CROW BUTTE RESOURCES, INC.

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October 17, 2006

Mr. Gary Janosko
Branch Chief, Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety and Safeguards
c/o Document Control Desk
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

RE: Docket No. 40-8943
License No. SUA-1534

Dear Mr. Janosko:

As you are fully aware, the uranium market has dramatically changed the last year or so. The demand for uranium has significantly increased. Crow Butte Resources, Inc. has been looking for ways to increase our production and restoration activities. We believe we have an innovative plan at Crow Butte Resources to take advantage of the economic climate, to help to meet the extra demand for uranium, and to improve the utilization of our natural resource.

License Condition 10.5 of SUA-1534 limits the Crow Butte Resources, Inc. (CBR) to an annual plant throughput of 5,000 gpm exclusive of restoration flow. CBR desires to increase the licensed flowrate in order to increase production which will increase recovery of a natural resource and enhance the restoration process. The production increase will be accomplished by expanding the ion exchange capacity in the existing plant and mining existing well fields to lower levels of soluble uranium.

CBR requests approval of a change to License Condition 10.5 to an annual plant throughput of 9,000 gpm exclusive of restoration flow and maintain the annual production rate of 2,000,000 pounds of U_3O_8 per year.

If you have any questions regarding this amendment request or need any additional information, please contact me.

Sincerely,

Stephen P. Collings
President

cc: Steve Cohen

1.0 DESCRIPTION FOR PROPOSED FACILITIES

CBR proposes to increase the permitted plant throughput flow from 5,000 gpm to 9,000 gpm excluding restoration flow. License Condition 10.5 of SUA-1534 also limits the annual production rate to 2 million pounds. This condition does not need to be modified.

1.1 INCREASED PRODUCTION

CBR proposes to increase the plant flow by expanding the ion exchange processing capacity in the existing plant and by operating production wells longer. This will allow production to increase in well fields where minimal mining is presently occurring. In addition, this mining will deplete more uranium from the wellfields prior to restoration which will enhance the restoration efforts.

The increased ion exchange capacity will be provided by adding 4 to 6 ion exchange (IX) columns in the existing facility. The IX columns will be pressurized downflow ion exchange columns and will be operated with 2 columns in series. Each set of 2 columns will be capable of processing 1500 to 2000 gpm of process solutions. The IX columns will be installed in the existing restoration area of the main facility. The columns will be nominally 11'6" in diameter and there is adequate space in the restoration area to install up to 6 IX columns. The existing restoration IX columns will be relocated to the R & D Building. This is illustrated in Figure A, Proposed Plant Modifications.

After the IX resin in the new columns is loaded with uranium, the resin will be cleaned and sized in an upgraded screening circuit. The uranium will be stripped from the resin using the same eluant circuit presently used in the process facility. This eluant is a mixture of sodium chloride and sodium bicarbonate. The pregnant eluant will then go to the existing yellowcake circuit for precipitation, dewatering, and drying. The existing yellowcake circuit has adequate capacity to process the additional 150,000 to 250,000 pounds of U_3O_8 per year. The process flowsheet for the existing facility (See Figure B) will remain the same except for the increase in IX capacity.

Additional plant flow would normally mean an increase in the volume of liquid waste generated at the Crow Butte Resources facility. However, that is not the present case. Areas with minimal mining activity have a water bleed maintained as if full mining activity was occurring. The volume of bleed is related more to the area under active mining or the number of active wells in the wellfields rather than tied to the plant production flow. The bleed is used to control the migration of water in the wellfields and it is more than enough to meet the plant production requirements of liquid disposal. The bleed rate, as a percentage of plant flow, has increased from less than 1% to close to 2% in recent months, while production rates have remained constant. This increase is due to the wellfield demands. The present water bleed matches or exceeds the proposed bleeds required by the proposed plant (See Plant Mass Balance Figure C1 & C2) which are calculated on the high end as 1% of the plant flowrate. Thus, increasing the mining activity in these areas will not or only minimally increase the liquid waste generation. The present storage and disposal methods of evaporation pond and deep disposal well are adequately handling the volume.

The solid waste generated from the additional flow (See Plant Mass Balance Figure C1 & C2) is expected to increase proportionally to the waste generated by the existing operation. This waste is fairly minimal and consists mainly of filter bags collecting broken resin and clay particles from the injection water.

1.2 RESTORATION FACILITIES

The restoration IX columns will be relocated from the existing building to the R & D Building so they will be close to the RO units. It is planned to add a fourth IX column to the circuit and install more barren solution pumping capacity. The restoration flow will continue to be treated using pressurized downflow IX columns.

2.0 RADIOLOGICAL EFFECTS

The proposed action is to allow a permitted in-situ uranium operation to increase production flow from 5,000 gpm to 9,000 gpm. This additional flow will enhance the restoration process by lowering the uranium content in the solutions from the wellfields prior to the restoration stage. The new 4,000 gpm of production flow rate will be processed at the existing plant by the addition of downflow ion exchange columns.

An assessment of the radiological effects of the Crow Butte Resources Project must consider the types of emissions, the potential pathways present, and an evaluation of the potential radiological hazards associated with the emission and pathways. Since the project is an in-situ operation, most of the particulate emission sources normally associated with a conventional mill will not be present. A vacuum dryer is in use at the commercial operation. The vacuum dryer works on the principle that gases or particulates released into the system are collected in a liquid condenser and there is no release of particulates. The routine radioactive emission will therefore, be radon-222 (radon) gas.

Radon is present in the ore body and is formed from the decay of radium-226. The radon dissolves in the lixiviant as it travels through the ore body to a production well. When the solution is brought to the surface, the radon is released if not contained within a pipeline or tank.

In order to assess the radiological effort of radon on the environment, an estimate of the quantity released during the operation must be made. Meteorological data and MILDOS-Area (June 1989) are used to predict the ground level air concentration at various points in the environment. The ingrowth of radon daughters is important and their concentration in the soil, vegetation and animals must be calculated. Finally, the impact on man from these concentrations of radionuclides in the environment must be determined.

In the following sections, the assumptions and methods used to arrive at an estimate of the radiological effects of the Crow Butte Resources Project at 9,000 gpm will be discussed briefly. A detailed presentation of the source terms is included as Appendix A. The anticipated effects will be compared to naturally occurring background levels. This background radiation, arising from cosmic and terrestrial sources, as well as naturally occurring radon, comprises the primary radiological impact to the environment in the region surrounding the proposed project.

2.1 Exposure Pathways

The Crow Butte Resources Project is an in-situ facility with a zero emission vacuum dryer and, thus, the only source of radioactive emissions for the facility is radon gas. Radon gas is dissolved in the leach solution and may be released as the solution is brought to the surface and processed in the plant.

In this proposal, approximately 5,000 gpm of the process solution is passed through the existing upflow ion exchange columns which vent the majority of the radon into the exhaust manifold. From these columns, the solution is pumped to an injection surge tank, where it is refortified with chemicals before being pumped to the wellfield.

In this amendment request, CBR is planning to use pressurized fixed bed downflow ion exchange columns to process the expanded flow requested. The additional 4,000 gpm requested will require 4 to 6 fixed bed downflow columns. These columns will be operated with 2 columns in series with either 2 or 3 sets in parallel. The columns would be nominally 11.5 feet in diameter and can process 1,500 gpm to 2,000 gpm per set.

With pressurized columns the radon will remain in solution and be returned to the formation and will not be released to the atmosphere. There will be minor releases of radon during the water blowdown prior to elution and during the filling of the columns after elution has been completed. It is estimated that less than 10% of the radon contained in the process solutions will be vented to atmosphere.

In the source term calculation CBR has adjusted the radon release value to show that all of the contained radon in the 5,000 gpm flow processed by upflow IX will be released to the environment and that 10% of the contained radon found in the 4,000 gpm flow processed by pressurized downflow IX columns will be released to the environment.

The injection wells are generally closed and pressurized, but are periodically vented. For purposes of this evaluation, it was estimated that 25% of the radon is released in the wellfield.

The remaining radon release was from the plant vent located 15.9 meters above the foundation of the facility. The above values were entered into the MILDOS-Area (June 1989) code as the source terms.

The atmospheric emission of radon will lead to its presence in all quadrants of the region surrounding the Crow Butte Resources Project. Due to the relatively short half-life of radon, the ingrowth of radon daughters during wind blown transportation must be considered. There exists an inhalation pathway as a result of the emission of radon gas. As the radon daughters ingrow, deposition on the ground surface increases. A pathway also exists due to external radiation exposure arising from two sources. One source is radon and its daughters in the air, which is considered the cloud contribution. The other source is from radon daughters deposited on the ground, this source being termed the ground contribution.

A third pathway exists, which is the ingestion pathway. This results from direct foliar deposition and radionuclides in the soil being assimilated by the vegetation. The vegetation may represent a direct ingestion pathway to man if consumed, and secondary pathway if fed to animals which are in turn consumed by man.

All of the above pathways are evaluated by MILDOS-Area (June 1989).

2.3 Exposures From Water Pathways

The solutions in the zone to be mined will be controlled and adequately monitored to insure that migration does not occur. The overlying aquifers will also be monitored.

Three commercial evaporation ponds located approximately 2,000 feet from the plant building have been constructed for commercial operation. There are also two R&D evaporation ponds located approximately 1,000 feet from the plant building. The R&D ponds have a 34 mil Hypalon liner and a leak detection system. The commercial evaporation ponds are lined with double impermeable synthetic liners. The ponds, therefore, are not considered a source of liquid radioactive effluents. There is a leak detection system installed to provide a warning if the liner develops a leak.

The Crow Butte Resources Plant is located on a curbed concrete pad to prevent any liquids from entering the environment. Solutions used to wash down equipment drain to a sump and are pumped to the ponds. The pad is of sufficient size to contain the contents of the largest tank in the event of its rupture.

Since there are no routine liquid discharges of process water from the Crow Butte Resources Plant, there is no definable water related pathway.

2.4 Exposures from Air Pathways

The only source of radioactive emissions is radon released into the atmosphere through a vent system or from the wellfields. This release results in radiation exposure via three pathways: inhalation, ingestion, and external exposure. The total effective dose equivalent (TEDE) to nearby residents in the region around the Crow Butte Resources Project was estimated by using a computer simulation, MILDOS-Area.

Based on the site specific data and method of estimation of the source term presented in Appendix 1(A), the emission rate of radon from the Crow Butte Resources Project will be 7,178 Ci/yr (See Appendix A for details) which consists of a flow of 5,000 gpm in existing upflow ion exchange columns (5,042 Ci/yr.) along with the proposed 4,000 gpm of flow treated in the pressurized downflow ion exchange columns (1,311 Ci/yr.).

In order to show compliance with the annual dose limit found in 10 CFR20.1301, MFG, Inc. studied what impact the increase in production flow would have on the previous MILDOS simulation. The results and procedure followed are explained in Appendix A "Comparison of MILDOS Results for 5,000 gpm and 9,000 gpm Scenarios". It is important to note that the current assessment considered only the increase in radon releases under stylized conditions to assure that all other factors being equal, increases in radon releases are linearly related to estimated TEDE. Thus, this analysis demonstrates by calculation that the total effective dose equivalent (TEDE) to the individual most likely to receive the highest dose from the licensed operation is much less than 100 mrem per year. These data are shown in Tables 2.1. The dose to the most effected resident (Receptor 19) was extrapolated to be 25% of the allowable limit.

The applicant reviewed the radon monitoring data obtained at the Crow Butte Resources site from January 1991 thru June 2006 for the various production rates. The data is found in Table 2.2 These data show no significant increase in radon concentration at the different production rates above background at any monitoring station.

Due to the downflow column technology and its specific characteristics, the radon emitted from the proposed plant flow is 26% of the value emitted by the upflow columns, even though the increase in flow is 80%. The data from the site monitoring show that the impact of the increase of plant flow from 3,500 gpm to 5,000 gpm, a 43% increase, on radon levels was minimal and thus, the proposed increase to 9,000 gpm production flowrate should have little, if any, impact on the radon levels in the surrounding area.

TABLE 2.1

Total Effective Dosage Equivalent to Nearby Residents

CROW BUTTE RESOURCES PROJECT

5,000 GPM (MILDOS) & 9,000 GPM (Calculated)

Receptor	**TEDE (mRem/yr.) 5,000 gpm**	**Multiplier Ratio**	**TEDE (mRem/yr.) 9,000 gpm**
#6 (Town of Crawford)	0.43	1.22	0.53
#18 (Ehlers)	8.9	1.22	10.9
#19 (Gibbons)	20.3	1.22	24.8
#20 (Stetson)	13.1	1.22	16.0
#21 (Knode)	2.6	1.22	3.2
#22	10.5	1.22	12.8
#26 (McDowell)	1.8	1.22	2.2
#27 (Taggert)	2.1	1.22	2.6
#28 (Franey)	2.9	1.22	3.5
#29 (Bunch)	3.7	1.22	4.5
#30 (Dyer)	1.2	1.22	1.5

TABLE 2.2

Track Etch Cup Ambient

Radon Concentration

CROW BUTTE RESOURCES PROJECT

Air Monitor Station No.	Average pCi/l	Standard Deviation pCi/l	Average pCi/l	Standard Deviation pCi/l	Average pCi/l	Standard Deviation pCi/l
AM-1	0.40	0.14	0.53	0.29	0.66	0.64
AM-2	0.41	0.11	0.60	0.21	0.88	0.61
AM-3	0.42	0.12	0.47	0.23	0.44	0.23
AM-4	0.63	0.20	0.53	0.40	0.58	0.32
AM-5	0.52	0.20	0.59	0.26	0.86	0.40
AM-6	0.51	0.24	0.40	0.17	0.59	0.37
AM-8	0.46	0.17	0.58	0.29	0.94	0.68
Plant Flow gpm	2500	2500	3500	3500	5000	5000

Note: AM-6 station is background monitoring station

3.0 Alternatives

Options available for consideration beside the original proposal with this amendment to License Condition 10.5 of SUA-1534 are:

1) Grant the request but at a reduced rate.

   This option would reduce the efficiencies of the equipment and would add unwarranted costs. It would also prolong or reduce the recovery of the uranium from the ore zone. The mine life would be extended primarily for the restoration process rather than for economical benefit from the ore. By lowering the uranium content in the ore zone through the production process, the restoration process will start with a solution lower in uranium. At a reduced rate, this will allow the restoration to proceed quicker into the final stages of cleanup of the water but not as effectively as at the higher proposed rate. From an environmental stand point, the difference between the two cases would be hard to distinguish.

2) Deny the request.

   Operation will continue as normal. The body of water containing uranium will have to be treated through the restoration circuit. The time required to accomplish closure of a wellfield will not be shortened. The recovery of the natural resource will suffer particularly in times of low product price. From an environmental stand point, the enhancement of the restoration circuit with better solution feed will not benefit this alternative.

4.0 Surety

CBR has maintained an acceptable surety mechanism throughout the course of commercial operations at the Crow Butte Resources Project. If this amendment warrants an adjustment to the surety, the normal process should handle the update.

5.0 NDEQ

A permit amendment has been filed with Nebraska Department of Environmental Quality for increasing plant flowrate. It is currently under review.

APPENDIX A

Comparison of MILDOS Results for 5,000 GPM and 9,000 GPM Scenarios

C.A. Little, Ph.D.
MFG Inc.
13 November 2006

Using the estimated releases of radon for two Crow Butte flow rate cases, 5,000 gpm (current flow rate) and 9,000 gpm (proposed flow rate), dose estimates were calculated for hypothetical receptors surrounding an ISL site. The ISL sample run embedded in the currently available MILDOS-AREA code (Argonne National Laboratory beta Version 1.2B) was used as the basis for the run. The wind rose used in the sample calculation was not modified. This means that the results of the model runs are unlikely to reflect Crow Butte conditions, but may be used for comparison purposes to determine whether more detailed analyses should be recommended. If doses calculated using the ISL sample calculation remain very low, we suggest that more detailed modeling may not be required to support permitting of this relatively minor operational modification.

Because the sources of radon for Crow Butte are point sources, the well field sources of the ISL sample calculation were deleted, as was the yellowcake dryer. Radon release values utilized during program executions using our data are shown below. For simplicity all three point sources were assumed to be located at the center of the plant, (0,0,0).

	Radon released annually (Ci)	
Source	**At 5,000 gpm**	**At 9,000 gpm**
Upflow tanks	5042	5042
Downflow tanks	0	1311
Restoration releases	825	825
Total	5867	7178
Ratio of Totals:		1.22

Sixteen receptor points were modeled, evenly spaced at each compass direction 2 km from the release points. Maximum estimated TEDE for each receptor point is shown below. It is important to re-emphasize that the results should be considered to be relative, as opposed to absolute, doses because actual meteorological data from the site were not used. The rightmost column is the ratio of estimated Total Effective Dose Equivalent (TEDE) from the 9,000 gpm case vs. estimated TEDE from the 5,000 gpm case. The variations in the estimated TEDE for both the 5,000 gpm and the 9,000 gpm case simply represent variations in direction, windspeed and stability class in the sample calculation's wind rose. The ratio of the 9K to 5K doses is roughly 1.22, which is also the ratio of the increased inputs for the amount of radon released.

This result indicates that the proposed flow rate modification at Crow Butte, with no other significant variations in the process, would probably result in no more than a 25%

increase in dose to any receptor. Compared to TEDE calculated for the 1994 license application (Table 7.3.1), this means that the maximum dose equivalent expected for the maximum receptor (#19, Gibbons) would increase from 20.3 mrem/yr to approximately 25 mrem/yr. This value represents only 25% of the 10CFR40 limit to exposure of the public of 100 mrem/hr. All other factors being equal, estimates to other receptors would also increase by 22% and would be predicted to be only about 0.5 mrem/yr in the town of Crawford.

Comparison of TEDE Surrounding Crow Butte Facility

	TEDE to Receptor at 2 km in compass direction noted (mrem)		
Location	**5,000 GPM**	**9,000 GPM**	**9K/5K**
N	3.25E+01	3.98E+01	1.22E+00
NNE	1.10E+01	1.34E+01	1.22E+00
NE	8.22E+00	1.01E+01	1.23E+00
ENE	5.76E+00	7.05E+00	1.22E+00
E	1.02E+01	1.25E+01	1.23E+00
ESE	1.06E+01	1.30E+01	1.23E+00
SE	8.84E+00	1.08E+01	1.22E+00
SSE	6.11E+00	7.47E+00	1.22E+00
S	1.74E+01	2.13E+01	1.22E+00
SSW	7.33E+00	8.97E+00	1.22E+00
SW	7.35E+00	8.99E+00	1.22E+00
WSW	6.24E+00	7.64E+00	1.22E+00
W	5.78E+00	7.08E+00	1.22E+00
WNW	3.81E+00	4.66E+00	1.22E+00
NW	6.31E+00	7.72E+00	1.22E+00
NNW	7.57E+00	9.26E+00	1.22E+00

TABLE 1(A)-1

CALCULATION OF ANNUAL RADON EMISSIONS

CROW BUTTE RESOURCE PROJECT

5,000 GPM UPFLOW/4,000 GPM PRESSURIZED DOWNFLOW

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1) To calculate radon release from leaching assuming that U-238 is in equilibrium with all its decay products:

$Ci/m^3 = 761\ pCi/g\ ore \times 1.89\ g/cm^3 \times 0.2 \times 0.71/0.29 \times 10^{-6} = 7.04 \times 10^{-4}\ Ci/m^3$

Where: 0.2 = Emanating Power
0.71 = 1-Porosity
0.29 = Porosity

Total radon in solution for 9,000 gpm is then:

$7.04 \times 10^{-4}\ Ci/m^3 \times 34065\ lpm \times (0.72) \times 365\ d/yr \times 1.44 = 9075\ Ci/yr$

Where: 34065 = liters per minute
0.72 = € $=1-e^{-(\lambda t)}$
= € $=1-e^{-(0.28)}$
1.44 = constant

2) Total radon in solution from restoration is given by:

7.04×10^{-4} Ci/ m^3 x 3785 lpm x 365 d/yr x (0.99) x 1.44 = 1387 Ci/yr

Where: 3785 = Restoration flow in liter per minute

0.99 = € =1-$e^{-(\lambda t)}$

= € =1-$e^{-(0.28)}$

1.44 = Constant

The total radon in solution for this proposed operation is then:

Production	9,075
Restoration	1,387
	10,462 Ci/yr

3) Actual Radon Release to the Environment

With 5,000 gpm being processed by upflow ion exchange columns, it is expected that all of the radon will be released to the environment and that 25% of the radon will be released in the wellfield and 75% will be released in the plant vent. The source term for 5,000 gpm will be 5,042 Ci/yr and the 25% released in the wellfield will be 1,260 Ci/yr and the 75% released in the plant will be 3,782 Ci/yr.

The 4,000 gpm of flow being processed by pressurized downflow ion exchange columns will release only a small fraction of the contained radon to the environment. Only about 10% of the contained radon will be released during regeneration and venting. It is also expected that 25% of the radon will be released in the wellfield. The source term for 4,000 gpm will be 4,034 Ci/yr and the 25% released in the wellfield will be 1,008 Ci/yr and the 10% of the remaining radon (3,026 Ci) will be 303 Ci/yr.

During restoration 1,000 gpm of recovered water will be processed by pressurized downflow ion exchange (IX) columns. After IX treatment, 400 gpm will be treated by reverse osmosis (RO). Only a small fraction of the contained radon will be released during ion exchange and virtually all of the contained radon will be released during RO treatment. The actual release of the source term of 1,387Ci of radon/yr will be as follows:

- 25% of the 1,387 Ci will be released in the wellfield-347 Ci/yr
- 10% of the radon in the 600 gpm to be treated by pressurized IX (Note: All of the radon in the 400 gpm to be treated by IX-RO will be released) will be released.

The calculation follows for the IX treatment:
(1387 Ci/yr – 347 Ci/yr (wellfield loss))x 600gpm/1000gpm x 0.10 = 62 Ci/yr

The calculation follows for the IX-RO treatment:
(1387 Ci/yr – 347 Ci/yr (wellfield loss))x 400gpm/1000gpm = 416 Ci/yr

A summary of the actual radon releases follows:

	Ci/yr Released
5,000 gpm upflow	
Plant Vent	3782
Wellfield	1260
4,000 gpm Pressurized downflow	
Plant Vent	303
Wellfield	1008
1,000 gpm	
Restoration	825
TOTAL RADON RELEASE	7,178 Ci/yr

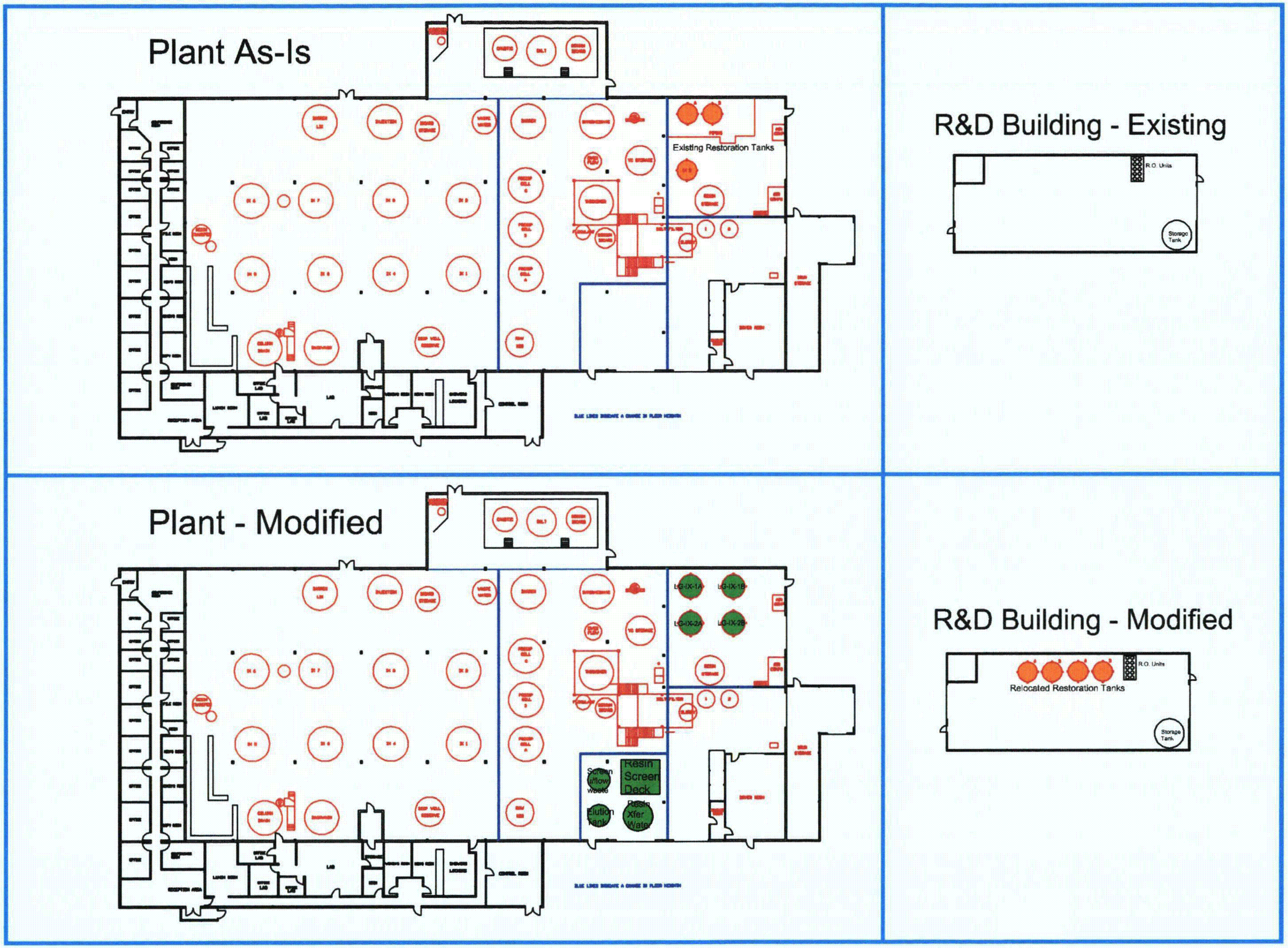


FIGURE A - Proposed Plant Modifications

Removed / Relocated

New Equipment

FIGURE B-PROCESS FLOWSHEET

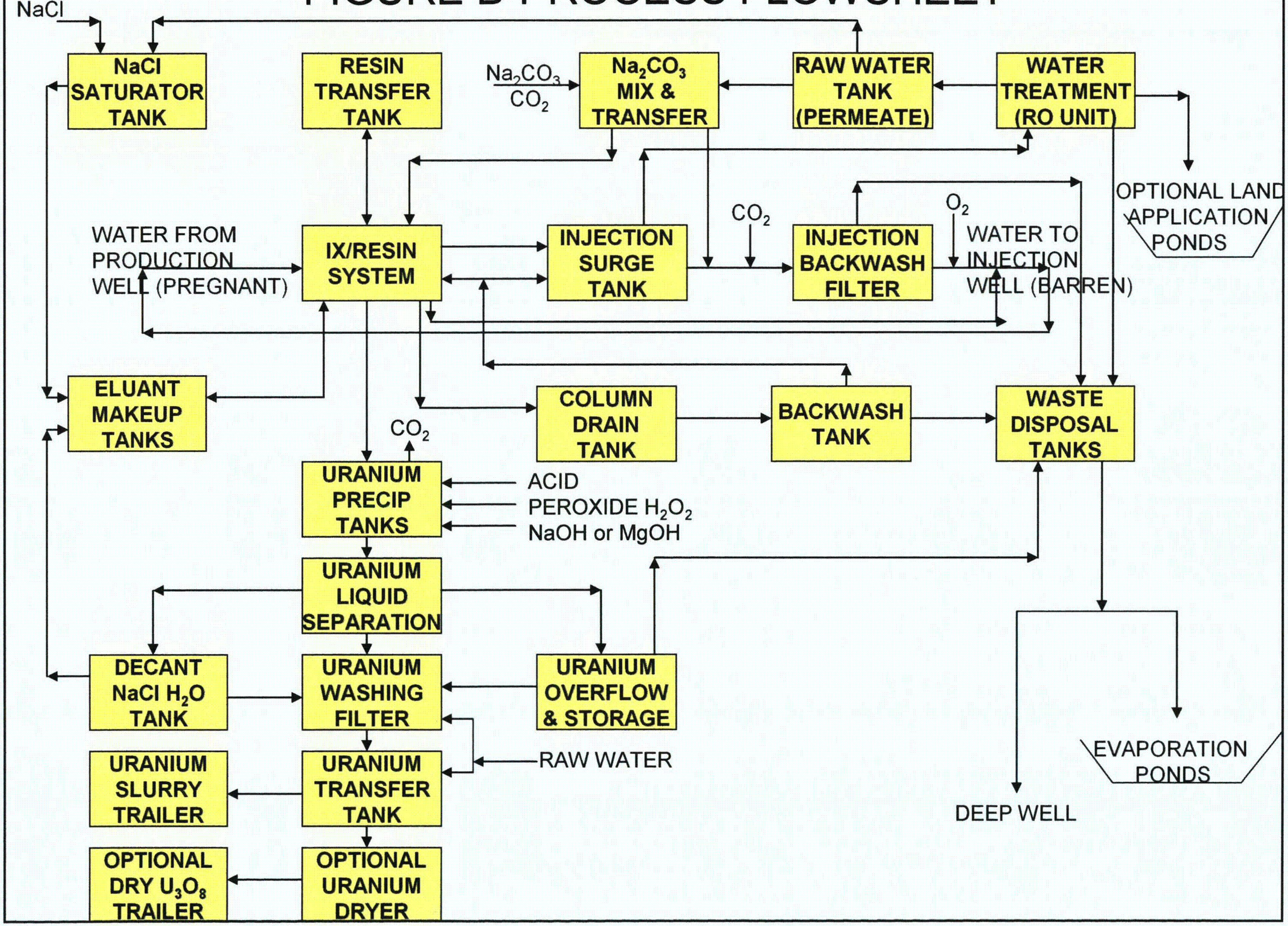
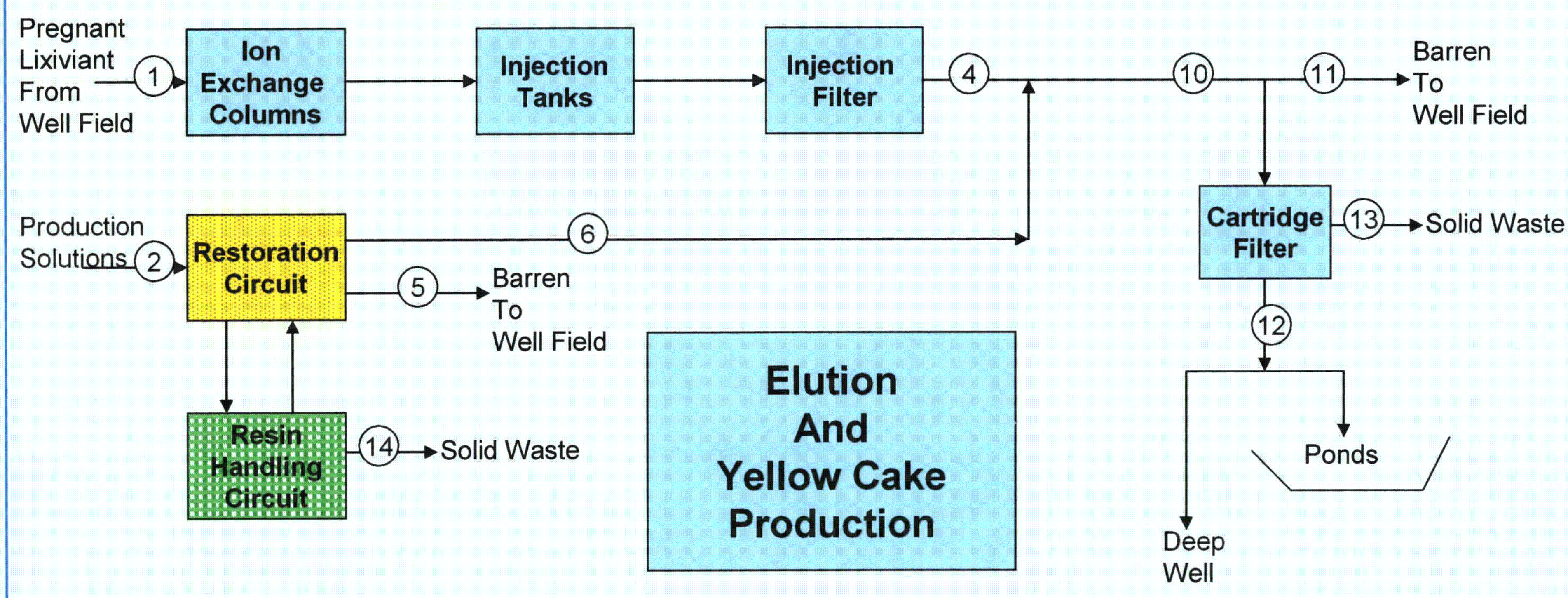


FIGURE C1-PLANT MASS BALANCE

5,000 GPM PLANT



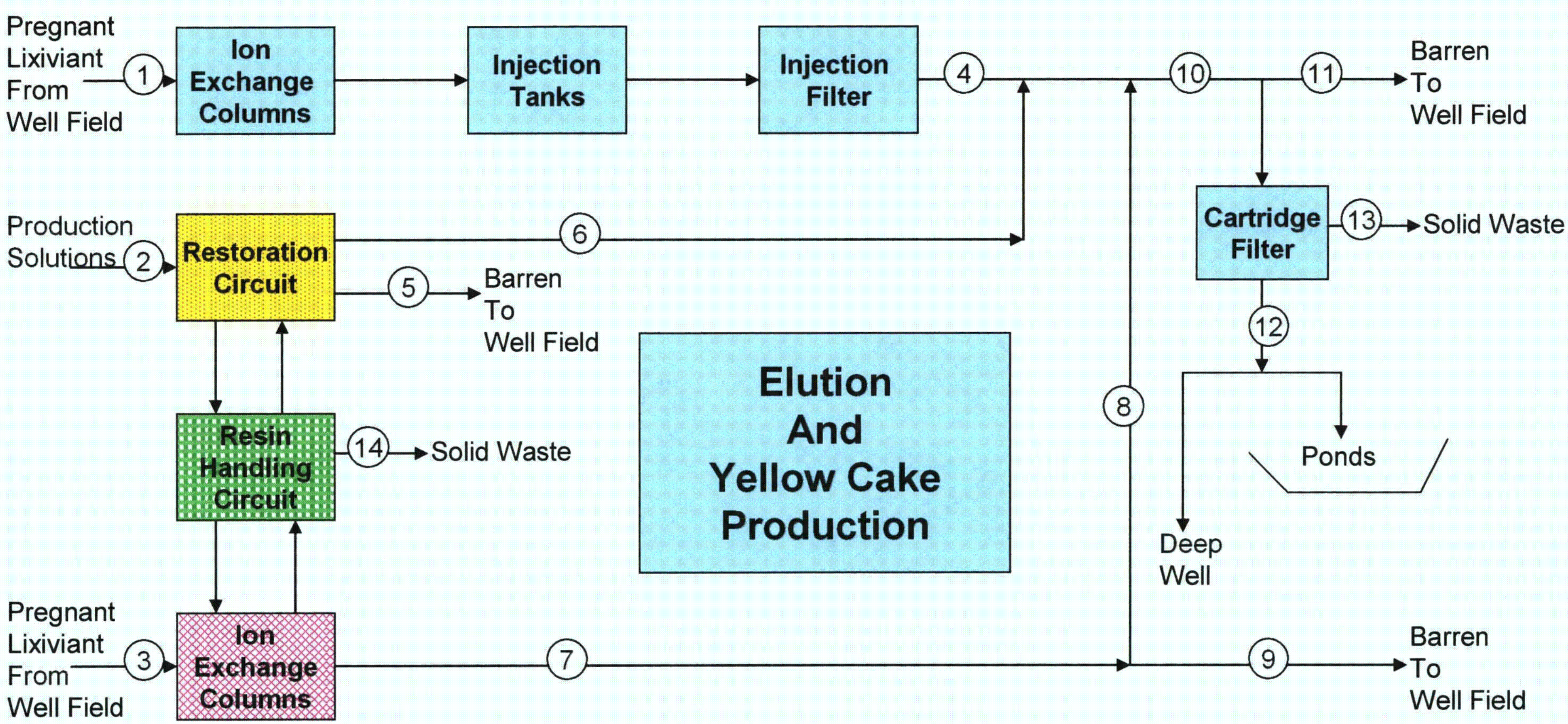
Stream #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Gpm liquid	5000	1000		5000	920	80				5080	4880	120		
Lbs solids/yr													4500	3500
Ppm U_3O_8	42	10		1.7	<1	<1				1.7	1.7	1.6		

Legend

- Existing
- Relocation
- Upgrade

FIGURE C2-PLANT MASS BALANCE

PROPOSED 9,000 GPM PLANT



Stream #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Gpm liquid	5000	1000	4000	5000	920	80	4000	8	3992	5080	4930	120		
Lbs solids/yr													8000	6400
Ppm U_3O_8	42	10	28	1.7	<1	<1	1.7	1.7	1.7	1.7	1.7	1.6		

Legend

- Existing
- Relocation
- Upgrade
- New