the Christensen Ranch satellite plant is strictly an ion exchange (IX) facility and will have no precipitation of uranium, the only significant radioactive airborne effluent will be Radon-222 gas. At the Irigaray facility, effluents are limited to the process facility and the drying/packaging unit.

4.1.1 CHRISTENSEN RANCH SATELLITE FACILITY

Radon gas is mobilized from the ore zone during the mining process and will be present in the recovery solutions when they enter the plant facility. The majority of the radon gas will remain in solution during the plant process because the IX trains are closed, pressurized systems. A limited amount of radon gas will be released from the barren lixiviant used in the soda ash makeup tank and soda ash mix tank. The radon gas released will be minimal due to the preceding de-gas column where the radon is vented to the outside atmosphere previous to the soda system. These unpressurized tanks will also be vented directly to the atmosphere outside of the plant building to minimize personnel exposure.

Another small release of radon gas can occur during the resin transfer from the loaded IX column to the resin tanker trailer. The IX column is vented to the atmosphere directly outside of the plant building to release the radon gas liberated during the transfer process. In addition to the tank ventilation, the plant building is equipped with exhaust fans to further remove radon that is released inside the building, on an as needed basis.

Since the satellite process is entirely a wet process and uranium is not concentrated on-site, there are no uranium particulate effluents from the facility. Spills inside the plant are immediately washed down which eliminates the potential for any buildup of radioactive particulates.

Sources of non-radiological particulate emissions are fugitive dust from vehicular traffic and minor soda ash releases during the filling of the outside storage silo. Particulate emissions from the processing facility primarily occur from the lixiviant make-up process, where soda ash (Na_2CO_3) is used to generate the sodium bicarbonate lixiviant. The soda ash is stored in an outside silo adjacent to the plant building, with access for receiving loads of soda ash. The silo is equipped with a baghouse dust collection system which routinely collects over 99.99% of the product particulate created during the addition of soda ash to the silo. Based on the receipt of twenty-one soda ash shipments per year during mining operations, 75,000 lbs/shipment, and a calculated loss of 7.5 lbs/shipment, it is estimated that approximately .079 tons/year of soda ash particulate is lost to the atmosphere during loading of the silo.

These emissions are considered minor and insignificant due to the limited traffic (in the case of fugitive dust) and the relatively low usage of soda ash (twenty-one shipments per year).

Christensen Ranch header houses associated with active wellfields (production or restoration) are routinely monitored monthly for radon daughters. A review of past radon progeny monitoring records for header houses was conducted; records for the period 1990 through 1999 were examined. That period was selected since it includes the last sustained period of production. Over that ten year span there were only four instances when header house radon daughter levels exceeded the 25% action level, indicating that elevated radon daughter levels in active header houses are relatively rare occurrences. In such cases the frequency of radon daughter sampling increased to a weekly schedule until working levels declined to a low level. In all four cases the resulting doses to workers were very small (less than 0.3% of the ALI) due to the limited amount of time that wellfield workers spent in header houses. The follow up investigations of the elevated radon daughter incidents pointed to two common elements: there was a gas vent line that was discharging into the building interior and/or there was an inoperable building ventilation fan. Future operations at Christensen Ranch will incorporate into maintenance procedures the routine checking of vent lines to assure they are properly vented to the outdoors, and the routine checking of building ventilation fans to assure they are operable. Additionally, the header house exhaust fan is required to be running whenever maintenance is done on bag filter systems, when production or injection lines are being bled into the building, or as determined by the RSO. There are also static vents installed in each header house that act to circulate outside air into the building.

4.1.2 IRIGARAY FACILITY

The primary source of emissions from the Irigaray facility involve fugitive dust from vehicular traffic, release of radon gas from the Christensen Ranch resin processing, and the release of yellowcake particulate emissions through the dryer/packaging system. A total of 92.8 tons per year of air particulates originally was estimated to be emitted from processing and product drying activities at the Irigaray site. This compares with the previous total of 100 tons estimated in the 1979 WDEQ-AQD air permit application with the dryer operating only 25% of the time. The 92.8 tons per year is also based on full scale operations, including wellfield operations; emissions will be correspondingly smaller without any wellfield operations at Irigaray. Also, the emissions would be far less during restoration at Christensen Ranch due to fewer vehicles on the roads and limited plant processing at Irigaray.

Fugitive Dust

Potential particulate emissions from fugitive dust were originally estimated at 89.5 tons per year from the Irigaray facility. This included traffic on access roads within the permit boundary (37.9 tons/year) and wellfield roads (51.6 tons/year). Although the number of vehicles used as the basis for the fugitive dust emissions estimate is actually higher than current practice, COGEMA has used the same fugitive dust particulate emission estimate for the purposes of impacts evaluation.

Process Facility

Particulate emissions from the processing facility primarily occur from the eluant solution make-up process (when in use), where soda ash (Na_2CO_3) is used to generate the sodium carbonate solution portion of the eluate solution. The soda ash is stored in a silo inside the plant building, with access for receiving loads of soda ash. The silo is equipped with a baghouse dust collection system which routinely collects over 99.99% of the product particulate created during the addition of soda ash to the silo. Based on the receipt of eight soda ash shipments per year during processing operations at 75,000 lbs/shipment, and a calculated loss of 7.5 lbs/shipment, it is estimated that approximately 0.03 tons/year of soda ash particulate is lost during loading of the silo. The particulate emissions from this system would be considered minimal.

Radon emissions from resin processing is another source of emissions within the process facilities. The majority of the emissions are from the top of the elution columns, which are self-contained pressure vessels and vented to the atmosphere outside the plant building. The plant buildings are equipped with exhaust fans to remove radon that is released inside the plant building, on an as needed basis.

The final source of emissions in the process facility is yellowcake particulate emissions diameter PVC pipe are installed at each end of the sumps to allow inspection and sampling of the six sumps. The leak detection taps are tested on a weekly basis to check for potential pond leaks. In the latter part of 2010 the existing Hypalon liner in Pond CR-1 will have a 60 mil High-Density Polyethylene (HDPE) textured liner placed over the top of it with an 8 ounce geotextile fabric placed in between. Since the existing liner and leak detection system will not be removed or changed, pond dimensions and design capacities will not change.

The use of leak detection sand beneath the Hypalon liners in the two constructed evaporation ponds eliminated the need for constructing vents in the liner material. Any gases produced under the liner are vented through the leak detection media. After construction, water placed in the ponds has prevented billowing or air foil effects.

4.2.1.2 Permeate Storage Pond Design

The permeate storage pond system at the Christensen Ranch satellite facility is designed to store high-quality, low-TDS permeate from the reverse osmosis process. The permeate quality will meet WYPDES water quality standards for surface discharge from uranium solution mines. Only one of the two ponds has been constructed to date; the other pond will be constructed on an as-needed basis.

Two trapezoidal storage ponds have been designed, each with a capacity of approximately 26 acre-feet. This capacity was designed initially to provide storage for a partial reverse osmosis bleed stream of approximately 25 gpm for about 1.3 years of plant operation neglecting evaporation. The stored permeate can be utilized for process solution makeup, drilling water supply, wellfield restoration, deep well disposal, or if approved, for land application or surface discharge.

The permeate storage pond design consists of two earthen lined ponds with identical inside dimensions. The ponds do not require synthetic lining or leak detection systems since they are only used to store the reverse osmosis permeate, which meets WYPDES water quality limitations. Drainage ditches are used where required to channel surface runoff away from the ponds. The storage ponds were designed to have a normal operating depth of 16 feet with an additional 2 feet of freeboard for a total depth of 18 feet. The maximum depth of water storage behind the embankment is 10 feet resulting in a maximum embankment storage capacity of 19.2 acre-feet. The rest of the storage capacity is created by excavation below grade.

4.2.1.3 Spillage Containment System

The Christensen Ranch satellite plant building is constructed with a curbed concrete floor equipped with a floor drain and sump system to control and reclaim spill and washdown water. The sump system is equipped with a pump which delivers liquid contents to the lined evaporation pond system or back into the plant process circuit.

All liquid chemical storage tanks located outside of the plant building, such as for hydrochloric or sulfuric acid, gasoline or diesel fuel storage, are bermed to contain the contents of the tank should the vessel rupture.

4.2.1.4 Other Liquid Effluent Disposal Options

Other liquid effluent disposal options which Uranium One has considered for the Christensen Ranch satellite facility are surface discharge after treatment, deep injection well disposal and land application. Currently, Uranium One maintains a WYPDES permit for surface discharge of restoration solutions. COGEMA installed two licensed deep disposal wells for injection of well field bleed, reverse osmosis brine and other liquid effluents from the process plant. The disposal wells are discussed below.

On March 15, 1989, approval was received from WDEQ (permit UIC 88-545) and the USNRC (Condition No. 24 of SUA-1341) for a disposal wellfield for Christensen Ranch. The Christensen Ranch Disposal Wellfield authorized two injection sites: the Federal Holler Draw 7-B well in the center of NW1/4 Section 7, T44N, R76W (an existing oil well), and the Christensen 18-3 well in the NE1/4 NW 1/4 Section 18, T44N, R76W (a plugged and abandoned oil well) in Johnson County, Wyoming. In June, 1995, the WDEQ permit was modified to allow the construction of a new disposal well at the plant site in lieu of the existing Federal Holler Draw 7-B.

The originally permitted injection zone for COGEMA DW No. 1 was the entire thickness of the Teckla, Teapot and Parkman formations, ranging from approximately 7,500 feet below ground surface to a total depth of approximately 8,500 feet below ground surface.

Because of the poor performance of the injection zone COGEMA applied for and received approval for an amended injection zone in the Lance formation. COGEMA currently holds Permit No. UIC 00-340 that authorizes four Class I Non-Hazardous disposal wells located at the Christensen Ranch in-situ leach uranium mine in Johnson County, Wyoming. Two of these wells are installed and operating (COGEMA DW No. 1 and Christensen 18-3) and two are permitted but not yet installed (COGEMA DW No. 2 and DW No. 3).

The injection fluid for the two permitted disposal wells is specifically limited to fluids produced at the Irigaray or Christensen Ranch facilities with allowances to accept oil field or other solutions after approval by WDEQ. Based on the results of a step injection tests in the surface injection pressure is limited to 1,200 psi for COGEMA DW No.1 and 1,320 psi for Christensen 18-3. Annulus pressures are maintained in the range of 200 to 800 psi for both wells.

In order to prevent fracturing of the confining strata, injection volume and/or pressure are controlled and monitored. The injected fluid is analyzed and sampled quarterly for TDS, bicarbonate, carbonate, and total radium. Results of this testing are submitted in a quarterly report to WDEQ. Mechanical integrity tests of the wells are performed with the test reports submitted to the WDEQ for review and approval.

4.2.1.5 Solid Effluents and Waste Disposal

Minor amounts of solid wastes are produced during the satellite operation. Solid residues from the sand filter systems, tank sediments, and sump sediments, as a result of the process effluent stream, will remain in the lined evaporation ponds until final decommissioning. These materials will be designated as byproduct materials and will be disposed of in a USNRC approved disposal area.

Other solid wastes such as trash, spent resin, and contaminated equipment are generated during the mining process. Waste materials and trash which are not contaminated are disposed of in an off-site industrial land fill. Unusable contaminated equipment, spent resin, bag filters or other contaminated materials are stored in a secured area until final disposition in a USNRC approved disposal area.

Uranium One is currently authorized to dispose of byproduct materials in the Pathfinder Mines Corporation Shirley Basin tailings facility. Uranium One maintains a contract with Pathfinder for the disposal of such materials, and is currently shipping byproduct materials to Shirley Basin from both the Christensen Ranch and Irigaray facilities.

4.2.2 IRIGARAY FACILITY

4.2.2.1 Lined Evaporation Pond Design

There are a total of seven lined ponds permitted at the Irigaray site. These include five lined evaporation ponds and two lined restoration storage ponds. The five lined evaporation ponds were constructed in 1978 and 1979 under WDEQ Permit to Mine No. 478 and Source Material License SUA-1341, as were the two lined restoration ponds constructed in 1979.

Previously (May 2008), five of the lined ponds (Ponds A, C, D, E and RA) were decommissioned. The liners, leak detection system, and all contaminated materials were removed and disposed of at the licensed Shirley Basin facility. The berms and supporting earthworks have been maintained intact; as it was anticipated that a combination of ponds A,C,D, and RA would need to be re-installed as necessary to support the evaporative disposal of process water, up to 25gpm, resulting from resumption of uranium recovery operations. Currently, Ponds D and RA have had new liner systems installed (July, 2010). Previously, ponds' D and RA liner consisted of a 30 mil nylon-reinforced Hypalon primary liner with a compacted clay secondary liner. Between the Hypalon and clay liners was a grid of 3" perforated leak detection piping with a collection sump and 4" recovery pipe. The primary liner of the new system consists of 60 mil High-Density Polyethylene (HDPE) textured liner with a secondary 30 mil Poly Vinyl Chloride liner. Between the two liners is an 8 ounce geotextile fabric that will wick fluid to the grid of leak detection piping. The overall pond dimensions and the layout for the leak detection grid remain the same as the previous design. Design drawings of ponds D and RA are provided in Figures 4.2 and 4.3. Capacities for the five evaporation ponds are as follows:

POND ID	SIZE	DEPTH (feet)	FREE-BOARD (feet)	FREE-BOARD CAPACITY (Acre/Ft)	TOTAL CAPACITY (Acre/Ft)	EVAP-ORATIVE CAPACITY (Acre/Ft/Yr.)
A[1]	160X390	6	2	6.3	10.0	6.12
B	250X250	6	2	6.3	9.9	6.02
C[1]	160X390	6	2	6.3	10.0	6.12
D	250X250	6	2	6.3	9.9	6.02
E[1]	100X250	6	2	2.7	4.4	2.73

[1]Has been partially decommissioned and would require reconstruction of drain system and leak detection system, and re-installation of a liner system prior to any further use.

4.2.2.2 Restoration Pond Design

Construction techniques for the two restoration storage ponds were essentially the same as for the lined evaporation ponds. As noted above, Pond RA has been reconstructed with the installation of a leak detection system and liner system. The restoration ponds will be used as storage/evaporation ponds during operations. Capacities of these two ponds are as follows:

POND ID SIZE	DEPTH (feet)	FREE-BOARD (feet)	FREE-BOARD CAPACITY (Acre/Ft)	TOTAL CAPACITY (Acre/Ft)	EVAP-ORATIVE CAPACITY (Acre/Ft/Yr.)
RA Polygonal	20	8	19.8	39.9	6.10
RB Polygonal	20	8	19.8	39.9	6.10

4.2.2.3 Spillage Containment System

The Irigaray facility building is constructed with a curbed concrete floor equipped with a floor drain and central sump system to control and reclaim spill and washdown water. The sump system is equipped with a pump which delivers liquid contents to the lined evaporation pond system or back into the plant process circuit.

4.2.2.4 Other Liquid Effluent Disposal Options

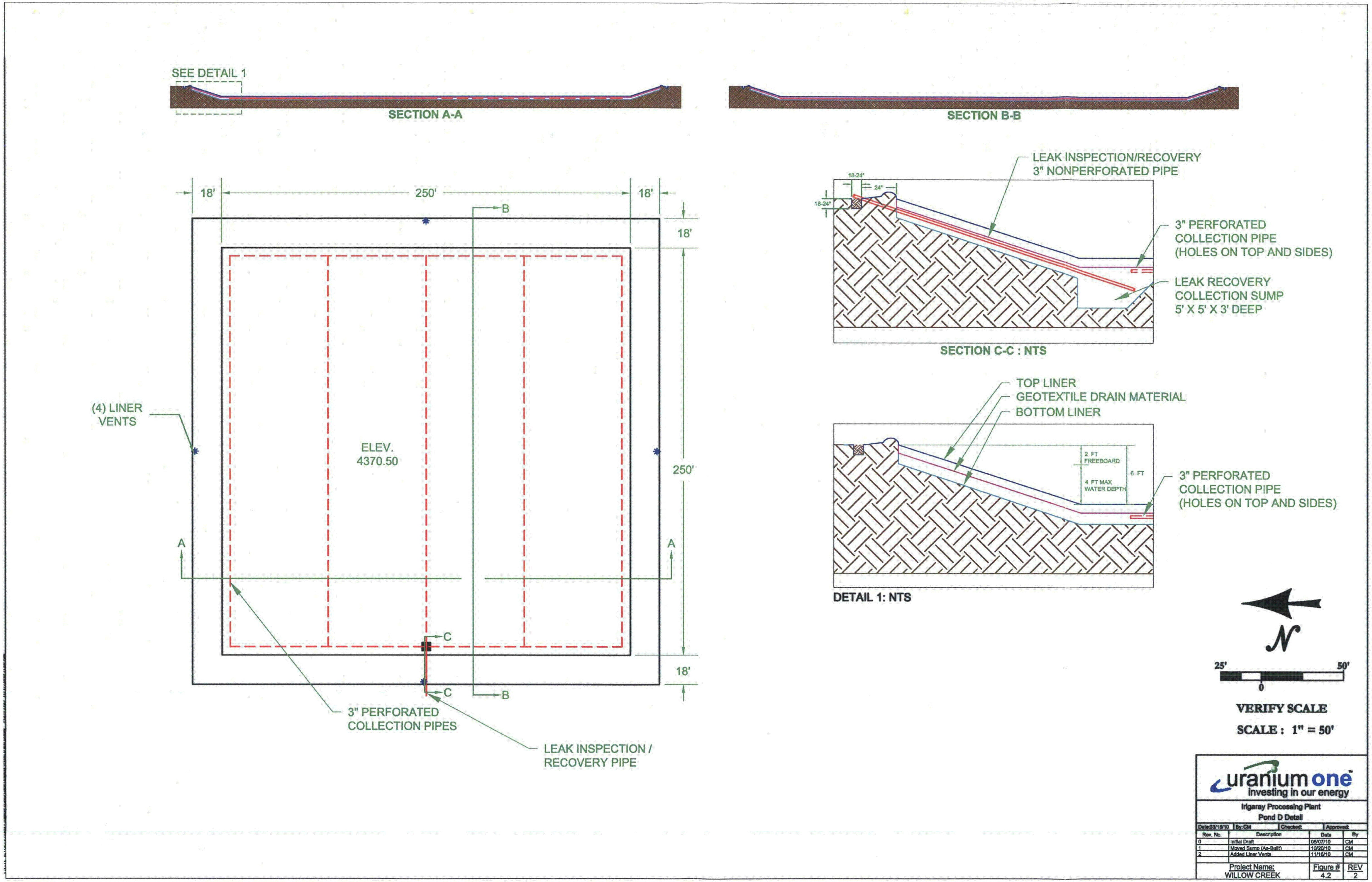
Another liquid effluent disposal option which Uranium One has considered for the Irigaray site is deep well injection. On May 27, 1992, COGEMA received approval from WDEQ (permit UIC-247) and the USNRC (Condition No. 24 of SUA-1341) for a disposal wellfield for the Irigaray site. The Irigaray Disposal Wellfield consists of two injection sites, DW-1, located in the W1/2 NW1/4, Section 9, T45N, R77W, and DW-2, located in the E1/2 NE1/4, section 8, T45N, R77W, both in Johnson, County, Wyoming. To date neither well has been constructed. The injection fluid for these two wells is specifically limited to fluids produced at the Irigaray or Christensen Ranch facilities, with allowances to accept oil field or other solutions after approval by WDEQ. Specific allowances for certain industrial wastes are contained in the permit. Injected volume as currently permitted is 180 gallons per minute (6,171 barrels per day or 259,182 gallons per day) into each of the two wells.

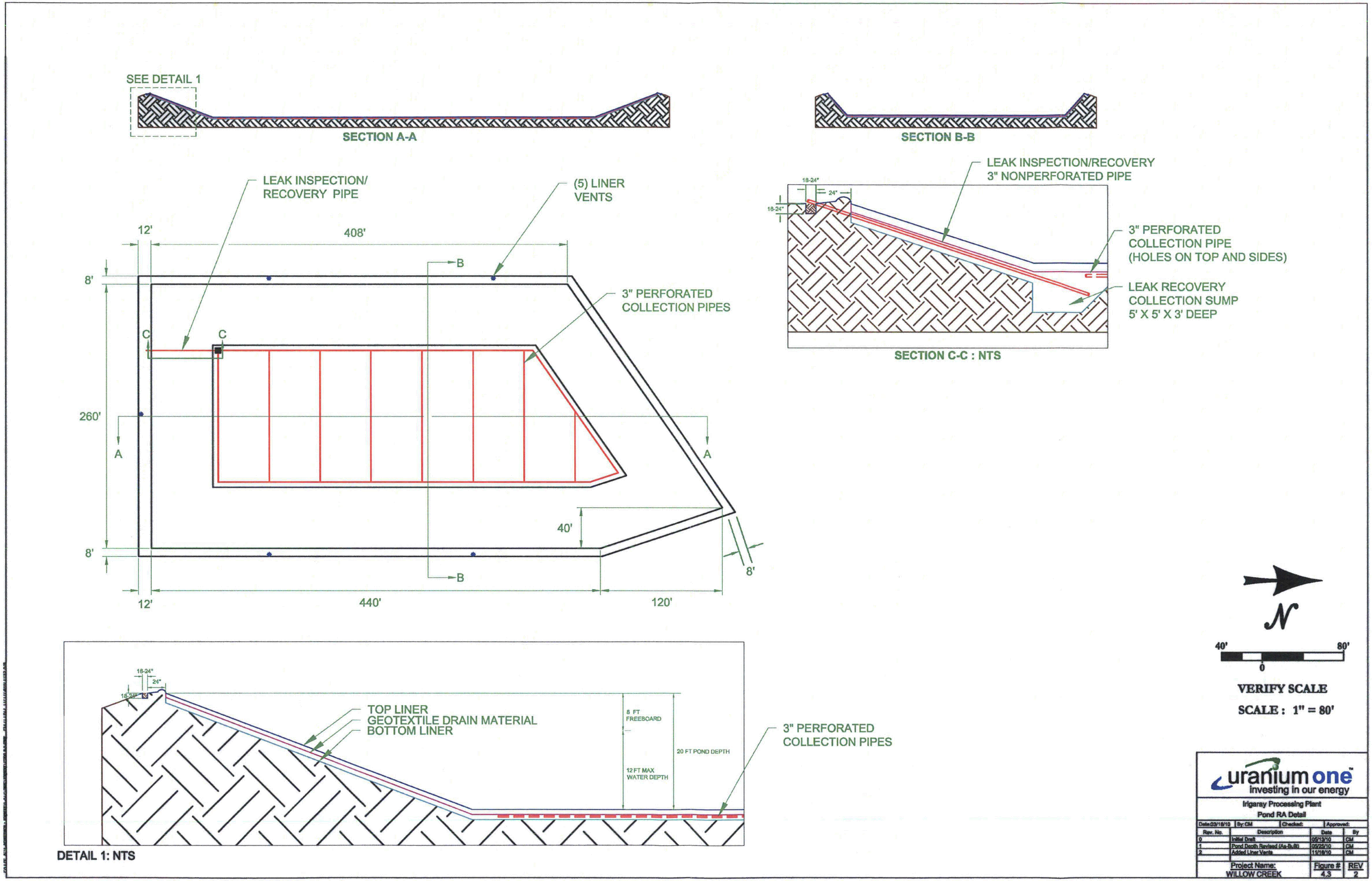
4.2.2.5 Solid Effluents And Waste Disposal

Dissolved solids from all waste streams will be retained in lined evaporation ponds. All pond solids will eventually be transported to an off-site licensed tailing facility when final decommissioning is effected. After solid wastes in the evaporation ponds are removed, the liner systems will also be removed to an off-site USNRC approved licensed tailings facility if contaminated. At that time, a gamma survey will be conducted to identify any contaminated surface present. If any contaminated material is found, this also will be removed to an off-site USNRC approved licensed tailing facility prior to final reclamation of the pond sites.

Chemicals separated by conventional water purification techniques, and further concentrated by evaporation, will be generated in the restoration program. Barium sludges will be present in the lined restoration pond. Since continuously better water quality is attained as restoration proceeds, a variable amount of waste solids will be generated throughout the restoration operation.

As previously stated, Uranium One maintains a contract for byproduct materials disposal with Pathfinder Mines Corporation, Shirley Basin tailings facility.


SEE DETAIL 1
SECTION A-A
SECTION B-B
18'
250'
18'
B
18'
LEAK INSPECTION/RECOVERY
3" NONPERFORATED PIPE
3" PERFORATED
COLLECTION PIPE
(HOLES ON TOP AND SIDES)
LEAK RECOVERY
COLLECTION SUMP
5' X 5' X 3' DEEP
SECTION C-C : NTS
TOP LINER
GEOTEXTILE DRAIN MATERIAL
BOTTOM LINER
(4) LINER
VENTS
ELEV.
4370.50
250'
2 FT
FREEBOARD
6 FT
4 FT MAX
WATER DEPTH
3" PERFORATED
COLLECTION PIPE
(HOLES ON TOP AND SIDES)
A
A
DETAIL 1: NTS
C
18'
C
B
3" PERFORATED
COLLECTION PIPES
LEAK INSPECTION /
RECOVERY PIPE
25'
0
50'
VERIFY SCALE
SCALE : 1" = 50'
uranium one
investing in our energy
Irigaray Processing Plant
Pond D Detail
Date:03/18/10
By:CM
Checked:
Approved:
Rev. No.
Description
Date
By
0
Initial Draft
05/07/10
CM
1
Moved Sump (As-Built)
10/20/10
CM
2
Added Liner Vents
11/16/10
CM
Project Name:
WILLOW CREEK
Figure #
4.2
REV
2


SEE DETAIL 1
SECTION A-A
SECTION B-B
LEAK INSPECTION/RECOVERY
3" NONPERFORATED PIPE
18-24"
24"
3" PERFORATED
COLLECTION PIPE
(HOLES ON TOP AND SIDES)
LEAK RECOVERY
COLLECTION SUMP
5' X 5' X 3' DEEP
SECTION C-C : NTS
LEAK INSPECTION/
RECOVERY PIPE
(5) LINER
VENTS
12'
408'
8'
B
3" PERFORATED
COLLECTION PIPES
C
260'
A
40'
8'
12'
440'
120'
TOP LINER
GEOTEXTILE DRAIN MATERIAL
BOTTOM LINER
8 FT
FREEBOARD
20 FT POND DEPTH
12 FT MAX
WATER DEPTH
3" PERFORATED
COLLECTION PIPES
DETAIL 1: NTS
N
40'
0
80'
VERIFY SCALE
SCALE : 1" = 80'
uranium one
investing in our energy
Irigaray Processing Plant
Pond RA Detail
Date:03/18/10
By:CM
Checked:
Approved:
Rev. No. | Description | Date | By
0 | Initial Draft | 05/13/10 | CM
1 | Pond Depth Revised (As-Built) | 05/25/10 | CM
2 | Added Liner Vents | 11/16/10 | CM
Project Name:
WILLOW CREEK
Figure #
4.3
REV
2

5.0 OPERATIONS

Uranium One USA, Inc. (Uranium One) is committed to conducting all operations at the Irigaray Mine and Christensen Ranch satellite operations in compliance with applicable parts of 10 CFR Chapter I, and conditions set forth in License SUA-1341. Irigaray Mine and Christensen Ranch satellite operations under Mine Permit No. 478 shall be conducted in compliance with the conditions as stated in Section 9, Chapter 11, Noncoal In situ Mining, Department of Environmental Quality, Land Quality Division Rules, as adopted May 3, 2005. The responsibilities described below have been designed to both ensure compliance and further implement Uranium One's policy for providing a safe working environment with cost effective incorporation of the philosophy of maintaining radiation exposures as low as is reasonably achievable (ALARA).

5.1 CORPORATE ORGANIZATION AND ADMINISTRATIVE PROCEDURES

The Uranium One organizational chart, as it pertains to the responsibility for radiation safety and environmental protection during preoperational refurbishment activities and initial uranium production at the Christensen Ranch satellite and Irigaray recovery facility is given as Figure 5.1. The personnel identified are responsible for the development, review, approval, implementation, and adherence to operating procedures, radiation safety programs, environmental and groundwater monitoring programs, as well as routine and non-routine maintenance activities. Specific responsibilities of the organization are provided below. As noted above, this Uranium One organization structure is for preoperational refurbishment and initial uranium production activities at the Christensen Ranch satellite and Irigaray recovery facility. It can be assumed that job titles and descriptions may be modified and positions added. Currently, it is anticipated the Site/Construction Manager will become the Operations Manager. Any changes in organization will likely not affect the reporting path of the Radiation Safety Officer and all will be enacted following appropriate regulatory and license procedures.

5.1.1 SENIOR VICE PRESIDENT, ISR OPERATIONS

The Senior Vice President, ISR Operations (Sr. VP) is responsible for management of all company in situ recovery (ISR) operations in the U.S. In this role, the Sr. VP has the responsibility and authority for the radiation safety and environmental compliance programs at ISR operations. The Sr. VP is responsible for ensuring that Uranium One personnel comply with industrial safety, radiation safety, and environmental protection programs as established in the Uranium One program. The Sr. VP is also responsible for compliance with all regulatory license conditions/stipulations, regulations and reporting requirements. The Sr. VP has the responsibility and authority to terminate immediately any activity that is determined to be a threat to employees or public health, the environment, or potentially a violation of state or federal regulations.

5.1.2 SITE/CONSTRUCTION MANAGER

The Site/Construction Manager is responsible for all facility refurbishment and initial uranium production activities at the Irigaray and Christensen Ranch Sites. During the site refurbishment and initial operations, all maintenance, construction, environmental health and safety, and support groups report directly to the Site/Construction Manager as shown in Figure 5-1. The Site/Construction Manager is authorized to immediately implement any action to correct or prevent hazards. The Site/Construction Manager has the responsibility and the authority to suspend, postpone or modify, immediately if necessary, any activity that is determined to be a threat to employees, public health, the environment, or potentially a violation of state or federal regulations. The Site/Construction Manager cannot unilaterally override a decision for suspension, postponement or modification if that decision is made by the RSO. The Site/Construction Manager reports directly to the Senior Vice President, ISR Operations.

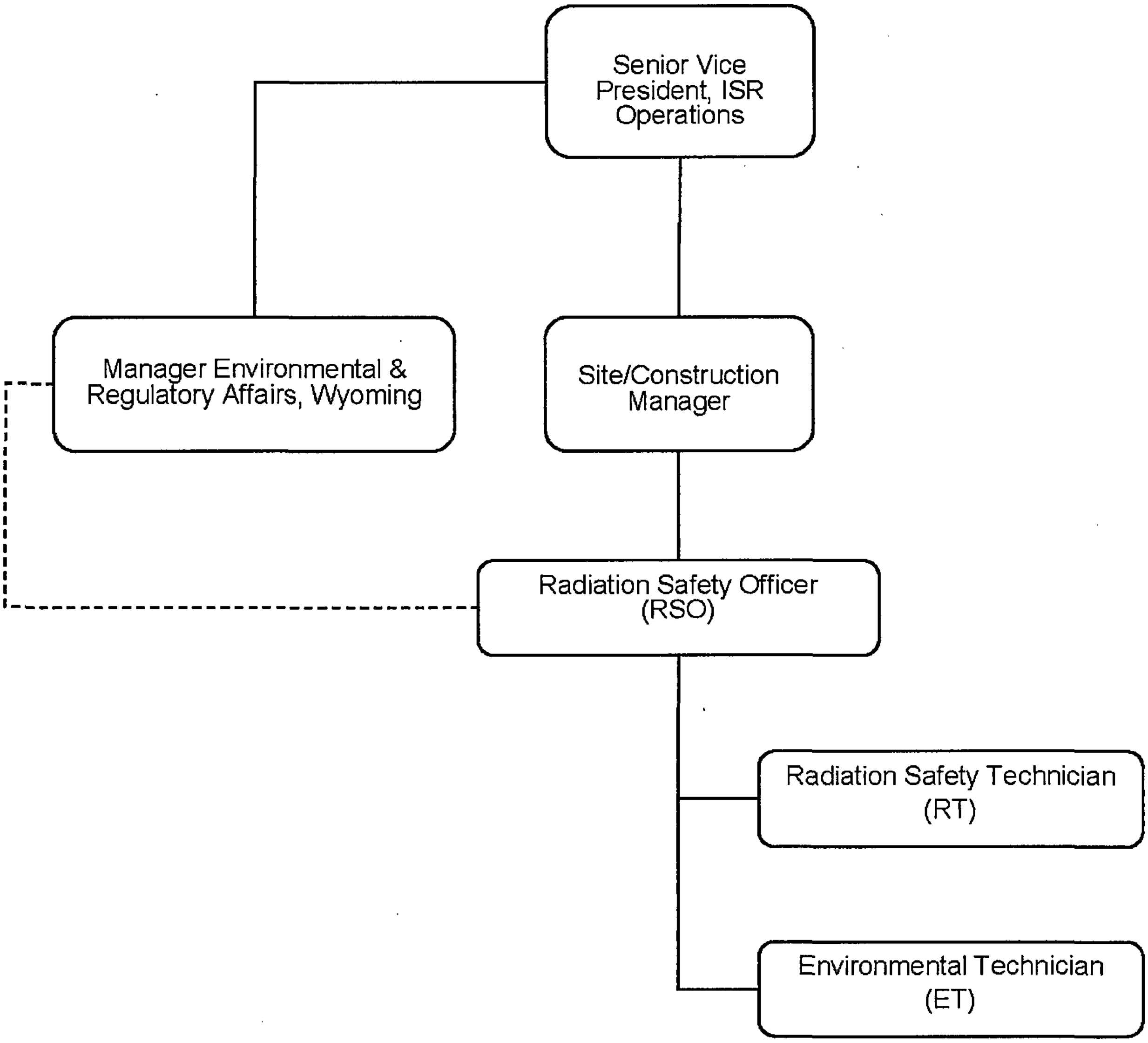
5.1.3 MANAGER, ENVIRONMENTAL AND REGULATORY AFFAIRS, WYOMING

The Manager, Environmental and Regulatory Affairs Wyoming, is responsible for the maintenance of all operational licenses and permits for continued mine operations including modifications, amendments and renewals. This individual also assists and guides the Radiation Safety Officer, if and when necessary, in his routine and special responsibilities. The Manager, Environmental and Regulatory Affairs has oversight for the development, review, approval, implementation and adherence to radiation safety programs, environmental and groundwater monitoring programs and associated quality assurance programs for the Wyoming sites. The Manager, Environmental and Regulatory Affairs has both the responsibility and authority to suspend, postpone or modify any work activity that is unsafe or potentially in violation of USNRC's regulations or license conditions, including the ALARA program. The Manager, Environmental and Regulatory Affairs reports to the Senior Vice President, ISR Operations.

5.1.4 RADIATION SAFETY OFFICER

The Radiation Safety Officer (RSO) has direct responsibility for the development, review, approval, implementation and adherence to radiation safety programs, industrial safety programs, environmental monitoring programs and associated quality assurance programs for the Irigaray and Christensen Ranch Sites.

FIGURE 5.1
URANIUM ONE USA, INC. ORGANIZATION CHART
RADIATION SAFETY AND ENVIRONMENTAL PROTECTION



The RSO is also responsible for the collection and interpretation of all safety and environmental monitoring data, and the proper recording and reporting of such. The RSO conducts routine training programs for the supervisors and employees with regard to the proper application of radiation protection and industrial safety procedures. This individual is also responsible for the implementation of and adherence to all regulatory license requirements and fulfillment of reporting requirements. The RSO, with assistance from the Radiation Safety Technician (RST) or Environmental Technician, or other qualified designee, personally inspects facilities to verify compliance with all applicable health physics and radiation safety requirements. The RSO has both the responsibility and authority to suspend, postpone or modify any work activity that is unsafe or potentially a violation of USNRC's regulations or license conditions, including the ALARA program. The RSO reports directly to the Site/Construction Manager.

5.1.5 RADIATION SAFETY TECHNICIAN (RST)

The Radiation Safety Technician (RST) assists the RSO with his routine radiation safety surveys, employee exposure records keeping, facility inspections, training, and industrial safety responsibilities. The RST reports directly to the RSO.

5.1.6 ENVIRONMENTAL TECHNICIAN

The Environmental Technician (ET) is responsible for the implementation of all environmental monitoring programs at both the Irigaray and Christensen Ranch sites. Specific duties include groundwater and surface water sampling, air monitoring and evaporation pond inspections. In addition, the ET is trained to act as an RST and may assist the RSO with the implementation of the radiological and industrial safety programs. The ET is responsible for the orderly collection and interpretation of all monitoring data. The ET reports directly to the RSO.

5.1.7 RADIATION SAFETY AUDITOR

Uranium One utilizes either the Manager, Environmental and Regulatory Affairs, a qualified employee, or a qualified outside radiation protection auditing service to provide assurance that all radiation health protection procedures and license condition requirements are being conducted properly at the Irigaray and Christensen Ranch Sites. Any outside service used for this purpose is qualified in radiation safety procedures as well as environmental aspects of in situ recovery operations.

5.2 MANAGEMENT CONTROL PROGRAM

5.2.1 OPERATING PROCEDURES

Written standard operating procedures (SOPs) have been developed for all process activities, including those activities involving radioactive materials, for both the Irigaray and

The following internal inspections, audits and reports are performed for the Irigaray facility and Christensen Ranch satellite operations:

Daily

The RSO or a qualified designee conducts a daily documented walk-through inspection of the Irigaray plant during periods of dryer operation to determine that radiation control practices are being implemented appropriately.

Weekly

The RSO or a qualified designee conducts a weekly inspection of the process area to observe general radiation safety control practices and make or review required changes in procedures and equipment. Any items of non-compliance or other problems are reviewed with the Site/Construction Manager.

Monthly

The RSO provides a written summary of the month's radiological activities at the Christensen Ranch and Irigaray facilities. The report includes a review of all monitoring and exposure data for the month, a summary of worker protection activities, a summary of all pertinent radiation survey records, a discussion of any trends in the ALARA program, and a review of adequacy of the implementation of the USNRC license conditions. Recommendations are made for any corrective actions or improvements in the process or safety programs.

Annually

On an annual basis, an audit of the radiation protection and ALARA program is conducted and a written report of the results submitted to corporate management. The audit team consists of either the Manager, Environmental and Regulatory Affairs and/or the outside radiation safety auditor identified in Section 5.1.6, the RSO, and the Site/Construction Manager. The RSO may accompany the audit team, but may not participate in the conclusions.

The annual ALARA audit report summarizes the following data:

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

The ALARA audit report specifically discusses the following:

1. Trends in personnel exposures
2. Proper use, maintenance and inspection of equipment used for exposure control
3. Recommendations on ways to further reduce personnel exposures from uranium and its daughters

The ALARA audit report is reviewed by the Senior Vice President, ISR Operations with the ALARA audit team. Implementations of the recommendations to further reduce employee exposures, or improvements to the ALARA program, are discussed at that time.

An audit of the Quality Assurance/Quality Control (QA/QC) program is also conducted on a biannual basis. The audit is performed by an individual qualified in analytical and monitoring techniques who does not have direct responsibilities in the areas being audited. The results of the QA/QC audit are documented and reported to the Manager, Environmental and Regulatory Affairs, the RSO and the Senior Vice President, ISR Operations. The RSO has the primary responsibility for the implementation of the QA/QC programs at the Irigaray and Christensen Ranch facilities.

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. Education - A high school diploma.

   Training - A total of at least 3 months of specialized training (up to 1 month may be ont he-job training) in radiation health protection relevant to UR facilities.

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

5.5 TRAINING

All site employees, and contracted personnel when present, at the Irigaray and Christensen Ranch ISL Project are administered a training program based upon the COGEMA Radiation Safety Training Plan covering radioactive material handling and radiological emergency procedures. This training program is administered in keeping with standard radiological protection guidelines. The technical content of the training program is under the direction of the Manager, Environmental and Regulatory Affairs. Training is conducted by the RSO.

5.5.1 TRAINING PROGRAM CONTENT

Visitors

Visitors to the Irigaray and Christensen Ranch ISL Project receive hazard training on the radiation safety requirements while in the restricted area and survey requirements upon leaving the restricted area.

Contractors

Contractors receive the same hazard training as visitors. In addition, contractors receive additional radiation safety training when applicable to their specific tasks.

Permanent Employees

The COGEMA Radiation Safety Training Program incorporates the following topics discussed in Regulatory Guide 8.31:

1. Fundamentals of health protection;
2. Personal hygiene at uranium mines;
3. Facility-provided protection;
4. Health protection measurements;
5. Mine emergency procedures.

As part of the employee initial training program, COGEMA issues to each new employee the following handouts:

1. Health Physics Manual for radiation training and decontamination procedures;
2. Regulatory Guide 8.29, "Instructions Concerning Risks From Occupational Radiation Exposure";
3. Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure"(females only);
4. Uranium-238 Decay Chain table;
5. Standard Operating Procedure for Alpha Contamination Monitoring for Release From a Restricted Area;
6. Standard Operating Procedure for Respiratory Protection Program (applicable only to employees who need to be trained to wear a respirator and have been medically certified to do so).

In addition to the training described for all employees, certain employees receive additional training as follows:

Supervisors

Supervisors receive additional annual training relating to their supervisory responsibilities in the area of worker radiation protection.

RSTs

At least one week of generalized classroom training is provided to RSTs by an outside instructor who is a specialist in such training.

5.5.2 TESTING REQUIREMENTS

A written test relevant to the principles of radiation safety and health protection in uranium mining is administered at the end of the training course. Employees who fail the test are retested after receiving additional training.

5.5.3 ON-THE-JOB TRAINING

RST

On-the-job training is provided to the RST in radiation exposure monitoring and exposure determination programs, instrument calibration, plant inspections, posting requirements, respirator programs and Health Physics Standard Operating Procedures.

During the first three months of employment the RST receives on-the-job training to conduct the following:

1. Daily facility radiation inspections;
2. Air surveys for radon daughters and airborne uranium;
3. Gamma, alpha and equipment release surveys;
4. Survey instrument calibration checks and air sampling pump calibrations; and
5. Maintenance and inspection of respirators.

During the second three months of employment the RST receives on-the-job training to conduct the following:

1. Assign Radiation Work Permits;
2. Calculate and document internal exposures;
3. Determining radiological posting requirements.

5.5.4 REFRESHER TRAINING

Following initial radiation safety training, all permanent employees receive on-going radiation safety training as part of the routine quarterly safety meetings. This on-going training is used to discuss problems and questions that have arisen in the past quarter, any relevant information or regulations that have changed, exposure trends and other pertinent topics.

5.5.5 TRAINING RECORDS

Records of training are kept for a period of five years for all process employees.

5.6 SECURITY

5.6.1 IRIGARAY SITE SECURITY

Entrances to the Irigaray Site are gravel roads to the north and south of the facility. Each entrance to the site is posted to alert visitors that any building or area within the facility may contain radioactive material and that permission is required prior to entry. In addition, the immediate mine permit area (WDEQ permit boundary) is fenced, with gates on each access route which can be locked. The plant site is within the fenced permit area and properly posted in accordance with 10 CFR § 20.1902(e) and SUA-1341. Posting and warning signs are placed at conspicuous places around the perimeter of the site. All visitors to the Irigaray Site are required to register at the main office and are not permitted inside the plant or wellfield areas without proper authorization. Inexperienced visitors are escorted unless they are frequent visitors who have been instructed regarding areas to be avoided. The process plant is posted as a hard-hat and safety glasses area. Strict adherence to safety rules restricts unauthorized persons from access. The access road through the site often carries passing traffic (such as oil/gas workers) that is allowed through the property unimpeded since they have no contact with radioactive materials.

5.6.2 CHRISTENSEN RANCH SITE SECURITY

Security for the Christensen Ranch satellite facility is provided by the personnel working at the facility. Security has not been a problem at the facility due to the remote location and private access road. The access to the site is a gravel road to the south of the plant site. The entrance to the facility is posted to alert all visitors that any building or area within the facility may contain radioactive material and that permission is required prior to entry. The plant site is properly posted in accordance with 10 CFR § 20.1902(e) and SUA-1341. Posting and warning signs are placed at conspicuous places around the perimeter of the site. The entrance to the site is equipped with a lockable gate. Pump houses in the wellfields which are near the county road and could be more easily accessed are equipped with a locking door with an access code to prevent access by unauthorized personnel.

All visitors to the Christensen Ranch satellite facility are required to report to the site office where they register and receive proper safety briefings prior to entering any process areas. Inexperienced visitors are escorted unless they are frequent visitors who have been instructed regarding areas to be avoided. The plant, wellfield and related mining activity areas are posted hard-hat and safety glasses areas. Pond areas are fenced and appropriately posted. Due to the anticipated increase in coal bed methane drilling/extraction activity in the general area, coal bed methane personnel will be proximate to COGEMA wellfields, but will not spend significant time actually in wellfields (it is

2. A spill from chemical storage tanks. Spills of this type from tanks within the plant buildings would normally be collected by the building sumps and pumped to an appropriate receiving tank. External tanks are diked or bermed to contain the specific tank's capacity. Isolation of the leak or rupture would be performed by closing accessible isolation valves or turning off pumping systems to minimize the volume of the spill.

3. Waste pond leakage. The ponds are lined with hypalon or CPE and are installed with underliner inspection tubes. Weekly inspections are performed and documented. Leaks in ponds are reported in accordance with SUA-1341.

4. Failure of a well casing. Such failures would usually occur during initial operation of a newly completed well due to improper completion. All wells undergo mechanical integrity testing following completion and are re-tested every five years of operation. Close monitoring of injection pressure and flow during initial operation would allow early detection of a leak. During normal operations, injection well pressures and flows are monitored and recorded at the manifolds located in the module buildings.

5. Transportation accidents. NUREG 0481 discusses the likelihood of a transportation accident involving shipments of yellowcake. COGEMA has developed an emergency action plan for responding to such an accident. The plan provides instructions for proper packaging, documentation, driver emergency and accident response procedures and cleanup and recovery actions.

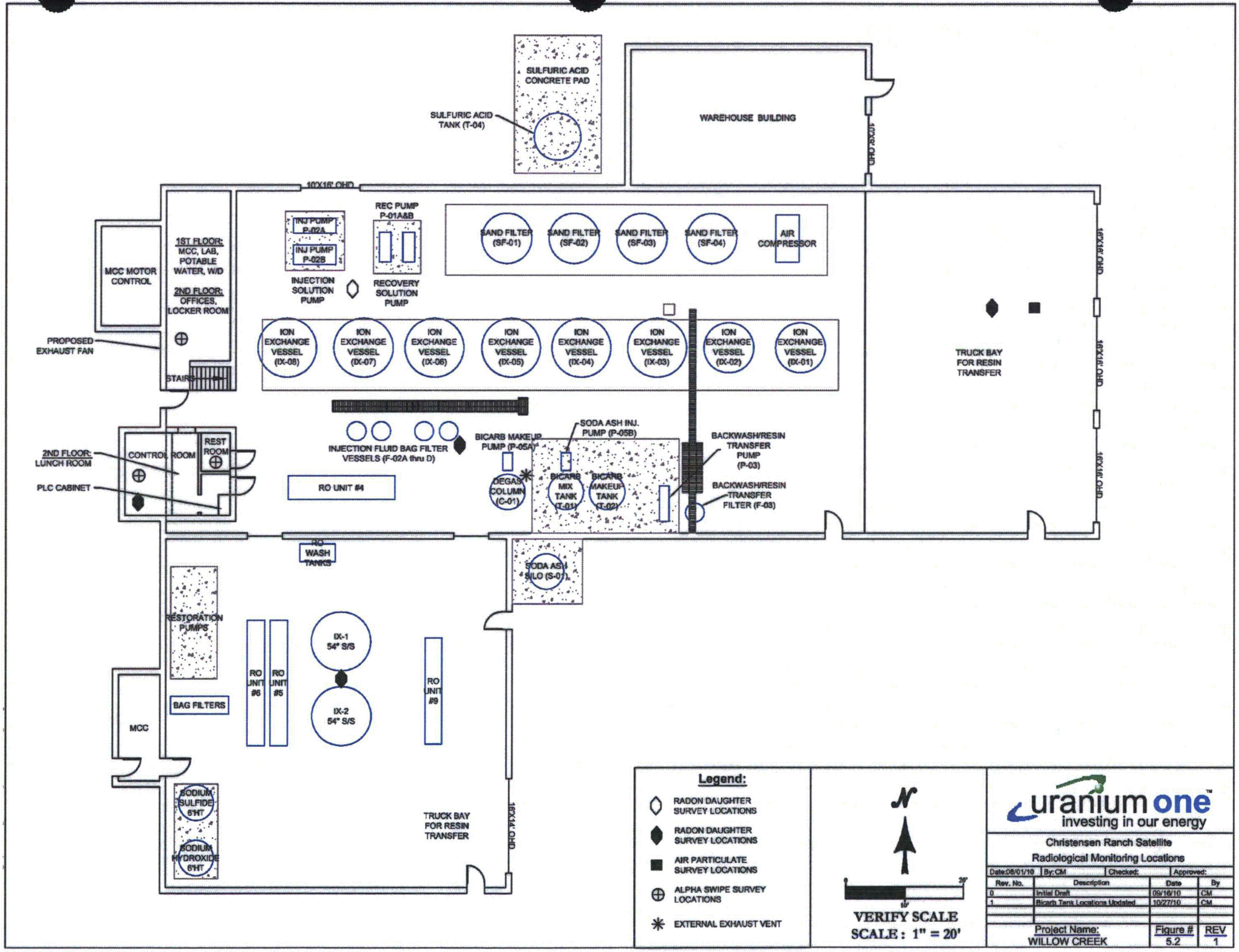
6. Failure of concrete foundation and subsequent tank spill. This is an unlikely occurrence but one which did occur at the Irigaray site in 1994. Moisture buildup underneath the building edge foundation weakened the underlying soils which eventually lost their load bearing capacity. A yellowcake thickener tank leg then punctured the concrete and fell over causing the contents to spill inside and outside of the building. In response to that incident the surface drainages around both plant sites, Irigaray and Christensen Ranch, were modified to keep water away from building foundations. More recently, deteriorating concrete building slabs have been replaced or repaired in order to keep spills or wash down water within the plants from seeping underneath the slabs. In the case of Irigaray, most of the uranium recovery circuits and attendant tanks have been removed (leaving only elution, precipitation, and drying). This Irigaray decommissioning activity has removed various potential sources of seepage that could impact the soils underlying the floor and foundation.

and Christensen Ranch that has been performed to date consisting of the following:

- Gamma exposure rate surveys will be performed in areas which are accessible to personnel and which could potentially exceed the criteria for designation and posting as radiation areas. Based on operating experience, these areas include, but are not necessarily limited to, the filtration equipment, reverse osmosis units, and columns shown in Figures 5.2 and 5.3.Because these areas may vary depending upon operational activities, no permanent gamma monitoring locations have been specified.

- The consistency and extent of the survey data available since 1987 indicates that the frequency of surveys can be continued on a quarterly basis for routine surveys and monthly for areas over the 2.0 mRem/hr administrative limit without a reduction in radiological safety. COGEMA believes that this survey frequency schedule is frequent enough to detect changes in conditions. Additionally, these frequencies are more stringent than the schedule recommended in USNRC Regulatory Guide 8.30, "Health Physics Surveys in Uranium Mills". Changes which could affect gamma exposure radiological conditions would be reviewed by the Safety and Environmental Review Panel (SERP) under the Performance Based License. The SERP would recommend any additional monitoring requirements.

Gamma exposure rate surveys will be performed in accordance with the guidance contained in USNRC Regulatory Guide 8.30 and under instructions provided in a Standard Operating Procedure. Gamma survey instruments will be checked each day of use in accordance with SUA-1341.


SULFURIC ACID CONCRETE PAD
SULFURIC ACID TANK (T-04)
WAREHOUSE BUILDING
10'X8' OHD
10'X16' OHD
MCC MOTOR CONTROL
1ST FLOOR: MCC, LAB, POTABLE WATER, W/D
2ND FLOOR: OFFICES, LOCKER ROOM
INJ PUMP P-02A
INJ PUMP P-02B
INJECTION SOLUTION PUMP
REC PUMP P-01A&B
RECOVERY SOLUTION PUMP
SAND FILTER (SF-01)
SAND FILTER (SF-02)
SAND FILTER (SF-03)
SAND FILTER (SF-04)
AIR COMPRESSOR
16'X16' OHD
PROPOSED EXHAUST FAN
STAIRS
ION EXCHANGE VESSEL (IX-08)
ION EXCHANGE VESSEL (IX-07)
ION EXCHANGE VESSEL (IX-06)
ION EXCHANGE VESSEL (IX-05)
ION EXCHANGE VESSEL (IX-04)
ION EXCHANGE VESSEL (IX-03)
ION EXCHANGE VESSEL (IX-02)
ION EXCHANGE VESSEL (IX-01)
TRUCK BAY FOR RESIN TRANSFER
2ND FLOOR: LUNCH ROOM
CONTROL ROOM
REST ROOM
PLC CABINET
INJECTION FLUID BAG FILTER VESSELS (F-02A thru D)
BICARB MAKEUP PUMP (P-05A)
SODA ASH INJ. PUMP (P-05B)
DEGAS COLUMN (C-01)
BICARB MIX TANK (T-01)
BICARB MAKEUP TANK (T-02)
BACKWASH/RESIN TRANSFER PUMP (P-03)
BACKWASH/RESIN TRANSFER FILTER (F-03)
RO UNIT #4
RO WASH TANKS
SODA ASH SILO (S-01)
RESTORATION PUMPS
RO UNIT #6
RO UNIT #5
IX-1 54" S/S
IX-2 54" S/S
RO UNIT #9
BAG FILTERS
MCC
SODIUM SULFIDE 6'HT
SODIUM HYDROXIDE 6'HT
TRUCK BAY FOR RESIN TRANSFER
16'X14' OHD
Legend:
RADON DAUGHTER SURVEY LOCATIONS
RADON DAUGHTER SURVEY LOCATIONS
AIR PARTICULATE SURVEY LOCATIONS
ALPHA SWIPE SURVEY LOCATIONS
EXTERNAL EXHAUST VENT
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SCALE: 1" = 20'
uranium one
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Christensen Ranch Satellite
Radiological Monitoring Locations
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Rev. No.
Description
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Initial Draft
09/16/10
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1
Bicarb Tank Locations Updated
10/27/10
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Project Name:
WILLOW CREEK
Figure #
5.2
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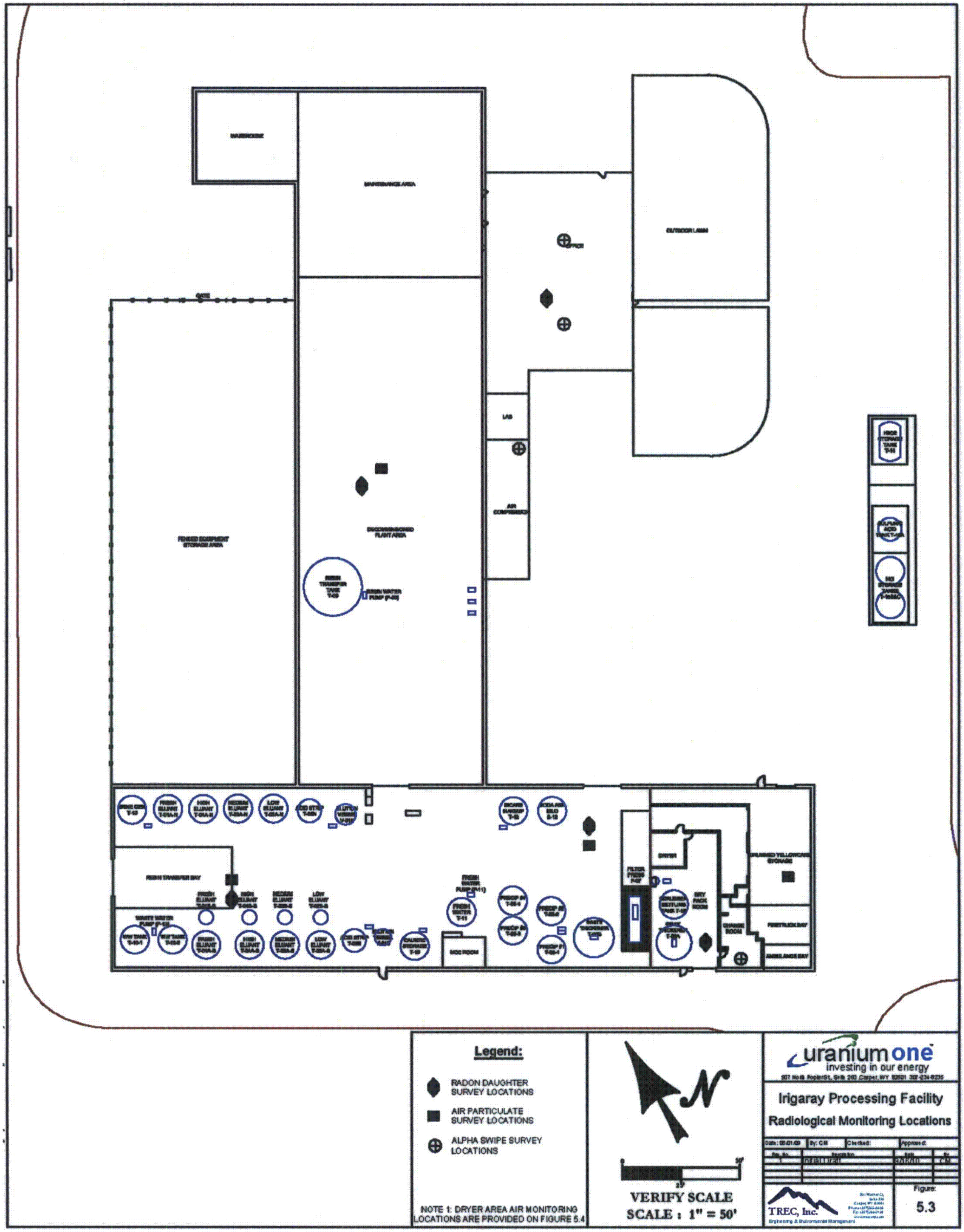
1


Legend:
RADON DAUGHTER SURVEY LOCATIONS
AIR PARTICULATE SURVEY LOCATIONS
ALPHA SWIPE SURVEY LOCATIONS
NOTE 1: DRYER AREA AIR MONITORING LOCATIONS ARE PROVIDED ON FIGURE 5.4
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25'
VERIFY SCALE
SCALE : 1" = 50'
uranium one
investing in our energy
Irigaray Processing Facility
Radiological Monitoring Locations
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TREC, Inc.
Figure:
5.3

5.7.2.2 Personnel Dosimetry

Program Description

Since 1987, all employees who were assigned full-time to the Irigaray and Christensen Ranch facilities were issued Thermoluminescent Dosimeters (TLD) or Optically Stimulated Luminescent (OSL) dosimeters for determination of external gamma exposure. TLDs and OSLs have been provided by TMA Eberline which is accredited by NVLAP of the US Department of Commerce as required in 10 CFR § 20.1501. The dosimeters were exchanged and read on a quarterly basis.

Historical Program Results

Table 5.2 contains a summary of the average and maximum annual exposure for all personnel at the Irigaray and Christensen Ranch facilities since 1995. As can be seen in Table 5.2, the average annual exposures at Irigaray and Christensen Ranch are well below 1% of the regulatory limits. The maximum annual individual exposures are well below 10% of the regulatory limit and indicate that exposures at Irigaray and Christensen Ranch are maintained ALARA.

Proposed Personnel Dosimetry Program

10 CFR §20.1502 (a)(1) requires exposure monitoring for "Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits in §20.1201 (a)". Ten percent of the dose limit would correspond to a Deep Dose Equivalent (DDE) of 0.500 rem. Maximum individual annual exposures at the Irigaray and Christensen Ranch facilities since 1987 have been well below 10 percent of the limit. COGEMA believes that it is not likely that any employee will exceed 10 percent of the regulatory limit. Although monitoring of external exposure may not be required in accordance with §20.1201(a), COGEMA proposes to continue to issue TLDs to process employees (including laboratory personnel when in production) and exchange them on a quarterly basis. COGEMA discontinued dosimeter issuance to employees in other work categories at the time of the last license renewal approval by the NRC.

Results from dosimeter monitoring will be used to determine individual Deep Dose Equivalent (DDE) for use in determining Total Effective Dose Equivalent (TEDE) in accordance with the methods described in Regulatory Guide 8.30.

5.7.3 IN-PLANT AIRBORNE RADIATION MONITORING PROGRAM

5.7.3.1 In-Plant Airborne Uranium Particulate Monitoring

Program Description

Monitoring for airborne uranium is performed routinely at Irigaray and Christensen Ranch through the use of area sampling and breathing zone sampling. The monitoring programs are described below.

Area Sampling

Area samples are collected monthly at the specified sample locations. Samples are collected using a glass fiber filter and a regulated air sampler such as an Eberline RAS-1 or equivalent. Sample volume is adequate to achieve the lower limits of detection (LLD) for uranium in air. Samplers are calibrated annually or at the frequency specified by the equipment manufacturer, whichever is more frequent, using a digital mass flowmeter.

Measurement of airborne uranium is performed by gross alpha counting of the air filters using an alpha scaler such as a Ludlum Model 2000 with a Ludlum 43-10 detector or an Eberline SAC-4. The current efficiency of both of these instruments is 35%. Counting time is adjusted to assure at least a lower limit of detection is 5E-11 µCi/ml (ten percent of the DAC in Table 5.6 below). Generally, the Derived Air Concentration (DAC) for soluble (D classification) natural uranium of 5 E-10 µCi/ml from appendix B to 10 CFR 20 is applied to the gross alpha counting results. This is a conservative method because the gross alpha results include Uranium-238 and several of its daughters (notably Ra-226 and Th-230) which are alpha emitters. An action level of 25% of the DAC for soluble natural uranium is established at the Irigaray and Christensen Ranch facilities. If an airborne uranium sample exceeds 25% of the DAC, an investigation is performed and sampling frequency is increased to weekly. The investigation and any corrective action taken are documented. Sample locations for the Christensen Ranch facility are shown on Figure 5.2; the Irigaray general plant sample locations are shown on Figure 5.3.

Continuous sampling in the dry-pack area is performed when the dryer is in operation. The air filters are collected weekly, as a minimum, for analysis. Sample locations for the dry-pack area are illustrated on Figure 5.4. Results are used to determine employee time weighted exposures (TWE). In the case of the dryer area air samples, a calculated DAC of 4.7E-10 uCi/ml Unat is utilized in personnel exposure calculation. The calculated DAC reflects the actual solubility of the dried yellowcake product. The product is composed of 85% Class D Unat and 15% Class W Unat. The evaluation process for the derivation of the calculated dried yellowcake DAC is discussed in Section 5.7.3.1 (pages 5-29 to 5-33) of the January 5, 1996 SUA-1341 license renewal application and is duplicated here:

Exposures to airborne uranium will be compared to the DAC for the natural uranium solubility classification (D, W or Y) that is appropriate for the material. Irigaray produces a very pure hydrogen peroxide precipitate of uranium ($UO_4 \cdot 2\ H_2O$). However, the solubility classifications for natural uranium in Appendix B of 10 CFR 20.1001 - 20.2401 are based on other uranium products such as UO_2, UF_6, U_3O_8, etc. (see uranium-230). Additionally, in Regulatory Guide 8.22 (Bioassay at Uranium Mills, 1988) the NRC makes a distinction between uranium solubility based strictly upon the temperature that the uranium is dried. Essentially, any material that is not dried or is dried at low temperature (defined as less than 400°C, or 752°F) is considered by NRC as soluble (Class D or W).

Product dried at a temperature greater than 400°C, as in the case of our product, is defined as high-fired or calcined yellowcake and is classified as insoluble U_3O_8 (Class Y). Even after drying at 540°C (1000° F), the final product has been analyzed by x-ray diffraction and found to be 79% $UO_4 \cdot 2H_2O$, 15% UO_3, and 3% $CaCO_3$.

Because of the uncertainty of what solubility classification and corresponding DAC to use for the dried $UO_4 \cdot 2H_2O$ product, COGEMA, in conjunction with Radiation Safety Engineering, Inc. (RSEI, out of Chandler, Arizona), conducted solubility profile testing of the uranium dusts in the Irigaray process plant during the summer of 1995. Breathing zone samples were obtained from all yellowcake process areas within the plant and submitted to RSEI for the solubility testing. The dissolution rate of the uranium on the air samples was then determined by RSEI over the next 28 days in a simulated lung solution (simulant of the extracellular airway lining fluid), or Gamble's solution. In summary, the results of the testing showed that airborne uranium in the wet process area (filter press) of the plant was highly soluble, with 97% of the uranium dissolving in a 0.3 day half-time, indicative of 97% Class D and 3% Class W material. The airborne uranium in the dryer drum loading and packaging area (where employees have the most potential for exposure) was also highly soluble, with 97% Class D material, and 3% Class W. Air in the control room outside of the dryer enclosure appeared to be a mixture of natural uranium in outside air (due to negative pressure on the dryer) and our dried product, showing 77% Class D and 23% Class W. Exhaust from the drier stack was slightly more insoluble, with approximately 47% Class D and 53% Class W material. No Class Y material (U_3O_8) was observed in any of the samples.

A summary of the solubility testing results is provided in Table 5.2a. For all areas associated with the dryer (drum packing room, furnace room and exterior control room), an average solubility classification of 85% Class D and 15% Class W could be conservatively calculated. The filter press, a wet uranium process, is obviously 100% Class D. For the stack effluent to unrestricted areas, the classification is essentially 50% Class D and 50% Class W. Because of these results, COGEMA will use the solubility classification and corresponding ALI and DAC provided in Table 5.6 when calculating employee exposure calculations, in lieu of the values currently provided in 10 CFR 20, Appendix B, Table 1. Additionally, a new effluent concentration is provided for use in lieu of the Appendix B, Table 2 air concentration.

TABLE 5.2a

RESULTS OF URANIUM SOLUBILITY TESTING
RADIATION SAFETY ENGINEERING, INC.

Sample Identification	Uranium Activity (Bq)	Sample Volume (L)	Airborne Concentration (Bq/m^3)	Fraction in ICRP Class D	Class W	Class Y
Stack 1	5.19	393	13.21	44	56	0
Stack 2	6.19	405	15.29	50	50	0
Average Stack	5.69	399	14.25	47	53	0
Control Room 1	0.227	88,020	0.0026	77	23	0
Control Room 2	0.806	78,930	0.010	76	24	0
Average Control	0.517	83,475	0.0064	77	23	0
Drum-Pack Room 1	12.35	1,269	9.73	98	2	0
Drum-Pack Room 2	1.47	6,675	0.220	97	3	0
Average Drum	6.91	3,972	4.98	97	3	0
Furnace Room 1	6.11	3,900	1.57	72	28	0
Furnace Room 2	21.83	1,284	17.00	91	9	0
Filter Press 1	0.669	7,170	0.0933	94	6	0
Filter Press 2	0.410	3,000	0.137	100	0	0
Average Filter	0.540	5,085	0.115	97	3	0

Breathing Zone Sampling

Breathing zone sampling is performed to determine individual exposure to airborne uranium during certain operations. Sampling is performed with an MSA pump or equivalent. The air filters are counted and compared to the DAC using the same method described for area sampling. Air samplers are calibrated at least every six months.

Historical Program Results

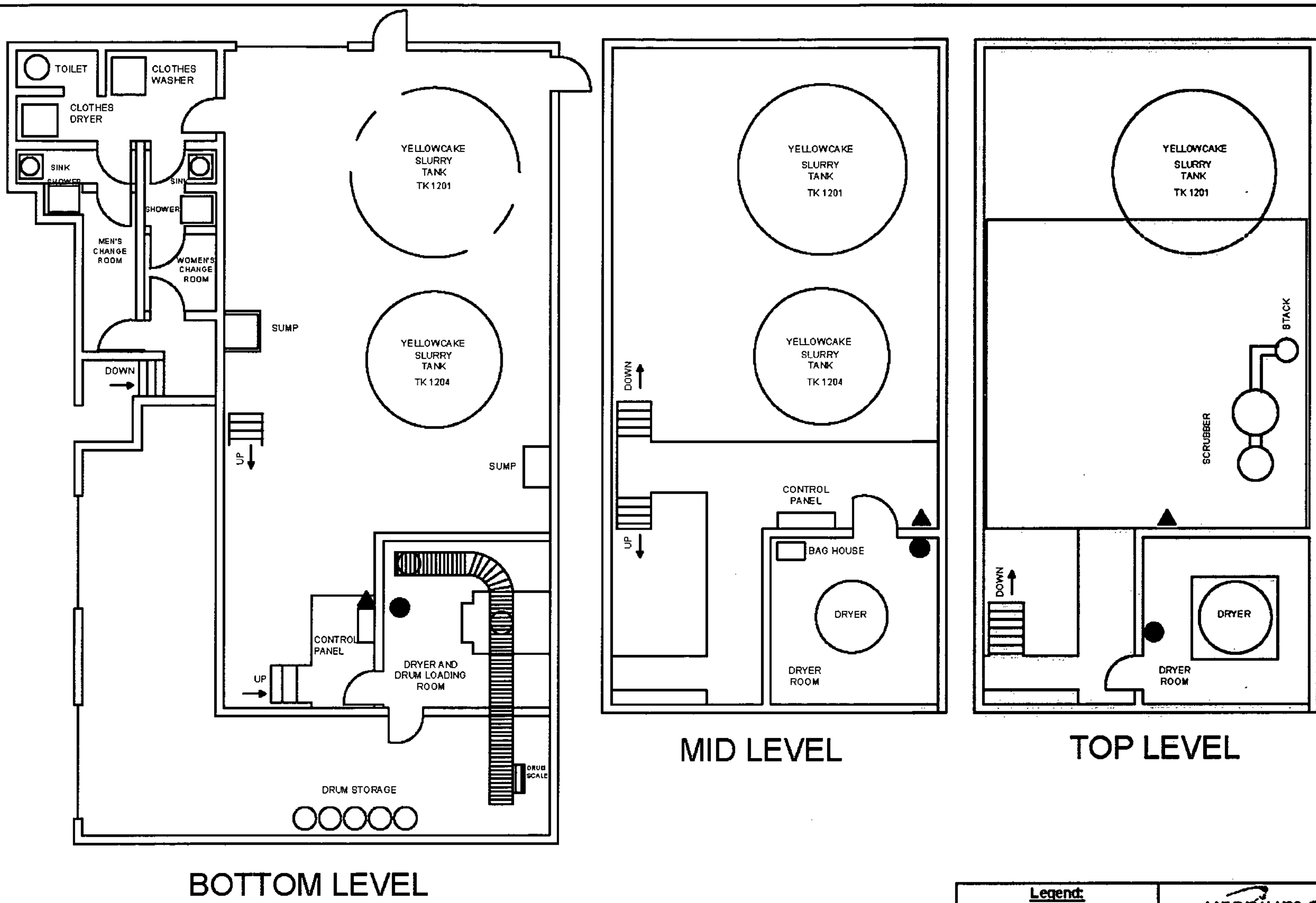
Table 5.3 provides the results of monitoring for airborne uranium from the period of 1995 through 2007. Average and maximum airborne gross alpha activity for this period shows concentrations of uranium which were very low percentages of the DAC. The data demonstrate that engineering controls were effective. The modest increase in airborne uranium in the last few years likely relates to various decommissioning activities being conducted at the time.

Proposed In-Plant Airborne Uranium Monitoring Program

COGEMA proposes to continue the same airborne uranium monitoring program at Irigaray and Christensen Ranch that has been performed to date.

Airborne sampling will be performed on a monthly basis and will implement the guidance contained in USNRC Regulatory Guide 8.25, "Air Sampling in the Workplace." COGEMA requires continuous sampling when the dryer is in operation. Sample frequency will return to monthly grab samples if the dryer is not in operation and final samples taken outside the furnace/drum loading rooms are less than 10% of the DAC for natural uranium.

Sampler calibration will be performed annually or at the frequency recommended by the manufacturer, whichever is more frequent, as required in SUA-1341.



Legend:

AIR SAMPLE LOCATIONS

▲ OUTSIDE DRYER AND DRUM LOADING ROOM

● INSIDE DRYER AND DRUM LOADING ROOM

uranium one
investing in our energy

Irigaray Dry-Pack Level
Air Sample Locations

TREC, Inc.

Figure: 5.4

5.7.3.2 In-Plant Radon Daughter Surveys

Program Description

Since 1987, Radon daughter surveys have been conducted in the operating areas of the Irigaray and Christensen Ranch (since 1989) facilities on a monthly basis at the specified locations. Samples are collected with a low volume air pump and then analyzed with an alpha scaler using the Modified Kusnetz method described in ANSI-N13.8-1973. Air samplers are calibrated annually or at the frequency recommended by the manufacturer, whichever is more frequent, as required in SUA-1341.

Results of radon daughter sampling are expressed in Working Levels (WL) where one WL is defined as any combination of short-lived Rn-222 daughters in one liter of air, without regard to equilibrium, that emit 1.3 E5 MeV of alpha energy. The DAC limit from Appendix B to 10 CFR 20 for Rn-222 with daughters present is 0.33 WL. COGEMA has established an action level of 25% of the DAC or 0.08 WL. Radon daughter results in excess of the action level resulted in an investigation of the cause and an increase in the sampling frequency to weekly until the radon daughter levels do not exceed the action level.

Historical Program Results

Table 5.4 provides the results of monitoring for radon daughters from the period of 1995 through 2007. The annual average and maximum values are presented. The data show that the average radon daughter activity concentration at Irigaray and Christensen Ranch was generally less than 5% of the regulatory limit.

Proposed In-Plant Radon Daughter Monitoring Program

COGEMA proposes to continue the same radon daughter monitoring program at Irigaray and Christensen Ranch that has been performed to date, utilizing the locations shown in Figure 5.2 and Figure 5.3.

Routine radon daughter monitoring will be performed on a monthly basis. Air sampler calibration will be performed annually or at the frequency recommended by the manufacturer, whichever is more frequent, as required in SUA-1341

See Section 4.1.1 for a discussion of radon progeny in wellfield header houses.

Proposed Airborne Uranium Exposure Monitoring Program

COGEMA proposes to continue the same internal airborne uranium exposure calculation methods at Irigaray and Christensen Ranch that have been used to date. Exposures to airborne uranium will be compared to the DAC for the natural uranium solubility classification (D, or 85%D/15%W) that is appropriate for the material (see Table 5.6).

Prenatal and Fetal Exposure

10 CFR §20.1208 requires that licensees ensure that the dose to an embryo/fetus during the entire pregnancy from occupational exposure of a declared pregnant woman does not exceed 0.5 rem (500 mrem). Licensees are also required to make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman that would satisfy the 0.5 rem limit. The dose to the embryo/fetus is calculated as the sum of (1) the deep-dose equivalent to the declared pregnant woman, and (2) the dose to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

The dose equivalent to the embryo/fetus is determined by the monitoring of the declared pregnant woman. 10 CFR §20.1502(a)(2) requires monitoring the exposure of a declared pregnant woman when the external dose to the embryo/fetus is likely to exceed a dose from external sources in excess of 10 percent of the embryo/fetus dose limit (i.e., 0.05 rem/yr). 10 CFR 20.1502(b)(2) also requires that the licensee monitor the occupational intakes of radioactive material for the declared pregnant woman if her intake is likely to exceed a committed effective dose equivalent in excess of 0.05 rem/yr. Based on this 0.05 rem threshold, the dose to the embryo/fetus must be determined if the intake is likely to exceed 1 percent of ALI during the entire period of gestation.

Prior to declaration of pregnancy, the woman may not have been subject to monitoring based on the conditions specified in 10 CFR §20.1502. In this case, Uranium One will estimate the exposure during the period monitoring was not provided, using any combination of surveys or other available data (e.g., air monitoring, area monitoring, and bioassay). Exposure calculations will be performed as recommended in USNRC Regulatory Guide 8.36 (USNRC, 1992).

External Dose to the Embryo/Fetus -- The deep-dose equivalent to the declared pregnant woman during the gestation period will be taken as the external dose for the embryo/fetus. The determination of external dose will consider all occupational exposures of the declared pregnant woman since the estimated date of conception and will be based on the methods discussed in Section 5.7.2.2.

Internal Dose to the Embryo/Fetus -- The internal dose to the embryo/fetus will consider the exposure to the embryo/fetus from radionuclides in the declared pregnant woman and in the embryo/fetus. The dose to the embryo/fetus will include the contribution from any radionuclides in the declared pregnant woman (body burden) from occupational intakes occurring prior to conception. The intake for the declared pregnant woman will be determined as discussed in Sections 5.7.4.1 and 5.7.4.2.

through 2007 was 48 DAC-hours, or 2.4% of the annual limit.

Proposed Radon Daughter Exposure Monitoring Program

COGEMA proposes to continue internal radon daughter exposure calculation methods at Irigaray and Christensen Ranch that have been used to date. Exposures to radon daughters will be compared to the DAC for radon daughters from appendix B of 10 CFR 20 (0.33 WL).

5.7.4.3 Total Effective Dose Equivalent

Table 5.8 contains the Total Effective Dose Equivalent (TEDE) results for 1995 through 2007 for Irigaray and Christensen Ranch. 1999 was the last full year of production. As can be seen from the data the average dose was generally less than 2% of the regulatory limit of 5 Rem.

TABLE 5.8
ANNUAL TOTAL EFFECTIVE DOSE EQUIVALENT SUMMARY

Exposure Monitoring Period	Max. # of Employees	Average Exposure (rems)	Maximum Exposure (rems)
1995	50	0.11	0.83
1996	65	0.13	0.43
1997	53	0.26	0.28
1998	45	0.05	0.17
1999	40	0.14	0.18
2000	31	0.04	0.13
2001	36	0.04	0.12
2002	20	0.03	0.063
2003	22	0.007	0.03
2004	24	0.007	0.02
2005	15	0.01	0.02
2006	12	0.008	0.02
2007	12	0.008	0.02

5.7.4.4 Respiratory Protection Program

Respiratory protective equipment has been supplied by COGEMA for activities where engineering controls may not be adequate to maintain acceptable levels of airborne radioactive materials or toxic materials. Use of respiratory equipment at Irigaray and Christensen Ranch is governed by the respiratory protection program, which has been designed to implement the guidance contained in USNRC Regulatory Guide 8.15, "Acceptable Programs For Respiratory Protection". The respirator program is administered by the Radiation Safety Officer (RSO).

5.7.5 BIOASSAY PROGRAM

Program Description

COGEMA has implemented a urinalysis bioassay program at the Irigaray and Christensen Ranch facilities that meets the guidelines contained in USNRC Regulatory Guide 8.22, "Bioassay at Uranium Mills." The primary purpose of the program is to detect uranium intake in employees who were regularly exposed to uranium. The bioassay program consists of the following elements:

1. Prior to assignment to either facility, all new employees are required to submit a baseline urinalysis sample.

2. During operations, urine samples are collected from process area workers on a monthly frequency and analyzed by an outside analytical laboratory for uranium content. Blank and spiked samples are also submitted to the laboratory with monthly employee samples as part of the Quality Assurance program. The measurement sensitivity for the analytical laboratory is 5 μg/l.

3. Action levels for urinalysis are established based upon Table 1 in USNRC Regulatory Guide 8.22, "Bioassay at Uranium Mills."

An average of 20 employees were monitored monthly. Two samples exceeded 15 ug/l U; both were attributed to sample bottle contamination.

2001-2007

An annual average of 11 employees were monitored monthly. Over that seven year span only two samples exceeded 15 ug/l U. On one occasion the worker had been washing down a yellowcake slurry trailer delivering material from COGEMA's Texas operation. In the other case the elevated reading was traced to sample bottle contamination.

Bioassay Quality Assurance Program Description and Historical Results

Elements of the Quality Assurance requirements for the Bioassay Program are based upon the guidelines contained in USNRC Regulatory Guide 8.22, "Bioassay in Uranium Mills". These elements include the following:

1. Each batch of samples submitted to the analytical laboratory is accompanied by two blind control samples. The control samples are from persons that had not been occupationally exposed and are spiked to a uranium concentration of 10 to 20 µg/l and 40 to 60 µg/l. The results of analysis for these samples are required to be within ± 30% of the spiked value. COGEMA has tracked the results of the blind spike analysis since 1987. All analytical results have fallen within the acceptable range.

2. The analytical laboratory spikes 10 to 30% of all samples received with known concentrations of uranium and the recovery fraction determined. Results are reported to COGEMA. All results have been within ± 30%.

Proposed Bioassay Program

COGEMA proposes to continue to implement the Bioassay Program described in this section in accordance with the guidance contained in USNRC Regulatory Guide 8.22, "Bioassay in Uranium Mills".

5.7.6 CONTAMINATION CONTROL PROGRAM

COGEMA's contamination control program at Irigaray and Christensen Ranch consists of the following elements:

Surveys For Surface Contamination

COGEMA performs surveys for surface contamination in operating and clean areas of the Irigaray and Christensen Ranch facilities in accordance with the guidelines contained in USNRC Regulatory Guide 8.30, "Health Physics Surveys in Uranium Mills". Surveys for performed during the period (not summarized here) show that the program is effective.

Proposed Contamination Control Program

COGEMA proposes to implement the same Contamination Control program which is currently in use. The program has proven to be effective at controlling contamination of personnel and clean areas. The program will be implemented in accordance with Standard Operating Procedures that describe instrument calibration and check requirements, surveys for removable contamination, surveys for alpha and beta/gamma contamination of items prior to release from restricted areas, and personnel monitoring. Surveys for beta contamination will be performed consistent with the recommendations of NRC Regulatory Guide 8.30, May, 2002; beta surveys will be conducted of specific operations that would involve the handling of large quantities of aged yellowcake. On a routine basis, an annual beta survey will be conducted in areas that would typically be subject to residual uranium concentrate contamination, specifically, the precipitation, drying, and packaging areas of the Irigaray plant. Equipment to be released from the restricted area for unrestricted use that is subject to potential beta contamination (from the aforementioned process areas) will be surveyed for beta contamination.

5.7.7 MONITORING PROGRAM SUMMARY

Section 5.7 of this renewal application has reviewed the radiological monitoring data produced at Irigaray and Christensen Ranch for the years of 1995 through 2007. Each section discussed the historical results of the data with an emphasis on regulatory compliance and trend analysis to determine whether COGEMA's ALARA goals are being met. The existing program has met the ALARA goals, and COGEMA proposes the continuation of the existing radiation safety monitoring program. Table 5.10 provides a tabular summary of the current program as well as the regulatory guidance provided in USNRC Regulatory Guide 8.30, "Health Physics Surveys In Uranium Mills".

5.8 ENVIRONMENTAL MONITORING PROGRAMS

5.8.1 AIRBORNE EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAMS

Program Description and Historical Monitoring Results

The airborne effluent and environmental monitoring programs were designed to monitor the release of airborne radioactive effluents from the Irigaray and Christensen Ranch facilities. To evaluate the effectiveness of the effluent control systems, the results of the monitoring program were compared with the background levels and with regulatory limits.

Restricted Areas

COGEMA has established restricted areas to control radioactive materials. At the Christensen Ranch facility, the plant building, ponds, and the wellfield module (header) buildings are designated as restricted areas with appropriate signs in accordance with 10 CFR 20.1902(e) and with the words "ANY MATERIALS WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL." At Irigaray the designated restricted areas consist of the process portion of the plant building, approximately two thirds of the fenced storage area adjacent to the plant building, and the ponds. Signs are posted for these areas as described above. Temporary restricted areas may be established as required for areas at both sites which contain radioactive material.

Radon

The radon gas effluent released to the environment was monitored at five locations at the Irigaray facility (IR-1, IR-3, IR-4, IR-5 and IR-6) and at four locations at the Christensen Ranch facility (AS-1, AS-5a, AS-5b and AS-6) when production was ongoing. Monitoring was performed using Track-Etch radon cups provided by Landauer Corporation. The cups were exchanged on a quarterly basis. In addition to the manufacturer's Quality Assurance program, COGEMA exposed one duplicate radon Track Etch cup per quarter. Table 5.11 contains the results of radon monitoring for the Irigaray facility since 1995. Table 5.12 contains similar data for the Christensen Ranch facility. Note that environmental monitoring was suspended in part after 2001 since the project had entered restoration/decommissioning. Table 5.13 presents annual calculated radon release estimates for both sites for the period 1995 – 2000, the last production run prior to entering exclusively into restoration. Table 5.13 summarizes the information presented in the semiannual effluent reports over that time period. Calculation of the semiannual radon release was suspended after year 2000.

TABLE 5.12
CHRISTENSEN ENVIRONMENTAL RADON GAS MONITORING SUMMARY

Monitoring Period		Radon Level in pCi/l			
		Monitoring Site[1]			
Year	Qtr.	AS-1	AS-5A	AS-5B	AS-6
1995	1	1.0	2.9	1.1	0.9
	2	1.2	1.1	1.2	6.2
	3	1.4	1.3	1.3	1.7
	4	1.2	1.0	1.5	1.4
1996	1	ND	0.8	1.0	1.0
	2	2.7	2.5	2.9	2.6
	3	2.3	2.2	2.3	2.6
	4	2.9	2.2	2.4	2.6
1997	1	0.8	1.0	1.1	0.4
	2	1.6	1.3	1.4	1.3
	3	1.2	0.9	0.7	0.8
	4	1.5	1.0	1.5	1.2
1998	1	0.7	1.3	1.3	1.0
	2	ND	1.0	0.7	0.3
	3	0.9	1.5	0.7	0.8
	4	0.7	0.7	0.6	0.8
1999	1	1.0	1.1	1.1	ND
	2	0.9	1.1	0.4	0.9
	3	1.0	1.1	1.2	1.3
	4	1.2	2.0	1.9	2.5
2000	1	3.3	2.4	2.4	2.2
	2	1.0	1.1	0.9	0.8
	3	1.0	0.9	0.8	1.7
	4	1.3	1.7	1.2	1.7
2001	1	1.7	1.8	2.6	1.5
	2	1.7	2.7	3.0	1.3
	3	1.1	2.1	2.5	1.0
	4	0.8	1.9	2.7	1.0
1995-2001	Average	1.4	1.5	1.5	1.5

[1] AS-1 is at Table Mountain (background).
AS-5A is upwind of the restricted area.
AS-5B is downwind of the restricted area.
AS-6 is at the nearest residence (Christensen Ranch).

ND = No Data.

Soil and Vegetation

Soil and vegetation samples from Irigaray and Christensen Ranch were collected on an annual basis at the nine air quality sampling station locations. Sampling was normally performed in July. The samples were collected at the five air quality monitoring sites at Irigaray (IR-1, IR-3, IR-4, IR-5 and IR-6) and at the four air quality monitoring sites at Christensen Ranch (AS-1, AS-5a, AS-5b and AS-6) using the following procedures:

- Soil A minimum of two pounds of soil was collected within a ten square foot section surrounding the sample point. The sample consisted of a composite of five to ten individual locations where the sample was taken from the top two inches of the surface. Soil was analyzed for natural uranium, radium-226, thorium-230 and lead-210. The results of annual soil sampling at the Irigaray and Christensen Ranch facilities are presented in Tables 5.15 and 5.16, respectively. No trends are apparent. Note that the annual environmental soil sampling was suspended after the project went exclusively into restoration.

- Vegetation A minimum of one pound of vegetation was collected at each site. The materials collected were primarily the seed/flower head and leafy portions of grasses and forbs along with young shoots of shrubs. Vegetation was analyzed for natural uranium, radium-226, thorium-230 and lead-210. The results of annual vegetation sampling at the Irigaray and Christensen Ranch facilities are presented in Tables 5.17 and 5.18, respectively. No trends are apparent. Note that annual environmental vegetation sampling was suspended after the project went exclusively into restoration.

Direct Radiation

Environmental gamma radiation levels were monitored continuously at the nine air quality monitoring stations (see Figure 5.5)." Gamma radiation was monitored through the use of thermoluminescent dosimeters (TLDs) obtained from Eberline Instrument Corporation. TLDs were exchanged on a quarterly basis. In addition to the Quality Assurance performed by Eberline, COGEMA provided one blind duplicate TLD per quarter. Results of the annual gamma radiation monitoring are shown in Tables 5.19 and 5.20. No trends are apparent.

5.8.2 GROUNDWATER AND SURFACE WATER MONITORING PROGRAM

Program Description

During past operations at the Irigaray and Christensen Ranch facilities, a detailed water sampling program was conducted to identify any potential impacts to water resources of the area. COGEMA's operational water monitoring program included the evaluation of groundwater on a regional basis, groundwater within individual well fields within the permit or licensed area and surface water on a regional and site specific basis. These programs are described in more detail following.

5.8.2.1 Regional Groundwater Monitoring

Historical Results

Five stock watering and domestic water wells are located within two kilometers of the Christensen Ranch mining area and one well is located near Irigaray that have been routinely sampled. Baseline data from these wells were collected prior to mining for reference to operational sampling results. Grab samples of groundwater from these wells were collected on a quarterly frequency when the wells were operational, with the exception of Willow No. 2 at Irigaray, where there is only a semi-annual sampling requirement. Groundwater monitoring results were submitted in the semi-annual activity and monitoring reports submitted to NRC. A summary table of regional groundwater monitoring results for Irigaray and Christensen Ranch since 1995 can be found in Table 5.23. As can be seen from Table 5.23, no variances are seen which can be attributed to the mining operations.

Proposed Program

COGEMA proposes to institute the same regional groundwater monitoring program during future operations. Table 5.24 summarizes the proposed regional groundwater sampling program.

Table 5.23
REGIONAL GROUNDWATER MONITORING RESULTS

Location	Year	Quarters	U (μCi/ml)	Ra_{226} (μCi/ml)	Th_{230} (μCi/ml)	Pb_{210} (μCi/ml)	Po_{210} (μCi/ml)
Willow No. 2 (Irigaray)	1995	1 & 2	<2.0E-10	<2.0E-10	<2.0E-10	1.90E-09	<1.0E-9
		3 & 4	<2.0E-10	<2.0E-10	<2.0E-10	1.40E-09	<1.0E-9
	1996	1 & 2	<6.8E-10	<9.0E-10	<1.5E-9	<6.3E-9	<2.0E-9
		3 & 4	<6.8E-10	<6.0E-10	<7.0E-10	<7.6E-9	<2.2E-9
	1997	1 & 2	<7.0E-10	<1.5E-09	2.80E-09	<5.6E-09	<4.4E-09
		3 & 4	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09	<1.0E-09
	1998	1 & 2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3 & 4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	1999	1 & 2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3 & 4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1 & 2	3.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3 & 4	3.00E-10	1.10E-09	<2.0E-10	<1.0E-09	<1.0E-09
	2001	1 & 2	<0.2E-09	<2.0E-10	<0.2E-09	<1.0E-09	<1.0E-09
		3 & 4	<0.2E-09	<2.0E-10	<0.2E-09	<1.0E-09	<1.0E-09
	2002	---	<0.2E-09	<2.0E-10	<0.2E-09	<2.7E-09	<2.7E-09
	2003	---	<2.0E-10	7.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2004	---	<0.2E-09	3.00E-10	2.00E-10	<2.7E-09	<2.7E-09
	2005	---	<2.0E-10	<2.0E-10	<2.0E-10	4.80E-09	<1.0E-09
	2006	---	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	<2.0E-10	<1.0E-9	<2.0E-10	<1.0E-09	<1.0E-09
Christensen Ranch No. 3	1995	1	1.20E-08	1.50E-09	<2.0E-10	1.90E-09	<1.0E-09
		2	9.50E-09	3.20E-09	6.00E-10	1.70E-09	8.00E-10
		3	1.50E-08	1.10E-09	<2.0E-10	5.60E-09	<1.0E-09
		4	1.80E-08	1.50E-09	<2.0E-10	<1.0E-09	6.00E-10
	1996	1	1.60E-08	1.60E-09	<1.4E-9	<6.3E-9	<2.6E-9
		2	1.60E-08	<1.8E-9	<1.4E-9	<6.0E-9	<2.3E-9
		3	1.40E-09	1.70E-09	<7.0E-10	<7.6E-9	<2.9E-9
		4	1.50E-08	1.60E-09	<5.0E-10	8.00E-09	<1.7E-9
	1997	1	1.60E-08	1.10E-09	1.50E-09	<5.3E-09	<1.5E-09
		2	<7.0E-10	2.20E-09	1.10E-09	9.60E-09	<2.4E-09
		3	9.10E-09	<1.5E-9	<1.3E-9	<5.6E-09	2.70E-09
		4	1.60E-08	1.20E-09	<2.0E-10	<1.0E-09	6.50E-09
	1998	1	2.40E-08	1.40E-09	<2.0E-10	6.80E-09	5.50E-09
		2	1.70E-08	1.60E-09	<2.0E-10	4.50E-09	4.90E-09
		3	1.70E-08	1.70E-09	<2.0E-10	<1.0E-09	2.40E-09
		4	1.70E-08	1.10E-09	<2.0E-10	<1.0E-09	<1.0E-09
	1999	1	1.60E-08	9.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	1.40E-08	1.10E-09	<2.0E-10	<1.0E-09	5.20E-09
		3	1.77E-08	1.00E-09	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.60E-08	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1	1.39E-08	9.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	1.81E-08	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	1.70E-08	1.10E-09	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.20E-08	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09

Table 5.23
REGIONAL GROUNDWATER MONITORING RESULTS

Location	Year	Quarters	U (μCi/ml)	Ra_{226} (μCi/ml)	Th_{230} (μCi/ml)	Pb_{210} (μCi/ml)	Po_{210} (μCi/ml)
	2001	1	1.69E-08	1.60E-09	<2.0E-10	<1.0E-09	<1.0E-09
		2	1.49E-08	1.30E-09	<2.0E-10	<1.0E-09	<1.0E-09
		3	2.29E-08	2.20E-09	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.88E-08	7.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2002	---	1.65E-08	7.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2003	---	1.60E-08	1.70E-09	<2.0E-10	<2.7E-09	3.10E-09
	2004	---	9.70E-09	1.80E-09	<2.0E-10	<2.7E-09	<2.7E-09
	2005	---	1.00E-08	1.00E-09	<2.0E-10	<1.0E-09	<1.0E-09
	2006	---	1.00E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	1.60E-08	2.00E-09	<2.0E-10	<1.0E-09	<1.0E-09
Ellendale No. 4 (Christensen)	1995	1	<2.0E-10	4.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	1.30E-08	5.00E-09	5.00E-10	1.80E-09	5.00E-10
		3	1.10E-09	2.00E-10	<2.0E-10	1.20E-09	1.50E-09
		4	6.80E-10	1.40E-09	<2.0E-10	<1.0E-09	<1.0E-09
	1996	1	<6.8E-10	<9.0E-10	<1.5E-09	<6.3E-09	<3.2E-09
		2	<6.8E-10	<1.8E-09	3.50E-09	<6.0E-09	<2.4E-09
		3	<6.8E-10	6.80E-08	<8E-10	<7.6E-09	<5.5E-09
		4	<6.8E-10	<1.1E-09	2.70E-09	7.00E-09	<2.5E-09
	1997	1	8.00E-10	1.20E-09	<1.8E-09	<5.3E-09	<2.8E-09
		2	<7.0E-10	<1.1E-09	2.10E-09	8.80E-09	<3.2E-09
		3	<7.0E-10	<1.5E-09	<1.2E-09	<5.6E-09	<5.2E-09
		4	9.40E-10	<2.0E-10	<2.0E-10	<1.0E-09	2.00E-09
	1998	1	1.70E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	3.30E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	5.00E-10	<2.0E-10	<2.0E-10	6.20E-09	6.70E-09
		4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	7.50E-09
	1999	1	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	5.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1	6.00E-11	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	9.00E-10	6.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	1.00E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.10E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2001	1	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	6.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	1.30E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2002	---	1.10E-09	<2.0E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2003	---	<2.0E-10	2.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2004	---	5.40E-10	5.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2005	---	NST	NST	NST	NST	NST
	2006	---	4.00E-10	1.20E-06	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	NST	NST	NST	NST	NST

Table 5.23
REGIONAL GROUNDWATER MONITORING RESULTS

Location	Year	Quarters	U (μCi/ml)	Ra_{226} (μCi/ml)	Th_{230} (μCi/ml)	Pb_{210} (μCi/ml)	Po_{210} (μCi/ml)
Willow Corral No. 32 (Christensen)	1995	1	<2.0E-10	2.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<6.8E-10	1.90E-09	5.00E-10	2.20E-09	1.00E-09
		3	2.70E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	<6.8E-10	8.00E-10	<2.0E-10	<1.0E-09	4.00E-10
	1996	1	<6.8E-10	<9.0E-10	<1.4E-09	<6.3E-09	<2.9E-09
		2	<6.8E-10	<1.8E-09	<2.1E-09	<6.0E-09	<2.4E-09
		3	<6.8E-10	<6.0E-10	<6.0E-10	<7.6E-09	<3.2E-09
		4	<6.8E-10	<1.1E-09	<5.3E-10	<5.8E-09	<3.7E-09
	1997	1	<7.0E-10	8.00E-10	<1.3E-09	<5.3E-09	<1.9E-09
		2	<7.0E-10	<1.1E-09	3.00E-09	<6.4E-09	<3.0E-09
		3	<7.0E-10	<1.5E-09	1.70E-09	<5.6E-09	<3.5E-09
		4	7.40E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	1998	1	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	1999	1	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	2.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	5.60E-09
		4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	<2.0E-10	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2001	1	<2.0E-10	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	1.50E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2002	---	<2.0E-10	<2.0E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2003	---	<2.0E-10	<2.0E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2004	---	<2.0E-10	4.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2005	---	NST	NST	NST	NST	NST
	2006	---	<2.0E-10	1.20E-08	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	<2.0E-10	<1.0E-09	<2.0E-10	<1.0E-09	<1.0E-09
First Artesian No. 1 (Christensen)	1995	1	<2.0E-10	1.00E-09	<2.0E-10	<1.0E-09	<1.0E-09
		2	<1.0E-10	2.98E-08	4.92E-08	8.70E-09	7.00E-09
		3	7.00E-09	7.00E-10	<2.0E-10	1.10E-09	1.80E-09
		4	2.70E-09	1.00E-09	<2.0E-10	3.00E-10	<1.0E-09
	1996	1	4.10E-09	<9.0E-10	<1.3E-09	<6.3E-09	<2.3E-09
		2	<6.8E-10	<1.8E-09	<2.0E-09	<6.0E-09	<2.3E-09
		3	6.80E-10	1.30E-09	<9.0E-10	<7.6E-09	<6.4E-09
		4	<6.8E-10	<1.1E-09	<4.7E-10	<5.8E-09	<2.4E-09
	1997	1	7.00E-10	1.00E-09	<1.9E-09	<5.3E-09	<1.5E-09
		2	7.40E-09	2.40E-09	3.20E-09	9.50E-09	<2.3E-09
		3	4.80E-09	<1.5E-09	<1.3E-09	<5.6E-09	<2.5E-09

Table 5.23
REGIONAL GROUNDWATER MONITORING RESULTS

Location	Year	Quarters	U (μCi/ml)	Ra_{226} (μCi/ml)	Th_{230} (μCi/ml)	Pb_{210} (μCi/ml)	Po_{210} (μCi/ml)
		4	4.40E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	1998	1	6.00E-10	1.20E-09	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	6.00E-08	6.00E-08	<2.0E-10	<1.0E-09	<1.0E-09
	1999	1	1.20E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	6.70E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	5.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1	7.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	5.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	6.00E-10	3.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2001	1	9.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	9.50E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	3.00E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2002	---	NST	NST	NST	NST	NST
	2003	---	NST	NST	NST	NST	NST
	2004	---	5.40E-10	3.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2005	---	NST	NST	NST	NST	NST
	2006	---	6.00E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	1.40E-08	<1.0E-09	<2.0E-10	<1.0E-09	<1.0E-09
Middle Artesian No. 2 (Christensen)	1995	1	NST	NST	NST	NST	NST
		2	3.80E-08	3.60E-09	2.00E-09	1.70E-09	7.00E-10
		3	NST	NST	NST	NST	NST
		4	NST	NST	NST	NST	NST
	1996	1	NST	NST	NST	NST	NST
		2	1.35E-08	<1.8E-09	<1.9E-09	<6.0E-09	<1.4E-09
		3	1.35E-08	1.10E-09	<7.0E-10	8.30E-09	<3.9E-09
		4	1.35E-08	<1.1E-09	<6.0E-10	7.60E-09	<1.9E-09
	1997	1	1.60E-08	<8.0E-10	1.40E-09	<5.3E-09	<2.8E-09
		2	<7.0E-10	1.30E-09	1.90E-09	1.10E-08	<3.3E-09
		3	6.80E-09	<1.5E-09	<6.0E-10	<5.6E-09	<2.4E-09
		4	1.00E-08	1.50E-09	<2.0E-10	<1.0E-09	<1.0E-09
	1998	1	NST	NST	NST	NST	NST
		2	6.50E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	1.00E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	9.10E-09	8.00E-08	<2.0E-10	<1.0E-09	<1.0E-09
	1999	1	6.20E-09	<2.0E-10	<2.0E-10	<1.0E-09	5.00E-09
		2	<2.0E-10	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	6.00E-10	8.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.00E-09	3.10E-09	<2.0E-10	<1.0E-09	<1.0E-09
	2000	1	3.40E-09	7.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	7.50E-09	1.10E-09	<2.0E-10	<1.0E-09	<1.0E-09

Table 5.23
REGIONAL GROUNDWATER MONITORING RESULTS

Location	Year	Quarters	U (μCi/ml)	Ra_{226} (μCi/ml)	Th_{230} (μCi/ml)	Pb_{210} (μCi/ml)	Po_{210} (μCi/ml)
		3	3.40E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	1.40E-09	<2.0E-10	<2.0E-10	<1.0E-09	3.00E-09
	2001	1	1.40E-09	6.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
		2	3.30E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		3	4.20E-09	<2.0E-10	<2.0E-10	<1.0E-09	<1.0E-09
		4	2.90E-09	6.00E-10	<2.0E-10	<1.0E-09	<1.0E-09
	2002	---	2.10E-09	<2.0E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2003	---	<2.0E-10	3.00E-10	<2.0E-10	<2.7E-09	<2.7E-09
	2004	---	1.00E-09	6.00E-10	3.00E-10	<2.7E-09	<2.7E-09
	2005	---	NST	NST	NST	NST	NST
	2006	---	<2.0E-10	1.00E-09	<2.0E-10	<1.0E-09	<1.0E-09
	2007	---	<2.0E-10	1.00E-09	<2.0E-10	<1.0E-09	<1.0E-09

NST = No Sample Taken.

Table 5.24
IRIGARAY AND CHRISTENSEN RANCH ENVIRONMENTAL GROUNDWATER AND SURFACE WATER MONITORING PROGRAMS

	SAMPLE COLLECTION				SAMPLE ANALYSIS	
CONSTITUENT	LOCATION	TYPE	FREQUENCY	METHOD	FREQUENCY	PARAMETER
Regional Groundwater	Christensen Ranch 1. Christensen Ranch House No. 3 2. Ellendale No. 4 3. Willow Corral No. 32 4. First Artesian No. 1 Irigaray 1. Willow No. 2	Grab	Quarterly	Pumped or bailed; downhole submersible pump or windmill	Quarterly	Uranium, Ra-226, Th-230, Pb-210, Po-210, Water levels
Groundwater	Monitor Wells: Ore Zone Perimeter Upper Aquifer Lower Aquifer	BASELINE Grab	4 samples each spaced two weeks apart	Downhole submersible pump	4 samples each spaced two weeks apart	One sample - Assay Suite A[1] Three samples Assay Suite B[2] Water levels
	Monitor Wells: Ore Zone Perimeter Upper Aquifer Lower Aquifer	OPERATIONAL MONITORING Grab	Twice per month	Downhole submersible pump	Twice per month	Assay Suite C[3] Water levels
	Mine Unit Baseline Wells (For definition of restoration goals)	BASELINE Grab	4 samples each spaced two weeks apart	Downhole submersible pump	4 samples each spaced two weeks apart	Two samples - Assay Suite A[1] Two samples - Assay Suite B[2] Water levels

Table 5.24 Continued
IRIGARAY AND CHRISTENSEN RANCH ENVIRONMENTAL GROUNDWATER AND SURFACE WATER MONITORING PROGRAMS

	SAMPLE COLLECTION				SAMPLE ANALYSIS	
CONSTITUENT	LOCATION	TYPE	FREQUENCY	METHOD	FREQUENCY	PARAMETER
Surface Water	Christensen Ranch 1. CG-05: Upstream Willow Creek 2. GS-1: Downstream Willow Creek 3. GS-03: 250 yds downstream of PU-3 in Willow Creek Irigaray 1. IR-5: Powder River at Irigaray Ranch 2. IR-9: Downstream Willow Creek 3. IR-14: Upstream Willow Creek 4. IR-17: 200 ft. east of Unit 1	Grab	Quarterly on runoff event basis	Grab	Quarterly	Assay Suite B[2], Th-230, Pb-210, Po-210 and estimated flow rate

1. Assay Suite A = Ca, Mg, Na, K, CO_3, HCO_3, SO_4, Cl, NH_4 (as N), NO_2 + NO_3 (as N), F, Si, TDS, Conductivity, Total Alkalinity (as $CaCO_3$), pH, Al, As, Ba, Bo, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, V, Zn, U, Ra-226.
2. Assay Suite B = TDS, SO_4, Cl, Conductivity, Total Alkalinity, pH, As, Se, U, Ra-226
3. Assay Suite C = Excursion parameters: Cl, Conductivity, Total Alkalinity

5.8.2.2 Mine Unit Groundwater Monitoring

Historical Results

Since existing wellfields restoration has been completed and approved by DEQ and the NRC for the Irigaray property, this discussion focuses on the Christensen Ranch operation. The Christensen Ranch monitor wells are completed in a minimum of three different stratigraphic horizons for monitoring the containment of mining solutions in the wellfields during operations. The ore zone wells have the same completed ore zone interval within the host sandstone (K sandstone) as the adjacent production and injection wells so as to intercept and detect any migration of mining solutions. In addition, monitor wells are completed in the overlying and underlying aquifers directly above and below the ore zone sandstone for detection of any vertical migration of mining solutions. Installed monitor well spacing and frequency at Christensen is as follows:

	Distance From Well Field (feet)	Spacing Between Monitoring Wells (feet)
Ore Zone, Downgradient	300	300
Ore Zone, Sides	500	500
Ore Zone, Upgradient	500	500
Overlying Monitor Wells	One well per 4 acres of well field pattern area	
Underlying Monitor Wells	One well per 4 acres of well field pattern area	

Monitor Well Baseline Water Quality

After delineation of the mine unit boundaries, monitor wells have been installed according to the previously noted spacing and frequency. After completion, wells were washed out and developed (by air flushing or pumping) until water quality in terms of pH and specific conductivity appeared stable and consistent with the anticipated quality of the area. After development, wells were sampled to obtain baseline water quality.

At Christensen Ranch, for future wellfields (M.U.8 and above) four baseline samples will be collected, with sample events spaced at least two weeks apart. For baseline sampling, a minimum of two casing displacements will be evacuated from each well prior to sample collection. Samples will be analyzed for **one** full suite analysis and **three** short list analyses (see Table 5.24).

Mine Unit Baseline Water Quality

Baseline water quality is established for the mineralized zones to be mined within the host sandstone. As a basis for determining the groundwater quality restoration goals for a particular mine unit, COGEMA collects samples from representative injection or production wells at a density of one well for every three acres of wellfield pattern area. The wells chosen for baseline are evenly distributed over the wellfield area. Baseline water quality is established by collecting four samples at least two weeks apart from each well and analyzing the samples for **two** full suite analyses and **two** short list analyses, as identified in Table 5.24. Water quality baseline sampling procedures were the same as those discussed for monitor wells.

Baseline water quality for a particular mine unit is established by combining the sample results from all mineralized zone wells within that mine unit and calculating an arithmetic average. Outliers are removed from the data base as described in the following section. The overall average baseline water quality results for a mine unit are used to define the restoration water quality target values for that particular mine unit.

Removal of Outliers from the Water Quality Data Base

Prior to any calculations for baseline mean, other statistics, or upper control limits, the water quality data base will be screened for outliers. Outliers are anomalously high or low values relative to the other values, which can compromise a data base. Outliers are typically caused by one of the following conditions:

- Transcription errors, either in the laboratory or in-house
- Analytical errors (multiplication errors, etc.)
- Incorrect units of measurements
- Sampling error

However, it is possible that the outlier is a true value, being caused by natural water quality variability, or geologic differences within the sampled aquifer. For this reason, the following procedures will be followed when analyzing the water quality data base for outliers:

- The data will first be screened visually, to identify obvious outliers, if present.
- The data will then be screened using a statistical analysis. COGEMA has used, and will continue to use, the tolerance-limit formula (Loftis, et al., 1987) as its method for outlier screening. This method is currently approved in the

for use in upper control limit calculation if no explanation could be found for the anomalous value.

If all four baseline sample results from an individual well would be eliminated by the tolerance limit process, the well would have its own set of UCLs based upon the average results of the four samples.

- Upper control limits were then calculated as follows:

Chloride	-	Baseline mean plus 15 mg/l, or baseline mean plus five (5) standard deviations, whichever is greater
Conductivity	-	Baseline mean plus five (5) standard deviations
Total Alkalinity	-	Baseline mean plus five (5) standard deviations

- After operations in Mine Unit 3 and 4 it became obvious that the upper control limit calculation for chloride (baseline mean plus five standard deviations) provided an upper control limit that was too restrictive, due to the relatively small variability in baseline chloride values. For Mine Unit 5, the chloride upper control limit was calculated as the baseline mean plus 15 mg/l. Control limits for conductivity and total alkalinity remained the same. This practice was approved by both the WDEQ and NRC for Mine Units 5 and 6.

- Trend well action limits are set the same as for monitor well upper control limits.

The above described method of setting upper control limits will be continued for future Christensen Ranch mine units.

Christensen Ranch Mine Unit 7 monitor wells and their respective proposed upper control limits were proposed in the Mine Unit 7 wellfield baseline data package which was submitted to LQD on June 8, 2007. Initial review comments were received from LQD in a letter dated November 9, 2007. <u>The Mine Unit 7 data package was approved September 13, 2010.</u>

5.8.3 EVAPORATION POND LEAK DETECTION MONITORING

Ponds A, C, and E at Irigaray have been decommissioned to the point of removing the accumulated bottom sludges, liners, leak detections systems, and residual contaminated soil under the liners. The decommissioned pond basins remain intact and available for potential reconstruction as lined systems. The remaining brine evaporation and restoration ponds at Irigaray and Christensen Ranch are lined and equipped with leak detection systems. During operations, the leak detection standpipes are checked for evidence of leakage on a weekly frequency. Visual inspection of the pond embankments, fences and liners and the measurement of pond freeboard are performed on the same frequency. Anytime six (6) inches or more of fluid is detected in a leak detection system standpipe, a sample of the solution is obtained and analyzed for chloride, conductivity, pH and uranium. Should the analyses indicate that the pond is leaking (by comparison to chemical analyses of pond water), the following actions are taken:

- The WDEQ and USNRC are notified by telephone within 48 hours of leak verification.
- The level of the leaking pond is lowered by transferring its contents into an adjacent pond, or a pond within the pond system. While lowering the water level in the pond, inspections of the liner are made to determine the cause and location of the leakage. The area of investigation first centers around the pond area specific for the particular standpipe which contains fluid. Each lined pond has six leak detection standpipes. Therefore, the area of leakage is readily identifiable.
- Once the source of the leakage is found, the liner is repaired and water is reintroduced to the pond to check the adequacy of the repair. Water in the leak detection standpipes is monitored on a daily basis while refilling the pond.
- A written report is submitted to the WDEQ and USNRC within 30 days of correcting the leakage. The report includes analytical data and describes the cause of the leakage, corrective actions taken and the results of those actions.

Because the permeate storage ponds are unlined and will contain water which meets NPDES surface discharge criteria, leak detection systems are not installed. Water quality in the permeate storage ponds is sampled on a quarterly frequency and analyzed for uranium, radium-226 (dissolved), pH, TDS, chloride, conductivity and zinc. Water quality in the brine evaporation ponds is sampled on a quarterly basis and analyzed for uranium, radium-226, pH, TDS, chloride, conductivity, sulfate, ammonium (NH_4), nitrate (NO_3) and

2. Testing procedures.
3. Exposure procedures.
4. Equipment operation and maintenance procedures.
5. Employee health and safety procedures.
6. Incident response procedures.
7. Laboratory procedures.

Routine monitor well samples, pond leak samples, and some radiological survey samples are analyzed at the Christensen Ranch site laboratory. The quality assurance plan for this laboratory is detailed in a Standard Operating Procedure.

5.10 REPORTING PROCEDURES

5.10.1 ROUTINE REPORTS

Routine reports and data submittals to the WDEQ and USNRC are described as follows.

5.10.1.1 Semi-Annual Report

Pursuant to 10 CFR 40, Section 40.64, a report will be submitted to the USNRC on a semi-annual basis outlining the results of the effluent and environmental monitoring programs described in Sections 5.8 and any other information required by license condition.

A report will also be submitted to the WDEQ on a semi-annual basis that will address the results of the operational groundwater monitoring program (monitor and trend well sample analyses and water levels in tabular form), summaries of the well integrity testing program, and an accounting of the total gallons injected and recovered. Normally, the WDEQ semi-annual report will be combined with the USNRC semi-annual report.

5.10.1.2 Annual Report

As required by W.S. 35-11-411, COGEMA will submit an annual report to the WDEQ. The report shall contain the following information:

1. Maps showing locations of all wells installed in conjunction with the mining activity and areas where groundwater restoration has been achieved or is taking place or planned to take place within the next year. The map also shows areas where mining is expected to commence during the next year.

2. The total quantity of recovery fluid injected and the total quantity of recovery fluid extracted during the annual reporting period for each mine unit including a description of how these quantities were determined.

3. Potentiometric surface maps for the ore zone, the overlying aquifer and the underlying aquifer as developed from pre-mining water levels.

4. Monitor well upper control limits.

5. Location and completion details for monitor wells and ore zone baseline water quality wells.

6. Average mine unit baseline water quality and proposed restoration target values.

7. If a mine unit is in an area where no previous baseline hydrologic data is available, the results of a multi-well aquifer test will be submitted. The test will define the aquifer properties within the affected area including average and directional transmissivity, permeabilities, hydrologic boundary conditions, and vertical confinement of the mining zone. An analysis of whether an excursion can be retrieved from a monitor well within the 60-day regulatory timeframe will be conducted, if the aquifer properties are significantly different than others identified in previous mine units.

The SERP review procedure for new mine units will involve the evaluation of the following information to assure that:

- The new mine unit is within the licensed area;
- Wells have been constructed pursuant to the application and applicable Standard Operating Procedures, including the spacing and density requirements for monitor wells;
- Mechanical integrity tests have been properly conducted for each operational well in the new mine unit;
- Baseline water quality has been properly established for all monitor and restoration wells;
- Upper Control Limits have been correctly established for monitor wells;
- Target Restoration Values have been established; and
- Hydrologic parameters have been confirmed.

baseline mean with an acceptable range provided by tolerance limits, to account for the baseline variability. This is necessary because we know that the **exact** average baseline value for a particular constituent will probably not be met at restoration, therefore the restored concentration should fall within a range of acceptable values around the mean baseline value. This range has been calculated with tolerance limits. This particular method for establishing target restoration values is currently under review by LQD and may be modified in the future to use statistical confidence limits for the mean instead of tolerance limits. For non-detectable values, the target is to restore to the same proportion of non-detectable values.

Secondary restoration standards approved by the NRC may be reflective of the pre-mining use suitability criteria as established by the WDEQ. Most of the ore zone groundwater at Christensen Ranch had been classified by WDEQ as Class I Domestic, with the general exception of radium-226. Subsequently, the November 2001-issued joint WDEQ-LQD and Wyoming Water Quality Division Advisory Board policy regarding the non-treatability of radium in water (due to the problem of safe disposal of water treatment by-products) effectively resulted in the re-classification of Christensen wellfield (exempt aquifer) areas as Class IV. Other classifications at Christensen range from Class I, II, III and IV in the shallow zones, to Class I in the deep zones.

Target values for each individual Mine Unit at Christensen Ranch can be found in the individual baseline data packages for each mine unit and in the Christensen Ranch restoration report noted above.

6.1.2 RESTORATION PROCESSES

The restoration programs conducted in the past involved essentially <u>four</u> phases of restoration processes. They are as follows:

1. Groundwater Sweep
2. Reverse Osmosis with Permeate Injection (includes metals reduction)
3. Groundwater Recirculation
4. Stabilization Monitoring

These phases of restoration have been shown to be effective in previous restoration efforts, including the 517 R & D site, the Irigaray E-Field restoration, Christensen Ranch Willow Creek R & D site, the Irigaray Units 1 through 9, and Christensen Ranch Units 2 through 6. The first three phases are active restoration processes. The last phase of restoration is the stability monitoring phase, where the groundwater is monitored for a minimum of nine months to assure that the restored concentrations are stable. A description of each restoration process is provided below.

6.1.2.1 Groundwater Sweep

The first step in the restoration process is to recall the mining solution from the periphery of the wellfields which has been affected by horizontal flaring. This process is termed groundwater sweep because the voids created within the ore zone aquifer during the removal of mining solutions are swept and filled with native groundwater. The goal of the groundwater sweep phase is to return all mining solutions back to the wellfield.

Groundwater sweep is accomplished by pumping the recovery and injection wells within the wellfield with no re-injection of solutions (total water withdrawal). Wells used for the recovery may be varied during the pumping to achieve maximum flow distribution throughout the wellfield. Flow rates during groundwater sweep are dependent upon the sustainable yield of the ore zone aquifer, and will fluctuate as the program progresses. At Christensen Ranch all solutions recovered from the wellfield during the groundwater sweep phase are treated, temporarily stored in the evaporation ponds, and then injected down a deep disposal well. An alternative is to sufficiently treat the water in order to surface discharge in compliance with 10 CFR 20 Appendix B, Table 2 limits for radionuclides and under the WYPDES permit The solutions would be treated for uranium, radium-226, and total suspended solids removal prior to discharge. Further explanation follows:

A typical groundwater sweep treatment process is shown in Figure 6.1 (Christensen Ranch Restoration Process Flow Diagram for Units 2 through 6). The process involves routing the recovered groundwater sweep solutions from the wellfields to a holding pond(s), where barium chloride will be added. Treatment with barium chloride will remove approximately 95% of the total radium-226 content by a reaction forming a barium sulfate/radium-226 co-precipitate. The barium treatment also assists with other metals reduction. Solutions in the holding pond will then be routed to the main processing plant for further treatment.

Within the process plant, the groundwater solutions from the pond will be filtered (total suspended solids removal) and then sent through the ion exchange columns for recovery of uranium. After the primary uranium removal, the solutions are sent to the treated water holding tanks, or to two optional circuits which are available to further reduce uranium and radium-226 concentrations as necessary to meet the requirements of 10 CFR 20, Appendix B, Table 2, and the WYPDES permit. These optional circuits include additional barium chloride treatment and filtration through a filter press, and additional ion exchange treatment. Solutions stored in the treated water holding tanks are then released by pipeline to surface discharge.

Flow rates during groundwater sweep will vary, depending upon the aquifer properties. Flow rates typically begin around 200 to 300 gpm, then will decrease during the program due to the 100% consumptive removal

Due to the limited success and excessive consumptive removal of groundwater sweep, Uranium One anticipates that use of groundwater sweep will be very limited or not used at all at the future Irigaray and Christensen Ranch wellfields.

were deemed necessary during future restoration at Christensen, the use would again be limited to one mine unit prior to full scale usage and would be subject to regulatory approval. The unit identified for testing would be chosen by Uranium One based upon water quality analysis. When using hydrogen sulfide gas as well as any other sulfur-based reductants that could result in some release of hydrogen sulfide gas, Uranium One will institute proper safety precautions. In April 1991, a hydrogen sulfide safety program was submitted to the WDEQ and NRC, and was approved by the NRC through license condition. This plan will be the basis for the safety procedures used during reductant usage, and will be updated on an ongoing basis as dictated by new technology or operational conditions.

6.1.2.3 Recirculation

In order to homogenize the aquifer, the wellfields previously restored at Irigaray and Christensen Ranch were recirculated by withdrawing from the recovery wells and injecting the recovered solutions into the injections wells. No treatment of the circulated water was performed with the exception that a small amount of reductant may be added to insure the depletion of oxygen during the process.

The recirculation phase is not planned for future mine units due to the minimal effectiveness of this step and the opportunity to reintroduce oxygen into the mining zone. Circulation of one pore volume of hydrogen sulfide or another reductant may be utilized if necessary.

6.1.2.4 Stabilization Monitoring

A post-restoration stabilization monitoring period of twelve months is proposed at the end of restoration for future mine units. Within this time frame, the designated restoration wells will be sampled at the beginning, middle, and end of the stabilization period. The samples will be analyzed for a full suite of chemical and radiological analyses. As the aquifer requires time to equilibrate after the active restoration, more frequent sampling of these wells is not recommended.

Monitor wells are typically sampled every 60 days during the post-restoration stability period. Analyses include the three excursion parameters.

6.1.3 PROPOSED RESTORATION PROGRAM

The proposed restoration program for future mining activities at Christensen Ranch (and Irigaray if future production occurs there) is essentially identical to that approved for the Irigaray Units 4 through 9, "Aquifer Restoration and Wellfield Decommissioning, Units 4 through 9, March, 1995". Anticipated flow and volumes given below are considered typical and will vary depending upon local aquifer properties and the area undergoing restoration.

The pore volume displacements (PVD) presented are derived from the average volumes experienced at Christensen Ranch during the restoration of Mine Units 2 through 6:

Treatment:	Groundwater Sweep
Flowrate:	Up to 300 gpm
Volume:	Up to 1 PVD Bleed to treatment, surface discharge, deep injection well, ponds, or other wastewater management practices approved in the future. Sweep solutions may be treated, stored and reinjected into other mine units undergoing restoration to minimize overall groundwater consumption and wastewater disposal volumes.

Treatment:	RO/permeate injection
Flowrate:	Up to 500 gpm
Volume:	Up to 10 PVD Brine to deep well injection, lined ponds, treatment and surface discharge or reinjection into another unit undergoing restoration, or other wastewater management practices approved in the future.

Treatment:	Circulation of 1 PV of Hydrogen Sulfide Gas Reductant
Flowrate:	Up to 500 gpm
Volume:	1 PVD

Treatment:	Stabilization Monitoring
Flowrate:	None
Time Period:	Minimum of 12 months

Groundwater volumes produced during restoration will depend upon the size of the mine unit and corresponding pore volume.

6.1.3.1 Restoration Schedule

It is anticipated that mining in a particular unit will be completed in a three year period. Restoration of a mine unit will follow the completion of mining consistent with the requirements of 10 CFR Part 40, §40.42(d) as may be modified by NRC agreement to a request under §40.42(f) (if such a request is submitted by Uranium One). During the interim between the end of production of a wellfield and the onset of active restoration of the wellfield, the equivalent of a one percent bleed will be maintained in the wellfield to ensure the maintenance of hydraulic control. If the mine unit is located adjacent to an active mining area or shares a trunkline with an active mining area, restoration may be delayed until the mining is accomplished in the adjacent unit or the trunkline is available for restoration. At that time, the mine unit in which production was just completed may serve as a buffer zone between the unit ready for restoration and another mine unit in a production mode. Restoration of each mine unit is designed to be accomplished within a two to three year period to keep up with the mining schedules. Mining and reclamation timetables for the Christensen Ranch area were previously discussed in Section 3.6.

Additional discussion of restoration timeliness follows.

Uranium One has committed to groundwater restoration to commence in each wellfield as soon as possible following completion of mining operations. To accomplish this, a number of technical constraints for the Christensen Ranch facilities determine an appropriate schedule:

a. Production flow is limited to a maximum of 4,000gpm (but typically averaging 3,600 gpm).

b. Restoration flow is limited to 1,000gpm during restoration phase only operations or 500gpm during combined operations of production/restoration. The restoration capacity is in part limited by the wastewater disposal capacity.

c. Wastewater disposal capacity is 150gpm, based on the combined capacity of the two deep disposal wells. This is the most critical constraint on schedule.

d. Groundwater sweep flow is 150gpm/wellfield with a maximum of two wellfields in GWS.

e. Transition time is required between different phases (production, restoration GWS, restoration RO), to re-plumb wellfield connections.

f. Conducting groundwater sweep in a wellfield immediately adjacent to a producing wellfield is normally inadvisable because of the dramatic drawdown effect of a 150gpm consumptive flow. This groundwater sweep drawdown would tend to promote excursions from the adjacent producing wellfield.

g. The availability of process pipe trunklines between wellfields and the plant.

For Christensen Ranch, using the above assumptions and limitations, production in MU7 would begin in month zero and end in month 32. Restoration operations in MU7 would initiate in month 34, and restoration would continue unabated through the sequence of mine units until the completion of restoration for MU12 in month 200. In other words, the restoration process would continue uninterrupted for the project from month 34 onward. Uranium One feels that adherence to such a schedule fulfills the overall requirement of timely renewal for the facilities. The schedule represents a good faith effort toward decommissioning while working within the constraints outlined above. However, if each wellfield is defined as a "separate outdoor area" under 10 CFR 40.42(d), Uranium One would probably have to apply for a delay of restoration commencement in some wellfields under 10 CFR 40.42(f). One of the key constraints that would likely trigger a request for restoration delay is the very finite waste water disposal capacity of the Christensen Ranch facility. In the context of a 150 gpm disposal rate, Uranium One is limited in terms of how much restoration can be done at one time, particularly when production is ongoing from another active wellfield, and depending on the restoration duration for individual wellfields. Regarding the latter factor, it is also likely that Uranium One would request extensions for the completion of the restoration of individual wellfields under 10 CFR 40.42(i). This is based upon the historical time span to complete wellfield groundwater restoration at Christensen Ranch: an average of 48 months per wellfield.

6.1.3.2 Monitoring During Restoration

The proposed schedule for monitoring various recovery streams, designated restoration wells, and monitor wells for the well fields undergoing restoration is provided in Table 6.1.

6.1.3.3 Determination of Restoration Success

After the restoration in an area has been achieved, and the post-restoration stabilization monitoring program is completed, a report will be completed summarizing the results of the restoration program. The restoration results will be compared with the restoration target values (discussed in Section 6.1.1 above). The report will also provide the results of the stability monitoring program. The report will be submitted to the regulatory agencies for their review and approval. The acceptance of the well field restoration and stability success will be based on the ability to meet the goals of the restoration program and the lack of significant increasing trends during the stability monitoring period.

The restoration report will also include pre-operational, operational, post-operational, and stability phase groundwater piezometric surface maps for the wells in the production zone, including the production zone monitor well ring, and piezometric surface maps for the monitor wells located in the aquifers immediately above and below the production zone.

After concurrence from the WDEQ and USNRC that the restoration goals have been achieved and stability criteria have been met, decommissioning and surface reclamation of the restored area will be initiated as described in Sections 6.2 and 6.3.

6.1.4 IRIGARAY RESTORATION HISTORY

Please see the previously referenced *Wellfield Restoration Report Irigaray Mine*, July 2004, for a complete discussion of the groundwater restoration at Irigaray.

6.1.5 CHRISTENSEN RANCH RESTORATION HISTORY

Please see the previously referenced "Wellfield Restoration Report, Christensen Ranch Project, Wyoming," March 5, 2008, for a complete discussion of the groundwater restoration to date at Christensen Ranch. The planned restoration program for future mine units at Christensen Ranch will be that described in Section 6.1.2, above. The program will be tailored to meet the individual characteristics of each mine unit, but will essentially follow Section 6.1.2.

TABLE 6.1
RESTORATION GROUNDWATER MONITORING SCHEDULE AND ANALYSES

RESTORATION PHASE	SAMPLE ORIGIN	FREQUENCY	ANALYTICAL PARAMETERS
Post-Mining	Designated Restoration Wells Ore Zone	Once	WDEQ Guideline 8* Water Level
	Monitor and Trend Wells Ore Zone Monitors Ore Zone Trends (if present) Coal Zone Trends (Irigaray only) Deep Zone Shallow Zone	Biweekly	Chloride, Conductivity, Total Alkalinity(monitor wells) Chloride (trend wells) Water Level
Restoration	Recovery Stream Composite	Weekly	HCO_3/CO_3, SO_4, Cl, Conductivity, pH, U_3O_8
		As Needed	Add Na, Ca, NH_4, TDS, etc.
		End of Each Pore Vol. Displacement	WDEQ Guideline 8*
	Designated Restoration Wells Ore Zone	End of Each Restoration Phase	WDEQ Guideline 8*
	Monitor Wells Ore Zone Deep Zone Shallow Zone	Every 60 days	Chloride, Conductivity, Total Alkalinity
	Trend Wells Coal Zone Trends (Irigaray only) Ore Zone Trends (if present)	Monthly (Groundwater Sweep Only)	Chloride

TABLE 6.1, Continued
RESTORATION GROUNDWATER MONITORING SCHEDULE AND ANALYSES

RESTORATION PHASE	SAMPLE ORIGIN	FREQUENCY	ANALYTICAL PARAMETERS
Post-Restoration Stability	Designated Restoration Wells Ore Zone	Beginning, Middle and End	WDEQ Guideline 8* Water Level
	Monitor Wells Ore Zone Deep Zone Shallow Zone	Every 60 days	Chloride, Conductivity, Total Alkalinity Water Level

* WDEQ Guideline 8 analysis consists of Ca, Mg, Na, K, CO_3, HCO_3, SO_4, Cl, NH_4 (N), $NO_2 + NO_3$, F, Si, TDS, Cond., Total Alk., Al, As, Ba, B, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, V, Zn, U, and Ra-226.

6.2 DECONTAMINATION AND DECOMMISSIONING

The NRC approved a decommissioning plan for the Irigaray and Christensen Ranch sites (see Condition 9.3 of License SUA-1341). That plan is still applicable to the sites, and the reader is referred to that plan ("Decommissioning Plan for Irigaray and Christensen Ranch Projects", December, 2000, revised June 2001). Even with a resumption of production at Christensen Ranch, and resin elution, and concentrate precipitation, drying, and packaging at Irigaray, the referenced decommissioning plan would remain applicable at some future date. Prior to final decommissioning, a revision or update of the approved decommissioning plan will be submitted to the NRC and DEQ to reflect site changes (such as additional wellfields requiring decommissioning, or other site changes) and any changes in applicable regulatory requirements.

Upon final approval by the NRC and the WDEQ of the groundwater restoration of a wellfield, the decommissioning (well abandonment and surface reclamation) of the wellfield will be initiated in accordance with 10 CFR 40.42.

The approved decommissioning plan does not include details of the previously approved well plugging and abandonment procedures. That discussion is retained below.

6.2.1 Well Plugging and Abandonment

All wells no longer useful to continued mining or restoration operations will be abandoned. These include all injection and recovery wells, monitor wells and any other wells within the mine unit used for the collection of hydrologic or water quality data or incidental monitoring purposes. The only known exception at this time may be a well which could be transferred to the landowner for domestic or livestock use.

The objective of COGEMA's well abandonment program is to seal and abandon all wells in such a manner as to assure the groundwater supply is protected and to eliminate any potential physical hazard. The abandonment procedures contained herein are designed to comply with Wyoming Statute 35-11-404 and applicable regulations of the Department of Environmental Quality, Land and Water Quality Divisions and the Wyoming State Engineer's Office.

Three abandonment methods may be used depending upon costs at the time of decommissioning. The first method consists of placing bentonite chips in the bottom75 feet and upper 30 feet of the well with the intermediate volume filled with gravel. This method is currently used in the financial surety estimate for reclamation. A variation of this method may be used for wells with large completed intervals and/or open holes, whereby the lower portion would be filled with gravel instead of bentonite chips. When this variation is used, the lower 75 feet of bentonite chips will be started at least 10 feet below the bottom of the casing to insure sealing of the well annulus in addition to the lower casing. The second plugging method consists of placing bentonite chips throughout the entire well bore, without the use of any gravel filler. The third method consists of placing only cement throughout the entire well bore. The cement mix would meet the same specifications given in Section 3.3.2.1 for well completions. After well plugging, the surface casing is cut off approximately two feet below the ground and a permanent tag identifying the well is attached to the top of the cement plug or cement cone. The hole where the surface casing was removed will be backfilled to the surface using local surface material. Surface reclamation will then be implemented. Records of abandoned wells will be tabulated and reported to the appropriate agencies after decommissioning. The tabulation will include the well name, permit number, total depth, aquifer or zone of completion, casing type and date and method of abandonment.

6.2.2 Records and Reporting Procedures

As noted in the approved decommissioning plan, within six months of the conclusion of site decommissioning and surface reclamation, a decommissioning report containing all applicable documentation will be submitted to the U.S. Nuclear Regulatory Commission and the Wyoming Department of Environmental Quality. Records of all contaminated materials transported to a licensed disposal site will be maintained for a period of five years or as otherwise required by applicable regulations at the time of decommissioning. A well abandonment report consistent with the requirements of Wyoming Statute 35-11-404(e) will be filed with the Administrator of the Land Quality Division and the State Engineer's Office upon completion of the decommissioning of all well fields.

6.3 SURFACE RECLAMATION

The reader is referred to Section 6.3 (pages 6-35 to 6-54) of the January 5, 1996 Irigaray-Christensen Ranch license renewal application (as revised in August, 2002) for a full discussion of surface reclamation for the sites.

6.4 BONDING ASSESSMENT

6.4.1 BOND CALCULATIONS

An up-to-date estimate for the restoration, decommissioning and surface reclamation at the Irigaray and Christensen Ranch sites is provided as Attachment 6.1. The cost assessment includes groundwater restoration, decontamination and decommissioning and surface reclamation costs for all areas affected to date by the installation and operation of the proposed mine plan through 2008 and into 2009. The detailed calculation utilized in determining the bonding requirements for the Irigaray/Christensen Ranch project are enclosed on Attachment 6.1. The current surety estimate was approved by the NRC on June 22, 2010 and issued as Amendment No. 16 for License SUA-1431. A revised standby letter of Credit was issued and accepted by the WDEQ-LQD on September 7, 2010.

Currently, an updated surety estimate accounting for Mine Unit 7 development, restoration costs and other Christensen Ranch Satellite and Irigaray Processing Plant refurbishments undertaken to restart mine operations was submitted as part of the August 2010, Annual Report to WDEQ for Mine Permit No. 478. This updated surety estimate was further revised in November 2010 to account for additional refurbishment activities and as of November 12, 2010 is under review for approval by both the NRC and WDEQ-LQD.

6.4.2 FINAL SURETY ARRANGEMENTS

Uranium One currently maintains an irrevocable letter of credit number BMCH278567OS issued by Bank of Montreal (BMO) in favor of the State of Wyoming for the purpose of complying with 10 CFR 40, Appendix A, Criterion 9 regarding restoration and reclamation costs.

Table 7.3-7
Highest surface radionuclide concentrations resulting from Christensen Ranch-Irigaray uranium ISR operations.

Radionuclide	Receptor Location	Surface Concentration (pCi/m^2)	Soil Concentration in upper 15 cm (pCi/g)
Uranium-238	No. 42. 200 M South of TD	1276	6E-03
Thorium-230	No. 42. 200 M South of TD	1.40	6E-06
Radium-226	No. 42. 200 M South of TD	0.83	4E-06
Polonium-218	No. 13. 200 M South	13.7	6E-05
Lead-214	No. 13. 200 M South	13.7	6E-05
Bismuth-214	No. 13. 200 M South	13.7	6E-05
Lead-210	25 Meters East of CR Satellite Facility	24	1E-04

Uranium-238 represents the radionuclide with the highest concentration (6E-03 pCi/g) which is at least an order of magnitude below most analytical laboratory detection limits. Site-specific surface soil (0-15 cm) data show that natural uranium ranges from 1.2 to 7.7 with a mean of 2.6 ± 1.5 pCi/g (COGEMA 2001). The increase in soil radioactivity is insignificant compared to site-specific background concentrations.

From this evaluation, the impact of operations at the Facility would be minimal and indistinguishable from current conditions.

7.3 REFERENCES

COGEMA 2001. COGEMA Mining Company, *Decommissioning Plan for Irigaray and Christensen Ranch Projects.*

Malapai Resources 1988. Application for In Situ Permit to Mine for Christensen Ranch, Wyoming Department of Environmental Quality, Approved Permit to Mine No. 478, 1977 (Amendment No. 2, 1988), Section D4, Meteorology.

NRC, 1987. U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.59, *Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations.*

NRC, 2003. U.S. Nuclear Regulatory Commission (NRC) NUREG-1569, *Standard Review Plan for In-Situ Leach Uranium Extraction License Applications-Final Report, Appendix D, MILDOS-AREA: An Update with Incorporation of In-Situ Leach Uranium Recovery Technologies*

NCRP, 1987. National Council on Radiation Protection and Measurements (NCRP) Report No. 93, *Ionizing Radiation Exposure of the Population of the United States.*

WEST, 2005. Western Environmental Services Testing, Inc (WEST), *Cogema Resources Company, Yellow Cake Dryer Stack Test Report.*

7.4 NON-RADIOLOGICAL EFFECTS

The in-situ solution mine is by design a self-contained mining circuit. Wastes generated by the facility are contained and eventually removed to disposal elsewhere. The potential non-radiological effects of the operation include the possibility of lixiviant excursion, evaporation pond leakage and temporary disturbance of the land during site preparation, construction and operations. The effects of these possible occurrences are considered small as discussed in Section 7.2 above. The environmental monitoring programs given in Section 5.8 are designed to quickly identify any adverse conditions that may result during operations. No long term irreversible effects are anticipated.

7.5 EFFECTS OF ACCIDENTS

Accidents involving human safety associated with the in-situ uranium mining technology typically have far less severe consequences than accidents associated with underground and open pit mining methods. In-situ mining provides a higher level of safety for personnel and neighboring communities when compared to conventional mining methods or other energy related industries. Accidents that may occur are minor and are not catastrophic as would be the case for explosions at oil refineries or in equipment malfunctions or human error in the public transportation industries. Radiological accidents at the Irigaray/Christensen Ranch site, if they occur, would typically manifest themselves slowly and are, therefore, detectable in sufficient time to be safely and methodically corrected. The remote location of the site and the low level of radioactivity associated with the process both decrease the potential hazard of an accident to the general public.

7.5.1 ACCIDENTS INVOLVING RADIOACTIVITY

7.5.1.1 Tank Failure

Process fluids are contained in vessels and piping circuits within the process plant or in bermed outside storage tanks. The process plants have been designed to control and confine liquid spills should they occur. The plant building structure and concrete curb will contain liquid spills from the leakage or rupture of a process vessel and will direct any spilled solution to a floor sump. The floor sumps are equipped with a pump to transfer any spilled solutions back into the plant process or to the lined evaporation pond system. Consequently, the accident would be of short duration and the remedial procedure is incorporated into the process plant design.

All tanks in the process plant(s) are made of fiberglass or steel. Instantaneous failure is highly unlikely. Tank failure would more likely occur as a small leak in the tank. In this case, the tank would be emptied to below the leakage level and repaired. Procedures to be followed in the event of an uncontrolled liquid release in the plant area are described in a Standard Operating Procedure for Plant Solution Spills.

7.5.1.2 Pipe Failure

The rupture of a pipeline within the process plant is easily visible and can be repaired quickly. The maintenance equipment within the satellite process plant will be adequate to handle this type of problem.

The rupture of an injection or recovery line between the plant and well field will result in either barren or pregnant leach solution contaminating the ground near the break. A large and sudden rupture will be detected by a drop in pressure in the system and interruptions in the flow of liquids. A small break will be detected visually during routine inspection of the lines. Any ground contamination will be removed to disposal. Procedures to be followed in the event of an uncontrolled liquid release in a well field are described in a Standard Operating Procedure for Well Field Solution Spills.

7.5.1.3 Lined Evaporation Ponds

An accident involving a leak in a solar evaporation pond is detectable via the leak detection system placed beneath the pond liner. If a pond leak does occur, the effects of the seepage will be mitigated by the natural clay content of the soils underlying the liner. The clays will absorb radium and other constituents contained in the seepage. Seepage from a pond leak should not affect the local groundwater system due to the large distance from ground surface to the water table. A breach in a pond berm is unlikely because of the design requirements which are incorporated to avoid such an occurrence. Leaks detected in site evaporation ponds have been discussed earlier in this section.

7.5.1.4 Lixiviant Excursion

Pre-mining hydraulic testing has defined the aquifer characteristics for the receiving strata or production zone at the site. The ore-bearing strata is physically and hydraulically separate from overlying and underlying aquifers. The well completion procedures used and the mechanical integrity testing for each injection well performed prior to leach solution injection ensure that injected solutions are contained within the well and are transmitted to the target production zone. The monitoring program for overlying and underlying aquifers is a backup check to ensure that the injection is controlled in this manner. Should an excursion occur, the excursion correction procedures outlined in Section 3.0 of this document will be instituted immediately.

Excursion parameter upper control limits for all aquifers are extremely close to baseline concentrations so that the slightest perturbation in water quality is detected and precautionary measures are taken. Because of the chemically conservative nature of the excursion parameters used, it would be extremely unlikely that at the time excursion correction procedures are instituted that any chemical parameter other than the excursion indicators will be different from baseline values. As such, no radiologic groundwater degradation should result when a well is in excursion status.

In the event that an excursion does occur and is accidentally undetected, concentrations of metals such as uranium, arsenic, selenium and radium-226 are likely to be low due to natural precipitation and adsorption onto clays. This phenomenon occurs because the metals, which are mobilized in the oxidized environment of the production zone, are selectively removed from solution via precipitation or adsorption as they move into the reduced environment outside of the production zone.

7.5.2 TRANSPORTATION ACCIDENTS

Transportation of materials to and from the Irigaray/Christensen Ranch site can be categorized as the event of a truck accident is estimated to be approximately 7,400 kg (16,200 lb) and 500 kg (1,100 lb) respectively. Most of the yellowcake released from the container would be deposited directly on the ground in the immediate vicinity of the accident. Some fraction of the released material, however, would be dispersed into the atmosphere. Additional details on this modeling can be found in the Irigaray Environmental Impact Statement, NUREG-0481. Slurry shipments, there would be no dust dispersion considerations as the uranium is contained on the slurry, thus the wet mixture creates no dust.

In the event of an emergency, detailed procedures are provided in a Standard Operating Procedure for transportation accidents involving radioactive LSA material.

7.5.2.2 Accidents Involving Resin Transfers

COGEMA anticipates that two tanker truckloads of uranium-laden resin and two tanker truckloads of barren, eluted resin could be transported on a daily basis to Irigaray from the Christensen Ranch satellite plant. The resin is transported in a specially designed, low profile, 2,500 gallon capacity tanker trailers.

The worst case accident involving the resin transfer would involve the total wreckage of the transport truck and tanker trailer when carrying uranium laden resin and where all of the tank contents were spilled. Because the uranium adheres to the resin and the resin is in a wet condition during shipment, the radiological and environmental impacts of such a spill should be relatively minimal. The radiological or environmental impact of a similar accident with barren, eluted resin would be very minor. The primary environmental impact associated with either accident would be the salvage of soils impacted by the spill area and the subsequent damage to the topsoil and vegetation structure. Areas impacted by the removal of soil would be revegetated.

In the event of a transportation accident involving the resin transfer operation from Christensen Ranch to Irigaray, COGEMA will institute its emergency response plan for transportation accidents. To minimize the impacts from such an accident, the following procedures will be followed:

1. Each resin hauling truck will be equipped with a radio which can communicate with either the Irigaray recovery facility or the Christensen Ranch satellite plant. In the event of an accident and spill, the driver can radio to both sites to obtain help.

2. A check-in and check-out procedure will be instituted where the driver will call the receiving facility prior to departure from his location. If the resin shipment fails to appear within a set time, a crew would respond and search for the vehicle. This system will assure reasonably quick response time in the case that the driver is incapacitated in the accident.

3. Each resin transport vehicle will be equipped with an emergency contingency package whereby the driver could use the contained equipment to begin containment of any spilled material.

4. Both the Irigaray and Christensen facilities will be equipped with emergency response packages to quickly respond to a transportation accident.

5. Personnel at both the Irigaray and Christensen facilities, as well as the designated

truck drivers, will have specialized training to handle an emergency response to a transportation accident.

7.5.2.3 Accidents Involving Shipments of Process Chemicals

The probability of an accident involving the transfer of resin or any shipment of process chemicals is very low. Chemicals which will be shipped to the Irigaray/Christensen Ranch site may include soda ash, hydrochloric acid, sulfuric acid, sodium bicarbonate, carbon dioxide gas, gaseous oxygen, propane, diesel fuel and gasoline. An accident involving a supplier of any of the above chemicals would be handled according to the same emergency response plan as yellowcake or resin transfer accidents. Specialized training will be provided to employees as to the various precautions regarding the different chemicals which could be spilled. The impacts of such accidents should be relatively minor due to the mitigation provided by the emergency response plan.

7.5.2.4 Accidents Involving Radioactive Wastes

Radioactive solid byproduct material or unusable contaminated equipment generated during the operations will be transported to a licensed disposal site as needed and at the time of decommissioning. Because of the low radioactive concentrations involved, these shipments are considered to have minimum potential for significant impacts as a result of transportation accidents. The effects of an accident during the transportation of such waste will be mitigated by the emergency response plan for transportation accidents.

7.5.3 OTHER ACCIDENTS

Other potential accidents involving non-radiological materials are associated with the various chemical and fuel storage tanks maintained outside the process facilities. Each of the liquid chemical storage tanks will be surrounded by earthen berms. Each tank will be labeled to identify the solution within the tanks. In the event that a tank should instantaneously rupture, the solutions will be retained by the surrounding earthen berm placed around the tank for that purpose.

Fuel storage tanks are placed in an area remote from the building to avoid fire damage to the building or injury to workers in the unlikely event of combustion of the fuel.

A spill prevention, control and countermeasure (SPCC) plan is in place for the Irigaray and Christensen Ranch sites. Although EPA only requires this plan for oil or raw petroleum fuel products, COGEMA has expanded our plan to include all stored chemicals.